EMERGENCY & TRAUMA CARE TRAINING COURSE

Basic Trauma, Anesthesia and Surgical Skills for Frontline Health Providers

Including management of injuries in women, children, elderly and humanitarian emergencies

Emergency & Essential Surgical Care
Clinical Procedures Unit
Department of Health Systems Policies & Workforce
World Health Organization
Geneva, Switzerland

INTRODUCTION

- **Objectives:**

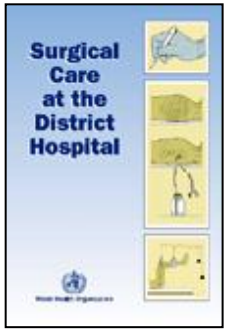
  This course is about managing trauma, from minor injury to humanitarian emergencies, including injuries in women, children and the elderly, with the principal goal of improving quality of care and patient safety.

- **Introduction of instructors and participants**
- **Presentation of WHO Integrated Management for Emergency and Essential Surgical Care (IMEESC) toolkit [www.who.int/surgery]**

This is a compilation of all WHO documents relevant to Emergency and Trauma Care Training Course Resources

www.who.int/surgery

Integrated Management for Emergency and Essential Surgical Care (IMEESC) toolkit



Surgical Care at the District Hospital

Pratique Chirurgicale de Base

Additional links to WHO Resources: www.who.int.publications/en

1. Guidelines for Essential Trauma Care
   http://www.who.int/violence_injury_prevention/services/traumacare/en/
2. Hospital Care for Children
   http://www.who.int/maternal_child_adolescent/documents/9241546700/en/index.html
3. Integrated Management of Adult Illnesses, District Clinician Manual: Hospital Care for Adolescents and Adults http://www.who.int/hiv/pub/imai/imai2011/en/index.html
   a) Quick Check and emergency treatments for adolescents and adults
      http://www.who.int/influenza/patient_care/clinical/IMAI_Wall_chart.pdf
4. Emergency Triage Assessment and Treatment
   http://www.who.int/maternal_child_adolescent/documents/9241546875/en/
5. Guidelines on Emergency Health Care
   http://www.who.int/hac/techguidance/tools/manuals/en/
6. Integrated Management of Childhood Illnesses
   http://www.who.int/maternal_child_adolescent/documents/IMCI_chartbooklet/en/index.html
7. Integrated Management of Pregnancy and Childbirth
   http://www.who.int/maternal_child_adolescent/documents/impac/en/
   a) Managing Complication in Pregnancy and Childbirth: a guide for midwives and doctors
      http://www.who.int/maternal_child_adolescent/documents/9241545879/en/index.html
   b) Pregnancy, Childbirth, Postpartum and Newborn Care: a guide for essential practice
      http://www.who.int/maternal_child_adolescent/documents/924159084x/en/index.html
8. Oxygen Therapy for Acute Respiratory Infections in Young Children in Developing Countries
   http://www.who.int/maternal_child_adolescent/documents/ari_93_28/en/
9. Mass Casualty Management Systems
   www.who.int/hac/techguidance/MCM_guidelines_inside_final.pdf
10. Prevention and Management of Wound infections
    www.who.int/hac/techguidance/tools/guidelines_prevention_and_management_wound_infection.pdf
11. Safe Surgery http://www.who.int/patientsafety/safesurgery/en/
12. Patient Safety Pulse Oximetry Project
    http://www.who.int/patientsafety/safesurgery/pulse_oximetry/en/
13. Tetanus Vaccination http://www.who.int/immunization/topics/tetanus/en/index2.html
14. Clinical Management of Rape Survivors
    http://www.who.int/reproductivehealth/publications/emergencies/9789241598576/en/index.html
15. Guidelines for Medico-legal Care for Victims of Sexual Violence
    http://www.who.int/violence_injury_prevention/publications/violence/med_leg_guidelines/en/index.html

MODULE 1

Principles and Techniques of Trauma Care

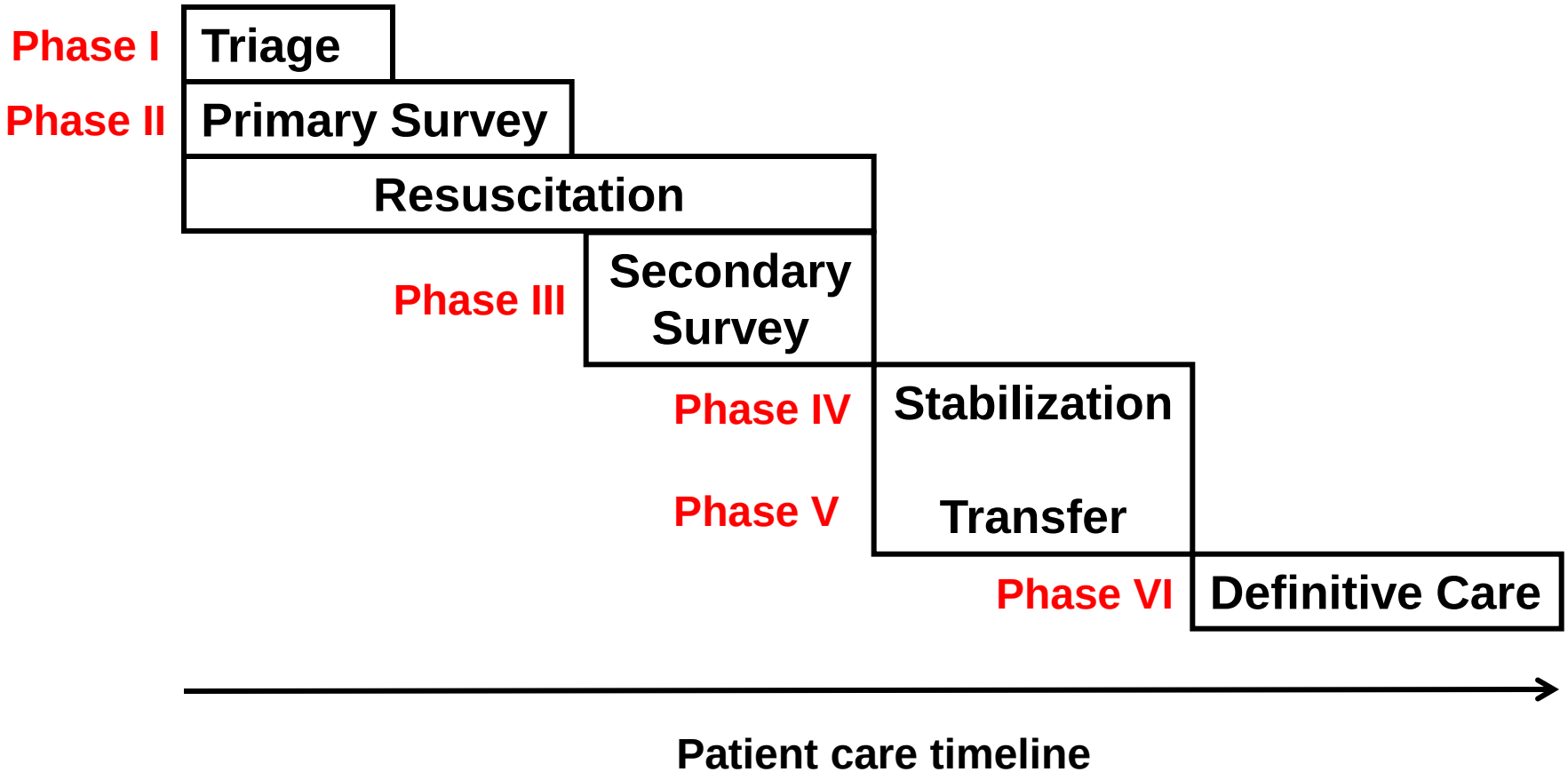
OBJECTIVES OF MODULE 1

Learn basic techniques of triage and emergency care within the first, most critical hour, of a patient's arrival at the hospital

Basic emergency resuscitation skills in adults and children

- open and maintain airway
- perform life-saving procedures
- manage active bleeding
- place intravenous lines
- learn shock management

SIX PHASES OF TRAUMA CARE MANAGEMENT



MANAGEMENT GOALS

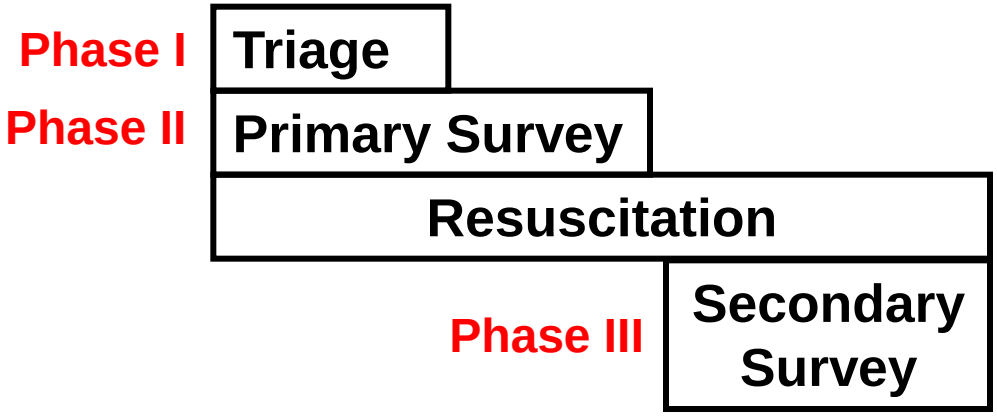
Primary survey

- Examine, diagnose, treat life-threatening injuries as soon as they are diagnosed
- Use simplest treatment possible to stabilize patient's condition

Secondary survey

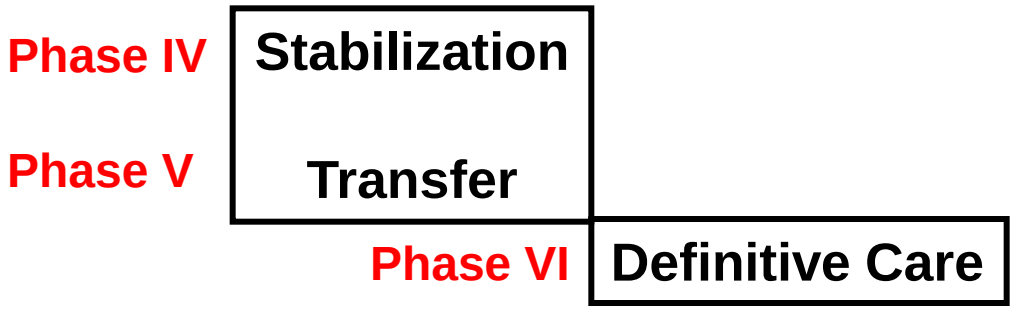
- Perform complete, thorough patient examination to ensure no other injuries are missed

TRAUMA CARE MANAGEMENT



- Start resuscitation at the same time as performing primary survey
- Do not start secondary survey until completing primary survey
- Constantly reassess patient for response to treatment; if condition deteriorates, reassess ABC

TRAUMA CARE MANAGEMENT



- Do not start definitive treatment until secondary survey is completed unless required as life-saving measure
- When definitive treatment is not available, have a plan for safe transfer of patient to another centre

MAJOR TRAUMA

Trauma mechanism:

- A fall >3 meters
- Road traffic accident: net speed >30 km/h
- Thrown from or trapped in a vehicle
- Pedestrian or cyclist hit by a car
- Unrestrained occupant of a vehicle
- Injury from high or low velocity weapon

MAJOR TRAUMA

Physical findings:

- Airway or respiratory distress
- Blood pressure <100 mmHg
- Glasgow Coma Scale <13/15
- Penetrating injury
- More than 1 area injured

Make a full primary and secondary survey of any patient who is injured, especially if major trauma

PHASE I: TRIAGE

Triage: sorting and treating patients according to priority; identify, treat patients with life-threatening conditions first

Priority may be determined by:

- Medical necessity
- Personnel skills
- Available equipment

Vital signs

- Pulse rate
- Blood pressure
- Respiratory rate
- SpO2%
- Temperature
- AVPU (Alert, verbal, pain or unresponsive)
- Urine output

PHASE II: THE PRIMARY SURVEY

Airway

Breathing

Circulation

Disability or neurologic Damage

Expose the patient

Purpose is to identify and treat life threatening injuries:

- Airway obstruction
- Breathing difficulties
- Severe external or internal haemorrhage

AIRWAY

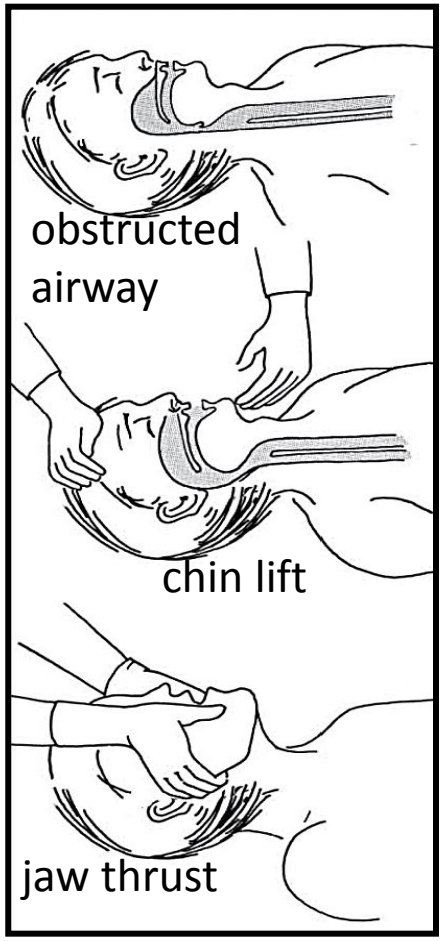
Always assess the airway

- Talk to the patient
  - A patient speaking freely and clearly has an open airway
- Look and listen for signs of obstruction
  - Snoring or gurgling
  - Stridor or noisy breathing
  - Foreign body or vomit in mouth
- If airway obstructed, open airway and clear obstruction

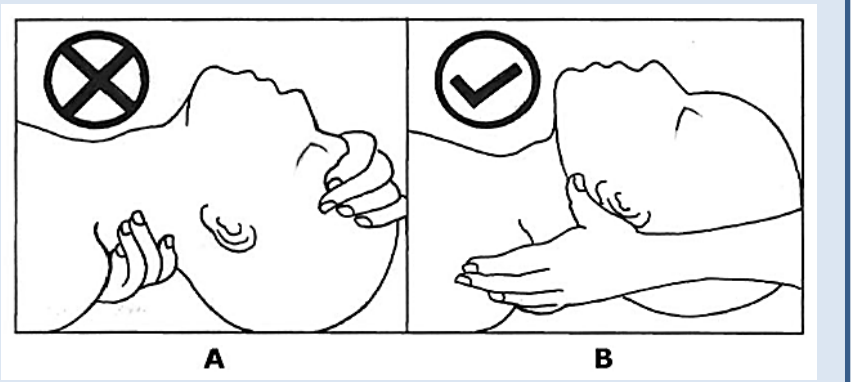
TECHNIQUES FOR OPENING THE AIRWAY

No trauma

- Position patient on firm surface
- Tilt the head
- Lift the chin to open the airway
- Remove foreign body if visible
- Clear secretions
- Give oxygen 5 L/min



TECHNIQUES FOR OPENING THE AIRWAY



Modified jaw thrust

In case of trauma

- Stabilize cervical spine
- Do not lift head!
- Open airway using jaw thrust
- Remove foreign body if visible
- Clear secretions
- Give oxygen 5 L/min

AIRWAY DEVICES

Oropharyngeal airway

- Use if patient unconscious
- Use correct size - measure from front of ear to corner of mouth
- Slide airway over tongue
- If patient resists, gags or vomits, remove immediately!

Nasopharyngeal airway

- Better tolerated if patient is semi-conscious
- Pass well lubricated into one nostril
- Direct posteriorly, towards the throat

AIRWAY

Before attempting intubation the answer to these questions should be YES:

Is there an indication?

- Failure to maintain or protect the airway (risk of aspiration) or
- Failure to oxygenate or ventilate or
- Impending airway failure (inhalation injury, angioedema)

Do you have working equipment?

- Functioning laryngoscope with working light
- Appropriate endotracheal tube size
- Bag-valve mask
- Working oxygen source
- Suction

Do you have a post-intubation plan?

- Is a mechanical ventilator available? (unless only short-term need)
- Are sedative drugs available?

BREATHING

Assess ventilation - Is the patient in respiratory distress?

Look

- For cyanosis, wounds, deformities, ecchymosis, amplitude, paradoxical movement

Feel

- Painful areas, abnormal movement

Percuss

- Dullness

Listen

- Reduced breath sounds

INDICATIONS FOR CHEST DECOMPRESSION

Signs and Symptoms

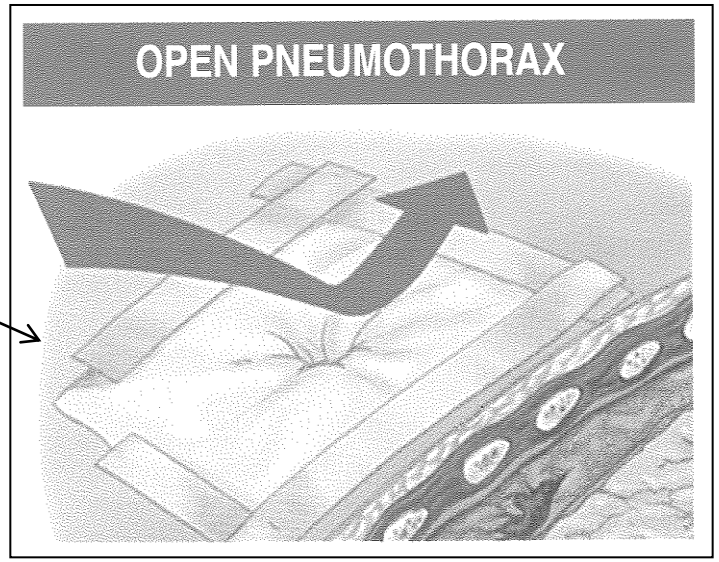
- Absent or diminished breath sounds on one side
- Evidence of chest trauma or rib fracture
- Open or "sucking" chest wound

Diagnoses

- Pneumothorax
- Tension pneumothorax
- Hemothorax
- Hemo-pnemothorax

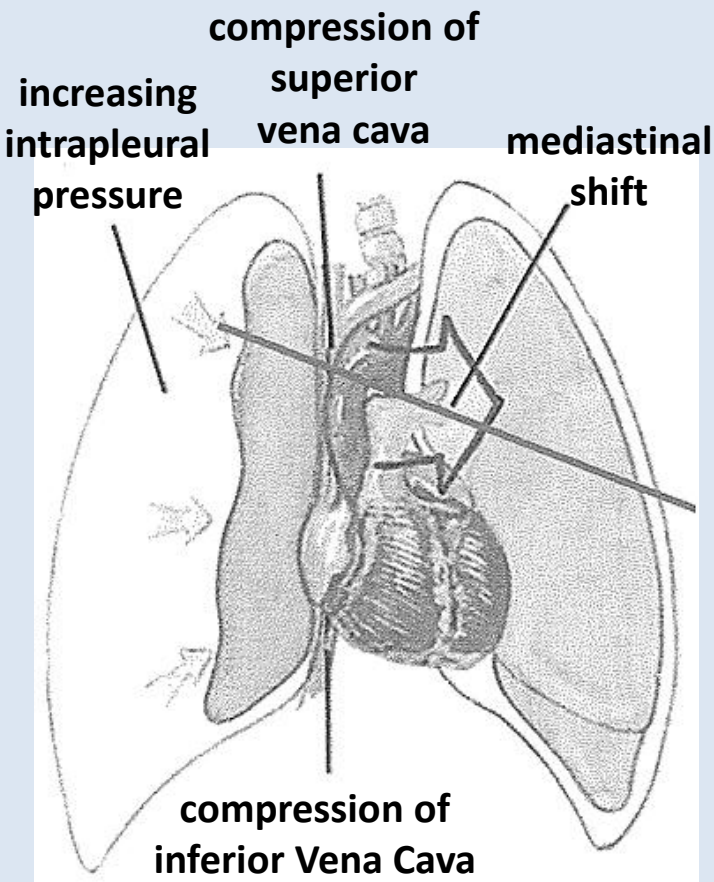
OPEN CHEST WOUND

- "Sucking" sound
- Requires very prompt treatment
  - Apply an occlusive "plastic pack" dressing to wound, tape down on **three** sides, leaving one side open for air to escape
- **Place a chest drain**
- Never insert chest tube through wound
- Give high flow oxygen
- Give antibiotics
- Debride wound and consider closure

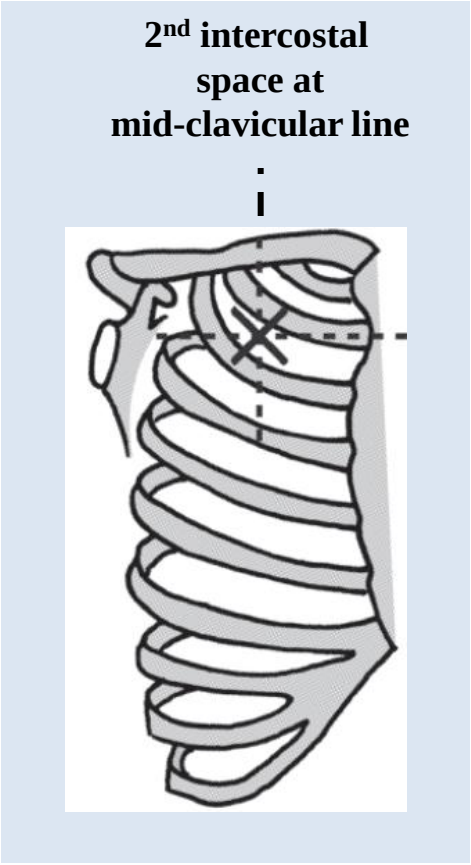


TENSION PNEUMOTHORAX

- Air from lung puncture enters pleural space, cannot escape
- Progressive increase in intrathoracic pressure causes mediastinal shift and hypotension due to reduced venous return
- Patient becomes short of breath and hypoxic
- Diminished breath sounds on side of pneumothorax
- Requires urgent needle decompression, then chest drain as soon as possible

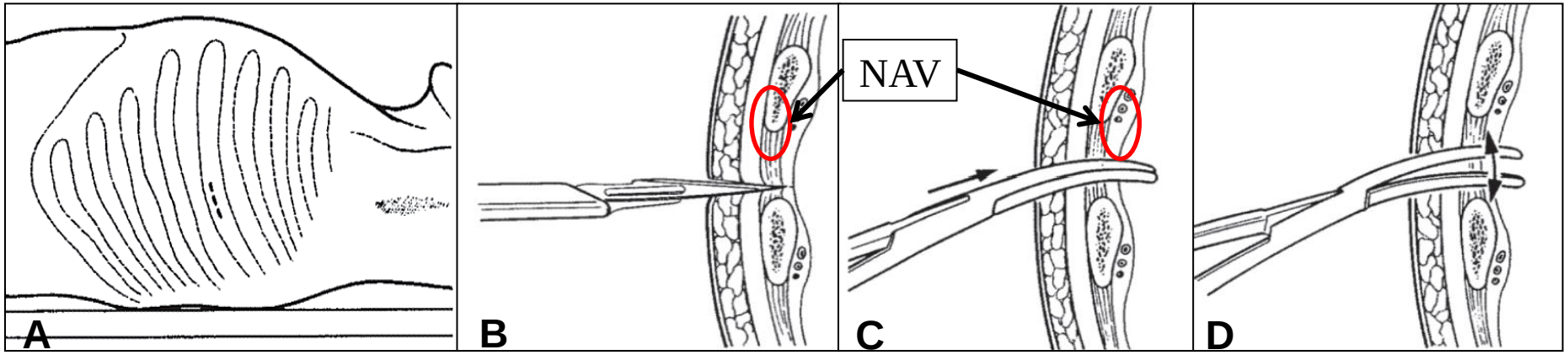


TENSION PNEUMOTHORAX



- Give high flow oxygen
- After aseptic skin preparation
- Insert a large bore needle over rib:
  - 2nd intercostal space
  - Over 3rd rib at mid-clavicular line
- Listen for hissing sound of air escaping
- **Insert chest drain**

INSERTION OF CHEST DRAIN



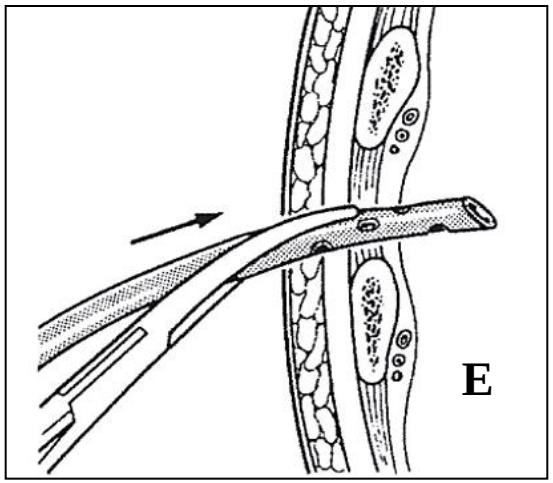
Mark incision just above rib in mid-axillary line; use nipple as a landmark so incision not too low (A)

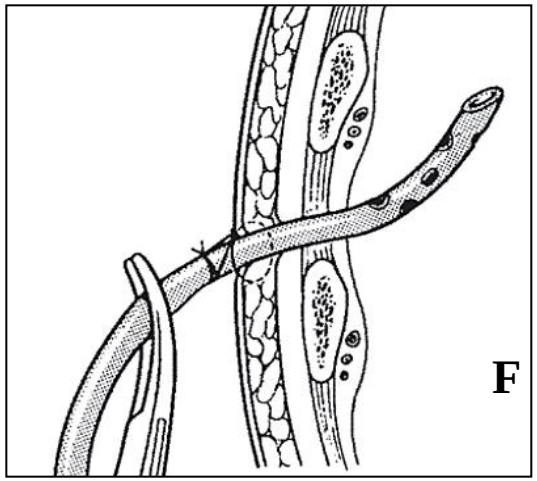
Prepare area with antiseptic; inject local anaesthetic in area of incision down to pleura

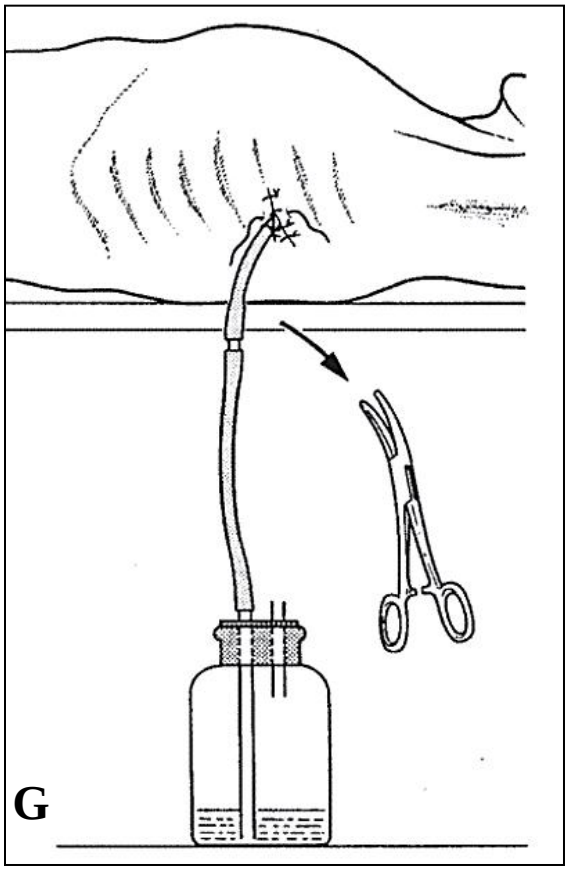
Make small transverse incision just above rib to avoid vascular injury; (A, B)

Using a pair of large curved artery forceps, go over top of rib, penetrate pleura bluntly, enlarge opening (C, D)

Insertion of Chest Drain and Underwater Seal Drainage







Use same forceps, grasp tube at tip, introduce into chest (E), advancing tube well past holes at end of tube

Close incision with interrupted skin sutures; use one stitch to anchor tube in place (F)

Leave additional stitch untied adjacent to tube for closing wound after tube removal (G)

Apply gauze dressing

Connect tube to underwater-seal drainage system, mark initial level of fluid in drainage bottle (G)

CIRCULATION: HAEMORRAGHIC SHOCK

Assess the circulation

Signs of hypoperfusion

- Confusion, lethargy or agitation
- Pallor or cold extremities
- Weak or absent radial and femoral pulses
- Tachycardia
- Hypotension

Examine the abdomen for tenderness or guarding

Carefully assess pelvic stability

CIRCULATION: HAEMORRAGHIC SHOCK

Large volumes of blood may be hidden in thoracic, abdominal and pelvic cavities, or from femoral shaft fractures.

To decrease bleeding:

- Apply pressure to external wounds
- Apply splint to possible femur fracture
- Apply pelvic binder to possible pelvic fracture

If patients is pregnant, she should not be on her back, put her on her left side.

Send blood for type and crossmatch

CIRCULATION

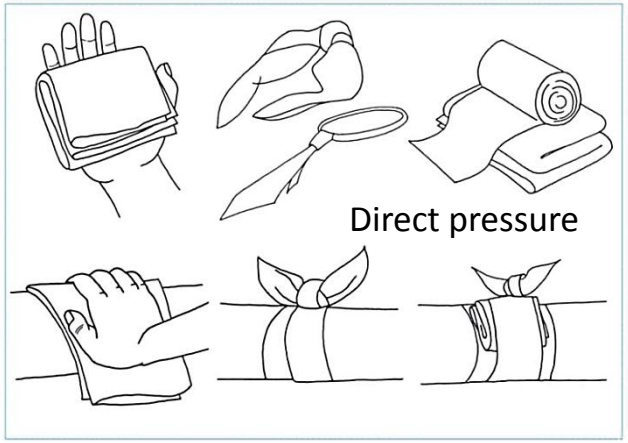
Obtain two large bore IV catheters

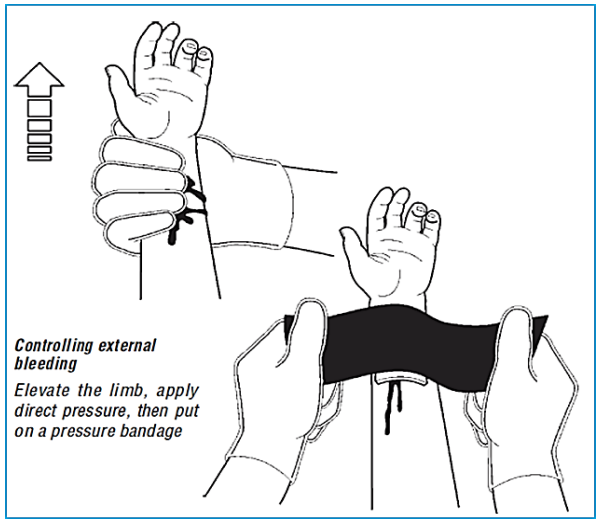
If systolic BP <90 mmHg or pulse >110 bpm

- Give 500 ml bolus of Ringer's Lactate or NS
- Keep patient warm
- Reassess vitals
- If still hypotensive after 2L of crystalloids, transfuse blood

STOP THE BLEEDING

Apply direct pressure to the wound, then put on compression dressing. Apply only enough pressure to stop the bleeding.





ONLY if bleeding is life-threatening and cannot be controlled, apply a tourniquet. Use a blood pressure cuff or wide elastic band over padded skin. Transfer urgently!

DISABILITY or DAMAGE

Checking for neurological damage: vital part of primary survey

Abbreviated neurological examination:

- ALERT
- VERBAL - responsive to verbal stimulus
- PAIN - responsive to painful stimulus
- UNRESPONSIVE

GLASGOW COMA SCORE (GCS)

Eyes	Score	Verbal	Score	Motor	Score
Open spontaneously	4	Oriented	5	Obeys commands	6
Open to command	3	Confused talk	4	Localizes to pain	5
Open to pain	2	Inappropriate words	3	Withdraws to pain	4
None	1	Incomprehensible sounds	2	Flexor (decorticate)	3
		None	1	Extensor (decerebrate)	2
				None	1

Total Score = Eye + Verbal + Motor Scores

GLASGOW COMA SCORE

Eyes +Verbal + Motor Scores = GCS

- Severe head injury: GCS 8 or less
- Moderate head injury: GCS 9-12
- Mild head injury: GCS 13-15

GCS is to be repeated and recorded frequently. It is the best way to determine deterioration

HEAD INJURY

Deterioration

- Unequal or dilated pupils may indicate increased intracranial pressure
- Avoid sedation or analgesics as it interferes with neurologic examinations, reduces breathing (increased CO_2 causes increased intracranial pressure)
- Bradycardia, hypertension may indicate worsening condition

EXPOSURE

- Remove all patient's clothing
- Examine whole patient
- Front and back; log roll carefully
- Do not allow patient to get cold (especially children)

IMAGING

X-Rays

- Chest
- Pelvis
- Cervical spine

Ultrasound

- FAST scan

PHASE III: SECONDARY SURVEY

Head Exam
- Scalp, eyes, ears
- Soft tissues

Neck Exam
- Penetrating injuries
- Swelling or crepitus

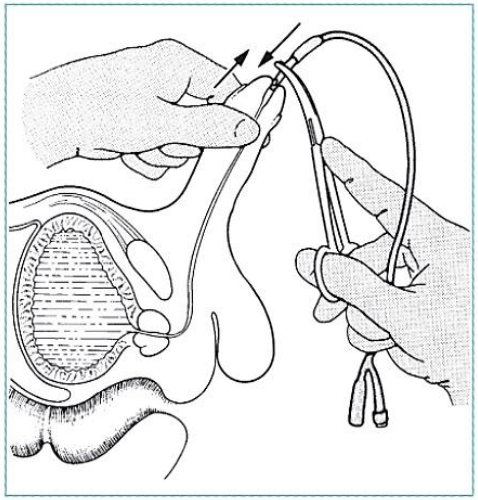
Neurological Exam
- Glasgow Coma Score
- Motor examination
- Sensory examination
- Reflexes

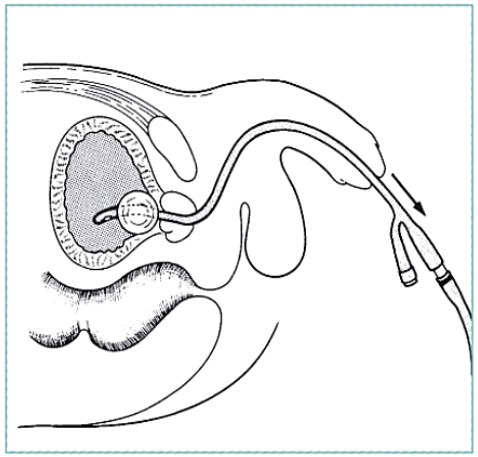
Chest Exam
- Clavicles, ribs
- Breath, heart sounds

Abdominal Exam
- Penetrating injury
- Blunt injury: nasogastric tube
- Rectal exam
- Urinary catheter

Pelvis and Limbs
- Fractures
- Pulses
- Lacerations, ecchymosis

URINARY CATHETER PLACEMENT





1. Wash area with soap and water, retract prepuce
2. Put on sterile gloves, apply bland antiseptic
3. Check integrity of catheter balloon
4. Lubricate catheter generously
5. Hold penis vertically, slightly stretched
6. Introduce catheter gently-don't force
7. Urine in catheter confirms placement
8. Inflate balloon slowly
9. Replace prepuce

REASSESSMENT

- Always perform an ABCDE primary survey if patient deteriorates

- Signs of adequate resuscitation
  - Slowing of tachycardia
  - Urine output normalizes
  - Blood pressure increases

MONITORING

- EKG monitoring if available
- Pulse oximeter
  - Most widely used physiological monitoring device for heart rate, oxygenation
  - Especially useful in anaesthesia, ICU
  - Simple to use
  - Should be minimum standard of monitoring in every surgical theatre
- Blood pressure
  - Manually or automated machine

Patient Referral and Transport

STABILIZATION AND TRANSFER

- Resuscitation completed
- Analgesia administered
- Laboratory specimen sent
- Fractures immobilized
- Documentation completed
- Transfer
  - Ward
  - Operating theatre
  - Higher level of care centre

DECISION MAKING

Can we do procedure here?

- Is operating theatre safe, ready to use?
- Are necessary equipment, drugs, supplies available?
- Are team members available?
- Do I have knowledge and skill to perform necessary procedure safely?
- Is there back-up or extra support available if needed?
- Can we manage potential complications if problems arise?
- Do we have facilities for good post-operative care?

If the answer to any of these questions is "NO" it is inadvisable to proceed with surgery!

TRANSFER OF TRAUMA PATIENT

Patient transfer carries inherent risk

Patients must be stabilized prior to departure:

- Effectively resuscitated
- Controlled airway
- Normalized circulation
- Immobilized fractures
- Appropriate analgesia
- Functioning intravenous lines

Patients should be transported only to facilities offering higher level of care

TRANSFER OF TRAUMA PATIENT

Planning and preparation:

- Mode of transport
- Accompanying personnel, including family
- Supplies needed for *any* possible treatment
- Identifying possible complications
- Communicate with all involved in transfer including receiving hospital

Be prepared: if anything can go wrong, it will and at the worst possible time!

PATIENT SAFETY: Consent

Informed consent means that patient and patient's family understand

- What is to take place
- Potential risks, complications of both proceeding and not proceeding
- Have given permission for intervention

Be attentive to legal, religious, cultural, linguistic, family norms and differences

Our job is not to judge, but to provide care to all without regard to social status or any other considerations

PATIENT SAFETY: Consent

With invasive, surgical procedures important to fully explain :

- What are you proposing to do?
- What are reasons for recommending procedure?
- What are expectations, goals?

Communicate effectively:

- Use language that can be understood
- Draw pictures, use an interpreter if necessary
- Allow patient, family members, elders to ask questions and consider what has been discussed

RECORD KEEPING

- Essential that patients receive written note describing diagnosis, procedure performed

- All records should be clear, accurate, complete, signed

RECORD KEEPING

Admission note/preoperative note

- Preoperative assessment, management plan, patient consent should be clearly documented

Delivery book

- Chronological list of deliveries, procedures, interventions, complications, outcomes for mother and baby

RECORD KEEPING

Operating theatre records

- Patient identity
- Procedure performed: both major and minor
- Personnel involved
- Complications
- Blood loss
- Standardized forms save time, encourage staff to record required information

Postoperative notes

- All patients assessed at least once after surgery
- Vital signs, patient's condition accurately recorded

RECORD KEEPING

Progress note

- Need not be long, must comment on patient's condition, note any changes in management plan
- Should be signed by person writing note

Discharge note

- Admitting and definitive diagnoses
- Summary of patient's course in hospital
- Outpatient instructions:
  - medication details
  - planned follow-up
  - suture removal, special wound care

Emergency procedures

OXYGEN SUPPLEMENTATION

- Reliable oxygen supply is essential for anaesthesia or any seriously ill patient
- Oxygen concentrators are the most suitable, economical way to provide oxygen; few cylinders in case of power failure
- Whichever source of oxygen, an effective system is needed for maintenance and repairs
- Clinical staff need training in how to use oxygen safely, effectively, economically

OXYGEN SUPPLEMENTATION

Cylinder System	Oxygen Concentrator
• Inexpensive to buy • Expensive to operate • Needs year-round supply of cylinders • Training and maintenance needed • Can store oxygen	• More expensive to buy • Inexpensive to operate • Requires only electricity • Training and maintenance needed • Cannot store oxygen; provides only when power supply is on

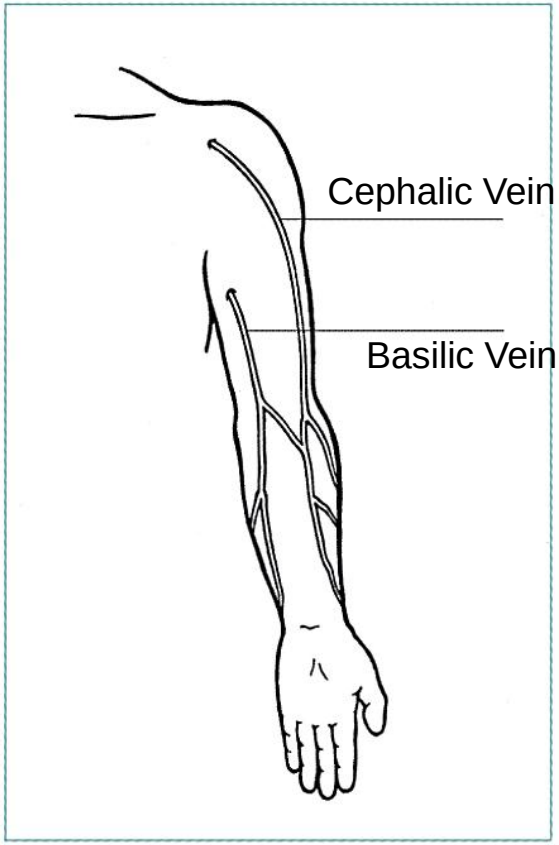
OXYGEN SUPPLEMENTATION

- Start oxygen at 5 L/min
- If no improvement, increase to:
  - 6-10 L/min via facemask or
  - 10-15 L/min via facemask with reservoir

- When improving, titrate down 1-2 L/min, allowing at least 2-3 minutes to evaluate effect.
- Strive to maintain saturation >90%

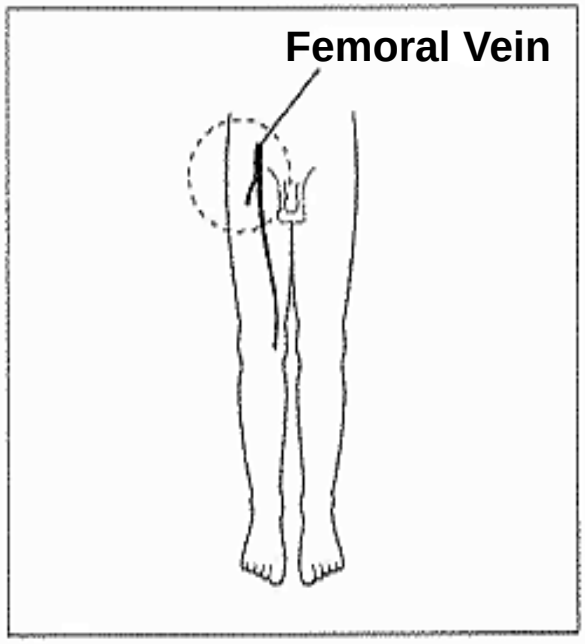
INTRAVENOUS ACCESS

- Cannula should be placed in arm vein, not over joint, easy fixation. Comfortable and convenient for drug administration and care
- Best veins in emergencies:
  - Antecubital fossa
  - Femoral
  - External jugular
- Do not attempt subclavian vein due to high risk of pleural puncture



Superficial veins

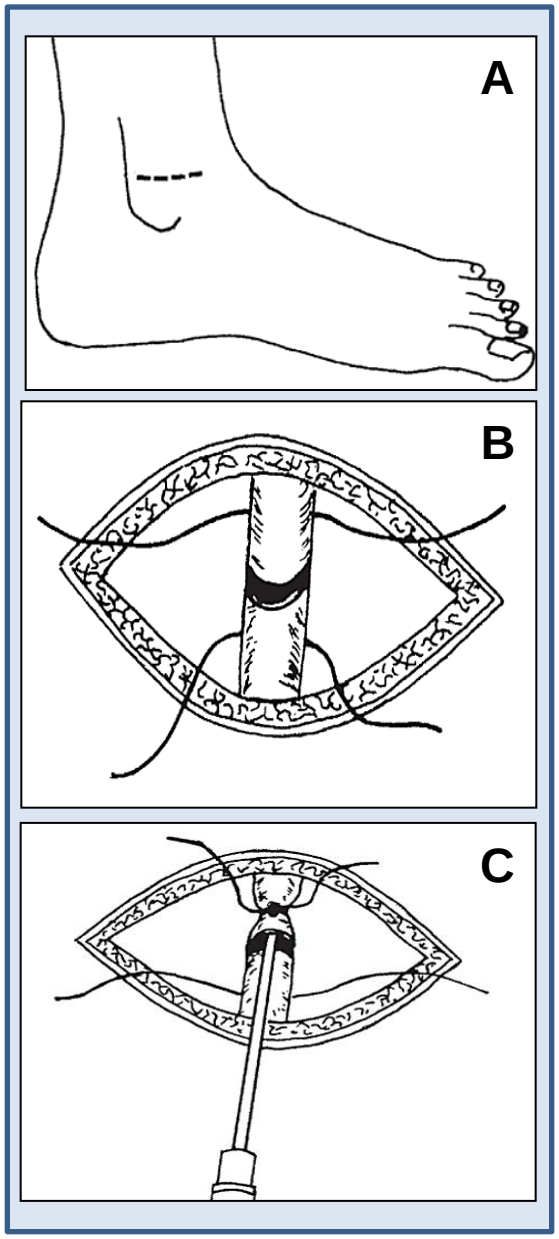
INTRAVENOUS ACCESS: Central veins



Lateral to medial:
Nerve, Artery, Vein, Empty space, Ligament (NAVEL)

Femoral vein

- If right handed, stand on patient's right, palpate femoral artery
- Prep area carefully; site is contaminated
- Use a 14, 16 or 18 G (20 G in child) cannula mounted on 5 ml syringe
- Avoid injured extremities, if possible



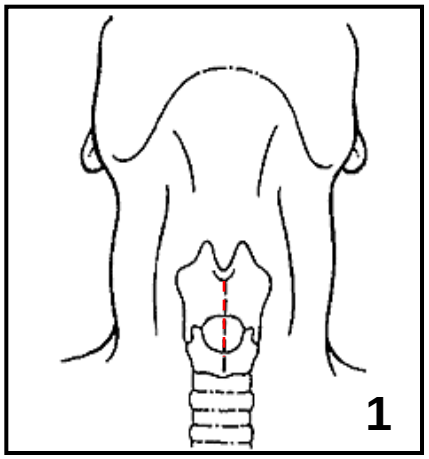
VENOUS CUTDOWN

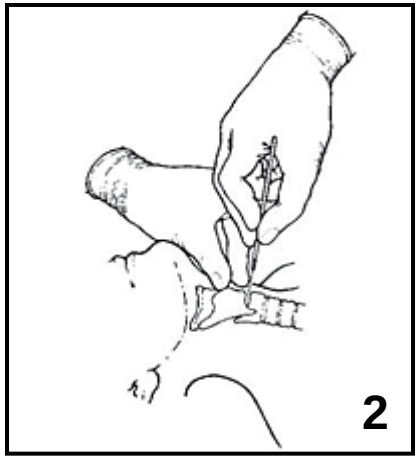
- Equipment
  - Small scalpel
  - Artery forceps
  - Scissors
  - Large catheter (or sterile infant feeding tube)
- Transverse incision 2 finger breadths above, anterior to medial malleolus (A); (use patient's own finger breadths to define incision)
- Place two sutures under vein (B)
- Once catheter in place, tie sutures (C)
- Use closing sutures to secure catheter

FLUIDS AND MEDICINES

- Avoid fluids containing dextrose during resuscitation
- Use Saline or Ringer's lactate
- For shocked patient: give fluids as fast as drip runs until blood pressure responds
- May need a pressure infusion bag to push fluids
- Monitor response carefully; look at vital signs, urine output
- Always give medicines intravenously during resuscitation

SURGICAL CRICOTHYROIDOTOMY

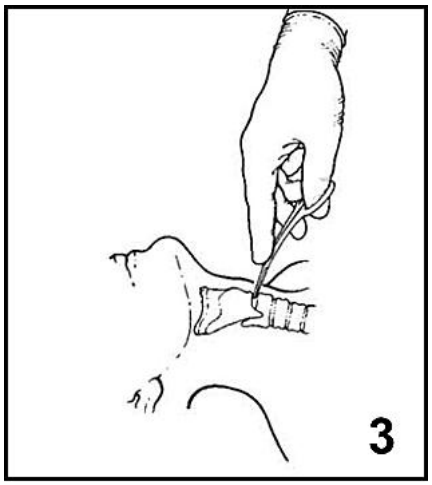


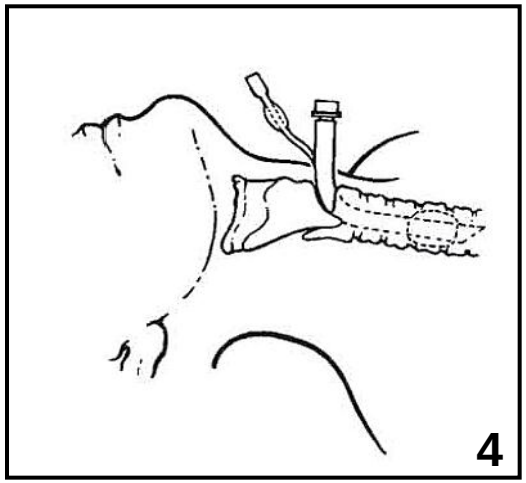


- Hyperextend neck, if possible
- Identify groove between cricoid and thyroid cartilages just below "Adam's apple"
- Clean area, infiltrate with local anaesthetic

- Incise through skin vertically, use blunt dissection to clearly see membrane between thyroid and cricoid
- Using small scalpel, stab through membrane into trachea

SURGICAL CRICOTHYROIDOTOMY



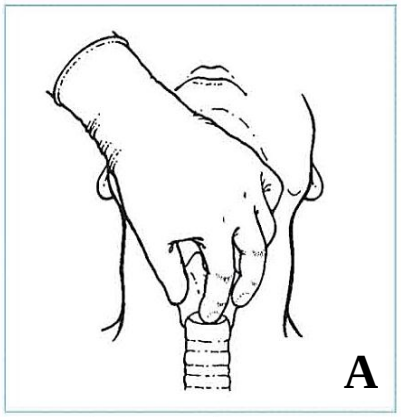


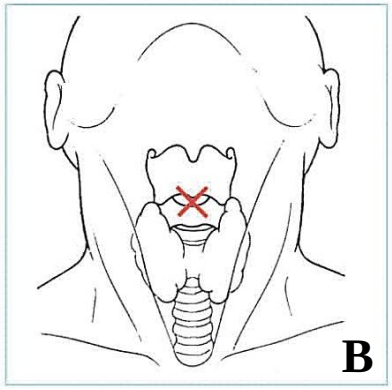
- Rotate blade, use curved forceps to widen opening
- Pass thin introducer or nasogastric tube into trachea if small access

- Run #4-6 size endotracheal tube over introducer, pass into trachea (D)
- Remove introducer, if used

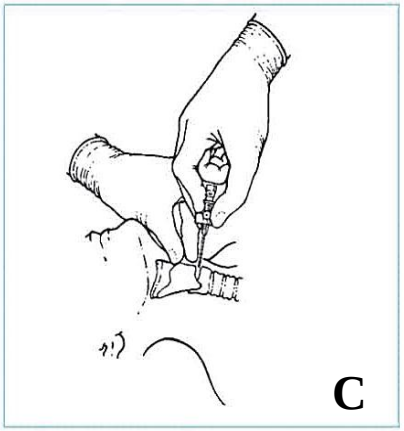
Do not attempt surgical cricothyroidotomy in children < 10 years

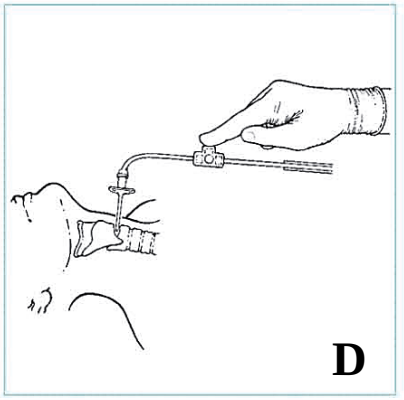
LARGE NEEDLE CRICOTHYROIDOTOMY





- Puncture the crico-thyroid membrane with a large bore catheter attached to syringe filled with water or saline.
- Aspirate as you insert. When entering the trachea, air bubbles will appear in the syringe.
- Advance the catheter and retract the needle
- Secure the catheter
- Connect the catheter to oxygen source, set to 15 L/min
- Use I:E ration 1:4 sec (Inspiration:Expiration ratio)





Trauma in Children

TRAUMA IN CHILDREN

- Trauma is the leading cause of death in all children
- Most common surgical problem affecting children
- Proper treatment can prevent death and life-long disability
- Infants and children differ from adults in significant physiological and anatomical ways
  - smaller physiological reserves
  - increased risk of:
    - dehydration
    - hypoglycaemia
    - hypothermia

TRAUMA IN CHILDREN

Airway

Breathing

Circulation

Disability

Exposure of child without losing heat

Principles of managing paediatric trauma patients are essentially same as for adult

MANAGING THE AIRWAY IN A CHILD WITH OBSTRUCTED BREATHING

NO NECK TRAUMA IS SUSPECTED

Neutral position to open the airway in an infant

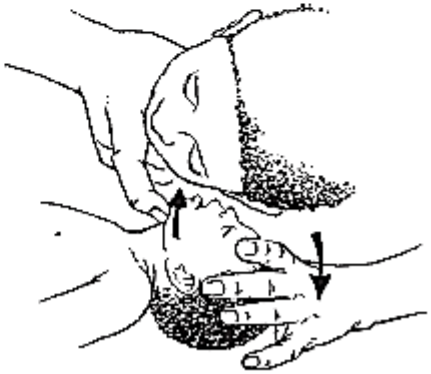
Sniffing position to open the airway in an older child

Child conscious

- Inspect mouth and remove foreign body, if present
- Clear secretions from throat
- Let child assume position of maximal comfort

Child unconscious

- Tilt the head as shown
- Inspect mouth and remove foreign body, if present
- Clear secretions from throat
- Check the airway by looking for chest movements, listening for breath sounds and feeling for breath



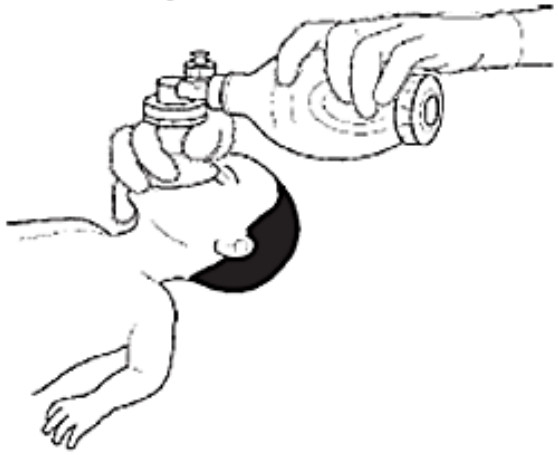
Look, listen and feel for breathing

MANAGING THE AIRWAY IN A CHILD WITH SUSPECTED NECK TRAUMA

NECK TRAUMA OR POSSIBLE CERVICAL SPINE INJURY IS SUSPECTED

- Stabilize the neck
- Inspect mouth and remove foreign body, if present
- Clear secretions from throat
- Check the airway by looking for chest movements, listening for breath sounds, and feeling for breath

Use jaw thrust without head tilt. Place the 4th and 5th finger behind the angle of the jaw and move it upwards so that the bottom of the jaw is thrust forwards, at 90° to the body



If the child is still not breathing after carrying out the above, ventilate with bag and mask

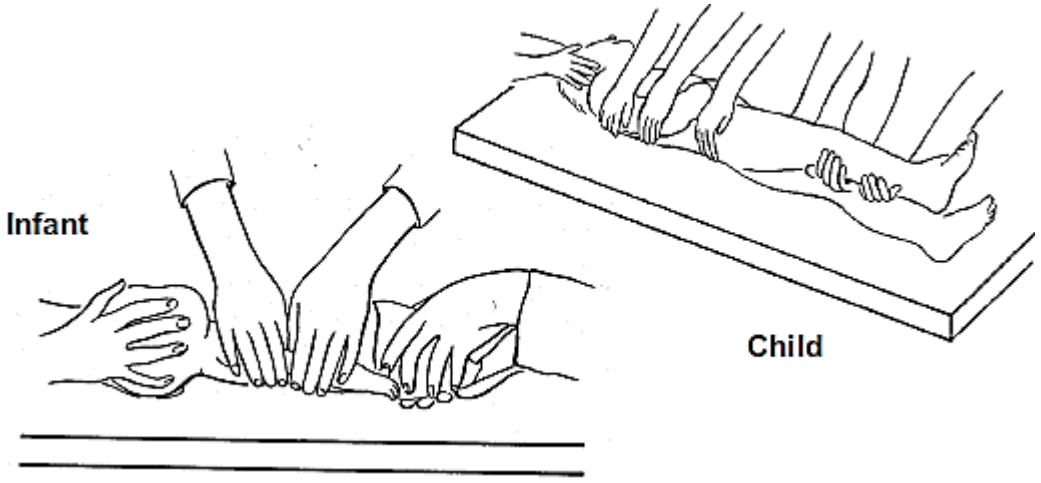
STABILIZE SUSPECTED NECK TRAUMA

If neck trauma is suspected:

- Stabilize the child's neck and keep the child lying on the back
- Tape the child's forehead to the sides of a firm board to secure this position
- Prevent the neck from moving by supporting the child's head (e.g. using litre bags of IV fluid on each side)
- If vomiting, turn on the side, keeping the head in line with the body

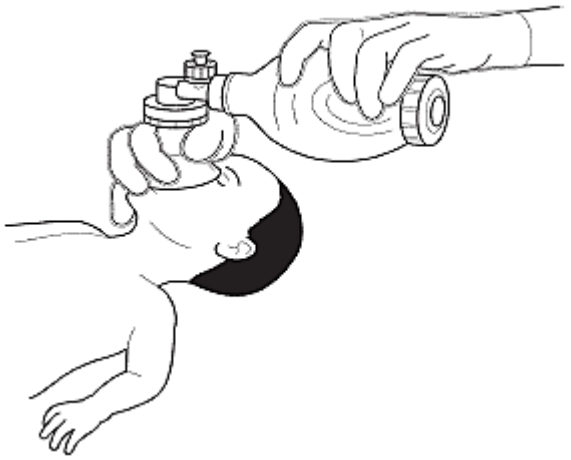
LOGROLL IN SUSPECTED NECK TRAUMA

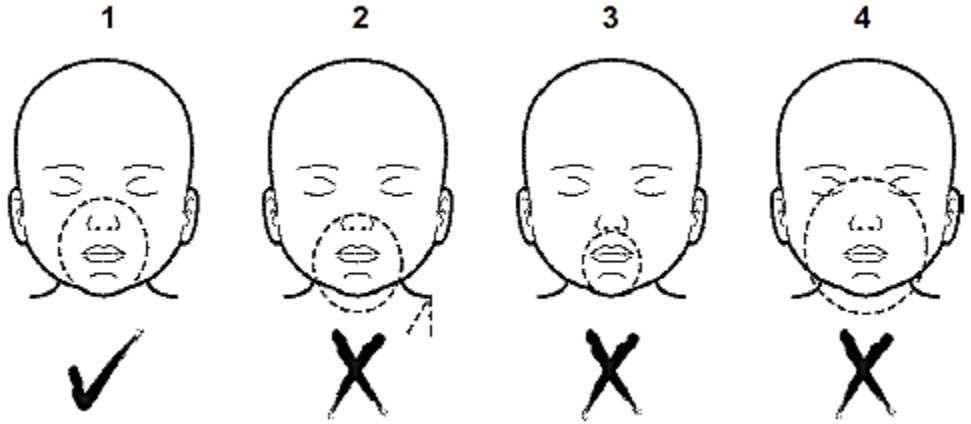
- Avoid rotation, extremes of flexion and extension of neck
- One person should assume responsibility for neck:
  - Stand at top of patient and hold head
  - Place fingers at edge of mandible with palm over ears
  - Maintain gentle traction to keep neck straight and in line with body



BREATHING

- If child not breathing, ventilate with self-inflating bag and mask
- Connect mask to oxygen if available
- Must have correct size and position of facemask to prevent leakage

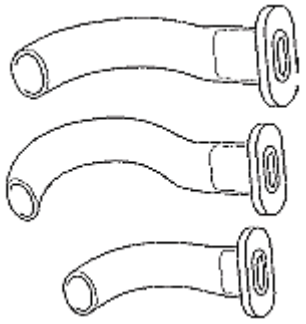


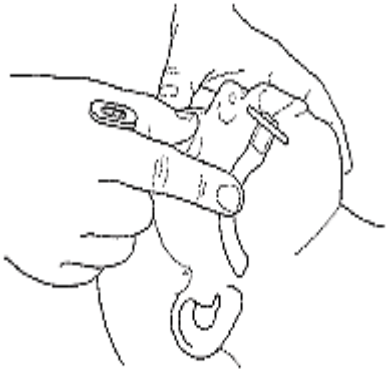


1. Correct size and position
2. Mask too large, overlaps the chin
3. Mask too small, nostrils not covered
4. Mask too large, overlap with eyes

OROPHARYNGEAL AIRWAYS

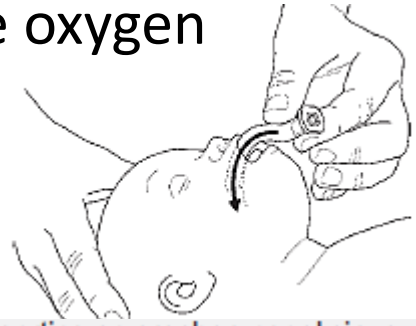
- Can improve airway opening
- Come in different sizes
- Appropriate sized airway goes from centre of teeth (incisors) to angle of jaw when laid on face with raised curved (convex) side up
- Take particular care in children because of possibility of soft tissue damage



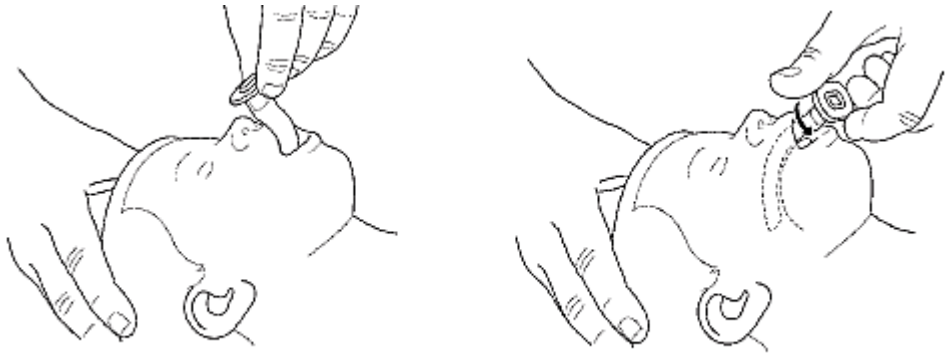


INSERTION OF OROPHARYNGEAL AIRWAY

- Select appropriate sized airway
- Position child to open airway
- Use tongue depressor, insert airway
  - Convex side up in infant
  - Concave side up in older child until tip reaches soft palate, then rotate 180˚ and slide back over tongue
- Recheck airway opening, use different size or reposition if necessary
- Give oxygen



Inserting an oropharyngeal airway in an infant: convex side up



Inserting an oropharyngeal airway in an older child

HOW TO GIVE OXYGEN

Give oxygen through nasal prongs or a nasal catheter

Nasal Prongs

- Place the prongs just inside the nostrils and secure with tape

Nasal Catheter

- Use an 8 FG size tube
- Measure the distance from the side of the nostril to the inner eyebrow margin with the catheter
- Insert the catheter to this depth
- Secure with tape

Start oxygen flow at 1-2 litres/minute

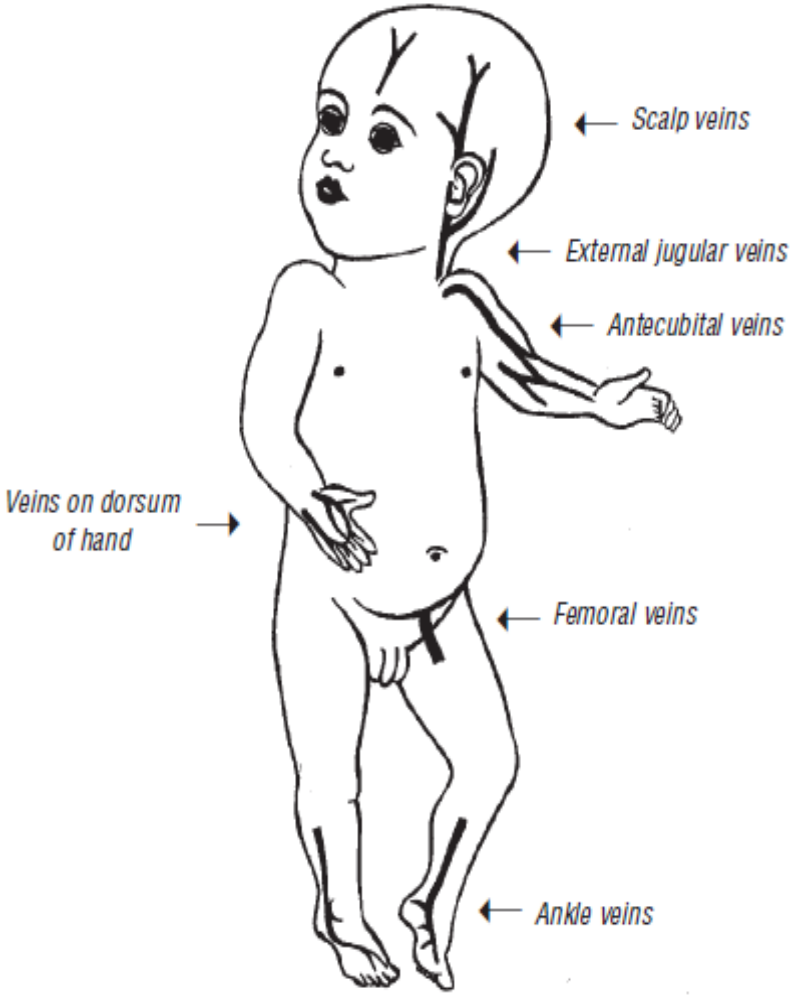
Nasal Prongs

Nasal Catheter

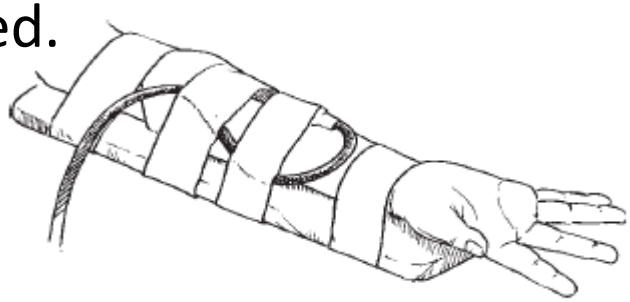
CIRCULATION

- The radial pulse at the wrist should be felt.
- If strong and not obviously fast, pulse is adequate
- If radial pulse is difficult to find, try brachial pulse in middle of upper arm

INTRAVENOUS ACCESS IN CHILDREN

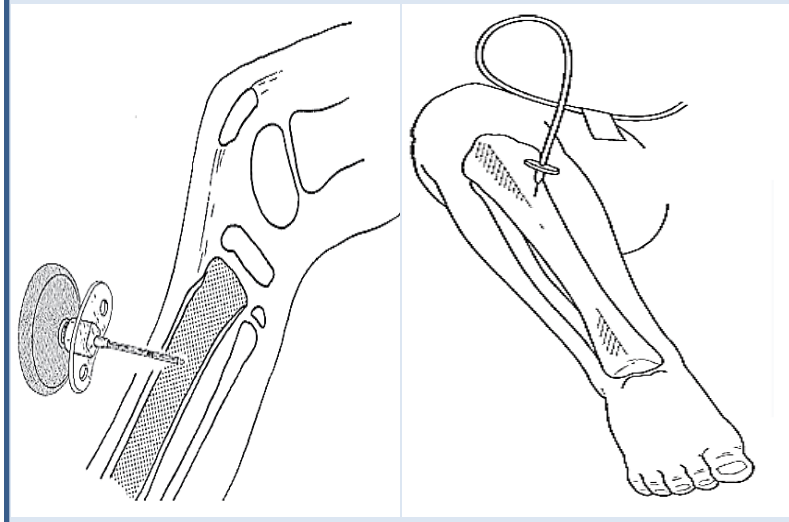


- Select suitable vein to place 22 or 24 gauge cannula
- Have assistant keep limb steady, use rubber glove or tubing as tourniquet
- Clean surrounding skin with antiseptic solution
- Introduce cannula into vein and fix securely with tape
- Apply a splint with elbow extended, wrist slightly flexed.



INTRAOSSEOUS ACCESS

- Intraosseous puncture provides quick access to circulation in shocked child if venous cannulation impossible
- Fluids, blood, medicines may be given
- Fluids may need to be given under pressure
- If intraosseous needles unavailable, use spinal or bone marrow biopsy needle



Intraosseous needle normally sited in upper tibia at junction of upper and middle third, avoiding growth plate

TRAUMA IN CHILDREN

- Most sensitive indicator of fluid status in a child is urine output
- Infants are unable to concentrate urine as well as adults, thus more susceptible to electrolyte abnormalities
- Dosage calculation (based on weight), for fluids, transfusions, drugs is crucial to correct management

Normal Urine output:
(ml/kg/hour)

Infants	1-2	ml/kg/h
Children	1	ml/kg/h
Adults	0.5	ml/kg/h

How much urine would you expect a 20 kg child to produce in 24 hours?

TRAUMA IN CHILDREN

- Monitor fluid status, electrolytes, haemoglobin diligently
- Maintenance fluid requirements must be supplemented to compensate for all losses
- Tachycardia is an earlier sign than hypotension
- Events happen quickly in babies; monitor closely

TRAUMA IN CHILDREN

- Malnutrition can impair response of children to injury, ability to heal and recover
- Good nutrition promotes healing - poor nutrition prevents it
- **Avoid hypothermia**. Infants and young children, especially those with little subcutaneous fat, are unable to maintain normal body temperature when there are wide variations in ambient temperature or when anaesthetized

SHOCK RESUSCITATION PROTOCOL IN CHILDREN

Age/weight	Volume of Ringer's lactate or normal saline solution (20 ml/kg)
2 months (<4 kg)	75 ml
2–<4 months (4–<6 kg)	100 ml
4–<12 months (6–<10 kg)	150 ml
1–<3 years (10–<14 kg)	250 ml
3–<5 years (14–19 kg)	350 ml

Reassess child after appropriate volume has run in

Reassess after first infusion:	If no improvement, repeat 20 ml/kg as rapidly as possible.
Reassess after second infusion:	If no improvement, repeat 20 ml/kg as rapidly as possible.
Reassess after third infusion:	If no improvement, give blood 20 ml/kg over 30 minutes (if shock is not caused by profuse diarrhoea, in this case repeat Ringer's lactate or normal saline).

TRAUMA IN THE ELDERLY

- Injury risk increases due to slower reflexes, reduced visual acuity, diminished strength
- Even though appearing minor, injuries should be given higher severity scores simply based on age
- Clinician's index of suspicion should be increased