

Primary Trauma Care

What is PTC?

Primary Trauma Care

is a

2 day course

training health professionals
in acute management of the
severely injured patient.

PTC Mission Statement

- A system of training for front-line staff in trauma management
- Aimed at preventing death and disability in seriously injured patients
- Using available resources
- To train clinicians to teach PTC principles in their hospitals

PTC 2 day course

At the end you will

- understand and apply a system for assessing and treating trauma patients
- have the knowledge, skills and attitudes of the PTC principles
- apply these PTC principles to where you work

PTC emphasises basic trauma care with the available resources

When do trauma patients die?

What are the common disabilities?

What resources are available?

When do trauma patients die?

Seconds - minutes (50% deaths)

- Brain and spinal cord, heart, great vessels

1-2 hours (35% deaths)

- Head injury, chest, abdomen, fractures causing large blood loss

Days to weeks (15% deaths)

- Sepsis, organ failure

PTC System

- Prevention
- Triage
- Primary survey
- Secondary survey
- Stabilisation
- Transfer
- Definitive care

PTC System

Triage

Sorting patients according to priority

Priority depends on

- experience
- resources
- severity of injury

PTC System

Primary Survey (ABCDE)

- rapid examination
- life-threatening injuries
- treat as you find

Secondary Survey

- history
- detailed head to toe examination
- all injuries
- special Investigations if available

PTC System

- **Stabilisation** includes
 - re-assessment
 - optimisation
 - documentation
 - communication

when stable

- **Transfer for definitive care**

PTC System



PTC System Summary

PTC offers

- a systematic approach
- rapid assessment and treatment of the injured patient
- adaptability to all healthcare environments

Primary Survey

At the end you will

- understand the elements of the Primary Survey
- know when to perform the Primary Survey

Primary Survey

- Systematic examination to detect life threatening injuries
- Rapid - 5 minutes
- Treat as you find
- Repeat if unstable
- Universal precautions

Primary Survey

- Airway + Cervical spine control
- Breathing
- Circulation
- Disability
- Exposure

A

Airway and Cervical spine

Airway Assessment

- Can the patient talk?
- Look, feel, listen
 - colour, conscious state
 - accessory muscle use
 - sounds

Airway Beware

- Airway obstruction
- Breathing difficulties with chest injuries
- Cervical spine injury

Airway Management

- Clear mouth
- Basic airway
- Advanced airway
- Cervical spine protection

B

Breathing

Breathing Assessment

- Is the breathing normal?
- Are there chest injuries?
- Look, feel and listen

Breathing Assessment

- Air / Chest movement
- Respiratory rate
- Tracheal deviation
- Accessory muscle use
- Percussion / Auscultation

Breathing

Beware

Life threatening injuries

- Airway injury
- Tension pneumothorax
- Open pneumothorax
- Massive haemothorax
- Flail chest
- Lung contusion

Breathing Management

- Give oxygen
- Assist ventilation
- Decompress pneumothorax
- Drain haemothorax

C

Circulation

Circulation Assessment

- Is the patient in shock?
- Is there bleeding?
- Look, feel and listen

Circulation Assessment

- External bleeding
- Signs of shock
 - fast pulse
 - poor capillary return
 - low blood pressure

Circulation

Beware

Life threatening haemorrhage may be hidden

- chest
- abdomen
- pelvis
- long bone
- external before arrival

Circulation Management

- Stop bleeding
- 2 large bore intravenous cannulae
- Take blood for crossmatch and base line investigations
- Give i/v fluid
- Monitor urinary output.

D

Disability

Disability

- AVPU
 - Is the patient **A**wake?
 - Is the patient responding to:
 - **V**oice?
 - **P**ain?
 - Is the patient **U**nresponsive?
- Pupils?

E

Exposure
(& Temperature Control)

Exposure

- Are there any hidden injuries under clothing?
- Keep patient warm

Primary Survey

- Monitoring
- Investigations
 - X rays
- Procedures
- Pain relief – preferably i/v

Reassessment of ABCDE

If patient is, or becomes,
unstable

Primary Survey



Primary Survey Summary

- Systematic examination
- Rapid – 5 minutes
- Treat as you find
- Repeat if unstable

Airway and Breathing

At the end you will

- understand the structured approach to airway and breathing
- be able to recognise and manage airway and breathing problems

Scenario

A 25-year-old man falls off the back of a truck and hits his head. On arrival in your hospital, he is unconscious and his breathing is noisy.



Scenario Questions

- How would you assess his airway quickly?
- What are the signs of airway obstruction?
- How would you open his airway?
- How would you immobilise his C-spine?



Airway

Quick Assessment

Immobilise Cervical Spine



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graph TD; A[Immobilise Cervical Spine] --> B[Can patient talk?]; B --> C["Yes<br/>Airway OK<br/>Give oxygen<br/>Then B"]; B --> D["No<br/>Airway not OK<br/>Open airway<br/>Give oxygen<br/>then B"];
```

Can patient talk?

Yes
Airway OK
Give oxygen
Then B

No
Airway not OK
Open airway
Give oxygen
then B

Cervical Spine

- Assume C-spine injury for all severely injured patients
- Excessive C-spine movement may cause paralysis

Cervical Spine Basic Techniques

- Manual immobilisation (with hands)
- C-spine collar
- Sandbags
- Tape



Airway Assessment

- Look
 - Conscious state
 - Colour
 - Chest movement
 - Respiratory distress
 - Foreign bodies
- Listen
 - Noisy breathing
- Feel
 - Tenderness
 - Crepitus

Airway Assessment

Signs Of Obstruction

- Noisy breathing
 - snoring, gurgling, stridor
- Agitation (hypoxia)
- Use of accessory muscles
- Paradoxical chest movement
- Cyanosis

Airway Management

Basic Techniques

- Chin lift



- Jaw thrust



Airway Management Adjuncts

- Suction
- Oropharyngeal airway
- Nasopharyngeal airway
- Bag valve mask (BVM)



Airway Management

Advanced Techniques

- Supraglottic airway eg LMA
- Tracheal intubation
- Surgical airway

Tracheal Intubation

- Intubate if:
 - unable to maintain the airway and breathing using basic techniques
- Consider intubation if:
 - risk of aspiration
 - control CO₂ (eg head injury)

Patients die from lack of oxygen,
not lack of a tube

Surgical Airway

Consider if:

- Unable to intubate
- Unable to ventilate



Breathing (Ventilation)

Breathing Look

- Cyanosis
- Respiratory rate
- Accessory muscle use
- Penetrating injury
- Flail chest
- Sucking chest wound

Breathing

Feel

- Tracheal shift
- Rib fractures: tenderness/crepitus
- Chest wall movement
- Subcutaneous emphysema
- Percussion

Breathing

Listen

- Breath sounds
- Heart sounds
- Bowel sounds

Breathing Management

- Give high flow oxygen
- Assist ventilation if necessary
- Treat pneumothorax or haemothorax

Breathing

Beware

- Airway injury
- Tension pneumothorax
- Open pneumothorax
- Massive haemothorax
- Flail chest
- Lung contusion

Tension Pneumothorax



Tension Pneumothorax

Signs

Look

- cyanosis, fast breathing rate

Feel

- tracheal deviation, overexpansion
- increased resonance on percussion
- ↓ BP

Listen

- ↓ breath sounds

Tension Pneumothorax Management

- Immediate decompression
- Large bore needle
- Second intercostal space
- Mid clavicular line
- Formal chest drain must follow

Tension Pneumothorax

- Should be a clinical diagnosis
- Treat before X-ray

Airway and Breathing



Airway and Breathing

Summary

- Open the airway
- Give oxygen
- Assist ventilation as required
- Consider intubation
- **Never** forget cervical spine

Circulation

At the end you will

- understand the structured approach to circulation problems
- be able to recognise and treat shock

Scenario

A 19-year-old woman is hit by a car. When she arrives at your hospital, she is complaining of lower abdominal and right thigh pain. She is pale and sweaty.

Scenario Questions

- What would you do first ?
- How would you assess her circulation?
- What is shock ?
- Where are the sites of “hidden” bleeding ?
- How do you treat shock ?

Circulation Assessment

- Peripheral colour
- Capillary refill
- Heart rate
- Peripheral temperature
- Blood pressure
- Urine output

Types of Bleeding

- Compressible / external
 - usually peripheral
- Non-compressible
 - e.g. intra-abdominal
 - surgery required

Shock

- Inadequate organ perfusion and tissue oxygenation
- Most often due to blood loss in trauma

Circulation

Types of shock

- i Haemorrhagic shock
- i Non haemorrhagic shock

Shock

Clinical Signs

- Skin - cold, pale, sweaty, cyanosed
- Respiratory rate
- Capillary refill time > 2 seconds
- Pulse rate and blood pressure
- Urine output < 0.5 ml/kg/hr

Shock

Clinical Signs

- Altered mental state: anxiety to coma
- Pulse present?
 - radial systolic > 80 mmHg
 - femoral systolic > 70 mmHg
 - carotid systolic > 60 mmHg
- Tachycardia
- Pulse pressure narrowed

Shock

Hidden haemorrhage

- Pleural Cavity
- Abdominal Cavity
- Pelvic Fractures
- Femoral Shaft
- External

“blood on the floor and four more”

Shock

Sites & approximate blood loss

Pelvic #	3 litres
Closed Femoral #	1.5-2 litres
Closed Tibial #	500 ml
Haemothorax	2 litres
Hand sized wound	500 ml
Fist sized clot	500 ml
Rib # (each)	150 ml

Clinical Signs in Shock

Blood Loss	Heart rate	Blood Pressure	Capillary Return	Resp Rate	Mental State
<750	<100	Normal	Normal	Normal	Normal
750-1500	>100	Systolic Normal	Prolonged	20-30	Mildly Anxious
>1500-2000	>120	Decreased	Prolonged	30-40	Anxious Confused

Circulation

Types of shock

- i Haemorrhagic
- i Non-haemorrhagic
 - i cardiogenic and obstructive
 - i neurogenic
 - i septic
 - i anaphylactic

Cardiogenic and Obstructive Shock

- Myocardial contusion
- Pericardial tamponade
- Tension pneumothorax
- Penetrating wound of heart
- Myocardial infarction

Neurogenic shock

- May occur in spinal cord injury
- Vasodilatation, hypotension and may be slow heart rate
- Never assume hypotension only from cord injury
- Look for other injuries

Circulation Management

- A + B, give oxygen
- Stop obvious bleeding
- Two large i/v cannula (14-16 gauge)
 - take blood for cross-match
 - fluid replacement
- Consider urgent surgical referral

Circulation

Stop bleeding

- Chest
 - drain tube and re-expand lung
- Abdomen
 - laparotomy if hypotensive after fluids
- Pelvis: pelvic sling
- Limbs
 - reduce and splint long bone fracture
 - pressure dressing

Circulation

Fluid replacement - How much?

Fast 250ml bolus Saline or Ringer's

Reassess

Repeat boluses as necessary

Reassess

Look for haemorrhage source

Consider blood

Consider surgery

Aim for systolic BP > 90 + HR < 100

Circulation

Blood transfusion

Consider blood transfusion if:

- Blood pressure unstable in spite of fluids
- Continuing bleeding
- Haemoglobin $<7\text{g/dl}$ and patient still bleeding

Circulation Management

- Maintain temperature
- Warm fluids
- Pain relief
- Monitor urine output

Circulation

Tranexamic Acid

- Use early if available
- Reduces bleeding and risk of death
- Loading dose 1 g i/v over 10 min
- Then iv infusion 1 g over 8 h.

Circulation



Circulation

Summary

- Careful assessment
- Stop the bleeding
- Replace volume
- Is there hidden bleeding?

Chest Injuries

At the end you will

- recognise common life threatening chest injuries
- understand the principles of management of chest injuries

Scenario

A 45-year-old man is admitted after being shot.

He is short of breath and complaining of severe right-sided chest pain.



Scenario Questions

- What would you do first?
- What are the possible causes of his shortness of breath and chest pain?
- How would you treat these?



Chest Injuries

- 25% of trauma deaths
- Immediate deaths
 - major disruption of heart and great vessels
- Early deaths
 - airway obstruction, cardiac tamponade or aspiration

Chest Injuries

Initial assessment

Primary Survey

- Airway + Cervical spine control
- Breathing
- Circulation
- Disability
- Exposure

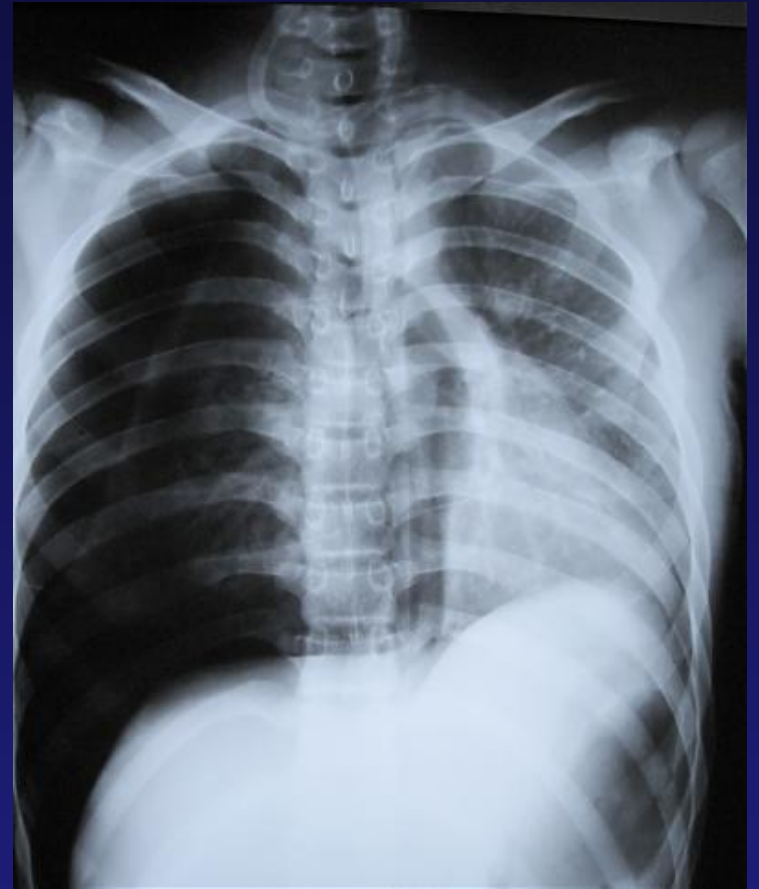
Chest Injuries

- Pneumothorax (tension, simple, open)
- Haemothorax
- Pulmonary contusion
- Flail chest
- Rib fractures
- Other
 - pericardial tamponade
 - myocardial contusion

Chest Injuries

Tension Pneumothorax

- Life threatening emergency
- Clinical diagnosis
- Does not need X-Ray
- Urgent decompression



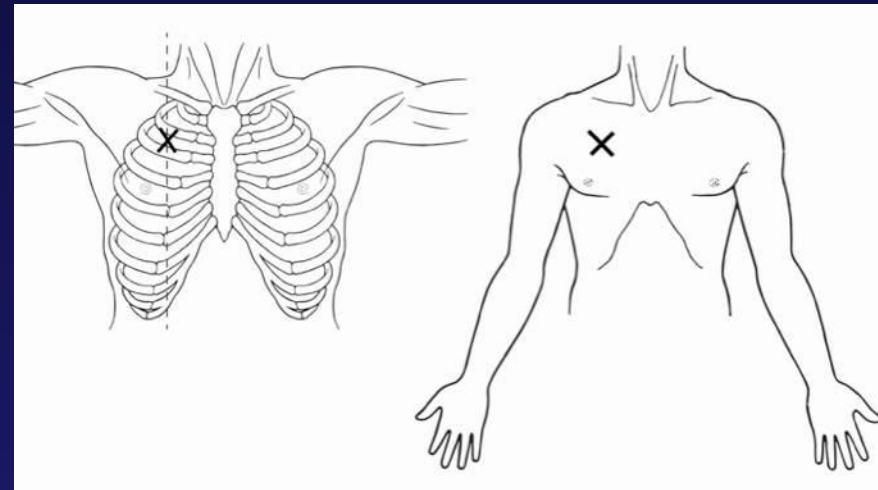
Chest Injuries

Tension Pneumothorax

- Air enters the pleural space but cannot leave
- ↑ Intrathoracic pressure
- Mediastinal shift
- ↓ venous return + ↓ cardiac output
- Respiratory distress and hypoxia

Tension Pneumothorax Management

- Immediate decompression
- Large bore needle
 - 2nd intercostal space
 - mid clavicular line
- Formal chest drain to follow



Chest Injuries

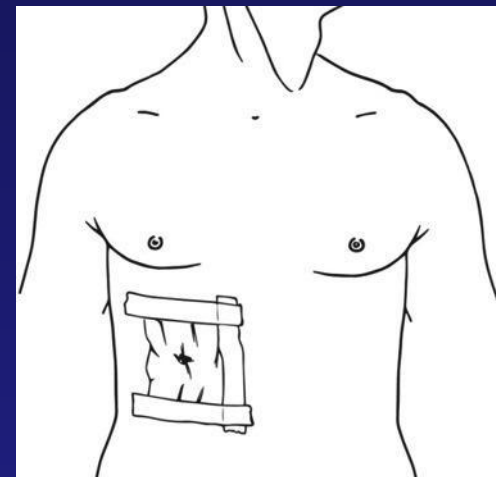
Simple Pneumothorax

- X-Ray to confirm and size
- Risk of tension
- Consider chest drain
 - large pneumothorax
 - patient needing ventilation
 - patient being transferred

Chest Injuries

Open Pneumothorax

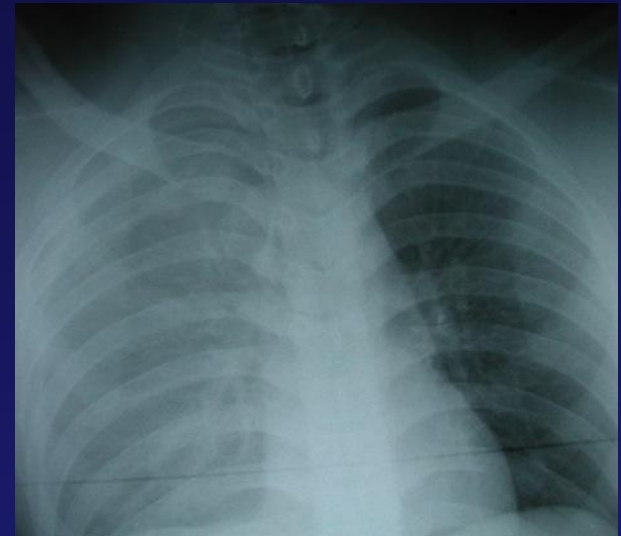
- “Sucking” chest wound
- Other signs of pneumothorax present
- Occlude wound (on 3 sides only)
- Air escapes on expiration
- Urgent chest drain



Chest Injuries

Haemothorax

- Breath sounds↓, percussion dull
- Hypovolaemic shock may occur
- Large bore chest drain
- Lung re-expansion may stop bleeding
- Involve surgeon if bleeding persists



Chest Injuries

Pulmonary Contusion

- Potentially life threatening
- Suspect if rib fractures
- Beware of progression over 24 hours
- Management
 - oxygen
 - pain relief
 - assisted ventilation if required

Chest Injuries

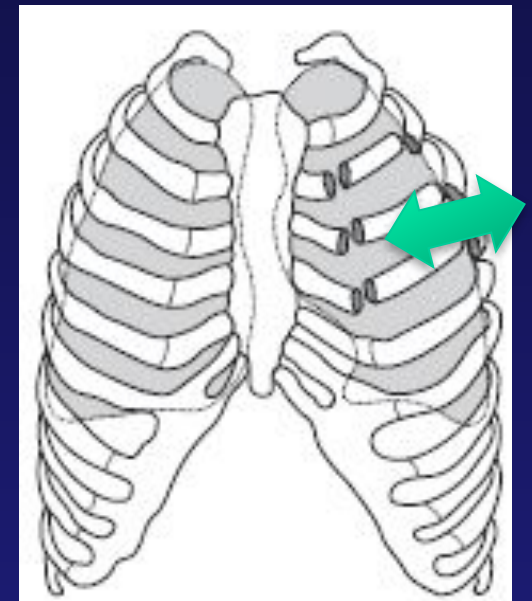
Rib Fractures

- May lead to underlying lung injury
- May be from simple trauma in elderly
- Remember pain relief

Chest Injuries

Flail Chest

- Unstable segment
- Paradoxical movement with ventilation
- Severe respiratory distress may result
- Adequate analgesia is vital
- Give oxygen
- Consider assisted ventilation



Chest Injuries

Myocardial Contusion

- Common in blunt trauma
- May mimic myocardial infarction
- Can cause sudden death
- ECG monitoring

Chest Injuries

Other Injuries

- Pericardial tamponade
- Thoracic great vessel injury
- Rupture of trachea or major bronchus
- Oesophageal trauma
- Diaphragmatic injury

Chest Injuries



Chest Injuries

Summary

- Management starts with Primary Survey (ABCDE)
- Recognise and treat life threatening injuries
- Most chest injuries do not need surgery

Abdominal and Pelvic Trauma

At the end you will

- be able to recognise life threatening abdominal and pelvic injuries
- understand the principles of management of abdominal injuries

Abdominal Scenario

A 20-year-old man gets into a fight while drinking at a local bar. He is brought to your hospital after being stabbed in the abdomen with a knife.

On arrival, he is pale and sweaty.



Scenario Questions

- What would you do first?
- What are the possible sites of injuries?
- How would you assess and manage the patient?



Abdominal Trauma

Initial Assessment

Primary Survey

- Airway + Cervical spine control
- Breathing
- Circulation
- Disability
- Exposure

Abdominal Trauma

- Common cause of shock
- Site of hidden bleeding
- Assessment can be difficult
- Reassess frequently
- Involve surgeon early

Abdominal Trauma

Categories

- Penetrating
 - gunshot, stabbing
 - consider early laparotomy
- Non-penetrating (blunt)
 - car crash
 - may also need laparotomy

Abdominal Trauma

Site of injury

- Liver
- Spleen
- Gastrointestinal tract
- Pancreas
- Kidney and urinary tract

Abdominal Trauma

Remember

Intra-peritoneal cavity extends into thorax up to 4th intercostal space

Abdominal Trauma

Look

- Lacerations
- Penetrating injury
- Distension
- Bruising may indicate significant injury
- Perineum & external urethral meatus

Abdominal Trauma

Feel

- Be gentle
- Tenderness
- Rigidity
- Rectal and vaginal examination

Abdominal Trauma

Listen

- Bowel sounds in the chest
- Suspect diaphragmatic injury

Abdominal Trauma

Management

- Oxygen and fluid resuscitation
- Diagnose bleeding and/or organ injury
- Early surgical referral
- Pain relief

Abdominal Trauma

Management

- Gastric decompression and aspiration
 - especially in children
 - look for blood
- Urinary catheterisation
 - after exclusion of urethral trauma

Abdominal Trauma

What is surgeon's role?

- Early surgical advice
- Penetrating trauma
- Haemodynamic instability with
 - obvious intra-abdominal injury
 - no other obvious cause

Pelvic Trauma

- Potential massive bleeding
- Immobilisation / Pelvic sling
- Consider genito-urinary injury



Pelvic Trauma Assessment

- ABC
- Bruising, tenderness, abnormal movement, crepitus (grating)
- Bleeding from penis
- Rectal examination
 - bleeding
 - high prostate
- Pelvic X-ray

Pelvic Trauma Management

- ABC
- Pelvic binder, tie legs together
- Early blood transfusion if shocked
- Early surgical assessment
- Pain relief

Abdominal and Pelvic Trauma

Special Investigations

- Diagnostic peritoneal lavage
- Ultrasound scan (FAST)
- CT scan
- Contrast X-rays of urinary tract

Abdominal and Pelvic Trauma



Abdominal and Pelvic Trauma

Summary

- Common site of injury
- Assessment can be difficult
- Site of hidden bleeding
- Continual reassessment important
- Seek early surgical consultation

Limb Trauma

At the end you will

- understand the structured approach to the patient with limb injury
- be able to treat limb injuries and prevent further injury

Scenario

A 35 year old man is brought to your hospital after standing on a landmine



Scenario Questions

- What would you do first?
- Outline your approach to limb examination.



Limb Trauma

Initial Assessment

Primary Survey

- Airway + Cervical spine control
- Breathing
- Circulation
- Disability
- Exposure

Limb Trauma

- Peripheral haemorrhage is a preventable cause of early death
- Infection of limb wounds is a cause of morbidity and mortality
- Early treatment reduces late disability

Limb Trauma Assessment

- ABC
- Look:
 - colour, deformity, wounds, swelling
- Feel:
 - tenderness, crepitus, temperature, movement, distal pulses, sensation
- Move:
 - active and passive

Limb Trauma Management

- ABC
- Control haemorrhage
- Maintain peripheral perfusion
- Prevent skin necrosis and infection
- Prevent damage to peripheral nerves

Limb Trauma

Control of haemorrhage

- Direct pressure preferable
- Traction and immobilisation will reduce bleeding
- Tourniquet
 - only if all else fails
 - release as soon as possible

Limb Trauma Management

- Analgesia
- Sterile wound dressing
- Align fractures
- Splint and immobilise
- Traction if appropriate

Limb Trauma

Compartment syndrome

- Due to ↑ pressure in fascial compartments
- Causes compression of vessels and nerves
- May result in peripheral nerve damage and muscle necrosis

Limb Trauma

Compartment syndrome

- **Pain** especially on passive movement
- Oedema / swelling
- Decreased sensation
- Muscle weakness
- **↓ pulses and ↓ sensation late signs**

Limb Trauma

Compartment syndrome

Management

- Early diagnosis
- Early fasciotomy



Limb Trauma

Open Fractures

- Consider wound near a fracture to be communicating
- Stop external bleeding
- Splint and immobilise
- Sterile dressing
- Relieve pain
- Tetanus prophylaxis and antibiotics

Limb Trauma

Crush injuries

- Lower extremities more frequently
- Pre-hospital scenario:
 - building or cave collapse
 - earthquake
 - explosions
- Traumatic amputation is the most severe immediate complication

Limb Trauma

Crush Syndrome

- From large skeletal muscle destruction
- Limb swollen, tense and pulseless
- Tea-coloured urine
- Shock and renal failure
- Early aggressive IV fluids
- Urine alkalinization

Limb Trauma



Limb Trauma

Summary

- Early treatment will prevent disability
- Avoid tourniquets if possible
- Beware compartment syndrome
- Analgesia

Head Trauma

At the end you will

- understand the structured approach to the patient with head trauma
- be able to identify serious and life-threatening head injuries

Scenario

A 25-year-old man has been hit by a car. On arrival at your hospital, he is unconscious and his breathing is noisy.



Scenario Questions

- What will you do first?
- What are the priorities in managing him?
- What are you trying to prevent?



Head Trauma

Approach

Primary Survey

- Airway + Cervical spine control
- Breathing
- Circulation
- Disability (AVPU, Pupils)
- Exposure

Head Trauma

- Common cause of trauma death
- Initial management does not depend on CT and neurosurgeon
- High risk of C-spine injury
- Hypoxia and hypotension double mortality
- **Avoid any further injury to the brain**

Head Trauma

Types of Brain Injury

- Primary brain injury
 - occurs at time of accident
 - Diffuse axonal injury
 - acceleration and deceleration
 - Cerebral contusion
 - Penetrating injury

Head Trauma

Types of Brain Injury

- Primary brain injury
 - occurs at time of accident
- Secondary brain injury
 - occurs after accident
 - may be preventable

Head Trauma

What causes secondary injury?

- Reduced brain blood flow
- Reduced brain oxygen supply
- Increased brain oxygen use
 - fever, seizures
- Other causes
 - low blood sugar

Head Trauma

What controls brain blood flow?

- Skull is a closed space

$$CPP = MAP - ICP$$

CPP = cerebral perfusion pressure

MAP = mean arterial pressure

ICP = intracranial pressure

- If ICP rises or MAP falls, brain blood flow falls

Head Trauma

What causes secondary injury?

- What increases ICP?
 - low blood O_2
 - high blood CO_2
 - haematoma or brain swelling
 - head down position
- What reduces MAP?
 - haemorrhage

Head Trauma

Prevention of secondary injury

Cause	Management
Low blood O ₂	Airway
High blood CO ₂	Breathing
Low BP	Circulation

Head Trauma Examination

Glasgow Coma Score (GCS)

- Grades severity of head injury
- Score out of 15
- Trend of GCS over time most useful
- Also important to describe responses

Glasgow Coma Scale (GCS)

Eye Opening (4)	Spontaneously	4
	To voice	3
	To pain	2
	None	1
Verbal (5)	Normal	5
	Confused talk	4
	Inappropriate words	3
	Inappropriate sounds	2
	None	1
Best Motor Response (6)	Obeys commands	6
	Localises pain	5
	Flexes limbs normally to pain	4
	Flexes limbs abnormally to pain	3
	Extends limbs to pain	2
	None	1

Head Trauma

Severity of Head Injury

Severe	GCS ≤ 8
Moderate	GCS 9-12
Minor	GCS 13-15

Head Trauma Examination

- Glasgow Coma Score
- Pupils
 - size
 - reactivity
 - equality

Head Trauma

Bilateral Dilated Pupils

- **Bilateral** fixed, dilated, unresponsive
- Causes
 - severe hypoxia
 - hypothermia
 - seizures



Head Trauma

Unilateral Dilated Pupil

- **Unilateral** fixed, dilated, unresponsive
- Causes
 - expanding lesion on same side
 - tentorial herniation



Head Trauma Examination

- Glasgow Coma Score
- Pupils
- Lateralising signs
- Breathing pattern
- Posture

Head Trauma

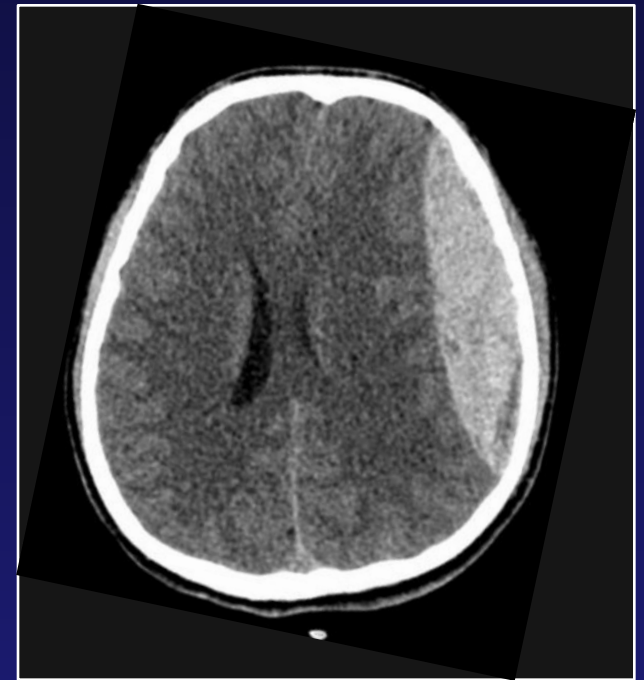
Intracranial Bleeding

- May be life-threatening
- Diagnose during Primary Survey
- May require surgical decompression

Head Trauma

Acute extradural haematoma

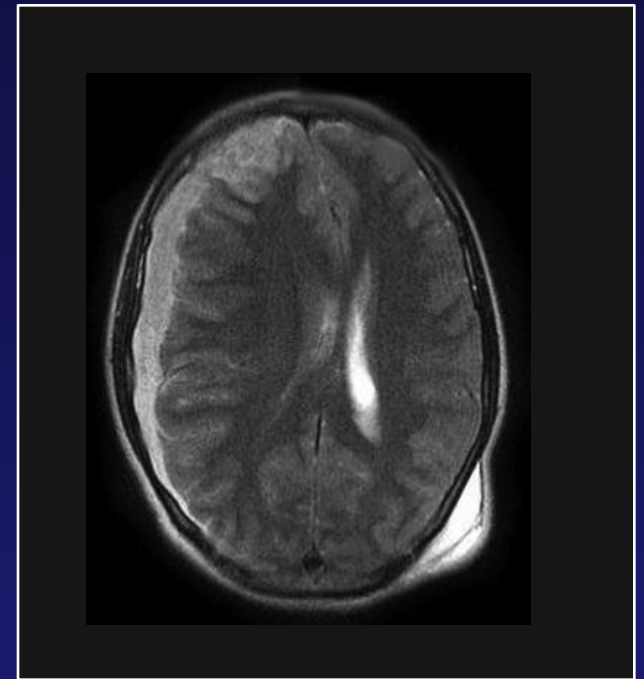
- LOC → lucid interval → deterioration
- Middle meningeal artery bleed
- Overlying skull fracture
- Contralateral hemiparesis
- Fixed pupil on side of injury



Head Trauma

Acute subdural haematoma

- Tearing of bridging vein between cortex and dura
- Usually no lucid interval
- Underlying brain injury
- Worse prognosis than extradural haematoma



Head Trauma

Other injuries

- Cerebral contusion (bruising)
- Depressed skull fracture
- Base of skull fracture
- Diffuse brain injury

May not require neurosurgery

Head Trauma Management

Airway

Breathing (ventilation)

Circulation

+

Avoid ↑ ICP

Aim to prevent secondary injury

Head Trauma

Severe (GCS<8)

- Intubate
- Good oxygenation
- Normal CO₂
- Treat hypotension with fluid
- Sedation +/- paralysis

Head Trauma

Severe (GCS<8)

- Nurse head up 20°
- Prevent hyperthermia
- Complete secondary survey
- Reassess frequently

Head Trauma

Secondary Survey

- Repeated examination and GCS
- Head and neck
 - lacerations, bruising, pupils, eardrums
 - scalp
- Limbs
 - movement, power, reflexes, sensation

Head Trauma

Beware

- Deteriorating conscious state
- Penetrating injury
- Focal neurological signs
 - unequal, dilated pupils
 - seizures
 - posturing

Head Trauma



Head Trauma

Summary

- ABCs
- Isolated head trauma doesn't cause hypotension
- Look for other injuries
- Prevent secondary injury
- Deterioration → reassess

Spinal Trauma

At the end you will

- understand the structured approach to the patient with spinal trauma
- be able to identify serious and life-threatening spinal injuries

Scenario

An 18-year-old man is stabbed in a fight. He is breathing fast, and complaining of back pain and is unable to move or feel his legs.



Scenario Questions

- What would you do first?
- How would you examine this man's back?
- What are the signs of a spinal cord injury?



Spinal Trauma

Initial Assessment

Primary Survey

- Airway + Cervical spine protection
- Breathing
- Circulation
- Disability
- Exposure

Spinal Trauma

Clinical findings suggesting cervical cord injury

- Mechanism of injury
- Head injury
- Difficulty in breathing
 - paradoxical or diaphragmatic
- Flaccid limbs and no reflexes
 - check anal sphincter
- Hypotension with bradycardia (without hypovolaemia)

Spinal Trauma

Secondary survey

- Examine in neutral position
- Log-roll to examine back
- Immobilise
 - stiff neck collar
 - sandbags + tapes
 - in-line immobilisation

Spinal Trauma

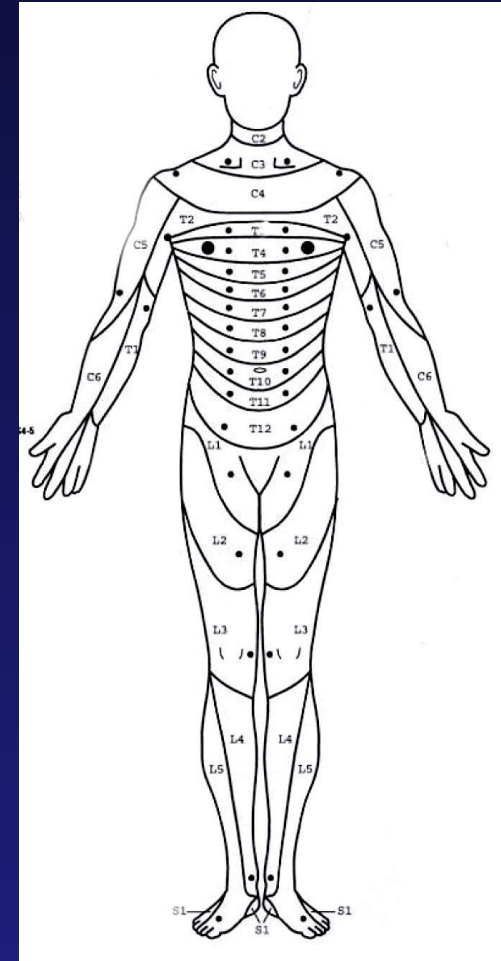
Secondary survey

- Local tenderness
- Swelling
- Deformity and stepping

Spinal Trauma

Assessment of level

- Motor response
- Sensory response
 - especially sacral sparing
- Reflexes
- Autonomic function
 - bowel control
 - bladder control



Spinal Trauma

Beware

- Inadequate breathing
- Look for other injuries
 - do not assume low BP is due to spinal injury
 - high risk of chest and abdomen injuries
 - difficult assessment of abdomen
 - hidden compartment syndrome

Spinal Trauma

Transport

- Stabilise spine prior to movement
- Never transport in sitting or prone position
- Log roll for transfer
- 10% have a second spinal fracture

Spinal Trauma



Spinal Trauma

Summary

- Initial management is ABC
- Immobilise until injury is excluded
- Thorough neurological examination

Trauma in Children

At the end you will

- understand the structured approach to the injured child
- recognise the physiological, anatomical and psychological differences between children and adults

Scenario

A 6-year-old boy falls from a tree. He is drowsy and confused when he is brought to hospital. He has a swollen right forearm.



Scenario Questions

- What would you do first?
- What differences are there in trauma in children?



Trauma in Children

Initial Assessment

Primary Survey

- Airway + Cervical spine protection
- Breathing
- Circulation
- Disability
- Exposure

The same for children as for adults

Trauma in Children

Children vs Adults

- Anatomical differences (especially airway)
- Physiological differences
- Psychological differences

Trauma management principles are the same

Trauma in Children

Psychological Differences

- Distress may not be due to pain
- Unhappy child is difficult to assess
- Consider parental presence at all times

Trauma in Children

Anatomical differences

- Large surface area to volume ratio
- Minimise exposure to prevent hypothermia
- $\text{Weight} = (\text{age} + 4) \times 2$

Trauma in Children

Airway differences

- Head + tongue larger
- Nose breathing in small babies
- Larynx higher + epiglottis bigger
- Cricoid is narrowest part of airway
- Particularly in children < 4 years

Trauma in Children

Airway differences

- Uncuffed endotracheal tubes preferred in small children
- ETT size = $\text{Age}/4 + 4$
- Child's little finger or nostril

Trauma in Children

Breathing differences

- Air swallowing common in distressed children
- Gastric distension compromises lung function
- Gastric decompression useful

Trauma in Children

Circulation Differences

- Normal values vary with age
- Wide range of normal BP + heart rate
- Capillary refill very useful sign

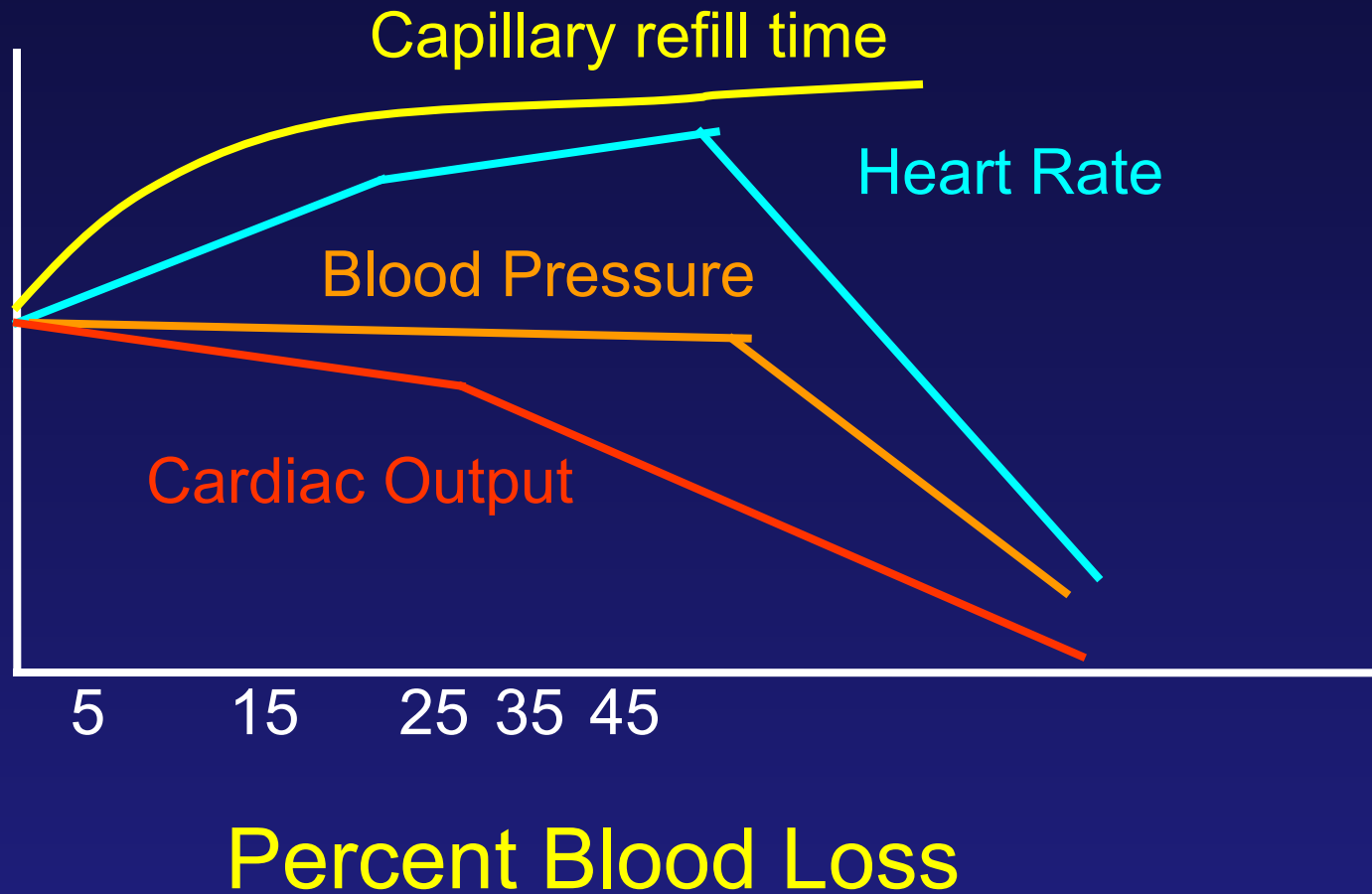
Trauma in Children

Circulation differences - Shock

- Tachycardia
- Weak pulse
- Capillary refill > 2 seconds
- Tachypnoea
- Agitation
- Drowsiness
- ↓ Urine output

Trauma in Children

Haemodynamic Changes



Trauma in Children

Circulation Differences

- Hypotension is a late sign in children
- Great reserve to compensate

Trauma in Children

Circulation differences

Pulse palpation

- Femoral artery
- Brachial artery

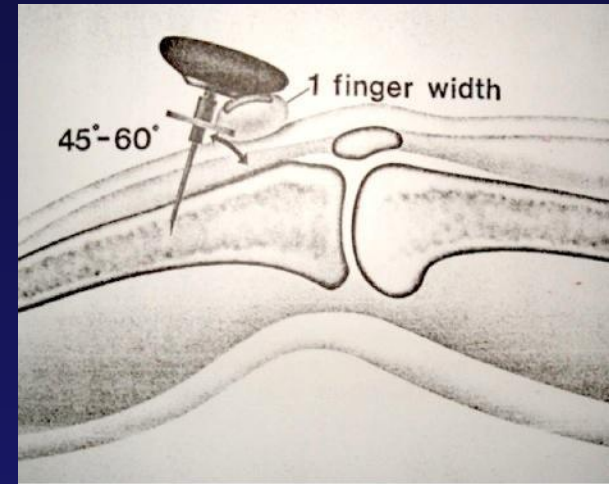
IV Cannulation

- Avoid CVCs
- Intraosseous
- Long saphenous vein (ankle)
- Femoral vein

Trauma in Children

Intraosseous Access

- Relatively safe + effective
- Anteromedial aspect of tibia below tibial tuberosity
- Other long bones
- Avoid epiphyseal growth plate
- Intraosseous needle or large spinal needle



Trauma in Children

Fluid Resuscitation

- Initial bolus 20ml/kg
- Second bolus 20ml/kg
- If no response give blood 10ml/Kg
- Aim for urine output 1-2 ml/kg/hour in infant
- Warm fluids if possible

Trauma in Children



Trauma in Children

Summary

- Same management principles as adults
- Remember anatomical, physiological and psychological differences

Trauma in Pregnancy

At the end you will

- understand the structured approach to the injured pregnant woman
- be able to recognise the physiological and anatomical changes in pregnancy that influence management

Scenario

A 25 year old women is the driver in a car accident. She was not wearing a seatbelt. She is 34 weeks pregnant. On arrival in hospital she is complaining of severe abdominal pain.

Scenario Questions

- What would you do first?
- What differences are there in trauma in a pregnant woman??

Trauma in Pregnancy

Primary survey

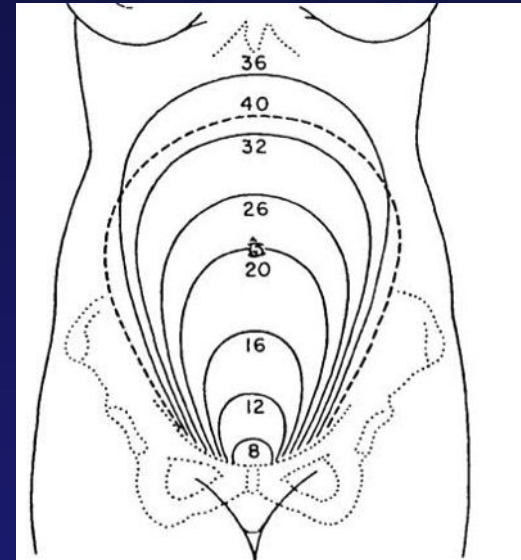
- Airway + Cervical spine control
- Breathing
- Circulation + uterine displacement
- Disability **Diagnose pregnancy**
- Exposure

Same in pregnant as in non-pregnant

Trauma in Pregnancy

Anatomy - Fundal height

12 weeks	symphysis pubis
20 weeks	umbilicus
36 weeks	xiphoid



Trauma in Pregnancy

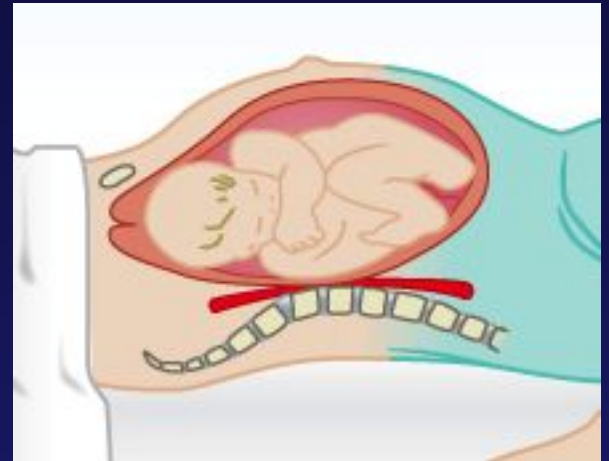
Physiological changes

- Tidal volume ↑
- Cardiac output ↑ 30%
- Blood volume ↑ 40%
- BP ↓ 15mmHg in second trimester
- HR ↑ 10-15

Trauma in Pregnancy

Aortocaval compression

- From 20 weeks
- Uterus presses on vena cava when lying flat on back
- Relieved by left lateral tilt or pulling uterus to left side
- Avoid twisting spine



Trauma in Pregnancy

Primary Survey Issues

- Airway
 - aspiration risk
- Breathing
 - difficult ventilation
 - reduced FRC
- Circulation
 - aortocaval compression
 - tolerate blood loss

Trauma in Pregnancy

Other Issues

- Uterine irritability and premature labour
- Rupture of uterus (partial or complete)
- Placental separation
- Pelvic fractures may result in severe blood loss

Trauma in Pregnancy

Management

- ABCDE of mother
- Left lateral tilt
- Secondary survey

Trauma in Pregnancy

Secondary Survey

- Abdomen
 - fundal height
 - uterus tenderness, contractions, fetal movement and heart rate
- Involve obstetrician early
 - gentle speculum examination?
 - caesarean section may be needed
- Monitor fetal heart rate
- Reassess mother frequently

Trauma in Pregnancy



Trauma in Pregnancy

Summary

- Important anatomical and physiological considerations
- Resuscitation of the mother is also resuscitation of the baby
- Trauma management principles are the same

Burns

At the end you will

- understand the structured approach to the burned patient
- recognise and treat the consequences of severe burns

Scenario

A 22-year-old woman is cooking dinner when her kerosene stove explodes. She is brought to your hospital with severe burns to her face, neck, upper chest and left arm.



Scenario Questions

- What would you do first?
- What are the complications of burn injuries?
- How are these treated?



Burns

Primary survey

- Airway + Cervical spine control
- Breathing
- Circulation
- Disability
- Exposure

Burns

Approach

- Stop the burning
- ABCDE
- Good IV access
- Determine area of burn
- Early fluid replacement
- Pain relief
- Prevent hypothermia

Burns

Mortality

Early death

- airway obstruction
- respiratory failure
- shock
- other injuries

Late death

- renal failure
- sepsis
- multiple organ failure

Burns

Airway

Consider early intubation

- ↑ Hoarseness
- Difficulty swallowing secretions
- ↑ Respiratory distress
- Transfer required



Swelling after burn



Burns

Breathing

Suspect inhalational injury

- Fire in enclosed space
- Burns around mouth, face, nasal hair
- Respiratory distress
- Hoarseness, cough, stridor
- Black carbon in sputum



Burns

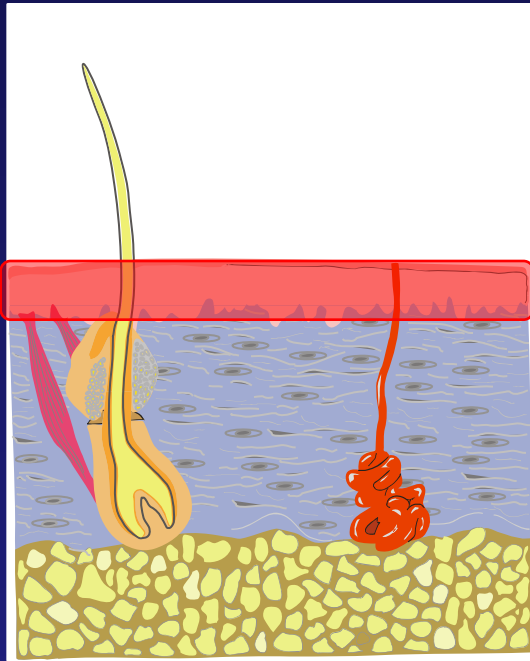
Circulation

- Treat shock
- Calculate fluids from size of burn
- Oral rehydration possible in smaller burns when no iv access
- Maintain urinary output 0.5-1.0 ml/kg/hr (more if electrical burn)

Burns

Assessment of depth

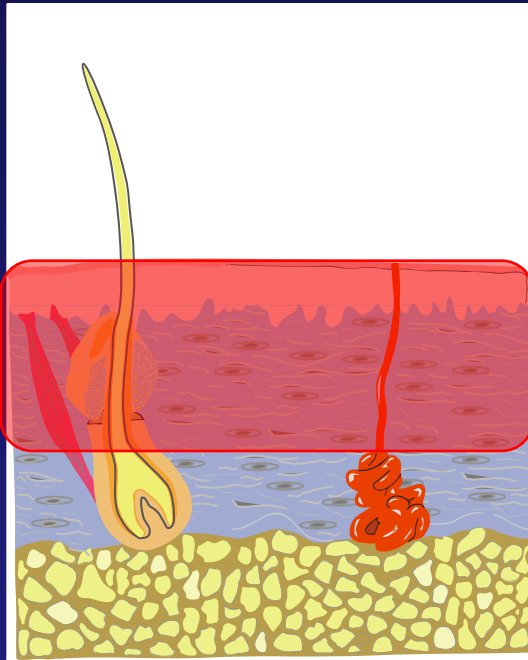
- Superficial: pain, erythema, no blisters



Burns

Assessment of depth

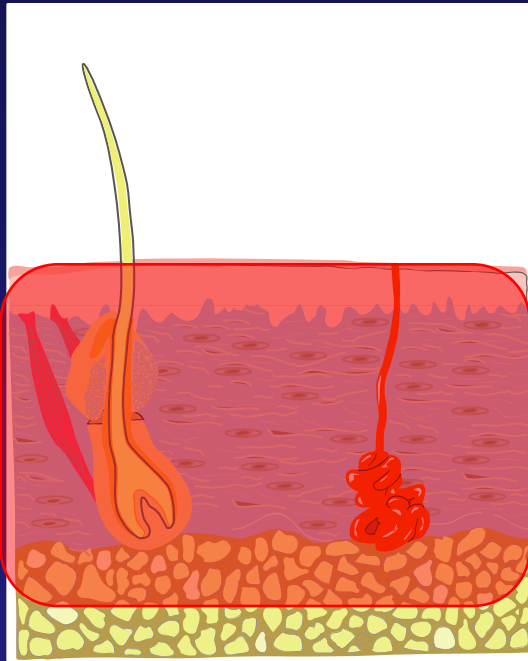
- Partial thickness: painful, weeping, blisters, mottled



Burns

Assessment of depth

- Full thickness: painless, white/dark and leathery

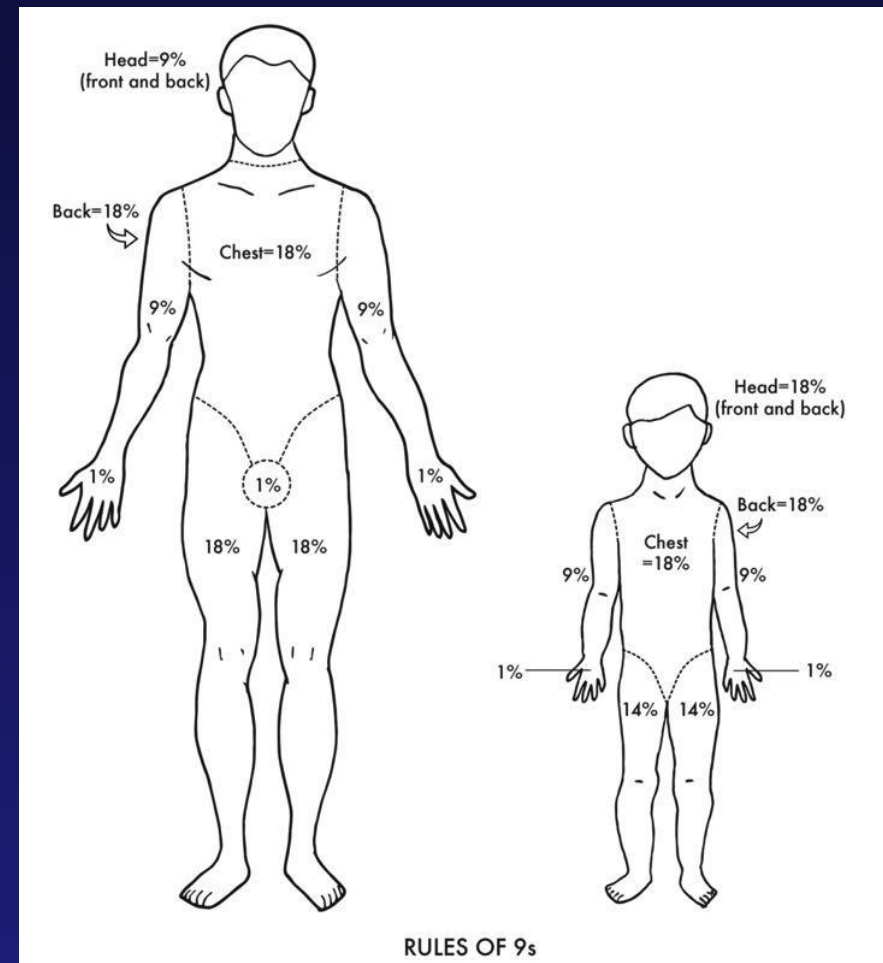


Burn Area Assessment

Head and neck	9%
Upper limb	9%
Front of trunk	18%
Back of trunk	18%
Lower limb	18%
Perineum	1%

Partial + full thickness

Depth less important than size in early resuscitation



Burns

Circulation - Fluid Resuscitation

- 2-4 ml crystalloid/kg/% burn in first 24 hours
 - 1/2 of fluid in first 8 hours
 - 1/2 of fluid over next 16 hours
- Remember maintenance fluids
- Calculations are only a guide
- Maintain urine output

Burns

Exposure

- Cover patient to prevent hypothermia
- Cover burns with cling film

Burns

Other issues

- Beware of other injuries
- Inhalational injury
- Analgesia
- Nasogastric drainage
- Prevent stress ulcers
- Tetanus prophylaxis



Burns

Other issues

Beware electrical burns

- .Electricity travels through muscle and deep tissues
- .Muscle necrosis
- .Consider fasciotomy
- .Renal damage
- .Keep urine output high



Burns

Other issues

- Constricting burns
- Consider escharotomy



Burns



Burns

Summary

- ABCDE
- Beware other injuries
- Consider early intubation
- Fluids
- Beware hypothermia
- Prevent infection

Secondary Survey

At the end you will

- know how and when to perform the secondary survey

Secondary Survey

- Head to toe examination, looking for all injuries
- After primary survey, when ABC stable
- Return to primary survey if any deterioration

Secondary Survey

Relevant history

- Allergies
- Medication
- Past history / Pregnancy
- Last meal
- Events / Environments of injury

Secondary Survey

Head and face examination

- Scalp (bruising, lacerations)
- Skull (tenderness, depression)
- Eyes (pupils, conjunctiva)
- Ears, nose mouth (blood, CSF)
- Facial bones

Secondary Survey

Neck

- Penetrating wounds
- Subcutaneous emphysema
- Tracheal deviation
- Expanding haematomas

Secondary Survey

Neck

- Assume neck is injured
- Immobilise in neutral position

Secondary Survey

Neurological examination

- Repeated Glasgow Coma Score
- Motor Function
- Sensation
- Reflexes

Secondary Survey

Chest, Abdomen, Pelvis

- Look
- Feel
- Listen
- Beware hidden bleeding

Secondary Survey

Limbs

- Look: deformity, bruising, laceration, colour
- Feel: tenderness, distal pulses, movement
- Power & sensation
- Remember compartment syndrome

Secondary Survey Log Roll

- Don't forget the back!
- Needs 4 people
- Airway/neck controller in charge
- Clear timing and instructions



Secondary Survey

- Investigations
- Procedures
- Monitoring
- Documentation

Secondary Survey



Secondary Survey

Summary

- Head to toe examination
- Return to primary survey if any deterioration
- Don't forget the back
- Documentation

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