EMERGENCY MEDICAL CARE IN THE OPERATIONAL ENVIRONMENT

AMedP-24

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MAY 2011

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NORTH ATLANTIC TREATY ORGANISATION

NATO STANDARDIZATION AGENCY (NSA)

NATO LETTER OF PROMULGATION

24 May 2011

1. AMedP-24 – EMERGENCY MEDICAL CARE IN THE OPERATIONAL ENVIRONMENT is a NATO UNCLASSIFIED publication. The agreement of NATO nations to use this publication is recorded in STANAG 2549.

2. AMedP-24 is effective on receipt.

Cihangir AKSIT, TUR Civ
Director, NATO Standardization Agency

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RECORD OF CHANGES

Change Date	Date Entered	Effective Date	By whom entered

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RECORD OF RESERVATIONS BY NATIONS

CHAPTER	RECORD OF RESERVATIONS BY NATIONS
GENERAL	NOR, SVK, USA
1	
2	

RECORD OF SPECIFIC RESERVATIONS

NATION	SPECIFIC RESERVATIONS
NOR	Norway will not teach the use of "Crithyreotomi" as standard procedure at Role 1.
SVK	The Slovak republic reserves the right not to implement chapter 2D.07.1, part "Adult cardiac arrest" referring to the procedure from year 2000, which contravenes the standards currently used in the Slovak Republic.
USA	The U.S. Navy does not agree with the meaning of Flag K and will operate using the meanings listed below. Since the meanings are different from those used by other NATO warships, U.S. commanding officer must take extra care when in port, or at anchorages in which NATO warships are present, to ensure that all concerned understand the requisite precautions that must be taken with personnel working aloft, over the side, or both: a. K Personnel working aloft. Stand clear. b. K1 Personnel working over the side. Stand clear. c. K3 Personel working aloft and over the side. Stand clear. The USAF reserves the option to employ tested and certified equipment and to maintain supplies by type and quantity as permitted by the situation and environment in which they operate.

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D. MEDICAL EMERGENCIES

CHAPTER 1- INTRODUCTION

101. Aim

1. The purpose of this AMedP-24 is to: establish current minimum standards for training, treatment and equipment at Roles 1-3 for specific medical topics in the broad categories of: (1) general principles of emergency care, (2) trauma, (3) environmental emergencies and (4) medical emergencies.

102. Scope and Limitations

1. The publication is intended for medical personnel working in the operational environment. The studies are published in the form of "Triptychs". These are three-part guidelines describing the key topics for training of medical personnel, the specific recommended treatments and a list of equipment and drugs necessary for such treatment.

2. The triptychs are regularly reviewed and updated and as such are collected in this publication. The topics are those selected based on the practical operational experience of the members of the EPEM, as well as those directed by COMEDS Plenary. The recommendations are based, wherever possible, on best available medical evidence.

3. This document is based on the accepted NATO definition of Emergency Medical Care. It defines emergency medical procedures based on the progressively more complex capabilities of medical facilities found in progressively higher roles. The provision of medical care is as close as possible to national medical standards, given the constraints of the operational environment

CHAPTER 2 – SECTIONS AND STUDIES

SECTION A. GENERAL PRINCIPLES OF EMERGENCY CARE

A.00 TACTICAL COMBAT CASUALTY CARE

PREAMBLE

The raise of terrorism and the appearance of uncontrolled armed groups as seen in the last years operating in theatres like Afghanistan and Iraq expose all military personnel, even in peace support operations, to great danger. More and more military medical personnel have been involved in riots and fire actions and need to be trained to manage such kind of situations.

Therefore, in present operations medical personnel can be called upon to treat trauma victims, beside ”routine life” events such as automobile accidents, in a combat environment.

Ninety per cent of combat wound fatalities happen on the battlefield before reaching a medical treatment facility. This sets a particular emphasis on combat prehospital care. Even if the training of military medical personnel has been based on ATLS, BLS, PHTLS principles, which are considered the golden standard in a civilian, mainly intra hospital phase, there are severe concerns on the applicability of those principles in a combat or combat like setting.

Factors like darkness, hostile fire and environment, prolonged evacuation times, transportation issues and tactical decision could heavily affect the effectiveness of rendered medical care in the early phase after wounding. Tactical Combat Casualty Care training should therefore be an important part of medical education for military medical personnel.

ATLS treatment principles have been followed except where military evidence based medicine and tactical situation require diverse actions.

THE FOLLOWING GUIDELINES ARE TO BE APPLIED SOLELY IN A TACTICAL PREHOSPITAL SCENARIO, considering that combat situations can develop also close to or within medical treatment facilities as consequence of a terrorist attack.

Planning.

In planning it must be sought to ensure evacuation to a facility with capability for stabilization surgery (“damage control surgery”) within one hour. If this is not possible, it should be recommended to support the unit with a medical officer, nurse or paramedic led team, with a kit for basic resuscitation. Considerations should as well be taken to carry further supplies of oxygen, infusions, antibiotics, analgesics and means for avoiding shock, according to environmental and tactical considerations.

If a normal evacuation system is supporting the unit, the unit’s leader will depend upon, according to advice from the medics, to just report the unit’s situation including the number of casualties, their injuries and condition and a pick-up point. He should then receive an answer indicating type and ETA of evacuation means. It is then the responsibility of the evacuation system to have the casualties forwarded to a proper facility according to priorities. If the usual evacuation system becomes non-operational, the unit’s leader will take considerations on how to get the casualties evacuated to a proper facility with possibility for stabilization surgery (Role2). Knowledge of the location of alternative proper facilities for surgical treatment is then paramount. It should be considered that on a battlefield the first cause of death is HEMORRHAGE, the second is TENSION PNEUMOTHORAX, both of them are preventable deaths.

Phases of Tactical Combat Casualty Care (TCCC).

Care in the frame of combat or combat like missions can be divided in three phases, following the principle that a correct medical intervention performed at the wrong time may lead to further casualties.

1.”Care under fire”.

Definition: care rendered at the wounding point while both casualty and medical personnel (physician, paramedic, nurse, and medic) are still under direct fire.
The risk of suffering additional wounds is very high for both casualty and rescuer. Available equipment is limited to that carried by casualty and medical personnel. Time prior to extraction may vary considerably.

2. ”Tactical Field Care”.
Definition: care rendered once the casualty and its unit are no longer exposed to effective direct fire. This phase applies also to situations occurred on mission with no direct fire. Available equipment is limited to that carried by casualty and medical personnel. Time prior to extraction may vary considerably.

3. ”Combat Casualty Evacuation Care”.
Definition: care rendered while the casualty is being evacuated by an aircraft, ground vehicle, or boat. Any additional medical personnel and equipment pre-staged in these assets will be available at this phase.

TCCC PROTOCOLS (1):

1.”Care under fire”.

A situation under direct hostile fire calls primarily for tactical control. Casualties, who are able to, should move to cover without assistance, in order to avoid unnecessary exposure of rescuers. If a casualty is unresponsive and not moving, he is probably beyond help and risking the lives of the rescuers is not warranted. Before moving to a casualty, environment and type of aggression should be carefully considered (direction of hostile fire, mines, direct or indirect fire, and environmental hazards). Rescuers should not move in a zeroed-in position.
Surrounding personnel should be made aware of rescue plan, in order to get covering fire and support.
Rescuers (medical and non medical) must:
return fire as directed or required.
try to avoid to become a casualty,
try to keep the casualty from sustaining additional injuries.

Airway is best deferred to Tactical Field Care phase.

Establish possibly a communication with the casualty offering reassurance and explaining rescue plan and first aid actions.
Stop any life threatening hemorrhage, using a tourniquet for extremities, apply pressure for non extremity wounds and/or apply haemostatic dressings or pressure dressings.

Consider the best methods to move the casualty to a covert place, according to tactical situation (drags and carries).

Spine immobilization is not necessary for casualties with penetrating trauma.

TCCC PROTOCOLS (2):

2. ”Tactical Field Care”.

Once the situation is under control or the casualty has been moved to a cover, rescue medical personnel will have a major freedom of movement for administer emergency care. Need to transport the patient to the nearest evacuation spot or MTF should be considered, in order to organize the evacuation by available assets.

Casualties with an altered mental status should be disarmed immediately.
Airway management.
Unconscious casualty without airway obstruction:
Chin lift or jaw thrust
Nasopharyngeal airway
Place casualty in recovery position
Casualty with airway obstruction or impending airway obstruction
Chin lift or jaw thrust
Nasopharyngeal airway
Place casualty in recovery position
Surgical cricothyroidotomy (with lidocaine if casualty conscious) if above actions unsuccessful
Spine immobilization is not necessary for casualties with penetrating trauma.

Breathing.
Consider tension pneumothorax and decompress with needle thoracostomy if casualty has torso trauma and respiratory distress.
Sucking chest wounds should be treated by applying vaseline gauze or any other sealing device during expiration, covering it with tape or a field dressing, placing the casualty in a sitting position, and monitoring for development of a tension pneumothorax.

Bleeding.
Assess for unrecognized hemorrhage and control all sources of bleeding.
Assess for discontinuation of tourniquets after application of haemostatic dressing or a pressure dressing.

IV lines.
Start an 18 Gauge IV or Saline lock, if indicated.
(If resuscitation is required and no IV access is obtainable, consider the use of the intraosseous route)

Fluid resuscitation.
Assess for hemorrhagic shock; altered mental status in absence of head trauma and weak or absent peripheral pulses are the best field indicators of shock.

If not in shock:
No IV fluids necessary
PO fluids permissible if conscious.
If in shock:
Colloids (hetastarch) 500 cc IV bolus
Repeat once after 30 minutes if still in shock.
No more than 1000 cc colloids.

Continued efforts to resuscitate should be weighed against logistical and tactical considerations and the risk of incurring further casualties.
If unconscious casualty with Traumatic Brain Injury (TBI) and no peripheral pulses, resuscitate to restore radial pulse.
Inspect and dress known wounds.

Check for additional wounds.

Analgesia as necessary.

Splint fractures and recheck pulses.

Antibiotics: recommended for all open combat wounds.

Communicate with casualty if possible:
Reassure and explain care.

Cardiopulmonary resuscitation.

Resuscitation on a battlefield for victims of blast or penetrating trauma who have no pulse, no respirations, and no other signs of life will not be successful and should not be attempted.

TCCC PROTOCOLS (3):

3. " Combat Casualty Evacuation Care".

Airway management.
Unconscious casualty without airway obstruction:
Chin lift or jaw thrust
Nasopharyngeal airway
Place casualty in recovery position
Casualty with airway obstruction or impending airway obstruction
Chin lift or jaw thrust
Nasopharyngeal airway
Place casualty in recovery position
Or
Laryngeal mask airway or Combitube or ET- tube or surgical cricothyroidotomy with lidocaine if casualty conscious)

Spine immobilization is not necessary for casualties with penetrating trauma.

Breathing.
Consider tension pneumothorax and decompress with needle thoracostomy if casualty has torso trauma and respiratory distress.
Consider chest tube insertion if no improvement and/or along transport anticipated.
Most combat casualties do not require oxygen, but its administration may be beneficial in case of:
Low oxygen saturation by pulse oximetry
Injuries associated with impaired oxygenation
Unconscious patient
Traumatic Brain Injury (maintain oxygen saturation above 90).
Sucking chest wounds should be treated by applying vaseline gauze or any other sealing device during expiration, covering it with tape or a field dressing, placing the casualty in a sitting position, and monitoring for development of a tension pneumothorax.

Bleeding.
Reassess for unrecognized hemorrhage and control all sources of bleeding.
Assess for discontinuation of tourniquets after application of haemostatic dressing or a pressure dressing.

IV lines.
Reassess need for IV access.
Start an 18 Gauge IV or Saline lock, if indicated.
(If resuscitation is required and no IV access is obtainable, consider the use of the intraosseous route)

Fluid resuscitation.
Reassess for hemorrhagic shock
Altered mental status in absence of head trauma and/or abnormal peripheral vital signs.
If not in shock:
No IV fluids necessary
PO fluids permissible if conscious.
If in shock:
Colloids (hetastarch) 500 cc IV bolus
Repeat after 30 minutes if still in shock.

Continue resuscitation with PRBC, colloids or crystalloids (LR) as indicated.
If unconscious casualty with Traumatic Brain Injury (TBI) and no peripheral pulses, resuscitate as necessary to restore and maintain systolic blood pressure of 90 mmHg or above.

Monitoring.
Institute electronic monitoring of pulse oxymetry and vital signs if indicated.

Inspect and dress wounds if not already done.

Check for additional wounds.

Analgesia as necessary.

Reassess fractures and recheck pulses.

Antibiotics: recommended for all open combat wounds.

Communicate with casualty if possible:
Reassure and explain care.

A.01 SORTING OF CASUALTIES

PREAMBLE

The creation of this triptych generated more discussion and difficulty than any other despite the fact that sorting is of vital importance.

Although apparently straightforward, the achieving of agreement between members of commonality in sorting policy that would be equally applicable in peace time disasters and war required much effort.

The concept of dynamic continuous re – ebvaluation was accepted without dissent as was imperative need for casualty sorting into priorities for treatment and evacuation.

The system, which is finalized in this triptych is the agreed standard policy but it must be accepted that individual member countries may need to modify the system for particular situation and operational requirement.

TRAINING	TREATMENT	EQUIPMENT

ROLE 1

Teach: Sorting of casualties for treatment and evacuation. Triage is a dvnamic svstem where patients are re-evaluated all along the evacuation chain and changes of priority are given according to change in : - clinical status - duration of transport - tactical military situation Teach: Mass Casualty situation sorting according to: - number of patients - evacuation facilities - time factor - tactical military situation	Responsible: medical officer. (senior paramedic) assisted by 1-2 medical assistant's T-1: immediate treatment group EMERGENCY (urgent) T-2: delayed treatment group CAN WAIT T-3: minimal treatment group SHOULD WAIT T-4: patients with very poor chance of survival MUST WAIT	Good general light. Flashlight. Pair of scissors for textile. Stethoscope. Thermometers normal and low reading - Field medical cards - Pencils Lifesaving medical equipment - I.V. fluids & I.V. sets - oxygen - laryngoscope & endotracheal tubes. - dressing equipment. - medicaments. Access to reliable system of communication

TRAINING	TREATMENT	EQUIPMENT
All priorities awarded be clearly indicated T-4: This category should only be used when a mass casualty situation pertains which by definition means that the medical services are overwhelmed by the casualty load.	<u>1. T-1 Group:</u> Asphyxia or respiratory distress due to: aspiration - mechanical obstruction - unconsciousness - face and neck injuries - inhalation injuries - chest injuries Incipient shock Shock due to: -bleeding: open concealed -loss of body fluids: burns (over 25%TBSA) Polytrauma Severe Hypothermia Severe Dehydration <u>2. T-2 Group:</u> Abdominal injuries Maxillo – facial injuries including ophtalmic Open fractures and joint injuries Closed unstable or dislocated injuries Lacerating, deep wounds (GSW) Burns 15 –25% TBSA but including smaller burns involving critical areas such as eyelids, hands, etc Local deep frostbite Hypothermia, moderate head and spine injuries	

TRAINING	TREATMENT	EQUIPMENT
	If patients in group T-2 become clinical unstable: Re – evaluation, CPR if necessary and upgrade to T-1 <u>3. T-3 Group:</u> Minor simple wounds Simple stable fractures Contusion and sprains Minor burns Psychiatric casualties incl. fai1ed resolution of combat stress. If patients in T-3 Group become clinical unstable: re-evaluation and change of priority <u>4. T-4 Group:</u> The obvious moribund Very extensive burn cases Extensive polytrauma Obvious radiation overdose	

TRAINING	TREATMENT	EQUIPMENT

ROLE 2 and 3

Triage and subdivision of T-1 casualties into: Treatment Group Hold Group Is performed where there is surgical expertise at 2nd or 3rd Role	Triage at 2nd and 3rd Role where surgical facility available. Responsible: senior surgeon senior anaesthesiologist senior medical officer Renewed triage of all patients, especially sorting out T-4 Group. 1.T-1: EMERGENCY <u>a.Treatment Group</u> stabilizing procedures surgery if needed renewed triage evacuation <u>b.Hold Group</u> stabilizing procedures surgery if needed renewed triage evacuation 2. T-2: CAN WAIT stabilizing procedures for injuries which are not lifethreatening before treatment/evacuation 3. T-3: SHOULD WAIT treatment if needed before evacuation 4. T-4: HOPELESS CASES, MUST WAIT not responding to evacuation give confort give analgesics give sedatives	

A.02 RESUSCITATION ON THE BATTLE FIELD

PREAMBLE

Battle field resuscitation can be complicated by the combat situation. The casualty could be under direct fire or danger, medical personnel could be in the same danger, and equipment may be limited and extraction and evacuation timing variable and uncertain. . It may not be possible to apply the ABCDE principles in the prehospital situtation and this paradigm should be adapted to the combat situation.
The care given in the tactical prehospital situation has been divided in three phases:
Phases of Tactical Combat Casualty Care (TCCC).
Care in the frame of combat or combat like missions can be divided in three phases, following the principle that a correct medical intervention performed at the wrong time may lead to further casualties.

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3. ”Combat Casualty Evacuation Care”.
Definition: care rendered while the casualty is being evacuated by an aircraft, ground vehicle, or boat. Any additional medical personnel and equipment pre-staged in these assets will be available at this phase.

As soon as the tactical situation permits care should revert back to the ABCDE principles used in the ATLS and BATLS

Care under Fire
This situation calls for assessment of the operation, the casualty, the environment and the threat to the casualty and the helpers.

Assessment: In the balance lies the life of the casualty, the lives of the helpers and the operational needs. When the casualty is unresponsive and not moving, risking the lives of others may not be warranted.
Priorities in the care of the casualty are:
Casualty self help:
return fire and maintain fire superiority
get to - or remain in cover and prevent further injury
self first aid consisting of stopping major bleeding, if neccesary with a tourniquet or compressive bandage whilst maintaining cover
If a helper can get to casualty or casualty to the helper care consists of
return of fire
maintain cover for casualty and helper
stop major bleeding with tourniquet or compresssive bandage
in case of an A problem: oral - or nasopharyngeal airway or recovery position
Plan and prepare for removal of casualty to more secure location.

Tactical Field Care

In this situation danger to the casualty and helper are such that there is space and time to give emergency care. Care can revert back to the ABCDE principles. Spine immobilisation is not needed for casualties with penetrating injuries. After insertion of an IV catheter and application of a pressure dressing removal of the tourniquet should be considered. Fluid resuscitation is guided by the presence of head trauma and shock of the casualty on one hand and the logistical and tactical considerations on the other side. In case of no shock casualty should not receive fluids IV. When casualty is in shock IV fluids should be limited to 1000 ml of colloids. If there is no response or a fast deterioration of the shock further fluid treatment should be guided by the logistical and tactical situation. In case of head injury and shock resuscitation should be aimed at restoration of the radial pulse.

Combat Casualty Evacuation Care

In the evacuation phase sufficient medical stores should be available. Once evacuation assets are available, a choice should be made to :" scoop and run" or " stay and play" Care should consist of continuation and completion of the ABCDE along the principles set out for the Tactical Field Care. Oxygen should be given to casualties that have low oxygen saturation, are unconscious or have traumatic brain in jury. Antibiotics should be given to all casualties with combat wounds. Analgesics should be given as required in this phase.

Beyond the battle field, care in role 1 - 3

Beyond the care in battle area care should be given as close to civilian standards as possible. The principle is: "*Treat first, what kills first*". The life saving procedures are prioritized in a primary survey that follows the letters ABCDE, as follows:

A. Airway with cervical spine control
B. Breathing
C. Circulation and Control of hemorrhage
D. Disability (neurological deficit)
E. Exposure and Environment control

After completing the primary survey, the secondary survey is started, in which the patient gets a complete physical examination from "head to toe". This requires a more thorough search so as not to miss any traumatic wound, or general physiologic disorder.

The advantages of the ABCDE-principle are:
1. It is a simple mnemonic
2. It follows the principle "treat first, what kills first", and is used in other life saving programs (ATLS, BATLS)
3. If a team is resuscitating the patient, every member of the team knows what to do and when

In a team situation, the leader can delegate procedures, whilst keeping overall control of the patients assessment and treatment. This allows concurrent treatment of the A,B,C's. If only one physician or medic has to do the job, he or she should stick to and follow the sequential ABCDE principle.

If during the resuscitation (ABCDE-sequence) or secondary survey, the patient is not responding or his vital parameters deteriorate, the caregiver should go back and evaluate again, according to ABCDE.

TRAINING	TREATMENT	EQUIPMENT

ROLE 1

Care under Fire *TEACH* Pressure points Pressure bandaging Use of tourniquet, dangers of tourniquet	Stop life threatening haemorrhage: pressure bandage, if unsuccessful tourniquet	Tourniquet, bandages
Tactical Field Care TEACH: - to establish a clear airway - to recognize airway problems: (i.) **look** for restlessness, dyspnea, cyanosis, use of auxiliary muscles, retraction in sternal notch (ii.) **listen** for noisy breathing (iii.) **feel** for no air movement detectable from mouth, nose TEACH: - Specific trauma associated with airway trouble include: coma, maxillo-facial injury, head/neck trauma, aspiration, and burns (inhalation)	Airway Management: Assess airway: Casualty unconscious or with obstructed airway: Temporary airway manouvres: chinlift, yawthrust Oro- or nasopharyngeal airway Recovery position	oropharyngeal airways (different sizes) nasopharyngeal airways

TRAINING	TREATMENT	EQUIPMENT
- often the tongue has fallen backwards and causes airway-obstruction - assess free airway: chin-lift or jaw-thrust, inspection and clearing of mouth and pharynx - (contra)indication for oral and nasopharyngeal tubes - indication and difficulties of endotracheal intubation (oral / nasal) - the most secure airway is achieved by a cuffed endotracheal tube TEACH: - indications for cricothyroidotomy - technique of needle and surgical cricothyroidotomy	Intubation or surgical cricothyroidotomy	Intubation-set: - laryngoscope, different blades - spare bulbs, batteries, handle - Magill-forceps, - malleable endotracheal tube-stylet - endotracheal (cuffed) tubes in various sizes - adhesive tape and/or cotton ties - 10 cc syringes (cuff filling) - stethoscope sterile lubricant skin cleansing swabs Surgical cricothyroidotomy set: - scalpel, spreader - hemostats - cuffed tubes, size 5 and 6 (or special tracheotomy-tubes) -local anesthetic -needles, syringes

TRAINING	TREATMENT	EQUIPMENT
TEACH - **look** for: dyspnea, cyanosis, auxiliary muscle activity, uneven chest wall motion, paradoxical movement, diaphragmatic respiration, bruising, haematomas, sucking wounds - **listen** (auscultation): breath sounds (presence, quality, symmetry), sucking wounds - **feel**: percussion of chest (hyperresonance versus dullness TEACH: - to diagnose life-threatening injuries: 1) Tension-pneumothorax: - trachea deviated to normal side - distended neck veins - severe respiratory distress - no breath sounds in injured side - hyperresonance percussion TEACH: - insertion site for needle thoracotomy: second	**Breathing:** Assess for tension pneumothorax or sucking chestwound Treat tension pneumothorax with needle thoracostomy or thoracostomy. Treat sucking chestwound with vaseline gauze or sealing device with one way valve	-disinfectants -gauze's -sutures, needle holders iv needle as large as possible 14 or 12 G Chest seal with one way valve

TRAINING	TREATMENT	EQUIPMENT
intercostal space midclavicular line - potential complications (subclavian artery puncture, brachial plexus injury) - insertion site of chest drain: anterior to mid-axillary line in the fifth intercostal space - potential complications (abdominal injury, intercostal nerve/artery injury, cardiac injury (left side)		
2) Open pneumothorax (sucking chest wound): - severe respiratory distress - noise of sucking with breathing - open chest wound	**Bleeding:** Assess for unrecognised bleeding and apply pressure bandages. Insert IV needles and start IV fluids if indicated. Insert intra osseous needle if iv needle unsuccesful	Bandages skin cleansing swabs, disinfectant infusion sets venapuncture tourniquet
TEACH - to insert iv cannulae - to set up infusion lines - to insert an inttraosseous needlde	Consider removal of tourniquet.	IV needle-cannulae (various sizes) connectors, infusion-extension, tubing with drip-set Injection-inlets (three-way stopcocks), skin adhesives, tape bone gun
Risk of maintaining tourniquet. Risk of removal of tourniquet. Bandaging techniques. Elevation of member	**Fluid resuscitation:** Reassess for hemorrhagic shock Altered mental status in absence of head trauma and/or abnormal peripheral vital signs. <u>If not in shock:</u> No IV fluids necessary	IV fluids
TEACH to recognize signs of shock: - early signs: skin pale and cold, tachycardia, pulse pressure weak, capillary refill time delayed, altered mental status. - late sign: hypotension	PO fluids permissible if conscious. <u>If in shock:</u> Colloids (hetastarch) 500 cc IV bolus Repeat after 30 minutes if still in shock.	

TRAINING	TREATMENT	EQUIPMENT
- the inability to palpate specific arterial pulses can be used as a rough guide to systolic blood pressure: Radial < 90 mm Hg Femoral < 70 mm Hg Carotid < 40 mm Hg TEACH Controversy colloids vs crystalloids Cerebral Perfusion Pressure (CPP) theory and secondairy brain injury theory	Continue resuscitation with PRBC, colloids or crystalloids (LR) as indicated. If unconscious casualty with Traumatic Brain Injury (TBI) and no peripheral pulses, resuscitate as necessary to restore and maintain systolic blood pressure of 90 mmHg or above.	
Combat Casualty Evacuation Care	Continue and re-evaluate care given as above.	cervical collars (different sizes) head-immobiliser, straps adhesive tape
Cervical spine control: TEACH: - to perform in line traction of the cervical spine with 1) a properly sized cervical collar and immobilizing head straps 2) with the hands of a helper - to suspect cervical trauma: if high energetic accident (traffic, sport, fall), coma, injury above clavicle	**Airway – C-spine:** Consider neccesity of spinal immobilisation at this point	long-spine board vacuum-mattress (bean bag) if available
	Breathing Consider chest tube insertion if appropriate for evacuation. Consider supplementing oxygen	Oxygen Non-rebreathing mask Pulse oximeter

TRAINING	TREATMENT	EQUIPMENT
TEACH Reasons for additional oxygen: Low oxygen saturation (pulse oximeter) Injuries associated with impaired oxygenation Unconscious patient Traumatic brain injury		
	Monitoring Institute monitoring as required e.g. pulseoximetry, electronic bloodpressure meassurement **Check for, inspect and dress wounds. Reassess fractures, check pulses** **Analgesics if required** **Give antibiotics for all open wounds** **Communicate:** With patient and explain care With operational command as required for casevac	
		Eyes, ears and hands of person providing care
PRIMARY SURVEY TEACH:	If suspicion of cervical trauma, the patient will be immobilized on a spine board with cervical collar and head-	gloves, gowns, masks, goggles cervical collars (different

TRAINING	TREATMENT	EQUIPMENT
- principles of advanced trauma life support, according to ABCDE-principles **A: Airway with cervical spine control** - to assess and clear an airway without causing secondary injury to the cervical spine Cervical spine control: TEACH: - to perform in line traction of the cervical spine with 1) a properly sized cervical collar and immobilizing head straps 2) with the hands of a helper - to suspect cervical trauma: if high energetic accident (traffic, sport, fall), coma, injury above clavicle Assess airway TEACH: - to establish a clear airway - to recognize airway problems: (i.) **look** for restlessness, dyspnea, cyanosis, use of auxiliary muscles, retraction in sternal notch (ii.) **listen** for noisy breathing	immobilizing straps Maintain cervical spine in neutral position if necessary, remove head straps and collar and have assistant maintaining in line traction using two hands, until collar and straps are back in place Talk to patient: If (s)he answers, (A) airway, (B) ventilation, (C) circulation and (D) consciousness are adequate for the moment If not, establish a clear airway first. Chin-lift or jaw-thrust Inspect and clear airway	sizes) head-immobilizer, straps adhesive tape long-spine board vacuum-mattress (bean bag) if available

TRAINING	TREATMENT	EQUIPMENT
(iii.) **feel** for no air movement detectable from mouth, nose TEACH: - Specific trauma associated with airway trouble include: coma, alcohol, drug abuse, maxillo-facial injury, head/neck trauma, aspiration, and burns (inhalation) - often the tongue has fallen backwards and causes airway-obstruction - assess free airway: chin-lift or jaw-thrust, inspection and clearing of mouth and pharynx - Heimlich maneuver for lower airway-obstruction - (contra)indication for oral and nasopharyngeal tubes - indication and difficulties of endotracheal intubation (oral / nasal) - the most secure airway is achieved by a cuffed endotracheal tube	(mouth, pharynx-region) of foreign materials (false teeth as well) Check for free airway Consider Heimlich maneuver Consider oral/nasopharyngeal Airway Consider endotracheal intubation	suction-apparatus suction catheters (rigid, soft) Gauze false teeth holder oropharyngeal airways (different sizes) nasopharyngeal airways Intubation-set: - laryngoscope, different blades - spare bulbs, batteries, handle - Magill-forceps, - malleable endotracheal tube-stylet - endotracheal (cuffed) tubes in various sizes - adhesive tape and/or cotton ties - 10 cc syringes (cuff filling) - stethoscope sterile lubricant skin cleansing swabs Needle-cricothyroidotomy set: Jet-insufflation equipment: - 12-14 Ga. Cannulae (iv catheters) - oxygen-tubing, with finger hole cut in the end of the tubing near the patient

TRAINING	TREATMENT	EQUIPMENT
TEACH: - indications for cricothyroidotomy - technique of needle and surgical cricothyroidotomy	Consider cricothyroidotomy: After any airway maneuvers, check for free airway Give sufficient oxygen by mask or through tube	- 2 cc syringe without plunger can be used as connection between intratracheal catheter and oxygen tubing Surgical cricothyroidotomy set: - scalpel, spreader - hemostats - cuffed tubes, size 5 and 6 (or special tracheotomy-tubes) -local anesthetic -needles, syringes -disinfectants -gauze's -sutures, needle holders Oxygen-administration kit: (cylinders 200 atm), with flow meter and pressure gauge oxygen-masks tubing non-rebreathing self-inflating bag oxygen-reservoir bag masks (different sizes) PEEP-device swivel-connectors CO_2-detectors pulse-oximeter

TRAINING	TREATMENT	EQUIPMENT
TEACH: - oxygen-therapy for severely wounded - use of pulse-oximeter - pitfalls of the use of pulse-oximeter (low temperature, vasoconstriction, carboxyhaemoglobin)	Consider use of pulse-oximeter	
TEACH: - systematic examination from A(Airway) to B(Breathing) including the neck: - assess the trachea-position - look for distended neck veins **B: Breathing** (See also triptych B.05 Chest-Injuries) TEACH: -less than 10% of blunt trauma and 15 - 30% of penetrating chest injury need surgery - to evaluate ventilation: - to measure rate and depth of respiration	Administer oxygen if not already done	Oxygen administration kit bag, masks, tubing

TRAINING	TREATMENT	EQUIPMENT
- **look** for: dyspnea, cyanosis, auxiliary muscle activity, uneven chest wall motion, paradoxical movement, diaphragmatic respiration, bruising, haematomas, sucking wounds - **listen** (auscultation): breath sounds (presence, quality, symmetry), sucking wounds - **feel**: percussion of chest (hyperresonance versus dullness		
TEACH: - to diagnose life-threatening injuries: 1) Tension-pneumothorax: - trachea deviated to normal side - distended neck veins - severe respiratory distress - no breath sounds in injured side - hyperresonance percussion TEACH: - insertion site for needle thoracotomy: second intercostal space midclavicular line - potential complications (subclavian artery puncture, brachial plexus injury) - insertion site of chest drain: anterior to mid-axillary line in the fifth intercostal space - potential complications (abdominal injury, intercostal nerve/artery injury, cardiac injury (left side)	Tension-pneumothorax - insert wide bore needle in second intercostal space midclavicular line to alleviate pressure - then insert chest drain in the 5th intercostal space, anterior to mid-axillary line	local anesthetic syringes, needles skin cleansing swabs 12-14 Ga iv needles chest drains scalpel, curved scissors, Retractors non-return valves (e.g. urine collecting bags with non-return inlet valve) under water seal drain set sutures, needles, needle-holder
	Open chest (sucking) wound	chest-seal (i.e. special bandage with one-let

TRAINING	TREATMENT	EQUIPMENT
2) Open pneumothorax (sucking chest wound): - severe respiratory distress - noise of sucking with breathing - open chest wound	- seal wound and insert chest drain: 1) cover wound with chest-seal and insert chest drain, or 2) cover wound on three sides with occlusive dressing and insert chest drain, than seal fourth side of dressing	valve for open chest sucking wound) bandages, tape dressings (chest drain set)
3) Massive haemothorax: - signs of shock - dull percussion affected side - no breathing sound - if more than 1500ml blood loss initially → thoracotomy probable - if more than 200ml/hour blood loss ongoing → thoracotomy probable	Massive haemothorax: - insert two peripheral iv infusions use short, large bore cannulae - insert chest drain - measure blood loss thoracotomy on role 3	intravenous infusion sets (see C: circulation) (chest drain set)
4) Flail chest: - rib fractures - paradoxical chest wall movement	Flail chest: - consider chest drain - analgesia - support affected side - intubate, sedate and - consider evacuation to Role 3 for ventilatory support (mechanical ventilation)	Analgesia Sedation (see Analgesia and Sedation in the Field - Triptych A.09.) (chest drain)
5) Cardiac tamponnade follows in C: circulation		
C: Circulation and Control of hemorrhage (See also Triptych A.05: Fluid and Blood Management in Traumatic		

TRAINING	TREATMENT	EQUIPMENT
Shock) TEACH: - pathophysiology of shock - different etiology of shock: hypovolemic (blood loss)versus non-hypovolemic (cardiogenic/heart failure, neurogenic, sepsis, mechanical) - mnemonic: "Blood on the floor and four more" - to look for ongoing exsanguinating hemorrhage: *"Blood on the floor"* - to have suspicion for ongoing internal bleeding: *"and four more"* (thorax, abdomen, pelvis, thighs) - to recognize signs of shock: - early signs: skin pale and cold, tachycardia, pulse pressure weak, capillary refill time delayed. - late sign: hypotension - the inability to palpate specific arterial pulses can be used as a rough guide to systolic blood pressure: Radial < 80 mm Hg Femoral < 70 mm Hg Carotid < 60 mm Hg - stopping bleeding with simple measures	Stop external hemorrhage by direct pressure control: pressure-bandage, proximal pressure point, elevate wound above heart level	blood pressure cuff and sphygmomanometer Dressings Bandages

TRAINING	TREATMENT	EQUIPMENT
	Consider hemostats, ligatures (rarely indicated except in skilled hands)	Hemostats, ligatures
- indication and contraindication of use hemostats,ligatures,	Consider tourniquet (extremely rarely indicated)	Tourniquets, slings skin marker
- indication and contraindication of use of tourniquet - to insert iv cannulae - to set up infusion lines	Insert two large bore, short Peripheral iv cannulae	skin cleansing swabs, disinfectant infusion sets venapuncture tourniquet IV needle-cannulae (various sizes) connectors, infusion-extension, tubing with drip-set Injection-inlets (three-way stopcocks), skin adhesives, tape
	Perform venasection	Venasection set: - scalpel, small blade, sharp pointed scissors - hemostats (small), fine tissue forceps - absorbable sutures, skin sutures, needle - needle holder - dressing, adhesive tape
- when to consider and how and where to perform venasection (venous cutdown)	Insert intra-osseous needle	intra-osseous needles cleansing swabs, disinfectant, local anesthetic adhesive tape
- when to consider and how to insert an intraosseous needle (see tript.A.03.Resuscitative Procedures) - not to forget to take blood samples for lab	Take blood samples for determination of blood-group, cross-match, Hgb, Ht, other lab tests	Cross-matching kit blood tubes, (lab)labels

TRAINING	TREATMENT	EQUIPMENT
		portable intravenous stand crystalloid-solutions
- guidelines to estimate blood loss and required fluid replacement (see triptych A.05. Fluid and Blood Management in Traumatic Shock)	Infuse warmed crystalloid solution according to 3:1 rule Keep patient warm	plasma-expanders IV-warming apparatus microwave oven
- 3 : 1 rule (3ml crystalloid for 1 ml blood loss) - guidelines for transfusion of blood products	Consider urinary catheter for urine output as indirect measure of organ perfusion	Urinary catheterization set: -antiseptic solution, sterile lubricants, gauze's -local anesthetic -urinary catheters, pincet, collecting bags -sterile saline, syringes
- indications and contraindications of urinary catheterization -method of insertion urinary catheter	Consider nasogastric tube	nasogastric tubes sterile lubricant, collecting bags
- indications and contraindications of nasogastric tube - monitoring of response to fluid bolus: rapid-minimal blood loss transient-ongoing blood loss minimal or no response:-major blood loss or non-hypovolemic causes	Look for response: rapid → slow infusion down transient → to role 3 surgical theatre, use plasma- expanders and blood products if available minimal or non: same as transient, consider non- bleeding cause	pericardiocentesis-needle three-way stopcocks, syringes antiseptic swabs , local anesthetic
	If suspicion on cardiac tamponnade: perform pericardiocentesis	pelvic slings MAST femoral splint, slings
- symptoms and treatment of cardiac tamponnade - method of pericardiocentesis	Consider reduction of pelvic Fracture Consider in-line traction and immobilization of femoral fracture	

TRAINING	TREATMENT	EQUIPMENT
- significance of pelvic and long bone fractures in hypovolemic shock - reduction of pelvic space, application of pelvic wrap - reduction and immobilization of femoral fractures -indications for referral to surgical care	Consider evacuation to Role 3	

D: Disability (Neurological deficit) (See also Triptych B.01. Head Injuries) TEACH: - short neurological examination to detect focal brain injury (life threatening) - to assess: 1) level of consciousness: - AVPU mnemonic - Glasgow Coma Scale	Assess level of consciousness: A - Spontaneous speech (Alert) V - Responds to verbal command P - Reacts to painful stimulus U - Unresponsive Glasgow Coma Scale (EMV-score):	Glasgow Coma Scale cards

TRAINING	TREATMENT	EQUIPMENT
	- minimal score 3 points - maximum score 15 points - score < 9 points: coma	
2) Pupillary reflex: - reaction to light - size - shape - left / right difference	Assess and record pupil signs:	penlight
3) Lateralization - to perform a rapid motor / sensory assessment to determine the presence of lateralizing neurologic deficits or spinal cord injury	Test for lateralization:	
E: Exposure and Environmental control		
TEACH: - importance of undressing the patient completely and complete examination (backside with log-roll)	Undress patient Rapid head to toe examination	scissors (clothing)
- that this procedure can lead quickly to hypothermia	Cover patient with warm blankets	warm environment warm blankets
- prevention of hypothermia (See Triptych C.01 Hypothermia)	Use warm infusions	warm infusions thermometer
	Reevaluate ABCDE before proceeding to	warming apparatus (e.g. Bair Hugger)

TRAINING	TREATMENT	EQUIPMENT
-importance of repetition of ABCD sequence	secondary survey Consider nasogastric and urinary catheter if not already done Consider evacuation to Role 3 if not already done	infusion warming apparatus (e.g.Level One) microwave oven
SECONDARY SURVEY TEACH: - to take history (AMPLE mnemonic) - thorough examination from head to toe - handling of injuries as per specific triptychs - danger of hypothermia (See Triptych C.01 Hypothermia) Head and neck (See triptychs B.01 Head Injuries and B.02 Maxillofacial Injuries) TEACH: - division into three regions above eyes and back of skull midface	 Ask for: A – Allergies M – Medications P – Past history L – Last Meal E – Events (details and mechanism of injury) Examine from head to toe: (look, listen, feel) Take measures to prevent hypothermia during this stage (warm blankets, etc) Examine head, skull and neck Reevaluate level of consciousness: GCS-score Assess and record pupil signs	Glasgow Coma Scale chart penlight otoscope ophthalmoscope

TRAINING	TREATMENT	EQUIPMENT
neck region - to look for eye-injuries before swollen lids prevent this (See Triptych B.03 Ophthalmic Injuries). - to be aware of potential airway problems with maxillofacial injuries (Triptych B.02.) - to assume cervical spine injury with injury above clavicle		Airway equipment cervical collars (different sizes) head-immobilization set
Upper limbs (See Triptych B.09. Limb Injuries) TEACH: -to look and feel for color, temperature, arterial pulsation, deformities, wounds compartment syndrome - neurological signs: movement, sensation, strength, reflex	Examine upper extremity Splint fractures Dress open wounds	splints compression dressings Compartment pressure measurement device
Chest (including back) (See Triptych B.05. Chest Injuries)) TEACH: - to reevaluate ventilation - to be aware of the potentially lethal injuries: pulmonary / myocardial contusion aortic disruption traumatic diaphragmatic rupture	Examine chest	Stethoscope

TRAINING	TREATMENT	EQUIPMENT
tracheobronchial / esophageal disruption		
<u>Abdomen</u>, <u>pelvis</u>, including back (See Triptych B.06. Abdominal Injuries): TEACH: -to be aware of the abdomen and pelvis as internal bleeding site - suspicion of intra-abdominal organ damage	Examine abdomen with high suspicion for trauma	
<u>Perineum, rectum, vagina:</u> (See Triptych B.07. Urogenital Injuries) Teach: - to perform rectal / vaginal examination - to look for scrotal haematomas, urethral bleeding - to feel for: sphincter pressure, high riding prostate, fractures and look for blood on finger (gloved)	Examine perineum, rectum, vagina	examination gloves
<u>Lower limbs</u> (See Triptych B.09. Limb Injuries).) TEACH: same items as Upper limbs	Examine lower extremity Splint fractures Dress open wounds	splints dressings
<u>Neurological examination</u> (See Triptych. B.04. Spinal Injuries) TEACH: - to look for loss of function motor and sensible	Perform thorough neurological examination	myotome / dermatome charts

TRAINING	TREATMENT	EQUIPMENT
- assessment sphincter function - to evaluate level of injury		
- not to forget examination of back - to perform log-roll - prevention of hypothermia (See Triptych. C.04.)	Perform log-roll once and examine whole back region at one time	
- "fingers and tubes in every orifice"	Consider inserting tubes if not already done (urinary and nasogastric tube)	
See relevant triptychs	Treat injuries according to relevant triptychs	
-to reevaluate ABCD's	If patients condition worsens go back to ABCD-protocol	

Training	Technique	Equipment
Same as in role 1 TEACH: to order, if diagnostic imaging avail: - standard trauma (high energy) series chest pelvis lateral cervical spine - additional, as indicated open mouth (odontoid) abdomen spine extremities - ultrasound abdomen TEACH: - use of x-ray facilities - basic X-ray interpretation - to consider other x-rays on indication - to consider ultrasound abdomen to detect bleeding	**ROLE 2** Performed by the x-ray technician F.A.S.T. ultrasound if available (Focused Abdominal Sonography for Trauma) Consider operation for stabilisation e.g. damage control surgery	X-ray apparatus and processor equipment supplies ultrasound machine

A03 RESUSCITATIVE PROCEDURES

PREAMBLE

In this chapter you will find the performance of the procedures described in A.02. Resuscitation in the Field.
It follows the ABCD-principle, so the procedures are not in an alphabetical order.
When working on patients contact with blood, sputum and other body juices is possible and this can lead to contamination.
Always protect yourself with gloves, mask, gown, goggles.

TRAINING	TECHNIQUE	EQUIPMENT

ROLE 1, 2 and or 3

A: Airway with cervical spine control Cervical spine control TEACH: - proper spinal immobilization techniques - inline traction by assistant (two hands) - how to measure for proper sizing of cervical collar - how to place collar and head straps	Fit properly sized cervical collar Head-immobilization: - place headstraps and head blocks or sandbags on both sides against the head - use tape to immobilize head in conjunction with straps and head blocks	Gloves, masks, goggles, gowns cervical collars (several sizes) head-immobilization set
AIRWAY MANAGEMENT TEACH: Airway management in patient immobilized in cervical collar and head restraint.	- arrange helper to perform in-line traction and restraint of head and neck - remove head straps and collar - helper uses hands alongside patients head to give in-line traction and immobilization until collar and head straps are back in place	
CHIN LIFT - a method to open mouth and make airway free with one hand (tongue and mandible are lifted making space in rear pharynx for air passage)	Chinlift: - lift chin with thumb and fingers (2 and 3) - gently place thumb on inside of lower lip (not behind teeth, you may get bitten!) and open mouth - inspect and clear mouth, throat	

TRAINING	TECHNIQUE	EQUIPMENT
	- remove false teeth - use suction apparatus if required - assess for clear airway	
JAW THRUST - two handed technique to clear airway - is painful, therefore can stimulate breathing - needs second person to inspect and clear mouth and throat	Jawthrust: - place finger 4 and 5 of both hands behind ramus of mandible - place fingers 2 and 3 and thumbs around corpus of mandible and on face - push forward and upward to open mouth and bring tongue forward	
INSPECTION - looking for and removal of foreign objects - danger of false teeth	- inspect and clear mouth and throat - remove false teeth - use suction apparatus if indicated - assess clear airway	non-sterile gauze holders for false teeth
SUCTION - removal of foreign objects with suction apparatus	- free mouth and throat from debris and foreign objects	suction apparatus suction catheters (soft and rigid)
HEIMLICH-MANEUVER - indications and technique	Heimlich-maneuver: A. - kneel behind sitting patient - put arms around under thorax - use abrupt forceful upward thrurst at the pit of the stomach - air will be pressed out thorax and can push obstruction out of larynx B.	

TRAINING	TECHNIQUE	EQUIPMENT
OROPHARYNGEAL AIRWAY TEACH: - use to keep airway free - not to use in awake patient - proper size estimation	- put hands on each side of chest of lying patient - press sharply and hard (see above) Oropharyngeal airway insertion: - select proper size airway (place airway against face: correct size extends from corner of mouth to earlobe) - open mouth with chin lift - insert airway upside down (concavity is directed upwards) - slide airway in along roof of mouth toward soft palate - rotate airway 180^0 so concavity is downwards and lies over back of tongue - perform eventually jaw-thrust to slide airway over the last part in place with thumb	oropharyngeal airways (various sizes)
NASOPHARYNGEAL AIRWAY - use to keep airway free in awake patient - contra-indications: maxillofacial injury basal skull fracture	- make sure lips and tongue are not between teeth and tube - assess for air movement Nasopharyngeal airway insertion: - select proper size airway (see above) - lubricate airway with jelly or water (preferably lubricate nostril with jelly) - identify least obstructed nostril - insert tip of airway into nostril directed 30^0 downwards and in the direction of the upper lip - gently pass the airway forward with a slight rotating motion - slide forward till the flange rests against the nose	nasopharyngeal airways (various sizes) endotracheal tubes7 mm lubricant jelly

TRAINING	TECHNIQUE	EQUIPMENT
3/4 PRONE POSITION TEACH: - indication (airway maintenance if no suspicion of cervical injury) - contra-indications	- assess for air movement make naso-pharyngeal airway from endotracheal tube no.7 : - measure (corner of mouth to earlobe) - take connector out -shorten tube on proximal side -put connector back on proximal side of shortened tube (push firm) - or put safety pin through tube on proximal side, to prevent tube disappearing in the nose	
OXYGEN ADMINISTRATION TEACH: - indications - different methods	3/4 prone position: - kneel beside patient - put arm of patient next to you alongside body - take other arm and put along contralateral side of face -take patient by pelvis and arm near head - roll patient over to your side - put palm of hand under face - flex upper knee and put it over extended leg until it reaches the ground - leave underlying arm free behind body on the ground - assess for clear airway -gently move head and neck to get free airway	Oxygen cylinders with pressure- and flow-meter oxygen masks, tubing non-rebreathing self-inflating bag masks (different sizes) bag-connectors

TRAINING	TECHNIQUE	EQUIPMENT
OROTRACHEAL INTUBATION TEACH: - indications - complications: -laryngoscope-failure (empty batteries, etc) -oesophageal intubation -right mainstem bronchus intubation -vomiting → aspiration -airway trauma→bleeding → aspiration -injury to teeth, -dislocation of mandible -inability to intubate -aggravation of cervical injury - to prepare equipment in advance -laryngoscope functioning -reserve laryngoscope -no air-leakage of cuff -suction ready and working -Magill forceps, malleable stylet nearby -air-syringe ready - tube-size in man 8 - 9 (internal diameter in mm), in women 7 – 8 - in orotracheal intubation: malleable tube stylet gives the endotracheal tube rigidity and form: tube is easier to manoeuvre to the larynx	Oxygen delivery: - place oxygenmask on patient face - open flowmeter, - deliver 12 liter/minute through endotracheal tube: - attach oxygenbag on self-insufflating non-rebreathing balloon - attach tubing (oxygencylinder to balloon) - open flowmeter, deliver 12 lt./min - attach balloon with swivel on tube - ventilate if necessary Orotracheal intubation: - check and prepare equipment in advance - prepare tube with malleable stylet and syringe filled with air attached to cuff port procedure: - remove false teeth (if not already done) - pre-oxygenate patient for 3- 5 minutes with 100 % oxygen by bag and mask - let helper perform cricoid pressure until tube is cuffed in place - if familiar use medication - hold laryngoscope in left hand - open mouth with right hand - bring scope in on the right side - move the tongue to the left - move backward over tongue towards the	Suction apparatus catheters (rigid, soft) holders for false teeth Intubation set: laryngoscope (complete, including spare batteries and bulbs and various sized blades)) malleable endotracheal tube stylet Magill forceps endotracheal tubes with cuff (different sizes) cuff clamp (old system tubes) (air) syringes CO_2-detecting device (Intubation medication See tryptich A.7. Anaesthesia in the Field) adhesive tape, cotton tape stethoscope

TRAINING	TECHNIQUE	EQUIPMENT
- if there is absolutely no suspicion of cervical injury, the head can be placed on a 10 cm high pillow and be put in sniffing position (neck extension) This position will facilitate intubation -If there is suspicion of cervical trauma, than the head and neck will be immobilized by in-line traction and intubation will be more difficult - orotracheal intubation in an awake patient is not easy to perform - usually it is done under sedation and relaxation, but only by physicians familiar with these form of medications (i.e. Rapid Sequence Intubation) - cricoid pressure is performed to prevent stomach-reflux leading to possible aspiration - how to perform cricoid pressure - normal laryngoscope is built to keep in left hand and to keep the tongue on the left side of the blade - care should be taken not to catch lip between blade and teeth - the laryngoscope should never be tilted backwards because the upper teeth will easily be damaged - the result of tilting is impaired vision of the trachea - the handle should be lifted in the direction of the longitudinal axis of the handle (right angles	midline until the epiglottis is seen - slide blade into correct position - pull the handle upward at a right angle to the blade to expose the larynx and visualize the vocal cords - bring the tube (with malleable stylet) between the vocal cords (- helper removes stylet, as tube is passed through vocal cords) - stop as cuff has passed vocal cords - hold tube in position (fingers on tube in corner of the mouth) - inflate cuff with air, remove syringe - attach self-inflating bag - ventilate patient - auscultate left and right lung near axillae for even breath sounds if properly situated - tape tube or use cotton tape to fix tube in the corner of the mouth - helper can stop cricoid pressure - assess adequacy of ventilation Cricoid pressure: - place the thumb at one and fingers 2 and 3 on the other side of the larynx on the level of the cricoid - press firmly downwards (the esophaguslumen will be pressed against the corpus of the cervical column)	

TRAINING	TECHNIQUE	EQUIPMENT
to blade) - if performed correctly no structure will be damaged and normally gives maximum vision on the trachea - difference between curved and straight blade - curved blade is normally used, straight blade is seldom used - intubating with curved blade: put blade under vallecula, between base of tongue and epiglottis, then pull handle upward to visualize the vocal cords - intubating with straight blade: put blade over vallecula on edge of epiglottis, pull handle upward to visualize the vocal cords - confirm correct position of tube in trachea by chest-auscultation, left and right near the axillae and stomach auscultation - breath sounds should be the same on both sides, - if right side stronger→ right mainstem bronchus intubation. Slowly withdraw tube till breath sounds are heard equally on both sides - if no sound heard: oesophageal intubation? -→ auscultate stomach. If positive: remove tube! - tube is in optimal position, if: .experienced physician saw it pass the cords .by pressing on the thorax, (when listening above the tube) escaping air can be heard and		

TRAINING	TECHNIQUE	EQUIPMENT
felt .there are chest-excursions on ventilation .a CO_2 detector indicates CO_2 .pulse-oximeter keeps giving good value - if tube is in optimal position, keep it fixed in the corner of the mouth with the fingers, until fixed with tape or cotton ties - auscultation not always reliable: .background noise .lung-pathology (trauma) NASOTRACHEAL INTUBATION TEACH: - nasotracheal intubation can be carried out on a spontaneous breathing patient (awake or unconscious) through blind insertion guided by breath sounds - performer must be confident with this method Indications: - where orotracheal intubation is expected to be difficult, as in: .trismus (closed head injury with seizures, tetany, decerebrate rigidity) .difficult laryngoscopy - nasotracheal intubation can also be carried out under direct visualization (as with oral intubation) Complications: - see orotracheal intubation - epistaxis	Nasotracheal intubation: Preparation: - prepare equipment in advance - test tube cuff for leakage - lubricate tube with jelly - spray both nasal passages with a topical anesthetic and vasoconstrictor if patient is awake - spray only vasoconstrictor if patient is unconscious - choose nasal passage with best patency - ensure that adequate ventilation is in progress - cervical collar is left in place - head straps are removed - helper maintains manual immobilization of head and neck - second helper performs cricoid pressure until tube is in place and cuffed	(Oxygen delivery set suction apparatus catheters (rigid, soft) holders for false teeth Intubation set: laryngoscope (complete, including spare batteries and bulbs and various sized blades)) malleable endotracheal tube stylet Magill forceps endotracheal tubes with cuff (different sizes) cuff clamp (old system tubes) (air) syringes CO_2-detecting device (Intubation medication See tryptich A.7. Anaesthesia in the Field) adhesive tape, cotton tape stethoscope) vasoconstrictor spray jelly lubricant topical anesthetic spray (lidocain 10%)

TRAINING	TECHNIQUE	EQUIPMENT
- perforation and dissection of posterior pharyngeal wall TEACH: - anatomy of nose, near entrance is the large inferior turbinate, a structure to avoid - use of vasoconstrictor to constrict the mucosa, to prevent bleeding - internal diameter of tube for nasotracheal intubation is generally 1 mm less than used by oral route (man 7 - 8, women 6 - 7) - in nasotracheal intubation malleable stylet can not be used. Instead Magill forceps are used to bring tube to larynx entrance. (be cautious of damaging the cuff)	Technique: - remove false teeth (if not already done) - pre-oxygenate patient for 3- 5 minutes with 100 % oxygen with bag and mask - insert tube upwards into nostril for a short distance (to avoid large inferior turbinate), or over a short distance with the bevel towards the septum - then back and downwards (tube curve follows nasal curve) - guide the tube slowly but firmly through the nasal passage into naso-pharynx - feel the release as the tube enters the pharynx - ventilate tube to expel foreign material so as not to obstruct the bronchus later on) - occlude other naris - listen to the breath sounds at proximal tube-end - advance tube toward the glottis, and when sounds are maximal insert the tube into the trachea during inspiration phase - when properly placed feel for expired air at the proximal end of the tube - confim placement and fix tube as with oral intubation. If placement is unsuccessful, - repeat procedure by applying gentle pressure on the thyroid cartilage - remember to oxygenate the patient in between attempts.	

TRAINING	TECHNIQUE	EQUIPMENT
	Nasotracheal intubation under direct visualization: - prepare the same way - consider medication ìf familiar with it - technique follows same remarks until tube is in the pharynx and cleared - open mouth and introduce laryngoscope the same way as with oral intubation, when glottis and vocal cords are visualized - insert tube, till cuff has passed vocal cords - use Magill forceps to bring tube in trachea (be cautious not to damage the cuff)	
CRICOTHYROIDOTOMY (CONIOTOMY): TEACH: - to identify cricothyroid membrane with tip of finger between cricoid and thyroid cartilage - in the cricothyroid area the trachea lies only a few mm under the skin and the membrane	- handle the same as with oral intubation from this point	disinfectant swabs iv cannulae over needle (12-14 Gauge) 5 ml syringe Oxygen jet-ventilation tubing: syringe-house 2ml tubing (with changing diameter every extending meter)
NEEDLE-CRICOTHYROIDOTOMY: TEACH: - indication - is immediate method to win time ìf oxygen jet-ventilation set is ready to use		adhesive tape
- will save life but will only give adequate PaO_2 for 30 - 45 minutes - no CO_2 exchange - to make oxygen jet-ventilation tubing: - dangers:	Needle-cricothyroidotomy: Assemble oxygen jet-ventilation set: - fit tubing in barrel of 2 ml syringe, -make fingertip hole just above syringe	

TRAINING	TECHNIQUE	EQUIPMENT
high pressure lung-trauma	barrel,	
asphyxia	- fit other end of tubing on oxygen-cylinder,	
aspiration	- fit syringe to IV cannula	
esophageal perforation,		
hematoma	- place patient supine	
subcutaneous or mediastinial emphysema	- cleanse skin of the neck with disinfectant	
	- take wide-bore iv needle with syringe attached	
	- palpate cricothyroid membrane	
	- direct needle 45^0 caudally in midline	
	- puncture skin while drawing air in midline over the membrane	
	- advance needle through membrane until aspiration of air indicates entry into trachea	disinfectant swabs
	- position needle as much as possible in same plane, as trachea, horizontal and longitudinal,	local anesthetic (lidocain 1 -2%) syringes, needles scalpel and blades (10, 11)
	- advance a few mm, to be sure cannula is in the trachea as well	hemostats spreader
	- keep needle steady	endotracheal cuffed tubes no 5, 6
SURGICAL CRICOTHYROIDOTOMY:	- advance cannula over the needle in the trachea	tracheostomy tubes
TEACH:	- withdraw needle and syringe	sutures, needles, needle-holder
- indications	- secure cannula to the neck	dressings
	- connect jet-ventilation set	adhesive tape, cotton ties
- complications	- open oxygen flow-meter	
see needle-crycothyroidotomy	- ventilate oxygen by occluding hole in tubing with finger one second and releasing four seconds	suction apparatus catheters (soft)
subglottic laryngeal stenosis		
laceration of trachea		
creation of a false passage into the tissues		
- disadvantages of commercial	Surgical cricothyroidotomy:	

TRAINING	TECHNIQUE	EQUIPMENT
cricothyroidotomy sets: no cuff, which means danger of aspirationn small internal diameter 4 -5 mm	- place patient supine - cleanse skin of the neck - infiltrate local anesthetic alongside trachea on both sides - palpate cricothyroid membrane - put two fingers alongside membrane - incise skin transversely over membrane - incise membrane - turn and insert scalpel handle - rotate 90^0 to open the airway - insert 6 mm tube or special tracheostomy tube in distal direction of trachea, until cuff has passed - inflate cuff - test position as for intubation - secure tube to neck - assess ventilation	
NEEDLE-THORACOCENTESIS For tension pneumothorax TEACH: - to locate second intercostal space - danger of puncturing subclavian artery in first intercostal space - after puncturing a tension-pneumothorax there is still a pneumothorax (without tension)!	- identify second intercostal space in midclavicular line on the side of the tension pneumothorax - cleanse chest skin locally - infiltrate local anesthetic (lidocain 1-2%) if time permits!!	cleansing swabs disinfectant local anesthetic (lidocain 1- 2%) syringes, needles 12 - 14 G iv catheter needles adhesive tape

TRAINING	TECHNIQUE	EQUIPMENT
	- puncture with a wide bore iv catheter through the skin just over the third rib into the second intercostal space hear the air escape - leave the canula in situ, take needle out - fix canula with adhesive tape - prepare for chest tube insertion	

TUBE DRAINAGE OF CHEST TEACH: - to locate fifth intercostal space midaxillary line - seen from the sternum, ribs curve up to the axillair line -lower puncture means easier abdominal outcome - artery and nerves are located under the rib - Heimlich valve will easily obstruct if bloods flows through - alternatives for Heimlich valve: urine container with inletvalve torn finger of glove, fixed on tube - underwater-seal apparatus	- locate insertion site: 4th of 5th intercostal space Just anterior of the midaxillary line left or right or both - cleanse skin - infiltrate local anesthetic - incise skin 3-4 cm over the lower rib of the intercostal space - dissect bluntly just over the top of the rib through the subcutaneous tissue - puncture the pleura, spread the intercostal muscles - feel with a gloved finger through the incision into the pleura to clear any adhesions -put proximal end of chest drain in clamp - bring in through incision, direct tube posteriorly and towards apex of pleural space - look for fogging on expiration	surgical drapes, garb (gloves, gowns, etc) cleanse swabs disinfectant local anesthetic (lidocain 1 -2%) needles, syringes scalpel, blades, heavy curved scissors dissecting scissors chest catheter #36 - 40 French catheter-clamp sutures, suture-handle Heimlich valve urine-containers with inletvalve adhesive tape dressings underwater-seal apparatus (gloves)

TRAINING	TECHNIQUE	EQUIPMENT
	- connect end to one-way valve: 1. Heimlich-valve 2. underwater-seal apparatus 3. collecting bag with inletvalve (cut away corner above to let air out) 4. torn finger of glove - suture the tube in place - or put tape around tube and suture tape to skin - close skin - apply dressing	
C: Circulation and Control of haemorrhage TEACH: - EXTERNAL HEMORRHAGE CONTROL - (pressure) dressing - arterial pressure points - IN LINE TRACTION AND IMMOBILIZATION if associated fracture with abnormal position - use of LIGATION, HEMOSTATS - use of TOURNIQUET - is last means to control bleeding when operational situation requires or manpower cannot be spared to apply pressure	External haemorrhage: - apply direct pressure on bleeding site - dress it - elevate wounded site above heart level - apply arterial pressure (special points) - apply pressure dressing if associated fracture with abnormal position: - in-line traction and immobilization (splint) Ongoing bleeding and vessel visible: - ligation or clamp on bleeding vessel remember: not in the blind in a wound! After these measures ongoing bleeding:	sterile dressings material for pressure dressing splints slings ligation, haemostats

TRAINING	TECHNIQUE	EQUIPMENT
- leads to loss of tissue distally - only to apply if all other methods have failed - to apply just above uncontrollable bleeding: to save healthy tissue and joint - to mark head with "T" and application time - to control necessity of tourniquet	apply tourniquet : - put two slings just above the wound-dressing - make reef knot in sling just above wound - apply tourniquet-handle on this knot (wood, cabin of thorax trocar-drain or anything alike) - apply another reef knot above - turn tourniquet till bleeding stops - fix tourniquet handle with other sling	tourniquets and slings
	- mark forehead of casualty with "T" and time of application	skin-marker
	try to avoid losing the limb: check if bleeding is ongoing by releasing some pressure of tourniquet every 10 minutes	
	if bleeding has stopped: replace tourniquet by pressure dressing if ongoing bleeding: tourniquet on and transport to surgical facility as fast as possible	
- ORIENTATION BLOODPRESSURE from pulse: if radial artery palpable: RR > 80 mm Hg if femoral ,, ,, RR > 70 mm Hg if carotid ,, ,, RR > 40 mm Hg - this is a rough guideline to measure the blood pressure	mark forehead with "T" and time of application start palpating radial artery: if present, RR > 80 mm Hg. If not palpable, palpate femoral artery: if present, RR > 60 - 70 mm Hg. If not palpable, palpate carotid artery: if present, RR > 40 mm Hg. If not present no circulation: resuscitate	
- to prepare infusion set - to use warm solutions	Prepare infusion set: - make infusion set ready from container	crystalloid infusing bags plasma-expanders

TRAINING	TECHNIQUE	EQUIPMENT
	crystalloid-solution and infusion tubing	infusion-tubing with drip-chamber
- IV NEEDLE INSERTION - to keep skin tight distally from vein to prevent "rolling" veins - iv cannula is shorter then needle (therefore blood (flow) in needle-house does not mean cannula has entered vein!) - insert cannula down the vein over the (fixed!) needle (as firm guide)	- dispel the air from the tubing under the drip-chamber Iv needle insertion: - look for peripheral vein on underarm or dorsal side of hand - apply venous tourniquet - feel for pulsating radial artery (if not, no venous filling) - keep arm below heart level - clean site of puncture with disinfectant - keep skin tight distally from vein with one hand - puncture through the skin the vein with iv (cannula) needle in other hand	infusion-warmer apparatus microwave venous tourniquet cleanse swabs disinfectant iv cannula needles (different sizes) adhesive dressings adhesive tape
- taking blood samples for laboratories. (casualty doesn't need another venapuncture)	as blood flows into needle-house: - align needle in all directions with the vessel (the needle will stay inside the vessel, and not puncture the opposite side with following manoeuvre) - proceed a few mm's (to be sure the cannula is in the vein) - carefully push the cannula over the needle (keep the needle fixed!) into the vein - withdraw the needle	
- setting up crystalloid infusion sets	- take blood samples for laboratories	laboratory tubes patient stickers
	- attach infusion set (warmed crystalloids)	

TRAINING	TECHNIQUE	EQUIPMENT
- VENOUS CUTDOWN: - may be required for resuscitation if iv needle insertion fails - when, where and how to perform	- fix cannula on skin with adhesive dressing and tape - make sling on skin with infusion-tubing and fix to prevent early disengaging	
Anatomy: - 1 - 2 cm anterior and medial to the medial malleolus at the ankle - in the fossa cubiti: here are 3 veins located from medial to lateral	Venous cut down - cleanse skin over chosen vein with disinfectant - infiltrate with local anaesthetic - incise skin transversely over the vein	skin cleansing swabs disinfectant local anaesthetic (lidocain 1-2 %) syringes, needles iv cannulae (needles)
	- dissect bluntly with pointed scissors or haemostats, until vein is identified - isolate it from surrounding structures (nerves and tissue) - ligate the vein distally with a suture and leave the suture-ends long to be used as a tractor - pass a ligature (suture) proximally under the vein - apply gentle traction to place the vein between the ligatures on tension - make a small transverse venotomy between the ligatures - insert an iv (needle) cannula through the venotomy in proximal direction into the vein - release eventually tension on proximal ligature to achieve this - tie proximal ligature around cannula and vein to prevent dislodging and bleeding	scalpel, small blades sharp pointed scissors haemostats (small) fine tissue forceps absorbable sutures skin sutures, needle needle holder dressing adhesive tape infusion drip set and tubing
- BONE NEEDLE - indications, complications - insertion-place: long bones, like uninjured tibia: anterior-medial surface, proximal, below the tubercle	- attach running iv infusion-set - close incision with sutures - apply sterile dressing - fix tubing to the skin with adhesive tape and eventually extra dressings.	skin cleansing swabs disinfectant local anaesthetic (lidocain 1-2 %) syringes, needles

TRAINING	TECHNIQUE	EQUIPMENT
	Bone needle insertion: - cleanse skin over chosen tibia: anterior-medial, proximal, under tubercle, with disinfectant - infiltrate local anaesthetic - screw bone needle through skin and the bone into the marrow	bone needles dressing adhesive tape infusion drip set and tubing
- PERICARDIOCENTESIS TEACH: - indication -to diagnose cardiac tamponnade non responding shock - Beck's triad: low bloodpressure, tachycardia, muffled heart-sounds distended neck-veins - performance - complications puncture of lung, aorta, oesophagus, peritoneum, inferior cava vein heart-rhythm disturbances aspiration ventricle blood laceration myocardium, epicardium, coronary artery or vein	- remove the stylet - aspirate bone marrow or inject saline if this runs easily the needle is in place - attach infusion set - fix needle with adhesive tape - apply sterile dressing Pericardiocentesis: - cleanse skin in xiphoid and subxiphoid region with disinfectant - infiltrate with local anaesthetic (if time permits) - puncture the skin 1 - 2 cm inferior to the left side of the xiphochondral junction with a 15 cm long (16 or 18 gauge) cannula over needle, with a three-way stopcock and syringe attached - direct the needle in a 45^0 angle to the skin	skin cleansing swabs disinfectant local anaesthetic (lidocain 1-2 %) syringes, needles cannula on catheter, 15 cm long, 16 - 18 gauge three-way stopcock sutures, needle, needle holder adhesive tape dressing
- CENTRAL VENOUS LINE INSERTION TEACH: - for massive iv infusion short wide-bore peripheral iv cannulae are to be used (Poiseuille's law) - only physician with experience should perform central line insertion	- and advance in the direction of the tip of the left scapula to enter the pericardial sac - aspirate as much non-clotted blood as possible - after aspiration, close the stopcock - and remove the syringe - secure the catheter in place, tape or suture - apply adhesive dressing	skin cleansing swabs disinfectant

TRAINING	TECHNIQUE	EQUIPMENT
- anatomy of accessible central veins: internal jugular subclavian femoral - indications: measurement central venous pressure (i.e. neurogenic shock) no accessible peripheral vein, no venous cut down possible, no bone needle possible long term intravenous fluid therapy (role 3 and higher) - it is preferable to have a peripheral venous infusion functioning before trying to insert a central line (!!). - contra-indications: absolute: no indication not familiar with the procedure extensive thrombosis of central veins relative: severe respiratory distress on opposite side haematoma in neck, groin central vein-injury planned surgery spot contamination source close to catheter-side non-cooperative patient - control possibility with x-ray	Central venous line insertion: as this should be done by experienced physicians and there are many ways to achieve the goal, only remarks will be made around the procedures if casualty is conscious, in order to lessen anxiety explain the procedure, prior to insertion if anxiety remains, give sedative instruct the Valsalva manoeuvre (jugular, subclavian puncture) before the preparation and draping - cleanse the surrounding skin widely with disinfectant - work aseptically with sterile draping, gloves, etc - place patient in Trendelenburg position for jugular and subclavian puncture - and turn the head away - pull arm downwards (alongside the body) on puncture side for subclavian puncture - infiltrate with local anaesthetic	local anaesthetic (lidocain 1-2 %) syringes, needles sedatives sterile draping, gloves, gowns sterile saline solution small lancet central venous line sterile set: puncture needle canula over needle, puncture needle guide wire (J-type) introducer syringes central venous catheter (1 - more outlets) sutures, needle, needle holder dressing adhesive tape infusion drip set and tubing

TRAINING	TECHNIQUE	EQUIPMENT
- complications and relevant symptoms of jugular and subclavian insertion: pneumothorax, haemothorax, hydrothorax arterial puncture, air embolism myocard laceration, infection and sepsis - complication and relevant attention points of femoral vein insertion: injury of femoral artery thrombosis of the vein - the right femoral vein is preferable because it is shorter and closer to the vena cava - to use only soft catheters, because rigid ones may easily cause thrombosis - malpositioning in internal iliac vein and ascending lumbar vein - performance - an experienced physician uses own technique - never use force - avoid losing guide wire in vein - once needle has withdrawn (using cannula over needle technique), don't push needle in again through the cannula, this may transect the cannula, causing it to embolize - attendance to central lines: - to renew dressing and disinfect puncture site		

TRAINING	TECHNIQUE	EQUIPMENT
at least every 2 days - to remove catheter at first sign of catheter-related sepsis		
-BLADDER CATHETERIZATION -TEACH: - indications - contraindication: signs of urethral injury: blood at the urinary meatus scrotal haematoma high riding prostate - risk of infection - to do the procedure clean and sterile - use enough lubricant - control position of catheter in bladder - if suspicion catheter is in the bladder but no urine flow, press on bladder area to squeeze urine out		Urinary catheterization set: antiseptic solution sterile lubricants gauze's local anaesthetic urinary catheters collecting bags sterile saline syringes pincer
	Bladder catheterization: - look for signs of urethral injury: - inspect area - perform rectal examination - put on sterile gloves - take penis in one hand - slide back preputium	
- GASTRIC TUBE INSERTION TEACH: -indications therapeutic: decompress stomach diagnostic: presence of blood - contraindications maxillofacial injuries	- clean glans with chlorhexidine 0.5%, repeat - apply local anesthesia gel and or sterile lubricant in urethra and alongside catheter - keep penis strengthened and slide catheter in with pincer - don't press to hard (fausse route !!) - if catheter in bladder→ urine flow	gastric tubes 16 – 20 gauge lubricant jelly collecting bags adhesive tape 50 ml syringe stethoscope

TRAINING	TECHNIQUE	EQUIPMENT
base skull fracture - measure length of tube and mark - awake patient must cooperate - when patient swallows, epiglottis will close trachea entrance - gastric tube can be put in through the mouth as well (in case of contraindication for nasal route) - check position - danger of positioning in trachea	- inject 10 ml NaCl 0.9% in balloon connector - attach urine collecting bag - slide back preputium gastric tube insertion: - measure length needed of gastric tube (mouth – ear – stomach region) and mark tube - lubricate tube - put on gloves (non steril) awake patient: -put tube through the nose in the pharynx - ask patient to swallow - every time the patient swallows push tube deeper - stop when measured length has been reached (tube should be in stomach) - keep distal part of tube under stomach level - test positioning comatose patient: same procedure until tube in pharynx don’t use force, tube should slide easily in to get into the oesophagus three ways to perform: - 1. make turning movement around longitudinal axis of tube, while protruding forward - 2. let helper perform a jawthrust to get space in the pharynx - 3. slide tube forward while blowing through and turning around longitudinal axis	(laryngoscope Magill forceps)

TRAINING	TECHNIQUE	EQUIPMENT
	if not successfull: - 1. use laryngoscope and work under vision slide tube in with Magill forceps - 2. (if patient can't bite) put finger two and three in over tongue in the throat and try to guide the tube downward control position: look for mark on tube near nose entrance auscultate stomach area while injecting air in tube fix tube with adhesive tape on skin connect collecting bag	

A.04 VENTILATORY SUPPORT

PREAMBLE

Acute respiratory failure is a vital threat to every casualty and requires immediate emergency medical intervention. Potentially, airway obstruction, hypoventilation and ARDS are frequent causes of death in the field. Due to short toleration-time of apnoea/hypoxaemia –five minutes maximum survival time- any action to secure a sufficient gas exchange is of vital importance and has priority to other treatment. Airway management is crucial in casualty care at all roles/echelons because even the most sufficient surgical treatment will be futile in a hypoxic patient. Ventilatory support and assistance to provide free airway may be needed at all levels of treatment and can be achieved at all roles/echelons with none or only minimal equipment with only basic training in emergency and intensive care medicine, simply by manual manoeuvres. If needed, immediate assistance should be followed by a chain of treatment which comprises insertion of oro- or naso-pharyngeal tubes or endo-tracheal intubation with a cuffed tube[1]. Cricothyreotomy remains the ultimate action taken when free airways cannot be maintained otherwise, and should be performed by specially trained people only. In case of respiratory insufficiency or arrest, oxygen should be offered as soon as possible, and mouth-to-mouth ventilation should be replaced as soon as possible with controlled ventilation by bag and mask or endotracheal, (mechanical ventilator if available).
There have lately been developed light weight field-ventilators that meet with most demands for immediate airway-breathing management in the acute treatment. In the future, High Frequency Jet Ventilation(HFJV) might become a useful alternative to patient ventilation. The patients are ventilated through a large bore canula (e.g. i.v. canula 2.0 mm) by a special injector with a high flow of oxygen and a frequency between 120 and 400 per minute. This may buy valuable time in emergencies but has also more specialised indications at Role 3 and 4.
Training , treatment and equipment described for Role 1 are the basis for the other Roles/Echelones of casualty care. I n a mass casualty situation there will be a conflict of interest whereas to do the triage or to attend some patients with acute ventilatory insufficiency. As a general rule, triage has priority. However, if situation permits that one or two patients are given special attendance, there is no real limit as to how serious respiratory failures can be handled, also at the site of the incident. This mostly depends on skills of the personnel and the equipment at their disposal. Since Peace Support Operations have dominated NATO activity lately, the expectations with regard to airway management and ventilatory support equals those of the civilian society. Also in Article 5 scenarios there are differences between the NATO members with regard to equipment and qualifications especially at Role 1 and 2.Unless in scenarios with mass-casualty situations, when triage prohibits attendance to the most hopeless cases, there is no real difference as to the emergency procedures needed to be commanded at the different Roles. Airway, Breathing and Circulation is always the valid approach. Slowly developing problems like ARDS (as seen frequently with multi-

[1] Laryngeal mask is not included here. It has certain advantages, but also some downsides which makes it a less suitable instrument for field emergencies. It has gained high popularity and may be a valuable backup for difficult situations. It has, however, been associated with mishaps due to gastric air-trapping and should only be used in the hands of experienced personnel.

traumaticed patients or severe burns) should, as a rule, be definitively dealt with at Role 4. Role 3 may be prepared for these patients, but normally they consume too much resources for a field hospital.

This triptych unavoidably touches many topics also covered in other triptychs, especially, A.02 and A.03). the reader is recommended to consult these for details otherwise missing in this triptych.

List of abbreviations:

ARDS: Adult Respiratory Distress Syndrom	MV : Minute Volume
ASB : Assisted Spontaneous Breathing	$PaCO_2$: Arterial Carbon dioxide Tension
CO_2 : Carbon Dioxide	PAW : Airway Pressure
FiO_2 : Fraction of inhaled Oxygen	PEEP : Positive End Expiratory Pressure
CPAP : Continuous Positive Airway Pressure	PPV : Positive Pressure Ventilation
HFJV: High Frequency Jet Ventilation	RR : Respiratory Rate
IPPB : Intermittent Positive Pressure Breathing	RTV : Respiratory Tidal Volume
IPPV : Intermittent Positive Pressure Ventilation	SIMV : Synchronised Intermittent Mandatory ventilation

TRAINING	TREATMENT	EQUIPMENT

ROLE 1

	Insertion of oro- or naso-tracheal tube	Endo-tracheal intubation set (endo-tracheal tubes, laryngoscope, syringe, Magill forceps
5) Cricothyreotomy, if feasible (see A.03)	Cricothyreotomy is the last option. Is dangerous in the hands of the unskilled!!!	Emergency Cricothyreotomy set
6) Indications for assisted/controled ventilation (cyanosis, dyspnoea) 7) Methods for artificial ventilation with and without technical equipment. a) NB: never insuflation mouth to mouth/mask/tube if any suspicion of inhalational injury from gas (chemical war-fare) or equivalent (pesticides, herbicides) 8) Assessment of effectiveness of ventilatory support (e.g. thoracic movement, auscultation of the lungs, change of skin condition, other signs like pupils, stabilisation of blood pressure) with and without technical equipment.	Oxygen therapy Artificial ventilation Mouth-to-mouth/nose Mouth to mask Bag to mask Bag to endo-tracheal tube(laryngeal mask Mechanical ventilator (IPPV)	 Face mask. Laryngeal mask Endo-tracheal tubes Self-expanding bag Field ventilator (preferably battery driven) Puls-oxymeter
9) Relief of tension pneumothorax	Insertion of chest cannulas. (Low potential risk)	Large bore canulas, simple one way valves Syringes and canulas.
10) For life threatening heamathothorax (Compression of mediastinum and blood-loss)	Insertion of chest tubes (high potential risk)	Chest tube sets, local anaesthetics (Lidocain 5 mg/ml), one way seals

TRAINING	TREATMENT	EQUIPMENT

ROLE 2

Review of assessment of respiratory and non-respiratory status as well as basic techniques (see Role I) Time frames/urgencies e.g.: Acute respiratory failure: minutes Tension Pneumothorax: hour(s) ARDS (in multi-trauma and burns): 1-2 days Cricothyreotomy (see: A.03) Assessment of ventilatory support by: Simple physical methods to control lung function Measurement of oxygen saturation Chest X-ray ECG interpretation Basic knowledge of pathophysiology and indications of	Continue basic airway management (See Role 1) Indications: Asphyctic patient and intubation and Esmarchs grip unsuccessful	) Basic equipment: a) Stethoscope, gloves suction apparatus b) Oro- pharyngeal tubes (naso-pharyngeal optional) c) Endo-tracheal intubation set d) Laryngeal masks (optional) e) Oxygen, face masks, self-expanding bag, PEEP valve f) Mechanical ventilator g) Pulsoximeter h) Chest-tube insertion set i) Drugs for intubation, respiratory and cardiovascular distress j) Syringes and canulas, infusion set Cricothyreotomi set. Pulsoximeter X-ray machine ECG
Failure of ventilation due to i) Pulmonary oedema (e.g. after	IPPV/CPAP and Oxygen	 Canulas, Chest tubes, Büllow drainage or one

TRAINING	TREATMENT	EQUIPMENT
neurotoxic exposition	IPPV/CPAP and Oxygen	way valves.
ii) Lung contusion	Chest-tube	Opioids
iii) Sever pneumo-haematothorax	IPPV and Oxygen	Longs acting Local anaesthetics
iv) Sever chest wall trauma (flail chest)	Pain teatment, Intravenuous or neural blockades	Oro-tracheal tubes Self-expanding bags/ventilator
v) Pain induced hypoventilation	Pain treatment NB Diagnosis	
vi) Sever intestinal trauma/ileus	Assisted vent/ IPPV	
vii) Paralysis of diaphragm	IPPV/PEEP	
viii) Neardrowning	IPPV/PEEP	
ix) Blast injury		
x) Cerebrospinal reasons:	Controlled vent	
(1) Apnoea	Assisted ventilation/Controlled vent.	
(2) Paralysis	Free airway/secure airway	
(3) Insufficient respiration due to unconsciousness with obstructed airway		
(4) Cerebral trauma with oedema (need for hyperventilation)	Hyperventilation	
b) Failure of perfusion		
c) Combined failures:		
i) Severe polytrauma ii) Lung contusion iii) Severe coagulopathy	Need higher level of care ASAP and NLT than 48 hours after being traumatised.	Intensive care ambulance transport system.
5) Weaning from ventilator (Patient should be transferred to Role 3/Role4	CPAP Patient-training Intermittent sighing of lungs by ventilation bag. Mobilisation of secretions	PEEP valve Simple mechanical ventilator
6) Principles of sorting casualties with ventilatory distress in mass casualty situations	Return to principle of individual therapy if permissible	
7) Basic knowledge of steps of ventilatory support, augmented by clinical	Artificial ventilation Short time ventilatory support,	

TRAINING	TREATMENT	EQUIPMENT
experience	mechanical artificial breathing For transport For short-time therapy O_2-insufflation IPPV-controlled breathing Desirable capacity Real capacity for controlled ventilation (IPPV) PEEP- by an additional valve Principles of monitoring: MV,TV,RR,PA O_2 concentration 21,5% (environmental air) 100% in toxic atmosphere	

TRAINING	TREATMENT	EQUIPMENT
ROLE 3		
1) Clinical assessment of the critically ill patients	Continuity of basic airway management	□ See Role II for basic qequipment
2) Respiratory, non respiratory and cardiovascular status		
4) Assessment of ventilatory support additionally by		Blood gas analyser
a) Blood gas analysis	Bronchoscopy	□ Fibre-optic bronchoscope (optional)
b) Airway assessment, diagnosis of foreign bodies	Therapy	
5) Knowledge of pathophysiology and indications of failures of ventilation and perfusion:	IPPV/PEEP Antibiotics, depending on micro biological evaluation	Simple mechanical ventilator
a) Post shock status	Infusion	
b) Status post mass transfusion	Special medication (e.g. vaso-active drugs)	Advanced ventilator with
c) Severe thoracic trauma		Volume control
d) sepsis		Pressure control
e) ARDS	Short term ventilatory support (see Role II)	Possibility to utilise environmental air
f) Multiple organ failure	Artificial breathing for long time ventilatory support (7 days or more)	IPPV, IPPB, PEEP, ASB, CPAP, IMV (Role 4) Integrated alarms for PAW. Apnoea
2) Methods and steps of short and long-time artificial ventilation -ARDS -Severe maxillofacial trauma with long time mouth closing fixation (not always necessary with tracheostomy)	Tracheostomy	Measurable parameters: MF, RR (See Role 2) Special respirator for HFJV[2]
3) Weaning from artificial ventilation	CPAP treatment	
4) Indications for HFJV:		

[2] The use of HFJV in field conditions requires experienced and continuously trained medical personnel. Up to now only few countries have introduced this method in their medical services. For an integration of HFJV in a current valid overall concept of ventilatory support for NATO medical services, the future development of HFJV has to be surveyed.

TRAINING	TREATMENT	EQUIPMENT
a) Enhancement of oxygenation when lower PAW is necessary or useful b) Intolerance of conventional ventilatory support c) ARDS d) Burn patients with inhalational injuries e) Patients with lung baro-trauma	Improved blood oxygenation and CO_2 elimination with lower flow of O_2 and lower PAW <and PEEP than in conventional ventilatory support via endo-tracheal tube Good haemodynamic tolerance Minimal risk of inducing baro trauma Increase of mobilisation of tracheal secretions Improvement of pulmonary drainage Resolving of pulmonary atelectasis Decrease of pulmonary infections	

Closing remarks:

Ventilatory support in the Field mostly exist as an integral part of intensive care at Role 2+/3 and sometimes also Role 2. It may also constitute a part of a well conceived EMS-system.

Remember: severe respiratory failure will mostly be accompanied by other severe medical problems like haemodynamical instability, hypovolaemia, nutritional problems, malfunction of different organs and a large number of surgical problems. The integration of ventilatory support in an overall concept of intensive care medicine, will demand well trained staff members, physicians as well as nurses and ambulance personnel to reduce the number of avoidable deaths at Role 2 and Role 3.

A.05 FLUID AND BLOOD MANAGEMENT IN TRAUMATIC SHOCK

PREAMBLE

We can distinguish two phases in traumatic shock: An early phase which prompts urgent reanimation of an acute hypovolaemia of haemorrhagic origin and a late phase developing to multiorganic failure. The purpose of early management in the field is to avoid subsequent multiorgan failure. The goal is **not** restoration of a normal blood pressure but rather the restoration of adequate circulation to the vital organs (essentially brain, heart and kidneys).

During war fighting, most cases of trauma will be penetrating and only a surgical procedure will be the definitive treatment. Rapid plasma volume expansion can therefore be dangerous and is unnecessary in the presence of central pulses. The time limit between the initial traumatism and the surgical approach must be as short as possible.

In the case of blunt trauma, the first phase of reanimation needs more attention because the diagnosis can require more time. Administration of IV fluid according to the protocols may be necessary during the examination.

Finally, it is necessary to pay attention to a third type of patient who also presents with a serious head injury and hypovolaemic shock. The loss of self-regulation of the cerebral blood flow and thus of the cerebral perfusion pressure may result in an increase in mortality. In this case, a compromise needs to be reached between fluid resuscitation in order to achieve an adequate cerebral perfusion pressure and avoidance of excessive fluid administration leading to dilution of clotting factors and ongoing haemorrhage.

TRAINING	TREATMENT	EQUIPMENT

ROLE 1

Teach: - The physical examination should always begin with an assessment of the airway and breathing. Once these have been evaluated and stabilized, the circulatory system should be evaluated looking for early signs and symptoms of shock. - Definition of shock and pathophysiology of traumatic shock. - The purpose of initial management is to prevent further injury, transport casualty to the appropriate Role as rapidly as possible, and initiate treatment. Casualties must have their cervical spines immobilised, if necessary, be extricated and be moved to a stretcher. First intervention revolves around immobilising the casualty (if required), adequate airway, ensuring ventilation and improving circulation. -Aggressive wound packing, especially on extremities. - The goals of fluid therapy are to restore an adequate circulating volume to perfuse vital organs and ensure oxygen delivery to tissues. - A blood pressure above 90 mmHg is sufficient (in case of cranial traumatism, above 100 mmHg), but we should not relay on systolic blood pressure as the main indicator for shock, as this will result in a delayed diagnosis. Compensatory mechanisms prevent a significant decrease in	Procedures for control of bleeding should be carried out if possible (e.g. wound packing) Rapid transport of casualties to the appropriate role remains the most important aspect of initial care. Definitive care of the traumatic shock usually requires surgical intervention. Any delay in definitive care, e.g., such as delayed transport to the appropriate role is potentially harmful. Most prehospital interventions involve immobilizing the patient, securing an adequate airway, ensuring ventilation, and maximizing circulation. Appropriate treatment usually can be initiated without delaying transport. Some procedures, such as starting intravenous (IV) lines, giving IV fluids or splinting of extremities, can be performed while a patient is being extricated (spinal immobilisation is not necessary for casualties with penetrating trauma unless they have been involved in a blast). 1. ESTABLISH PATENT AIRWAYS. - Consider ventilatory support if needed (see relevant triptych). 2. CONTROL OF BLEEDING Control of external haemorrhage (control of blood loss is essential and has to be obtained before	Stethoscope, gloves, suction apparatus. Oxygen supply and administration kits (facial masks). Ventilatory-bags. If ventilatory support: see relevant triptych. Syringes and large-gauge needles. Skin cleansing swabs. Material for venous cut-down (see B.02.and B.13). IV infusion sets. IV crystalloid/colloid solutions. Dressings, bandages, haemostat, ligatures. Blankets and aluminium sheets. Sphygmomanometer. Material for urinary catheterization. Cleansing fluids, lubricants. Urinary catheters and urine collecting bags.

TRAINING	TREATMENT	EQUIPMENT
systolic BP until the patient has lost 30% of the blood volume. More attention should be paid to the pulse, respiratory rate, and skin perfusion (capillary refill time). Treatment should be directed by response to therapy, and not by classification. NB: Normalisation of blood pressure often restarts bleeding. The “Clot Pop Off Pressure” seems to be 80mm Hg systolic. <u>Staging shock</u> : 1) Clinical assessment of shock will be carried out using the following parameters, in accordance with the following staging : Pulse (quality, rate, regularity). Skin colour Core temperature Capillary refill time on forehead or sternum (normal < 2 seconds after pressing for 5 seconds) Blood pressure (if unable to feel pulse, systolic BP is probably less than 80 mmHg for radial, 70 mmHg for femoral and 60 mmHg for carotid pulse). Glasgow Coma Score Trauma Score Estimation of blood losses: See Table I at the end of the triptych . - In the patient with trauma, haemorrhage usually is the presumed cause of shock. However, it must be distinguished from other causes of shock. These include cardiac	anything else). Remove tourniquet if present after application of haemostatic dressing or a pressure dressing. Splinting of fractures minimizes further neurovascular injury and blood loss. 3. FLUID: IV therapy through large bore cannulae (18+ Gauge)., but only if BP is low and consciousness is impaired. Give aliquots of 250ml IV fluid STAT and monitor the response. There is no significant difference between crystalloids or colloids therefore local policy should determine which is given. NB be aware of other mechanisms that impair the sensorium (e.g. head trauma and Carbon monoxide intoxication) 4. . KEEP THE CASUALTY WARM: Use of Blankets ROLE 2 and 3 1. ESTABLISH PATENT AIRWAYS. Supplemental oxygen should be administered and ventilatory support should be given, if needed. In case of head injury, avoid SpO2 < 95%. 2. FLUID RESUSCITATION Establish large bore IV access (two peripheral lines). If central lines are obtained, a large-bore single-lumen catheter should be used. The most important factor in determining the route of	Pulse-oximeter. Lab test (if available on this role): CBC, electrolyte levels (e.g. Na, K, Cl, HCO_3, BUN, creatinine, glucose levels), prothrombin time, activated partial thromboplastin time, ABGs, and urinalysis (in patients with trauma). Blood should be typed and cross-matched.

TRAINING	TREATMENT	EQUIPMENT
tamponade (muffled heart tones, distended neck veins), tension pneumothorax (deviated trachea, unilaterally decreased breath sounds), and spinal cord injury (warm skin, lack of expected tachycardia, neurological deficits). The 4 areas in which life-threatening haemorrhage can occur are as follows: chest, abdomen, thighs, and outside the body. 1. The chest should be auscultated for decreased breath sounds, because life-threatening haemorrhage can occur from myocardial, vessel, or lung laceration. 2. The abdomen should be examined for tenderness or distension, which may indicate intraabdominal injury. 3. The thighs should be checked for deformities or enlargement (signs of femoral fracture and bleeding into the thigh). 4. The patient's entire body should then be checked for other external bleeding. Lab Tests: - After the history is taken and the physical examination is performed, further workup depends on the probable cause of the hypovolaemia, as well as on the stability of the patient's condition. - Initial laboratory studies should include analysis of the CBC, electrolyte levels (e.g. Na, K, Cl, HCO_3, BUN, creatinine, glucose levels), prothrombin time, activated partial thromboplastin time, ABGs, and urinalysis (in patients with trauma). Blood should be typed and cross-matched. Imaging Studies:	access is the practitioner's skill and experience. Fluids: (a) **Crystalloids**: - Normal Saline (0.9% isotonic sodium chloride) or Lactated Ringer solution: An initial bolus of 250 ml is given, and then the casualty's response is assessed. If vital signs return to normal, the casualty may be monitored to ensure stability. If vital signs transiently improve, type-specific blood obtained and an urgent surgical opinion sought. If little or no improvement is seen blood should be started, if it is available on these Roles and a surgical opinion sought immediately. If a casualty is critically injured and remains markedly hypotensive, initial treatments may require urgent delivery of fluids and type O blood transfusion, provided his low blood pressure is associated with a reduced level of consciousness . Preparations for rapid infusion must be established before the start of surgery, unless surgery is immediately needed to stop exsanguination. When blood transfusion facilities are not available at these Roles, the patient will be moved quickly towards the following Role to receive blood transfusion and an urgent surgical opinion. Some nations may choose to use hypertonic saline according to nationally developed protocols. (b) **Colloids:** - Artificial colloids (gelatines, hetastarch or	Radiology (if available on this role): C-spine, chest and pelvic x-rays, ultrasound (FAST scan), CT scanning. - Casualty heating units

TRAINING	TREATMENT	EQUIPMENT
- Patients with marked hypotension and/or unstable conditions must first be resuscitated adequately. Further studies are directed toward finding the source of blood loss. - In thoracic trauma, in addition to the initial chest x-ray, if thoracic dissection is suspected, the workup may include transoesophageal echocardiography, aortography, or CT scanning of the chest. - If a traumatic abdominal injury is suspected, an ultrasound exam may be performed. Computed Tomography (CT) scanning typically is performed in the stable patient. - If long-bone fractures are suspected, radiographs should be obtained. - Remember, erythrocytes in blood from the blood-bank has a significantly reduced property for oxygen delivery to the tissue partly through a reduced 2,3 DPG which takes days to restore. - Erythrocytes in bank-blood are rigid and deformed and consequently travel poorly through the capillary system. - Oxygen delivering capacity of normal Hb (14,8g/100ml) is the same as for 7g/100ml. Optimal delivery occurs between 9-10g/100ml. Consequently no transfusion over 7g/100ml. Transfusion trigger in otherwise healthy patients 6g/100ml.	dextrans) may be used in resuscitation. A bolus of 250 ml of colloids (hetastarch) could be started initially. Both dextran and hydroxyethyl starch interfere with platelet function if more than 1 litre is used. (c) **Blood transfusion (+ derivates):** In these roles, the capability to provide blood transfusion may be scarce. If vital signs only transiently improve with volume, type specific blood should be obtained expeditiously. In the case of refractory haemorrhagic shock (with no response to volume replacement), type O blood should be started and a surgical opinion immediately sought. 3. ETIOLOGIC MANAGEMENT as soon as possible: Control of external haemorrhage (control of blood loss is essential and has to be obtained before anything else). Immobilization of long bone fractures. Other procedures: If required, chest drainage of tension pneumothorax and haemothorax. and pericardiocentesis and thoracotomy for cardiac tamponade (see relevant triptychs). 4. KEEP THE CASUALTY WARM (prevent oxygen consuming shivering): Use of: Blankets Temperature regulation of infusion. Casualty heating units	

TRAINING	TREATMENT	EQUIPMENT
	5. MONITORING THE ADEQUACY OF RESPONSE Clinical parameters: - Patient regains consciousness Systolic BP between 70 and 80 mmHg (more than 90 mmHg in case of head injury). or the radial pulse is palpable. pulse rate: less than 100/min.	
	Central Venous Pressure (CVP). A normal CVP in a normal compliant heart is typically 1-3 cm H_2O. Pressures much higher than 12 cm H_2O may reflect volume overload that could result in tissue oedema and volume overload. Hourly diuresis: between 0.5-1,0 ml/Kg in case of crush: more than 1 ml/Kg. Pulse-oximetry (if available): more than 95%.	

TABLE I: ESTIMATION OF BLOOD LOSSES

Estimation of blood losses: (for a 70 Kg male patient) depending on:

Kind of injury

TYPE OF FRACTURE	ASSOCIATED BLOOD LOSS
Forearm	400-800 ml
Humerus	500-1000 ml
Leg	800-1200 ml
Femur	1000-1500 ml
Pelvis	1500-2500 ml
Lumbar spine	500-1000 ml

Clinical parameters:

Class of Shock	I	II	III	IV
Blood loss (ml)	<750	750-1500	1500-2000	> 2000
Pulse rate	<100	>100	>120	>140
Blood pressure	Nl or ↑	Nl	↓	↓
Capillary refill	Nl	+	+	+
Respiratory rate	<20	20-30	>30	>30
Urine output (ml/h)	>30	20-30	10-15	<10
CNS-mental status	Anxious		Confused	

c) Evaluation of response to treatment:

Clinical parameters

Diuresis

Pulse-oximetry (if available).

A.06 ANTIBIOTIC POLICY IN THE FIELD

PREAMBLE

Terminology:

Antibiotic policy differentiates between empiric use (A), prophylaxis (B) and therapeutic use (C):
Empiric use is "the best guess" treatment without information on the causative agent.
Prophylaxis is a short term (24 hrs) preventive antimicrobial use (e.g. as in civilian use before surgery).
Antibiotic therapy is the AB use to follow once the causative agent and its resistance pattern have been identified and according to the clinical course.

INTRODUCTION

Penetrating wounds in the field must be regarded as contaminated both by bacteria and foreign materials. A lag time exists between this stage of contamination and invasive infection. Contamination is likely to involve several microorganisms although one will predominate depending upon local conditions of oxygenation and tissue perfusion. Early surgery by excision and decompression will most effectively prevent infective complications but may not be tactical or logically possible.

Empirical antibiotic administration given early (Role 1 and 2) in adequate dosage and to cover the appropriate spectrum will delay the infective process and allow surgery to be deferred for some hours.
In regard to resistance-patterns there has to be choice in just a small group of antibiotics for the first and second role. The antibiotics have to be aimed at the most likely expected microorganisms.
As there are different resistance patterns all over the world, there can be more than one empiric AB policy to follow.
Antibiotics should be started as soon as possible after being wounded -preferably within four hours after penetrating trauma - and should be given normally until 24 hours after surgery.
For maximum effectiveness the antibiotic should be given intravenously to obtain an optimal peak-concentration in the tissue.

TRAINING	TREATMENT	EQUIPMENT

ROLE 1

TEACH: - type of wound: non-penetrating wounds penetrating wounds wounds with foreign bodies -severity of wounds depth muscle mass bowel involvement (see triptych on Abdominal injuries B.06.) head-brain injuries (see triptych B.01. Head Injuries.) - associated conditions exposed fractures impaired blood supply burns (see triptych B.10.) cold injuries (see triptych C.01. Hypothermia and C.02. Local Cold Injuries) chemical agent contamination (see triptych C.05. Chemically Contaminated Wounds.) - spectrum of antibiotic effectiveness existence of different resistance patterns: old useful combination : penicillin - chloramphenicol more recent combination: amoxycillin/clavulanic acid - clindamycin, metronidazol, co-trimoxazol - adverse drug reactions penicillin hypersensitation - type of microorganisms - bacterial resistance	Penetrating wounds: all patients with penetrating wounds must receive: either penicillin G: 4 x 5.000.000 IU iv / 24 hrs (old regime), or amoxycillin/clavulanic acid 4 x 1000/200 mg iv /24 hrs (modern regime). Hypersensitation: in case of penicillin hypersensitation use erythromycin 3 x 1g iv/ 24 hrs. Abdominal (bowel) wounds: patients with abdominal (bowel) wounds are to receive in addition as extra cover against gramnegative rods and anaerobic bacteria: 1. ceftriaxone 1-2 g iv / 24 hrs (old regime), or clindamycin 4 x 300 mg iv /24 hrs with metronidazol 3 x 500 mg iv / 24 hrs, both for 5 days. 2. or amoxycillin/clavulanic acid 4 x 1000/200 mg iv /24 hrs with gentamicine 4 – 5 mg/kg/24 hrs (with normal kidney function) Head-brain injuries: consider by patients with head-brain injury to administer in addition: co-trimoxazol 2 x 1440 mg iv / 24 hrs (modern regime). Ensure complete stabilization of the patient,	penicillin G 5.000.000 IU flasks/amps amoxycillin/clavulanic acid 1000/200 mg flasks/amps erythromycin 1 g flasks/amps Ceftriaxone 1 g flasks/amps clindamycin 300 mg flasks/amps metronidazol 500 mg flasks/amps gentamicine 800 mg /amp co-trimoxazol 1440 mg flasks/amps tetanus prophylaxis syringes and needles skin cleansing swabs iv sets

TRAINING	TECHNIQUE	EQUIPMENT
- appropriate stabilization of the patient - tetanus prophylaxis	treatment of wounds and check tetanus prophylaxis (see triptych A.02., A.03. and other relevant triptychs). Document treatment: time of start and dose	

ROLE 2

TRAINING	TECHNIQUE	EQUIPMENT
TEACH: - same as in Role 1 - alterations when adverse reactions have occurred - penicillin-hypersensitation	If not already started in role 1, start AB-treatment, if indicated (see role 1) continue antibiotic regime if signs of hypersensitation with use of penicillin or amoxycillin/clavulanic acid, change to erythromycin check for tetanus prophylaxis treat wounds if not proper done document treatment.	same as Role 1

TRAINING	TECHNIQUE	EQUIPMENT

ROLE 3

TEACH: - recognition of signs and symptoms of developing infections possible problems with patients catheterized and/or tracheal intubated - changes to antibiotic regimes	- perform the surgical treatment, if indicated. - take specimen for microbiological cultures (tissue, blood) consider also false negative results	same as in Role 1 and 2 microbiological cultures equipment
- alterations when adverse reactions have occurred hypersensitation	- consider to change the antibiotic regime according to the clinical course and the cultural and antibiogram results (i.e. mostly from empirical to therapeutic use) -if signs of hypersensitation with use of penicillin or amoxycillin/clavulanic acid, change to erythromycin	consider as extra: antibiotic from cephalosporins group antibiotic from aminoglycoside group antibiotic from gyrase-inhibitor group
- microbiological techniques tissue cultures blood cultures - antibiotic association	-continue antibiotic treatment for (a total time of) 24 hrs, in case of abdominal and/or head surgery for 5 days. 1- no signs of infection are present: continue previous treatment for (a total time of) 24hrs. 2- signs of infection are present: take microbiological cultures and give appropriate antibiotics. - document treatment	

A.07 ANAESTHESIA IN THE FIELD

PREAMBLE

Anaesthesia in a NATO Military organisation must be designed for optimal function under any given circumstances. This will demand equipment and procedures that are designed to function under even harsh conditions in a rough environment when supplies are scarce and with “unfriendly” treatment of both personnel and equipment.
There is a logical gap in splitting General anaesthesia and Local anaesthesia, since many anaesthetics can be either combined or replace each other. To have a full understanding as to how a patient will benefit from the different techniques, local anaesthetic techniques often are compared to a general anaesthetic technique. –{This sentence adds nothing to the document. Recommend deletion.}
Regardless of methods chosen, your choice has to be guided by some principles, both in general terms and more specific.
Priority will be the safety of the patients combined with an optimal quality of anaesthesia and analgesia, and a stable and short post-operative phase. At the same time, top priority will be given to avoid unnecessary strains on the logistic system, procurement and storage facilities.
As in several other situations of disaster management, the increased use of advanced technology has the potential to increase our vulnerability more than it improves our capacity for proper medical treatment. This problem must be dealt with in all organisations with regard to equipment and procedures. We must aim at being fully updated on new techniques and modern equipment and learn to benefit from them in a field situation, at the same time having designed our equipment and done our training so that we can immediately adapt to most difficult low resource situations.
The author of this chapter strongly recommends the possibilities for a minimum of two operating tables in each operating room. Properly planned the anaesthetist is then able to prepare the next patient even while working on the patient currently being operated on, even if he is alone. By the time surgery is completed on the previous patient, the surgeon may then proceed directly to the next patient without any unnecessary delay. This has proven crucially timesaving when there is a high influx of patients. For a full utilisation of the potency of local anaesthetic techniques two tables in one operating room is even more important. (See Chapter A.08 Local anaesthesia (or B.04 in old version))

All techniques for anaesthesia have advantages and concomitant disadvantages. These must be known and mastered by any person who takes upon himself or is being tasked to use these techniques.

In recent military scenarios for peacesupport operations, the distinction between the Roles have been less clear. Top qualified peronnel has been found in very forward positions. This is partly mirrored in this triptych, but does not mean that specialists as a rule are needed at Role 1, even if you find them there in certain scenarios.

Certain basic criteria are applicable to all elements involved in providing general anaesthesia.

The elements involved are:

Personnel

Field proficiency is not easily acquired and demands profound theoretical knowledge combined with clinical experience and field training/experience. The lesser equipped the more you may benefit from knowledge and experience.

Professional skill

To deliver anaesthesia

To monitor patient

To prevent complications

To treat complications

Communication skills/team work

Endurance

Equipment

To deliver anaesthesia, including assisted/controlled ventilation.

To monitor

patient

Manually

Technically

anaesthesia

Manually

Technically

Drugs

To the extent possible any anaesthetic technique should be complete, that means function both for induction and maintenance. If it combines analgesia and adequate muscle relaxation, this is also a bonus.

Pathways/Templates/Flowcharts/Standards

The basic demands will comprise

Optimal Patient Safety

Optimal Analgesia

Optimal Surgical Conditions

Adequate anaesthesia/No risk of awareness

Thereafter the we must aim at avoiding psychomimetic side effects and also provide basic trust, and a feeling of safety. ***To some extent we state that lack of equipment can be compensated for by improved competence and field proficiency. There is also a limited possibility to compensate for lower competence by high tech equipment. There are, however, thresholds below which no anaesthetic service will function, both for professional skills and for equipment.***

I. General anaesthesia in the field should comprise:

easy and rapid induction (iv.);
secure airway;
minimal cardio-respiratory depression;
where possible, omission of N_2O and (if desired) volatile agents.
Easily adaptable to difficult logistical situations (i.e. not totally dependent on compressed gases – cf.IV.3).
Not time consuming (no unnecessary delays).
No rebound effects.
Smooth, rapid recovery with minimal need for monitoring support.

II The medical staff offering anaesthesia in the field has to meet the following demands:
Master all relevant emergency medical techniques, including resuscitation and volume substitution;
They must master different techniques of general anaesthesia. This includes induction, maintenance; and possible side effects relevant for post-operative surveillance.
They must command all clinical methods sufficient to monitor a patient but also be proficient in the use of advanced technology if such equipment is available in the monitoring of a patient in general anaesthesia;
Understand the surgical needs and be able to collaborate with the surgeons to facilitate surgery without compromising patient safety at any stage of pre- peri- and post-operative care.

III The ideal drugs for anaesthesia in the field have to offer:
long shelf life;
stability at extreme temperatures;
¨multifunctionality¨, (e.g. suitable for both induction and maintenance or both for anaesthesia and post-operative pain treatment). This helps to reduce the total number of drugs which burden the logistic chain
minimal cardio-vascular effects; (like blocking of pulmonary hypxic reflex)
minimal respiratory depression.
easy to steer and/or available antagonists.

IV The ideal equipment for anaesthesia in the field has to be:
simple but well conceived; easy to operate, compact and robust (WHO standards for oxygen concentrator plus NATO vibration test);
standardised to the extent possible. This will facilitate personnel exchanges.
flexible and adaptable. An anaesthetic machine must have ¨draw over¨ option, The vaporiser should be multi agent. Monitoring and gas delivering equipment must be multi voltage functional, This includes stabile function also with unstable voltage/line frequency.
transportability, with low weight and small volume

TRAINING	TREATMENT	EQUIPMENT

ROLE 1 and 2

Triage; always the job of the most experienced available Life saving measures Guarantee of free airways and methods of ventilatory support Stop bleeding. Proper dressing technique. Establish i.v. line **Analgesia** and sedation (see triptych A.09). Ketamine analgesia (iv.) Teach: (I)Pharmacological effects on central nervous system: analgesia amnesia hallucinations increased intracranial pressure (introducing of the Mayo or Guedel tube, if necessary) extrapyramidal motions nystagmus cardio-vascular systems: tone of sympathetic nervous system increase of heart rate increase of blood pressure respiratory system: depression caused by quick injection hypersalivation (controllable by atropine) bronchodilation in general (II) Ketamine pharmacokinetics: beginning of effects: 30 sec. After iv. Injection; 2-10 min post i.m.injection; duration of effects:	Resuscitation procedures free airways intubation, suction Stop bleeding Volume substitution (iv.), alt. Iv. Canula (contingency) Analgesia, O_2 application, if available Practical advice: Since this is for analgesic purposes mainly, titrate not to pass threshold for anaesthesia Inject ketamine slowly (avoid risk of respiratory depression); Benzodiazepines are recommended. Have necessary preparedness for assisted ventilation.; experience with iv. Application necessary: Only full anaesthetic dose if free airway/sufficient respiration can be guaranteed Indications: Analgesia for the hypotensive patient. Extraction of casualties e.g. trapped in destroyed vehicles.	Anaesthesia kit, including sets for intubation and ventilatory support: Mayo or Guedel tube tracheal tubes (different sizes) Cricothyreotomy set Suction apparatus Laryngoscope Ambu bag Ringer-Lactate and colloids for infusion Analgesics Morphine – tablets (if available) or ampoules Acetylsalicylic acid tablets Paracetamol tablets Anxiolytics: Benzodiazepins, tablets or ampoules (if available) Ketamine ampoules e.g. 500 mg in 10 ml. Diazepam ampoules 10 mg in 2 ml or Midazolam 5 mg in 1 ml if available NB Local Anaesthetics is covered in triptych A.08

TRAINING	TREATMENT	EQUIPMENT
5-10 min./2 mg/kg b.w. (body weight) iv.; 15-25 min./6 mg/kg b.w./i.m. half-time of elimination: 3 hours large therapeutical width; no toxicity; metabolised in the liver (III) Contraindications: absolute: hypertonus cardiac insufficiency eclampsia/pre-eclampsia relative: severe psychiatric disorders; surgical stimulation of pharynx, larynx; severe cerebral trauma (except in hypotensive patients); severe tachycardia perforating eye injuries; REMEMBER, Ketamine, now found in ambulances and very forward positions provides general anaesthesia.	Acute treatment of severe burn casualties without or with inhalation injuries. Before Ketamine anaesthesia, as a general rule, administer Atropine 0.5 mg iv. (always in children 0.01-0.02 mg/kg) Diazepam 5 mg iv. Or Midazolam 1 mg iv. (if available) In case of General anaesthesia needed also from first echelon and, onward start with Ketamine : 1-2 mg iv/kg b.w.; repeat injections depending on consumption, usually half of the initial dose. THIS WILL REQUIRE TRAINED PERSONNEL ALSO DURING TRANSPORT.	Atropine amps. 1,0 mg/ml
Side effects of benzodiazepines (especially if combined with opioids) (e.g.: diazepam. Midazolam): respiratory depression temporary loss of free airways, cardio-circulatory depression.	Depression/prevention of the psychomimetic side effects of Ketamine.	
Diazepam versus midazolam Teach: Pharmacological effects on Central nervous system:		

TRAINING	TREATMENT	EQUIPMENT
sedation anxiolysis; hypnosis anti convulsion relaxation cardiovascular system low effects on the healthy adults; respiratory system: depression until apnoea depending on dosage; in general: irritation of veins. (non-fat solvents)		

TRAINING	TREATMENT	EQUIPMENT

ROLE 2 Enhanced

Techniques of anaesthesia in spontaneously breathing assisted ventilation and artificial ventilation; with muscle relaxation; without muscle relaxation General monitoring of anaesthesia in the field **without** electronic devices (COMPULSORY) with electronic monitors Basic knowledge of the "**Continuous Air Flow Anaesthetic Machine"**, (also known as **Boyle's** machine or **plenum** machine): its function maintenance, testing cleaning and simple repair non-re-breathing systems re-breathing systems without CO_2absorber (semi) re-breathing systems with CO_2 absorber Monitoring measures needed for each of the above (3), Oxygen, CO_2 Basic knowledge of Draw Over anaesthetic machines Their construction alternative low pressure oxygen supplies (O_2-concentrators, chemical methods etc.) Well trained with non-N_2O anaesthesia Well trained with most volatile anaesthetics: Halothane: Isoflurane Sevoflurane Ether (Desflurane)	Spontaneously Breathing All limb surgery, some face, head and neck. Burn treatment. Ketamine anaesthesia is very appropriate for most spontaneously breathing patients. Be sure that that the patient is ¨deep¨ enough. A patient emitting sounds is not properly anaesthetised. Ventilation on air only is normally quite sufficient. (Preferably fasting patients, but not compulsory in a war scenario) If proper waste gas suction system is available, and the patients are known to be fasting (unlikely at Role 2+), volatile agents are well applicable for spontaneously breathing patient. All volatile gases block the pulmonary hypoxic response (except ether). Therefore these patients need added oxygen. If surplus resources, Boyle's anaesthetic machine (pressurised gases) can be used. If limited resources, use the draw over system based on ambient air. Controlled ventilation./ Intermittent Positive Pressure Ventilation (IPPV). For most abdominal surgery, thoracic surgery, oral and jaw surgery, and for all brain surgery. Ketamine anaesthesia is an appropriate drug especially combined with opioids and benzodiazepines. NSAIDs are also relevant for combined anaesthesia. Pentazocine represents an alternative to opioids, especially if post-operative ward is crowded and surveillance is poor.	Field Anaesthetic Machine (this means either a ¨Draw-over¨ anaesthetic machine or a convertible (both Boyle's and Draw-over in one machine). Non-rebreathing or semi-rebreathing systems (without CO2 absorbers) are to be preferred for patient safety and technical and logistical reasons). Use multi-agent vaporiser. O2 -bottles, mobile (5-litres) and stationary (40 litres) Oxygen concentrators (Meeting WHO standards for district hospitals and NATO standards) Self-expanding bag Halothane in bottles 500 ml. (Remind: store the bottles away from light). Other volatile agents are also recommended Avoid N_2O in the field, unless heavily

TRAINING	TREATMENT	EQUIPMENT
Volatile gases and their inbuilt properties, advantages and disadvantages with and without N_2O MAC values Analgesic properties Sleep/unawareness/ muscle relaxation; Pharmacological additional effects: on vascular resistance Chronotropic effects Inotropic effects on respiratory function broncho dilatation increase of intra cranial pressure (ICP) possible toxicity for the liver; Malign hyperthermia Pharmacokinetic effects: elimination of metabolites fat solubility recovery with sufficient ventilation Contraindications: combination of halothane with liver disease severe cerebral trauma and spontaneous ventilation and volatile gases. NB: Most anaesthetic agents are normally not recommended for cranial/brain trauma. Reality shows that all such statements are relative, and that no anaesthetic agents in itself is absolutely contraindicated, provided necessary precautions are taking (proper ventilation priority 1). In most of the NATO European Countries	Inhalational anaesthesia: All are appropriate if combined with an intravenous rapid induction. Otherwise they have some limits: Halothane: Arrythmogenic, (cave adrenaline), Halothane-hepatitis. MAC 1= 0,8% in air/O_2 Also for induction Long induction, long recovery Cheap Not registered in all western countries Isoflurane Not suitable for induction MAC 1= 1,15% in air/O_2 Stable patient Expensive (9 x Halothane) Medium induction time, medium recovery Sevoflurane MAC 1= 2 % in air/O_2 Needs two OMV (field anaesthetic vaporisers) for induction Rapid and easy induction, short recovery. **alert anaesthetists** Expensive (15 X Halothane); Desfluran: Needs specially heated vaporiser. MAC 1= 6% in air/O_2 Ether: Still the safest volatile agent Stimulates Cardiac Output and respiration in acceptable surgical stage Needs two OMV (field anaesthetic vaporisers) for induction. EMO vaporiser is preferred Can be produced in the field, or obtained locally (from technical resources).	integrated in the system. If N_2O is an integral part of the system, the anaesthetic machines should preferably be equipped with preventive devices for low oxygen delivery.

TRAINING	TREATMENT	EQUIPMENT
Halothane is still used in the field; however, modern volatile agents (Efrane, Isoflurane, Sevoflurane etc.) are recommended, if available. N_2O merits special attention. It is a drug with very limited anaesthetic properties, but with considerable logistical and medical consequences: It can never be produced in the field. It demands that the other gas is 100% oxygen. It demands technical solutions that prevents N_2O and O_2 from being confused. Pharmacological effects of N_2O: analgesic, but, MAC 1= 105%; mild sedation; haemodynamic depression in reduced cardiac function increase of ICP Pharmacokinetical aspects: biotransformation not proved but expected; diffusion in air-filled cavities (cuff of the tube), intestinal walls in ileus, pneumothorax); NB: Reminder: pre oxygenation before offering of N_2O; Avoid hyperaemia by offering O_2 minimally in 30%, N_2O maximally in 70%	Does not block the pulmonary hypoxic response. Flammable with air, explosive with O_2 Very long induction Post-operative nausea and vomiting Inhalation Anaesthesia is suitable for most surgical procedures, but not for rapid induction. NB If Ventilated on N_2O 70% (and O2 30%), MAC is 0.6, which is to be added to the MAC of the other drugs given. N_2O is only supplemental to all other anaesthetics, due to its limited properties.	
Medical contraindications for the use of N_2O: pneumothorax without drainage; Emphysema of mediastinum pneumopericardium; ileus (relative contraindications)	Muscle relaxation is needed for Several types of surgery Close collaboration between surgeon and anaesthetists is mandatory to provide optimal muscle relaxation: Minimal dosage needed for surgery to prevent any unnecessary post-	Succinylcholine amps 100 mg/ampoule or 500

TRAINING	TREATMENT	EQUIPMENT
Muscle relaxation: Depolarising Succinylcholine Pharmacokinetics: beginning of effects: 30 sec; duration of effects. 5-10 min, short neuromuscular blockade (depolarising). Side effects: hyperpotassaemia liberation of histamine; arrhythmia. Contraindications: hyperpotassaemia severe burns polytraumatized casualties; sepsis perforating eye injuries Glaucoma	operative care problems due to rest curarisation and also unnecessary delay between operations. For complete airway and ventilation control Rapid induction for emergency surgery (Succinylcholine is drug of choice, but demands proper pre-oxygenation due to significantly increased oxygen consumption). Hyperventilation of brain injuries/surgery, if feasible. Prevent or treat Respiratory Distress Syndrome (Evacuation possibility to 3rd echelon is mandatory) Both Oral and Nasal intubation may be needed For nasal intubation use either preheated tip or suction catheter as guide wire. For maintenance Pancuronium is an adequate drug, but has been over dosed for decades.. After succinylcholine induction, a total of 4 mg (one ampoule) is normally sufficient if given as 3 mg plus two times 0,5 mg. (Optionally 0.5mg as priming dose prior to succinylcholine)	mg anhydrons, powder. NB: Be aware Succinylcholine is delivered in concentrations of 10 mg/ml, 20 mg/ml and 50 mg/ml. Normally one ampoule contains 100 mg regardless of concentration.
Non-depolarising. There are now several with different properties. Effects of all of them are prolonged differently depending on anaesthetic agent. All with brom-ion in the formula may cause allergic reactions (some times strong and also cross-over) : Pancuronium (bromide) (by fare the cheapest of agents used in the industrialised society): Pharmacokinetics: beginning of effects: 2-3 minutes duration of effects: approx. 40-60 minutes., initial dose: 3,5-4 mg in adults iv. repetition dose: 0.01 mg/kg b.w. (max 0,5 mg) i.v.	**Succinylcholine should not be used for severe burns and cervical spinal injuries.** In case of contraindications of succinylcholine, use one of the shorter acting non-depolarising	Pancuroniumbromide ampoules 4 mg/2 ml

TRAINING	TREATMENT	EQUIPMENT
total neuromuscular blockade (non depolarising) Side effects tachycardia; moderate decrease of blood pressure. Contraindications: no one. Remember: Obligations for the use of all kinds of muscle relaxation	agents if at hand. Remember the dosage needed for rapid induction by means of non-depolarising drugs may give a muscle relaxation of up to two hours, regardless of drug chosen.	Atropine ampoules 0,5 mg/ml or 1 mg/ml. NB: If Atropine is used for treatment of bradycardia 0,5 mg is a too low dose. Therefore we recommend ampoules of atropine 1 mg/ampoule and Neostigmin 0,5 mg/ml- 5 ml. ampoules
Vecuronium (bromide): Dose (most practical) 0,08-0,1 mg/kg bw Onset time ca. 2 minutes Duration 20-30 minutes Hardly any release of histamine Anaphylaxis has been seen Atracurium Dose 0,3-0,6mg/kg b.w. Onset time ca. 2 minutes Duration 15-35 minutes. May release Histamine	<u>Controlled artificial ventilation.</u> All kinds of surgery in a total neuromuscular blockade (e.g.: surgery of head, chest, abdomen, pelvis).	
Metabolised through Hoffmans elimination. Rocuronium (bromide) Dose 0,4-0,6 mg /kg b.w. Practical onset time 2 minutes (company says less) Duration 30-40 minutes Histamine release is moderate High doses give tachycardia (0,9 mg/kg) Mivacurium Dose 0,15-0,2 mg/kg b.w. Onset time 2-3 minutes Duration 10-25 minutes Histamine release (not seldom by rapid injection) Allergic reactions have been seen	Measurement of the depth of relaxation by the use of train of four method is theoretically preferred. Proper **clinical judgement**, combined with skilled surgeons are for **<u>practical reasons</u>** preferred.	Nerve stimulator (incl. batteries), if available

TRAINING	TREATMENT	EQUIPMENT
NB. Metabolised by plasmacholinesterase Cisatracurium Dose 0,1-02 mg/kg b.w. Onset time 2-5 minutes Duration 45-80 minutes Hoffmans elimination Allergies (crossover to atracurium) Histamin release (+?) Reverse all non-depolarising muscle relaxation (also mivacurium), but wait till signs of recovery opf some muscular movements! mixture of Neostigmin 1.5 mg and Atropine 1.0 mg iv.; repeat if necessary; especially with pancuronium Children<30 kg: reduced dosage. Compulsory for the use of all kinds of muscle relaxation: Anaesthetic personnel only, except in extreme situations Self expanding bag with face mask at hand Intubation equipment at hand Ample experience in intubating **Prefer spontaneous breathing in absence of these requirements.**	NB: Control the hypersalivation with atropine or any other vagolytic drug	

TRAINING	TREATMENT	EQUIPMENT

ROLE 3

There is no significant difference between the needed skills and field proficiency as compared to Role 2+.	All methods of ¨balanced anaesthesia¨ should be offered for the benefit of severely injured or ill patients. Post-operative care and capacity should be more advanced. The elegant titration of anaesthesia, as absolutely required more forward, is not so significant here, but should be a prime objective, unless the patient is to recover on a ventilator/respirator. Multitrauma Respiratory Distress (PEEP) Brain damage/Surgery	Full laboratory service including Blood Gas Analyser The anaesthetic equipment for the operating theatre should be the same as for 2nd Role. More advanced and respirators should replace the more simple ventilators used more forward (2nd echelon/role). Target Controlled Anaesthesia may be appropriate at this level, but is no must. Propofol has advantageous properties (except in hypotensive patients), but is expensive and is very exposed to bacterial contamination and growth (thiopentone is bactericide). Administer special medicaments (e.g. opioids, Propofol, Vecuronium and others), -if available- by the use of a mobile and simple infusion pump with built in accumulators, which guarantees the continuous application of drugs and allows to renounce volatile agents and N_2O

Epilogue

Monitoring:
Modern general anaesthesia mostly includes electronic monitoring of multiple functions. However, no electronic equipment can replace proper skilled clinical surveillance. Both Blood pressure and pulse rate can easily be monitored by means of traditional non-electronic methods. Skin-condition, and eyes give additional sufficient information.
If possible, a pulsoximeter is recommended.
Other monitoring equipment falls under the category nice to have, provided the personnel have the necessary skills.
Nevertheless military forces have multi-monitoring equipment available as far forward as at least Role 2+.
Aspiration/emptying of the stomach is not cost-effective and hardly beneficial at all for these patients. That means that all anaesthetics normally are started on non-fasting patients.
This means that all intubated patients are to have crash-induction
Patients having ketamine anaesthesia and spontaneous ventilation will not have their stomachs emptied.
This has not been reported to cause problems, provided adequate analgesic depth.
Premedication: is very difficult to administer in a busy over crowded war scenario. It may have definite positive effects but is for practical reasons seldom achievable.

Closing remark:
Anaesthesia in the field needs well defined standards of training and equipment. For all practical purposes it is not more difficult than in a civilian setting. Professional assistance is, however, not that easily available. Therefore it is recommended that those selected for forward positioning are highly skilled since lack of equipment also may be compensated for by adequate professional proficiency.

Appendix to the Triptych B.5 “Anaesthesia in the field”

MONITORING OF PATIENTS DURING ANAESTHESIA

The following table is recommended for practical purposes in the field. It mirrors to some extent an increased dependence on electronic equipment, but is
kept at lowest possible level..They are grouped in two series: Recommended and Optional.
Monitoring should simplify and provide safer patient care. It should not take the attention away from the patient It should measure a parameter that is not easily monitored clinically. It should not be cumbersome and time consuming.

Parameters to monitor	**Devices**
1. RECOMMENDED	
Blood oxygenation	Pulse oximetry
Temperature	Thermometer (electronic for hypothermia)
Cardiac auscultation	Stethoscope
Cardiac function	ECG apparatus
Heart rate	ECG apparatus
Blood pressure	Automatic non invasive (and manual of course)
2. OPTIONAL	
Blood pressure (3rd echelon and onward)	Invasive pressure monitor (Role 3 and onward)
Central venous pressure	Invasive pressure-monitor or H_2O manometer.
Muscle relaxation	Monitor of neuromuscular block (Role 3 and onward)
Expired CO_2	Capnograph (Role 3 and onward)
Inspired gas/FiO_2	Oxygen analyser inside the anaesthetic apparatus
Ventilation: Tidal volume	Spirograph or as ventilator function
Ventilation: Minute volume	Spirograph or as ventilator function
Respiratory rate	RR monitor
Airway pressure	Manometer
Anaesthetic gas concentration	Expired gas analyser (Role 3 and onward)

A.08 Local Anaesthesia

PREAMBLE

Local anaesthesia (LA) is valuable for pain relief and surgical care under field conditions and especially in a chemical environment. Its application depends essentially on the physicians training, expertise and attitude towards this method. Only when the physician has experience with local anaesthesia, this method is safe and fast. The necessary experience also includes the knowledge of possible complications, and their treatment.
Performing regional anaesthesia requires for the experienced user on the average 5 – 10 minutes. Full effect for certain peripheral blocks is not reached until 15 – 30 min. after injection. since the anaesthesia is limited to one region it makes this method unsuitable for multiple trauma patients.
With these limitations in mind, correctly performed regional anaesthesia has little effect on circulation, respiration and metabolism. The equipment consists only of needles, syringes, local anesthetics, but resuscitation equipment must be available.
Long – lasting local anesthetics will provide good post – operative anaesthesia. The patient is awake and co – operative, needs less monitoring, care and personnel.
Local anaesthesia will be considered under these headings in relation to the military role system.

Topical or surface anaesthesia
Infiltration anaesthesia
Regional anaesthesia:
Nerve blocks;
Epidural block;
Spinal block.

TRAINING	TREATMENT	EQUIPMENT

ROLE 1 and 2

Teach indications: Small operations; Manipulation of fractures; Foreign body removal. Teach principles of simple local anesthetic techniques: Topical anaesthesia; Local infiltration; Digital nerve blocks. Teach: Basic pharmacology; Dose Onset; Duration, Toxic reactions. Teach: Contraindications of regional anaesthesia in	Topical anaesthesia: The anesthetic is applied directly to the skin, mucous membranes or cornea. Infiltration: The site of the block and operation site should first be washed with soap and water. The skin is thereafter prepared as for surgery. Fan-wise infiltrate into cutaneous and subcutaneous tissues. Aspirate before injecting local anesthetic (LA) and repeat whenever you change needle position. If analgesia and sedation is required, refer to the relevant triptych (A.09). Digital nerve block: Introduce the needle on either side of the base of the digit. To avoid compression ischemia, avoid the use of excessive volume of LA. A rubber catheter drawn round the digit and clipped with a hemostat prevents bleeding and stops LA being washed away. Do not use local anesthetics with adrenaline.	Local anesthetics: Lignocaine 1 – 2 %; Long acting LA (e.g. Bupivacaine. Ropivacaine) Amethocaine 4%; Lignocaine gel. Syringes 10 ml. Needles 1.5 – 5 cm. Resuscitation equipment.

TRAINING	TREATMENT	EQUIPMENT
presence of local infection. Local anesthetics without vasoconstrictors in organs with end arteries (fingers, toes, penis).		

TRAINING	TREATMENT	EQUIPMENT

ROLE 2+ and 3

<u>Teach:</u> Use of femoral nerve block in lower limb injuries Use of ischiadic nerve block in lower limb injuries. Indications for LA techniques: <u>Intercostal block:</u> rib fractures with respiratory problems due to pain ; <u>Intravenous forearm block:</u> operations, fractures of hand and forearm; <u>Axillary plexus block:</u> same, pain relief during transport.	<u>Intercostal block:</u> Skin is cleaned. The rib is palpated with the free hand. A 2.5 cm needle is passed through the skin in the posterior axillary line downwards to strike the rib above the nerve to be blocked. It is advanced just beneath the lower border of the rib. It is then pushed in a further 3 mm, and 2 ml of solution is injected. Syringe is always attached to the needle to reduce the risk of pneumothorax.	
<u>Teach:</u> Special precautions: Keep arm elevated; Deflate slowly. Advantage of double cuff technique if available.	<u>Intravenous forearm block:</u> Insert a cannula into a good vein (hand). Also insert a cannula into the uninjuried upper limb, for use in case of a complication, and also for analgesia/sedation. Elevate the arm. Put on the pressure cuff. Bandage and massage all blood out. Inflate the cuff to 100 mmHg above systolic BP. Inject LA (Lignocaine or Prylocain or Mepivacaine 0.25 – 0.5%). Anaesthesia will be obtained after 10 min. After injection there should be a time lapse at least 30 min. before deflating the cuff.	Local anesthetics: Lignocaine 0.5%. BP cuff. Prylocaine 0.25 – 0.5%. Mepivacaine 0.5%.
<u>Teach:</u> Use of nerve stimulator for axillary blocks.	<u>Axillary block of the brachial plexus:</u> Arm abducted to a right angle, forearm flexed and externally rotated. A soft rubber tourniquet is placed as high as possible round the arm. Skin is cleaned and axillary artery is palpated. A needle is inserted so that the tip lies just above the artery. If it is in a correct position it will move	Nerve stimulator. Venous tourniquet.

TRAINING	TREATMENT	EQUIPMENT
	in time with pulsation of axillary artery. 40 – 50 ml is needed for complete block (1% Lignocaine or 0.25% Bupivacaine or Ropivacaine)	
Teach: Topographic anatomy (reference marks): femoral artery; inguinal ligament; anterior superior iliac spine.	Femoral nerve block: Patient in supine position. Put a cuff around the thigh. Locate the femoral artery with three fingers of the left hand and displace it medially. Needle is inserted immediately lateral to the vessel to a depth of 3.5 – 4.0 cm. The needle must pulsate when disconnected from syringe. Inflate cuff. Inject 20 ml 1% lignocaine in a fan – shape pattern. To block the lateral cutaneous nerve of the thigh, insert needle 2 cm below and medial to anterior superior iliac spine at 90 degrees to the skin surface. Ischiadic Block. Teach anterior and dorsolateral approach. Anterior approach is useful in prehospital settings or for transport as it gives no systemic effect, but effectively controls pain. Needs to be mastered prior to arrival in theatre.	
Teach: Toxic effects of LA: Neurological symptoms: drowsiness; twitching; convulsions respiratory depression, Circulatory failure and arrhythmias with hypotension;	Schema of treatment of toxic side effect. Respiratory depression: oxygen, artificial respiration via mask or intubation. Circulatory failure: oxygen, elevate the legs and upper body in "V" position, infuse plasma expander and consider pressure drugs (e.g.:	Ephedrine. Adrenaline. Diazepam amp 5 mg/ml.

TRAINING	TREATMENT	EQUIPMENT
Prompt treatment is essential.	ephedrine, adrenaline). Consulsions: give oxygen and diazepam 10 mg IV, repeated once if necessary. Treat arrhythmias and circulatory arrest in normal way consider giving intravenous lipids 100 ml	Thio-pentone. 25 mg/ml. Intravenous lipids for IV feeding
<u>Teach:</u> Indications of spinal block: Operations of lower limbs. External genitalia. Anal regions Cæsarian section/ lower abdomen on rare occasions. Contraindications: Hypovolemic sepsis patients. Anticoagulants and antiplatelet drugs. Aseptic technique to pass epidural catheter in cephalad direction. Monitoring and care. Treatment of complications. Complications with spinal anaesthesia: Headache. Acute urinary retention. Extradural abscess or meningitis. Cardiac arrest from vasodilatation and reduction of venous return.	<u>Spinal block.</u> Make a small intradermal weal. Insert introducer through the weal. Remove stylet. Insert spinal needle. As it is felt to snap through the lig. flavum, withdraw the stylet and cerebrospinal fluid will flow through the hub. Attach syringe without moving the needle. Inject the required dose and remove spinal needle. Turn patient on his/her back for 5 min. before putting him/her in the required position. Use a fine spine needle, give good postoperative care. Prevent BP falls. Absolute sterility. No spinal for patients with reduced circulation. A fall of systolic BP should be corrected by a small IV dosage of vasopressor (ephedrine 10 – 25 mg) and by plasma expanders, airway and ventilatory support as required (see relevant triptych A.04).	Equipment to obtain asepsis (towel, swabs). A small metal box: 2 syringes (2 and 5 ml); 2 spinal needles (24 – 26 g); Needles of assorted sizes; 1 swab holder; 1 scalpel blade or size introducer. Heavy Nupercaine 6%. Bupivacaine plain and heavy. Ephedrine. Urethral catheter.
<u>Teach:</u> Indications and contraindications of epidural anaesthesia (both thoracic and lumbar epidural).	<u>Epidural block.</u> Patient lies on one side near edge of a straight table with knees drawn towards the chest and neck fully flexed. Choose the widest space between two vertebrae (L3 and L4) and make a small intradermal weal. Infiltrate between two	One box containing Tuohy needle. Syringes and needles. Swabs and swab holder. Local anesthetics. Saline.

TRAINING	TREATMENT	EQUIPMENT
Trained anesthetist must be available to perform epidural, paramedic to monitor. Basic anatomy. Single shot and catheter technique. Contraindications: Hypovolemic sepsis patients. Anticoagulants and antiplatelet drugs.	vertebrae. While this is taking effect, assembly Tuohy needle and a syringe with normal saline. Needle is inserted through selected interspace until the lig. flavum is reached. Resistence will then be felt. The moment lig. flavum is penetrated, the normal saline can easily be infiltrated (loss of resistance test). Keep the needle steady. Inject test dose of 2 ml of LA with adrenaline. Observe for tachycardia or toxic reactions for 1-2 mins. Thereafter 20 ml 1 – 2% LA is introduced into epidural space.	

A.09 ANALGESIA AND SEDATION IN THE FIELD

PREAMBLE

The majority of patients needing emergency medical care are in genuine pain often with an overlay of apprehension and anxiety and proper pain management should be an integral part of emergency medicine, also pre-hospitally.

Relief of pain and anxiety carries the extra bonus of improving tissue perfusion. Pain relief can be achieved by using analgesics acting peripherally (Acetylsalicylic Acid, Paracetamol) or centrally (opiods, Ketamine). Minor tranquillisers and neuroleptics can be used alone or in combination with analgesics for sedation.

All analgesics, however, have side-effects and thereby concomitant limitations. Unfortunately fear of dangers associated with such side effects has often led to insufficient pain treatment. To facilitate proper pain treatment, also in difficult field situations and to reduce the risk of unexpected side effects, the number of analgesics should be kept at a minimum combined with simple and safe standards and procedures for their use..
The prime objective must be to deliver an adequate pain treatment and anxiolysis, without suppressing also that part of the stress reaction which is a physiologic reaction to bodily harm.

TRAINING	TREATMENT	EQUIPMENT

ROLE 1

Teach: Principles of indirect pain relief by correct positioning, immobilisation of fractures. and careful transportation. Acute pain is treated by correct diagnosis and treatment supplemented by analgesics. (NB: Pain associated with acute diseases mostly are important for correct and rapid diagnosis.) Standardized pain policy with indications for and contraindications of analgesics. Psychological first aid (fear is companion to pain)(see relevant triptych D.04). Properties and side effects of Ketamine e.g. hyper salivation (se also A.07) Importance of writing on field medical card: Dose; Route of administration; Date; Time. Parenteral agents should be given IV in small incremental doses until desidered effect is achieved. Altered absorption of medicaments in shock.	Collecting area. Assess patient's pain reaction. Assess type and location of injury. Assess how to relieve patient's pain. In mild pain reactions choose if possible peroral analgesics Acetylsalycic acid tabs 0.3 – 0.5 g x 4; Paracetamol tabs 1g x 4. (Adults) Consider in cases of strong pain IM injection of either Ketamine 50 mg or Morphine 20 mg (one only) to be given by paramedic. Then the patient fcannot be left unattended!! Note in the field medical card. Battalion Aid Station. Pain relief: Paracetamol tabs 1g x 4; Acetylsalycic acid tbs 0.3 – 0.5 g x 4; Morphine sulphate oral, IM (in absence of shock); or even better iv in repetitive small doses Ketamine 50 mg IM. Where sedation/tranquillisation is imperative and does not interfere with other requirement, (like monitoring of head injuries) sedation may be achieved by means of bezodiazepines. Mostly used today: Diazepam 5-10 mg (orally or parenterally) Midazolam 1-2 mg i.v..	Bandage material. Splints. Stretchers. Resuscitation equipment. Acetylsalycic acid tabs Paracetamol tabs. Ketamine 50 mg amp. Atropine 1mg/ml Diazepam 10 mg/ml Morphine autoinjectors, tabs, amp. Non Steroid Anti Inflammatory Drugs (NSAIDs)

TRAINING	TREATMENT	EQUIPMENT
Consider IM administration only if IV application is not practical. Pain may impair gastrointestinal uptake, thereby making oral medication less predictable.	In psychotic patients chlorpromazine derivates may be needed. Recommend careful titration i.v. especially if patient is in a vulnerable haemodynamic state.	

TRAINING	TREATMENT	EQUIPMENT

ROLE 2 and 2 Enhanced

All opioids and sedatives have basically similar properties and side effects (depression of respiratory and hemodynamic function). Difference between opioids with morphine agonistic properties and morphine antagonistic properties must be known. All analgesics have undesired side effect (. Benzodiazepines are effective sedatives in the apprehensive, restless and uncooperative patient and may increase the effect of the specific pain relieving agents. Use of antidots Naloxone for opioid overdose Flumazenil for benzodiapine overdose. Ketamine infusion to be administered by a trained physician; give Ketamine if free airway is guaranteed. (only for anaesthesia) Pharmacology, indications and side effects of Propofol. (Should not be used for sedation below Role 3.) The only anaesthetic that is also a bacterial growth medium and as such very vulnerable to storage and must be discarded when opened. When using Ketamine in head injuries, beware	Pain relief (peroral): Morphinecloride tablets. Pain relief (parenteral): Morphinesulphate iv in repetitive doses of 2.5 mg until adequate pain control or unacceptable side-effects (e.g. respiratory depression, severe hypotension). Sedation (peroral): Diazepam 5 mg x 3 tabs. Sedation (parenteral): Diazepam 5 – 10 mg IM or Diazepam 2,5 – 5 mg IV, or Midazolam (if available) 1-2 mg IV. Choose Ketamine single injection technique: Atropine 0.2 mg/10 Kg IV. Diazepam 0.2 – 0.3 mg/Kg IV (max 10 mg) or Midazolam (if available) 5 mg IV; afterwards: Ketamine 0.25 – 0.5 mg/Kg IV over 60 –90 s; duration 5 – 10 min; maintainance: half of the initial dosis IV, or In case of psychosis forcing drug treament, choose one of the following regimens: Haloperidol 5 – 10 mg IM/IV, or Trifluopromazine (in special psychiatric indications) 5 – 10 mg IM/IV. Treat hypovolemia if present. Evacuate the casualty.	Analgesics: Ketamine. Morphine. Minor tranquillisers: Diazepam tabs. Diazepam amp. Midazolam. Neuroleptics according to national policy, to be kept at medical facility. Resuscitation equipment. IV infusion sets. Endotracheal tubes. Suction apparatus. Ambu – bag. Naloxone amps 0.4 mg/ml. Flumazenil Ketamine amps 500 mg/10 ml. Atropine Tranquillisers: Diazepam. Droperidol (Today main indication is as anrti-emetics). Haloperidol. Trifluopromazine.

TRAINING	TREATMENT	EQUIPMENT
of elevated intracranial pressure. Protective laryngeal reflexes in Ketamine analgesia are no guarantee against aspiration and vomiting.		

TRAINING	TREATMENT	EQUIPMENT

ROLE 3

Consider prophylactic administration of an antisialogue as premedication (e.g. Atropine 0.5 mg). (Compulsory in cvhildren) Use of antidotes in opioid overdose; use of naloxone only in case of inadequate spontaneous breathing: Modern opioids like fentanyl (long acting) and remifentanyl (ultra short acting). Side-effects e.g. stiff chest syndrom.. Knowledge of severe psychiatric disorders (psychoses and the battle stress reaction – see relevant triptych D.04). Neuroleptics are primarely antipsychotic drugs. Knowledge of the central nervous and hemodynamic effect of neuroleptics. Possible side effects of neuroleptica (e.g. extra pyramidal symptoms and more seldom vegetative disturbances) In depth knowledge of pharmacokinetics of relevant Local anaesthetics (see triptych A.08) Epidural in a field setting has considerable limitations.	Continue Ketamine infusion (if adequate infusion control is guaranteed e.g. with an infusion pump,if available). Atropine before induction as a single injection; Ketamine 500 mg; Diazepam 20 mg in 500 ml Ringer lactate; Induction: 60 100 drops/min Requires an infusion pump to prevent anaesthetic dosage. The use of Propofol should be limited to the transport of an intubated and ventilated patient, assisted by an anesthetist. Pain relief: If experienced in techniques of regional anesthesia and hygienic conditions permit, consider epidural analgesia by a catether and local anesthetics (Bupivacaine 0.125 – 0.25% 20 ml) . It is recommended to add fentanyl 2 microgram/ml. Do not consider epidural analgesia if the patient is to be evacuated in a short time.	Resuscitation equipment. Infusion sets. Local anesthetics. Epidural catheters. Infusion pumps. Atropine. Ketamine. Propofol. Bupivacaine 2,5 mg/ml 20 ml vilas Or Bupivacaine 5 mg/ml and Dilution with normal saline to proper concentration (1,25-2,5 mg/ml)

A.10 PERORAL FLUID REPLACEMENT IN THE FIELD

PREAMBLE

The replacement of salt and water for dehydration in the field by the peroral route is simple.
This method is valid for all. roles and can very well be used for the less severely wounded casualties to delay the onset of shock and may obviate the possible need for i.v. infusion, particularly where the setting up of i.v. infusion is not operationally practical in any role or is not recommanded for each soldier, e. g. in warm environment or under fire.

The operational commander has to instruct all soldiers in combat conditions on the local drinking regime in order guarantee sufficient intake of fluid as a prophylaxis.
The triptych is not divided into different Roles, because in the field at all roles there is the same peroral fluid replacement.

TRAINING	TREATMENT	EQUIPMENT

ALL ROLES

Teach: Pathophysiology of shock and hypovolaemia. Management with hypotonic electrolyte solutions. Indications: Hypovolaemia. Hemorrhagic blood loss without shock. 20% or less body surface burns. Heat exhaustion. Dehydration prevention and treatment in diarrhoea, infections and fevers. Supplement to intravenous administration of water and electrolyte solutions. Contraindications: Shock. Acute trauma of pharinx, oesophagus, abdomen. Abdominal distension. Imminent emergency operation. Nausea. Low levels of consciousness.	Instructions: Time of administration: Early application in condition of severe fluid deficiency, before “shock” develops. Preparation: Mix the contents of one sachet of Haldane or Moyer’s solution or ORS salt mixtures with 1l fresh water in a bottle. Add flavouring if available. N. B.: Avoid the time honoured regimen of “1 teaspoon” of common salt in 1l of water, because this solution is too concentrated. Single dose: Draughts of more than 30 ml at any one time should be avoided because of risk of vomiting. Daily dose: Daily dosage should not exceed 4 l/24 hrs. Precaution: Do not force drinking when nausea, vomiting or shock are present or in casualties that have a diminishing level of consciousness.	Modified Haldane solution. Content in a litre: Na 41 mmol/l Cl 41 mmol/l NaHCO3 14.2 mmol/l Osmolarity 146.4 mmol/l In the UK, Moyer’s Solution: Sachet for 1 l with NaCl 4.5 g NaHCO3 4.5 g ORS, if available: Sachet for 1 l with NaCl 1.75 g KCl 1.45 g Na Citrate 1.45 g Glucose 10.00 g Any other commercially available electrolyte solution. 2 sachets of Haldane or Moyer’s or ORS salt mixtures to be carried by soldier. Store of sachets to be held by the medical facility.

B.01 Head injuries

PREAMBLE

Traumatic Brain Injury (TBI) is a leading cause of death and disability in children and adults in their most productive years. TBI has a devastating effect on the lives of the injured individuals and their families because disability results in a significant loss of productivity and income potential. Neurotrauma is a serious public health problem that mandates continuing efforts in the areas of prevention and treatment.

In the military setting TBI is caused mainly by traffic and other accidents, far less by the impact of war weapons.

During the past two decades, understanding of the pathophysiology of TBI has increased remarkably. One central concept is now known: All neurological damage does not occur at the moment of impact (primary injury), but rather evolves over the ensuing minutes, hours, and days. This secondary brain injury can result in increased mortality and more disabling injuries.

Early assessment, adequate immediate treatment, and transport to appropriate facilities for severe head injury patients in the prehospital setting are a mainstay to reduce secondary brain injury.

Secondary brain injury is caused by potentially treatable factors, such as:
Hypoxia
Hypercarbia.
Hypotension.
Anaemia.
Increased intracranial pressure due to different causes
The most important in the management of head injured patients is to avoid or diminish “secondary brain injury” in order to decrease the overall mortality and morbidity.
Patients with penetrating brain injuries who remain unconscious (CGS < 8) after adequate resuscitation consistent with ABC’s principles are unlikely to survive .ventilation may sustain “life” for long period of time but may not be warranted in wartime.
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TRAINING	TREATMENT	EQUIPMENT

ROLE 1

Teach: The pathophysiology of brain injuries (N.B.: hypotension can greatly increase secondary neurological damage) The mechanisms of head injuries and associated injuries. The relations between the energy of missiles and the degree of neurological injuries in gunshot wounds. Closed versus open head wounds Penetrating versus blunt head wounds Cerebral perfusion theories Current infusion therapies in isolated and concurrent brain injuries General examination: check vital signs, examination of head, face and neck (wounds, haematomas, loss of blood or CSF or brain tissue), pallor, coldness, incontinence, seizures, vomiting. The assessment of level of consciousness either using AVPU (note 1), or GCS (note2) scores. Basic and advanced life support (see relevant triptychs A.02, A.03).	Assess vital signs: airways, breathing (RR) and circulation (P, BP). Give oxygen via non-rebreathing mask Carry out any life – saving procedures as required (see relevant triptych A.02). Perform a rapid neurological examination. Arrest superficial haemorrhage by firm dressing; administer antibiotics; give tetanus prophylaxis. Cover open skull fractures If conscious and in pain: analgesics should be used cautiously in small doses; morphine should be titrated carefully. If shock: check for associated injuries and stop blood loss and start IV infusion; blood pressure must be restored before an accurate neurological assessment can be made, but avoid huge infusions, which could cause further brain damage from cerebral oedema. Aim at 100 mmHg systolic blood pressure Reassess regularly If seizures, treat them aggressively. If unconscious: clean and maintain airway,	Sphygmomanometer and stethoscope. Pocket light. Oxygen cylinders and administration kit. Oropharyngeal and nasopharyngeal airways, laryngoscope, endotracheal tubes. (See relevant triptych A.04) Cricothyrotomy set complete, field dressings. Skin cleansing swab. Antibiotics (see relevant triptych A.06) Tetanus toxoid, analgesics (see relevant triptych A.09) IV infusion sets complete

TRAINING	TREATMENT	EQUIPMENT
	stabilise head and neck, nurse in side position. Consider spinal precautions. Record essential information. Evacuate.	Benzodiazepines Phenobarbital amp. 200 mg Neck collar Field medical card, stretcher

TRAINING	TREATMENT	EQUIPMENT

ROLE 2

Refer to Role 1. Teach: Increased Intracranial pressure is a major complication and its detection is important and can be made by progressive deterioration of neurological and general state: Somnolence, blunting, deep coma. Pupillary signs (anisocoria, midriasis). Hemiparesia, hemiplegia. Seizure Vomiting, bradycardia, hypertension. Shock in head injuries necessitates search for other injuries. Recognise limited role of hyperventilation and the role of CO_2 in cerebral perfusion. Remember: Intracranial oedema is the major cause of cerebral death after injury. Mannitol should be used only for short-term emergency resuscitation. Hypovolemia is a relative contraindication to Mannitol solution. Treatment of unconscious state.	Check the effect of Role 1 resuscitation efforts. Continue and expand as required. Reassess and document, check antibiotics, tetanus, consider invasive pressure monitoring. Stop bleeding contributing to shock if possible. If not in shock and with signs of increased ICP hyperventilate and/or mannitol bolus pending surgical decision Rush to appropriate facility with CT-scan and neurosurgical capacity	Refer to Role 1 . Surgical instruments for laparotomy or thoracotomy. Antibiotics (see relevant triptych A.06) Tetanus toxoid, analgesics (see relevant triptych A.09) IV infusion sets complete IV solutions (see relevant triptych A.05) Blood grouping and cross matching kit Blood giving sets Blood storage transportation. Mannitol solution 500 and ml 20%Mechanic ventilator (if available) Urethral catheters and urinary drainage bags. Field medical card

TRAINING	TREATMENT	EQUIPMENT

ROLE 3

Refer to Role 1 and 2 Teach: Head injuries classification: Skin injuries: contusion scalp wound; subcutaneous haematoma. Skull fractures: Linear and depressed; Closed and open; Skull base: with or without cerebrospinal fluid loss. Penetrating injuries Cranial nerve lesions. Vascular lesions: epidural, subdural, subarachnoidal, intracerebral haematomas. Brain injury: Primary: Diffuse axonal injury (DAI) involving The lobar white matter; The corpus callosum; and The dorsolateral aspect of the upper brain stem Cortical Contusion subcortical grey matter injury Secondary: Brain swelling; Cerebrospinal fluid hyper – hypotension; Brain displacement (cerebral hernia)	Assess and continue resuscitation efforts Treat shock Perform CT-scan as soon as possible Neurological re-evaluation if possible Initiate invasive monitoring: BP, ICP Consider surgical treatment of the head-injured patient with any of the following: Intracranial haematomas that cause significant mass effect A midline shift of 5 mm or more; Obliteration of the basal cisterns on the CT scan; ICP >30 mm Hg (used in conjunction with neurological examination to determine which patients with intracranial haematomas may require surgery). Early surgery in selected cases: Large (>30-cc) temporal-lobe haematomas Posterior fossa haematomas; Contusions >2 cm; Gunshot wounds Admit to Intensive Care unit and continue to monitor and control CPP and treat other injuries Start on antiepileptic medication Inspect for undiscovered injuries Record essential information.	Refer to role 1 and 2 CT-scan Invasive pressure monitors Antibiotics (see relevant triptych A.06) Tetanus toxoid, analgesics (see relevant triptych A.09) .

TRAINING	TREATMENT	EQUIPMENT
	Evacuate urgently to a specialist unit.	
Teach: Cranio – cerebral gun shot wounds prognosis Anaesthetic techniques to reduce or minimise brain swelling: Surgical technique trepanation, burr holes	If it is considered that the casualty will be beyond saving before arrival at a specialist unit, craniotomy operation, or burr holes, should be undertaken at field hospital under general anaesthesia with endotracheal intubation (see relevant triptych A.7). A minimum of brain wound toilet should be carried out removing only fragments of bone or missile readily presenting them selves on gentle irrigation and draining any released haematoma. Use Mannitol only for short-term emergency resuscitation. Temperature control may be indicated.	Anaesthetic apparatus and supplies. Anaesthetic drugs. General operating instruments set. Neurosurgical instrument set. Standard and neurosurgical swabs and dressings. Ligatures, neurosurgical clips. Skin grafting instrument set. Antiepileptic medication

NOTE:
AVPU - Alert
Vocal response
Pain response
Unresponsive

CGS (Glasgow Coma Scale):

EYES	*Open:*
4	*spontaneously*
3	*To verbal command*
2	*To pain*
1	*No response*
BEST VERBAL RESPONSE	
5	*Oriented and converses*
4	*Disoriented and converses*
3	*Inappropriate words*
2	*Incomprehensive*
1	*No response*
BEST MOTOR RESPONSE	
6	*To verbal commands: obeys*
5	*To painful stimulus localises pain*
4	*Flexion –withdrawal*
3	*Anormal flexion*
2	*Extension*
1	*No response*

min.3 – max 15

TOTAL

B.02 MAXILLO – FACIAL INJURIES

PREAMBLE

ROLE 1

TRAINING	TREATMENT	EQUIPMENT
Teach:		
Anatomy of airways.	Clear and maintain airway. Place in ¾ prone position on stretcher.	Field dressings.
¾ prone position.	Arrest accessible hemorrhage.	Oropharyngeal, nasopharyngeal and endotracheal airways.
methods of arresting hemorrhage.	Apply field dressings.	Cricothyrotomy set.
Removal of fragments obstructing airways.	Consider airways and possible cricothyrotomy	Bandages.
Stabilisation of displaced soft tissue (e. g. tongue).	Consider simple bandage.	Antibiotics.
Cricothyrotomy technique.	Administer antibiotics (see relevant triptych A.06).	Analgesics.
Simple immobilisation of maxillo – facial fractures.	Consider analgesia (see relevant triptych A.09). N. B. : these injuries often do not need much analgesia.	Syringes,needles, water for injection.
Intra – muscular injection.		Skin cleansing swabs.
Venepuncture.	Give fluids (see relevant triptych A.05). N. B.: shock in maxillo – facial injuries might suggest other injuries.	IV infusion sets.
		Electrolyte fluids.
Administration of IV infusions.	Evacuate.	Suction apparatus and catheters.

ROLE 2 and 2 Enhanced

<u>Teach:</u>	Clear and maintain airway.	Field dressings.
Anatomy of airways.		Oropharyngeal, nasopharyngeal and endotracheal airways.
¾ prone position.		Cricothyrotomy set.
methods of arresting hemorrhage.	Consider airways and possible cricothyrotomy.	Bandages.
Removal of fragments obstructing airways.		Antibiotics.
Stabilisation of displaced soft tissue (e. g. tongue).		Analgesics.
Cricothyrotomy technique.		Syringes,needles, water for injection.
Simple immobilisation of maxillo – facial fractures.	Check, adjust or reapply dressings.	Skin cleansing swabs.
Intra – muscular injection.	Continue antibiotics and analgesics. Tetanus prophylaxis, if not already made.	IV infusion sets.
Venepuncture.	Ontinue to give fluids (see relevant triptych A.5). N. B.: shock in maxillo – facial injuries might suggest other injuries.	Electrolyte fluids.
Administration of IV infusions.		Suction apparatus and catheters.
Physiology of fluid loss.	Evacuate.	
Positive pressure ventilation.		

TRAINING	TREATMENT	EQUIPMENT
ROLE 3		
<u>Teach:</u> Anatomy of airways. ¾ prone position. Methods of arresting hemorrhage. Removal of fragments obstructing airways. Stabilisation of displaced soft tissue (e. g. tongue). Cricothyrotomy technique. Simple immobilisation of maxillo – facial fractures. Intra – muscular injection. Venepuncture. Administration of IV infusions. Physiology of fluid loss. Positive pressure ventilation. Anesthetic support. Training. Wound toilet. Eyelet wiring. Application of arch bars. Application of bottons. Intermaxillary fixation (wiring or elastic).	Continue antibiotics and analgesics as necessary. Maintain airway or secure airway by endotracheal intubation or tracheostomy technique. Resuscitate as necessary. Because of good blood supply, facial injuries can withstand some delay in primary treatment. Maxillo – facial injuries should therefore, where possible, be evacuated to a Gen. Hospital with a “Head Unit”, to be dealt with by a specialist maxillo – facial team. Where evacuation is delayed: X – rays are required; Anesthetic for : Operation of wound toilet with minimal excision of skin edges. All viable bone except fragments which are soiled by foreign bodies should be preserved. Completely loose teeth only are removed. Immobilisation of the jaws, using elastic bands for fixation over Leonard buttons helped by interdental wires. Mucosa is then closed intraorally then skin closure as a primary procedure. Bone should not be left uncovered (skin graft and mucocutaneous suture may be required to achieve this and also to prevent distorsion of lips and eyelids); nasogastric feeding may be rquired. Evacuate when fit to travel.	Field dressings. Antibiotics. Analgesics. Syringes,needles, water for injection. Skin cleansing swabs. Oropharyngeal, nasopharyngeal and endotracheal airways. Laryngoscope. Tracheostomy set. Suction apparatus and catheters. IV infusion and complete blood giving sets. Blood pumps and warming coil. Electrolyte fluids. Colloid fluids. Nasogastric tubes. Anesthetic apparatus, drugs and gases. Wound excision instrument set. Maxillo – facial instrument set including sutures. Swabs. Cotton wool. Bandages. Strapping. Safety pins. Wire. Elastic fixation. Dental buttons. Leonard’s buttons. Arch bars. Blood specimen bottle. X – ray apparatus. Films and developing chemicals and apparatus.

B.03. OPHTALMIC INJURIES AND SEVERE EYE ILLNESSES

PREAMBLE

Ophtalmic injuries occur in 10% of wounded soldiers in conflict situations; in 15% both eyes are injured.
Often in multitrauma-patients there are eye-injuries as well. The problem is that they are frequently overlooked because of the other overwhelming injuries.
It is important to inspect the eyes as early as possible during the trauma management. In maxillofacial injury the eyelids can become oedemateous and swollen within an hour and inspection and treatment is then more difficult.

Simple therapeutic measures can save the vision and prevent worsening.
Loss of or damage to an eye is a serious threat and invalidating. Loss of both eyes renders the patient completely invalid.

Some injuries can easily be managed on role 1.
Other, more severe injuries must be treated by an ophtalmologist in role 3 (if available) or in an ophtalmologic centre.

Besides injuries there are some severe eye-illnesses, which need attention from an ophtalmologist

Some remarks about medication:
Antibiotic eye ointment should be instilled 3 x dd

NB. Mydriatic medication: the effect of
Atropine 1% lasts 1 week
Homatropine 2% lasts 2 days
Tropicamide 1% lasts 3 – 6 h

TRAINING	TREATMENT	EQUIPMENT

ROLE 1

TEACH: to obtain history of the trauma or illness: . blunt trauma . penetrating injury . thermal, chemical . acute visual disturbance Wearing spectacles, lenses? Measure visual acuity: establish baseline value alerts for trouble (p.e. acute glaucoma, vitrous haemorrhage, eye-injury) Most eye-injuries are characterized by trias: . tears, blepharospasmus, photophobia . difficult to examine, use local anesthetic Inspection of the eyes: . inspect lids and lashes . inspect cornea, conjunctiva and sclera with aid of penlight . assess depth of anterior chamber . assess pupilary shape, stand and reactions . assess ocular movements (both eyes together and each eye separately) . assess ocular tonus . assess fundus . assess infraorbital sensation Inspection eyelids: . Edema can develop early following trauma and prevent inspection of the eye(s) for	Inspection of the eyes Remove lenses Measure visual acuity: . Test vision with hand movements . patient should count fingers at a distance of 1 meter . use letter chart or near reading chart (bedside examination) Inspection: - give local anesthesia . look for eyelid lacerations, edema, haematoma, conjunctival redness, abrasions, foreign bodies, bleeding ophtalmic burns, perforation cornea erosion, ulceration . look for pus, blood (hyphaema) in anterior chamber . examine pupils (position, movement, distortion, light reaction, equal size), . look for cataract, orbital injury, closed lids soft palpation	illumination penlight loupe ophtalmoscope / dark room or location contact lens aspirating device letter chart (Snellen eye chart) near reading chart eye pads local anesthetic: oxybuprocaine 0.4% minims eye stream / irrigation cotton wool tips fluoresceine eye drops/strips skin cleansing swabs, asepticum, oxybuprocaine o.4% minims syringes, needles

TRAINING	TREATMENT	EQUIPMENT
several days. Inspect globe as soon as possible . Ecchymosis, ptosis, burns, chemical injury, lacerations	no specific treatment for edema, ecchymosis and ptosis treatment of lacerations, burns, chemical injury , consider irrigation	Ophtalmic suture set: eye forceps surg 1.4 mm eye forceps anat 1.4 mm eye scissors straight 12 cm eye scissors curved 12 cm
Eyelid lacerations: . torn lid margins and damaged lacrimal ducts need specialist attention	Eyelid lacerations: . protect eyes and stop bleeding . if necessary suture to approximate wound edges . pad and bandage . evacuate to ophtalmic unit if lid margins are torn and or lacrimal ducts are damaged . consider systemic antibiotics (trypt A.06. Antibiotic Policy in the Field) . consider tetanus vaccin	fine sutures (atraumatic): vicryl 8x0 silk 6x0 nylon 6x0 eye pads, bandages penicillin, erythromycin or amoxyclavulanic acid tetanus vaccine 0.5 ml
Ptosis upper eye lid: . secundary to edema . damage to m. levator palpebrae . injury n. oculomotorious (III)	Ptosis: no specific treatment Give local anaesthestic	oxybuprocaine 0.4%
Inspection for conjunctival foreign bodies and lacerations: . signs: foreign body sensation "red eye" (conjunctival vessel injection/ redness) . eversion of upper eye lid	Conjunctival foreign bodies and lacerations: . inspect conjunctiva, everse upper eye lid . exclude suspicion of penetrating injury . remove foreign bodies . eventually wash out conjunctival sac . consider antibiotic eye drops/ointment . consider applying pad and bandage	cotton wool tips eye stream / irrigation saline, water antibiotic eye drops/ointment: chloramphenicol 0.5%, eye pads, bandages
Inspection for corneal abrasions, foreign bodies: . history of blunt injury (hammer and chisel) . conjunctival redness	Corneal abrasion: . instill local anesthesia eye drops . instill fluoresceine	Oxybuprocaine 0.4% fluoresceine mydriaticum eye drops: atropine 1%, homatropine 2%, tropicamide 1%

TRAINING	TREATMENT	EQUIPMENT
. abrasions are only to be seen after instilling fluoresceine . iron foreign body gives easily rusted cornea, which must (both) be removed very carefully	. confirm diagnosis . instill mydriaticum . instill antibiotic ointment . apply eye pad and bandage	chloramphenicol 0.5%, fucidin acid 1% ointment eye pads, bandages
	Corneal foreign body: . instill local anesthesia eye drops . instill fluoresceine . look with cobalt blue filter . remove foreign body with cotton wool tip or (foreign body) spatula . remove rust with special rotary drill . treat remaining epithelial defect as an abrasion	same as abrasion, and cotton wool tips (foreign body) spatula cobalt blue light (filter) or woods light loupe ophtalmic rotary drill
Inspection for corneal ulceration: . signs: usually painful conjunctival injection (redness) . without fluoresceine the diagnosis will be easily missed . can lead to loss of the eye . caused by infection (bacterial, viral, fungal) . primary or secundary (abrasion, contact lens wear, topical steroids)	Corneal ulceration: . confirm with fluoresceine . instill local anesthetic . instill mydriatcum . as soon as possible to an ophtalmic unit . apply eye pad and bandage	ophtalmoscope, loupe, blue filter oxybuprocaine 0.4% fluoresceine (strips/drops) atropine, homatropine 2%, tropicamide 1% eye drops eye pads, bandages
Ilnesses presenting with a “red eye” (conjunctival injection) which need attention by an ophtalmologist:		
Episcleritis and scleritis . signs: painful, red eye, tender to touch both present as a localised area of inflammation in the region of the conjuntiva . (epi)Scleral vessels are larger than conjunctival vessels	Scleritis needs ophtalmological review send to an ophtalmic unit	

TRAINING	TREATMENT	EQUIPMENT
. scleritis is much more painful than episcleritis and a more serious illness	Iridocyclitis must be send to an ophtalmic unit	
Iridocyclitis signs: pain with photophobia and ciliary spasm ciliary flush (injection of vessels) pupil small or irregular (spasm or adhaesions) . normal or impaired vision . often secundary to other illnesses (tuberculosis, herpes zoster, syphillis, etc) . complication: continued inflammation can lead to permanent damage: glaucoma, cataract, macula-edema	Acute glaucoma must be send immediately to an ophtalmic unit palpation ODS	
Acute glaucoma . consider in patient over 50 years old with “red eye” . signs: painful, impaired vision eye feels harder than normal eye . danger of permanently damage to the eye	Ophtalmic burns: Thermal: . cool down if eye involved: . instill mydriaticum . instill antibiotic ointment . eye pad and bandage	atropine 1%, homatropine 2%, tropicamide 1% chloramphenicol 0.5% , fucidin acid 1% eye pads, bandages
Ophtalmic burns Thermal trauma: . hot water, fat, fire . normally anterior segment (eyelids, lashes, cornea, conjunctiva) involved	Chemical: . instill local anesthesia eye drops . wash out thoroughly the eye (saline, clean water)	oxybuprocaine 0.4% eye stream / irrigation saline, water
Chemical trauma: . blepharospasm extensive		cotton wool tips

TRAINING	TREATMENT	EQUIPMENT
. often non-physiological vehiculum (soap, hairspray, etc) . in the military frequently gasoline, etc Acid burns . normally only surface damage Alkali burns: . much more tendency to deeper burns: cornea, iris, lens, corpus ciliare . 4 degrees: 1 redness,dotted cornea erosions 2 chemosis conjunctiva, edema 3 avascularity and necrosis are < 180^0, fisheye appearance 4 same, area > 180^0 . remember: “ïf the eye looks good red, it won’t perhaps be that bad” . complications: cornea opacification, glaucoma, symblepharon, phtisis bulbi Radiation burn damage: . signs: painful, irritated eyes . kerato-conjunctivitis photoelectrica, by welding without protection . snow blindness, damage by UV-radiation Blunt injuries: . inspection for (other than corneal foreign body)) blunt injuries: . eyelid haematoma: the eye is here protected	. in case of acid/alkali burn immediately wash out the eye(s) at least for 20 minutes . after eyewash reinspection . remove foreign body . instill mydriatic eye drops . instill antibiotic ointment . apply eye pad and bandage . 3rd and 4th degree as soon as possible to an ophtalmic unit Radiation damage see corneal abrasion Blunt injuries: . eyelid haematoma: no treatment . contusio bulbi: no treatment Hyphaema:	(foreign body) spatula atropine 1%, homatropine 2%, tropicamide 1% chloramphenicol 0.5%, fucidin acid 1% eye pads, bandages atropine 1%, homatropine 2%, tropicamide 1% eye drops

TRAINING	TREATMENT	EQUIPMENT
by the orbita . contusio bulbi: if eye is hit by subject smaller than orbita this can lead to a contusio bulbi (hyposphagma)	. total ocular rest . instill mydriatic eye drops . instill antibiotic ointment . apply eye pads and bandage both eyes	chloramphenicol 0.5%, fucidin acid 1% eye pads, bandages
. be aware of bleeding: . look for an hyphaema (blood visible in anterior eyechamber) . here danger of a worse secundary bleeding on 3rd to 5th day with total hyphaema, secundary glaucoma and corneal staining	. stretcher case, evacuate for full bed rest . evacuate to ophtalmic centre Orbital blowout fracture: . Consider systemic antibiotics (trypt A.06.) . consider tetanus vaccin . expectative in an ophtalmic centre	penicillin, erythromycin, amoxyclavulanic acid tetanus vaccin
Inspection for orbital blowout fracture: . Signs: diplopia, enophtalmus, defective eye movements (mostly vertical up), ipsilateral nose bleeding, diminished sensation in area of infraorbital nerve. . usually in orbita floor . complication: infection of sinusses Inspection for penetrating injuries: . signs: acute pain after accident (high velocity injury), bad visual accuity, foreign body sensation	Penetrating injury: . examine the eye carefully for small lacerations and possible site of entry . instill mydriaticum . look for foreign body . apply eye pads and bandage, no pressure on the globe . consider systemic antibiotics, tetanus vaccin . evacuate as lying case to an ophtalmic unit	dark room ophtalmoscope, loupe atropine 1%, homatropine 2%, tropicamide 1% eye drops penicillin, erythromycin, amoxyclavulanic acid tetanus vaccin
Cornea perforation: . signs: pupil distortion, poorly reaction, iris prolaps . loss of eye pressure Sclera perforation: . if accompanied by vitrous haemorrhage then no red reflex by light shining on the eye	Acute visual disturbances: . test acuity (counting fingers) . test fields (quadrants) of sight	letter chart ophtalmoscope, dark room short acting mydriaticum eye drops: tropicamide 1%

TRAINING	TREATMENT	EQUIPMENT
. can be masked by conjunctival bleeding . complications: lens damage leading to cataract damage to draining angle (anterior chamber) leading to glaucoma Acute visual disturbances: . history of floaters, field loss, flashing lights, headache as with: . retinal detachment . posterior vitreous detachment . vitreous haemorrhage	. test pupil reactions . instill short acting mydriaticum eye drops . elicit red reflex with ophtalmoscope: if absent or diminished there is an opacity between cornea and retina (cataract, bleeding) . study with ophtalmoscope the retina, macula and optic nerve . every patient with visual disturbances must be send to an ophtalmic unit	

TRAINING	TREATMENT	EQUIPMENT

ROLE 2

Same as in role 1	Continue all treatment Evacuate patients with: . eyelid lacerations with torn lid margins and or damaged lacrimal ducts . corneal ulceration . scleritis . iridocyclitis . acute glaucoma . chemical burns . hyphaema . orbital blowout fracture . penetrating injury . acute visual disturbance To an ophtalmic unit in role 3 or higher.	letter chart (Snellen, near reading) ophtalmoscope, loupe, cobalt blue filter illumination, dark room slit lamp contact lens aspirating device eye stream / irrigation, saline, water oxybuprocaine 0.4% minims fluoresceine drops/strips atropine 1%, homatropine 2%, tropicamide 1% eye drops chloramphenicol 0.5%, fucidin acid 1% ointment cotton wool tips (foreign body) spatula ophtalmic rotary drill ophtalmic surgery set (instrumentation, sutures) eye pads, bandages penicillin, erythromycin, amoxyclavulanic acid tetanus vaccin

TRAINING	TREATMENT	EQUIPMENT

ROLE 3

Same as in previous roles	Continue treatment as outlined in previous roles Evacuate patients specially named in previous roles to an ophtalmic unit.	Same as in role 1 and 2

B. 04 SPINAL CORD INJURIES

PREAMBLE

Spinal cord injury (SCI) must be considered in every high energy trauma such as in motor vehicle acccidents, in falls, during sporting activities and in more overt penetrating vertebral or paravertebral trauma (gun shot wounds). All unconscious patients and all patients who underwent severe blunt trauma should be assumed to have spine injuries until proven otherwise and should be treated as if those were unstable. The cervical spinal cord is most vulnerable and accounts for almost one half of all SCI locations; cervical SCI also leads to tetraplegia in 30 to 45%. Paraplegia occurs in more than 50% of SCI below the cervical level.

The initial neurological evaluation of SCI must be thorough and will include a motor and sensory score of deficit according to the American Spinal Injury Association (ASIA).

The prognosis of SCI depends essentially on the location and the mechanism of injury, the patient's age, an early (<8h) and adequate spine stabilization and resuscitation and an early prevention of secondary spinal tissue damage.

Correct spinal stabilization requires whole body immobilization including head and neck, torso, pelvis and lower limbs maintained from the point of injury until a radiographic evaluation can be performed and any spinal fracture or subluxation excluded and subsequently treated.

Additional mechanical trauma to the skull, the thorax and the abdomen should always be excluded. Shock must be assumed to be hemorrhagic until proven otherwise and treated accordingly.

Patients with high SCI however tend to develop typical neurogenic shock as well. Initial resuscitation consists of rapid administration of large amounts of fluid completed with vasopressor agents if required. The early use of corticosteroids is not recommended anymore, harmful secondary effects beeing superior to neurologic benefit.

The overall early mortality rate of SCI still is about 11%, the most common causes of death being respiratory and cardiovascular problems. In patients with tetraplegia mortality may be increased by as much as the threefold.

TRAINING	TREATMENT	EQUIPMENT

ROLE 1

Teach: *Normal anatomy of the spinal column and different types of injuries.* *Conditions in which a SCI must be suspected.* *Principles of initial resuscitation (A - B - C). >- Objectives of resuscitation:* - normoxia; - normocapnia; - normovolaemia; - normotension; - normothermia.	***Initial resuscitation*** Avoid unnecessary and injudicious movement of head, neck and spinal column. Assess vital signs: **A**irway – **B**reathing – **C**irculation (A, B, C). Oxygenate always and as soon as possible. Provide ventilatory assistance (intubate if necessary) in case of impending respiratory (ventilatory) insufficiency. Take care that the head and neck be kept in the neutral body axis.	Equipment for ventilatory support at Role 1 (see relevant triptych A.04).
Extrication and transport techniques with respect to the head-neck-torso-pelvic axis. Primary survey of the polytraumatized patient.	Search for associated injuries (see relevant triptychs) and hypovolemic hemorrhagic shock. Control any external hemorrhage.	
Pathophysiology of SCI. Pathophysiology of neurogenic shock. Association of high (cervical or upper thoracic) SCI with loss of sympathetic input and subsequent unopposed parasympathetic stimulation, resulting in e.g.: haemodynamic instability; myocardial dysfunction; ventilatory impairment. Mechanisms of spinal (cord) injury and ischemia.	Treat “neurogenic shock” if present and start aggressive fluid resuscitation with normal saline solution in an effort to keep systolic BP >120 mmHg. Avoid hypotonic solutions. *If inadequate response:* Consider again hemorrhagic shock; Add vasopressor agents. *If marked sinus bradycardia:* consider intermittent use of atropine.	Material for IV fluid management at Role 1 (see relevant triptych A.05). Vasopressors. Atropine.

TRAINING	TREATMENT	EQUIPMENT
Teach:	***Spine examination***	
	Avoid unnecessary and injudicious movement of head, neck and spinal column.	
Mechanisms of spinal (cord) injury.	Ascertain the mechanism of injury.	
	Inspect and palpate carefully the entire spine without twisting.	
(Simplified) neurologic evaluation according to the ASIA score.	Note the level of any sensory and motor deficit according to the ASIA.	
	Test sacral/perianal sensation and enquire after bladder dysfunction.	
	Spinal (cord) protection	
Principles of correct spine immobilization and stabilization: placement of cervical collar, use of long spine board, vacuum matress.	Immobilize head and neck with a semi-rigid cervical collar.	Semi – rigid cervical collar.
	Lift (with 4 aidmen) the patient onto a long spine board.	Long spine board.
	Immobilize the patient preferably in a vacuum mattress in an effort to stabilize the whole spine.	Vacuum matress.
	Any move should be done using a suitable extrication board.	
	Sedate if un-co-operative . Give adequate analgesia.	Equipment for analgonsedation at Role 1 (see relevant triptych A.09).
	Give iv antibiotics if open wound. Check tetanus prophylaxis.	Antibiotics
Early gastrointestinal and genitourinary complications.	***Evacuation***	
	Insert an indwelling bladder catheter and a nasogastric tube.	Urinary catheter. Nasogastric tube.
	Assure stable and smooth transport with cardiocirculatory and respiratory monitoring.	Transport monitoring devices.
	Prevent hypothermia.	Whool blankets, aluminium sheets.

TRAINING	TREATMENT	EQUIPMENT

ROLE 2

Teach: Same items of pathophysiology, clinical assessment and stabilization as taught at Role 1.	Avoid unnecessary and injudicious movement of head, neck and spinal column, if not adequately immobilized. Complete and continue as started at Role 1: *Initial resuscitation* and Spinal (cord) protection. Re-assess vital signs (A - B - C).	Same equipment as in *role 1.* Equipment for ventilatory support at Role 2 (see relevant triptych A.04). Material for IV fluid management at Role 2 (see relevant triptych A.05). Equipment for analgesia and sedation at Role 2 (see relevant triptych A.09).
	Secondary survey of the trauma patient	
Secondary survey of a polytraumatized patient	Search for associated injuries that might have been overlooked. Inspect and palpate carefully the entire spine by log rolling in a semilateral position. Note the level of any sensory and motor deficit according to the ASIA. Test sacral and bladder dysfunction. Obtain spine x-rays if available.	
Cervical spine dislocation reduction	Reduce as early as possible cervical spine dislocation when associated with motor or sensitive deficiency, and maintain traction. Finally, immobilize the whole spine again.	Calliper
	Evacuation Secure, if not already present, an indwelling bladder catheter and a nasogastric tube. Assure stable and smooth transport with cardiocirculatory and respiratory monitoring. Maintain calliper traction when previously applied. Prevent hypothermia.	

TRAINING	TREATMENT	EQUIPMENT

ROLE 3

Teach: Same items of pathophysiology, clinical assessment and stabilization as taught at Role 1. Cardiopulmonary and cardiocirculatory hemodynamics. Pathophysiology of autonomic hyperreflexia after neurogenic shock has resolved. Most common radiographic diagnostic findings on conventional spine x-rays and computed tomography. Indications for and techniques of surgical decompression and stabilization of the spinal cord. Indications for early surgery. Importance of early respiratory physiotherapy, gastric protection and physical rehabilitation.	Avoid unnecessary and injudicious movement of head, neck and spinal column, if not adequately immobilized. Complete and continue: Initial resuscitation; Spinal (cord) protection. Re-assess vital signs (A - B - C). Assess more correctly fluid status (urinary output, central venous pressure, pulmonary artery wedge pressure); consider extra blood loss. Be aware of "autonomic hyperreflexia" and treat subsequently. Obtain spine computed tomography or AP, lateral and odontoid spine x-rays. Complete with skull, thorax and pelvic x-ray and with abdominal ultrasound. Obtain bloodsamples for complete blood screen (hematology, glucometry, biochemistry, gazometry, type and cross match). Consider surgical decompression and stabilization of the spinal cord and consider indication for early surgery (<8h). Start transfusion if necessary. Ensure as soon as possible aggressive, sterile pulmonary toilet. Careful cardiac monitoring is required during tracheal suctioning in patients with high SCI. Ensure early gastric protection. Start passive and active range-of-motion exercises of muscles and joints. Avoid decubiti. Ensure evacuation to a *Role 4* facility with a	Same equipment as in *role I.* Equipment for ventilatory support at Role 3 (see relevant triptych A.04). Material for IV fluid management at Role 3 (see relevant triptych A.05). Equipment for analgesia and sedation atRrole 3 (see relevant triptych A.09). Equipment for invasive hemodynamic monitoring : arterial catheter, central venous catheter, pulmonary artery catheter, and adapted pressure monitoring equipment. Fully equipped field hospital X-ray unit. Laboratory equipment for various blood analysis. Surgical decompression equipment.

TRAINING	TREATMENT	EQUIPMENT
	neurosurgical unit. Assure stable and smooth transport with cardiocirculatory and respiratory monitoring. Prevent hypothermia. Prevent venous thrombo-embolism 48 h after trauma.	Heparin

B05 CHEST INJURIES

PREAMBLE

Chest injuries are very common in both civilian and military environments. After head injury, chest injury is the second commonest cause of trauma death being responsible for roughly 25% of all fatalities and a contributing cause in another 25%. Many of these deaths can be prevented by prompt recognition of life-threatening conditions and the early initiation of simple methods of treatment well within the capability of any medical officer.

Chest injuries which are immediately life threatening include airway injuries, tension pneumothorax, open pneumothorax, massive haemothorax, flail chest and cardiac tamponade. In addition, the physician must be able to recognise and treat those injuries to the chest that are potentially life-threatening.

Injuries can be classified as:
Penetrating injuries.
Blunt injuries.
Combination of both.

Penetrating injury can be obvious or occult. An occult injury can result from, for example, a penetrating injury tracking through the abdomen and across the diaphragm. The reverse is also true: a penetrating chest injury can involve organs in the abdominal cavity.

Blunt injuries include all the forms seen in civilian practice, such as road traffic accidents and crush injuries, plus the additional hazard of lung/thoracic cage damage caused by blast. Lung injuries are commonly compounded by the presence of fractured ribs. Nevertheless, pulmonary function is primarily affected by the degree of lung tissue damage which may or may not be accompanied by rib fractures.

Approximately 10% of battlefield casualties will have sustained a chest injury. Only 10% of chest injuries require a surgical operation; most need relatively simple techniques to save and maintain life, such as airway opening manoeuvres, oxygen administration, the application of an Ashermann seal (Heimlich valve), needle thoracocentesis or chest tube insertion. More complex treatment modalities are rarely required as life-saving measures and will not be further discussed in this triptych.

It must be emphasised that chest injuries frequently occur in combination with injuries to other parts of the body. It is possible that increased use of Combat Body Armour to protect the chest has reduced both the number and severity of chest injuries sustained in recent conflicts. Other triptychs covering injuries to other body areas must therefore be consulted as required.

TRAINING	TREATMENT	EQUIPMENT

ROLE 1

Knowledge of chest anatomy and physiology Methods of airway control (see triptych A3) Examination of the chest Recognition of immediately life-threatening conditions: Tension pneumothorax Open pneumothorax Massive haemothorax Flail chest Cardiac tamponade Recognition of potentially life-threatening conditions: Aortic injury Diaphragmatic rupture Pulmonary contusion Myocardial contusion Tracheo-bronchial injuries Oesophageal rupture Venous cannulation Needle thoracocentesis Chest tube insertion Needle pericardiocentesis	Assess and obtain airway control Measure vital signs: Pulse, Blood Pressure, Respiratory Rate. Expose and examine chest. In particular assess:- Chest expansion Position of trachea Resonance note Air entry Administer 100% oxygen using tight fitting mask with reservoir bag. Immediately treat any life-threatening condition: •Tension pneumothorax: Needle thoracocentesis followed by chest drainage •Open pneumothorax: Cover wound on three sides with occlusive dressing or use an Ashermann seal. Insert chest drain away from wound •Massive haemothorax: Insert chest drain •Flail chest: Chest drain; consider need for evacuation for intubation & controlled ventilation •Cardiac tamponade: Needle	Oropharyngeal and nasopharyngeal airways. Endotracheal tubes Oxygen delivery systems IV cannulae, fluids and giving sets Stethoscope Chest drain sets; to include scalpel, large dissecting forceps, chest tubes (varying sizes), suture material & suture holders, occlusive dressings Ashermann chest seals (Heimlich valve) Unidirectional valve chest drainage bags Pericardiocentesis cannulae

TRAINING	TREATMENT	EQUIPMENT
The aims of treatment are to save life, to restore pulmonary function and to prevent or manage complications	pericardiocentesis; recognise need for evacuation for urgent thoracotomy Obtain venous access with two large cannulae and start IV fluids if required (see IV fluids protocol) Recognise potentially life-threatening conditions and evacuate to Role 2	

ROLE 2

TRAINING	TREATMENT	EQUIPMENT
As above Interpretation of chest x-rays Emergency thoracotomy: Indications for and techniques available	Repeat primary survey: ABC Treat any immediately life-threatening injuries as described in ROLE I. Recognise potentially life-threatening chest injuries: Aortic injury Diaphragmatic rupture Pulmonary contusion Myocardial contusion Tracheo-bronchial injury Oesophageal rupture Perform full secondary survey Secure definitive airway, ventilate with 100% oxygen and resuscitate with IV fluids if indicated. Chest drains as required. Laparotomy if indicated.	As for Role 1, plus:- Thoracotomy surgical instruments

TRAINING	TREATMENT	EQUIPMENT
	Thoracotomy if indicated Evacuate to Role 3	

ROLE 3

As Role 1and Role 2	As Role 1 and Role 2 Repeat primary survey and treat ABCs Repeat full secondary survey Definitive surgical and intensive care	Surgical and intensive care facilities CT scanner: this has an increasing Role in the evaluation of patients after blunt trauma. Important findings in thoracic trauma include acute traumatic aortic injury, pneumothorax, haemothorax, pulmonary contusions and lacerations, mediastinal haematoma, and diaphragmatic rupture.

B.06 ABDOMINAL INJURIES

PREAMBLE

Evaluation of the abdomen is one of the most critical components of initial management of the trauma patient. Assessment of patients with blunt trauma includes early recognition of occult sites of hemorrhage such as the abdomen. Reliable and very portable Ultrasound units have come into widespread use in the diagnosis of occult intra-abdominal bleeding, almost eliminating the traditional DPL. Topical haemostatic agents are being used increasingly at the Role 1 and 2 levels in current conflicts, although predominantly for extremity wounds. Case reports have indicated the successful use of QuikClot powder in some abdominal trauma cases, particularly cases of liver trauma, where others means of control of bleeding have been unsuccessful. Factor rVIIa has great potential for use in abdominal trauma and it has gained considerable attention as a result of its use by US and UK medical forces in Iraq. Further clinical studies are yet to be evaluated or are still ongoing. The true benefits and precise indications have yet to be fully developed but Factor rVIIa may come into wider use in the near future as these are established.

Delay in surgical treatment of abdominal injuries can be a significant cause of preventable death or morbidity following truncal trauma. Initial assessment of the abdomen can be compromised in patients with decreased level of consciousness, spinal cord injury or injury to adjacent bony structures such as ribs, spine or pelvis. Significant blood loss can occur in the abdomen before appreciable change in size or appearance occurs. Any patient sustaining blunt truncal injury (direct blow, deceleration or blast related injury), or penetrating injury to pelvis, abdomen or lower half of thorax, must be assumed to have abdominal visceral or vascular injury until proven otherwise. Haemodynamically unstable and temporarily stabilized abdominal trauma patients require immediate surgical attention and must be transferred as quickly as possible to the nearest appropriate surgical facility.

Current doctrine places initial surgical capability at Role 2, where emphasis will be on life or limb saving procedures. The concepts and techniques of Damage Control surgery should be well understood by surgeons in this environment. Expanded surgical (and diagnostic) capability will be at Role 3 and 4 facilities, where more definitive procedures may be emphasized. Medical personnel at the point of conflict must be aware of the requirements for early surgical intervention in these patients and the requirement for evacuation directly to an appropriate surgical facility, rather than the more traditional echelon evacuation chain. Dependable and rapid evacuation, usually by air (helicopter) will be of utmost importance.

TRAINING	TREATMENT	EQUIPMENT

ROLE 1

General Principles: Systematic approach to care of the trauma victim (as per ABC's) Assessment of airway (with C-spine control), breathing, circulation and neurologic status Management of airway (with C-spine), intervention to ensure adequate ventilation, control of hemorrhage, fluid resuscitation, avoidance of secondary neurologic injury. Exposure and Environmental Control (See Triptych B1) Documentation of injuries, interventions and progress Prevention of wound infection (including basic broad spectrum antibiotic, if available (see Triptych A4 Types, indications, side effects of Haemostatic agents First Aid: Control of airway, ventilation Control of hemorrhage Spinal immobilization Recognition of requirement for surgical resuscitation for abdominal injury with shock IV access techniques Extremity splinting Analgesic control of pain Consider paradoxical bradycardia due to peritoneal irritation	Systematic Trauma Care: See Triptych B.01 and B.02 – Emergency Life Saving / First Aid in the Field See Triptych A.05 – Fluid Resuscitation First Aid Treatment: Assure clear airway with C-spine control Immobilize spine to prevent secondary neurologic injury Give O2 by mask. Assist ventilation as required. Direct pressure/field dressing to obvious hemorrhage Establish IV access Splint injured extremities, with appropriate reduction Transport directly to facility with surgical capability without delay Consider Analgesics Consider Antibiotics Consider use of Haemostatic agents Continuous heart rate monitoring	As per Triptychs B.01 and B.02 Airways (Oral, nasal endotracheal depends on skill level of provider) Cricothyrotomy kits Field dressings O2 Delivery System – Bag and mask Splints Cervical collar / head immobilizer Spine board Stretcher IV catheters, lines, solutions (warmed preferable) Heat reflective blankets Antibiotics, Analgesics (See Annex to Emergency Care in the Field) Haemostatic agents

TRAINING	TREATMENT	EQUIPMENT

ROLE 2

Reassessment: Principle of frequent re-evaluation of ABC's and triage status Systematic (as per ATLS or similar) approach to trauma patient Secondary survey Tetanus prophylaxis Antibiotic prophylaxis Analgesics NG tube insertion Bladder catheterization Technique, Indication and Complication of Blood product transfusion Appreciation of: External abdominal anatomy - thoracic/pelvic extent of abdominal contents Internal abdominal anatomy - peritoneal, pelvic and retroperitoneal Indications for surgical resuscitation/laparotomy Abdominal exam including rectal (vaginal/gluteal) Technique/contraindications for NG tube Technique/contraindications for bladder catheterization Indications and technique of Diagnostic Peritoneal Lavage (DPL) Indication and use of FAST Ultrasound (Focused Abdominal Ultrasound for Trauma) Damage control surgical procedures (vascular control, temporary shunts,	Continue airway/ventilation management (inc. O2) Continue treatment of shock (Triptych A.05) Blood Products as indicated Reassess primary survey Perform secondary survey when appropriate Damage control surgery / surgical resuscitation as indicated External fixation of pelvic fracture Consider Haemostatic agents If stable consider: - NG tube (if not contraindicated) - Bladder catheterization (if not contraindicated) - Check Tetanus prophylaxis - Antibiotics (broad coverage inc. gram neg and anaerobic) - Analgesics - Consider ultrasound imaging Transfer to Role 3/ 4 for definitive care	As per Role 1 NG tubes sets Bladder (Foley) catheter sets Antibiotics, analgesics, sedative, tetanus toxoid, tetanus IG (See Annex to Emergency Care in the Field) IV infusion sets Crystalloid fluids Haemostatic agents Portable FAST Ultrasound (e.g. Sonosite) Pelvic external fixation sets Surgical sets for laparotomy Vascular shunts

TRAINING	TREATMENT	EQUIPMENT
temporary closures, etc Pelvic external fixation Mark dressings or surgical sites after damage control procedures as requiring second look (records get lost)		

TRAINING	TREATMENT	EQUIPMENT

ROLE 3

As per Role 1 & 2 Use of appropriate lab equipment and venipuncture technique Technique, Indication and Complication of Blood product transfusion Damage control surgical procedures, requirements for "second-look" procedures Definitive surgical procedures	Continue as per Role 1 & 2 Blood Products as indicated Surgical resuscitation if unstable shock Further investigation if stable - Laboratory investigations (Group/cross, CBC, Lytes, Chem, ABGs) - Ultrasound Diagnostic imaging - X-ray (Chest, pelvis, cervical spine) - Consider DPL (rarely indicated) - Urethrogram/Cystogram - IVP - Contrast studies - Consider CT scan (inc CT Angio) Laparotomy for definitive treatment Ventilator support Postop care (See Triptych A.02) Transfer to Role 4	As per Role 1 & 2 X-ray apparatus and developing materials, possible CT scan Ultrasound apparatus Anaesthetic apparatus and monitoring (see Triptych B.05) Anaesthetic drugs/gases (See Annex to Emergency Care in the Field) Surgical sets for laparotomy Pelvic external fixation sets Graft material (vascular) Ventilators and tubing Laboratory equipment, reagents, venipuncture kits, sample tubes Blood Products and infusion sets

B. 07 UROGENITAL INJURIES

PREAMBLE

Traumatic injury to the genitourinary tract accounts for less than 10% of all trauma admissions. Traumatic factors are classified basically into 2 groups.
Blunt trauma: most common and less emergency intervention necessity.
Penetrating trauma: less common but more emergency intervention necessity.
For the purpose of easy and rapid assessment, genitourinary tract trauma subdivided into upper urinary tract (trauma involving the kidney and its vascular supply), trauma to the drainage system from the kidney (the renal pelvis and ureters) trauma to the bladder, and trauma to the external genitalia.
Traumatic injury to the renal parenchyma and its vasculature, the ureters, and bladder may be classified as internal trauma, because the extent of injury may not be readily apparent to the examining physician. Many patients who receive traumatic injury to the kidney, ureters, or bladder also have severe associated intrathoracic, intraabdominal or pelvic trauma, which may direct attention from these genitourinary organ sites. Therefore medical history as well as first symptoms and signs are very important diagnostic clues. Macroscopic haematuria and microscopic haematuria associated with a penetrating injury or with a high energy trauma or hypotension should alert the treating physician to genitourinary injury.

TRAINING	TREATMENT	EQUIPMENT

ROLE 1

Systemic approach to care of the trauma victim. Knowledge of uroanatomy and physiology. Obtaining of a detailed medical history if possible. Recognition of the signs and symptoms. Skin lesions (hematoma, ecchymosis etc.) esp. in blunt traumas. Anuria or oliguria. Gross hematuria. Blood at the urethral orifice. Pelvic bone fractures. Urinary retention Inability in bladder catheterization (suspect from urethral injury). Venous access techniques. Administration of IV fluids. Techniques, indications and contraindications of urinary catheter placement.	Focus on the ABC of resuscitation. Gross physical examination Set up IV fluids. Adequate hydration. Consider analgesia. Administration of broad spectrum antibiotics in penetrating traumas (see triptych A.06). Check urine output simply if possible. Rapid dipstick urinanalysis. Transport to Role 2 ASAP.	Oropharyngeal, nasopharyngeal and endotracheal airways. Oxygen delivery systems. IV catheters, syringes, lines, solutions. Bandages. Analgesics. Antibiotics (broad spectrum – see triptych A. 06). Skin cleansing swabs. Urinary catheters

TRAINING	TREATMENT	EQUIPMENT

ROLE 2

As described in Role 1. Note that urogenital injuries frequently have concomitant chest and/or abdominal injury. Role and type of splint techniques (for pelvic stabilization).	All above plus: Detailed physical examination and reassessment of patient. Stabilization of pelvis Check, adjust or reapply dressings. Urethral – bladder catheter placement and urine collection. Urethrogram, cystogram, IVP Ultrasound scan/ FAST Tetanus prophylaxis, if not already done. Continue antibiotics and analgesics especially in penetrating traumas. Continue IV fluids. Check urinalysis and FBC. Cystostomy if indicated. Conservative approach to minor traumas. Bed resting. Adequate hydration. Analgesics and broad spectrum antibiotics. Evacuate to Role 3.	Oropharyngeal, nasopharyngeal and endotracheal airways. Oxygen delivery systems. IV catheters, syringes, sets, solutions, colloid fluids. Splints, bandages. Analgesics. Antibiotics (broad spectrum – see triptych A. 06). Skin cleansing swabs. Tetanus vaccine. Urinary catheters and urine collecting bags. Limited laboratory equipment. Lubricants. Percutaneous cystostomy sets.

TRAINING	TREATMENT	EQUIPMENT

ROLE 3

As described in Role 1 and 2. Indications and techniques of temporary urinary diversions (e.g. cystostomy). Indications of upper and lower urinary tract imaging studies.	As Role 1 and 2. Blood typing, full blood screen. Perform appropriate radiological investigations. Surgical and intensive care facilities.	Enhanced Role 3 equipment Urinary catheters and urine collecting bags. Laboratory equipment, reagents, sample tubes. Cross matching kit, blood giving sets. Central venous catheterization sets. Surgical sets, suture sets.

B.08 VASCULAR INJURIES

PREAMBLE

Major vascular injuries are to be considered, alone or in association with other injuries, always life – threatening. In this triptych only injuries involving the extremities are addressed, because those to central vessels like thoracic and abdominal aorta or central veins do not allow long survival and therefore are not usually observed in a field medical facility (see related triptychs in case of suspected injuries to thoracic and abdominal vessels).

Peripheral vascular injuries range between 1-2% of all major injuries observed in casualties in modern wars (see STANAG 2068 - Emergency War Surgery NATO Handbook). You can observe primary injuries due to the direct effect of high velocity bullets and mine parts and/or secondary injuries caused by indirect effects of expansion and cavitation or bone fragments in the tissues surrounding the vessels.

Prompt diagnosis and treatment are the necessary conditions required to save life, limb and function. Easy maneuvers are required to manage peripheral vascular injuries at Role/Echelon 1. They are aimed to control bleeding, in order to avoid hemorrhagic shock, but further treatment needs specific surgical training. Even if depending from environment (MASSCAS situation), the goal is represented by surgical repair of the vessels rather then ligation or amputation. A well established medical evacuation chain will reduce both loss of lives and amputation rate, particularly high for knee and below knee injuries. In general, consider Role 3 (+) (Echelon 3) to be the appropriate level to treat this kind of injuries. Once the patient arrives at this level, take into account the time needed for concomitant life-threatening injuries and the ability of the patient to tolerate additional operative time.

Methodological approach is based on the ATLS® concept of the American College of Surgeons.

TRAINING	TREATMENT	EQUIPMENT

ROLE 1

Teach: - Vascular anatomy and anatomical points. - Exposure and environmental control - Systematic approach to trauma patient (A, B, C).	Systematic approach to trauma: See triptych B.01 and B.02 (Emergency Life Saving/First Aid in the Field). See triptych A.05 (Fluid Resuscitation).	As for Triptychs B .01 and B.02.
	Treatment: - Assess and obtain airway with C-spine control. - Check for vitals (pulse, respiratory rate and, if appropriate, blood pressure). - Give O² by mask and assist ventilation properly.	Airways (oropharyngeal and nasopharyngeal). Intubation and cricothyrotomy kits. Cervical collar, spine board. Oxygen delivery system.
- Recognition of immediately life- threatening vascular conditions: Hemorrhage. Rapidly expanding hematoma. Ischaemia.	- During primary survey, check for : External bleeding Expanding hematoma (rapid, progressive swelling) Abnormal pulses	
- Different types of field dressings. - Correct dressing technique.	- Apply direct pressure on wounding site and dress it. In case of injured extremity with no associated fracture, elevate.	Field dressings.
- Splint technique. - General surgical skills.	- If associated fracture, splint before and then elevate. - If bleeding continues and if appropriate, apply pressure dressing.	Splints.
- Indications and technique of tourniquet. The use of tourniquet should be considered as the <u>last resource</u> to stop bleeding wound, because it occludes the collateral circulation. Therefore apply as distal as possible (ca 3 fingers proximal to the wound), tight enough to control arterial bleeding. It should be removed by a medical officer where a surgical team is available (forward surgical teams or up to 2(+) role medical facility).	- If bleeding still continues and **only** if bleeding source is **obvious**, clamp the injured vessels. - DO NOT WASTE TIME; if you do not succeed rapidly, then apply tourniquet. -If you use a tourniquet, **do not forget** to record the time and to mark the casualty's forehead with a visible "T", in order to make the <u>use</u> of tourniquet immediately <u>evident</u> to other medical personnel along the EVAC chain.	Surgical clamps. IV catheter, lines and solutions, analgesics (see related triptych). Analgesics, broad spectrum antibiotics.

TRAINING	TREATMENT	EQUIPMENT
- Venous cannulation. - Field Medical Card. - Training for casualties transport (litter, carries).	- Initiate IV crystalloid infusion. - Consider analgesics. - Consider antibiotics. - Prepare to evacuate to higher role completing Field Medical Card. - Evacuate without delay to higher role.	Field Medical Cards. Stretcher.

TRAINING	TREATMENT	EQUIPMENT

ROLE 2

As per Role 1. - Secondary survey. - Emphasize typical vascular trauma signs as reported in role 1 and additional diagnostic signs: Bruit or thrill. Pallor. Empty veins. Decreased capillary refill (≥ 2 s). Relative coldness. Wounds close to major artery and/or vein. Decreased sensation. Motor weakness Progressively increasing pain after immobilization of extremity trauma. - Always remember that: distal pulses examination is essential for early identification of arterial injury. Diminished pulses or skin pallor should not be attributed to vasospasm. - Doppler ultrasound technique. - Consider that surgery should be performed **as soon as possible** (once the "GOLDEN HOUR" concept), particularly for injuries of vessels distal to popliteal artery. - Remind that Emergency Surgery is surgery urgently requested to save LIFE, LIMB and FUNCTION. Indications to amputation related to field environment	- Reassess casualty's ABC. - Perform a second triage. - Perform secondary survey. - Maintain airway and O2 delivery. - Continue shock treatment. - Doppler examination. - Surgery , if: patient unstable, delayed evacuation time, surgical team trained to manage vascular injuries available. Mass Casualties situation. -Evacuation to higher Role Facilities.	As per Role 1 NG tubes, bladder catheters, IV infusion sets Doppler instrument Surgical instruments, vascular sets. Hemorrhage control devices (balloon-tipped catheters, umbilical tapes, silastic loops).

TRAINING	TREATMENT	EQUIPMENT

ROLE 3

- As per Role 1 and 2. - Specific training vascular surgery.	- As per Role 1 and 2. - **Repeat** primary survey and perform subsequent actions (ABCs). - Definitive surgical and intensive care treatment.	As forseen for vascular surgery units. As forseen for intensive care units.

B.09 LIMB INJURIES

PREAMBLE

Experience from previous major and minor conflicts in the past has shown that 60-70% of battlefield traumatic wounds involve the extremities. Accordingly, it should be expected that a large proportion of casualties from a conflict who survive to reach medical care will have limb injuries. The management of these injuries will therefore comprise a significant and substantial part of the work of medical staff in the first three roles of the chain of medical care.

The principles of early treatment for limb injuries in the operational setting are reasonably simple and the equipment required is not overly complex or costly. The proper and timely application of these simple techniques and equipment however can very dramatically reduce the mortality and morbidity from such injuries, and potentially reduce the requirement for very complex and costly reconstructive procedures.

General Aims of Treatment: The aims of treatment as outlined in this triptych are the prevention of unnecessary death from potentially life threatening extremity trauma, and the prevention of unnecessary loss of limb or limb function from extremity trauma. This includes the control of haemorrhage, restoration of perfusion, prevention of wound infection, stabilization of fractures and restoration of motion to injured joints. The following lists indicate a number of the associated injuries or complications of limb trauma that can be reduced or eliminated if the basic principles are followed consistently

Life Threatening	Limb or Function Threatening
- Haemorrhage	- Vascular Injury
- Major Crush Injury	- Compartment syndrome
- Proximal Traumatic Amputation	- Limb / Joint Sepsis
- Major Limb Sepsis	- Crush Injury
- Pulmonary Embolism	- Dislocation
- Respiratory Distress Syndrome	- Mal-union / non-union

Trauma Classification: It is strongly recommended that a consistent standard of classification be developed and adopted for the reporting and recording of extremity bone and soft tissue injuries. Such a system must be practical and intuitive, and not overly complex. It should allow for consistent classification of injuries by a diverse group of treating personnel. It should be clinically relevant and specific enough to allow for clinical decision-making. The use of such classification schemes allows for greater ease of communication from one medical Role to the next, more accuracy in pre-planning for incoming surgical cases, better continuity of care, and greater accuracy in diagnosis for research, rehab and pension applications well after the patient has completed his care.

A number of classification systems are currently used in civilian practice, most of which can be easily used in the military setting. The AO Group have developed a comprehensive system of fracture classification which is recognized in Europe and North America, and in most other developed areas of the world. The Gustillo and Anderson classification system for open fractures is based on important soft tissue variables and has proven clinical relevance. It also is widely used at present and is very simple to learn and apply. These or similar classification systems should be incorporated into any system being considered for electronic patient documentation and can be readily adapted to a checklist format within the software application for such a system.

External Fixation: The use of external fixation devices with percutaneously inserted threaded pins has been a mainstay of military fracture care in the field since developed in WW 2. Modern advances in these devices have lead to great improvements in their versatility and ease of use. Concurrent advances in knowledge and management of soft tissue and fractures using percutaneous intramedullary and minimally invasive internal fixation in the civilian setting have, however, supplanted much of the traditional role of the external fixation devices. These are being much more utilised in more complex reconstructive procedures although they still play a definitive role in some of the less common complex primary fracture scenarios.

In the military operational setting, the external fixator still has a broader role where there are environmental restrictions on orthopaedic surgical capability and in the mass casualty situation. In such situations application of external fixation can provide appropriate fracture stability until definitive fracture fixation can be achieved. It should be understood, however, that the use of the external fixator as a temporary or definitive device can lead to increased complications so this treatment should be undertaken only by surgeons trained in it’s use and understanding of the potential risks and pitfalls.

Fasciotomy: Proper fasciotomy of the affected compartment is indicated when a diagnosis of compartment syndrome is made. It must also be strongly considered in case of crush injury or vascular compromise of a limb even prior to confirmed diagnosis of compartment syndrome. Surgical fasciotomy should be performed as early as possible in the post injury treatment as delay results in poorer outcome for the patient. It is fully expected that fasciotomy should be available at the Role 3 surgical facility whether this be in the form of a field hospital or an advanced surgical team. Traditionally, surgical expertise would not be available at a Role 2 facility. However, in our current often non-traditional deployments, it is possible that such expertise may occasionally exist at this Role. This being the case, consideration should be given to this procedure as a limb saving treatment, if rapid transfer to a definitive Role 3 facility is not available.

Amputation: Considerable attention has been given in recent trauma literature to the problem of deciding when it is appropriate to recommend amputation for a patient with a mangled extremity. A number of scoring systems have been developed and proposed but as yet none have been critically validated and found to be predictive in all cases. This is a very emotional situation for all of our patients but it must also be kept in mind that it is particularly problematic for certain religious and ethnic groups. The decision to amputate or preserve for reconstruction will also be affected by the operational environment (i.e. single patient vs. mass casualty, austere vs. mature hospital setting, etc) and the immediate and follow-on availability of reconstructive expertise. A number of features have been supported in the literature as strong indications for lower extremity amputation. They are as follows:
complete amputation at time of injury
irreparable sciatic or posterior tibial nerve injury in association with open fracture and significant vascular injury
warm ischemic time >6-8 hours
life threatening limb sepsis (gangrene, necrotizing fasc2tis)
cadaveric limb at initial presentation

TRAINING	TREATMENT	EQUIPMENT

ROLE 1

General Principles -Systematic approach to care of the trauma victim -Airway management techniques -Ventilatory support techniques -Direct pressure technique for control of haemorrhage -I.V. access techniques and crystalloid fluid resuscitation -Basic wound management techniques -Basic fracture and dislocation reduction / alignment techniques -Use of MAST or pelvic binder for pelvic fracture with exsanguinating haemorrhage -Effective application of extremity and spinal splinting / immobilisation -Basic antibiotic prophylaxis -Use of analgesics -Preparation of patient for evacuation, including aeromed considerations if applicable	Systematic Trauma Care (see also Triptych A.04, A.05, B.01, B.02 and B.03) -Assessment of airway, adequacy of ventilation, circulatory, and neurologic status -Management of compromised airway, intervention to ensure adequate ventilation, control of haemorrhage, fluid resuscitation and prevention of secondary neurologic injury -Prevention of contamination / infection of wounds -Reduction / Splinting of fractures and dislocations. Check distal circulation and neuro status before and after -Use of analgesics and limited antibiotics as indicated -Documentation of injuries and interventions. Consider use of standardized trauma / extremity injury classification system. -Evacuation to Role 2 / 3 as per triage priority	(See also Triptych A.04, A.05, B.01, B.02 and B.03) -Oral airways, nasopharyngeal airways -I.V. Infusion sets, cannulae (See Triptych A.05 Fluid Resuscitation) -Wound dressings -Limb splinting materials, traction splints, bandages, slings (various types) -Cervical collars, spine boards -Analgesics (See Triptych .03 Analgesia and Sedation) -Antibiotics (See Triptych .04 Antibiotics in the Field)

TRAINING	TREATMENT	EQUIPMENT

ROLE 2

-As above -Principle of re-evaluation and change of triage category as indicated, maintaining a systematic approach to the trauma patient. -Tetanus prophylaxis -Adjuncts to crystalloid resuscitation (eg. Blood, colloid, hypertonic saline, etc) as per availability at Role 2	-Repeat primary survey: ABC -Repeat secondary survey and assess adequacy of previous interventions -Treat any immediately life-threatening injuries as described in Role I. -Continue treatment initiated at Role I -Continue fluid resus as indicated by initial response and consider adjuncts to crystalloid resuscitation as indicated -Check Tetanus status and treat accordingly -Provide further appropriate analgesia and antibiotic coverage -initial wound lavage if delay to definitive treatment -Prevention of skin pressure necrosis, adjust splints, spine board padding -Evacuate to Role 3 according to triage priority	-As for Role I (see triptych A.04, A.05, B.01, B.02 and B.03) -Additional resuscitative equipment as listed in triptych B.01/B.02 Emergency Lifesaving First Aid -Tetanus vaccine / immunoglobulin

TRAINING	TREATMENT	EQUIPMENT

ROLE 3

-As Role I and Role 2 -Additional requirements depending on the type of surgical specialist available. Ideally at least general and orthopaedic trauma surgical specialists should be available. Others may be added depending on national requirements. -Principles of thorough wound excision and delayed primary closure. -Knowledge of fasciotomy techniques and the indications -Thorough knowledge of potential complications of the limb injury and of the relative risks of the various forms of treatment (compartment syndrome, neurovascular injury, sepsis, mal-union, delayed or non-union) -Thorough knowledge of techniques of external and internal fixation techniques and their relative merits and risks, with particular regard to the operational setting -Awareness of potential reconstructive procedures for soft tissue defects and how the initial treatment will impact on them -Knowledge of techniques for amputation and the indications, including basic knowledge of prosthetic function as it pertains to proper amputation technique	-As Role I and Role 2 In addition: -Laboratory, radiographic assessment as indicated -Life and limb (function) saving surgery. Thorough wound excision and compartment decompression when indicated should be the minimum requirement -Application of orthopaedic surgical principles for optimal preservation of limb function and prevention of complication, within constraints of the operational setting -Consider if definitive surgical management can wait for evacuation to Role 4 -Consider temporary external fixation or definitive internal fixation where appropriate. Utilise minimally invasive internal fixation techniques when possible. -Vascular repair as indicated if time and resources available. Temporary shunt may be considered if other resources not available -Continued postoperative care including continued resuscitation, analgesia, antibiotics, DVT/PE prophylaxis as indicated	Surgical and intensive care facilities The degree of Orthopaedic surgical intervention possible will depend on the nature of the operational scenario and the maturity of the surgical facility -Lab and radiographic facilities including C-arm imaging for OR if possible -Blood and blood products -Infusion warming systems -Rapid infusion systems -Anaesthesia apparatus and monitoring -OR table adaptable for lower extremity traction and radiograpic C-arm imaging -Surgical sets for wound excision, fasciotomy, vascular repair and amputation -External fixation apparatus and tools (possibly including hybrid fixator capability) -Internal fixation apparatus and tools (as appropriate) -various size plate screw sets -cannulated screw sets -intramedullary nail set -K-wire sets and driver

B. 07 BURNS

PREAMBLE

The application of simple but stringent rules should demystify bum care. Timely and well co-ordinated, correct management of bum injuries will discharge the military medical relief and evacuation chain and limit mortality, morbidity and disability. However, after the initial approach on the field, major bums will represent a significant burden to that chain.
Mortality from bum wounds is primarily determined by the extent of bum and the age of the patient and is severely increased by as much as 20% if a significant inhalation injury is associated.
Associated systemic toxicity and mechanical trauma should always be excluded; additional injuries must certainly be suspected when fluid requirements are much greater than estimated from the apparent extent of the bum.
Removing the patient from the heat source and early cooling and copious irrigation with water is the keystone of the emergency management; wet dressings and cold compressses applied to large bum wounds for prolonged periods however may cause hypothermia. Chemical burns must not be irrigated with neutralizing acid or alkali solutions because of possible further tisssue damage.
In general profylactic antibiotics are not given for bum wounds. Profylactic antibiotic use and corticosteroid use are also absolutely contraindicated in inhalation injuries. Specific and formal bum dressings with topical agents, all kind of ointments or tanning are avoided
Patients with major burns should be kept in a warm environment (at least 28°C) in order to maintain a core temperature of 37.5°C.

TRAINING	TREATMENT	EQUIPMENT

ROLE 1

Teach: Types of burn. The cause of burn affects the extent and the depth of the injury. Immediate cooling of the bums with water at room temperature minimizes the wound depth; a real risk of hypothermia however exists in patients with large burns. Risk factors of inhalation injury: - bums in an enclosed space; - facial burns involving mouth and/or nose; - altered level of consciousness; - hoarseness or loss of voice; - symptoms of respiratory distress. Estimation of Total Burned Surface Area (TBSA) - 'rule of nines'; - one side of patients palm of the hand with the thumb adducted, is about 1% TBSA. Patients restlessness and/or anxiety can be due to hypoxemia and/or hypovolemia and will respond to prompt oxygenation and increased fluid administration.	Stopping the burning process Remove the patient from the source of injury (hot clothes, chemicals, electrical current,...). Extinguish smouldering gardments. Cool immediately the burn wound with water (if available) at room temperature for at least 10 minutes by douzing or irrigation (continuous exposure). *Chemical burn:* remove the clothing as soon as possible and dilute quickly the chemical by irrigation with copious amounts of water for at least 20 minutes. Initial resuscitation. Assess vital signs: Airway - Breathing - Circulation and perform a neurological assessment. Consider airway distress, CO-intoxication, inhalation injury: OXYGENATE ALWAYS and AS SOON AS POSSIBLE. Search for associated injuries and start fluid resuscitation according to the estimated TBSA: *<15%:* peroral replacement (Haldane solution, Moyer's solution, ORS or any other available electrolytesolution); *>15%:* IV fluid therapy through a large bore peripheral venous access (preferably in unburned skin) with Ringer's lactate solution guided by the clinical response and mainly the diuresis. Check tetanus prophylaxis. Keep the patient warm with wool blanket and/or isothermic aluminium sheet).	Heavy scissors. Equipment for ventilatory support Role 1 (see relevant triptych A.04). Solutions for peroral replacement at Role 1 (see relevant triptych A.I0). Material for IV fluid management at Role 1 (see relevant triptych A.05). Wool blankets, aluminium sheets.

TRAINING	TREATMENT	EQUIPMENT
Recording data and time of burn and detail of the cause of burn.	**Pain relief.** Give adequate analgesia and sedation. **Wound covering.** Cover the burn wounds with temporary clean or sterile dressings or sheets. No topical agent should be applied. Consider the use of plasticized – chloride film (“cling film”). **Evacuation.** Without delay and with prevention of hypothermia.	Equipment for analgosedation at Role 1 (see relevant triptych A.09). First aid burn dressings (plasticized polyvynilchloride film). Usual dressing packs.

TRAINING	TREATMENT	EQUIPMENT

ROLE 2

Teach: Same items of clinical assessment teached at the fast ROLE. Treatment of suspected inhalation injury (see relevant triptych B.12). Assessment of the severity of burns **MINOR or AMBULATORY BURNS** - 2nd degree burns of < 5% TBSA and without any other criteria of severity; **MODERATE BURNS** - 2nd and 3rd degree burns of ≥ 5% TBSA, but < 15% TBSA and without any other criteria of severity; - 3rd degree burns of < 5% TBSA; **MAJOR BURNS** - 2nd and 3rd degree bums of ≥ 15 % TBSA; - burns association with inhalation injury; - chemical and electrical burns; - burns to head, face, hands, feet or perineum; - circumferential burns of the limbs or the chest; - burns with associated injuries or pre-existing co-morbidity.	Stopping the burning process *Chemical burns:* irrigate with copious amounts of water, even if previously already done. Further resuscitation Assess vital signs with special attention to CO-intoxication and/or inhalation injury. Assess the severity of bum (triage) according to patients age, depth, size, presence of inhalation injury, involvement of critical areas, associated injuries and co-morbidity. *If inhalation injury is present or suspected:* - Administer humidified oxygen through a non-rebreathing mask with continuous positive airway pressure (CPAP) if possible. - Intubate at the first sign of impending airway obstruction and ventilate with positive end expiratory pressure (PEEP). - Consider nebulized/inhaled bronchodilators (intravenous if indicated). Continue or start fluid resuscitation according to the estimated TBSA: *<15%:* peroral replacement (Haldane solution, Moyer's solution, ORS or any other available electrolyte solution); *>15%:* IV fluid therapy through a large bore peripheral venous access (preferably in unbumed skin) with Ringer's lactate solution at a rate of 500 ml/hr if <40% TBSA or 1000 ml/hr if ≥40% TBSA.	Equipment for ventilatory support and treatment of inhalation injury at Role 2 (see relevant triptych A.04 and B.12). Solutions for peroral replacement at Role 2 (see relevant triptych A.10). Material for IV fluid management at Role 2 (see relevant triptych A.05)
Principles of fluid resuscitation:	A urinary catheter should be inserted and the	

TRAINING	TREATMENT	EQUIPMENT
- Burns of >. 20% TBSA result in «burn shock»; - Early and correct fluid administration therefore is vitally important to prevent organ failure; - Lactated Ringer's solution is the fluid of choice in the first 24 hrs; - So far, colloids are not indicated. (see relevant triptych A.05). Principles of escharotomy: - Escharotomy incisions are made longitudinally along the axis of the limb and/or the digits through the complete depth of the dead skin until viable tissue is reached; - Because of the dead skin, no analgesia is needed; - There is no indication for fasciotomy, electrical burns excepted.	urinary output measured hourly. Fluid therapy will be guided by the clinical response and mainly the diuresis and sufficient to obtain an expected urinary output of 30 to 50 ml/Hr for a young burned adult. Perform escharotomy incision through the complete depth of the dead skin in the circumferential third degree burn of limbs and/or chest. Except for electrical injuries, fasciotomy should be avoided! Insert a nasogastric tube if the burn involves > 15% TBSA or if the patient presents with nausea, vomiting or abdominal distention. Check tetanus prophylaxis. Keep the patient warm. **Pain relief.** Continue or start adequate analgesia and sedation. **Wound covering.** Apply or readjust the dressings (see ROLE 1). **Evacuation.** Without delay and with prevention of hypothermia.	Scalpel. Nasogastric tube and drainage bags. Wool blankets, aluminium sheets. Equipment for analgosedation at Role 2 (see relevant triptych A.09). First aid burn dressings (plasticized polyvynilchloride film). Usual dressing packs.

TRAINING	TREATMENT	EQUIPMENT

ROLE 3

Same items of clinical assessment and management teached at ROLE 1 and 2. Chart for estimating the severity of burn wounds (Lund and Browder). Most appropriate topical treatment and burn dressings.	*Chemical burns:* irrigate with copious amounts of water, even if previously already done. Continue the previous basic management. Re-assess the severity of burn. ***Burns <** 15%* ***TBSA*** Continue oral salt solutions. Continue oral analgesics if required. Assess the distal circulation in circumferential limb and/or hand burns; if compromised: elevate the affected limb or hand and perform escharotomy incision. Carry out antiseptic clean up, initial debridment and topical therapy and apply dressings. Evacuate when possible. Burns >. 15% TBSA Assess vital signs. Secure a large bore peripheral venous access (preferably in unburned skin); insert a central venous catheter only if strictly necessary. Insert a urinary catheter. Insert a nasogastric tube. Continue the fluid replacement according to the burnshock resuscitation formula: *first 24 hrs post burn*: Ringer's lactate solution 3 ml/Kg BW/% TBSA, ½ dose in the first 8 hrs and the second ½ dose in the next 16 hrs.	Oropharyngeal, nasopharyngeal and endotracheal airways. Oxygen delivery systems. IV catheters, syringes, sets, solutions, colloid fluids. Splints, bandages. Analgesics and antibiotics (broad spectrum – see relevant triptych A. 06). Skin cleansing swabs. Tetanus vaccine. Urethral tubes, Foley catheter sets and urine collecting bags. Laboratory equipment, reagents, sample tubes. Lubricants. Cross matching kit, blood giving sets. Central venous catheterization sets. Cleansing fluids. Surgical sets, suture sets. X – ray apparatus and developing materials, water soluble contrast material. Percutaneous cystostomy sets.

TRAINING	TREATMENT	EQUIPMENT
	second 24 hrs post burn and later: Glucose or dxtrose solution to maintain an urinary output of at least 50ml/hr. Protein solution according to plasma deficit and/or losses. Correct serum K+ if required. Replace red blood cells if required. Continue analgosedation if required by slow IV push. Consider antibiotic therapy. Assess the distal circulation in circumferential limb and/or hand burns. If compromised: elevate the affected limb or hand and perform escharotomy incision. Carry out antiseptic clean up, initial debridment and topical therapy and apply dressings. Evacuate without delay and with prevention of hypothermia. **If moreover TBSA exceeds 40%,** Remind that prognosis could be very poor as part care in the field; Consider support treatment in accordance with the opportunities	Equipment for analgosedation at Role 3.

TRAINING	TREATMENT	EQUIPMENT
	Critical types of burn – related injury. *Inhalation and blast injuries:* See relevant triptychs B.12 and B.13. *Chemical and white phosphorus burns:* See relevant triptych B.11 *Burns of the face.* Consider inhalation injuries. Consider ophtalmic injuries: Inspect the eye before facial edema makes an evaluation impossible. Treat ocular injuries if required (see relevant triptych B.03). Avoid compression of burned ears. Consider endotracheal intubation before facial edema leads to life – threatening upper airway obstruction and makes this intubation impossible. *Burns of the hands.* Assess the distal circulation. If compromised, perform escharotomy incision at the dorsal side of the hand extended longitudinaly along the axis of the digits. Elevate the burned hand and encourage frequent exercises. Carry out antiseptic clean up, initial debridment and apply dressings with silver sulphadiazine or other ointment; cover with polyethilene or surgical gloves/bag/envelope. *Perineal burns:* Remind the very high risk of infection. A clostomy must be considered very often during the first week of treatment.	

B.11 WHITE PHOSPHORUS BURNS

PREAMBLE

Incendiary agents are generally used to burn supplies, equipment and structures. They may also be found in some antipersonnel munitions. Many of these various types of munitions contain white phosphorus as the incendiary device. Due to the nature of many of these weapons fragments of white phosphorus may be driven through traumatized skin and into deeper tissues. Fertilizer based improvised explosive devices may also result in phosphorous burns, as may those improvised from fireworks. Phosphorous burns may be considered if the specific source is known. The burns are often multiple, deep, necrotic and yellowish in colour, and may have an aroma of garlic.

In general the overall treatment is as for any burn, however phosphorous burns have special considerations. The important feature of white phosphorus when dealing with it in a burn wound is that when dry and in contact with air it will spontaneously ignite, causing further burn injury to the patient. The particles will continue to burn until deprived of atmospheric oxygen. When used in explosive devices, as is most typical, the fragmented white phosphorus causes burn wounds which are often multiple, deep and variable in size. These features give rise to the requirement for specific methods of treatment not generally considered for other types of burns.

Removal of all fragments or particles of white phosphorus is imperative. This will require formal surgical debridement of any burn areas penetrating below skin as an emergency procedure. All particles must be removed in order to prevent further burn injury. Involved areas must be covered with a saline soaked occlusive dressing and kept moist until debridement can be performed**. Oil based ointments should not be used as these may exclude water and allow the phosphorus to combust**. In situations where such weapons are known to be in use, consideration should be given to deployment of resources to treat such wounds as far forward as is practically possible in order to expedite the initial surgical burn care. Once the burn wounds have been debrided of all white phosphorus further care can proceed as for any other thermal injury. UV light (Wood's lamp) may be of use in identifying phosphorus particles.

Treating medical personnel should be aware of the potential systemic effects of phosphoric acid absorption and hyperphosphatemia in producing potentially fatal cardiac arrhythmias. Hypocalcemia may result from calcium binding by phosphorous oxidation by-products. Intravenous calcium is administered as treatment. Topical wash with bicarbonate solution may be use to neutralize phosphoric acid produced in the wounds prior to it's absorption. Bicarbonate solution is also effective for initial treatment of phosphorus injury to the eye, followed by copious saline or water irrigation. A 5% Bicarbonate solution can be readily made in large quantity by dissolving 7 ounces (5/6 cup) of bicarbonate soda in 1 gallon of water.

Cupric (copper) Sulfate 1% solution has been recommended as a treatment for white phosphorus burns in the past. It forms a black cupric oxide film on phosphorous particles, preventing oxidation. It has been found to be a toxic material and its use has been associated with renal and cerebral toxicity and intravascular haemolysis**. Its use is no longer recommended,** and if used should be a 0.5% solution applied only as a wash, not as a dressing, and immediately rinsed with saline to prevent systemic absorption.

TRAINING	TREATMENT	EQUIPMENT

ROLE 1

- Fire fighting drills - Self Aid techniques - First Aid techniques - White phosphorus specific knowledge that ignition will occur on contact with air, therefore the requirement to keep the wounds moist. Particles phosphoresce in the dark or under UV (Wood's lamp) light, allowing easy identification as luminescent spots. - Disposal of phosphorus particles in water to prevent further combustion and injury to others	**- Remove patient from further danger** - Assess and treat life threatening injuries as per ABC's - Remove contaminated clothing - Smother any burning particles with water or wet cloth. Mud can be used as a last resort but should be avoided due to increased infection risk - Remove any obvious particles of phosphorus from skin and wounds with bayonet or other clean object. - Apply moist dressings to wounds and keep them moist at all times - Estimate total body surface area burned (TBSB) using "Rule of Nines" or one surface of hand = 1% as estimate guides. - Initiate IV fluid resuscitation according to the size of burn (see triptych C4 for more on this) - Give analgesic and/or sedation as required. Consider antibiotic prophylaxis for dirty wounds - Prevent hypothermia after removal of clothing - Evacuate to surgical facility for wound debridement, insuring dressings will be kept moist	- Equipment required is the same as for conventional burns, as described in triptych C.04 - Water -I.V. Infusion sets, cannulae - IV crystalloid solutions -Burn dressings -Analgesics (See Triptych B.03 Analgesia and Sedation) -Antibiotics (See Triptych A.04 Antibiotics in the Field)

TRAINING	TREATMENT	EQUIPMENT

ROLE 2

- As for Role 1 - Awareness of the systemic effects of phosphoric acid absorption causing hyperphosphataemia and hypocalcaemia resulting in potential cardiac arrhythmias and sudden death	- Tetanus prophylaxis - Consider adjuncts to fluid resuscitation such as blood or colloid as are available - Continue treatment as per ROLE 1 - Surgical debridement of all phosphorus particle from involved wounds - Bicarbonate solution will neutralize phosphoric acid which may be produced at the site of phosphorus fragments - Possible management of Hypocalcemia / hyperphosphatemia	-As for Role 1 -Tetanus vaccine / immunoglobulin - Bicarbonate solution - IV Calcium solution - Surgical burn debridement equipment - Lab equipment for serum electrolyte determination

TRAINING	TREATMENT	EQUIPMENT

ROLE 3

- As Role 1 and ROole 2	- Continue treatments as Role 1 and Role 2 for general management of burns and other injuries - Intensive management of secondary effects of burn injury prior to evacuation	**- Same as for Role 1 and 2** - UV (Wood's Lamp) Light source **- Surgical and intensive care facilities for burn management**

B.12 INHALATION INJURIES

PREAMBLE

Overview

This triptych addresses toxic chemical exposures not otherwise covered in STANAG and A-Med publications that address chemical, biologic or radiation injuries – particularly organophosphate and carbonate inhalation. There are hundreds of potentially toxic inhalational agents. This triptych only reviews the major, life threatening types of inhalation injuries.

Definitions of Airborne Toxic Material

Gas: The molecular form of a substance, in which molecules are dispersed widely enough to have little effect (attraction) on each other.
Vapor: Refers to the gaseous state of a substance that at normal temperature and pressure would be liquid or solid. Vaporized substances often re-liquefy and may have a combined inhalation and topical effect.
Mist: The particulate form of a liquid (droplets) suspended in air. Particle size is a primary factor in determining the airborne persistence of a mist and the level of its deposition in the respiratory tract.
Fumes, Smokes, and Dusts: Solid particles of various sizes that are suspended in air. They may be toxic themselves or may carry, adsorbed to their surfaces, any of a variety of toxic gaseous substances.
Aerosol: Particles, either liquid or solid, suspended in air. Mists, fumes, smokes, and dusts are all aerosols.

Pathophysiology - Inhalational agents exert their toxic effects by:

Direct respiratory depression. (anesthetic agents and certain hydrocarbons)
Pulmonary irritation leading to bronchospasm or non-cardiogenic pulmonary edema. (Tear gas, MACE or phosgene gas.)
Simple asphyxiation. Any agent, whether inert or toxic, can cause symptoms at FiO2 <16% and death at FiO2 <6%. (closed space propane exposure displaces O_2 from environment)
Binding to the hemoglobin molecule. Oxygen carrying and release into the tissues is impaired. (carbon monoxide)
Binding to mitochondrial cytochromes blocking the use of oxygen by the cells themselves. (cyanide and hydrogen sulfide)

D. Clinical Considerations - It is most practical to consider inhalation injury based on the following clinical presentations:

Acute intoxication. (Immediate presentation)
Acute respiratory failure (Immediate presentation)
Acute respiratory distress syndrome. (ARDS) (Delayed presentation)

The goals of treatment are to safely remove the victim from the area of exposure, provide immediate supportive therapy and quickly determine whether a specific therapy or lifesaving antidote for an acute intoxication is needed. All victims of inhalation injury should be evacuated to ROLE 3 as soon as possible.

TRAINING	TREATMENT	EQUIPMENT

ROLE 1

Teach the 5 mechanisms of inhalation injury and other items listed in the introduction. In addition, teach: The immediate goal is to safely remove victim from area of exposure and begin oxygen therapy. Singed facial or nasal hair or carbonaceous sputum due to prolonged exposure to heat or steam can lead to sudden airway edema and compromise. Bronchospasm or pulmonary edema may result in acute respiratory failure. Symptoms may be delayed for over 24 hours in the case of ARDS. Teach effects of exertion and toxic inhalation. Exposure can have minimal effects at rest but significant or lethal results with exertion. (main cause is hypoxia) Suspect carbon monoxide (CO) toxicity if victim has headache, altered mental status, or hemodynamic instability following smoke or engine exhaust exposure. The half-life of CO decreases from 4 hours in room air, to 90 minutes on	Safely remove victim from exposure. If possible, rescue personnel should use a self-contained positive pressure breathing apparatus. Standard MOPP gear may not be effective. Provide O_2 and maintain an adequate airway. Consider prophylactic intubation if singed facial or nasal hair or carbonaceous sputum. Provide 100% O_2 via NRB facemask or endotracheal tube in all circumstances. Establish IV 0.9% NS. Provide standard ACLS therapy based on hemodynamic status. If isolated CN or HS exposure is suspected in a comatose or hemodynamically unstable patient, begin therapy with high concentration oxygen therapy via non rebreather mask, keep patient at rest for transport or until clinically stable.	Standard Role 1 Airway Equipment: Non-rebreathing (NRB) reservoir face mask. Oxygen. Portable suctioning device. Self-expanding bag-valve-mask device. Ventilation face masks (various sizes). Oral and nasal pharyngeal airway devices Laryngoscope, (handle and various blades). Endotracheal tubes (various sizes). Endotracheal tube malleable stylet. Nasogastric tubes. Intravenous cannulae and tubing. 1 liter bags of 0.9% Normal Saline solution. Standard ACLS medications such as : Intravenous Atropine. Intravenous Epinephrine. Intravenous Lidocaine. Intravenous Amiodarone or Procainamide Intravenous Bicarbonate. Pralidoxime (2-PAM), IV/IM

TRAINING	TREATMENT	EQUIPMENT
100% O_2 atmosphere, to 30 minutes with Hyperbaric Oxygen Therapy (HBOT) with 100% At one atmosphere, to 30 minutes with Hyperbaric Oxygen Therapy (HBOT) with 100% oxygen at 3 atmospheres. Suspect cyanide toxicity (CN) in a comatose victim exposed to known industrial source (eg: electroplating or film developing), burning plastics, or if victim smells of bitter almonds. Suspect hydrogen sulfide toxicity (HS) if victim found unresponsive in closed space with sewage gas exposure. (eg: leakage of shipboard sewage holds.) Toxicity and therapy similar to CN – although victims often improve with O_2 alone. The 3 step CN kit uses: Inhaled amyl nitrate and IV sodium nitrite to induce met-hemoglobinemia. (Met-Hgb removes CN from mitochondrial cytochromes.) Sodium thiosulfate to remove CN from met-Hgb to form non-toxic renal cleared thiocyanate. NB: The 3 Step CN kit should NOT be used when CO toxicity is suspected. Met-Hgb can further compromise O_2 carrying capacity in these patients.	Antidote options: (DO NOT use 3-step CN kit if CO toxicity is suspected) 3-step CN kit: Amyl nitrite pearls crushed and inhaled, or placed in self-expanding ventilatory bag, 30 seconds out of each minute. Stop once IV established. Sodium nitrite 3%, 10cc (300mg) slow IV over 5 minutes. Sodium thiosulfate 25%, 50cc slow IVP over 10 minutes. Alternative: Hydroxocobalamin 5%, 5 grams slow IV over 10 minutes. (combines with CN to form cyanocobalamin (B12) Alternative: Dicobalt-EDTA 300mg slow IV over 5 minutes. (Treatment of organophosphate and carbamate inhalation is covered in STANAGs and A-Med Publications addressing CBR injuries.) Evacuate all patients to ROLE 2 as soon as possible.	3-Step Cyanide Kit Amyl nitrite pearls 0.3 cc Sodium nitrite 5%, 10cc ampule Sodium thiosulfate, 50cc ampule Alternative: Hydroxocobalamin 5%, 100cc Alternative: Dicobalt-EDTA 300mg

TRAINING	TREATMENT	EQUIPMENT

ROLE 2

Training similar to ROLE 1. In addition, teach: Positive pressure ventilation can improve gas exchange but can also increase the risk of circulatory compromise due to a decrease in venous return. The two main methods of providing positive airway pressure are : CPAP: Continuous Positive Airway Pressure – applied to the face with a tight fitting mask in a spontaneously breathing patient. PEEP: Positive End-Expiratory Pressure – for endotracheally intubated patients.	100% oxygen, standard ACLS therapy and specific antidote therapy begun at ROLE 1. In addition, provide: If needed, apply CPAP or PEEP, while monitoring the patient's hemodynamic response, to improve oxygenation. Treat bronchospasm with beta-mimetic bronchodilators and IV corticosteroids. In the setting of pulmonary edema, administer IV Furosemide if hemodynamically stable. Diazepam IV may be given for status epilepticus. Bladder catheterization is useful to monitor urine output. Following stabilization, all patients should be evacuated to ROLE 3.	See ROLE 1 materials. Suppression valve. Beta-mimetic drugs. (Aerosol and IV) Corticosteroids. Furosemide. Diazepam. Bladder (Foley) catheter and measurement pouch.

TRAINING	TREATMENT	EQUIPMENT

ROLE 3

Training similar to Roles One and Two. In addition teach: Patients who are conscious upon arrival at ROLE 3 have an excellent prognosis if provided ongoing intensive care. Arterial blood gas (ABG) analysis, using a co-oximeter that can determine true oxygen, CO and met-hemoglobin saturation, is essential for assessing respiratory and ventilatory status and managing CO and CN toxicity. NB: Pulse oximetry will reflect falsely elevated oxygen saturation in the presence of CO poisoning. Chest radiographic findings initially may not correlate well with the degree of pulmonary injury and respiratory compromise. Adult Respiratory Distress Syndrome (ARDS) and pneumonia are common delayed causes of death in inhalation injury. Prophylactic treatment, with antibiotics is not recommended. High dose corticosteroids do NOT prevent ARDS. Standard therapeutic doses of corticosteroids are beneficial in reactive airway disease – especially for	Continue 100% oxygen, standard ACLS therapy and specific antidote therapy begun at Roles One and Two. In addition: Frequently monitor vitals signs, cardiac rhythm and SpO_2 . Check ABG, CO level, electrolytes, BUN, creatinine, glucose, white blood cell count and hematocrit. Obtain an ECG upon admission. Obtain a chest radiograph. In the setting of trauma, obtain standard cervical spine radiographs to rule out occult cervical injury. Correct acid-base and electrolyte abnormalities as indicated by the patients overall clinical condition. In the setting of Sepsis, (fever, leukocytosis) obtain cultures of blood and bronchial aspirants. Initiate empiric antibiotic therapy and adjust according to culture results. Consider Hyperbaric Oxygen Therapy (HBOT) at 3 atmospheres in CO exposed patients with: Neuropsychiatric abnormalities or Coma. Myocardial ischemia or hemodynamic instability.	See materials for Roles First and Second Roles. Standard Role 3 laboratory equipment and materials: Chemistry, Hematology, and Microbiology. Arterial blood gas analyzer with co-oximeter. ECG machine. Standard plain radiologic equipment. Ventilator. Cardiac monitor. Pulse oximetry (SpO_2) monitor. Central intravenous catheters. Central venous pressure monitor. Broad-spectrum empiric antibiotics to cover pulmonary pathogens. Multiplace Hyperbaric Oxygen Chamber. (May require emergent Role Four evacuation.)

TRAINING	TREATMENT	EQUIPMENT
patients with history of asthma. HBOT not only shortens CO half-life, it also increases tissue oxygen delivery by increasing the dissolved oxygen in plasma. The criteria for HBOT are controversial. Most authorities recommend HBOT in the presence of any neuropsychiatric or cardiac abnormalities. Others believe that HBOT should be given to all victims to prevent the development of delayed neuropsychiatric abnormalities.	CO level >25%. (15% in pregnancy) HBOT may require evacuation to a Role Four or higher medical treatment facility.	

B.13 PRIMARY BLAST INJURY

PREAMBLE

1. All forms of violence can transmit energy to the human body and cause injury. The mechanism by which injury is caused can differ according to the nature of the violence and the mechanism of energy transfer. Generally these mechanisms are similar, well known (eg blunt vs penetrating trauma) and merit no specific attention. Sometimes special mechanisms play a dominant role in injury and a thorough knowledge of these mechanisms is a prerequisite for correct diagnosis and management of specific injuries. Such is the case for Primary Blast Injuries. The energy impulse wave of an explosive blast is characterized by an abrupt and very transient rise in atmospheric pressure above the ambient level. This energy wave attenuates rapidly over distance and thus proximity to a blast device is relatively more important than the size of the explosive device. Energy transmission will be greater if the blast occurs within a confined space, or if the blast exposure occurs in water.

2. The type of injuries that can occur due to the effects of blast can be summarized in four types. These are as follows:

a. **Primary Blast (PBI)** is a direct result of the energy impulse wave of atmospheric overpressure (“shock wave”) whether in air or water. Hollow organs will be most at risk as injury tends to occur in areas of tissue-fluid/gas interface or tissue tethering boundaries. The middle and inner ear are most sensitive to injury, followed by lung and gastrointestinal tract;

b. **Secondary Blast Injury (SBI)** results from fragments from the exploding device or fragments blown from materials adjacent to it. The injuries are predominantly penetrating with some degree of blunt trauma also possible;

c. **Tertiary Blast Injuries (TBI)** result when the body is thrown against a solid object or the ground secondary to the blast wind. Blunt trauma injuries predominate; and

d. **Quaternary Blast Injuries (QBI)** are caused by falling debris, noxious gas inhalation, heat and, in the case of nuclear blast, radiation effects.

3. The initial diagnosis of injury is largely presumptive, based on the history of the event, primary physical exam and knowledge of the pathophysiology of blast injury. As no specific investigations are available to confirm exposure to primary blast effects, this must be recognized on the basis of history of blast exposure and of examination for its sequelae.

4. Several points relating to blast injury require particular emphasis:

a. injuries are frequently multiple. Primary, secondary, tertiary and quaternary blast injuries may all co-exist. SGI and TBI are often much more severe when seen in conjunction with PBI, due to the close proximity to the blast required to produce the PBI;

b. secondary injury, I the form of penetrating and blunt trauma from projectiles, will make up the majority of blast related injuries;

c. blast is unpredictable in its outcome for individuals exposed to the effect;

d. development of signs and symptoms may be significantly delayed after exposure;

e. there is no specific therapy for primary blast injury and each specific injury is treated according to the accepted protocol for the system injured;

high-level blast energy carries a high potential for injury morbidity and mortality. Even low-level blast energy can result in significant injury to susceptible organs;

air embolism (cerebral, cardiac, etc) is often noted in older literature concerning the effects of PBI. Its true incidence is unknown due to the difficulties and specific requirements for post-mortem autopsy diagnosis. The incidence of significant air embolism in survived blast injury is probably very low and this is reflected in the lack of emphasis given to this problem in more recent PBI research and literature. Although it should be considered in blast victims with neurologic signs and symptoms, the far more common cause of these will be related to traumatic brain injury.

5. The incidence of blast injury is increasing as both civilian and military personnel are exposed to terrorist bombing and unmarked mines/munitions in various geographical trouble spots.

6. As the blunt and penetrating injuries seen with Secondary, Tertiary and Quaternary blast effects are covered elsewhere in this manual, this triptych will emphasize the recognition and management of Primary Blast Injury.

TRAINING	TREATMENT	EQUIPMENT

ROLE I

Teach: - Basic blast physics - Four types (Primary, Secondary, Tertiary, Quaternary) of blast related injuries - High index of suspicion for PBI		
Teach: - Explosion occurring near the face can produce severe injury to the eye - Pressure wave is capable of causing rupture of cortical veins and subdural bleeding	HEAD INJURY - See Triptych C.07 OCULAR INJURY - See Triptych C.01	
Teach: The middle and inner ear are most sensitive to primary blast effects. The ear drum is particularly fragile, such that the presence of ear drum rupture is not a reliable indicator of PBI to other organs - Symptoms/Signs of ear injury - Otoscopic examination - The majority of perforated ear drums heal spontaneously	EAR INJURY **Ear drum rupture** - Clean external canal without irrigation - Apply sterile bandage - Transfer to appropriate specialist if complicated Middle/Inner ear injury - Clean external canal without irrigation - Apply sterile bandage - Treat conservatively - Transfer to facility with appropriate specialist	Otoscope Sterile dressings

TRAINING	TREATMENT	EQUIPMENT
Teach: - The lung is the next most sensitive area for Primary blast injury - Potential lung injuries include air embolism, pneumothorax, subcutaneous emphysema, pneumomediastinum and blast lung - Air emboli pose the most immediate threat to life, and significant embolism is generally rapidly fatal. Neurologic symptoms/signs are more likely due to traumatic brain injury - Examination of Chest - Symptoms/ Signs of Air Embolism Syndrome - Fundoscopic examination - Symptoms/Signs of Subcutaneous emphysema and Pneumomediastinum - Awareness of association of pneumomedisatinum with abdominal free air and tension pneumoperitoneum after blast injury - Intubation technique **Teach**: (see Triptych B.01, B.02)	capability Dislocation of the ossicles - Same as for Middle/Inner ear injury LUNG INJURY **Air embolism, Pneumomediastinum, and Subcutaneous emphysema** - Rule out closed head injuries and confirm air embolism by clinical signs - Position patient in Trendelenburg (Head down) and on his left side - Treat neurological and cardiac dysfunction by direct and supportive methods - Consider endotracheal intubation if unprotected airway (See Triptych B.01, B.02) - Transfer to facility with critical care capability (consider possibility of Hyperbaric treatment if immediately available) **Pneumothorax – hemothorax** (see Triptych B.01, B.02)	Flashlight Tongue depressors Stethoscope Ophthalmoscope Laryngoscope set Cuffed endotracheal tubes (Intubation kits) Syringe Bag-Valve-Mask set Connectors Portable ECG monitor Oxygen supply

TRAINING	TREATMENT	EQUIPMENT
- Symptoms/Signs of pneumothorax and hemothorax - Needle decompression of tension pneumothorax - Chest tube insertion **Teach**: - Symptoms/Signs of blast lung - May present acutely or after delay of 12-24 hours - Risks of fluid overload (see Triptych A.05)	- Observe carefully for development of a hemopneumothorax - Chest decompression with large bore needle/cannula if tension pneumothorax - Insert chest tube with non-return valve - Transfer to facility with surgical capability **Blast Lung** - Give oxygen by face mask - If clinical situation deteriorates, intubate and ventilate (see Triptych B.01, B.02) Recommend use of PEEP valve if intubated. - Insert I.V. cannula and infuse fluids taken into account all injuries. If only Primary blast injuries, avoid fluid overload - Transfer to facility with critical care capability	Large bore needle/cannula sets Non-return valves Chest tubes (large sizes) Chest tube insertion tray
Teach: - Physiology of Primary blast effect on hollow organs - Potential delayed onset of symptoms (Bowel contusion progressing to necrosis) - Gastrointestinal injuries may predominate or may be the sole major injury in underwater blast. - Signs and Symptoms of visceral rupture - Concept of tension pneumoperitoneum and requirement for surgical decompression - Abdominal examination	GASTROINTESTINAL INJURY - Prevent or treat shock - Insert nasogastric decompression - Transfer to facility with surgical capability	Non-Rebreather face masks PEEP valves (intubation kit) Oxygen tubing IV cannulae and tubing IV fluids (crystalloid)

TRAINING	TREATMENT	EQUIPMENT
- Nasogastric tube insertion (including indications and contraindication)		Nasogastric tubes

ROLE 2

TRAINING	TREATMENT	EQUIPMENT
Teach: Same as for Role 1	HEAD INJURY Continue or carry out treatment as in Role 1 (see Triptych C.07) OCULAR INJURY - Continue or carry out treatment as in Role 1 (see Triptych C.01) EAR INJURY - Continue or carry out treatment as in Role 1 LUNG INJURY - Baseline chest radiograph Air Embolism, Pneumomediastinum and Subcutaneous Emphysema - Continue or carry out treatment as in ROLE 1 Pneumothorax – Hemothorax - Continue or carry out treatment as in ROLE 1 Blast lung - Continue oxygen by face mask	Same as for Role 1 Diagnostic Imaging (x-ray) Mechanical ventilator and relevant tubing

TRAINING	TREATMENT	EQUIPMENT
	- Consider intubation and mechanical ventilation (see relevant triptych)	(PEEP capable)
Teach:	CARDIAC INJURY	
Cardiogenic shock may arise from a vagally mediated reflex as a PBI. Hypovolemia should be considered the primary cause of shock in trauma patients until it is ruled out	- Supportive treatment - Consider central line monitoring, inotropic support, as indicated	ECG Monitoring Central line insertion kits
	GASTROINTESTINAL INJURY	
	- Continue or carry out treatment as in ROLE 1 (see Triptych B.06)	

TRAINING	TREATMENT	EQUIPMENT

ROLE 3

Teach: Same as for Role 1/2	HEAD INJURY - See Triptych C.07 **OCULAR INJURY** - See Triptych C.01 EAR INJURY - Initial conservative treatment as in Role 1/2 Transfer to Role 4 for surgery if indicated	Same as for Role 1/2
Teach: - Hyperbaric therapy can protect against air embolism related death - Chest x-ray in all victims of blast injuries regardless of clinical condition. Repeat at 24 and 48 hours after exposure or sooner if signs present - CT scan would be more valuable as an imaging method but is not yet ROLE 3 standard	LUNG INJURY - Continue standard treatment regimes for neurological and cardiac disorders - Consider hyperbaric treatment if available - Consider intubation	Diagnostic Imaging - x-ray - CT scan if available
	Pneumo-Hemothorax - Chest x-ray - Continue draining Consider thoracotomy in presence of continuing major air leak or bleeding of more than 200 ml/hour	Chest drain collection apparatus
	Blast Lung	

TRAINING	TREATMENT	EQUIPMENT
	- Chest x-ray - Provide or continue treatment as per ROLE 1/2 - Consider mechanical ventilator support (with PEEP) for intubated patients - Insert nasogastric tube in patient requiring mechanical ventilation - Carry out suction and respiratory physiotherapy as indicated - Consider broad spectrum antibiotics (Triptych A.04) CARDIAC INJURY Same as Role 2	- Mechanical ventilator with PEEP capability - Broad spectrum antibiotic (see Triptych A.06)
Teach: - Contused bowel may undergo gradual necrosis and perforate several days after the initial trauma - CT Scan would be more sensitive in detection of bowel perforation and other abdominal injury, but is not yet ROLE 3 standard	GASTROINTESTINAL INJURY - Continue treatment as per Role 1/2 - Upright chest radiograph to look for sub-diaphragm free peritoneal air and carry out abdominal sonography to look for haematomas and solid organs injuries (FAST or standard sonography) - Perform laparotomy if signs of visceral rupture or Tension Pneumoperitoneum - Give antibiotics if perforation - Continue to monitor patient for delayed perforation	Diagnostic Imaging - Ultrasonography (FAST) - CT scan if available

B.14 CRUSH SYNDROME EMERGENCIES

PREAMBLE

OVERVIEW
This triptych deals with crush syndrome emergencies, which are germane to both civilian and military situations. Extensive skeletal muscle injury (rhabdomyolysis), whether caused by mechanical crush or by extreme physical exertion is incompatible with life, unless treated early and vigorously. Historically it was first observed in 1941 by Bywaters and Beall who described victims of the aerial bombing of London. . The typical clinical picture was a victim trapped for prolonged periods under collapsed buildings and then extricated. One or more extremities were compressed or crushed under fallen building material. The patients were usually pale, hypotensive, and hypovolemic. Subsequent clinical histories and experiences are from Vietnam and in particular the Hanshin-Awaji and Taipei earthquakes. In Bywater's cases 67% usually died within ten days. Many of the deaths were related to hyperkalemia and arrhythmias. Thus, Crush Syndrome is the systemic manifestation of muscle injury caused by limb compression. Therefore evaluation and treatment must be directed at the injured limb in regards to compartment syndrome, fractures, neurovascular compromise and the systemic effects derived from the local pathology.

PATHOPHYSIOLOGICAL CONSIDERATIONS
Manifestations are caused by the disintegration of muscle tissue (rhabdomyolysis) and leakage of the contents of myocytes into the plasma.
Myoglobin, an oxygen carrier is a key component released. It is filtered by the glomeruli and reaches the tubules causing obstruction and renal failure.
Other intracellular components such as protons, phosphate, potassium and nucleotides are released from damaged muscle and play a role in crush-associated pathophysiology.
Volume depletion is a determinant of renal injury.
THE ROLE OF CALCIUM: excess calcium enters the damaged muscle cell in exchange for intracellular sodium. Large quantities of free calcium ions trigger contraction, resulting in energy depletion. Calcium activates phospholipase A2, various vasoactive molecules, proteases, and induces free radical release.
Stretching of muscle cells increases the influx of sodium, chloride and water across the sarcoplasmic membrane, resulting in cell swelling.
REPERFUSION INJURY: Additional muscle damage, and calcium influx, takes place after the compression has been relieved, in particular post fasciotomy to treat compartment syndrome. Leukocytes migrate into the damaged tissue and activate the release of free radicals and other injurious compounds. This process is enhanced by the sudden availability of oxygen.
COMPARTMENT SYNDROME: Many striated muscles are contained within rigid compartments formed by bones and fascia. If muscle cells swell, the intracompartmental pressure raises causing additional damage and necrosis.

ACUTE RENAL FAILURE (ARF): The main pathophysiological events are renal vasoconstriction; intraluminal cast formation, and direct heme-protein-induced cytotoxicity. Myoglobin passes easily into the tubules. When water is progressively reabsorbed from tubular fluid, the concentration of myoglobin rises until it precipitates. This causes obstructive cast formation. These processes are aggravated by renal vasoconstriction and decreased glomerular perfusion pressure. They are caused in main by intravascular hypovolemia via the uptake of water by the damaged muscle tissue. It is not uncommon for more than 10 liters of fluid to accumulate in the damaged limbs. Another factor in the precipitation of myoglobin is a low pH in tubular urine. When pH decreases the solubility of myoglobin is progressively lost. The intratubular disintegration of the iron carrying myoglobin leads to the release of iron, which catalyses free radical production. Free radicals potentiate ischemic renal damage.
GASTROINTESTINAL ISCHEMIA: Secondary to hypovolemia favors endotoxin absorption and release of cytokines, which further enhance the inflammatory reaction and hemodynamic instability via lipid damage in cell membranes.

CLINICAL CONSIDERATIONS

The pathophysiologic mechanisms are presented in some detail because they have important therapeutic implications
Intravascular dehydration and myoglobin precipitation in the tubules must be prevented.
This is the rational behind early and aggressive administration of fluid and alkalinization of urine.
Expeditious transfer to level 2 for initial trauma care, dealing with possible compartment syndrome, and immediate evaluation of possible life threatening hyperkalemia.
Possibility of level 3 for hemodyalysis in the event of progressive renal failure
Possible referral to level 3 for hyperbaric oxygen therapy in regards to treatment of crushed extremity tissue.

TRAINING	TREATMENT	EQUIPMENT

ROLE 1

TEACH INITIAL EVALUATION	TREATMENT	
1. Causes of Crush Syndrome- entrapped limbs from Collapsed structures secondary to military or Natural disasters. When muscle compression is relieved or vascular interruption is corrected, the cellular contents of the affected muscle are released. 2. Based on historical experience and pathophysiology have a high index of suspicion for Crush Syndrome in patients with entrapped limbs. 3. Safety! Collaborative effort with Civil Defence, Emergency /Disaster site managers to secure area. 4. Initially treat patient as a whole: Hypovolemia is often the first manifestation of the Crush Syndrome. Large amounts of fluid leak into the interstitial space. 5. Attempt extrication of the patient with regard to spinal precautions. This will facilitate evaluation and treatment. If extrication is delayed then consider insitu treatment. This would be primarily IV fluid and pain med administration. Consider environmental insults such as hypothermia.	Evaluate, resuscitate, and stabilize the patient addressing the ABC's. Make sure the airway is cleared; the patient is breathing and the presence of a pulse. The laboratory diagnosis of Crush Syndrome is not possible at this stage. Therefore a specific diagnosis is less important than the rapid identification of a crushed extremity. Apply supplemental oxygen via mask Place patient on spine board with C-collar if indicated 16-18 ga. IV in the antecubital area or leg vein for fluids to treat hypovolemic shock with 20 ml. /kg of Normal Saline or Ringer's Lactate boluses to maintain blood pressure and urine output. Large amounts of IV fluid replacement is defined as potentially giving up to 10 to 12 liters. The experience in the Marmara (Turkey) earthquake used 6 L during the first 24 hrs, until the patients are admitted to a role 2 hospital for better monitoring. This avoids complications resulting from the lack of close medical supervision. Specifically when dealing with the elderly or patients who become anuric	Basic field resuscitation materials to include: Stethoscope, blood pressure cuffs Oxygen delivery system, mask or non rebreathing reservoir face mask Self-expanding bag-valve-mask device. Other airway adjuncts such as oral and nasal pharyngeal airway devices. Endotracheal intubation equipment Initial Fluid Administration Supply of intravenous catheters: 16 to 18 ga. Intravenous tubing 1-liter bags of 0.9% Normal Saline solution. Medications Primarily morphine for IV or IM routes. May use ketamine and benzodiazopines for pain control. Transport Equipment Spine boards C-collars Army or similar litter Coordination to role 2 facilities either by air, land or sea.

TRAINING	TREATMENT	EQUIPMENT
6. If extricated evaluate for hemodynamic compromise in crushed limbs. If suspected fractures and deformities apply splints for comfort and preserving circulatory function. Monitor pulses via palpation or Doppler if available. 7. Emphasize that Crush Syndrome is the main cause of Acute Renal Failure (ARF) via rhabdomyolysis. Early intervention is necessary to Preserve kidney function. Be aware that ARF is Aggravated by secondary compartment syndrome, dehydration, sepsis and hypothermia. Treat with large amounts of IV fluids. 8. Stress that time is of the essence for treatment of Crush Injury and total trauma management, but studies have suggested that the duration of muscle compression or time elapsed between extrication and treatment do not correlate with predicting Crush Syndrome/ Acute Renal Failure. The reason for this lack of correlation is unclear but suggests that muscle may be extensively damaged even if the victim is extricated soon after being entrapped.	due to long periods of entrapment and delayed initial treatment. Urine output via foley catheter is desirable but may not be practical in Role 1 echelon. Immobilization, elevation and cooling the crushed extremity. .	Splints, chemical cold packs or ice pack.

TRAINING	TREATMENT	EQUIPMENT

ROLE 2

TEACH- Continuum of Role 1 with attention to ABC's and IV fluids. Emphasize the management of Crush Syndrome and contributing Compartment Syndrome. Patient needs monitoring: labs, EKG, Foley Catheter, Blood pressure, pulse, and Temperature. EKG changes i.e. hyperacute T-wave, and serum potassium levels greater than 6meq/l on admission to a Role 2 facility require immediate treatment. Teach Laboratory interpretation: (Referenced from the studies of patients with Crush Syndrome from the 1995 Kolbe, Japan, earthquake). Triage via blood testing –early labs if available can be predictive of Acute Renal Failure especially the serum CK. A serum CK of 20,000 U/L is the current threshold for risk and requirement of treatment. A close correlation between the concentrations of serum potassium and creatine kinase. A weak correlation between serum potassium and creatinine concentrations. A close correlation between the serum myoglobin the serum potassium and the CK level.	Airway, Breathing, and Circulation! Treatment of Hyperkalemia K+ > 6 meq/L treat with IV Sodium Bicarbonate, glucose and insulin. Give Sodium Bicarb. 50 mg IV Give 10-20 units regular insulin per 100 gms of glucose. May need to continue treatment with ion-exchange resins. (Kayexalate or sodium polystyrene sulfonate 1 gm/kg P.O.) Monitor serum glucose, Sodium and Potassium. Treatment Guidelines for Patients With Rhabdomyolysis After fluid resuscitation: Continue with forced alkaline diuresis with mannitol and bicarbonate. Goals are a urine output of approx. 200cc/hr; maintain urine pH between 6 and 7, to keep serum pH below 7.50.	Dependent on the availability of laboratory analyzers- There are a variety of mobile lab monitoring devices.

TRAINING	TREATMENT	EQUIPMENT
NOTE: ROLE 2 MAY NOT HAVE THE LABORATORY TECHNOLOGY AVAILABLE FOR ABOVE ANALYSIS. THEREFORE ROLE 3 WOULD BE NEEDED. ROLE 2 WOULD BE THE IDEAL DUE TO TIME. Goals of Role 2: Goal at this stage is to prevent or stabilize Acute Renal Failure secondary to myoglobin and hypotension. Define ARF as a serum creatinine more than .5 mg/dl over baseline or concentration above the upper limit of the normal level (1.8 mg/dl) Be aware of alkalinization exacerbating hypocalcemia seen in Rhabdomyolysis Mannitol: 1) increases renal blood flow and GFR (Glomerular Filtration Rate); 2) is an osmotic agent that attracts fluid from the interstitial compartment, thus counterbalancing hypovolemia and reducing muscular swelling and nerve compression; 3) osmotic diuretic that increases urinary flow and prevents obstructive myoglobin casts; and 4) scavenges free radicals. Teach caution on mannitol, furosemide and dopamine; give only after volume replacement. Avoid mannitol in oliguria. Monitor other metabolic complications:	Treatment begins with a bolus of 1 liter D5 0.22% NaCL +100mEq $NaHCO_3$ over 30 minutes Follow by an infusion at 2 to 5 ml/kg per hr.At the same time, a bolus of 0.5 gm/kg 20% mannitol is given over 15 minutes and followed by an infusion at 0.1 gm/kg per hour. Consider: When the serum pH exceeds 7.45 or urine pH remains below 6.0, the administration of acetazolamide (Diamox) can help to increase the excretion of bicarbonate in the urine. Consider dopamine at 3 to 5 ug/kg/min. To facilitate renal output. Consider furosemide 1 mg/kg to maintain urinary output	Oxygen source with masks including 100% non rebreather IV equipment 12 Lead EKG machine Basic lab analysers: electrolytes, glucose, Blood Urea Nitrogen, Creatinine, Urine Analysis, Myoglobin, Creatine Kinase. NOTE: These would be ideal for complete patient management however some analysis such as Myoglobin may not be available in a role 2 level.

TRAINING	TREATMENT	EQUIPMENT
Hypercalcemia and Hyperphosphatemia Allopurinol may be useful because it reduces the production of Uric Acid and also acts as a free radical scavenger. Pentoxyfilline has been considered in the management of Rhabdomyolysis Diagnosis and treatment of Compartment Syndrome. Raised pressure within a closed osteofascial compartment compromises the circulation to the tissues within that space. Suspect raised intracompartmental pressure with the following: Pain, Swelling, Altered Sensation, Muscle weakness, or pain on passive muscle stretching. Always check the presence or absence of pulses Compartment Syndrome has a high association with Crush Injury and contributor to the Crush Syndrome. Teach that reperfusion after decompression, (Reperfusion Injury) i.e. the release of renal toxic substances as stated in the Preamble can contribute and exacerbate the Crush Syndrome. Crush Syndrome/time issue-Reported that	Hypercalcemia: treat with saline diuresis and IV furosemide. Hyperphosphatemia: use oral phosphate binders when serum levels exceed 7 mg/dl Allopurinol: dosage guideline- give 200-300 mg PO per day Pentoxifylline (Trental) 400 mg. PO tid. Decompressive fasciotomy is the definitive treatment. Can be performed without pressure measurement if equipment not available and clinical suspicion is high. . Note that pain is the most common symptom; paresthesias are the most sensitive feature of developing compartment syndrome. Suspect Compartment Syndrome if the difference between the intra compartment pressure and diastolic Blood Pressure is less than 30mm Hg. Compartment pressures can be measured by needle placed in compartment.	Surgical equipment Anaesthesia both general, Narcotics, Ketamine, and sedatives. Doppler for arterial pulse documentation.

TRAINING	TREATMENT	EQUIPMENT
Acute Renal Failure could successfully be prevented with the initiation of aggressive fluid therapy if started within 10 hours of release of muscle compression.	If pressure marginally raised record pressure periodically until a clear fall. Patients with compartment pressures of 30-40 mmHg generally are considered for emergent fasciotomy.	

TRAINING	TREATMENT	EQUIPMENT

ROLE 3

COMPARTMENT SYNDROME MANAGEMENT VIA PRESSURE MONITORING EQUIPMENT; FOLLOW THESE GUIDELINES: CONTINUED THERAPY TO PREVENT ACUTE RENAL FAILURE: Mannitol: 1) increases renal blood flow and GFR (Glomerular Filtration Rate); 2) is an osmotic agent that attracts fluid from the interstitial compartment, thus counterbalancing hypovolemia and reducing muscular swelling and nerve compression: 3) osmotic diuretic that increases urinary flow and prevents obstructive myoglobin casts. Use of diuretic, Furosemide Use of Dopamine Teach caution on mannitol, furosimide and dopamine usage. Give only after volume replacement. Avoid mannitol in oliguria.	Suspect Compartment Syndrome if the difference between the intra compartment pressure and diastolic Blood Pressure is less than 30mm Hg. Compartment pressures can be measured by needle placed in the compartment. Patients with compartment pressures of 30-40 mm Hg generally are considered for emergent fasciotomy. 20% mannitol is recommended. Give as a single 1g/kg IV dose over 30 min. Alternative is: 25 Gms IV initially, followed by 5 g/h IV for a total of120g/day. Dopamine: 3 to 5 ug/kg/min to facilitate renal output. Furosemide 1mg/kg to maintain urinary output	MODALITIES TO MEASURE INTRACOMPARTMENTAL PRESSURES: Slit catheter technique. 18 ga. Needle over a fenestrated (slit) catheter. Pt. is locally anaesthetized and the catheter is inserted with a digital readout. Stryker Intracompartmental Pressure System. This is a hand held apparatus for intermittent or Continuous monitoring of compartment pressures. Note: normal compartment pressures range From 0-10 mm Hg. Absolute compartmental pressure of 30-45 mm Hg for 4-8 hours in an injured extremity will produce irreversible myoneural injury.
RENAL DIALYSIS:	Requires specialized hemodialysis teams	

TRAINING	TREATMENT	EQUIPMENT
Once Acute Renal Failure has been established, or severe Hyperkalemia and Acidosis are present the patient requires Dialysis.	Aaa Continuous artiovenous hemofiltration equipment. Allows hemodialysis with only 12 L of water every 12 hours, it does not require electricity or pumps, it does not necessitate dialysate delivery, the equipment is disposable, and large quantities of potassium can be removed	RENAL DIALYSIS: Dialysis machines Artificial kidney membranes Dialysate Concentrate Dialysis catheters Kayexalate
ADVANTAGES OF RENAL DIALYSIS: Provides efficient removal of solutes Creates the possibility of dialyzing without anticoagulants. Provides opportunity to treat several patients per day on the same machine.		Recent Recommendations: Continuous arteriovenous hemofiltration equipment
Peritoneal dialysis is difficult to administer in patients with abdominal trauma but may offer temporary help.		
Be aware of the existence of (RDRTF) Renal Disaster Relief Task Force, created in 1995- The European Branch of RDRTF is now fully operative.	Prepares stocks of goods and lists of volunteers who could intervene immediately in the event of a large-scale disaster.	
Some studies advise not to treat ARF patients via dialysis in the disaster area particularly when earthquakes are involved. There is the real threat of aftershock damage to treatment facility. During this stage transport of patients might be impossible further increasing mortality. Consider transport options: Air, Land, and Sea	ROLE OF HYPERBARIC THERAPY:	ROLE OF HYPERBARIC THERAPY:

TRAINING	TREATMENT	EQUIPMENT
ROLE OF HYPERBARIC THERAPY: Oxygen as an adjuvant for preventing myonecrosis in Compartment Syndrome. Hypoxia plays a central part in muscle ischemia and edema. Increases diffusion gradient of oxygen into the tissues. Red cells become more deformed at such pressures facilitating transport through constricted microcirculation. Hyperbaric oxygen therapy abolishes neutrophil adhesion. Crush Injury is often accompanied by hypotension and fat embolism causing cerebral edema, which can also benefit from hyperbaric oxygen treatment. Has the effect of arteriolar vasoconstriction with subsequent reduction in transcapillary flow of fluid, this causes: 1) Increased capillary resorption of extravascular fluid. 2) Rapid decrease of tissue edema 3) Fall in intra-compartmental pressure	100% O2 at 3 ATM can produce arterial oxygen tensions up to 250 Kpa by direct solution in plasma. Given after fasciotomy Given for 90 min 3 times a day for the first day then twice daily thereafter until clinically stabilized	Hyperbaric Chamber Need to know referral centers preplaced.

C.01 HYPOTHERMIA

PREAMBLE

Hypothermia is defined as a deep body (or core) temperature of 35°C or less. By convention it is further classified into Mild, Moderate and Severe according to the following temperature bands:

Mild	35 to 32°C
Moderate	32 to 30°C
Severe	below 30°C

Hypothermia occurs when heat loss exceeds heat production; due either to increased heat loss or decreased heat production. Primary hypothermia occurs with overwhelming cold exposure in the presence of normal thermoregulation, as in immersion, extreme cold environments and in deep diving. Secondary hypothermia occurs with mild to moderate cold exposure in the presence of abnormal thermoregulation due to injury, illness, age, poor nutrition etc. Thus military personnel are at risk of developing hypothermia and cold injury due to the extreme environments they are exposed to and can be at additional risk if wounded. The simultaneous occurrence of hypothermia and trauma worsens prognosis, and there is a 'lethal triad' of hypothermia, acidosis and coagulopathy.

Prevention

Military personnel need to be educated about the risks of cold injury and hypothermia, and the factors that predispose to such injury e.g. wet clothing, physical exertion, poor nutrition, dehydration, wind chill, high altitude, immersion, alcohol and drugs. They should be taught strategies to avoid putting themselves unnecessarily at risk, and first aid and self-care/buddy care measures to prevent a minor problem developing into a life or limb-threatening situation.

Aims of treatment

The aim of treatment is to remove the victim from the hostile environment and prevent further heat loss, to effect rewarming and to avoid the life threatening complications of severe hypothermia. The approach to treatment has to vary according to the individual, the circumstances, the resources available, but the following triptych attempts to outline an integrated graded approach.

TRAINING	TREATMENT	EQUIPMENT

ROLE 1 and 2

General Training of all military personnel in the recognition of and prevention of cold injury is the responsibility of every individual commander. First Aid Prevention and first aid measures – self help and buddy help. Principles Definition of hypothermia. Increased cooling effect of wind – Wind-chill. High thermal conductivity of water – 25 times that of air. Thermoregulation – In the healthy individual, if the cold insult is removed, spontaneous rewarming will occur by normal physiological mechanisms, however thermoregulation is impaired by severe hypothermia. Fluid balance – dehydration and fluid shifts. The “afterdrop” phenomenon. Patients should be rewarmed at a similar rate to that at which they were cooled. Rapidly occurring hypothermia: rewarm rapidly Slowly occurring hypothermia: rewarm more slowly		Quality, tested clothing and footwear.

TRAINING	TREATMENT	EQUIPMENT
Features, symptoms and signs Mild Hypothermia – core temp <35°C >32°C Shivering. Occurs at 36 degrees C in 30% of people. Increased heart rate Increased blood pressure Increased respiratory rate Pale cold skin Weakness False feeling of well-being Impaired mental processes Irritability and aggression	Treatment of Mild Hypothermia Remove from cold environment. Treat in a warm environment or shelter if possible. Remove wet clothing, dry patient, and put on dry warm clothing. Wrap patient in insulating blankets e.g. woollen blankets and cover the head- (foil blankets are only equivalent to the same thickness of plastic and of little value). Each part of the body should be wrapped separately Measure core body temperature. If conscious and not confused give warm drinks. Prohibit smoking and alcohol intake. Do not thaw frostbite if there is risk of re-freezing. Evacuate in insulating blankets.	Scissors Dry warm clothing – thick, insulating Insulating blankets Low reading thermometer Warm energy-containing drinks
	Return to unit Confirm normal core temperature, cessation of shivering and normal pulse rate. Nourish adequately (calories and fluid intake).	Food and warm energy-containing drinks
Moderate Hypothermia – core temp <32°C >30°C	Treatment of Moderate Hypothermia As for mild hypothermia.	Warming blankets or pads Warmed IV fluids

TRAINING	TREATMENT	EQUIPMENT
No shivering Reduced heart rate Reduced blood pressure Reduced respiratory rate Pale cold skin Confusion Stupor	Active external rewarming if available. Consider warmed (40°C) IV fluids. Consider warmed humidified oxygen.	IV cannulae and giving sets Oxygen Face masks and tubing Bair Hugger™ warming device Well-heated vehicle for evacuation
Severe Hypothermia – core temp <30°C No shivering Bradycardia Arrhythmias Hypotension – pulse may be impalpable ECG – long PR and QT, J waves Hypoventilation, bronchorrhoea Pale cold skin Dehydration – cold diuresis, hydrostatic pressure in immersion Stupor or coma Dilation of pupils Areflexia and rigidity Disordered metabolism – impaired heat production, altered drug effects Ventricular fibrillation risk high <28°, - careful handling avoid any patient effort Asystole and cessation of cerebral electrical activity by 20°. At temperatures below 26 degrees, a patient becomes poikilothermic During evaciuation, always transport patient horizontally	Treatment of Severe Hypothermia As for moderate hypothermia Extreme care in patient handling and avoidance of patient effort during movement and transport. If breathing protect or secure airway. Warmed humidified oxygen. Warmed IV fluids. If in cardiac arrest (confirmed by ECG) start CPR, but only if can be sustained for a prolonged period without risk to carers. Rewarming may take many hours. Active internal rewarming if possible. Rewarm actively to at least 32° to reduce risk of cardiac arrest. Evacuate.	Nasal or oral airways Endotracheal tubes and laryngoscope Manual ventilation equipment – bag, valve mask Monitors Chest drain, peritoneal catheter, urinary catheter, nasogastric catheter. Bair Hugger™ warming device

TRAINING	TREATMENT	EQUIPMENT

Nobody is dead until he/she is warm and dead. Associated injuries Freezing and non freezing cold injury Masked trauma	Resuscitation should be attempted even if cardiac arrest has occurred before rescue as hypothermia protects from ischaemic tissue damage and salvage may be possible.	
IV infusion in cold environments Never attempt to set up IV infusions in open air in temperatures below 0°C. Prepare the infusion in shelter in the warm. Carry infusion set under wind-proof jacket, preferably next to skin. If infusion essential out of shelter, place IV fluid bag under patients clothing, in armpit, insert cannula, connect infusion, infuse with pressure bag. Risks of fluid therapy Severely hypothermic patients will not tolerate large IV fluid loads. Rewarming cannot be achieved by copious warm IV infusions. Beware patient dilating rapidly during rewarming and becoming hypovolaemic. Monitor diuresis closely Warmed air and oxygen Warmed gases can be produced by coiling oxygen delivery tubing in a container of hot water (45°C).		Short IV giving sets, 80cm long without drip chamber if available. Pressure infusion bag Portable Infusion Heaters (e.g. Heatpac™)

TRAINING	TREATMENT	EQUIPMENT

Warmed inhaled gases reduce respiratory heat loss, but do not contribute to rewarming significantly.		

ROLE 3

Rewarming techniques Passive external rewarming Warm environment - >25°C Insulating clothing and blankets Active external rewarming Immersion in warm water – 40°C – conscious uninjured patients only. No contraindication to inclusion of limbs. External warming devices e.g. warmed blankets, hot water bottles, heated pads and blankets, Bair Huggers™ – beware burns to skin Active internal (core) rewarming Warmed inhaled gases – max. 45°C Warmed IV fluids – max 40°C Gastric, bladder irrigation – max 40°C Peritoneal, pleural irrigation – max 40°C – non potassium containing isotonic solutions only Extra-corporeal blood warming using haemodialysis or haemofiltration apparatus Cardiopulmonary by-pass. Not suitable for the field	Further treatment of Severe Hypothermia Start or continue CPR if necessary – prolonged CPR may be required. Monitor deep body temperature accurately – rectal or oesophageal sites. Monitor ECG continuously. Invasive monitoring – central venous pressure, Arterial pressure. Correct fluid volume with warmed colloid or crystalloid. Monitor urine output – urinary catheter. Ventilation with warmed humidified gases if necessary. 100% oxygen as appropriate. Rewarming according to available resources. Blood sampling for biochemistry as appropriate –IF pH less than 7 half correct with sodium bicarbonate. Do not treat cardiac arrhythmias without ECG monitoring and not before core temperature above 30°C. Defibrillation of the cold heart is ineffective and damaging. Arrhythmias (except Ventricular Fibrillation) may spontaneously correct as core temperature increases. Treat cardiac arrhythmias according to	Airway adjuncts Laryngoscope Endotracheal tubes Manual ventilation device or mechanical ventilator Oxygen administration apparatus Blood pressure monitoring Stethoscope Syringes and needles Low reading thermometer or electronic thermometer. Monitoring apparatus – ECG, CVP, Invasive BP CVP and arterial catheters. IV fluids – crystalloid and colloid Urinary and naso-gastric catheters Hot water bath and thermometer to monitor temperature Fluid warmers – e.g. Level 1'™ if available. Peritoneal dialysate, fluids for extra-corporeal systems if available Warming cabinet Haematological and biochemical tests Blood gas analyser

TRAINING	TREATMENT	EQUIPMENT
Monitoring Temperature correction of pH and pCO_2 is unnecessary in hypothermia	standard resuscitation protocols if core temperature above 30°C.	Drugs as resuscitation protocols – Epinephrine, Lidocaine, Atropine. Amiodarone.

C.02 LOCAL COLD INJURIES

PREAMBLE

Definitions
Local cold injuries (LCI) can be divided into freezing injuries (frostbite) and non-freezing injuries (chilblain, pernio, trench or immersion foot). Frostbite is a result of tissue freezing, especially involving exposed parts such as hands, feet, nose, ears and cheeks. Non-freezing injuries typically occur after prolonged exposure to moist environment and temperatures just above freezing point. Soldiers and sailors are especially susceptible to trench foot.

Pathogenesis
Continuous exposure to cold will induce vasoconstriction in the micro vascular bed. This vasoconstriction is followed by a cold induced vaso-dilation with an attendant increase in skin blood flow and temperature counteracting LCI. This cyclic phenomenon is known as cold induced vasodilatation (CIVD) or "hunting reaction", which will be abolished in case of systemic hypothermia. Severe cold may lead to intracellular ice-crystal formation and mechanical destruction of cells. Moreover, vascular constriction in addition to thrombosis causes hypoxic tissue damage. For trench foot an alternating vasospasm and dilation progressing to hyperaemia appears to occur, but the mechanism of injury is obscure.

Predisposing factors
Increased heat loss due to wet clothing, or a damp, drizzling and windy environment. Other factors are fatigue, high altitude (relative hypoxia), lack of acclimatization, smoking and previous cold injury.

Symptoms and signs
Frostbite: The initial presentation comprises pain, discomfort and pruritus. The injury progresses to numbness and eventually loss of sensation. The involved skin appears white or blue-white, firm or even hard to touch. The degree (1-4 degree) or depth of LCI cannot be determined till after rewarming of the skin. First degree is characterized by hyperaemia and oedema, second degree by blisters, third degree by hemorrhagic vesicles associated with subcutaneous tissue necrosis, and fourth degree by full thickness necrosis.
Chilblain or pernio may develop after repeated exposure to cold and, is characterized by red or purple pruritic skin lesions often associated with oedema or blistering.
Trench foot: The skin is first cold, oedematous with sensibility disturbances. In the hyperaemic stage (after 24-48 hours of exposure) the tissue damage is characterized by redness, blistering, ecchymosis and ulcerations.
Prophylactics
Prophylactic measures are crucial to prevent severe late sequelae. Hypersensitivity to cold will ensue in the vast majority of cases, and the degree of disability is not clearly associated with the degree of frostbite. Even non- freezing injuries are likely to sustain long-term disability.

Predisposing factors should be reduced or eliminated.

Longer periods with immobilization are avoided. In previous conflicts a great number of cold injuries were incurred during long periods of immobilization due to hostile activity.

Under longer periods of immobilization, seek shelter from predisposing environmental weather conditions. Avoid cooling from the ground by means of grass, branches etc.

Wet or moist clothing are dried up or exchanged if possible.

Constrictive clothing which may compromise blood circulation should be avoided

Sensation of cold with pin-pricking pain or loss of sensation should prompt inspection. Immediate action is taken by ”skin against skin” re-warming. Rubbing or exercising the affected skin does not augment blood flow.

Proper hygiene is important. Feet are kept as dry and clean as possible, and filthy clothing exchanged regularly for optimal insulation

Under predisposing weather conditions the soldier should refrain from smoking.

Intake of alcohol is avoided. Initially, alcohol leads to an increase in skin blood flow, which will gradually abate, with an attendant drop in core temperature.

TRAINING	TREATMENT	EQUIPMENT

ROLE 1

Teach:	**Frostbite:**	
Prophylactic measures	Shield from wind and elements which may inflict further damage	Warm fluids for oral intake
Predisposing factors	Remove moist or wet clothing	Woollen blankets, large woollen socks
Recognition of symptoms and signs of hypothermia	Remove constrictive garment which may compromise blood circulation	Analgesics
Recognition of symptoms and signs of local cold injuries	The injured area is air dried	
Treatment of hypothermia takes precedence over local cold injuries	The affected limb is elevated to minimize oedema	
Repeated bouts of freezing and thawing worsen injury. Rewarming in the field is therefore avoided before definitive care can be rendered	Blisters are not punctured or deroofed	
	Alternatively, loose layers (of cotton) dressing are used for coverage	Dressings
Rubbing or exercise of the affected tissue may cause mechanical tissue damage, and should be avoided	If available, a cradle (or similar device) is used for protection against pressure spots.	
Although undesirable, a soldier with a frozen foot can walk. Once the rewarming has begun, weight bearing must be avoided	Core temperature is maintained by casualty bag and Heat-packs if available	Casualty bags Heat-packs
. **Teach:**		
A tetanus toxoid booster is administered if time since immunization exceeds 10 years	Tetanus toxoid booster (0,5 ml) if not fully immunized	Tetanus toxoid
Antibiotics are reserved for identified infections	Antibiotic and specific immunoglobulines are *not* routinely administered	

TRAINING	TREATMENT	EQUIPMENT
	Non-freezing Injuries	
See frostbite	**Trench foot** Treatment is best started during or before the reactive hyperaemia state.	
	Same measures as delineated for frostbite	
See frostbite	Rewarming by warm, dry air. Rapid re-warming is not indicated.	
	Chilblain	
Calcium channel blocking agents seem to diminish symptoms, accelerate healing and reduce the risk for new lesion	Same measures as delineated for frostbite	See frostbite
	Gradual rewarming at room temperature (20– 22°C)	Heat-pack
	Calcium blocking agents	See frostbite
		Nifedipine

ROLE 2 and 3

Teach:	**Frostbite**	
See frostbite first role	If necessary, same measures as delineated for role 1	See frostbite first role
	Additional measures:	
Rapid rewarming may significantly reduce	Frost-bitten tissue is immersed in a large water	Warm water

TRAINING	TREATMENT	EQUIPMENT
tissue damage	bath (40-42 °C) for about 30-45 minutes	
	Analgesic agents	
Rewarming process is quite painful		Morphine IV (2-5 mg)
Pharmacological and surgical sympathectomy, low-molecular weight heparin, thrombolytic agents, hyperbaric oxygen and anti-inflammatory agents have failed to demonstrate any significant beneficial effect	Consider lumbar epidural or brachial plexus blocks for (1) pain relief and (2) possible reduced risk for late cold hyper-sensitivity	
	Local wound care:	
For dry necrosis and non-seeping blisters local or systemic anti-microbial or disinfectant agents are not indicated	Dry necrosis is only protected by cotton dressings or gloves to prevent skin maceration	Dressings
Constrictive dressings should be avoided to prevent a tourniquet like effect	Topical anti-microbial agents are applied to raw wound surfaces and seeping blisters	Silver sulfadiazine ointment (Flamazine, Silvadine)

TEACH:		
	Topical anti-microbial agents and dressings are reapplied at 12 hour intervals	Surgical detergent disinfectant solution for removal of silver sulfadiazine
The choice of antibiotics should be based on the causative microbe identified	Systemic antibiotics are administered for septic complications and significant local infection with cellulitis	Benzyl penicillin, aminoglucocide, metronidazol Swabs cultures
The difficulty in the early determination of depth of tissue destruction has lead to the	Surgical debridement or amputation if wet gangrene or severe infection with sepsis	Scissors, forceps, scalpels/(cautry), saw, file, ligatures, sutures, dressings, gypsum

TRAINING	TREATMENT	EQUIPMENT
general rule that surgical debridement and amputation should be postponed for 2-3 months unless sever infection supervenes Often the permanent tissue loss is must less than anticipated Vigilance should be maintained during and after the rewarming for development of compartment syndrome For adequate decompression of all four compartments, ample access through long skin incisions under anaesthesia may be required	supervenes Fasciotomy mat be required, especially after the rewarming phase	Scalpel, scissors, forceps, ligatures
	2. Non-freezing Injuries **Trench foot** The same principles as for frostbite *Exceptions:* Submersion in warm water is avoided. The affected part is exposed to warm dry air. Prophylactic antibiotics **Chilblain**	Consider use of narrow spectrum of antibiotics (Penicillin IV 5 mill IE x 3 for five days)

TRAINING	TREATMENT	EQUIPMENT
Mobilization is imperative to maintain full range joint movement, and to counteract thrombo-embolic complications	The same principles as for frostbite Mobilization All types of local cold injuries, except for lower limb injuries are mobilized Lower limb local cold injuries may require bed rest until oedema has subsided. The patient is mobilized in a chair with limbs elevated as soon as possible Thrombo-embolic prophylaxis	Low molecular weight heparin

C. 03 SUBMERSION INJURIES

PREAMBLE

Definitions:
Drowning is defined as death due to suffocation by submersion in a liquid – usually water.
Near drowning refers to a submersion incident that results in, at least temporary, survival of the victim.
Secondary drowning refers to deaths from complications of a near drowning episode – generally occuring greater than 24 hours after rescue.
Immersion Syndrome is sudden cardiac arrest on cold immersion. May be vagal response coupled with vasoconstriction.

2. Pathophysiology:

Hypoxemia causes cardiac arrest and cerebral hypoxia in drowning.
Water is, in effect, an occlusive barrier to respiration that precludes ventilation, leading to hypoxia, and subsequent cardiac arrest.
“Dry drowning” occurs in about 15% of cases and is due to laryngospasm, while pulmonary aspiration is found in up to 80% of drowning cases.
Pulmonary aspiration can lead to substantial alveolar injury, hypoxemia, and ultimately, secondary pulmonary complications, such as the Adult Respiratory Distress Syndrome (ARDS).

3. Key points:

The goal of treatment is to rapidly ventilate the patient with 100% oxygen to reverse hypoxemia.
Survival is most strongly correlated with the success of initial resusitation attempts at the scene.
Cervical spine and intracranial injury, particularly following diving, falls from heights, or submersion in high surf, should be considered in all cases.
Hypothermia is common in submersion injuries. (See Hypothermia Triptych).

TRAINING	TREATMENT	EQUIPMENT

ROLE 1

Always call for lifesaving assistence. One should never enter the water to save a drowning victim if not a competent swimmer. Consider the possibility of secondary trauma, especially cervical spine injury, in all cases of falls, diving accidents or high surf injury. The duration of submersion is directly proportional to the duration of hypoxia and subsequent neurologic injury. Cold water submersion can quickly result in significant hypothermia. Hypothermia can have a protective effect against cerebral hypoxia following prolonged hypoxemia. The submersion event can result in: Drowning – no survival. Near drowning – at least temporary restoration of cardiac function. Ventilation and oxygenation are the fundamentals of treatment. Hypothermia alters the half – life and effectiveness of standard ACLS cardiac medications, and these should be avoided during rewarming. (See Hypothermia triptych).	**<u>Initial treatment may begin while the submersion victim is still in the water:</u>** Clear the AIRWAY. Remove dentures, vomitus and other debris from the mouth. Begin mouth to mouth breathing while the patient is still in the water. Chest compressions are NOT effective in the water. The Heimlich maneuver may be attempted if there is a suspicion of upper airways obstruction. Remove the victim from the water using C – spine immobilization if there is a suspicion of trauma. The casualty should be kept horizontal. **<u>If spontaneous respirations return after the initial resusitative measures:</u>** Provide oxygen by high flow non – rebreathing face mask. (15 liter/min NRB). Use portable suctioning to maintain the upper airway clear of vomitus and debris. If the patient's ventilatory effort is ineffectual, assist ventilation with bag – valve – mask ventilation connected to a high flow oxygen source. Insert airway adjuncts as required.	Cervical collar, (semi – rigid). Long rescue board with head immobilizer. Non – rebreathing reservoir face mask. Oxygen. Portable suctioning device. Self expanding bag – valve – mask device. Ventilation face masks (various size). Airway adjuncts. Nasogastric tubes. Intravenous cannulae and tubing. Crystalloid solutions Standard resuscitation medications. Sphygmomanometer. Stethoscope. Thermometer, low reading. Warm blankets.

TRAINING	TREATMENT	EQUIPMENT
The initial assessment and resuscitation of victims of submersion injury follows standard cardio – pulmonary (CPR) techniques. Near drowning victims often have a stomach full of water – posing a great risk for secondary pulmonary aspiration. Endotracheal intubation should be performed as soon as possible in the setting of ventilatory arrest, persistent respiratory insufficiency, diminished level of consciousness or a weak, ineffective gag reflex.	If qualified personnel and equipment are available, consider endotracheal intubation with ventilatory assistance and tracheobronchial suctioning for spontaneously breathing near drowning victims that have: Glasgow Coma Scale (GSC) 8 or less; Poor gag reflex, or; Ineffectual ventilatory effort. Monitor vital signs frequently. Protect from ongoing heat loss, remove all wet clothing and cover the patient with warm blankets. 3.**For submersion victims without spontaneous ventilations or a palpable pulse following initial ventilatory attempts:** Begin CPR with chest compressions once the victim is removed from the water and placed on a hard surface. In the setting of severe hypothermia only asystole and ventricular fibrillation should be treated with compressions. If qualified personnel and equipment are available, endotracheally intubate and provide positive pressure ventilation with a self expanding bag – valve device connected to a high flow oxygen source. Establish a peripheral intravenous cannula with crystalloid solution. If qualified personnel and equipment are available, administer medications according to ACLS standards. 4.**All victims of submersion injury should be immediately evacuated to Second Role:**	

TRAINING	TREATMENT	EQUIPMENT
	Continuous cardio – respiratory monitoring and assistance should be provided throughout the evacuation. The cervical spine should remain immobilized if there is a suspicion of occult injury.	

TRAINING	TREATMENT	EQUIPMENT

ROLE 2

Positive pressure ventilation can improve gas exchange and it is helpful in the treatment of all types of submersion-induced pulmonary injury. The two main methods of providing positive airways pressure are: CPAP: continous Positive Airway Pressure – applied to the face with a tight fitting mask in a spontaneously breathing patient. This can also be instigated in intubated patients. PEEP: Positive End – Expiratory Pressure – for endotracheal intubated patients.	Reassess the patient. If necessary, continue CPR. (See Role 1). Consider intubation and insert nasogastric tube. Apply CPAP or PEEP, while monitoring the patient's hemodynamic response, to improve oxygenation. Treat bronchospasm with beta – mimetic bronchodilators. In the setting of pulmonary edema, administer IV diuretics if hemodynamically stable. Appropriate medication may be given for status epilepticus. Bladder catheterization is useful to monitor urine output. Following stabilization, evacuate to Role 3.	See Role 1. Urinary catheter and urometer. Ventilator.

ROLE 3

TRAINING	TREATMENT	EQUIPMENT
Patients who are conscious upon arrival at Role 3 have an excellent prognosis if provided ongoing intensive care. Pulse oxymetry (SpO2) along with arterial blood gas (ABG) analysis are essential for assessing respiratory and ventilatory status. Chest radiographic findings often do not correlate well with the degree of pulmonary injury and respiratory compromise. The most important secondary complications following near drowning are the Adult Respiratory Distress Syndrome (ARDS) and pneumonia. Prophylactic treatment, with antibiotics or corticosteroids, is not recommended.	Reassess the patient. Continue ongoing resuscitative measures as described for Role 2. Frequently monitor vitals signs, cardiac rythm and SpO2. Check ABG, electrolytes, BUN, creatinine, glucose, white blood cell count and hematocrit. Obtain an ECG upon admission. Obtain a chest radiograph. If C-spine injury can't be ruled out in the setting of trauma, obtain appropriate cervical spine X- rays. Correct acid – base and electrolyte abnormalities as indicated by the patient's overall clinical condition. In the setting of sepsis, (fever, leukocytosis) obtain cultures of blood and bronchial aspirants. Initiate empiric antibiotic therapy and adjust according to culture results.	See Role 1 and 2. Standard Role 3 laboratory equipment and materials. (Chemistry, Hematology and Microbiology). ECG machine. Standard plain radiologic equipment and film. Ventilator. Cardiac monitor. Pulse oximetry (SPO2) monitor. Central intravenous catheters. Central venous pressure monitor.

C. 04 HEAT RELATED DISORDERS

PREAMBLE

Heat illness is a preventable cause of morbidity, and occasionally death, caused by a rise in body temperature. Armed forces personnel are at risk from heat illness because of exposure to a combination of high intensity physical training, high environmental heat loads and protective clothing (for example; NBC clothing, Combat Body Armour).

There is a wide variation in human tolerance to heat stress. In some cases of heat illness it is possible to identify factors that have caused particular individuals to become heat casualties. These recognised risk factors are:

Obesity

Lack of physical fitness and/or lack of sleep

Concurrent mild illness, e.g. Diarrhoea, common cold

Dehydration

Medication or illegal drugs e.g. Ecstasy

Nutritional status

The primary method of heat loss is through evaporation of sweat. The efficiency of this is determined by the temperature, humidity and wind speed. These factors can be integrated into an index of environmental temperature called he Wet Bulb Globe Temperature Index (WBGT). The use of this index forms part of the risk assessment in assessing the risk of heat illness.

All commanders and medical officers need a sound understanding of the principles of working under conditions which impose a thermal stress on their personnel in order to make an informed assessment of the associated risks to health.

TRAINING	TREATMENT	EQUIPMENT

Heat cramps.

ROLE 1

Teach: Prevention is essential. Maintenance of complete hydration; soldiers should be advised that their urine should remain clear. Adequate dietary salt intake. Teach symptoms: Usually seen with intense physical exercise. Brief, intermittent often excruciating cramps in those skeletal muscles that have been subjected to intense work (legs, arms, back, abdomen). The cramps tend to occur either during the latter part of the physical exercise or during rest after physical exercise.	In mild cases: oral administration of balanced salt solutions. Massage and passive stretching. In severe cases: intravenous saline solutions. Evacuate severe cases and if heat exhaustion is suspected. .	Oral salt solution: Haldane or Myer's solution IV infusion sets and cannulae. Saline solutions IV infusion sets and cannulae. Saline solutions.

TRAINING	TREATMENT	EQUIPMENT

ROLE 2 and 2+

	Exclude heat exhaustion. **Continue IV saline infusion.**	**IV infusion sets and cannulae.** **Saline solutions.**

TRAINING	TREATMENT	EQUIPMENT

Heat exhaustion.

ROLE 1

Teach: PREVENTION IS ESSENTIAL. Good general physical condition. Complete acclimatisation for the particular environment and physical exercise encountered. As little clothing should be worn as is consistent with protection against solar radiation, insect bites and trauma. Until intake of fluid of more than 6 l/24 hrs, no extra salt should be given. Maintainance of complete hydration hour by hour adequate salt intake day by day. No extra salt should be taken when water is in short supply. Salt loading through the indiscrimanate administration of salt probably leads to serious K+ depletion. No medication should be taken without medical consultation. All commanding officers should understand the principles of risk assessment with respect to heat illness. Heat llness is classically divided into heat exhaustion & heat stroke. In practice a continuum of signs and symptoms is seen from mild symptoms such as muscular weakness, headache and excess fatigue to collapse, coma	STOP activity Start first aid Move the victim into a cooler environment/ shade. Lie casualty down Remove victim's pack and uniform. If syncope has occurred, elevate the feet. Sponge or spray casualty with cool water & fan the skin Check history. Check consciousness. Give water to drink if conscious Place in recovery position if unconscious Record pulse, BP, respiratory rate and rectal temperature. If conscious give oral glucose. Arrange evacuation Reassess risk for all remaining personnel carrying out the same activity	Water. Oral salt solutions: Haldane or Moyer's. IV infusion sets and cannulae. Isotonic crystalloid solutions (e.g. 0.9% sodium chloride) Thermometer.

TRAINING	TREATMENT	EQUIPMENT
and death. The critical element seems to be cardiovascular decompensation between the demands of thermoregulation and maintenance of critical central circulation. Although pure forms rarely occur, one may divide heat exhaustion into that associated with predominant dehydration and that associated with predominant salt depletion. However, it is usually impossible to distinguish these two entities without laboratory investigations.		

ROLE 2 and 2 Enhanced

<u>Teach symptoms of:</u> Any individual who experiences the following symptoms or who demonstrates the following signs during physical activity, in a hot environment or whilst wearing protective clothing, or any combination of these activities should be presumed to have heat illness: Agitation Nausea or vomiting Staggering or loss of coordination Cramps Disturbed vision Confusion, collapse or loss of consciousness Dizziness <u>Signs:</u> Core temperature may be normal or only mildly	ROLE 2 and 2+ Reassess consciousness (GCS), pulse, BP, respiratory rate, pulse oximetry and rectal temperature. Check blood glucose (BM stick). If laboratory equipment is available check serum Na, Cl, total protein, Hct or Hb and check urinary specific gravity and Na. Continue: oral replacement of water or salt solution. Continue: IV administration of isotonic saline solution or 5% glucose in water. If heat stroke is suspected, continue cooling procedures and evacuate IMMEDIATELY. Evacuate severe cases.	High - reading thermometer or electronic thermometer. Water. Oral salt solution: Haldane or Moyer's. IV infusion sets and cannulae. Isotonic saline solutions. 5% glucose in water.

TRAINING	TREATMENT	EQUIPMENT
elevated. Pulse rate is often rapid. The skin may be warm & dry or moist with sweat. <u>Teach:</u> Early recognition and treatment will prevent mild cases becoming worse. Heat illness can occur at low ambient temperatures if protective clothing is worn, or if physical workloads are high.	**Role 3** As per Role 2.	

TRAINING	TREATMENT	EQUIPMENT

Heat stroke.

ROLE 1

Teach PREVENTION: Influence on heat regulation of: Level of ambient heat, radiation, humidity and air movement. Physical condition - exertion – acclimatization – adequate rest before and during physical exertion. Physical exertion – salt loss – hypokalemia. Clothing (impermeable clothing). Drugs, alcoholism Dermatologic diseases Hot weather hygiene. Teach Wet Bulb – Globe Temperature (WBGT) index. Teach: atropine reduces thermoregulatory sweating causing increased heat storage particularly while undergoing vigorous exercise or while wearing a chemical protective ensamble. Teach: the duration of hyperthermia is of greater prognostic importance than the degree of hyperthermia. Teach: heat stroke can also occur under a temperate climate.	**REMEMBER this is a medical emergency.** STOP activity Start first aid Move the victim into a cooler environment/ shade. Lie casualty down Remove victim's pack and uniform. If syncope has occurred, elevate the feet. Sponge or spray casualty with cool water & fan the skin vigorously with any object at hand. Check history. Check consciousness. Give water to drink if conscious Place in recovery position if unconscious Record pulse, BP, respiratory rate and rectal temperature. If conscious give oral glucose. Administer a saline solution. If available, administer oxygen in high concentration. Pay attention to airway protection and adequacy of ventilation. Pulmonary aspiration should be prevented by proper positioning in the semilateral position. If necessary treat seizures with diazepam IV (5 to 10 mg over 2 min).	Thermometer. Saline solutions IV infusion sets and catheter. Oxygen & regulators Diazepam.

TRAINING	TREATMENT	EQUIPMENT
Individuals with former heat intolerance are at higher risk. Decrease in mortality and morbidity can be achieved: Prompt recognition of symptoms and signs of heat by personnel responsible for the soldiers in the field. Appropriate on the spot first aid measures. Rapid evacuation of heat casualties to heat wards specifically established for the care of these patients. All commanding officers should understand the principles of risk assessment with respect to heat illness.	Arrange evacuation IMMEDIATELY Reassess risk for all remaining personnel carrying out the same activity Evacuate as soon as possible by air with open doors to Role 3 or in a shaded vehicle to Role 2. Keep the skin wet with water and fan during transport.	

TRAINING	TREATMENT	EQUIPMENT

ROLE 2 and 2 Enhanced

Teach symptoms Heat stroke is usual of the exertional type. Triad: Severe central nervous disturbance. Severe hyperthermia (core temp often > 40.5°C). Anhydrosis *but* the ability to sweat can remain intact in exercise induced heat stroke in fit individuals. Clinical manifestation of heat stroke represent features of multiple-system damage which occur simultaneously and very rapidly: Usually sudden collapse into unconsciousness but in some cases prodromal symptoms: general weakness, mental confusion, disorientation, performance of purposeless and irrational movements, combativeness. Generalized convulsive seizures are frequent. Rectal temperatures at the onset of fainting and collapse usually exceeds 41°C and may reach 43°C to 45°C. A mild elevation of body temperature does not preclude the diagnosis however. The absence of sweating is often seen and patient usually presents with a flushed, hot and dry skin (absence of sweating is not necessary for establishing diagnosis). Tachycardia with a heart rate from 120 to 180/min is usual. Wide pulse pressure in the beginning.	Continue to monitor vital signs. Check rectal temperature. Continue with cooling. A mesh hammock is placed in a tent with flaps elevated to utilize wind cooling. The victim is sprayed with cool. A fan is placed1.5 to 2 meters from the hammock end and directed at the casualty. If the above method is unsuccessful, additional methods can be used: Immerse the victim in a tub of iced water whilst the skin is massaged vigorously. Apply ice packs to neck, groin and axillae, wet the skin and fan to promote evaporation. Consider intubation & ventilation to protect the airway or position in semilateral position. Give 100% oxygen initially until temperature is controlled. Control seizures and muscular hyperactivity: Check BM stick (give 25 g glucose IV if appropriate). Diazepam 5 to 10 mg IV over 2 min., repeat once after 5 to 10 min; If unsuccessful and general anaesthetic capability is unavailable: phenobarbital (100 mg/min IV to a total dose of 20 mg/kg or thiopental 2 – 3 mg/kg to a max dose of 300 mg). Slow infusion if hypotension occurs; If unsuccessful and general anaesthetic capability is available, muscle paralysis may be	High – reading thermometer Electronic thermometer IV infusion sets and IV catheters. Saline solutions. Oxygen & regulators Equipment for intubation & ventilation Manual or mechanical ventilator. Bladder catheter and urinary bags. IV glucose Appropriate anti-convulsive and anaesthetic drugs (to include diazepam, Phenobarbital, thiopental, pancuronium). Mesh hammock. Standard garden hose with standard brass garden hose nozzle or handoperated garden sprayer. Electric fan.

TRAINING	TREATMENT	EQUIPMENT
Hypotension or shock is often present in severe cases. The respiratory rate is usually very rapid. Vomiting and/or diarrhoea can appear in the acute stage of heat stroke	required if there is continued muscular hyperactivity. Use pancuronium 0.04 to 0.10 mg/kg, if available. Measure body temperature continuously.	BathTub. Ice.
Complication of hyperthermia: Brain damage. Circulatory abnormalities: hyperdynamic circulation; hypodynamic circulation arrythmias. Coagulation abnormalities: petechiae, ecchymoses, conjunctival hemorrhages, melaena and bloody diarrhoea. thrombocytopenia, impaired synthesis of clotting factors, fibrinolysis, disseminated intravascular coagulation. Acute renal failure. Rhabdomyolysis. Fluid – electrolytes and acid – base disorders: respiratory alkalosis and metabolic acidosis. hypokalaemia. hypercalcaemia. hypocalcaemia. hypophosphataemia Gastro – intestinal disorders: liver damage. GI bleeding. Metabolic alterations: hypercatabolic state. hypoglycaemia.	Whichever method is chosen, active cooling should be stopped when rectal temperature reaches about 38.5°C in order to avoid producing hypothermia. Sedatives may be needed when patient emerges from coma due to confusion and irrational or violent behaviour. Vomiting can occur during the initial period of rapid cooling, requiring emergency measures to prevent aspiration of gastric contents. Insert bladder catheter and monitor urine output closely. Saline should be infused according to urinary output. The amount of fluid replacement is determined by the clinical setting. The average volume required is not great, generally 1 to 2 l in the first 4 hrs. Larger volumes of IV fluid should not be given initially because vasoconstriction which can occur after cooling which may cause overloading of the central circulation and produce acute pulmonary oedema.	

TRAINING	TREATMENT	EQUIPMENT

ROLE 3

	Record vital signs at appropriate intervals. Control seizures and muscular hyperactivity: see role 2. Continue cooling: cooling procedures (see role 2). Maintain an adequate oxygenation (oxygen, intubation and mechanical ventilation). Haemodynamic assessment. Insert central venous catheter and monitor blood volume. Insert bladder catheter and monitor urine output. Insert NG tunbe. ECG monitoring; arrhythmias are common & myocardial necrosis can occur in severe heat stroke. Investigations: FBC, serum urea & electrolytes, creatinine, LFT's (bilirubin, AST, ALT), CPK, clotting screen, blood gases, lactate, myoglobin clearance, plasma proteins and hematocrit. Treat hypotension and/or stroke when present with IV fluids (no dextran). Inotropic agents may be required to maintain an adequate cardiac output. Potent vasopressor drugs such as noradrenaline should be avoided. Correct fluid and electrolyte deficits. Anticipate renal failure with mannitol or frusemide. When rhabdomyolysis is suspected (black urine and increased serum CPK), alkalinization of the	AS PER Role 1 & 2, PLUS: ECG Monitoring. Central venous catheter sets. Arterial line sets Fluids: Saline solutions glucose solutions (varying concentrations) Blood & blood products e.g., fresh frozen plasma (FFP), platelets, cryoprecipitate Drugs: Sedative & anaesthetic drugs. Frusemide IV. Sodium bicarbonate. Inotropic agents e.g. dopamine/ dobutamine Mannitol Insulin Heparin KCl, KH2PO4. Ca gluconate or Ca chloride IV. Antibiotics Laboratory equipment: Na, Cl, K, Ca, P, creatinine, urea, proteins, Hb, Hct, leukocytes, platelets, bilirubin, ALT, AST, LDH, CPK, PT, PTT, fibrinogen, arterial blood gas analyser

TRAINING	TREATMENT	EQUIPMENT
	urine with sodium bicarbonate and forced diuresis with mannitol are advised. Hyperkalemia should be treated by standard methods (10ml 10% calcium chloride or 10% calcium gluconate, 5mg salbutamol nebuliser, NaHCO3 50 mmol over 5 min if necessary repeat after 15 min, 250ml 20% glucose + 10 U insulin IV over 10 – 30 min). **Heat stroke.** Treat Hypothrombinaemia and hypofibrinogenaemia with FFP, thrombocytopenia with platelets and disseminated intravascular coagulation with heparin (1 mg/kg every 6 hrs). Once acidosis is corrected and cooling is achieved, hypokalaemia may become apparent and necessitate substantial K replacement. Since both Ca and P affect myocardial performance, correction of the decreased concentration of these ions might improve cardiac functon. Glucose supplementation is often needed. Antibiotic treatment should be as specific as possible for identified pathogens.	(ABG) & lactate.

C.05 CONTAMINATED WOUNDS BY CHEMICAL AGENTS

PREAMBLE

OVERVIEW

Medical operations in a chemical warfare environment will be complex. In addition to providing care in protected environments or while dressed in protective clothing, medical personnel will have to treat chemically injured and contaminated casualties, sometimes in large numbers. The doctrine, organisation and equipment available to handle chemical casualties will vary between countries and most particularly between Services, because of differences in military operational requirements.

Contamination of traumatic wounds by chemical warfare agents present specific medical problems due to combined injury effect. Nerve agents and vesicants, especially if thickened, may persist within wounds and present a hazard to surgical teams during primary surgery. The potential threat to the casualty with a combined injury depends on the quantity and type of agent that exists within the wound, and on the amount remaining in the wound. Agents may be absorbed rapidly but some remain with in the wound for some time, particularly on foreign bodies. The amount and form of in-driven contaminated cloth and the type of agent then determine the persistence of the agent within the wound. It must be assumed all wounds are contaminated in a chemical environment except with other agents such as cyanide and phosgene.

The severity of toxic effects depends on a number of factors:

(1) Type of agent: nerve agents or vesicants (thickened or unthickened, liquid).

(2) The extent of the contamination of the wound. Agent is usually carried into the wound by contaminated clothing, or may directly contaminate a previously clean wound.

The size of the wound.

Nerve agents are highly lethal, and a large proportion of casualties may die unless care is given immediately after an attack. Other agents, such as mustard and Lewisite may be more incapacitating than lethal. The onset of symptoms will differ by type of agent and by route of exposure. Nerve agents, especially by the inhalation route of exposure, are characteristically very rapid in onset of effects, whereas mustard may have a latent period of several hours between exposure and onset of symptoms. During the latent phase the prognosis and future clinical course will not be apparent and the decision on whether to treat or evacuate will be difficult.

Capabilities for prompt casualty (including wound) decontamination and systemic treatment must be provided as far forward as possible. Subsequent definitive wound decontamination is achieved by surgical treatment

The objectives of medical support in chemical operation are:

To provide medical services and support to the maximum extent possible.

To protect medical personnel from chemical injuries while handling contaminated casualties, or while working in contaminated areas. *

To minimise morbidity and mortality from conventional and chemical injuries.

To avoid the spread of contamination into medical vehicles and facilities.

TRAINING	TREATMENT	EQUIPMENT

ROLE 1

See Tactical Combat casualty Care Protocols See Triptych B.0I and B.02 – Emergency Life Saving / First Aid in the Field Use of of the Individual Protective Ensemble Use of antidote treatment Skin decontamination Wound decontamination	Systematic Trauma Care (but without airway management): See Tactical Combat casualty Care Protocols See Triptych .0BI and B.02 – Emergency Life Saving / First Aid in the Field First aid procedures (See Tactical Combat Casualty Care Protocols): Immobilize spine to prevent secondary neurologic injury Direct pressure / field dressing to obvious haemorrhage, if unsuccessful tourniquet Recovery position Splint injured extremities, with appropriate reduction Consider analgesics Antidote treatment if indicated (nerve agent) Emergency wound decontamination: Skin surrounding the wound should be decontaminated If an approved wound decontaminant is available (such as the MK 291) use generously in the wound Apply dressing Restore the integrity of the Individual Protective Ensemble	Field dressings / tourniquets Cervical collar / head immobilizer Spine board Stretcher Antidote agents Skin decontamination device

TRAINING	TREATMENT	EQUIPMENT

ROLE 2 (before complete decontamination)

As per Role 1	Systematic Trauma Care (See Tactical Combat Casualty Care Protocols) : As in role 1 except in vapour-only environment or in collective protection aera where the removal of the respirator is possible. Carry out basic and advanced life support, including continued antidote treatment. Wound decontamination: Expose to treat decontamination or definitive casualty decontamination as necessary according to triage category. Irrigate the wound with a chemical neutralizing solution (0.3-0.5% hypochlorite solution). The solution should be given two minutes to act before copious water irrigation of the wound.	As per role 1 Chemical neutralizing solution

ROLE 2 (after complete decontamination)

Training	Treatment	Equipement
See Triptych B.0I and B.02 – Emergency Life Saving / First Aid in the Field	Systematic Trauma Care (See Tactical Combat Casualty Care Protocols) : Airway/ventilation management (inc. O_2) Establish IV access Continuous heart rate monitoring (except if casualties in large number) Treatment of shock (Triptych A.05) Continue Analgesics	See Triptych B.0I and B.02 – Emergency Life Saving / First Aid in the Field Antidote agents Skin decontamination device Chemical neutralizing solution

TRAINING	TREATMENT	EQUIPMENT
	Consider Antibiotics Blood Products as indicated Reassess primary survey Perform secondary survey when appropriate Damage control surgery / surgical resuscitation as indicated Consider Haemostatic agents Antidote treatment if indicated (nerve agent) Wound decontamination: If clinically required or if chemical agent is detected.	

TRAINING	TREATMENT	EQUIPMENT

ROLE 3

Training	Treatment	Equipement
See Triptych B.0I and B.02 – Emergency Life Saving / First Aid in the Field	Systematic Trauma Care (See Tactical Combat Casualty Care Protocols) : Continue as per Role 2 Blood Products as indicated Surgical resuscitation if unstable shock Further investigation if stable - Laboratory investigations (Group/cross, CBC, electrolytes, Chem, ABGs) - Ultrasound Diagnostic imaging - X-ray (Chest, pelvis, cervical spine) - IVP - Contrast studies - Consider CT scan (inc CT Angio) Laparotomy for definitive treatment Ventilator support Postop care (See Triptych A.02) Transfer to Role 4 Wound decontamination: -All dressings may be contaminated, and should be removed and disposed of in a concentrated hypochlorite solution or in a vapour proof container; -The wound should be irrigated with a wound neutralizing solution, the solution should be given two minutes to act, then copiously irrigate the wound with water. -The wound should be enlarged, debrided adequately and left widely open.	See Triptych B.0I and B.02 – Emergency Life Saving / First Aid in the Field

TRAINING	TREATMENT	EQUIPMENT
	-The wound should be explored with surgical instruments rather than fingers (a “no touch” technique should be used) since a contact hazard may remain until all contaminated tissue and foreign bodies are disposed of promptly and properly. -Surgical gloves give very little protection against chemical warfare agents. Protection of staff can be enhanced by the use of thin butyl rubber gloves or the use of double latex surgical gloves, dipped frequently in wound decontaminant solution and changed when contact or puncture is suspected. -All operating room staff must wear eye protection to protect against chemical warfare agent splashes. -Used surgical instruments should be immersed in the wound decontaminant solution when not in use during the operation. -Deep or complex wounds may require repeated irrigation since exploration may uncover further contamination. -Automatic decontamination devices can be used for evaluation of contamination remaining in the wound. With deep or complex wounds, it may be used repeatedly. -No active decontaminant should be used in the eye or brain. Saline, water or dilute	

TRAINING	TREATMENT	EQUIPMENT
	bicarbonate should be used. -The abdomen and thoracic cavity should be washed out with saline because of the possibility of irritation and reaction. Saline irrigation may cause a vapour hazard and an automatic device should be used constantly. Irrigation fluid is potentially contaminated; it should be sucked out with a larger bore sucker and disposed of in a concentrated hypochlorite solution rather than mopped out with swabs.	

C.06 BITES, STINGS AND ENVENOMATIONS

PREAMBLE

The operational scenarios are changing and more and more military personnel have to face environmental hazards in remote countries. Exposure to animal life is unavoidable. Apart from some countries, accurate international data on these events do not exist and it can be affirmed that they are surely underestimated.

It is very difficult to describe exhaustively all types of injuries, because they can be particular for any kind of animal bite, sting or envenomation. Nevertheless some general principles can be drawn up for treating casualties in the field as well as civilian populations during peace support operations. Apart of general emergency procedures that are the basic knowledge of all medical personnel, theatre-specific information should be gathered through medical intelligence in a pre-deployment phase, in order to make military personnel aware of specific risks and to make specific antivenoms, if needed, timely available to the field medical facilities.

In order to get an overview, this triptych will try to summarize those events into three gross groups, even if you should take into account that many animals often harm with more than one mechanism: Bites are usually caused by insects, animals or humans. Relevant Stings are usually caused by bees and hymenoptera; envenomations are usually due to insects and animals, mostly marine animals.

Bites: INSECT: many patients confuse insect bites with insect stings and may use those two terms interchangeably. Venomous arachnids (spiders) as well as scorpions and others like will be considered in the stings and envenomations chapters of this triptych. Major concern in such cases is anaphylaxis and the **transmission of infectious diseases**. To mention as an example are flies (blackflies, fly larvae, botflies, Wohlfahrtia flies, Tumbu flies, etc), ticks, mosquitoes, New – and Oldworld screwworms, cockroaches, earwigs, ants and so on.

Bites: NON INSECT: dog and cat bites account for the large majority of them, even if a small percentage is due to other animals like monkeys, large cats (tigers, lions), wolves, hyenas, crocodiles, herbivores and humans. Generally they have two kind of effect on tissues: crushing and /or puncturing (deep tissue bacterial inoculation). Apart of evident tissue loss or avulsion of anatomical parts, the major concern in all bites is infection (hand bites are at high risk). Local infection can lead in untreated or immunocompromised patients to meningitis, osteomyelitis, septic arthritis and to fatal sepsis. Always consider rabies.

Stings: The order Hymenoptera includes bees (European, African), vespids (wasps, yellow jackets, hornets) and ants. They are responsible for the most part of stings all over the world. In addition some venomous marine animals may only sting and not inject the victim with poison. Most deaths result from immuglobulin E mediated reactions (anaphylaxis), in other cases by direct toxicity. **50% of all deaths occur within 30 minutes of the sting, and 75% within 4 hours**. Consider: very frequently a fatal allergic reaction follows a previous, milder generalized reaction, the shorter the interval from sting to onset of generalized symptoms (even if mild) the more likely a severe reaction will take place.

Envenomations: arthropods such as centipedes and millipedes, arachnids (spiders, scorpions), snakes, marine animals ranging from coelenterates to echinoderms, shells (Mollusca), fishes and to sea snakes are involved in those events. For some of them specific antivenoms were developed. Those are more likely to be found in the countries, where such animals are living in. They could be provided through Host Nation Support (HNS), through the medical logistic chain or through the chain of command (relate to Theatre Surgeon).

*In order to help understand the subdivision operated in the triptych, a partial taxonomic classification of some of the involved animals is tried in the following algorithm after the Kingdom → Phylum → Class → Order → Family → Genus → Species criteria:

Kingdom Animalia has 36 phyla, 1 of them is that of Arthropoda. This has 4 Classes:

Uniramia (Insecta): insects.
Crustacea: crabs, lobster etc.
Myriapoda: Centipedes, Millipedes etc.
Chelicerata: (Arachnids): spiders, scorpions, mites, ticks etc.

Related Triptychs: **D.03** on Anaphylaxis, **.01** and **B.02** (Emergency Life Saving/First Aid in the Field), **A.05** (Fluid Resuscitation).

**Envenomations from African, Asian and American coral snakes as well from sea snakes follow the same procedure as for the Cobra snake. You will find a small note on them in the Cobra section.

Contents

This triptych addresses:

BITES.

STINGS.

ENVENOMATIONS:

Insects, Centipedes, Millipeds.

Arachnids: venomous spiders.

scorpions.

Cone shells.

Echinoderms.

Coelenterate and Jellyfishes.

Octopus.

Stingray.

Lionfish and Scorpionfish.

Snake: Cobra (within coral and sea snake).

TRAINING	TREATMENT	EQUIPMENT

BITES

ROLE 1

Teach: Systematic approach to trauma patient (A, B, C). Pre-deployment information on environmental risks through Medical Intelligence chain. Differences among three main types of bites: insects, animals other than insects, humans.	Consider: Systematic approach to trauma: See triptych B.01 and B.02 (Emergency Life Saving/First Aid in the Field). See triptych A.05 (Fluid Resuscitation). Obtain history and identify: Type of animal and its status (health, rabies vaccination, behavior). Time and location of event. Circumstances surrounding the bite (provoked or defensive versus unprovoked bite). Location of the animal (observable in quarantine?)	As for Triptychs B.01 and B.02. As for Triptych A.05.
Recognition of immediately life- threatening conditions: Shock. Recognition of immediately limb and function-threatening conditions. Recognition of vascular supply integrity. Signs of muscular and/or tendon lesions. Signs of bone fracture. Different types of field dressings. Correct dressing technique. Consider diseases transmission (Malaria, Trypanosomiasis, Rabies, etc.).	Treatment: If necessary: Assess and obtain airway. Check for vitals (pulse, respiratory rate and, if appropriate, blood pressure). Give O_2 by mask and assist ventilation properly. During primary survey, check for: Bite sites. Bleeding. Abnormal pulses (vascular supply impairment). Muscular and tendons integrity. Signs of underlying fractures. Signs of infection (crepitation). Apply direct pressure on wounding site and dress it. Initiate IV crystalloid infusion. Consider analgesics and antibiotics. Consider tetanus prophylaxis.	Airways (oropharyngeal and nasopharyngeal). Intubation and cricothyrotomy kits. Oxygen delivery system. Field dressings. Splints. IV catheter, lines and solutions, analgesics (see related triptych). Analgesics, broad-spectrum

TRAINING	TREATMENT	EQUIPMENT
Splint technique. General surgical skills. Venous cannulation. Field Medical Card. - Training for casualties transport (litter, carries).	Consider rabies prophylaxis If possible collect and preserve avulsed parts, keeping them as cool as possible for possible later reimplantation. - Prepare to evacuate to higher role completing Field Medical Card. - Evacuate without delay to higher role.	antibiotics Tetanus vaccination, booster. Rabies immunoglobulins. Ice box. Field Medical Cards. Stretcher

TRAINING	TREATMENT	EQUIPMENT

STINGS

ROLE 1

Teach: Systematic approach to trauma patient (A, B, C). Pre-deployment information on environmental risks through Medical Intelligence chain. Teach: Preventive measures (how to avoid stings). **Teach: Local reactions may produce:** Pain immediately after sting. Marked edema extending to 10 cm from stinging site, erythema. Compromised distal circulation as result of edema. Drainage from sting site. Bleeding at stinging site. Pruritus (itching). Vasodilatation (sensation of warmth). The stinging apparatus may be still onsite (in case of bees) or be previously removed. Distal sensation loss from stings over peripheral nerve. Corneal ulceration from corneal sting. Nausea and/or vomiting may occur without generalization. Visceral pain occurrence in case of insect ingestion. Urticaria with or without the above mentioned symptoms.	Consider: Systematic approach to trauma: See triptych B.01 and B.02 (Emergency Life Saving/First Aid in the Field). See triptych A.05 (Fluid Resuscitation). Obtain history and identify: Type of animal. Time and location of event. Location of the animal, if possible. Treatment: **50% Deaths within 30 minutes!** If necessary: Assess and obtain airway. Check for vitals (pulse, respiratory rate and, if appropriate, blood pressure). Give O_2 by mask and assist ventilation properly. Initiate IV crystalloid infusion. During primary survey, check for: Sting site(s) and number. Administer diphenhydramine. Cleansing of the sting site wound and sting apparatus removal (it injects venom into the wound for 1 minute after the sting!) – no preferred method or means (pinching = traction) ASAP. Presence of local reaction, CAVE if close to the airway! Apply ice or cool packs.	As for Triptychs B.01 and B.02. As for Triptych A.05. Airways (oropharyngeal and nasopharyngeal). Intubation and cricothyrotomy kits. Oxygen delivery system. IV catheter, lines and solutions. Diphenhydramine. Swabs, forceps. Ice, cool packs.

TRAINING	TREATMENT	EQUIPMENT
*Ants' stings: vesicles from fire ants (classic arc of fire ants stings) and ants stings on mucous membranes or conjunctival surfaces cause dramatic edema in sensitive patients. **<u>Teach:</u> Generalized reactions may produce:** Urticaria (Confluent red rash). Shortness of breath (tachypnea), wheezing, respiratory arrest. Edema in airway (laryngoedema), tongue (lingular edema) or uvula. Weakness (hypotension), syncope. Anxiety, confusion, (delirium, shock). Chest pain.	Elevate extremity to limit edema. <u>If anaphylactic</u> shock signs appear, see same level of triptych D.03 on Anaphylaxis. - Prepare to evacuate to higher role completing Field Medical Card. - Evacuate without delay to higher Role.	As per triptych D.03 relative Role. Field Medical Cards. Stretcher.

TRAINING	TREATMENT	EQUIPMENT

ENVENOMATIONS
(Insects, Centipedes, Millipedes)

ROLE 1

Teach: Systematic approach to trauma patient (A, B, C). Pre-deployment information on environmental risks through Medical Intelligence chain. Teach: Among arthropods, insects like Caterpillars as well Millipedes and Centipedes (genus Scolopendra) are very commonly involved in this kind of accidents. Normally death after envenomation from these animals is rare and mostly due to anaphylactoid reactions, less frequently to direct effect of venoms. Those are not extensively studied yet, but almost all of them contain 5 – hydrossitriptamine and many other substances like, in some Centipede, a necrosis inducing cytolysin and, in some Caterpillar, a fibrinolytic factor (CAVE bleeding). Teach: Frequently the patient sees the animal. Symptoms: Pain (mild to severe). Local erythema (redness). Mild local edema (swelling). Vesicles.	Consider: Systematic approach to trauma: See triptych B.01 and B.02 (Emergency Life Saving/First Aid in the Field). See triptych A.05 (Fluid Resuscitation). Obtain history and identify: Type of animal. Time and location of event. Location of the animal, if possible. Treatment: If necessary: Assess and obtain airway. Check for vitals (pulse, respiratory rate and, if appropriate, blood pressure). Give O_2 by mask and assist ventilation properly. Initiate IV crystalloid infusion. During primary survey, check for: Sting and bite site(s) and number. Cleansing of the bite/sting site, removal of spines with adhesive tape. Apply ice or cool packs. If extremity involved in Caterpillar stings, splint and elevate. If eye exposure: Irrigate immediately copiously and pad it. If respiratory exposure:	As for Triptychs B.01 and B.02. As for Triptych A.05. Airways (oropharyngeal and nasopharyngeal). Intubation and cricothyrotomy kits. Oxygen delivery system. IV catheter, lines and solutions. Antiseptic solutions, swabs, forceps, adhesive tape. Ice, cool packs. Splints

TRAINING	TREATMENT	EQUIPMENT
Conjunctivitis in case of ocular exposure (Caterpillar's hairs and setae). Acute rhinitis, cough, dyspnea, wheezing, respiratory distress, chest pain in case of respiratory exposure (Caterpillar's hairs and setae). Lymphangitis and/or lymphadenopathy. Nausea and/or vomiting. Possibility of local necrosis (Centipedes). Gingival bleeding, hematuria, petechiae, coagulopathy (Caterpillars). Anxiety. Low fever.	Give O_2 antihistamines PO or IM and beta – agonist inhalers, if available. If anaphylaxis occurs, treat it accordingly to same level of Triptych D.03. - Prepare to evacuate to higher role completing Field Medical Card. - Evacuate without delay to higher role.	Normal saline, ocular antiseptic solutions. Oxygen delivery system, antihistamines, β – agonist inhalers. As per triptych D.03 relative role/echelon. Field Medical Cards. Stretcher

TRAINING	TREATMENT	EQUIPMENT

ENVENOMATIONS
(Arachnids: venomous Spiders)

ROLE 1

Teach: Systematic approach to trauma patient (A, B, C). Pre-deployment information on environmental risks through Medical Intelligence chain. Teach: Among spiders, the spiders of the genus *Latrodectus* (generically called widow spiders) are widespread in almost all geographic regions; in North America (redlegged, black and brown widow), in Australia, Pacific Islands, New Zealand (redback spider), South Africa (button spider), Europe, and South America with some other species. Alpha – latrotoxin stimulates motor endplates with neurologic and autonomic clinical effects. In some countries antivenom is available (identify). Attempts to secure the spider could be helpful to confirm widow spider envenomation. Teach: Symptoms: Pain (mild, sometimes only a ”pinch”). Within 1 hour developing of systemic symptoms (they may last for few days) such hypertension, tachycardia. Neurologic effects include mild weakness, fasciculations, and ptosis.	Consider: Systematic approach to trauma: See triptych B.01 and B.02 (Emergency Life Saving/First Aid in the Field). See triptych A.05 (Fluid Resuscitation). Obtain history and identify: Type of animal. Time and location of event. Location of the animal, if possible. Treatment: If necessary: Assess and obtain airway. Check for vitals (pulse, respiratory rate and, if appropriate, blood pressure). Give O_2 by mask and assist ventilation properly. Initiate IV crystalloid infusion. Cleansing of the bite site. Apply ice or cool packs. Do not administer antivenoms in the field because of the risk of severe allergic complications. If anaphylaxis occurs, treat it accordingly to same level of Triptych D.03. - Prepare to evacuate to higher role	As for Triptychs B.01 and B.02. As for Triptych A.05. Airways (oropharyngeal and nasopharyngeal). Intubation and cricothyrotomy kits. Oxygen delivery system. IV catheter, lines and solutions. Antiseptic solutions, swabs. Ice, cool packs. As per triptych D.03 relative role/echelon.

TRAINING	TREATMENT	EQUIPMENT
Muscle cramping (locally around bite, it may extend to large muscle groups, such as abdomen – miming an acute abdomen, back, chest and thighs). *Latrodectus facies* (spasm of facial muscles, edematous eyelids and lacrimation) may occur after *L. mactans tredecimguttatus* envenomation (Europe, South America). Bronchorrhea and pulmonary edema reported in cases from Europe and South Africa. Headache. Anxiety.	completing Field Medical Card. - Evacuate without delay to higher role.	Field Medical Cards. Stretcher

ENVENOMATIONS
(Arachnids: Scorpions)

ROLE 1

Teach: Systematic approach to trauma patient (A, B, C). Pre-deployment information on environmental risks through Medical Intelligence chain. Teach: All potential lethal scorpions belong to the family *Buthidae* (except for the genus *Hemiscorpius* – family of Scorpionidae). A triangular sternal plate distinguishes Buthidae from other scorpion families (more pentagonal sternal plate). Medically relevant scorpions are distributed as follows: *Centruroides* (Southern of US, Mexico, Central America and the Caribbean), *Tityus* (Central and South America and the Caribbean); *Buthus* Across the Mediterranean Area – from Spain to the Middle East); *Mesobuthus* (throughout Asia); *Parabuthus* (Western and Southern Africa); *Buthotus* (across southern Africa to southeast Asia); *Leiurus* (across northern Africa and the Middle East); *Androctonus* (Northern Africa to the southeast Asia). Scorpion venom contains many toxins, which clinical effects are neuromuscular (somatic and cranial nerve hyperactivity), neuroautonomic (cardiopulmonary) and local. Serotonin probably contributes to the severe pain	Consider: Systematic approach to trauma: See triptych B.01 and B.02 (Emergency Life Saving/First Aid in the Field). See triptych A.05 (Fluid Resuscitation). Obtain history and identify: Type of animal. Time and location of event. Location of the animal, if possible. Treatment: next page.	As for Triptychs B.01 and B.02. As for Triptych A.05.

TRAINING	TREATMENT	EQUIPMENT
associated with scorpion stings. Specimen identification by entomologist is helpful (if scorpion capture is safe). Teach: Symptoms: Local: pain and paresthesias (they vary among species (minimal for *Centruroides*). Nausea and vomiting. Hypo - or hypertension, tachycardia and dysrythmias. Secondary pulmonary edema. Hyperthermia. Respiratory arrest and loss of protective airway reflexes. Autonomic: Sympathetic overdrive symptoms (hypertension, tachycardia, hyperthermia, pulmonary edema). Parasympathetic: hypotension, bradycardia, salivation, lacrimation, urination, defecation and gastric emptying. Cranial nerves: classic roving or rotary eyes movements, blurred vision, tongue fasciculations, loss of pharyngeal muscle control (difficult		

TRAINING	TREATMENT	EQUIPMENT

ROLE 1

Teach: Swallowing combined with excessive salivation may lead to respiratory difficulty) Somatic effects: restlessness and involuntary jerking (can be mistaken for seizures), true seizures, cerebral infarction, cerebral thrombosis and acute hypertensive encephalopathy (described in some *Butidae* envenomations). Teach: Prophylactic antibiotics are not required.	Treatment: If necessary: Assess and obtain airway. Check for vitals (pulse, respiratory rate and, if appropriate, blood pressure). Give O_2 by mask and assist ventilation properly. Initiate IV crystalloid infusion. Clean the sting site. Apply ice or cool packs. Check for tetanus immunization of casualty. If status cannot be verified, proceed to tetanus prophylaxis. Consider analgesics (caution with narcotics in patients with unsecured airway; scorpion envenomations can have synergistic effects). If anaphylaxis occurs, treat it accordingly to same level of Triptych D.03. - Prepare to evacuate to higher role completing Field Medical Card. - Evacuate without delay to higher role.	As for Triptychs B.01 and B.02. As for Triptych A.05. Airways (oropharyngeal and nasopharyngeal). Intubation and cricothyrotomy kits. Oxygen delivery system. IV catheter, lines and solutions. Antiseptic solutions, swabs. Ice, cool packs. As per triptych D.03 relative role/echelon. Field Medical Cards. Stretcher

TRAINING	TREATMENT	EQUIPMENT

ENVENOMATIONS
(Cone Shells)

ROLE 1

Teach: Systematic approach to trauma patient (A, B, C). Pre-deployment information on environmental risks through Medical Intelligence chain.	Consider: Systematic approach to trauma: See triptych B.01 and B.02 (Emergency Life Saving/First Aid in the Field). See triptych A.05 (Fluid Resuscitation). Obtain history and identify: Type of animal. Time and location of event.	As for Triptychs B.01 and B.02. As for Triptych A.05.
Teach: To the phylum Mollusca belong about 300 species, this part of the triptych focuses particularly on Cone Shells, which can be found mostly in temperate oceans, especially in the Indo – Pacific regions. Envenomation is associated with 18 species of conus. The venom is delivered through a detachable radula (dartlike barb) and through an extensible proboscis. Cone Shells venom is a neurotoxin. Serious envenomations may result in paralysis and respiratory failure. Death occurs secondary to cardiac failure. *C. Geographus* may produce rapid cerebral edema, coma, respiratory arrest, and cardiac failure. Disseminated intravascular coagulation (DIC) may also occur. *Stings* occur in shallow tropical waters (mostly fingers/hands and feet). Some species of	Treatment: Focus on following actions: Assess and obtain airway. Check for vitals (pulse, respiratory rate and, if appropriate, blood pressure). Give O_2 by mask and assist ventilation properly. Initiate IV crystalloid infusion. Clean the sting site. Keep the stung extremity in a dependent position. Keep the casualty still. Careful use a pressure immobilization bandage. Tourniquet use is not recommended. - Prepare to evacuate to higher role	Airways (oropharyngeal and nasopharyngeal). Intubation and cricothyrotomy kits. Oxygen delivery system. IV catheter, lines and solutions. Antiseptic solutions, swabs. Pressure bandages.

TRAINING	TREATMENT	EQUIPMENT
cones, particularly *Conus Geographus*, are lethal. Symptoms may be mild (nausea, weakness, diplopia) and last for several hours. 2- 3 weeks of symptoms may be associated with more severe exposure. Symptoms include: Sharp burning or stinging sensation. Local, perioral, and generalized paresthesias. Nausea. Diplopia. Malaise. Weakness. Dysphagia. Aphonia. Areflexia, paralysis. Apnea. Pruritus	completing Field Medical Card. - Transport the casualty appropriately, as patient may have oropharyngeal muscle paralysis and the risk of aspirating vomitus is real. - Evacuate without delay to higher role.	Field Medical Cards. Stretcher

TRAINING	TREATMENT	EQUIPMENT

ENVENOMATIONS
(Echinoderms)

ROLE 1

TRAINING	TREATMENT	EQUIPMENT
Teach: Systematic approach to trauma patient (A, B, C). Pre-deployment information on environmental risks through Medical Intelligence chain. Teach: To the phylum Echinodermata belong diverse groups of animals, slow moving and nonagressive such as brittle stars (class *Ophiuroidea*), starfish (class *Asteroidea*), sea urchins (class *Echinoidea*), and sea cucumbers (class *Holothuroidea*). The venomous species populate mainly the Indo-Pacific region. Usually they have a pentamerous (5-part) radial symmetry. Only few animals of the *Asteroidea*, *Echinoidea*, and *Holothuroidea* classes are capable of causing venomous injury in humans. Crown – of – thorn starfish (*Acanthaster planci - Asteroidea*) possesses extremely sharp dorsal spines, covered by a 3-layered integument that, if broken during spine penetration, releases bioactive substances, causing local and generalized toxicity. Similar defense system or venom release through hollow spine fracture is used by sea urchins (long – and short spined). Sea urchins with	Consider: Systematic approach to trauma: See triptych B.01 and B.02 (Emergency Life Saving/First Aid in the Field). See triptych A.05 (Fluid Resuscitation). Obtain history an d identify: Type of animal. Time and location of event. Treatment: Focus on following actions: Assess and obtain airway, if necessary.	As for Triptychs B.01 and B.02. As for Triptych A.05.

TRAINING	TREATMENT	EQUIPMENT
pedicellaria (small tripled-jawed seizing organs supported by long stalks and interspersed among non venomous spines), like the flower urchin, belong to the most venomous of all sea urchins. These fanglike appendages are associated with venom glands, capable of penetrating the skin, difficult to dislodge (they continue envenoming). **To be removed promptly.** Symptoms include: *Local*: Starfish: Sharp burning, often incapacitating pain (may last for several hours). Bleeding. Ecchymosis, surrounding soft tissue swelling.	Check for vitals (pulse, respiratory rate and, if appropriate, blood pressure).	Airways (oropharyngeal and nasopharyngeal). Intubation and cricothyrotomy kits.
Teach: Symptoms include: *Systemic*: Starfish: Nausea. Headache. Arthralgias, paresthesias. Muscular paralysis. Symptoms include:*Local*: Sea Urchins: Long/short spined: Severe burning pain (may last for several hours, reappearing by touching the wound). Edema, erythema. Bleeding. Wound tattooing, synovitis (if joint space violated); wound infection and granuloma formation (foreign body retention) as delayed complications. *Systemic*: Sea Urchins: Long/short spined: Nausea, vomiting.	Give O_2 by mask and assist ventilation properly, if respiratory distress is setting on. Initiate IV crystalloid infusion. Clean the sting site, remove foreign material. Control bleeding. Careful use a compression bandage to impede lymphatic flow at a pressure range of 40-70 mmHg for upper extremities and 55-70 for lower limbs. Immobilization is useful to avoid muscle pump effect. In absence of generalized allergic reactions, pressure immobilization is strongly contraindicated. Tourniquet use is not recommended. - Prepare to evacuate to higher role	Airways (oropharyngeal and nasopharyngeal). Intubation and cricothyrotomy kits. Oxygen delivery system. IV catheter, lines and solutions. Antiseptic solutions, swabs, dressings. Pressure bandages. Field Medical Cards.

TRAINING	TREATMENT	EQUIPMENT
Paresthesias. Muscular paralysis. Respiratory distress. Be aware that short spined urchins may deliver a severe sting without penetrating wound. Be aware that simple handling of sea urchins with pedicellaria is sufficient for envenomation. The flower sea urchin is the most venomous. Intense radiating pain, paresthesias, hypotension, respiratory distress, and muscular paralysis are potential effects and may last up to 6 hours. Generally injuries from all these animals are not directly lethal (only 1 death following loss of consciousness and subsequent drowning in a Japanese pearl diver stung by a flower sea urchin), but long spined black sea urchins were surely implicated twice in severe neurologic sequelae. Be aware of possible tetanus transmission.	completing Field Medical Card. - Evacuate without delay to higher role.	 Stretcher.

ENVENOMATIONS
(Coelenterate and Jellyfish)

ROLE 1

Teach: Systematic approach to trauma patient (A, B, C). Pre-deployment information on environmental risks through Medical Intelligence chain. Teach: Coelenterates represent the phylum of marine invertebrates more responsible of envenomation than any other marine animal. About 100 species of them are toxic to humans. The phylum is divided into 4 classes: 1. *Hydrozoa* (Portuguese man-of-war - Atlantic ocean from Nova Scotia to Caribbean sea-; and fire coral –tropical waters) 2. *Scyphozoa* (true jellyfish); 3. *Cubozoa* (box jellyfish and sea wasp – Pacific waters) and 4. *Anthozoa* (sea anemones and corals). Toxins (catecholamines, histamine, hyaluronidase, fibrolysins, kinins, phospholipases, and various hemolytic, cardiotoxic, dermatonecrotic toxins) are contained in the nematocysts, which are present on the outer surfaces of tentacles. Most reactions to venom are presumed to be toxic rather than allergic. Symptoms include: *Local*: Painful papular - urticarial eruption that	Consider: Systematic approach to trauma: See triptych B.01 and B.02 (Emergency Life Saving/First Aid in the Field). See triptych A.05 (Fluid Resuscitation). Obtain history an d identify: Type of animal. Time and location of event. Nature of event **Protect yourself** when rescuing casualties. Wear protective clothing and gloves. To prevent further injury to the casualty: Inactivate nematocysts.: diluted acetic acid (5%) is useful for Pacific box jellyfish and Atlantic Portuguese man-of-war. Avoid fresh water. It stimulates further release of toxins. Remove tentacles with forceps. Shaving cream can be applied to the wound to remove any unseen nematocyst by	 As for Triptychs B.01 and B.02. As for Triptych A.05. Protective clothing, gloves. Acetic acid solutions (5%). Forceps.

TRAINING	TREATMENT	EQUIPMENT
may last for minutes to hours and progress to urticarial, hemorrhage, ulceration. If ocular contact, conjunctivitis, chemosis, corneal ulceration, lid edema Uncommon local reactions include angioedema, contact dermatitis, papular urticarial. Sea bather's eruption is an intensely pruritic maculopapular eruption, due probably to the larvae of thimble jellyfish, developing 24 hours after exposure and lasting for 3-5 days. <u>Symptoms include</u>: *Systemic*: they develop with local symptoms: Nausea and vomiting. Headache. Weakness, muscle spasm. Fever, Pallor. Respiratory distress and paresthesias.	scraping with knife or razor blade. Adhesive tape applied to skin and removed is also effective. Baking soda may be effective for stings of sea nettle (*Chrysaora quinquecirrha*). Save and preserve tentacle could be helpful for identification by experts.	Adhesive tape. Baking soda.
<u>Symptoms include</u>: *Systemic*: Irukandji syndrome, occurring after the small jellyfish *Carukia barnesi* consists of: Backache. Arthralgias. Myalgias. Vomiting. Sweating and pyrexia. Tachycardia, dyspnea, hypertension. <u>Be aware</u>: sting site is often not visible. Hypersensitivity may occur but anaphylaxis	<u>Treatment:</u> If necessary, assess and obtain airway. Check for vitals (pulse, respiratory rate and, if appropriate, blood pressure). If needed, give O_2 by mask and assist ventilation properly. If needed, start full CPR. Initiate IV crystalloid infusion. Immobilize envenomed area to minimize venom uptake. Consider analgesics.	Airways (oropharyngeal and nasopharyngeal). Intubation and cricothyrotomy kits. Oxygen delivery system. IV catheter, lines and solutions. Antiseptic solutions, swabs.

TRAINING	TREATMENT	EQUIPMENT
is rare. Be aware: Venom of box jellyfish and sea wasp can induce respiratory and myocardial arrest. Therefore: Deaths may occur within minutes after venom release. Systemic reactions may include also malaise, hemolysis, and acute renal failure. Consider secondary drowning for incapacitation following severe pain.	Consider tetanus prophylaxis. Do not give antibiotics prophylactically. If pruritus, administer antihistamines. - Prepare to evacuate to higher role completing Field Medical Card. - Evacuate without delay to higher role.	Splints. Analgesics Tetanus vaccination, booster. Antihistamines. Field Medical Cards. Stretcher

ENVENOMATIONS
(Octopus)

ROLE 1

Teach: Systematic approach to trauma patient (A, B, C). Pre-deployment information on environmental risks through Medical Intelligence chain. Teach: Octopuses belong to the phylum *Mollusca*, class *Cephalopoda* and are generally harmless and nonagressive. Only the bite of the blue-ringed octopus (*Hapalochlena luminata* and *H. maculosa*) – Indo-Pacific region – is potentially life threatening. This specie is dark brown with blue rings, about 20 cm length with tentacles. The venom contains a tetrodotoxin like substance, 5-hydroxytryptamine, hyaluronidase, tyramine, histamine, tryptamine,	Treatment: If necessary, assess and obtain airway. Check for vitals (pulse, respiratory rate and, if appropriate, blood pressure). If needed, give O_2 by mask and assist ventilation properly. If needed, start full CPR. Initiate IV crystalloid infusion. Wound care: Immediately irrigate and clean the wound as usual. Perform local suction without incision or local venom sequestration by applying a constricting band proximal to the injury. Perform pressure immobilization technique	Airways (oropharyngeal and nasopharyngeal). Intubation and cricothyrotomy kits. Oxygen delivery system. IV catheter, lines and solutions. Antiseptic solutions, swabs. Suction device, bands. Splints.

TRAINING	TREATMENT	EQUIPMENT
octopamine, taurine, acetylcholine, and dopamine. Teach: pressure immobilisation technique Compress a cloth pad with a bandage directly over the wound and surrounding tissues at 70 mmHg. Consider: The bite is usually painless, involving the limbs: In sensible individuals similar to a bee sting (1-2 puncture wounds), sometimes progressing to pain, edema, and erythema of entire extremity. If envenomation occurred, symptoms onset within 10 minutes from bite. If envenomation severe, the casualty goes through: Nausea and vomiting. Blurred vision. Ataxia. Muscle flaccid paralysis. Respiratory failure (may lead to cardiac arrest and death). Possible anaphylactoid or anaphylactic reactions.	Consider analgesics. Consider tetanus prophylaxis. Do not give antibiotics prophylactically. Prepare to evacuate to higher role, where ICU treatment is available. Complete Field Medical Card. - Evacuate without delay to higher role.	Analgesics Tetanus vaccination, booster. Field Medical Cards. Stretcher

ENVENOMATIONS
(Stingray)

ROLE 1

Teach: Systematic approach to trauma patient (A, B, C). Pre-deployment information on environmental risks through Medical Intelligence chain. Teach: Stingrays represent the first common piscine envenomation. They are flat cartilaginous bottom-dwelling fishes with 1 or more stout spines on the tail. Northern hemisphere stingray (Family *Dasyatidae*) are marine animals. Fresh water stingrays (Family *Potamotrygonidae*) are often poisonous creatures living in lakes and rivers of South America. Stingrays live half-buried in sand or mud. Injury occurs mostly stepping on them. Venom, a protein-based toxin, is injected into the wound by 1 or more barbed stingers situated on the tail. Venom causes immediate intense pain, which worsens over the next hour, but it can be deactivated by heat. The pain may last 48 hours. If no complications occur, healing within 1-2 weeks. Death cases were reported (rare). Consider: wound infection is highly possible. Pathogens of specific concern are	Treatment: If necessary, assess and obtain airway. Check for vitals (pulse, respiratory rate and, if appropriate, blood pressure). If needed, give O_2 by mask and assist ventilation properly. If needed, start full CPR. Initiate IV crystalloid infusion. AS SOON AS POSSIBLE **immerse the affected body part in very** *hot water* **(as hot as tolerated by the patient without causing burns), preferably** 42-45°C **for** 30 to 90 minutes**, in order to deactivate as much venom as possible. Additionally it could be helpful to infiltrate the wound with local anesthetics, if available.** Wound care: Immediately irrigate and clean the wound as usual. Remove foreign bodies (broken stinger, sand). Apply direct pressure to control bleeding. Consider analgesics. Consider tetanus prophylaxis. Consider to give antibiotics	Airways (oropharyngeal and nasopharyngeal). Intubation and cricothyrotomy kits. Oxygen delivery system. IV catheter, lines and solutions. Syringes. Local anesthetics Antiseptic solutions, swabs. Forceps. Dressings. Analgesics Tetanus vaccination, booster. Antibiotics (ciprofloxacin, tetracycline, late generation cephalosporins).

TRAINING	TREATMENT	EQUIPMENT
Vibrio species in saltwater and *Aeromonas* in fresh water. Teach: The wound may bleed freely. Symptoms are the following: Local severe pain. Syncope. Nausea and vomiting. Diarrhea. Diaphoresis. Muscle cramps and fasciculations. Abdominal pain. Seizures. Hypotension.	prophylactically, because of high probability of wound contamination (5 days oral). Prepare to evacuate to higher role. Complete Field Medical Card. - Evacuate without delay to higher role.	 Field Medical Cards. Stretcher

TRAINING	TREATMENT	EQUIPMENT

ENVENOMATIONS
(Lionfish and Scorpionfish)

ROLE 1

Teach: Systematic approach to trauma patient (A, B, C). Pre-deployment information on environmental risks through Medical Intelligence chain. Teach: The fishes belonging to the family *Scorpionidae* are responsible for the second most common piscine envenomation after stingrays. They can be divided into 3 groups, relating to their venom organ and toxicity: **1**. *Pterois*, long slender spines with small venom glands and less potent sting (lionfish, zebrafish, butterfly cod); **2**. *Scorpaena*, shorter and thicker spines with larger venm glands and more potent sting (scorpionfish, bullrot, sculpin); **3**. *Synanceia*, stout powerful spines with highly developed venom glands and potential fatal sting (stonefish, warty-ghoul, "nofu"). The venom toxicity is due to antigenic, heat labile, high molecular weight proteins. Treatment is based on the heat labile characteristics of these proteins. This large family is widespread throughout tropical, subtropical and temperate regions. Even if tropical	Treatment: If necessary, assess and obtain airway. Check for vitals (pulse, respiratory rate and, if appropriate, blood pressure). If needed, give O_2 by mask and assist ventilation properly. If needed, start full CPR. Initiate IV crystalloid infusion. AS SOON AS POSSIBLE **immerse the affected body part in very** *hot water* **(as hot as tolerated by the patient without causing burns), preferably** 42-45°C **for** 30 to 90 minutes**, in order to deactivate as much venom as possible. Additionally it could be helpful to infiltrate the wound with local anesthetics, if available.**	Airways (oropharyngeal and nasopharyngeal). Intubation and cricothyrotomy kits. Oxygen delivery system. IV catheter, lines and solutions. Syringes. Local anesthetics

TRAINING	TREATMENT	EQUIPMENT
waters contain the majority of species, the temperate waters of the Indo – Pacific, India, South Africa, Australia, Philippines, China, Japan and USA are home for many venomous species. Wounds can be graded as follows: Grade I: erythema. GradeII: vesicle formation. GradeIII: tissue necrosis. The mortality rate is probably overestimated (documented deaths linked more to 2nd and 3rd group). Nonetheless severe and incapacitating, local and systemic symptoms are well described.		
Teach: Symptoms: Pain: immediately excruciating and incapacitating localized pain (*Synanceia* – stonefish). Pain may spread to involve the entire limb and lymph nodes, peaking at 60 – 90 minutes and lasting up to 12 hours. Lesser pain, although extremely painful, follows envenomations of *Scorpaena* (scorpionfish) and *Pterois* (lionfish). Mild subsequent way may persist for days to weeks. N.B. The severity of envenomation depends upon offending species, number of stings, age and health of the victim, progressing from *Pterois* (lionfish) to *Scorpaena* (scorpionfish) and to *Synanceia* (stonefish). Puncture wound: one or more, each	Treatment: Consider analgesics. Wound care: Immediately irrigate and clean the wound as usual. Remove foreign bodies (broken stinger). Apply direct pressure to control bleeding. Consider tetanus prophylaxis. Consider to give antibiotics prophylactically, because of high probability of wound contamination (5 days oral).	Analgesics Antiseptic solutions, swabs. Forceps. Dressings. Tetanus vaccination, booster. Antibiotics (Trimethoprim / sulfamethoxazole, ciprofloxacin, tetracycline, late generation cephalosporins).

TRAINING	TREATMENT	EQUIPMENT
discolored by bluish cyanotic tissue. Edema, erythema and warmth may involve the entire limb (rare necrosis in absence of secondary infection, in contrast to stingray injuries). Vesicle formation, particularly of the hands, may be followed by cellulites and surrounding hyperesthesia. Systemic symptoms may be present (nausea, muscle weakness, dyspnea, hypotension).	Prepare to evacuate to higher role. Complete Field Medical Card. - Evacuate without delay to higher role.	Field Medical Cards. Stretcher

ENVENOMATIONS
(Snake: Cobra)

ROLE 1

<u>Teach:</u> Systematic approach to trauma patient (A, B, C). Pre-deployment information on environmental risks through Medical Intelligence chain. <u>Teach:</u> **Cobras** addressed by this triptych belong to the genus *Naja* and other similar such as *Ophiophagus hannah* (king cobra), *H. haemacathus* (ringhals), *Walterinnesia aegyptia* (desert black snake), *Boulangeria* species (water cobras) and *Pseudohaje* species (tree cobras). Cobras are large snakes (1.2 to 5.2 m length). Habitat comprises most Africa and Southern Asia.	<u>Treatment:</u> Always consider Cobra bites patients as exposed to a severe envenomation. Observe casualty for at least 24 hours. Every safe effort should be made to identify the snake species, this will be helpful for proper antivenom administration. It should be administered as soon as systemic symptoms set on.	

TRAINING	TREATMENT	EQUIPMENT
They are usually well known for the way they defend themselves. In addition to biting, some species (ringhals, African and some Asian Naja species) eject the venom towards the victim, usually at the eyes. The effective discharge range of a large snake is at least 3 m. Of all bites, about **45%** results in envenomation. The venom is a blend of toxins: postsynaptic neurotoxins, so called “cardiotoxins” (cell membrane poisons), complement activating toxins (alternative pathway), enzyme toxins (phospholipase A2, hyaluronidase etc.). It acts mainly causing neurologic abnormalities and tissue necrosis. Mortality rate is in average high. Teach: How to use tourniquet technique proximal to bite site (ALWAYS CONSIDER LIMB LOSS). A completely arterial occlusive tourniquet is reasonable when: Casualty is bitten by a highly poisonous snake and Casualty is close to medical care. Teach: Use as **alternative first aid procedure** the *Australian pressure immobilization technique*: (its use in cobra bites still controversial): wrap rapidly an elastic compress around the bitten extremity, beginning at the bite site and progressing proximally to encompass the entire limb as tigh as for sprain immobilization. Keep extremity at heart level.	Consider tetanus prophylaxis. If appropriate, apply tourniquet or wrap the extremity after the Australian technique. Species specific antivenom administration (heterologous antivenom may also be helpful), if available at this level. Incisions are not helpful. Avoid cooling or ice application (increased necrosis risk).	Tetanus vaccination, booster. Tourniquet, constriction band, pressure device. Species specific antivenom.

TRAINING	TREATMENT	EQUIPMENT
<u>Teach:</u> Symptoms: Pain: immediate localized pain. Soft tissue swelling (may be progressive). Mental status alteration (drowsiness, occasionally with euphoria). Cranial nerve dysfunction such as ptosis (often earliest neurologic symptom – systemic compromission), ophtalmoplegia, dysphagia and dysphasia. Profuse salivation, vomiting and abdominal pain. Generalized weakness or paralysis. Impending respiratory failure (muscle paresis, accumulated secretions), cyanosis. Chest pain. Tachy – or bradycardia, hypotension. Eye pain, tearing, blurred vision due to ocular congestion, edema of conjunctiva and cornea with whitish discharge. Coral snakes**: red, yellow, black, red banding pattern. A simple rule is followed to distinguish a venomous from a mimic: “Red on yellow, kill the fellow”, “Red on black, friend of Jack”. These snakes need to hang on for a brief time to cause significant**	<u>Treatment:</u> If necessary, assess and obtain airway. Check for vitals (pulse, respiratory rate and, if appropriate, blood pressure). If needed, give O_2 by mask and assist ventilation properly. If needed, start full CPR. Initiate IV crystalloid infusion. Immediately irrigate copiously the eyes with any bland fluid (water, normosaline, milk). Antibiotic prophylaxis is no necessary. Prepare to evacuate to higher role. Complete Field Medical Card. Evacuate without delay to higher role.	Airways (oropharyngeal and nasopharyngeal). Intubation and cricothyrotomy kits. Oxygen delivery system. IV catheter, lines and solutions. Normosaline, milk. Field Medical Cards. Stretcher

TRAINING	TREATMENT	EQUIPMENT
envenomation in humans. **Sea snakes:** are found mostly in tropical and subtropical waters in the western Pacific and Indian Ocean, often in coastal waters and river mouths. They are not found in the Atlantic, the Caribbean and North American coast north of Baja. Mortality is about 10% of the bites.		

TRAINING	TREATMENT	EQUIPMENT

ROLE 2 and 2+

As per role 1. Secondary survey. Antivenoms administration, related complications, where to find them in the operational theatre Emphasize that after apparent stabilization of the patient, rebound phenomena could be expected up to 12 hours after sting. Envenomations symptoms, in some cases, could be delayed (up to 10 – 12 hours).	- Reassess casualty's ABC. - Perform secondary survey. - Antivenom administration. - If necessary, maintain airway and O_2 delivery. - Continue treatment of anaphylaxis. - Continue steroids administration, if indicated. - Continue antihistamines administration, if indicated. - Cool stings sites for 12 hours. - Keep extremities with stings elevated for 12 hours when developing of edema can represent a risk. - In cases of envenomation (mostly by snakes), do not remove compression devices if no antivenom is available, but evacuate to higher role facilities, where it is available. - Check for bites -, stings - , envenomation site infection. - In case of infection perform wound care. - Administer antibiotics. Consider in case of stings and bites, serum – sickness –type reactions may occur up to 14 days after sting. If systemic complications, do not hesitate to -Evacuate to higher Role Facilities.	As per role 1 Specific antivenoms according to area of ops. As for same role in triptych D3 on Anaphylaxis. Steroids. Antihistamines. Ice, cool packs Dressings, swabs, forceps. Broad-spectrum antibiotics.

TRAINING	TREATMENT	EQUIPMENT

ROLE 3

- As per Role 1 and 2.	In envenomation cases, administer specific antivenoms. (For sea snake envenomation cases, if antivenom no available, consider dialysis). - As per Role 1 and 2. - **Repeat** primary survey and perform subsequent actions (ABCs). - Definitive surgical and intensive care treatment.	Specific antivenoms according to area of ops. Dyalisis Units. As foreseen for surgery units. As foreseen for intensive care units.

D.01 Poisoning and Drug Overdose

PREAMBLE

Overview

Poisoning can be defined as the exposure to any chemical substance than can cause death or loss of function. This triptych will focus on poisonings due to accidental or intentional ingestion or intravenous overdose. It is meant to complement the triptych on inhalational injury and those STANAG and A-Med publications which address chemical, biologic or radiation injuries – particularly organophosphate and carbamate exposure. There are hundreds of potentially dangerous pharmaceuticals and toxic agents. This triptych will outline the initial management of the patient who has ingested the more common classes of potentially harmful substances.

Pathophysiological Considerations

Almost any chemical has the potential to act as a poison when a large enough dose is ingested. Conversely, limiting exposure by decreasing absorption or increasing elimination renders most chemicals innocuous. Once a potentially toxic amount of a substance has been absorbed one must consider the mechanism whereby the chemical exerts its systemic toxic effects in order to counteract these effects. In addition, the unique metabolism and elimination of the agent will affect therapy as well.

C. Clinical Considerations

The goal of treatment is to provide immediate supportive therapy, assess the need for gastrointestinal decontamination, and quickly determine whether empiric administration of a lifesaving antidote is indicated. All potentially fatal ingestions should be evacuated to Role 3 as soon as possible.

TRAINING	TREATMENT	EQUIPMENT

ROLE 1

Teach Goals of Initial Evaluation: Recognize the potential for poisoning in all unresponsive patients, patients with unexplainable abnormalities in vital signs and all depressed, despondent or suicidal patients. Identify the potential substance ingested by interviewing friends or colleagues and by requesting a search of the patient's quarters for pill bottles or other unusual substances. Predict the potential for toxicity based on the type and estimated amount of substance ingested and by the specific clinical presentation. Recognize that potentially fatal ingestions can appear relatively asymptomatic at the time of initial presentation for medical care. Examples include paracetamol, aspirin, sustained release anti-hypertensives and hypoglycemics, and iron. Maintain a low threshold for evacuating intentional overdoses to Role 3 where laboratory support and specific antidotal therapy should be available. Teach Goals of Initial Management: Provide supportive care focusing on the ABCs. In particular, many anti-depressants and sedative-hypnotic agents	Standard Emergency Toxicologic Management General Supportive care: Evaluate, resuscitate and stabilize patient addressing ABCs as presented in triptych on resuscitation using standard ACLS protocol. Treat status epilepticus using appropriate medication. In addition, perform the following. In the unresponsive patient: Measure the patient's blood sugar by finger prick test. Give IV glucose (10-50%) if hypoglycemia is present. Administer IV Naloxone titrated to effect (IM or intra oral routes can also be used), if opiate overdose is suspected. Up to 10 mg may be needed for some opiates such as propoxyphene. Secure the airway with airway adjuncts as required and administer high flow oxygen. Evacuate to Role 3 facility. In the awake patient: Administer activated charcoal if potentially highly toxic amount of substance ingested less than 1 hour prior to presentation. Evacuate to Role 3. For unintentional ingestions with low potential for toxicity, based on substance and amount ingested, (eg. pediatric ingestions), patients may be medically	Standard Role 1Airway Equipment: Refer to triptych A.03 for airway management. Nasogastric tubes. Intravenous cannulae and tubing. Crystalloid solutions. Standard ACLS medications Standard Anti-epileptic medications: *Material for GI decontamination:* Activated charcoal 25-50 gram bottles. *Specific Antidotal Therapies*: For opiates: Naloxone For hypoglycemics: Glucose solutions (10- 50%) IV For cyanide: Refer to triptych B.12 For organophosphate ingestions: Atropine IV and specific antidotes.

TRAINING	TREATMENT	EQUIPMENT
may result in a rapid deterioration in the level of consciousness and vital signs. Hypoglycemia and narcotic overdose are rapidly reversible situations that avoid the need for intubation. Secure the airway with endotracheal intubation if there is any doubt of the patient's ongoing ability to maintain an airway. Depending on the suspected substance, immediately begin reducing ongoing absorption. (See discussion on ipecac, and activated charcoal below.) While specific antidotes may not be available in Roles 1 and 2, the potential need for such antidotal therapy should dictate the urgency and prioritization of medical evacuation to Role 3 or higher. <u>Teach the danger of using emetic agents such as ipecac:</u> Emetics (eg. ipecac) should always be avoided for almost all potentially fatal oral ingestions where sudden loss of airway integrity can lead to aspiration pneumonitis. It is absolutely contraindicated in caustic ingestions. <u>Teach the appropriate early use of activated charcoal (AC):</u> Superactivated charcoal is an innocuous inert substance that is highly effective in binding many drugs and organic compounds.	cleared if asymptomatic after 4-6 hours. In all <u>intentional ingestions</u>, (eg. Suicidal patients), evacuate to Role 3 for further medical evaluation prior to psychiatric referral. <u>Activated Charcoal (AC) Administration:</u> Indicated when there is a potential that a toxic substance remains in the GI tract. Assure bowel sounds present. Contraindicated in caustic alkali ingestions. Not useful for metals. Give roughly 1-1.5 gram/kg OG, NG or PO. <u>Specific Antidotal Therapy:</u> Cyanide ingestions may be given immediate antidotal therapy as outlined in the Inhalational Injury triptych. Organophosphate ingestions (eg. insecticides) are treated with atropine beginning with 2mg IV with large doses often needed to titrate to relief of muscarinic symptoms. (Please see AMED-P and STANAGS on NBC therapy for detailed discussion)	

TRAINING	TREATMENT	EQUIPMENT
It is generally indicated for almost all potentially toxic ingestions. Its use is relatively contraindicated for patients with caustic ingestions who might require endoscopy. It does not bind highly charged ions such as lithium, iron and other metals AC is given mixed with water or via a NG tube. The patient must be able to protect the airway or else be intubated. May form concretions in absence of bowel sounds. <u>Recognize common poisoning syndromes:</u> Opiates: (eg. heroin) Respiratory and CNS depression. Miosis. Sympathomimetics: (eg. cocaine) Anxiety, agitation, mydriasis, diaphoresis, tachycardia, hypertension, hyperthermia, seizures. Cholinergics: (eg. organophosphates) SLUDGE – salivation, lacrimation, urination, defecation, GI upset and emesis. Also: diaphoresis, muscle fasciculations, miosis, and bradycardia. Anticholinergics: (eg. diphenhydramine) Confusion, tachycardia, dry skin, hyperthermia, seizures.		

TRAINING	TREATMENT	EQUIPMENT

ROLE 2

Training similar to Role 1. In addition, teach: The limited indications and technique of gastric decontamination Prolonged ventilatory support may be required for intubated patients. All potentially fatal ingestions or overdoses should be evacuated on to Role 3 as soon as possible.	Gastric Decontamination (GD): Indicated for potentially lethal ingestions in patients that are already intubated, if there is potential to recover clinically significant amounts of a toxic substance - generally within 1 hour of ingestion. Contraindicated in an unprotected airway, in caustic alkali ingestions, or in patients at risk of GI haemorrhage or perforation. Relatively contraindicated in hydrocarbon ingestions with low risk for systemic toxicity but high risk for pulmonary toxicity. (eg. automotive fuels) Technique: Place in left lateral decubitus position. Place large bore gastric tube orally into stomach. Confirm placement by aspirating gastric contents or auscultation over epigastric during insufflation of 50 cc of air. Aspirate as much material as possible by rotating and repositioning the tube. Lavage and aspirate using 250 cc aliquots of water with a minimum of 1 liter after clearing of	In addition to Role 1 material: *Material for GI decontamination:* Nasogastric tubes Orogastric tubes 36-40 French. N-acetylcysteine 20% solution (NAC) Ventilator.

TRAINING	TREATMENT	EQUIPMENT
	aspirates. Continue standard ACLS therapy and specific antidote therapy begun at Role 1. In addition, provide as needed: Standard ventilatory support. Bladder catheterization is useful to monitor urine output. Give NAC loading dose of 140 mg/kg PO if toxic acetaminophen OD suspected and a delay in evacuation to Role 3 anticipated. Following stabilization, all patients should be evacuated to Role Three.	

TRAINING	TREATMENT	EQUIPMENT

ROLE 3

The goals of Role 3 emergency management include reassessing the overdose patient as presented in Role 1 and 2. Review the indications for gut decontamination and use of activated charcoal (AC). Teach ongoing reassessment to recognize the presence of potential toxidromal signs and symptoms as presented in Role 1. In addition, teach the important points for the diagnosis and treatment for each of the following drug overdoses:	Continue to provide ongoing emergency toxicologic management with general supportive care as outlined in Role 1 for the responsive and unresponsive patient. Assess the need for gastric decontamination and AC if not adequately performed in Roles 1 or 2. For all serious drug overdoses or toxic exposures: Maintain patient on a cardiac monitor. Monitor and maintain vital signs and O_2 saturation. Obtain an EKG. Obtain basic laboratory testing such as CBC, Electrolytes, Glucose, BUN and creatinine and urinalysis. Consider urine toxicology testing if available. Obtain an acetaminophen level on all intentional overdoses when acetaminophen ingestion cannot be reasonably excluded, at least 4 hours post-ingestion. Consider telephonic consultation with a regional poison control center if available.	Cardiac and O_2 saturation monitor Electrocardiogram Standard Role 3 laboratory support Serum acetaminophen assay
<u>For acetaminophen overdose, teach:</u> Overdose may lead to hepatic failure and death due to accumulation of toxic metabolite produced via the cytochrome P-450 system. Patients with highly toxic overdoses	In addition, consider the following actions for each of the following drug overdoses:	Acetaminophen OD N-acetylcysteine(NAC) 20% solution Antiemetics IV

TRAINING	TREATMENT	EQUIPMENT
may appear relatively asymptomatic during the first 12-24 hours. Drug levels are crucial to rule out acetaminophen if any doubt exists. A drug level obtained at least 4 hours post-ingestion using the Rumack-Matthews nomogram predicts potential toxicity. The antidote, N-acetylcysteine (NAC) is highly effective if given within 8 hours of ingestion.	Acetaminophen OD GD and AC as above. Give NAC 140 mg/kg as loading dose, (if not given in Role 2), then 70 mg/kg over next 4 hours if nomogram predicts potential toxicity. Begin NAC empirically while awaiting drug level if >8 hours post-ingestion.Treat NAC induced emesis with IV antiemetics. If available, IV NAC is an acceptable alternative to PO NAC if PO not tolerated.	

D. 02 FIELD TREATMENT OF DIARRHOEA

PREAMBLE

Peace support operations, including humanitarian aid, generally take place in areas where bad hygiene conditions and food and waterborne diseases are frequently encountered.
Profuse, watery diarrhoea causes dehydration and electrolyte imbalance that needs proper treatment.
A few practical and timely prescriptions can be useful in minimising the morbidity and the severity of the illness in the deployed forces.
This triptych is intended primarily for military personnel.
If used for civilian population, local knowledge regarding causative organism is often available and can be acted upon.

TRAINING	TREATMENT	EQUIPMENT

ROLE 1

Teach: Causes of acute diarrhoea (bacterial, viral, parasites and non infectious causes). Pathophysiology of acute diarrhoea. Diagnosis: clinically; assess circulation; assess hydration. Prognosis: the disease is usually self – limiting; in severe cases dehydration and even shock may occur; cholera is the most likely cause of severe dehydration/shock by massive fluid loss; thyphoid fever may cause intestinal bleeding and heavy blood loss; combined with other causes of hypovolemia dehydration may occur earlier than expected. Epidemiology of diarrhoea. Prevention of diarrhoea: careful choice of food and drinks; thoroughly roasting of meet and boiling of open liquids assigned for consumption; no prevention by vaccination or drugs; preventive use of antibiotics contraindicated because of side effects.	General: usually the disease is self – limiting and recovery occurs without specific therapy and diet only. Treat dehydration if necessary by peroral fluid replacement (in absence of contraindications). Use modified Haldane solution or equivalent. Treat shock or severe dehydration (determined clinically) by IV. Antibiotics: not in Role 1. Evacuation policy: In case of protracted, non bloody diarrhoea, evacuation to Role 2 may be considered (related to housing conditions); In case of diarrhoea with bloody stools or high fever, severe dehydration or shock,evacuation to Role 3 is indicated.	Sphygmomanometer. Carbo medicinalis. Loperamide. Metoclopramide. Modified Haldane solution, Moyer's solution, or equivalent like ORS. Infusion solutions: Ringer laccate; 0.9 % NaCl. IV infusion and cannulae.

TRAINING	TREATMENT	EQUIPMENT

ROLE 2

Teach: see Role 1. Diagnosis: Blood analysis (sedimentation, blood smear); Serum K, HCt, pH.	See Role 1. Treat hypokalemia and acidosis if found. Antibiotics: not in Role 2. Evacuation policy: Admission in case of non bloody diarrhoea and good general condition or mild dehydration. In case of diarrhoea with bloody stols or high fever, severe dehydration or shock, evacuation to Role 3 is indicated.	Sphygmomanometer. Carbo medicinalis. Loperamide. Metoclopramide. Modified Haldane solution, Moyer's solution, or equivalent like ORS. Infusion solutions: Ringer laccate; 0.9 % NaCl. IV infusion and cannulae. KCl NaHCO3

TRAINING	TREATMENT	EQUIPMENT

ROLE 3

Teach: See Role 2. Diagnosis: Stool specimen; Culture of faeces and determination of sensitivity for antiobiotics. Blood analysis (sedimentation, blood smear, thick film); Serum K, HCt, pH.	See Role 2. Treat hypokalemia and acidosis. Antibiotics: only in case of serious or continuing infection. Chose appropriate antibiotic according to causative agent in culture.	Sphygmomanometer. Carbo medicinalis. Loperamide. Metoclopramide. Modified Haldane solution, Moyer's solution, or equivalent like ORS. Infusion solutions: Ringer laccate; 0.9 % NaCl. IV infusion and cannulae. KCl NaHCO3 Antibiotics: Ciprofloxacin, Amoxycillin, Cotrimazole, Erytromycin, Metronidazole, Vibramycin, Praziquantel, Mebendazole.

D. 03 ANAPHYLAXIS

PREAMBLE

Anaphylactic and anaphylactoid reactions comprise a spectrum of clinical conditions ranging from mild, spontaneously resolving discomfort, to life threatening circulatory collapse, and/or respiratory arrest. Because of the extremely rapid progression in some cases, and because efficacious therapeutic intervention is available, it is of utmost importance that all relevant personnel are drilled in recognition of early symptoms, and in the correct course of action once the anaphylactic reaction is under way.
The pathogenesis of *anaphylactic reactions* is a type I allergic reaction mediated by immunoglobulin E causing massive release of potent mediators, which set off cascades of systemic reactions. Circulatory collapse is caused by a combination of peripheral vasodilatation, plasma leakage, and reduced cardiac output. In the respiratory tract, proximal edema, bronchoconstriction and alveolar gas exchange impairment may cause a critical ventilatory failure.
The *anaphylactoid reaction* is an identical or very similar clinical response not mediated by IgE. One cannot distinguish between them on the basis of clinical observation.

Offending agents.
Although a wide variety of offenders have been described,the most common are :
Injection therapy – penicillin is important in the field setting. X – ray contrast agents and various anesthetic agents are also important, but they are given in a setting where trained personnel and therapeutic agents are readlily available.
Insect or snake bites.
Peroral intake of offending foodstuff or drugs.
Symptoms and signs.
Itching in head, ear passages, palms of hands, and footsoles, lethargy, dizzines and anxiety may precede more dramatic presentations, and should be noted when occurring e.g. in the course of intravenous drug administration. Initiation of treatment in this stage is the best way to avoid a dramatic development.

Cardiovascular:	Palpitations, pallor, sweating, hypotension, circulatory collapse, cardiac arrest.
Respiratory:	Sneezing, coughing, stridor, expiratory whezee and prolonged expiration, laryngeal edema, cyanosis, respiratory arrest.
Cutaneous:	Pruritus, erythema, exanthema, wheal, flares, urticaria, edema.
Gastrointestinal:	Nausea, vomiting, abdominal cramps, diarrhoea.
Cerebral:	Uneasiness, anxiety, dizziness, coma, seizures.

Treatment.

A plan for the treatment must be established before the anaphylactoid event. Airway maintainence, O2 administration, intravascular volume expansion and epinephrine are essential to treat the hypotension and hypoxemia that results from vasodilatation, capillary hyperpermeability and bronchospasm. The treatment plan is the same for life – threatening anaphylactic or anaphylactoid reactions, but the therapy must be titrated to the desidered effect, related to the severity of the event.

TRAINING	TREATMENT	EQUIPMENT

ROLE 1 to 2

TRAINING	TREATMENT	EQUIPMENT
General: The pathophysiology of anaphylactic reactions in general and anaphylactic shock in particular. The mechanism and importance of epinephrine in the management. The difference between light and severe anaphylactic reactions. Precautions: Knowledge of the potential of all intravenous administration to cause anaphylactic reactions in general, and penicillin, sulfa and iodine in particular, and suxamethonium among anesthetic drugs. Recognition of early signs of anaphylaxis, and the importance of pre – shock treatment, as well as preparedness of personnel for this situation. Knowledge of location and use of epinephrine and other necessities in an anaphylactic emergency. Severity assessment: Early reactions: palpitations, itching, sneezing, lethargy, dizziness and anxiety. The more immediate the reaction after antigen exposure, the more severe the reaction is likely to be. Shock stageing.	Precautions: Routine questioning on previous allergic reactions before medical treatment. The potential of all intravenous administered drugs to cause anaphylactic reactions must be known, but in particular penicillin, iodine – and sulfa – containing preparations. All injections to be followed – up at least ½ - 1 hour before discharge. Rapid access to epinephrine and intravenous fluids at sites where IV administration is done. Imminent or manifest circulatory or respiratory collapse. Stop any ongoing infusions of drugs or colloids. Place in supine position, legs raised. Tourniquet proximal to injection site of antigen (sufficient to occlude venous and lymphatic return without compromising arterial flow). Assure patent airways – artificial ventilation and/or endotracheal intubation may be necessary. Establish intravenous access. Administer Ringer's lactate solution at rapid rate – 2000 ml. Administer epinephrine 0.2 – 0.5 mg slowly IV in 0.1 mg steps (in case of circulatory collapse). If respiratory signs are predominat (e.g. stridor, laryngeal edema), first use a controlled dosage aerosol of epinephrine, e.g. with a nebulizer). Keep the patient warm.	Stethosope. Resuscitation equipment: Oxygen supply and administration kits (facial masks or nostril catheters). Ventilatory bags (AMBU), PEEP – valves. Suction equipment. Tracheostomy sets. Cricothyroidectomy sets. If ventilatory support: see relevant triptych A.04. Syringes and large – gauge needles. Material for venous cutdown (see A.03). Epinephrine for injection (1 mg units). Epinephrine for controlled dosage inhalation. IV infusion sets. IV crystalloid solutions. Blankets and aluminium sheets. Tourniquets.

TRAINING	TREATMENT	EQUIPMENT

ROLE 1 to 2

Treatment. General resuscitation (A, B, C). Fluid treatment. Drug treatment. Supportative measures. Drug indications and side effects. Epinephrine. Hydrocortisone Aminophylline. Phenamin. Diazepam. Techniques. Insertion of peripheral intravenous canula. Venous cutdown. Urinary catheterisation (for monitoring purposes). Drug nebulization. General monitoring. Circulatory status. Ventilatory status. Mental status. Specific monitoring. Arrythmia. Hypoxemia.	Initial field monitoring. Skin circulation (skin temperature, dryness, capillary blanch test). Pulse rate, - quality and – regularity. Respiratory adequacy (check for cyanosis and respiratory distress). Mental status (normal -, anxious/confused, coma).	

TRAINING	TREATMENT	EQUIPMENT
Coronary ischemia. Hemostasis (external hemorrhage). Fracture stabilization.		
Supplementary techniques. Sphygmomanometry. Urinary catheterisation (for monitoring). Pulse oxymetry. Drug nebulization.	Supplementary measures (if available). Oxygen – always on respiratory distress (5 l/min in nostril catheter). Additional fluids – when initial response to primary fluid replacement is inadequate, crystalloids are preferable. At development of circulatory collapse: administer epinephrine 1 ml slowly IV, during continuous ECG monitoring. Nebulized epinephrine (Role 2). Aminophylline (250 mg IV) – consider on rspiratory distress. Corticosteroids: (Hydrocortisone 100 mg IV), ameliorates late progression of symptoms. Antihistamines (Dexchlorpheniramine 5 mg IV) - consider on respiratory distress. Diazepam (10 mg IV) – consider on seizures Repeat as needed. Supplementary monitoring. Pulse oxymetry – above 95% O2 saturation. Diuresis monitoring (insert Foley catheter) – above 30 – 50 ml/hr. ECG – check for arrythmias.	IV crystalloids. Drugs: Epinephrine 1:10.000 Hydrocortisone amp 100 mg. Aminophylline amp 250 mg. Dexchlorpheniramine amp 5 mg/1 ml Diazepam amp 10 mg Sphygmomanometer. Equipment for urine catheterization : cleansing fluids, lubricants. Urinary catheters and collecting bags. Pulse oxymetry (if available).ù ECG monitoring.

TRAINING	TREATMENT	EQUIPMENT

ROLE 3

<u>Supplementary techniques.</u> Central venous pressure monitoring. Arterial catheterization. ECG monitoring. <u>Monitoring.</u> CVP evaluation: hypotension with: low CVP: suspect hypovolemia; high CVP: suspect myocardial failure. Blood gas evaluation: need for exogenous oxygen or ventilatory support. Arrythmia detection.	Continue previously established therapy and monitoring. At persisting invasive monitoring: Central catheter for CVP monitoring; Arterial catheter for blood gases and pH monitoring. Consider inotrophic treatment: Dopamine at renal rates (2 – 5 µg/kg/hr). Isoprenalin?	Drugs: see Role 2. In addition: Dopamine; Isoprenaline. Material for central venous catheterization. Material for arterial catheterization. Blood gas analyzer. ECG monitor. catheterization.

D.04 PSYCHOLOGICAL TRAUMA AND PSYCHIATRIC DISORDERS

PREAMBLE

1. Definitions:

- Psychological trauma may be produced by exposure to an extreme stressor involving direct personal experience of an event that involves actual or potential death or serious injury, or a threat to one's physical integrity, or witnessing the death, injury, or threat to the physical integrity of another person, or learning about unexpected or violent death, serious harm, or threat of death or injury experienced by a close associate.
- Psychiatric disorders are disorders of mood and thought patterns, and may involve excessive anxiety, depression, and impulsive behaviour. These disorders may range from simple anxiety disorders to flagrant psychoses and severe depressions and may lead to homicidal and suicidal acts.

2. Key Points:

- Psychological trauma is individualised to a degree, and what would be a trauma for one individual - depending on that individual's past life and past traumas - may well not be a trauma for another.

- Some trauma will be of such a degree of intensity and magnitude that it would be expected to produce psychological trauma in almost anyone.

- Some individuals will experience immediate responses to the psychological trauma, such as panic attacks, severe anxiety, dissociative reactions, conversion disorders, and insomnia, among many other possible responses.

- Some individuals will not experience immediate responses to psychological trauma, but instead may develop signs and/or symptoms weeks, months, or years later. Post traumatic stress disorder is one syndrome which may not appear for years.

- When acute reactions occur one must remember that psychoses may occasionally be precipitated by traumatic stress. It is important to differentiate these from the commoner stress reactions because the treatment is quite different.

- One must also be aware that psychiatric symptoms can be produced by direct trauma (physical or toxic) to the central nervous system. A detailed physical examination is needed to make a diagnosis of this nature.

A variety of medications can be used to stabilise and treat non-psychotic reactions to stress, whereas a different family of medications is needed to treat the psychotic reactions to stress. Thus, accurate diagnosis of the condition is important.

TRAINING	TREATMENT	EQUIPMENT

ROLE 1

ACUTE STRESS REACTION - Appears immediately after the trauma or in the following days. - Patient normally reacts to the trauma with intensity, highly emotional state. - Patient presents some of the following symptoms: Emotional hyperactivity, anxiety, loss of sense of reality and of himself, dissociative amnesia, referred normally to the trauma or some aspects of it. - Patient reacts by avoiding those situations that remind him of the trauma. - Patient relives the traumatic event in different ways as thoughts, images, repetitive dreams, flashbacks, or sensations of reliving the traumatic situation. - Patient presents symptomatology related to the increased anxiety; tachycardia, sweating, trembling, dizziness, breathing problems, chest pains, headache, constipation, increased micturation. In extreme cases patient can suffer delusions,	Preventive measures are important. After intensive trauma debriefing measures are important. Soldiers should be able to speak about the situation, their feelings, sensations, in order to reduce anxiety. Also hygienic measures are important. Adequate food, sleep, rest and clean clothes help the soldier to manage trauma. Adequate group cohesion is very important. When mild symptomatology appears and the previous measures are not enough, or the combat situation changes, the soldier should be evacuated following the specific evacuation lines of the CSR. By definition an acute stress reaction will resolve within 24 - 48 hours with minimal symptoms remaining within 3 days. Other somatic problem or drug abuse should be excluded.	Diazepam (tablets 5 mg and injection 5 mg/ml).

TRAINING	TREATMENT	EQUIPMENT
hallucinations and psychomotor agitation.		
POST TRAUMATIC STRESS DISORDER - Appears after one month of a traumatic situation in patients that have suffered significant psychological trauma. - Patient begins to present with intrusive memories of the trauma producing high levels of discomfort. - Patient presents repetitive dreams about the traumatic situation, with a high degree of realism. - Patient can feel that the traumatic situation is happening again, reacting with high anxiety even with hallucinations and dissociative symptoms. - When the patient is in a situation similar to the trauma, symptomatology increases. This may lead to avoidance. - Patient has restricted affect, loses interest, tendency to isolation, hopelessness. Patient has hyperarousal symptoms; sleep disturbances, irritability, fear, concentration problems, hypervigilancy, hyperactivity.	This symptomatology appears after a month of the trauma. This disorder can be produced by repetitive trauma that can reactivate the symptomatology. Early detection is important in order to start treatment. Anxiety can be treated with Diazepam, in the short term. Sleep disturbance can be treated with hypnotics as Zopiclone if necessary. When anxiolytic and psychotherapeutic treatment is not enough, using anti depressants (Paroxotine) may help. Evaluation by psychological/psychiatric teams is necessary in order to establish adequate treatment.	Diazepam (tablets 5 mg and injection 5 mg/ml). Zopiclone (tablets 7.5 mg (2nd level and above). Paroxotine (tablets 20 mg) (2nd level and above).
ACUTE ANXIETY CRISIS - After acute trauma a patient can present acute	It is necessary to exclude the symptoms of somatic	Haloperidol (tables 5 mg and injection 5

TRAINING	TREATMENT	EQUIPMENT
symptoms of anxiety. - Symptoms presented are palpitations or tachycardia, sweating, trembling, breathing problems, constipation, chest pain, instability or dizziness. Sense of unreality, shivering. - Patients can feel a sudden fear of losing control, of dying or going mad. In severe cases psychomotor agitation can appear. With the following symptoms: - Marked agitation. - Aggressiveness against himself or others.	pathology, or drug abuse. Alprazolan (0.5 - 1 mgs) or Lorazepam (1 - 2 mgs) under tongue is useful (however this may not be available). Doses can be repeated after 20 minutes if symptoms continue. If it is not possible to use oral medication it is possible to use IM medication such as Diazepam. Patient should be kept in a quiet place, without stimulus if possible. In case of agitation, IM medication can be used as before or in severe cases HALOPERIDOL IM 5 mgs. Security measures should be taken, detaining the patient in order to prevent damage to himself or the other people. Ensure adequate staffing. In order to prevent agitation, patient should be kept in a quiet place, with not too many people, with few stimuli and without dangerous and harmful objects.	mg/ml).
DEPRESSIVE SYNDROME Patient begins to feel the following symptoms as a consequence of psychological trauma: - Sadness during most of the day.	Early detection of this syndrome is important. Detection of risk factors is important.	Diazepam (tablets 5 mg and injection 5 mg/ml).

TRAINING	TREATMENT	EQUIPMENT
- Loss of interest - libido. - Anhedonia. - Anorexia. - Sleep disorders. - Idea of guilt or hopelessness. - Inhibition. - Suicidal ideas or thoughts of death. - Loss of relationships. Tendency to isolation. - Possible anxiety. It is important to detect suicide risk. The main risk factors are: - History of depressive disorders. - History of suicidal attempts. - Anxiety. - Isolation. - Intensive guilt feelings. - Loss of relatives or friends. - Frequent speech about death. - Inadequate risk behaviour. - Hopelessness. Detection of risk of suicide means urgent therapeutic measures are necessary.	Security measures should be adopted: - Vigilance. - Prevent isolation. - Reduce anxiety with Diazepam as before. - Remove harmful and dangerous objects and avoid dangerous places as much as possible. - General hygienic measures. **ROLE 2** Patients with depressive syndrome should be evaluated by psychiatric/psychological teams. Patient with high risk of suicide, should be evacuated to psychiatric Unit in Third Echelon.	
ACUTE PSYCHOTIC EPISODE An acute psychotic episode can appear in people who have suffered intense trauma. It is commonest in patients with a previous history of psychosis. Psychotic symptoms can be reactivated by trauma.	Urgent evacuation to **ROLE 3** Medical Unit is necessary. Treatment with HALOPERIDOL can be instituted until specific psychiatric treatment is started. Doses can be 20 mgs/day if necessary.	Haloperidol (tablets 5 mg and injection 5 mg/ml).

TRAINING	TREATMENT	EQUIPMENT
Main symptoms are: - Delusions. - Hallucinations. - Speech disorders, may be incomprehensible. - Confusion. - Strange behaviour. - Catatonia. - Incongruent affect. These acute episodes can have a prodromic period. During this period the patient has strange behaviour, feelings of unreality, anxiety, sleep disorders, strange affectivity. The possibility of self harm and posing risk to others together with the possibility of psychomotor agitation makes necessary an early detection and therapy.	Soldier should be under special observation.	

D.05. RESPIRATORY EMERGENCIES

PREAMBLE

This triptych deals with respiratory emergencies that have non-traumatologic causes. Normally, they are independent of war injuries. (Chest injuries are discussed in triptych B.05.)

Likewise, the effects of chemical weapons are excluded, and reference is made to the relevant NATO documents.

Chest pain as a presenting symptom will not be discussed, since the major reasons for this are cardiac (myocardial infarction, angina pectoris).

For the principles of ventilatory support, see also the following triptychs:
- A.03 Resuscitative Procedures,
- A.04 Ventilatory Support, and
- B.12 Non-NBC Inhalation Injuries.

Acute respiratory problems can be divided into those causing a primary airway restriction (foreign body, epiglottitis, asthma), and those causing an infectious condition where generalised (septic) symptoms may be more important than the local signs (pneumonias).

Several of the common respiratory afflictions take the form of an underlying, chronic disease that undergoes periodic exacerbation. Prime examples are asthma and COPD (chronic obstructive pulmonary disease). While the latter is seen mainly in middle age and older smokers, asthma affects all ages. Patients will usually be well versed in the phases of their disease, and know the treatments for both quiet periods, and for acute bouts. In some cases, however, failure to bring his/her normal medication upon deployment may lead to an unnecessary deterioration in a patient's condition.

Acute lower respiratory infections (pneumonia), on the other hand, are seen in many patients as isolated events, while attacks of bronchitis are a great deal more common in COPD patients. The strategy for treatment of these infections must take into account not only the probable etiology (bacterial vs. viral).

TRAINING	TREATMENT	EQUIPMENT

ROLE 1

Everybody should be able to do the Heimlich manoeuvre for a foreign body lodged in the airway (see triptych A.03), and to ventilate a casualty by the mouth-to-mouth technique (see triptych A.04). Anatomy: Upper airway: Nose (with paranasal sinuses), mouth, and pharynx. Apart from trauma, foreign objects in the pharynx can cause obstruction. In an unconscious patient, the tongue will fall back and obstruct the airway. Mucous swelling at this level seldom causes serious airway blockage. Lower airway: Larynx, trachea and bronchi. Obstruction can result from an inhaled foreign body, from mucous swelling, or from bronchial constriction. An acute infection of the epiglottis can cause severe airway obstruction. Thoracic wall, pleural space, and lungs: An intact thoracic wall is necessary for breathing. Inspiration is normally active, expiration passive, but in certain conditions (asthma), a voluntary effort is needed. If the pleural space is punctured, the lung will collapse. This can also occur as a result of an inherent weakness in the lung surface (spontaneous pneumothorax). Heart and great vessels: Obviously not part of the respiratory system. However, ventilation and circulation have a very close relationship with each other, both anatomically and physiologically.	At this Role, a specific diagnosis is less important than the rapid identification, and treatment of, the symptoms of respiratory insufficiency by simple techniques. Respiratory arrest or respiratory insufficiency has absolute priority in treatment! Hypoxia can lead to irreversible brain damage after only 3-4 minutes. Immediate action: Oxygen therapy is the first and most important treatment to start! Humidification of the oxygen is not essential for survival at this stage. The oxygen therapy equipment must be capable of administering 100 per cent oxygen at flows of 5-10 litres/minute. This requires a breathing reservoir and a tight-fitting mask. (Nasal catheters and similar devices will only give the patient 20-30 per cent oxygen in the inspired gas mixture.). Adjust the oxygen flow so that the patient is free from cyanosis, and comfortable. (If a pulse oximeter is available, SaO_2 values of >90-95 per cent should be aimed for.) In cases of suspected foreign body lodged in the lower airway, perform the Heimlich manoeuvre. If the foreign body is not dislodged by the Heimlich manoeuvre, the patient should be urgently evacuated to a unit/level with the relevant expertise for emergency bronchoscopy (i.e. ENT or thoracic surgery).	Oxygen therapy equipment with breathing reservoir and mask. Pulse oximeter (if available at this Role). See Role 2 for details.

TRAINING	TREATMENT	EQUIPMENT
Ventilation physiology An adult has a minute ventilation of 6-8 litres, divided in 10-20 breaths of around 0.5 litre. During heavy work, the breathing rate can increase to 40-50, and the tidal volume to 2-3 litres. The objects of ventilation are twofold; to bring oxygen to the blood via the alveoli and the lung capillaries, and to remove carbon dioxide from the blood by the same way. The respiratory centre in the brainstem governs the minute ventilation. If the p_aO_2 sinks below 10 kPa (75 mmHg), a slight increase in ventilation results. Below 7 kPa (60 mmHg), this increase is very pronounced. When the p_aCO_2 rises above 6 kPa (45 mmHg), the result is hyperventilation (both tachypnoea and larger tidal volumes). Levels over 8-9 kPa (60-70 mmHg) result in pronounced hyperventilation. This reaction, however, is absent when the level of consciousness is severely depressed. Document all findings, to be able to monitor the patient's progress. Bronchial asthma is a chronic inflammatory condition of the lower airways, leading to recurrent attacks of dyspnoea and wheezing. These symptoms lead to an obstruction of the airflow, which subsides either spontaneously or after treatment. In the young adult, the attack is often mediated by an allergic reaction.	How to examine a patient at Role 1 *(N.B. Do it quickly, don't waste time!)*: Ask the patient if he can breathe. A reply will tell you that he is able to transport air into his lungs through a patent airway, and to transfer oxygen to his brain! No reply can mean one of several things (decreased level of consciousness, ventilatory problem, etc.), but always requires urgent diagnostic and therapeutic action. Listen to, and feel, his breathing. Count the respiratory rate. If >25 (or <10), a problem exists. Are the breath sounds normal (i.e. quiet but audible), or abnormal (distressed, rasping, panting, wheezing, etc.)? Prolonged and wheezing expiration points to obstructive lung disease (asthma). If the noise is inspiratory, suspect a foreign body in the airway, or laryngeal oedema. Check the heart rate (HR) by palpating a pulse (or reading it off the pulse oximeter). If >110, there may be a problem (although not necessarily respiratory). Check the blood pressure. What is the patient's level of consciousness? (AVPU score – cf. triptych B.01 Head Injuries, note 1.) Confusion or unconsciousness signals an immediately life-threatening state! Briefly elicit the patient's medical and drug history. A respiratory emergency is frequently caused by a known underlying condition, e.g. asthma or chronic bronchitis. The patient may be on long-time medication that he has failed to take.	Stethoscope Sphygmomanometer Field Medical Card

TRAINING	TREATMENT	EQUIPMENT
Most individuals who present with an acute asthma attack are already diagnosed, and on pharmaceutical treatment. A patient with chronic obstructive pulmonary disease (COPD) lives in a constant state of hypoxia, and therefore develops compensatory mechanisms in the form of pulmonary vasoconstriction and an increased haemoglobin level. His respiratory centre gradually loses its ability to react to abnormal carbon dioxide levels. Oxygen therapy will lead to the risk of the patient developing carbon dioxide narcosis, since the increased p_aO_2 makes his ventilatory volumes decrease accordingly. Note, however, that if the pO_2 is very low oxygen administration is indicated, and takes precedence over the risk of respiratory depression mentioned above.	Drug therapy in acute asthma attacks: β_2 bronchodilators (salbutamol 2.5-10 mg, terbutaline 5-20 mg) can be given by nebuliser where available, if the patient is able to use it. In life-threatening conditions, give salbutamol 200 µg or terbutaline 250-500 µg IV over 10 minutes. Ipratropium 0.5 mg by nebuliser In extremis, adrenaline 0.5 mg can be given SC. Steroids: A conscious patient can be given betametasone 5 mg as soluble tablets. In urgent cases, give prednisolone 60 mg, hydrocortisone 200 mg or betametasone 8 mg IV immediately. Drug doses may have to be repeated, e.g. q4-6h. When a patient has been given adequate doses of beta-stimulating drugs and steroids, no indication exists for theophylline. On the contrary, this drug will merely tend to cause major side effects. Before evacuation is instituted for a patient needing supplementary oxygen, find out the estimated transport time and compute the oxygen consumption to the next stage. Ensure that enough oxygen is available in the ambulance vehicle. If the patient is dependent on oxygen when seen by you, he cannot be expected to survive if sent along in an ambulance without oxygen!	Drugs: salbutamol, terbutaline ipratropium bromide nebuliser for the above adrenaline (epinephrine) prednisolone, hydrocortisone, betametasone Oxygen equipment and monitors for evacuation

TRAINING	TREATMENT	EQUIPMENT
ROLE 2 Common causes of a respiratory emergency include: Bronchial asthma Asthma is a killer in young adults! Patient's history indicative Physical signs are diagnostic (see Role 1) An acute attack often follows a period of reduced drug control, or a respiratory infection. Acute exacerbation of chronic bronchitis (COPD) Patient's history usually indicative Can be mistaken for left heart failure, or bronchospasm (asthma) Key symptoms include a productive cough with green or yellow sputum, and inspiratory crackles on auscultation. Seldom dramatic emergencies. However, if neglected, the patient may develop CO_2 retention. This will give rise to drowsiness or confusion, cyanosis, and bounding pulses. Inhalational injury See triptych B.12 Non-NBC Inhalation Injuries.	*At this Role, specific treatment for a specific diagnosis!* From the medical literature, the relative frequencies of various problems can be presented. This type of statistics will tell us that the most common diagnosis by far is "acute upper respiratory infection". Obviously, this is of help only in logistic planning, not when a patient is admitted. The treatment of asthma is outlined under Role 1. COPD patients must not be treated with oxygen in high concentrations (>30 per cent) without the ability to monitor, and if necessary ventilate the patient. The aim is to relieve some of the hypoxia, without producing further respiratory depression. Ventilatory support (cf. triptych A.04): Some form of mechanical ventilator may be available at Role 2 in some forces, mainly for transport purposes. Using it, however, necessitates intubating the patient, and having skilled personnel available for continuous monitoring. A patient can be supported by manual ventilation, using a self-expanding reservoir bag, either with a facemask or after tracheal intubation. This, however, is quite resource consuming, and may lead to the inability to save the lives of other patients. If a patient is intubated, the skills and equipment must exist to handle him during evacuation!	General equipment: Oxygen (see Role 1). Pulse oximeter Drugs (in addition to those listed under Role 1) for tracheal intubation and other invasive therapeutic measures (see triptychs A.03 and A.04). Equipment for tracheal intubation Mechanical ventilator as available, or self-expanding reservoir bag ("AMBU bag").

TRAINING	TREATMENT	EQUIPMENT
Common causes, continued. Acute lower respiratory infections (LRI) Bronchitis is an inflammation of the tracheo-bronchial tree. Often it accompanies upper respiratory infections, or is related to COPD (*see* above). Most cases are non-bacterial in etiology, as least initially. Pneumonia is an infection in the lung alveoli. Pneumonias can be divided into *bacterial* and *atypical*. Originally, the latter referred only to infections caused by *Mycoplasma pneumoniae*, but now a variety of viral, fungal, and other agents are also implicated. *Community-acquired pneumonia* distinguishes all cases not contracted in hospital. Sometimes, a pulmonary infection can be serious enough for the patient to present as a respiratory emergency. Usually no history of respiratory problems. Symptoms may include a high or spiking fever, a cough with purulent sputum, chest pain on inspiration (due to pleurisy), and breathlessness. Cyanosis is seen in severe cases. A viral etiology is likely, but bacteria such as *Str. pneumoniae* and *H. influenzae*, as well as the so-called atypical pathogens that also cause community acquired pneumonia (*M. pneumoniae*, *Legionella* spp., *and Chlamydia pneumoniae*) should be considered. The absence of purulent sputum usually indicates a viral or atypical cause.	Acute bronchitis is treated symptomatically. There is a long-standing controversy as to the use of antibiotics, and all the evidence is not yet in. Serious cases of pneumonia should be started on antibiotics at this level, despite the probability of a viral cause. Therapy traditions vary widely between nations, and will also have to be adjusted for the local flora of pathogens. The negative ecological effects of antibiotics, as well as the risk of inducing bacterial resistance, should be kept in mind. Benzylpenicillin remains the drug of choice in adult community-acquired pneumonia, but decreasing bacterial susceptibility means that higher doses are needed. In cases of beta-lactam allergy, a macrolide is appropriate. In serious cases, patients will usually be started on broad-spectrum antibiotic combinations (3rd or 4th generation cephalosporines or fluoroquinolones, plus a macrolide). It is to be expected that 10-20 per cent of cases fail to respond to the empirically chosen therapy. However, antibiotic therapy should not be changed in the first 72 h, unless there is marked deterioration.	Lab tests: White cell count (WBC) Antibiotics in LRI: Primary choice (examples only): *penicillins*: benzylpenicillin, amoxicillin *macrolides*: erythromycin, azitromycin, clarithromycin Secondary choice (examples only): *3rd generation (extended Gram-negative spectrum) cephalosporines*: cefotaxime, ceftriaxone *4th generation cephalosporines*: cefepime, cefpirome *carbapenems*: imipenem, meropenem *fluoroquinolons*: ciprofloxasine, moxifloxasine *tetracyclines:* doxycycline

TRAINING	TREATMENT	EQUIPMENT
Common causes, continued: Pneumonia, cont'd: A definite etiological diagnosis will seldom be made while the patient is at this treatment level (cf. Role 3 below). A severe coronavirus infection, SARS (severe acute respiratory syndrome) has received much publicity lately. At this level, the diagnosis of solitary cases will be only tentative, while a history of exposure offers compelling evidence.	If SARS is strongly suspected, anti-viral therapy (e.g. ribavirin) and corticosteroids should be added, preferably after specialist consultation.	
Foreign body in airway Sudden onset of dyspnoea, stridor, cyanosis and exhaustion. When the obstruction is partial, bouts of paroxysmal coughing are common. Obstruction at the level of the larynx is the most lethal ("*café coronary*"). A lower obstruction is nearly always partial. Aspiration of vomitus can occur in patients with depressed consciousness.	Treatment of a foreign body in the airway is outlined under Role 1. As the resources for bronchoscopy probably do not exist at Role 2, urgent evacuation to a Role 3 facility is needed if the foreign body cannot be dislodged by the Heimlich manoeuvre, or ventilation restored by tracheal intubation.	Surgical equipment for cricothyroidotomy Antibiotics (*see above*).
Epiglottitis Often supposed to be a disease of infants and children, but is in fact not uncommon in adults. Can give rise to a life-threatening obstruction of the airway in a short time. The patient presents with severe inspiratory stridor, fever, and a sore throat. The patient is sitting up and drooling, because the swollen epiglottis makes swallowing painful or impossible.	A patient with epiglottitis must never be made to lie down, as this can rapidly worsen the condition. All cases of epiglottitis are candidates for early tracheal intubation. This, however, requires a very skilled person as the oedema often makes the normal anatomical landmarks disappear. When skilled staff is present, induce anaesthesia in the sitting position. A variety of techniques and equipment for intubation should be available. If no specialist is at hand, a safer method is cricothyroidotomy (see triptych A.03). At the same time, antibiotic treatment is started, and evacuation to a Role 3 hospital is organised.	

TRAINING	TREATMENT	EQUIPMENT
Common causes, continued:		
Spontaneous pneumothorax Suspected when a previously healthy individual develops dyspnoea without external cause. On examination, diminished or absent breathing sounds, and a hyperresonant percussion note is found over one lung. The symptoms often can be quite insidious, especially when the resulting pneumothorax is partial.	Spontaneous pneumothorax is treated by the insertion of an intercostal drain using standard technique. The drain can be attached to active suction, or to a Heimlich valve or similar device for transport.	Chest drain, and equipment for insertion Pleural suction apparatus Heimlich valve
Pulmonary embolus Although a circulatory problem, an important differential diagnosis! Usually secondary to a deep vein thrombosis. Risk increased by prolonged immobilisation. In the elderly often caused by a fibrillating heart, with thrombi forming in the right atrium. Sudden onset of dyspnoea, pleuritic pain, and sometimes haemoptysis. In severe cases, cyanosis, distended neck veins, and cardiac decompensation follow.	A patient with pulmonary embolus should be started on anticoagulation therapy using low molecular weight heparin. Doses differ for different preparations; *see* literature. Further treatment (with coumarine/warfarin) should be instituted later in hospital (Role 3-4).	Low molecular weight heparin (LMWH)
A psychogenic (hysterical) cause of acute respiratory distress is possible, especially in situations of great stress. However, this diagnosis must only be made after the exclusion of other conditions.		

TRAINING	TREATMENT	EQUIPMENT
Pulse oximetry This non-invasive method of monitoring has become the method of choice for clinical monitoring of oxygenation, both before and at the hospital level. This technique measures the oxygen saturation (S_aO_2), not the oxygen tension (p_aO_2) as does ABG's, but this does not deter from its usefulness in acute situations. The relation between S_aO_2 and p_aO_2 exists because the oxygen pressure is the factor that gradually saturates the haemoglobin molecules. The relationship, however, is not linear. At low (pathological) oxygen pressure levels, small changes in p_aO_2 result in steep shifts in the S_aO_2, while at 'physiological' levels, the change in p_aO_2 will not influence the S_aO_2 very much. This can be seen graphically in the so-called oxygen dissociation curve, which is steep in its lower part, but flat in its upper part. Due to the shape of the oxygen dissociation curve, the S_aO_2 is an insensitive indicator of p_aO_2 at high (normal) saturation levels. The clinical rule of thumb in acute situations is to aim for a saturation reading of 90-95 per cent. (A healthy person breathing room air will show a S_aO_2 of 95 %.) As a fringe benefit, the pulse oximeter will also indicate the patient's heart rate. Of the measuring errors that can occur, the only one that needs to be considered in the acute situation is failure of the sensor probe to obtain a reading, due to poor peripheral circulation or vasoconstriction.		Pulse oximeter (either as a separate apparatus, or as part of a modular monitor). In its simplest form provides digital display of S_aO_2 and pulse, often together with an indicator of signal strength. More sophisticated machines may present trend curves,, as well as providing print-outs and/or data transfer.

TRAINING	TREATMENT	EQUIPMENT

ROLE 3

	For patients not responding rapidly to treatment at Role 2, and/or where a diagnosis has not been made.	
Where a respiratory emergency has progressed to this stage, the chances are small of returning the patient to his unit within the normal evacuation policy time limits. Plan for the repatriation of these patients (i.e. to Role 4).	Where respiratory effort is grossly inadequate, or much laboured, the first mode of action in the hospital setting always is to intubate, and put the patient on a ventilator. This, obviously, requires an adequate level of care (ICU or equivalent). Before instituting ventilator treatment, the presence of a tension pneumothorax must always be ruled out!	Equipment and drugs for tracheal intubation (see triptychs A.03 and A.04). Ventilator with humidifier (see triptych A.04) Equipment for bronchoscopy (if available)
		Pulse oximeter Capnograph
	Various methods for monitoring include: Pulse oximetry – *see* Role 2	
	Capnography – measures the carbon dioxide content of the patient's expired air. Can be used as an aid to ventilator therapy.	PEF apparatus
	PEF (peak expiratory flow) measurements – for verification of therapeutic effect in spontaneously breathing patients.	Arterial blood gas analyser
	Arterial blood gas analysis (ABG's). For precise monitoring, and for the titration of ventilator settings and oxygen concentration. The most important values in the emergency situation are the oxygen partial pressure (p_aO_2), the carbon dioxide partial pressure (p_aCO_2), and the pH.	X-ray machine
	Other lab tests – of little use in the acute setting.	CT scanner
	Pulmonary X-ray – seldom essential in the initial phase of treatment, but important to rule	

TRAINING	TREATMENT	EQUIPMENT
	out other diagnoses in complicated cases, and to ascertain progress. To visualise a pulmonary embolus, a CAT scan is the method of choice.	
While a patient is treated at a Role 3 facility, it may be judged that the primary (empirical) treatment of a severe infection has failed. As mentioned under Role 2, at least 72 hours should normally elapse before the antibiotic regime is changed. This, however, necessitates that certain secondary choice antibiotics are available at Role 3.	Bacteriological cultures (with Gram's stains) and other laboratory tests for verification of antibiotic therapy. However, a preliminary etiologic diagnosis has to be made, and empirical treatment started before results are in. Reports on bacteriological cultures must include antibiotic sensitivity tests, to be consulted in cases of therapy failure. Cultures should be made both from sputum and blood. Blood should also be obtained for serologic tests (both high acute titres, and titre rises indicative of viral cause). Urine antigen tests exist for *Str. pneumoniae* and *Legionella* spp. Antibiotic treatment in severe cases of therapy failure.	Swabs, test tubes etc for bacteriological cultures and lab tests Secondary choice antibiotics, *see* Role 2 above.

D.06 ACUTE MANAGEMENT OF FEBRILE ILLNESS

PREAMBLE

For the purposes of this Triptych, fever is arbitrarily defined as a deep body (or core) temperature of 38°C or more.

Fever occurs when heat production exceeds heat loss; due either to decreased heat loss or increased heat production.

Causes of fever can be divided into three groups:

Heat Illness, usually related to exercise
Infection and Inflammatory diseases
Miscellaneous e.g. malignant hyperpyrexia

Each of these will be dealt with in the triptych.

When deciding which part of the triptych to use in the management of any particular febrile patient, particular emphasis must be given to the preceding circumstances. A careful history will often provide sufficient information to allow reasonably accurate diagnosis. For instance, if the patient has recently undertaken strenuous physical exercise, the cause of the fever should be assumed to be heat illness until proven otherwise. Although briefly discussed in this triptych, this form of febrile illness is covered in more detail in the triptych on “Heat related Illness”

If the patient has recently received anaesthetic drugs or anti-psychotic medication, the possibilities of malignant hyperpyrexia or neuroleptic malignant syndrome should be considered. Again, this topic will be briefly covered here for completeness, however the incidence of these is rare and will generally be initially recognized by the specialist administering the relevant causative drugs.

Most patients presenting with febrile illness as the primary complaint will have some form of infectious or inflammatory disease. The specific causative agents are of course quite numerous and variable. A detailed history is required to determine the nature and pattern of fever, other associated symptoms, potential infectious contact or vector contact, and so on. This triptych does not attempt to cover the presentation of nosocomial “Fever Of Unknown Origin” which can occur in hospital patients particularly in the critical care or post -operative surgical patient. The intent is to provide a rational, yet simplistic approach to dealing with the previously healthy patient who presents with a fever.

One of the more important capabilities which will impact on the ease or ability for diagnosis of infectious causes of febrile illness will be the presence or absence of Microbiological laboratory capability. Many of the more common infectious diseases can now be diagnosed with rapid immunological testing. These tests are relatively easy to use and can often be deployed to Role 2 and even some Role 1 scenarios. Basic microscopic techniques such as gram stain and blood smears may also be easily deployed at thes levels. Laboratory requirements for more traditional cultures and determination of antibiotic sensitivities as are currently performed however, require significant equipment and rigorous environmental controls that may be very difficult to deploy at even the Role 3 Level. This will greatly limit the ability to determine specific diagnosis. A basic approach however, will generally enable at least a reasonable approximation and the institution of empirical antimicrobial therapy, until such time as definitive diagnosis can be confirmed.

TRAINING	TREATMENT	EQUIPMENT

HEAT ILLNESS

ROLE 1 and 2

General Training of all military personnel in the recognition of and prevention of heat illness is the responsibility of every individual commander. First Aid Prevention and first aid measures – self help and buddy help. Principles Differences between oral, rectal, oesophageal, tympanic and axillary temperatures Homeostatic mechanisms that maintain normal body temperature. At-risk groups: -very young and very old -increased ambient temperatures and humidity -those undertaking unaccustomed or prolonged physical activity -athletes -military recruits Spectrum of severity: -Heat cramps -Heat exhaustion -Heat stroke In heat cramps and heat exhaustion, homeostatic mechanisms still function but		Thermometers suitable for reading core temperature; usually rectal at Roles One and Two. Oesophageal probes to be available at Role Three.

TRAINING	TREATMENT	EQUIPMENT
are overwhelmed. In heat stroke, all thermoregulatory control is lost. Mortality in the latter case is approximately 10%.	Rehydrate with oral electrolyte solutions Return to unit once fully recovered	
Heat Cramps Core temp 37-39 degrees C Mental function normal Sweating during exercise and replacement with hypotonic fluids causes sodium deficiency. Cramps occur in muscles used in heavy work	In mild cases, rehydrate with oral electrolyte solutions More severe cases require IV Saline 0.9% or Saline/Glucose. Use clinical signs to guide therapy. Urea and Electrolyte assays and Haematocrit are useful, but not usually available until Role Three.	Oral Electrolyte Solutions
Heat Exhaustion Core temp <40 degrees C Mental function normal Mixed sodium and water depletion Symptoms include weakness, fatigue, headache, vertigo, nausea, vomiting. Tachycardia and sweating occur	Avoid over-transfusion, which may cause pulmonary or cerebral oedema Evacuate to Role Three	Oral Electrolyte Solutions Isotonic IV Fluids, IV Cannulae, Giving Sets
Heat Stroke Suspect in anyone who collapses during or after exercise Core Temp is very high (>40 degrees C) Multi-system damage, especially to CNS Features:	Remove all clothing and from hot environment Secure airway and give 100& oxygen Cool: spray with tepid tap water and blow air over body with fans. Apply ice packs to axillae, groins, neck and scalp. Aim for cooling rate of 0.1 degree C per minute. Stop cooling when core temp is 37 degrees C, in order to prevent over-cooling. IV Fluids. Give 50 ml of 50% dextrose if blood sugar <4.0. Resuscitate with 0.9% Saline.	Airway equipment Oxygen Ice Packs IV Cannulae, Fluids and Giving sets Urinary catheters and collection bags

TRAINING	TREATMENT	EQUIPMENT
-Sweating may or may not occur -Confusion, delirium, fitting, coma, tremor, cerebellar dysfunction -Tachycardia, hypotension, arrhythmias -coagulopathy; melaena, haematuria, purpura, conjuctival haemorrhages	Catheterise and aim for urine output >50mls per hour Use IV diazepam for seizures Evacuate to Role Three	Diazepam IV preparation Bedside Glucose measuring strips

TRAINING	TREATMENT	EQUIPMENT

ROLE 3

As above for Roles One and Two	Treatment of Heat Exhaustion As for Roles One and Two Monitor Urea, Electrolytes, Haematocrit Use blood results to guide fluid therapy Treatment of Heat Stroke As for Roles One and Two Measure Arterial Blood Gases, Urea, Electrolytes, Clotting, Liver Function Tests, Calcium Perform Chest X-Ray and 12-Lead ECG Consider cold gastric or peritoneal lavage if cooling techniques described above do not achieve satisfactory rate of cooling If urine output < 50mls per hour, consider Bicarbonate or Mannitol	Laboratory Facilities Laboratory facilities Radiology facilities ECG machine Nasogatric tubes Peritoneal Dialysis catheters Sodium Bicarbonate 8.4% Mannitol 20%

TRAINING	TREATMENT	EQUIPMENT

B. FEVER DUE TO INFECTION OR INFLAMMATION

ROLE 1 and 2

Causes of Pyrexia Bacterial infection Mycobacterial infection Viral infection Protozoal infection Chlamydial and Rickettsial infection General Management Principles Antipyretic medication Microbiological investigations before starting treatment Antibiotic sensitivities Antiviral therapy	General Treatment Resuscitate ABC's: -Airway -Breathing -Circulation Treat symptomatically with antipyretics If well, consider treatment with oral drugs, including antibiotics if indicated. Then return to unit Collection of Samples Collect:: -Blood -Urine -Sputum -CSF if clinically indicated These should be collected before antibiotic treatment is started *Empirical Treatment* Treat bacterial infections with broad spectrum antibiotics See Triptych 'Antibiotic Policy in the Field' for more specific guidance for particular conditions. Indications for Evacuation Deranged physiological parameters Possible serious sepsis e.g. Septicaemia, meningitis, malaria etc.	See Triptych A.02 'Resuscitation in the Field' Antipyretics e.g. Aspirin, Paracetamol Blood Culture Bottles Collection pots Spinal Needles Antibiotics. See Triptych A.06 'Antibiotic Policy in the Field'

TRAINING	TREATMENT	EQUIPMENT
	Failure to respond to simple therapy If any of these pertain, evacuate to Role Three.	

TRAINING	TREATMENT	EQUIPMENT

ROLE 3

As for Roles One and Two	*Investigations*: Cultures as above Full Blood Count, Glucose, Urea, Electrolytes, Liver Function Tests Lumbar Puncture if indicated Virology Thick and Film Blood films Chest X-Ray Invasive Monitoring Central venous pressure Pulmonary artery wedge pressure Arterial blood pressure Intensive Care Respiratory support Inotropic support Evacuate to Role Four if indicated	 Laboratory facilities Radiology Spinal needles Microscope Virology assays CVP equipment Swann-Ganz equipment Arterial lines Ventilators Inotropes

TRAINING	TREATMENT	EQUIPMENT

C. MISCELLANEOUS CONDITIONS

ROLE 3

Malignant Hyperpyrexia Rare Associated with anaesthetic drugs e.g. Halothane, Suxamethonium Rapid rise in core temperature Features include muscle rigidity, leading to rhabdomyolysis, oxygen consumption and high carbon dioxide levels	Treatment of Malignant Hyperpyrexia Resuscitate ABC's: -Airway -Breathing -Circulation Stop anaesthesia. Give 100% Oxygen Intravenous Dantrolene 1mg/kg, repeated as necessary up to maximum cumulative dose of 10mg/kg Cool patient with ice Correct acidosis with Sodium Bicarbonate Forced diuresis, using Mannitol, Furosemide	See Triptych 'Resuscitation in the Field' Dantrolene Sodium Bicarbonate 8.4% Mannitol 20% Furosemide
Neuroleptic Malignant Syndrome Occurs in some patients on antipsychotic drugs (e.g. Chlorpromazine, Haloperidol). Features include: -Increased core temperature -Muscle rigidity -Extrapyramidal signs -Autonomic dysfunction	*Treatment of Neuroleptic Malignant Syndrome* Resuscitate ABC's: -Airway -Breathing -Circulation Stop antipsychotic drugs Consider Dantrolene	See Triptych 'Resuscitation in the Field' Dantrolene

D.07.0 CARDIOLOGICAL EMERGENCIES: PART 1
ACUTE CORONARY SYNDROME (UNSTABLE ANGINA AND MYOCARDIAL INFARCTION)

PREAMBLE

Part One of this triptych deals with Acute Coronary Syndromes (ACS). Part Two deals with related path physiologies: Hypertensive Emergencies, Acute Pulmonary Edema, and Arrhythmia Management. These subjects are arbitrarily divided for clear presentation but in reality they can be interrelated and manifest simultaneously in the same patient.

- General considerations:

Coronary artery disease manifests symptomatically more frequently in an aging population, and the presenting symptoms tend to change with age. Chest pain is a symptom, not a diagnosis. Chest pain in this context implies a wide symptom complex. “Chest discomfort” may be a more appropriate term. Acute Coronary Syndromes symptoms are non-specific, they present with variations of chest discomfort and shortness of breath.

Acute Coronary Syndrome (ACS) is a broad term that may include the diagnoses of unstable angina, non-ST-segment elevation myocardial infarction, and acute myocardial infarction (AMI). Consider ACS a continuum of illness that a patient may progress through- from asymptomatic to plaque rupture and thrombus formation.

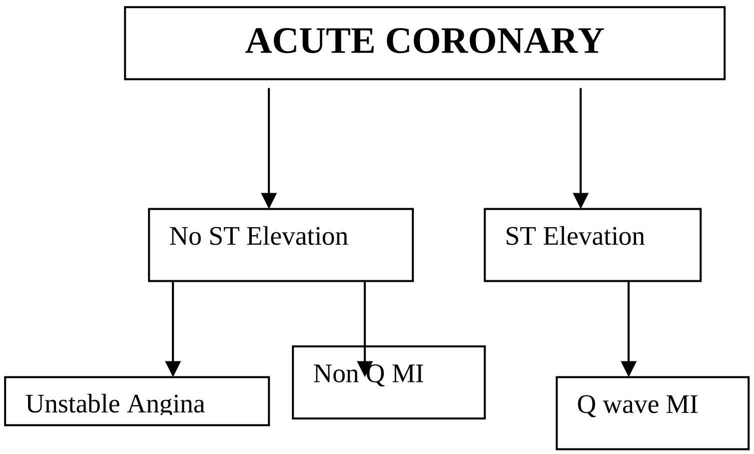
The extreme of the clinical continuum known as Acute Coronary Syndrome is myocardial infarction. The large majority of patients with Acute Myocardial Infarction (AMI) have coronary artery disease (CAD). Concepts concerning the cause of AMI include the interaction of multiple factors that also cause unstable angina: progression of the atherosclerotic process to the point of total occlusion, plaque fissuring and subintimal hemorrhage at the site of an intimal plaque, platelet aggregation and thrombosis at the site of existing narrowing, coronary artery spasm, and coronary artery embolism. Infarction is death of the tissue however some of processes of progression to MI are reversible thus the rational for antiplatelet, thrombolytics, and invasive procedures. Time is of the essence and is the key determinant of success.

- Transfer of patients with cardiological emergencies:

The optimal outcome occurs when a patient is taken directly and swiftly to a Role 4 facility where all relevant capabilities are on site and further transfer is unnecessary. However increased risk in mortality may be associated to inadequate level of treatment and stabilization prior to and during the transfer. Particularly, from a Role 2/3, patients must never be transferred before the medical crew makes sure that the necessary equipment for monitoring and resuscitation procedures is available.

SUMMARY:

Patients with thoracic pain compatible with myocardial ischemia should be transferred to a Role 2 or higher Role if available as quickly as possible and an ECG tracing performed. Initial management includes rest, sublingual nitroglycerin and aspirin. Accessibility to a defibrillator should be available. If ECG tracing discloses ST elevation, reperfusion strategy is to be implemented immediately. If no ST elevation is present, the probability of myocardial ischemia and risk factor evaluation is essential for adequate management.



In Acute Coronary Syndrome (ACS) there are two principal ECG groups. Patients with No ST Elevation probably have Unstable Angina (UA) or Non Q Myocardial Infarction (Non Q MI). Patients with ST Elevation will probably develop Q wave Myocardial Infarction.(Q wave MI).

TRAINING	TREATMENT	EQUIPMENT

I. UNSTABLE ANGINA AND NO Q MI

ROLE 1

Care providers on Role 1 must know the principles of cardiopulmonary resuscitation, according to ABC-principles. Elicit appropriate, focused history, that includes characterization of the pain and assessment of risk factors.	ANTI- ISCHEMIC TREATMENT Bed rest. ECG, if available. Oxygen at 4 L/min. Nitroglycerin (NTG) sublingual tablet or spray; repeat twice at 5- minute interval for active chest pain unless Systolic BP < 90 mm Hg. Aspirin (160 to 325 mg) Morphine 2 mg IV if pain not relieved with NTG. Transfer patients directly and swiftly to the higher Role available!.	Stethoscope. Sphygmomanometer. EKG set and/or EKG monitoring with defibrillator if available. Oxygen supply and administration kits (facial masks). IV infusion sets. Nitroglycerin 0,4 mg sublingual or spray Aspirin tablets (chewable aspirin is absorbed more quickly than swallowed tablets in the early management). Morphine, 10 mg injection.

TRAINING	TREATMENT	EQUIPMENT

ROLE 2 and 3

ACS should be seen initially in a Role 2 or 3 if possible. Management of ACS in these Roles includes: ABC survey, provide Basic/Advanced CPR if appropriate, check heart rate and blood pressure, perform ECG, treatment for pain relief, stabilize, classify into a low/intermediate/high risk group and, finally, refer to a higher Role if available. Clinical presentation: Patients with UA/No Q MI have three principal presentations: Rest Angina: Angina occurring at rest and prolonged, usually >20 minutes. New-onset angina. Increasing angina: Previously diagnosed angina that has become distinctly more frequent, longer in duration or lower in threshold. Patients with suspected ACS with chest discomfort at rest for >20 min, hemodynamic instability, or recent syncope or presyncope should be referred immediately to the higher medical Role available.	Bed rest with continuous ECG monitoring in patients with ongoing rest pain. Serial ECG's Nitroglycerin, sublingual tablet or spray, followed by IV infusion administration for ongoing chest pain. Infusion is administered by pump with a dose of 0,5 – 4 mg/h. Add 50 mg of Nitroglycerin to 250 ml D5%W and start at 3 ml/min. Oxygen , 4 L/ min; continue if hypoxemia, cyanosis, respiratory distress or arterial oxygen saturation <90%. Aspirin. Patients should chew 200-250 mg initially and then 75-325 mg orally each day. If contraindications: *Clopidogrel*, tablets, 75 mg/day. Morphine 2 to 4 mg IV when symptoms are not immediately relieved with NTG or when acute pulmonary congestion. β-blockers (unless contrindications are present) with the first dose administered IV if there is ongoing chest pain, followed by oral administration. Doses require to be adjusted in an individual way for each patient. The goal is to	Stethoscope. Sphygmomanometer. EKG set. EKG monitoring with defibrillator Pulse-oximeter. Oxygen supply and administration kits (facial masks). IV infusion sets. Ventilatory-bags. If ventilatory support: see relevant triptych. Lab tests for complete blood count, electrolytes, BUN, creatinine, cardiac enzymes and coagulation. Aspirin tablets. Morphine, 10 mg injection Nytroglycerin 5 ml/ 5 mg and 10 ml/ 50 mg injection. β-blockers, tablets, injection.

TRAINING	TREATMENT	EQUIPMENT
Other patients with a suspected ACS may be seen initially in a Role 2/3 . UA/Non Q MI Clinical Triage: Chest pain or severe epigastric pain, typical of myocardial ischemia or MI: Substernal pressure or crushing chest pain Pressure, tightness, heaviness, cramping, aching sensation Unexplained indigestion, belching, epigastric pain Radiating pain to neck, jaw, shoulders, back or to one or both arms Associated dyspnea, nausea and/or vomiting, diaphoresis If these symptoms are present obtain initial 12- lead ECG! Regardless of the initial management, check cardiac enzymes to diagnose myocardial necrosis. If laboratory facilities are not available, serum should be collected, spun down, if possible, and kept on ice until sent with the patient at the time of medical evacuation.	obtain in rest a heart rate around 60 bpm.. *Atenolol* can be given by intravenous push in 2 separate 2.5 to 5-mg doses and then 25 mg PO every 12 hours. *Metoprolol* is administered IV in 3 separate 5-mg doses. Then give 50mg PO every 6 hours A nondihydropyridine Ca2+ blocker (e.g. *verapamil or diltiazem*) as initial therapy in patients with continuing or frequently recurring ischemia when b-blocker is contraindicated. An Angiotensin Convering Enzyme Inhibitor (ACEI) in patients with heart failure, acute pulmonary congestion or hypertension despite treatment with NTG and a β-blocker Low molecular weight heparin (LMWH) : *Enoxaprin* 1 mg/kg subcutaneous every 12 hours is effective to adjusted dose heparin in unstable angina and non-Q wave infarction. GP IIb-IIIa inhibitors. Platelet aggregation and thrombosis play a key role in the development of unstable coronary syndromes and their ischemic complications. GP IIb-IIIa inhibitors (eptifibatide, abciximab or tirofiban), by blocking the terminal	Nondihydropyridine Ca^{2+} blockers, tablets. Angiotensin Converting Enzyme inhibitors (ACEI), tablets. Low molecular weight heparin. Enoxaparin, subcutaneos.

TRAINING	TREATMENT	EQUIPMENT
Absolute contraindications to β-blockers are: Severe Left Ventricular Failure and Pulmonary Edema. Heart rate (HT) < 60 bpm. Systolic BP < 100 mm Hg. Signs of poor peripheral perfusion. Second or third degree hear block. Contraindications for GP IIb-IIIa Therapy Active internal bleeding or bleeding diathesis within 30 days. History of stroke within 30 days or any history of hemorrhagic stroke. Severe hypertension (systolic blood pressure >200 mm Hg or diastolic blood pressure >110 mm Hg) not adequately controlled on antihypertensive therapy. Acute pericarditis. Major surgery or trauma within 6 weeks. Serum creatinine ≥ 2.0 mg/dL. Current or planned administration of another parenteral GP IIb/IIIa inhibitor. History, symptoms or findings	step in platelet aggregation, prevent thrombus formation. Patients with unstable angina or non-ST segment elevation myocardial infarction are considered candidates for GP IIb-IIIa inhibitors therapy (see contraindications). *Eptifibatide (Integrilin)* is a selective, reversible GP IIb-IIIa inhibitor. The recommended doses of *eptifibatide* is 180 microgram/Kg given as an intravenous bolus as son as possible after diagnosis, then 2 microgram/Kg/min as a continuous intravenous infusion administered until discharge or percutaneous coronary intervention is started (maximun duration should be 72 h). Patients pretreated with aspirin and heparin should not discontinue the treatment with these agents. Transfer, if necessary, should be performed in conjunction with continued GP IIb-IIIa inhibition, based on either the patient's high risk profile or the likelihood of subsequent revascularization. 13. Transfer the patient to a Role 4 as quickly as possible!.	GP IIb-IIIa inhibitors, injection (e.g. *Eptifibatide*).

TRAINING	TREATMENT	EQUIPMENT
suggestive of aortic dissection. Platelet count <100,000/mm. Known hypersensitivity to any component of the product.		

TRAINING	TREATMENT	EQUIPMENT

II. ACUTE MYOCARDIAL INFARCTION (AMI)

ROLE 1

Training in the principles of cardiopulmonary resuscitation, according to ABC-principles. Appropriate history, focused on risk factors. Basic stabilization. Goal is to preserve myocardium. Pain control. IF ECG available determine if Inferior/right/posterior or anterior. Caution with hypotensive agents in Inferior/ Right heart MI	1. Inmediate Assesment: ABC survey. Basic Cardiac Life Support if needed Measure vital signs (standard BP cuff) Obtain IV access. Obtain 12-lead ECG, if available. Perform brief, targeted history and physical exam; focus on eligibility for fibrinolityc therapy. 2. Immediate general treatment: Oxygen at 4 L/m Aspirin 160 to 325 mg chewed or swallowed as soon as possible after symptom onset. Nitroglycerin (NTG) sublingual tablet or spray; repeat twice at 5- minute interval for active chest pain unless Systolic BP < 90 mm Hg. Morphine IV, 2 mg IV (if pain not relieved with NTG) or meperidine (if HT< 60bpm) 25 mg IV. 3. Transfer patients directly and swiftly to the higher Role available!.	Stethoscope. Sphygmomanometer. EKG set and/or EKG monitoring with defibrillator, if available. Oxygen supply and administration kits (facial masks). IV infusion sets. Nitroglycerin 0,4 mg sublingual or spray Aspirin tablets (chewable aspirin is absorbed more quickly than swallowed tablets in the early management). Morphine, 10 mg injection. Stethoscope. Sphygmomanometer. EKG set.

TRAINING	TREATMENT	EQUIPMENT
		EKG monitoring with defibrillator Pulse-oximeter. Continuos blood pressure monitoring: Direct (intraarterial) or indirect (cuff). Chest portable x-ray. Oxygen supply and administration kits (facial masks). IV infusion sets. Ventilatory-bags. If ventilatory support: see relevant triptych. Lab tests for complete blood count, electrolytes, glucose, BUN, creatinine, cardiac enzymes and coagulation. Aspirin tablets. Morphine, 10 mg injection Nytroglycerin 5 ml/ 5 mg and 10 ml/ 50 mg injection. β-blockers, tablets, injection. Angiotensin Converting Enzyme inhibitors (ACEI), tablets.

TRAINING	TREATMENT	EQUIPMENT
		Low molecular weight heparin. Enoxaparin, injection. Thrombolytic agents, injection.

TRAINING	TREATMENT	EQUIPMENT

ROLE 2 and 3

Training in the principles of cardiopulmonary resuscitation, according to ABC-principles. Serial ECG's evaluation Goals of treatment are to limit the ischemic damage and stabilize the patient. Risk stratification is essential in assessing the probability of ACS. This includes a history focused on the characterisation of the pain by location, nature, radiation, what made it better, and what made it worse. Be suspicious of atypical presentations for ACS (fatigue, dyspnea or epigastric pain). Check past medical history to learn about risk factors. The ECG has a central role in the early risk stratification approach to ACS; it has a limited role in excluding the diagnosis. The terms Q wave and non-Q wave infarction are used to distinguish between a transmural (Q-wave), and non transmural (subendocardial) infarction. In general Q-wave infarctions tend to be larger and damage more myocardial tissue than non-Q wave infarctions. Serial ECG's and serum markers	1. Inmediate Assesment: ABC survey. Advanced Cardiac Life Support if needed Measure vital signs (automatic/standard BP cuff) Measure oxygen saturation. Obtain IV access. Obtain 12-lead ECG. Perform brief, targeted history and physical exam; focus on eligibility for fibrinolityc therapy. Obtain initial serum cardiac marker levels, electrolyte and coagulation tests. Request portable chest x-ray. 2. Immediate general treatment: Oxygen at 4 L/m Aspirin 160 to 325 mg., chewed or swallowed, as soon as possible after symptom onset. Maintenance dose of 75-325 mg daily should be taken indefinitely. If any contraindications: *Clopidogrel*, tablets, 75 mg/day. Nitroglycerin (NTG) sublingual tablet or spray; repeat twice at 5-minute interval for active chest pain unless Systolic BP < 90 mm Hg. Morphine IV , if pain not relieved	Stethoscope. Sphygmomanometer. EKG set. EKG monitoring with defibrillator Pulse-oximeter. Continuos blood pressure monitoring: Direct (intraarterial) or indirect (cuff). Chest portable x-ray. Oxygen supply and administration kits (facial masks). IV infusion sets. Ventilatory-bags. If ventilatory support: see relevant triptych. Lab tests for complete blood count, electrolytes, glucose, BUN, creatinine, cardiac enzymes and coagulation.

TRAINING	TREATMENT	EQUIPMENT
of total CK, CK-MB, troponin are critical in diagnosis and decisions in regards to thrombolytic therapy. The presence of significant ST-segment elevation in appropriate leads (>1 mm in two or more contiguous limb leads or 2 or more contiguous precordial leads) meet the guidelines for reprofusion therapy by either fibrinolytic therapy or coronary angioplasty. Appropriate patients with new Left Bundle-Branch Block (LBBB) should also receive coronary reperfusion therapy. Monitoring the patient for blood pressure changes and secondary arrythmias as a consequence of AMI is essential for successful resuscitation. Low risk patients with chest pain, with stable clinical status and a normal or nondiagnostic ECG, should be checked by 6 to 12 h of monitoring and serial cardiac biomarkers. In addition, patients with ischemia should be distinguished from those with other potentially serious (aortic dissection, pericarditis, pulmonary embolism) or less serious causes of chest pain. Ischemic pain due to stable angina is often relieved or lessened within 2 to 5 min of the	with NTG. Add 10 mg / 1 ml (1%) morphine to 9 ml Normal Saline and give 2-4 ml (= 2-4 mg) bolus, then repeated this dose every 10-15 minutes until pain is relieved. Check respiratory status. Meperidine 25 mg IV, if HT<60 bpm. 3. Adjunctive treatment (ST elevation or new LBBB): (As indicated, do not delay fibrinolityc therapy). Nitroglycerin IV. Nitroglycerin may cause hypotension, especially in patients with right ventricular infarction. After sublingual tablet or spray, continue with IV infusion. Infusion is administered by pump with a dose of 0,5 – 4 mg/h. Add 50 mg of Nitroglycerin to 250 ml D5%W and start at 3 ml/min. β-Blockers. Early intravenous treatment is recommended for AMI in the absence of contraindications (see Training). First dose is administered IV if there is ongoing chest pain, followed by oral administration. Doses require to be adjusted in an individual way for each patient. The goal is to obtain a heart rate around 60 bpm in rest. *Atenolol* can be given by intravenous push in 2 separate 2.5	Aspirin tablets. Morphine, 10 mg injection Nytroglycerin 5 ml/ 5 mg and 10 ml/ 50 mg injection. β-blockers, tablets, injection.

TRAINING	TREATMENT	EQUIPMENT
administration of sublingual nitroglycerin whereas pain due to infarction may not be relieved by nitroglycerin. Pharmacologic treatment for MI can be divided into antiischemic and anti-thrombotic therapy. Three types of antithrombotic therapies are utilized including antiplatelet agents, anticoagulants, and fibrinolytics. Standard treatment for acute ACS, regardless of whether it is unstable angina or myocardial infarction, consists of oxygen, nitrates, aspirin, heparin, and, unless a contraindication exists, ß-blockers. Fibrinolytics are indicated only for patients with myocardial infarction associated with ST segment elevation and are not indicated for those with unstable angina or myocardial infarction not associated with ST segment elevation. Other Laboratory test and Diagnostic Procedures: Right-sided ECG leads should be recorded in patients with evidence of inferior or posterior MI. Posterior ECG leads (V 7 through V 9) should be recorded in patients in whom posterior infarction is	to 5-mg doses and then 25 mg PO every 12 hours. *Metoprolol* is administered IV in 3 separate 5-mg doses. Then give 50mg PO every 6 hours Heparin: Patients with acute myocardial infarction are considered candidates for heparin therapy. Low-molecular weight heparins (LMWHs) have a number of advantages over unfractionated heparin (UFH), including ease of administration. *Enoxaparin* is given at doses of 1 mg/kg subcutaneously / 12 hrs. Angiotensin Convering Enzyme Inhibitor (ACEI) after 6 hours or when stable. Appropriate starting doses of an ACEI in patients with acute MI include: *captopril* 6.25-12.5 mg every 8 hours, *enalapril* 2.5-5.0 mg every 12 hours or *ramipril* 2.5-5.0 mg once daily. The dosage should be gradually titrated upward over a period of several days to achieve daily maintenance dosages of captopril 150 mg, enalapril 20 mg or ramipril 10 mg, (or equivalent dosages of other ACE inhibitors). Contraindications to early initiation of an ACE inhibitor include systolic blood pressure of less than 100 mm Hg, worsening renal function, and	Low molecular weight heparin. Enoxaparin, injection. Angiotensin Converting Enzyme inhibitors (ACEI), tablets. Thrombolytic agents, injection.

TRAINING	TREATMENT	EQUIPMENT
suspected. In addition to cardiac enzymes (total CK, CK-MB, troponin), obtain peripheral blood smear, glucose, BUN, creatinine, electrolytes and coagulation. If laboratory facilities are not available, serum should be collected, spun down, if possible, and kept on ice until sent with the patient at the time of medical evacuation. Obtain chest portable x-ray. Standard echocardiography cannot be recommended for routine use in this setting because of technical limitations, resource requirements and limited incremental diagnostic value. <u>Absolute contraindications to β-blockers</u> are: Severe Left Ventricular Failure and Pulmonary Edema. Heart rate (HT) < 60 bpm. Systolic BP < 100 mm Hg. Signs of poor peripheral perfusion. Second or third degree hear block. <u>Absolute and Relative Contraindications for Fibrinolytic Therapy:</u> *Absolute Contraindications*	known intolerance to this class of drugs. Time from onset of symptoms within 12 hours: *Reperfusion therapy: Thrombolysis:* *Consider Angioplasty if a Role 4, where all relevant capabilities are on site, is available.* *Fibrinolityc therapy as soon as possible. Current data do not provide a clear mandate for selecting one thrombolytic agent (alteplase, reteplase, tenecteplase, SK) over another. Indeed, the avoidance of undue treatment delays is more crucial than the choice of agent for minimizing myocardial damage. A* Tenecteplase (TNK) plus Enoxaparin protocol *is ease of administration: Tenecteplase 30 to 50-mg (depending on weight*) i.v. bolus over 5 sec plus enoxaparin 30-mg IV bolus followed immediately by 1 mg/kg subcutaneously every 12 hrs up to discharge or revascularization for a maximum of 7 days*. *Time from onset of symptoms after 12 hours*: Adjunctive therapy as noted above.	

TRAINING	TREATMENT	EQUIPMENT
Previous hemorrhagic stroke at any time or cerebrovascular events within 1 year. Known intracranial neoplasm. Active internal bleeding (does not include menses). Suspected aortic dissection. *Relative Contraindications:* Severe uncontrolled hypertension on presentation (BP> 180/110 mm Hg). History of prior cerebrovascular accident or known intracerebral pathology not covered in contraindications. Current use of anticoagulants in therapeutic doses (INR > 2); known bleeding diathesis. Recent trauma (within 2-4 wks.) including head trauma. Noncompressible vascular punctures. Recent (within 2-4 wks.) internal bleeding. For strptokinase (SK)/anistreplase: prior exposure. Pregnancy. Active peptic ulcer. History of chronic hypertension.	In selected patients, consider reperfusion therapy if appropriate. 4. Transfer patient to a Role 4 as quickly as possible!.	

TRAINING	TREATMENT	EQUIPMENT

* TENECTEPLASE (TNK) DOSAGE:

WEIGHT	DOSAGE
<60	30 mg – 6000 IU – 6 ml
60-<70	35 mg – 7000 IU – 7 ml
70-<90	40 mg – 8000 IU – 8 ml
80-<90	45 mg - 9000 IU - 9 ml
90	50 mg - 10000 IU – 10 ml

D.07.1 CARDIOLOGICAL EMERGENCIES: SECOND PART: HYPERTENSIVE EMERGENCY, ACUTE PULMONARY EDEMA AND ARRITHMIA MANAGEMENT

PREAMBLE

Cardiological emergencies in the field should be seen initially in a Role 2 or 3 if possible. Management of the emergencies described in this chapter includes: ABC survey, provide Basic/Advanced CPR if appropriate, check heart rate and blood pressure, perform ECG, stabilize, classify into a low/intermediate/high risk group and, finally, refer to a higher Role if available.

- Clinical Situations:

HYPERTENSIVE EMERGENCY:
Hypertensive crisis is defined as having a diastolic Blood Pressure (BP) greater than 120 mm Hg. Or systolic BP greater than 200 mm Hg.. Hypertensive emergency is further characterized by end organ damage (hypertensive encephalopathy, stroke, acute pulmonary edema, acute myocardial infarction, adrenergic crisis, dissecting aortic aneurysm, and eclampsia), while hypertensive urgency is characterized by a lack of end organ damage. The most common cause of hypertensive crisis is inadequately treated primary (essential) hypertension.

ACUTE PULMONARY EDEMA:
Congestive heart failure (CHF) is a term used to describe conditions in which the heart is unable to adequately pump blood throughout the body and/or unable to prevent blood from "backing up" into the lungs.The most severe manifestation of CHF, Pulmonary Edema, develops when these conditions cause an increase in lung fluid secondary to leakage from pulmonary capillaries into the interstitium and alveoli of the lung.

ARRYTMIAS:
Arrhythmias, serious electrical abnormalities of the heart, cause most sudden coronary deaths. Establish ECG monitoring as soon as possible for all patients who collapse suddenly or who have symptoms of coronary ischemia or infarction. A quick diagnose can be made using defibrillator's paddles. Patients with acute myocardial infarction or severe ischemia have the greatest risk for serious arrhythmias during the first hour after the start of symptoms.

TRAINING	TREATMENT	EQUIPMENT

I. HYPERTENSIVE EMERGENCY

ROLE 1

General Training: History : asses for the following: Pre-existing hypertension. Pre-existing renal disease. History of cardiac or neurologic symptoms. Medication: Prescription. Illegal substance abuse: amphetamines, cocaine, LSD, other sympathetic CNS stimulants. Recent withdrawal from prescription antihypertensive drugs (particular attention should be given to clonidine and beta blockers). Physical Examination: BP. Left upper extremity and right upper extremity BP's: look for a difference in the two arms to asses for aortic disease. Examination of the heart for abnormalities in rate and rhythm, increased size, pericardial heave, clicks, murmurs, and third and fourth heart sounds. Neurological exam: check any deficit. Examination of the lungs for rales and evidence for bronchospasm. Ophthalmoscopy: look for signs of hypertensive emergency (papilla edema, and hard exudates).	*1.* General Measures*:* Bed rest. Establish IV access. Check Blood Pressure. Continuos monitoring of arterial pressure (Role 2/3). Place the patient on cardiac monitor (Role 2/3). Pulse-oximeter (Role 2/3). Do not wait for lab data to return before initiating therapy. Avoid too rapid lowering of the blood pressure. The initial goal in hypertensive emergencies is to reduce mean arterial blood pressure by no more than 25% (within minutes to two hours), then toward 160/100 mm Hg within two to six hours, avoiding excessive falls in pressure that may precipitate renal, cerebral, or coronary ischemia. 2. Pharmacologic Treatment Sedation. Consider the possibility of “false hypertension” due to anxiety, pain or stress. Captopril (ACE inhibitor): It is administered sublingual with a dose of 25 mg. If needed, dose of 25 mg every 10 to 15 minutes for a total of 3 doses. Excessive response may occur in cases of renal artery stenosis or after diuretics. Additionally, captopril should not be used during pregnancy. Nifedipine. Sublingual nifedipine is not	Stethoscope. Sphygmomanometer. EKG set. Diazepam (tablets 5 - 10 mg and injection 10 mg). Captopril, tablets 25 mg.

TRAINING	TREATMENT	EQUIPMENT
	recommended for hypertensive emergencies due to several serious adverse effects and the inability to control the rate or degree of fall in blood pressure. Transfer patients directly and swiftly to the higher Role available.	

TRAINING	TREATMENT	EQUIPMENT

ROLE 2 and 3

Laboratory Tests and other Diagnostic Procedures EKG looking for left ventricular hypertrophy, strain, ischemia-injury, or infarction. Chest x-ray looking for cardiomegaly and/or pulmonary edema. Peripheral blood smear. Electrolyte panel, glucose, BUN, creatinine, myocardial necrosis markers. Urinalysis with a dipstick testing for proteinuria and hematuria. CBC when available. Summary: Tailor the therapy to the situation and the patient Avoid too rapid lowering of the blood pressure Become familiar with the use of a few select drugs which will cover most situations. Institute appropriate oral therapy as soon as possible. <u>Special Situations:</u> - Hypertensive Encephalopathyis the syndrome of central nervous system impairment associated with hypertensive crisis. It is associated with severe headache, vomiting, visual disturbances, transient paralysis, convulsions or coma. Examination reveals papilledema, focal	Furosemide: It is a IV loop diuretic. It is administered I.V. with a dose of 20 mg. Nitroglycerin: It is administered by I.V. infusion pump with a dose of 0,5 to 4 mg/h. Add 50 mg of Nitroglycerin to 250 ml D5%W and start at 3 ml/min. Labetalol is a safe and effective agent, provided that the patient does not have asthma, heart failure, or heart block. Labetalol is an alpha and beta blocker. Add 2 vials of Labetalol (200 mg / 40ml) to 200 ml D5W and start at 2 ml/min. Continue until the desired BP is reached.. Labetalol can also be given as a 20mg bolus over 2 minutes. It is then repeated with a 40 mg dose every 10 minutes until the desired BP is reached or 300 mg have been given. Nitroprusside . It dilates both arteries and veins. It's onset of action is rapid and minute by minute BP monitoring is required. It is administered by I.V. infusion pump with a dose of 0.5 - 8 micrograms/kg/min. Add 50 mg of Nitroprusside to 250 ml DW5 and start at 10 ml/h. It has a rapid onset (seconds) and lasts for 3-5 minutes. Thiocyanate (a metabolite of nitroprusside which is excreted by the kidney) toxicity may occur if infusion is given too rapidly (more than 15 micrograms/kg/min) or > 48 hours. Nitroprusside is not recommended for use in pregnant patients.	Stethoscope. Sphygmomanometer. EKG set. EKG monitoring with defibrillator IV infusion sets. Pulse-oximeter. Continuous blood pressure monitoring: Direct (intraarterial) or indirect (cuff). Ophthalmoscope. Lab tests for complete blood count, eectrolytes, BUN, creatinine and cardiac enzymes. Urinalysis with a dipstick testing for proteinuria and hematuria. Pulmonary X-ray. Antihypertensive drugs: Captopril, tablets 25 mg. Furosemide, 20 mg. injection

TRAINING	TREATMENT	EQUIPMENT
neurologic findings, seizures, and disorientation. High blood pressure may cause infarction in areas of the brain. - Acute Ischemic Heart Disease: See First Part of Cardiological Emergencies. - Cerebrovascular disease. Treatment of hypertension after acute ischemic or hemorrhagic stroke is controversial. Elevated BP after a stroke is not a hypertensive emergency itself. Antihypertensive drugs are indicated for patients with markedly hypertensive condition or specific medical conditions. Antihypertensive therapy can lower the cerebral perfusion pressure and lead to worsening the stroke. - Cardiac Failure: See Acute Pulmonary Edema chapter in this triptych. - Preeclampsia: Preeclampsia is increased blood pressure accompanied by proteinuria, edema, or both and at times by abnormalities of coagulation and renal and liver function that may progress rapidly to a convulsive phase, eclampsia. Drug treatment must be used with caution as over aggressive treatment may cause reduced placental blood flow and fetal perfusion - Aortic Dissection: Aortic dissection is characterized by severe BP elevations accompanied by chest, back, or abdominal pain. Signs of aortic dissection include discrepant pulses, new aortic insufficiency murmur, and mediastinal	3. Special Situations: - Hypertensive Encephalopathy. This condition is associated with severe headache, vomiting, visual disturbances, transient paralysis, convulsions or coma. Administration of potent IV drugs (Nitroprusside, for instance) is warranted. Blood pressure should be reduced by 25% of the mean arterial pressure and should not be reduced below a diastolic BP of 100-120 mm. - Acute Ischemic Heart Disease: See First Part of Cardiological Emergencies. - Cerebrovascular disease. The eventual goal is to lower blood pressure gradually. SBP of >=180 mm Hg or DBP of >=110 mm Hg may be controlled with intravenous agents with careful monitoring for worsening of the neurologic status. - Cardiac Failure: See Acute Pulmonary Edema chapter in this triptych. - Preeclampsia: Hydralazine given intravenously is a safe regime. Hydralazine is given 5-10 mg every 20-30 minutes until BP is controlled and then 5-25 mg IV every 3-6 hours to maintain control. - Aortic Dissection: The goal of therapy should be to lower systolic BP to 120mm Hg and heart rate to 60 beats/min. Avoid direct vasodilators such as Hydralazine as these will increase heart rate. Labetalol	Nitroglycerin, 5 ml/ 5 mg and 10 ml/ 50 mg injection. Labetalol (Trandate), 20 ml/100 mg, injection. Nitroprusside, 50 mg injection. Nitroprusside solutions deteriorate when exposed to light so the IV solution must be covered with aluminum foil. Hydralazine, 20 mg injection.

TRAINING	TREATMENT	EQUIPMENT
widening on chest x-ray. - Renal Insufficiency: Renal insufficiency may be the cause or the result of the severe elevations of BP. Therapy is aimed at reducing systemic vascular resistance without compromising renal blood flow	20-40 mg IV q10min or as an infusion is a good choice.. - Renal Insufficiency:. Labetalol is a good choice. If necessary, it can be used Nitroprusside (but beware of thiocyanate toxicity in renal failure).	

TRAINING	TREATMENT	EQUIPMENT

II. ACUTE PULMONARY EDEMA

ROLE 1

General Training: Elicit focused history: There are several etiologies of Pulmonary edema ranging from Pulmonary edema secondary to altered capillary permeability (acute respiratory distress syndrome – ARDS-), volume overload, lymphatic insufficiency, neurogenic pulmonary edema, heroin or other overdoses, altitude pulmonary edema (HAPE), et cetera. This chapter is limited to cardiac causes of pulmonary edema. <u>Cardiac Causes</u>: The most common causes of congestive heart failure (CHF) are coronary artery disease and hypertension. Other diseases include valvular heart disease, congenital heart disease, other cardiomyopathies, myocarditis, and infectious endocarditis. CHF often is precipitated by cardiac ischemia or dysrhythmias. <u>Signs and Symptoms</u>: Tachypnea, using accessory muscles of respiration Anxiety, Restlessness, Cough, Inability to lie down. Hypertension Pulsus alternans (alternating weak and strong pulse indicative of depressed left ventricle function)	ABC survey. Basic Cardiac Life Support if needed. Administer supplemental oxygen, initially 100% nonrebreather facemask. Elevate the head of the bed (in a sitting position) to reduce venous return and decrease preload. Obtain intravenous access. Obtain ECG, if available. Provide nitroglycerin sublingual or spray ; repeat twice at 5- minute interval for active chest pain unless Systolic BP < 90 mm Hg. Furosemide: 0.5 to 1.0 mg/kg IV, if patient is hemodynamically stable. Transfer patients directly and swiftly to the higher Role available.	Stethoscope. Sphygmomanometer. EKG set. Oxygen supply and administration kits (facial masks). IV infusion sets. Nitroglycerin 0,4 mg sublingual or spray Furosemide, 20 mg injection.

TRAINING	TREATMENT	EQUIPMENT
Skin may be diaphoretic or cold, gray, and cyanotic. Jugular venous distention frequently is present. Wheezing or rales may be heard on lung auscultation. Apical impulse frequently is displaced laterally. Cardiac auscultation may reveal aortic or mitral valvular abnormalities, S_3 or S_4. Lower extremity edema also may be noted, especially in the subacute process. The cardiac conditions combined with asthma or symptoms of chronic obstructive pulmonary disease (COPD) are difficult clinical challenges.		

TRAINING	TREATMENT	EQUIPMENT

ROLE 2 and 3

As in Role 1 Laboratory Tests and other Diagnostic Procedures Laboratory Test: Creatinine, BUN, ALT, AST, bilirrubin, looking for signs of prerenal azotemia and congestive hepatopathy. Electrolytes. Cardiac enzymes. Arterial blood gas. Electrocardiogram (ECG) may suggest cardiac ischemia, myocardial infarction , cardiac dysrhythmias and chronic hypertension. Chest x-ray: Cardiomegaly may be observed and pleural effusions may be present. Early CHF may manifest as cephalization of pulmonary vessels and Pulmonary edema is characteristically observed as perihilar infiltrates in the classic butterfly pattern. Emergency transthoracic echocardiography (ECHO) may identify regional wall motion abnormalities, depressed ventricular function, pericardial effusion and valvular heart disease.	As in Role 1 Obtain ECG. Utilize cardiac monitoring and continuous pulse oximetry. Morphine 2 to 4 mg IV. Furosemide: 0.5 to 1.0 mg/kg IV, if patient is hemodynamically stable. Nitroglycerin: It is administered by I.V. infusion pump with a dose of 0,5 – 4 mg/h. Add 50 mg of Nitroglycerin to 250 ml D5%W and start at 3 ml/min if Systolic Blood Pressure is over 100 mmHg. In case of Hypertensive Emergency with no response to Nitroglycerin and Furosemide, consider Nitroprusside. It is administered by I.V. infusion pump with a dose of 0.5 - 8 micrograms/kg/min. Add 50 mg of Nitroprusside to 250 ml DW5 and start at 10 ml/h. Inotropic agents: Occasionally, patients develop severe heart failure that is refractory to the medications described so far. In these cases, consider a continuous intravenous infusion of an inotropic agent, a medication that stimulates the heart to contract more vigorously The most commonly used inotropic agents are Dobutamine and Dopamine. - Systolic Blood Pressure is over 100 mmHg: Dobutamine 3 to 20 micrograms/kg/min IV.	As in Role 1 Cardiac monitoring and continuous pulse oximetry. Continuos blood pressure monitoring: Direct (intraarterial) or indirect (cuff). Chest x-ray If available, transthoracic echocardiography (ECHO). Lab tests for complete blood count, electrolytes, BUN, ALT. AST, bilirrubin, creatinine and cardiac enzymes. Arterial blood gas. Morphine Nitroglycerin 5 ml/ 5 mg and 10 ml/ 50 mg injection. Nitroprusside, 50 mg injection. Dobutamine, 250 mg injection. Dopamine, 200 mg injection.

TRAINING	TREATMENT	EQUIPMENT
	- Systolic Blood Pressure 70 to 100 mmHg: Dopamine 5 to 15 micrograms/kg/min IV. If possible, treat the underlying cause as well, if identified. This is particularly true for patients with known diastolic dysfunction who respond best to reductions in blood pressure, rather than to diuretics, nitrates, and inotropic agents. Eliminate contributing factors when possible. Transfer to the Role 4 as soon as possible. Other treatment modalities: If avalaible, continuous positive airway pressure (CPAP) and bilevel positive airway pressure (BiPAP) facemask ventilation therapy may decrease need for intubation with mechanical ventilation. BiPAP and CPAP are contraindicated in the presence of acute facial trauma, the absence of an intact airway, and in patients with an altered mental status or who are uncooperative.	

TRAINING	TREATMENT	EQUIPMENT

III. ARRYTHMIA MANAGEMENT

ROLE 1

Care providers on Role 1 must know the principles of cardiopulmonary resuscitation, according to ABC-principles. Elicit appropriate, focused history, that includes presence of chest pain and assessment of risk factors. The patient must be stable enough to allow time for rhythm diagnosis or transport to a Role more capable of diagnosing the rhythm.	Check vital signs and Blood Pressure. Perform basic CPR if necessary. Provide O2 if symptoms of impaired respiratory function or poor perfusion. Obtain ECG if available. Obtain intravenous access if possible. Categorise patients in high, intermediate or low risk. Transfer patients directly and swiftly to the higher Role available.	Stethoscope. Sphygmomanometer. EKG set and/or cardiac monitor, if available. Oxygen supply and administration kits (facial masks). IV infusion sets.

TRAINING	TREATMENT	EQUIPMENT

ROLE 2 and 3

Initial management should be performed in a Role 2 or 3 if possible. After establish cardiac monitoring (to avoid delay, use the defibrillator's paddles), start by considering the patient's clinical signs, such as ventilation, oxygenation, heart rate, blood pressure, level of consciousness, and other signs of inadequate organ perfusion. Always interpret all ECG and rhythm information within the context of total patient assessment. Train the ability to detect and treat serious arrhythmias. Medical staff must be able to distinguish between supraventricular and ventricular rhythms and be aware that most broad-complex) tachycardias are ventricular in origin. If a patient is pulseless, in shock, or in congestive heart failure, such rhythms should always be presumed to be Ventricular Tachycardia (VT). Initial management should proceed under the presumption of VT. Otherwise, it is often said that VT leads to haemodynamic compromise whereas supraventricular tachycardia (SVT) does not. <u>This is not true</u>. If the patient is	As in Role 1 **ATRIAL FIBRILATION (AF)** 1. Oxygen. 2. IV access. 3. HIGH RISK PATIENTS (Heart Rate> 150 bpm; ongoing chest pain; critical perfusion). Inmediate heparin[1] and synchronised electrical shock[2] (100 J, 200 J, 300 J). Amiodarone 300 mg IV over 1 h. If necessary, may be repeated once. 4. INTERMEDIATE RISK PATIENTS (Rate 100-150 bpm; breathnessless, poor perfusion). **- Hemodynamically Unstable and /or known structural heart disease:** If onset is known to be <u>within 24 hours:</u> Attempt cardioversion: Inmediate heparin[1] and synchronised electrical shock[2] (100 J, 200 J, 300 J). Amiodarone 300 mg IV over 1 h. If necessary, may be repeated once. If Atrial Fibrilation has been present <u>for > 24hours</u>: Initial rate control: Amiodarone 300 mg IV over 1 h. If necessary, may be repeated once.	As in Role 1 EKG set. EKG monitoring with defibrillator Pulse-oximeter. Ventilatory-bags. If ventilatory support: see relevant triptych Continuos blood pressure monitoring. Antiarrhythmic Drugs: Adenosine, injection. Amiodarone, injection. Atropine sulfate, injection. Beta-blockers Atenolol, tablets, injection. Propanolol, tablets, injection. Esmolol, injection. Calcium Channel Blockers Verapamil, injection. Diltiazem, injection.

TRAINING	TREATMENT	EQUIPMENT
haemodynamically compromised arrange urgent electrical cardioversion Obtain a 12-lead ECG as soon as practicable. Always check for precipitants – e.g. electrolytes, ischaemia, toxins, thyroid status. Become familiar with the use of a few select antiarrhythmic drugs which will cover most situations. Amiodarone is particularly interesting when medical resources are scarce because of its broad therapeutic range (SVT, VT and AF) and safety during the emergency. Antiarrhythmic Drugs Adenosine Adenosine depresses AV node and sinus node activity. Adenosine is effective for narrow-complex supraventricular tachycardia. Adenosine is not an effective agent for common forms of ventricular arrhythmias or for preexcited atrial arrhythmias such as atrial fibrillation or atrial flutter. Adenosine has vasodilatory effects and it can produces hypotension. Side effects with adenosine are common	Anticoagulation (heparin[1], oral anticoagulants). Later, after at least 3 weeks of adequate anticoagulation, perform synchronised electrical shock[2], if indicated. **- Hemodynamically Stable without known structural heart disease:** If onset is known to be <u>within 24 hours</u>: Heparin[1]. Attempt pharmacological cardioversion: Amiodarone 300 mg IV over 1 h. If necessary, may be repeated once. Flecainide 100 – 150 mg IV over 30 min. Synchronised electrical shock[2], if indicated. If Atrial Fibrilation has been present <u>for > 24hours</u>: Initial rate control: β-blockers oral/IV **or** Verapamil oral/IV (not to be used in patients receiving β-blockers) **or** Diltiazem (not to be used in patients receiving β-blockers) **or** Digoxin oral/IV **or** consider adequate anticoagulation (for at least 3 weeks) for later synchronised electrical shock[2], if indicated. 5. LOW RISK PATIENTS (Heart Rate < 100 bmp, mild or no symptoms, good perfusion). If onset is known to be <u>within 24 hours:</u> Heparin[1]. Amiodarone 300 mg IV over 1 h. (may be	Digoxin, tablets, injection Flecainide, injection. Lidocaine, injection. Magnesium sulphate, injection. Potassium chloride, injection. Procainamide, injection. Other medications. Adrenaline (epineprine), injection. Heparin: Enoxaparin, injection.

TRAINING	TREATMENT	EQUIPMENT
but transient; flushing, bronchospasm and chest pain are the most frequently observed. **Amiodarone (IV)** Intravenous amiodarone is a complex drug with effects on sodium, potassium, and calcium channels as well as α- and ß-adrenergic blocking properties. The drug is useful for treatment of atrial and ventricular arrhythmias. In patients with severely impaired heart function, IV amiodarone is preferable to other antiarrhythmic agents for atrial and ventricular arrhythmias. The major adverse effects from amiodarone are hypotension and bradycardia, which can be prevented by slowing the rate of drug infusion. **Atropine** Atropine sulfate reverses cholinergic-mediated decreases in heart rate. Atropine is useful in treating symptomatic sinus bradycardia and may be beneficial in the presence of AV block at the nodal level or for asystole and slow pulseless electrical activity. Atropine is not indicated in bradycardia from AV block at the His-Purkinje level (type II AV block and third-degree block with new wide-QRS complexes). Doses of atropine sulfate of <0.5 mg may be parasympathomimetic and further slow the cardiac rate. Atropine should be used cautiously in the	repeated once if necessary) or Flecainide 100 – 150 mg IV over 30 mins and/or synchronised electrical shock[2]. If Atrial Fibrilation has been present <u>for > 24hours</u>: Consider anticoagulation with heparin[1] and subsequent oral anticoagulation. Later synchronised electrical shock[2], if indicated, in patients adequately anticoagulated for at least 3 weeks. **NARROW COMPLEX TACHYCARDIA** - If patient PULSELESS (heart rate usually > 250 bpm): Synchronised electrical shock[1] 100 J : 200 J : 360 J. - Determine whether regular or irregular. If irregular treat as per Atrial Fibrilation advice (see appropriated section). 1. INMEDIATE GENERAL MANAGEMENT OF NARROW COMPLEX TACHYCARDIA: Give oxygen. Establish intravenous access. Vagal manoeuvres (e.g. carotid sinus massage/ valsalva). Caution if possible digitalis toxicity, acute ischemia or presence of carotid bruit for carotid sinus massage. Adenosine 6 mg by rapid bolus injection; if unsuccessful, follow, if necessary with up	

TRAINING	TREATMENT	EQUIPMENT
presence of AMI or infarction because excessive increases in rate may worsen ischemia or increase the zone of infarction. **Beta-Adrenergic Blockers** ß-Adrenergic blockers have potential benefits in patients with acute coronary syndromes. Atenolol, metoprolol, and propranolol have been shown to reduce the incidence of VF significantly in post-MI patients. IV esmolol is a short-acting (half-life of 2 to 9 minutes) $ß_1$-selective ß-blocker that is recommended for the acute treatment of supraventricular tachyarrhythmias, including rate control in AF or atrial flutter. Side effects related to ß-blockade include bradycardias, AV conduction delays, and hypotension. See contraindications to ß-blockers (first part of Cardiological Emergencies). Bretylium Bretylium is no longer recommended. Bretylium has been removed from ACLS treatment algorithms and guidelines because of a high occurrence of side effects. **Calcium Channel Blockers** Verapamil and Diltiazem are calcium channel blocking agents that slow conduction and increase refractoriness in the AV node. These actions may terminate reentrant arrhythmias that require AV	to 3 doses each of 12 mg every 1-2 min. (Caution con adenosine in known Wolff-Parkinson-White syndrome). 2. IF ADENOSINE FAILS, TRY THE FOLLOWING: - If adverse signs are present (Systolic BP < 90 mm Hg; Chest pain; Heart failure; Heart rate > 200 bpm.): Synchronised electrical shock[1] 100 J : 200 J : 360 J. If necessary, Amiodarone 150 mg IV over 10 min, then 300 mg over 1 h and repeat shock[1]. - If adverse signs are not present, choose from: Esmolol: 40 mg over 1 min + infusion 4 mg/min (injection can be repeated and infusion increased incrementaly to 12 mg/min. Or Verapamil 5-10 mg IV (not to be used in patients receiving beta-blockers). Or Amiodarone: 300 mg IV over 1 h, may be repeated once if necessary. Or Digoxin: maximum dose 500 micrograms IV over 30 min x 2. **BROAD COMPLEX TACHYCARDIA** (Treat as sustained ventricular tachycardia) 1. PRIMARY SURVEY: Check responsiveness.	

TRAINING	TREATMENT	EQUIPMENT
nodal conduction for their continuation. Intravenous verapamil is effective for terminating narrow-complex SVT and may also be used for rate control in AF. Adenosine, however, is the drug of choice for terminating narrow-complex SVT. The initial dose of verapamil is 2.5 to 5 mg IV given over 2 minutes. In the absence of a therapeutic response or drug-induced adverse event, repeated doses of 5 to 10 mg may be administered every 15 to 30 minutes to a maximum of 20 mg. When beta-blockers are contraindicated, diltiazem is effective and safe in treating critically ill patients with sinus tachycardia (ST).Give a slow 10-mg bolus dose of diltiazem and then an intravenous infusion starting at 5 mg/hr or 10 mg/hr. The dose was increased to up to 30 mg/hr, if necessary, to reduce the heart rate to below 100 bpm.. However, Calcium Channel Blockers may decrease myocardial contractility and may exacerbate congestive heart failure in patients with severe heart dysfunction. Flecainide Flecainide is a potent sodium channel blocker with significant conduction-slowing effects. IV flecainide is effective for termination of atrial flutter and AF, and supraventricular tachycardia associated with an accessory pathway (Wolff-Parkinson-White syndrome). Because of	Check pulse. Call for defibrillator. Give oxygen. Establish intravenous access. 2. PULSELESS: USE VENTRICULAR FIBRILLATION PROTOCOL. 3. PATIENT WITH PULSE: - If adverse signs are present (Systolic BP < 90 mm Hg; Chest pain; Heart failure; Heart rate > 150 bpm.): Synchronised electrical shock[1] 100 J : 200 J : 360 J. If potassium known to be low: Give potassium chloride up to 60 mmol (maximum rate 30 mmol/h). It requires central venous access. Give magnesium sulphate IV 5 ml 50% in 30 min. Amiodarone 150 mg IV over 10 min. Further cardioversion[1] as necessary For refractory cases consider additional pharmacological agents: amiodarone, lidocaine, procainamide, or sotalol. - If adverse signs are not present: If potassium known to be low: Give potassium chloride up to 60 mmol (maximum rate 30 mmol/h). It requires central venous access. Give magnesium sulphate IV 5 ml 50% in 30 min. Amiodarone 150 mg IV over 10 min **or** Lidocaine IV 50 mg over 2 min repeated	

TRAINING	TREATMENT	EQUIPMENT
significant negative inotropic effects, flecainide should be avoided in patients with impaired heart function and when coronary artery disease is suspected. **Lidocaine** Lidocaine may be used for treatment of ventricular ectopy, Ventricular Tachycardia (VT) , and Ventricular Fibrillation (VF). However, due to its toxicity, lidocaine remains a second choice behind other alternative agents (amiodarone, procainamide). **Magnesium** Severe magnesium deficiency is associated with cardiac arrhythmias, symptoms of cardiac insufficiency, and sudden cardiac death. Hypomagnesemia can precipitate refractory VF. In addition, a form of polymorphic VT called torsades de pointes, which usually occurs in a setting of bradycardia and prolongation of the QT interval, may be treated with magnesium even in the absence of magnesium deficiency. For paroxysm of torsades de pointes, give magnesium sulphate IV 5 ml 50% in 30 min. **Procainamide** Procainamide is acceptable for the pharmacological conversion of supraventricular arrhythmias (particularly AF and atrial flutter) to sinus rhythm, for	every 5 min to a maximum dose of 200 mg. Synchronised electrical shock[1] 100 J : 200 J : 360 J. If necessary, further amiodarone 150 mg IV over 10 min, then 300 mg over 1 h and repeat shock[1]. **VENTRICULAR FIBRILATION/ PULSELESSVENTRICULAR TACHYCARDIA (VF/TV ADULT CARDIAC ARREST**) 1. Establish Basic/Advanced Life Support, if appropriate (see relevant triptychs). Check responsiveness. Open the airway. Check breathing. Give 2 effective breaths. Asses circulation. Compress chest (no signs of circulation detected). 2. Precordial thump (it is unlikely to be successful after >30 s of arrest). 3. Attach defibrillator/monitor. 4. Asses rhythm: Asses the rhythm on the monitor. Check for signs of a circulation, including carotid pulse, but only if the ECG waveform is compatible with cardiac	

TRAINING	TREATMENT	EQUIPMENT
control of rapid ventricular in preexcited atrial arrhythmias , and for wide-complex tachycardias that cannot be distinguished as being of supraventricular or ventricular origin. Procainamide is given in an infusion of 20 mg/min to a total dose of 17 mg/Kg. Use of procainamide in pulseless VT/VF is limited by the need to infuse the agent relatively slowly. Check the **list of potential reversible causes** (the “4 Hs and 4 Ts”) DURING VF/VT PULSELESS OR ASYSTOLE (CARDIAC ARREST) The four “Hs”: Hypoxia Hypovolemia Hyper/hypo kalemia, acidemia. Hypotermia The four “Ts” Tension pneumothorax Cardiac Tamponade Thromboembolic or mechanical obstruction (e.g. pulmonary embolism) Toxic or therapeutic substances in overdose	output. Take no more than 10 s. 5. If the rhythm is Non VF/TV- Asystole or Pulseless Electrical Activity, perform CPR if the patient is in cardiac arrest. 6. If the rhythm is VF/TV, continue the sequence of actions: 7. Attempt defibrillation for VF/ pulseless VT, up to 3 times (200 J, 200 J, 300 J) in less than 1 min, as necessary. Ensure that everybody is clear of the patient. 8. Rhythm after first 3 defibrillations? 9. If persistent VF/VT after 3 unsuccessful attempts to achieve defibrillation, provide approximately 1 minute of CPR (15:2). 10. During this CPR: Consider and correct reversible causes (see Training). If not already: Check electrode/paddle positions and contact. Attempt to place, confirm, secure AIRWAY. Administer oxygen (100%). Attempt and verify IV ACCESS. (Once the trachea has been intubated, chest compressions at a rate of 100/min should continue uninterrupted, with ventilations performed at about 12/min asynchronously) Give Adrenaline 1 mg IV. (If IV access is not available, consider 2-3 mg adrenaline via tracheal tube in a 1: 10 000 solution). The interval between the third and a subsequent fourth defibrillation should not	

TRAINING	TREATMENT	EQUIPMENT
	be more than 1 min. 11. Reassess the rhythm on the monitor. Check for signs of a circulation, including carotid pulse, but only if the ECG waveform is compatible with cardiac output 12. If VF/VT persists: Attempt defibrillation with three further defibrillations at 360 J. Give 1 mg IV Adrenaline. The process of rhythm reassessment, delivery of three electrical shocks and 1 min of CPR will take approximately 3 min. One mg of Adrenaline is given in each loop every 3 min. Repeat the cycle of three electrical shocks and 1 min of CPR until defibrillation is achieved. Consider Amiodarone in VF/VT refractory to three initial electrical shocks. The initial dose for Amiodarone is 300 mg diluted in 20 ml 5% dextrose given as an IV bolus. A further dose of 150 mg may be required in refractory cases, followed by an infusion of 1 mg/min for 6 h and then 0.5 mg/min (maximum cumulative dose: 2 g over 24 h). Lidocaine (a single IV push of 1 to 1.5 mg/Kg) is alternative if Amiodarone is not available, but should not given in addition to Amiodarone. 13. Each period of 1 min of CPR offers a new opportunity to check electrode/paddle positions and contact, secure and verify the airway, administer oxygen, obtain IV	

TRAINING	TREATMENT	EQUIPMENT
	access, if not already done. 14. Consider giving sodium bicarbonate (50 ml of a 8.4% solution) to correct a severe metabolic acidosis (pH<7.1) or if there is a long arrest interval. **BRADYCHARDIA** (Includes rates inappropriately slow for hemodynamic state). CHECK THE PRESENCE OF ADVERSE SIGNS! Systolic BP less than 90 mm Hg. Rate less than 40 bpm. Ventricular arrythmias requiring suppression. Heart failure. - NO ADVERSE SIGNS ARE PRESENT: 1. If there is RISK OF ASYSTOLE (Recent asystole; Mobitz II AV block; Complete heart block with wide QRS; Ventricular pause greater than 3 s). Interim measures: Atropine 500 microgram IV (repeat to maximum 3 mg). Transcutaneous (external) pacing or Adrenaline 2 – 10 microgram/min. Transfer patient to a Role 4 as quickly as possible: : Transvenous pacing is necessary. 2. NO RISK OF ASYSTOLE: Observe.	

TRAINING	TREATMENT	EQUIPMENT
	- ADVERSE SIGNS ARE PRESENT: 1. Atropine 500 microgram IV. 2. If there is SATISFACTORY RESPONSE: Treat as described on “No adverse signs are present”. 3. If there is NO SATISFACTORY RESPONE: Interim measures: Atropine 500 microgram IV (repeat to maximum 3 mg). Transcutaneous (external) pacing or Adrenaline 2 – 10 microgram/min. Transfer patient to a Role 4 as quickly as possible: Transvenous pacing is necessary.	

NOTE 1: Subcutaneous Enoxaparin (1 mg/Kg every 12 h) has been shown to be at least as effective as intravenous heparin during cardioversion of AF
NOTE 2: Electrical shock is always given under sedation/general anaesthesia (see relevant triptychs).

D.08 OBSTETRICAL AND GYNAECOLOGICAL EMERGENCIES IN THE FIELD

PREAMBLE

In a historical perspective military forces have not been challenged with obstetrical and gynaecological emergencies. The Forces have mostly included but men and also, if they have had women enrolled, the field medical challenges have practically exclusively been emergencies and casualties related to general trauma to be approached using none gender specific medical treatment.

For reasons related to change of composition of the defence forces and also for changes in tasks, challenges and operational procedures, situations will arise when gender specific treatment may be needed, especially with regard to obstetrics and gynaecology. In this context we will have to identify 4 generic challenges listed as a four fold table belonging to a combination of Female troops and Needs of the Civilian population and gynaecological and obstetrical needs.

Trauma treatment as such focus on Life, limb and Eyesight saving intervention. Be aware of that life saving refers to the injured person, it has never meant life to come. Therefore special surgical skills to preserve the reproductive capacity of female troops has never been on the priority list, and probably will not be in any field setting. If a Role 4 hospital is erected in a mission, this may change.

If gynaecological needs are to be covered beyond the capacity of a general surgeon, specialists of gynaecology may be included. However, the rationale for such deployment seems so far not substantiated as the capacity for lifesaving treatment should be within reach by the equipment and expertise already there. The diagnostic skills to identify life threatening infections or an emerging bleeding must be considered generic skill, both by forward positioned physicians and medical staffs at Role 2-3.

Obstetrical needs are practically always civilian. No female troops will be allowed in the field after a pregnancy has been verified. Also the obstetrical skills are not easily acquired and will need a trained obstetricians if such service is to be provided. This goes for monitoring and also any needed treatment. A trained surgeon will be able to perform a Caesarean Section, if needed, and should probably be part of demanded curriculum for and surgeon deploying in the field where Civilian Military Co-operation is part of an SOP. Obstetricians also indicate that vacuum extractor as delivery assistance can be done without jeopardising the outcome too much, even by a non-obstetrician. However, the very infrequent and seldom need for such services, hardly justifies the deployment of specialists in gynaecology and obstetrics.

The Obstetrical and Gynaecological Emergencies do not fall under the obligations embedded in the Geneva Conventions and their Protocols. Willingness to provide such services therefore falls under the Medical Ethical Codes of the World Medical Association, the legislation of the Host Country and/or the ethical and operational procedures of the forces involved.

As a general recommendation all forces are encouraged to establish good contacts with Host Nation facilities as they may prove better than the service available by the integral medical services of the forces deployed.

LIKELY COMBINATIONS	CIVILIAN POPULATION	MILITARY PERSONNEL
GYNAECOLOGICAL EMERGENCIES	Yes	Possible
OBSTETRICAL EMERGENCIES	Yes	No

TRAINING	TREATMENT	EQUIPMENT

ROLE 1 and 2

Gynaecological diagnostics Infections Clinical Examination Specimen sampling Bleeding Spontaneous abortion Ectopic pregnancy (Extra-uterine) Obstetrics pre-partum diagnostics: Pre-eclampsie and Eclampsie. Placenta Praevia Abruptio Placenta Beech position Obstetrics post-partum Atonic postpartum bleeding Placenta Accreta	Gynaecology Infections Collect specimen for bacteriological testing Start antibiotic treatment Refer to Role 2 (3) for follow up. Bleeding: Initiate intravenous access (NB-hypotensive rescucitation). Evacuation to referral hospital for final treatment. Obstetrics pre-partum: Evacuation to Role 2 or Role 3 for all obstetrical emergencies. Intravenous infusion (NB-Hypotensive Perfusion) Sedation and blood pressure reducing drugs Uterine relaxing drugs (to by time) Obstetrics post-partum: Evacuation to Role 2/3 Pharmacological uterus contraction for atonic bleeding post.	Gyn.: Infections Speculum Collecting device, Agar tubes Antibiotics Broad spectrum (Ampicillin 1g x 4) Bleeding: Intravenous canula and electrolyte solution. Obstetrics: Iv-infusion equipment Anti-hypertensiva i.v. (e.g.Nepresol) Benzodiazepines Contraction preventive drugs Oxytocin and Methergine Wooden stethoscope

TRAINING	TREATMENT	EQUIPMENT

ROLE 2 (enhanced)

The same as Role 1/2. In addition: Diagnose ruptured Corpus Luteum Diagnose torequired Ovarial Cystis Capable of doing a Caesarean Section Revision of Uterus (spontaneous abortion and post partum plancenta residuals). Pre eclampsia- eclampsia Ruptured Vulva Ruptured Cervicis	Same as Role 2 Laparatomy Caesarian Section Uterinary revision For Pre-eclampsia/eclampsia: Continue sedation and anti hypertensive treatment, Continue Fluid therapie Evacuation to Role 3 Suturing of ruptures from labour.	Same as Role 2. In addition Surgical equipment Simpsons Forceps (or equivalent) Uterine cuvettes

TRAINING	TREATMENT	EQUIPMENT

ROLE 3

The same as Role 2 In addition: Diagnose dys-proportion, head of fetus and pelvic opening (especially if beech position) Rescucitation of premature and of neo-nates in distress. Manual extrication of retained placenta and placenta accreta.	Same as Role 2 Laparatomy Caesarian Section Uterinary revision	Same as Role 2 In addition Surgical equipment Simpsons Forceps (or equivalent) Uterine cuvettes Vacuum extractor Kranioklast