Trauma

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Session Outline

- Assessment
  - Scene
  - Recognition & Prioritisation
  - Risk Scores
  - Transfer/Transport
- Specific Issues
  - Neurological
  - Limb/Soft Tissues (MDD Overlap)

Trauma Assessment

In trauma, what do we need to assess? *(Clue: Both Pre- and In-Hospital)*

- Scene

Scene Assessment

- Safety
  - Check the **four** dimensions
  - SAFE approach:
    - Shout for help
    - Assess the scene
    - Free from danger
    - Evaluate the patient
- Hazards
  - Consider PPE

Hazards

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Hazards

- Moving vehicles
- Fuel spillage
- Fire
- Chemicals
- Electricity
- Falling masonry
- Fighting/angry people/crowds
  - Combative patients
- Weather
- Rescue work (e.g. cutting equipment)

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- Hazards
  - Consider PPE
- Reporting from the scene
  - ETHANE

ETHANE

- **E** xact location
- **T** ype of incident/injuries
- **H** azards
- **A** ccess
- **N** umber of casualties
- **E** mergency services on scene or required

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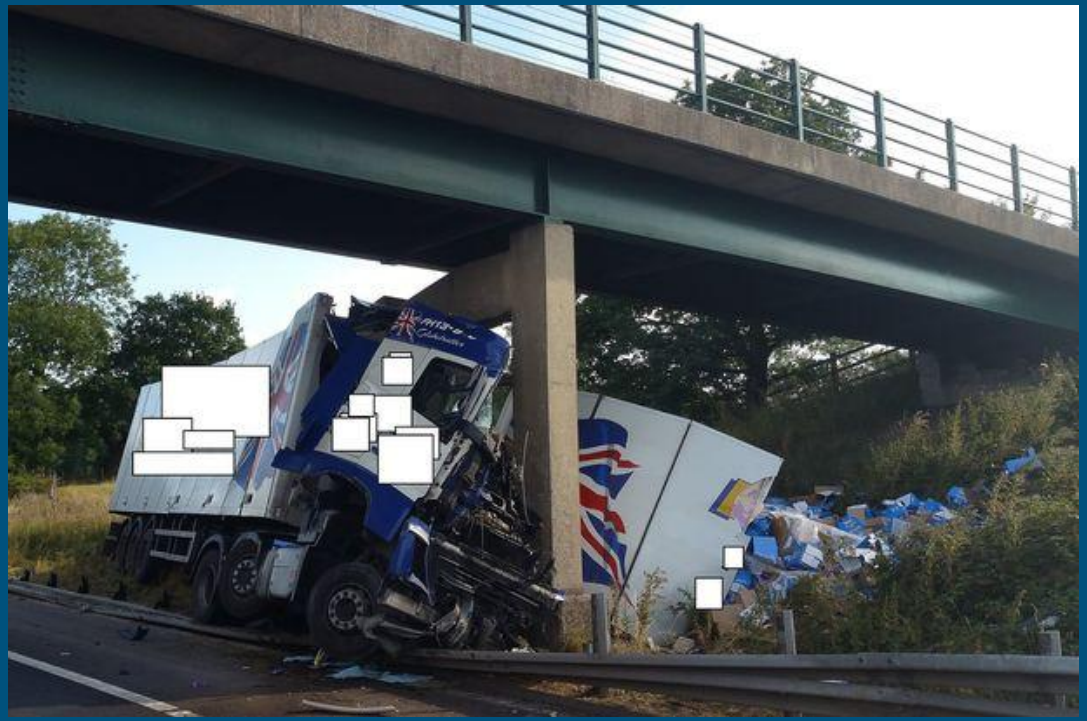
Scene Assessment

Scene Assessment



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- Hazards
  - Consider PPE
- Reporting from the scene
  - ETHANE
- Examine wreckage
  - Mechanism of injury

Mechanism of Injury

- Observe accident scene
  - Reconstruct the accident
    - Who hit what?
    - At what speed?
    - Restraint or protection?
  - Like taking a history
- Think of Kinetics:
  - More speed = More damage
  - KE = ½ M V^2

Traffic Collisions

- Four collisions
  - Vehicle hitting another object
  - Occupant colliding with inside of vehicle
  - Internal organs/structures moving within body cavities
  - Unrestrained passengers/vehicle contents hitting occupant

Traffic Collisions

Risks for unrecognised injury:

- Fatality in same vehicle
- Speeds of impact >30mph
- Patient ejected from vehicle
- Rollover
- Side Impact
- Significant reduction in vehicle length or width

Traffic Collisions - Vehicles

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Frontal Impact

- Contact with fascia/steering wheel
- Contact of head with windscreen
- Hyperextension of neck
- Injuries to:
  - Lower limbs (fractures, posterior hip dislocations)
  - Pelvis
  - Abdominal/Thoracic compression
  - Head injuries
  - Spinal cord injuries
  - Laryngeal injuries from contact with steering wheel

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Traffic Collisions - Vehicles

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Side Impact

- Injuries often more serious than frontal
  - Lack of crumple zones
- Common injuries:
  - Rib fractures, Pulmonary contusion
  - Splenic, Hepatic, Renal injuries
  - Upper limb fractures
  - Femoral and Pelvic fractures
  - Head and neck injuries
  - Brain injury

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Traffic Collisions - Vehicles

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Rear Impact

- Risk from unrestrained passengers/luggage
- Common injuries:
  - Whiplash
  - Knee and femoral injuries
    - From dashboard or front seat

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Traffic Collisions - Vehicles

Deceleration Injuries

Deceleration forces can cause internal injuries due to excessive bending/twisting

Injures:

- Cranial: Brain/Cerebral vessels
- Thoracic: Aorta, Heart/coronary arteries
- Abdominal: Liver, Mesentery, Kidneys/Urinary tract

Traffic Collisions - Vehicles

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Motorcycle Collisions

- Injuries to rider from contact with:
  - Motorcycle
  - Other vehicle
  - Street furniture
  - Surface

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Traffic Collisions - Vehicles

Motorcycle Collisions

- Pattern of injuries:
  - C-spine
  - Bilateral mid-shaft femoral fractures
  - Bilateral wrist fractures
  - Shoulder girdle injuries
  - Multi-system trauma
  - Traumatic amputations

ALWAYS wear a helmet (and leathers)
Ensure the helmet is brought to hospital with the patient for inspection - demonstrates forces involved

Traffic Collisions - Pedestrians

- Depend on height of pedestrian
  - Different patterns in children and adults
- Adults:
  - Lower legs - tibia/fibula fractures
  - Depending on subsequent movement:
    - Hit by vehicle (up and over)
    - Knocked to ground
- Children:
  - Higher impact - femoral/pelvic fractures
  - More likely to be run over
    - Can be dragged along
    - May have thermal injuries from contact with exhaust

Traffic Collisions - Pedestrians

Injuries tend to be to:

- Lower limbs (from initial contact)
- Head/C-spine (from subsequent contact with windscreen)
- Trunk/Head/Spine (from subsequent run over)

Blast Injuries

- (Fortunately) Rare
- Well-recognised pattern of injuries
  - **Primary** - shockwave damages gas-containing organs
    - Lungs, GI tract, Ears
    - High temperature of gases likely to cause burns
  - **Secondary** - high-speed objects hit patient
    - Vary from lacerations to severe crushing
  - **Tertiary** - patient thrown by explosion
    - Injuries caused upon landing
- Secondary/Tertiary obvious, don't overlook the Primary
  - Acute deafness following explosion indicates primary injury
    - Suggests high probability of other internal injuries
- Traumatic amputations common if close blast epicentre

Blast Injuries

20th Sept 2017

Blast at Colwick industrial estate

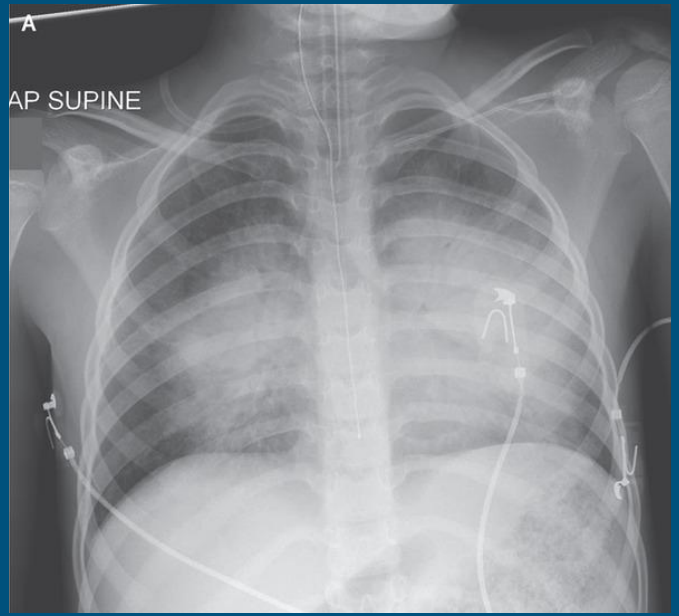
- Two patients taken to QMC
- One suffered traumatic leg amputation
- Significant burns suffered by both
- Wound contamination from contents of “Anaerobic Digestion” facility

Blast Lung

- Caused by exposure to pressure-waves
- Cellular mechanism speculative

CXR:

- Butterfly pattern
  - Interstitial and alveolar filling defects
  - Air bronchograms



Management:

- Supportive - volume-controlled, pressure-limited ventilation

Scene Assessment

- Safety
  - Check the four dimensions
  - SAFE approach:
    - Shout for help
    - Assess the scene
    - Free from danger
    - Evaluate the patient
- Hazards
  - Consider PPE
- Reporting from the scene
  - ETHANE
- Examine wreckage
  - Mechanism of injury
  - Consider method of extrication
- Evacuation Route
- Correct Facility

Extrication and Transport

Extrication:

- Can they safely self-extricate?
- If not, what is the priority:
  - Safety?
  - Speed?
- When might speed be the bigger priority?
  - Acutely unstable patient
  - Patients pinned under vehicles

Extrication and Transport

Extrication Routes:

- Lateral (through doorway):
  - Maintain C-spine control (collar and rescuer holding head/neck)
  - Patient pivoted (rotated) in seat and moved onto long spine board
- Vertical (after removal of roof):
  - Maintain C-spine control
  - Slide longboard between seat and patient
  - Rescuers slide patient onto the board
  - Straps and head blocks applied
  - Patient positioned and secured to stretcher

Extrication and Transport

Transport - Consider:

- Mode of transport
  - Land ambulance
  - Helimed
- Destination
  - Major trauma centre (MTC)
  - Nearest Trauma Unit
    - Secondary transfer to MTC

Trauma Assessment

In trauma, what do we need to assess? *(Clue: Both Pre- and In-Hospital)*

- Scene
- Patient(s)

Patient Assessment

Overall structure?

- Pre-hospital:
  - SAFE approach
  - Primary Survey
    - With interventions
- In-Hospital:
  - Repeat Primary Survey
    - With interventions and investigations
  - Secondary Survey
    - With treatment
  - Definitive Treatment

Primary Survey

Guess the format?

<C> Ac B C D E:

- Safety 123
- Stop life-threatening external compressible bleeds
- **A**irway with C-spine control
- **B**reathing
- **C**irculation
- **D**isability: Assess level of consciousness
- **E**xposure/Environment/Evacuation

REASSESS!!!

Catastrophic Haemorrhage

Recognition?

- Look!
- “Bleeding that you can hear is bad” (Prof. Sir Keith Porter)

Management?

- Compress
  - Direct Pressure
  - Indirect Pressure
    - Femoral/Brachial artery (against long bone)
  - Tourniquet
    - If not successful, add further tourniquet just distal to first
- Packing/Haemostatic dressing

Airway

Assessment begins on approach - talking demonstrates:

- Clear airway
- Patient breathing
- Adequately perfused brain

If airway silent or noisy, aim is to open and clear any obstruction

- Tongue
- Foreign objects (e.g. dentures, food, blood, vomit)
- Swelling (e.g. anaphylaxis, burns, epiglottitis)
- Trauma (e.g. facial, neck, laryngeal)

Airway - Management

Remember your airway ladder!

- Open using manual methods while maintaining C-spine stabilisation
  - If unable to achieve open airway without moving C-spine, airway is the priority
- Adjuncts:
  - Simple
  - Supraglottic
  - Intubation
  - Surgical

Breathing

- Not breathing?
  - Ventilatory support required
- R/V WET FLAPS
  - **R/V** - **R**ate and **V**olume of Breathing
  - **W**ounds around neck
  - **E**mphysema in neck tissue
  - **T**rachea central at sternal notch
  - **F**eel
  - **L**ook
  - **A**rmpits and **A**uscultate
  - **P**ress and **P**ercuss
  - **S**earch back, shoulders, sides of chest

Life-Threatening Chest Injuries

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- **A** irway injury
- **T** ension pneumothorax
- **O** pen pneumothorax
- **M** assive haemothorax
- **F** lail chest
- **C** ardiac tamponade

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Circulation

Assessment:

- Pulse - presence, rate, volume
  - Carotid pulse indicates minimum SBP ~60mmHg
  - Femoral pulse indicates minimum SBP ~70mmHg
  - Radial pulse indicates minimum SBP ~80mmHg
- Colour (noting pallor)
- Mental status
- CRT (central)
- BP

Disability

AVPU (serial)

Pupils

Temp

Exposure

In Pre-Hospital environment, minimise exposure to both respect and protect the patient:

- Don’t let the patient get cold
  - Hypothermia has a significant impact on trauma survival

Parallel Resuscitation

Sort the airway immediately, and once open - maintain!

High flow O_2

Access and resuscitation fluids

Consider TXA if bleeding

Analgesia prior to extrication

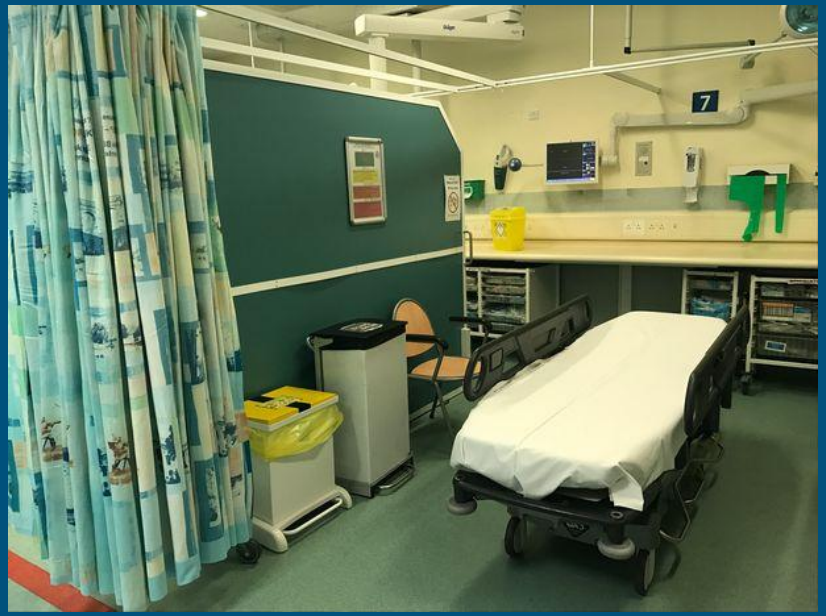
History

- **A** llergies
- **M** edications
- **P** ast medical history
- **L** ast meal
- **E** verything else

Arrival at A&E

Priorities on arrival?

- Clear verbal handover
- Safe transfer into bay



Handover

- **A** ge
- **T** ime of incident, ETA
- **M** echanism of Injury
- **I** njuries found or suspected
- **S** igns/symptoms
- **T** reatments given

Secondary Survey

Usually delayed until patient is in hospital (Brief top-to-toe may be done)

Full secondary survey involves:

- Systematic head to toe examination
  - Removal of all clothing
- Time-consuming
- Requires controlled log-roll
  - (with five people!)

Designed to detect **all** of the patient's injuries, even minor

Trauma Scoring

Many available:

- Injury Severity Score (ISS) - anatomical scoring system
- Revised Trauma Score (RTS) - GCS, SBP, RR

See: http://www.trauma.org/archive/scores/index.html

Limitations include:

- Lack of inter-rater reliability
- Lack of injury-weighting
- Full description of injuries may not be known

Trauma Scoring - Role

Can be used to assess risk of death, and guide management choices (e.g. who goes to a Major Trauma Centre)

Most common use has been in the scientific study of trauma

Specifics

- The Unconscious Patient
- Raised ICP
- Spinal Cord Injury
- Limb immobilisation
- Pelvic Binding

The Unconscious Patient

- Require rapid assessment
  - <C>AcBCDE approach
  - Mini-neuro exam (GCS, Pupils, Limb strength, Blood Glucose)
- Beware threats to life:
  - Internal (e.g. airway compromise)
  - External (e.g. environmental - loss of autoregulation)
- Is LOC the result of trauma, or the cause?
- DDx:
  - Head trauma, Hypoperfusion, Hypoglycaemia, Poisoning (incl. drugs and alcohol), PE, Cardiac dysfunction, Stroke, Infection, etc.

Head Injuries

Aim in management of the head-injured patient is to maintain Cerebral Blood Flow (CBF)

CBF requires Cerebral Perfusion Pressure (CPP), which is determined by:

- Mean Arterial Pressure (MAP)
- Intracranial Pressure (ICP)

(MAP = ⅓SBP + ⅔DBP)

CPP

Normal CPP is ~80mmHg

If CPP <60mmHg, CBF will fall

Low CPP can be due to:

- Low MAP
  - Pump failure
  - Volume loss
  - Loss of venous return
- High ICP

ICP

Monro-Kellie Hypothesis: The skull is a closed box, with (broadly) three contents:

- Brain
- Blood
- CSF

Increased volume of one means a rise in ICP

Some level of compensation, however once exhausted, ICP rises rapidly

Cushing Response

As ICP rises, CBF falls

Fall in CBF causes further brain damage

Compensatory mechanism is to increase MAP (i.e. systemic blood pressure)

Reflex bradycardia occurs

Combination of Hypertension and Bradycardia in a patient with raised ICP is known as the Cushing Response

Treating Raised ICP

- Sedation
- Paralysis
- CSF drainage
  - EVD
- “Osmotherapy”
  - Mannitol (diuretic, but must maintain euvolaemia with isotonic fluids)
  - Hypertonic saline
- For refractory cases, can consider:
  - Barbiturate coma (last resort) with EEG monitoring - contraindicated in hypotension
  - Hypothermia
  - Decompressive craniectomy

C-Spine Injury

When to immobilise?

All patients subjected to blunt trauma with mechanism that may have injured the neck, with any of:

- GCS <15
- Presence of paralysis, focal neurological deficit, or paraesthesia (tingling) in extremities
- Severe neck pain (≥7/10)
- Any neck pain, and high-risk injury

High-Risk Injuries

- Fall from >2 person's height
- Axial/vertical load to the head (e.g. diving accident)
- Motor vehicle collisions:
  - High-speed (combined speed >60mph)
  - Ejection or Rollover
  - Motorised "recreational vehicles" (quadbikes?)
- Bicycle collision
- Age ≥65
- Known bone disease (e.g. RA, previous cervical surgery etc.)
- Injury above clavicles
- Severely painful (≥7/10) thoracic injury

C-Spine Injury

Who can we avoid immobilising?

- Absence of above risk factors
- Presence of following factors:
  - Simple rear-end MVC (but not if pushed into another vehicle, hit at high speed, or by large vehicle)
  - Ambulatory at any time since injury
  - Delayed onset of neck pain
  - Absence of midline C-spine tenderness
- Then assess ROM:
  - Active rotation 45 to left and right without significant pain increase
  - If this elicits severe pain, immobilise immediately

Spinal Stabilisation

- Manual in-line stabilisation (MILS)
- Hands (patient sitting) and knees (patient lying on floor)
- Semi-rigid collar
  - Must be correctly fitted
  - Must be supported with MILS once applied
  - Blocks (once on stretcher/bed)
- Long spine board
  - Rescue device used in extrication - beware pressure issues
- Scoop stretcher
  - Used for lifting

Limb Stabilisation

Why?

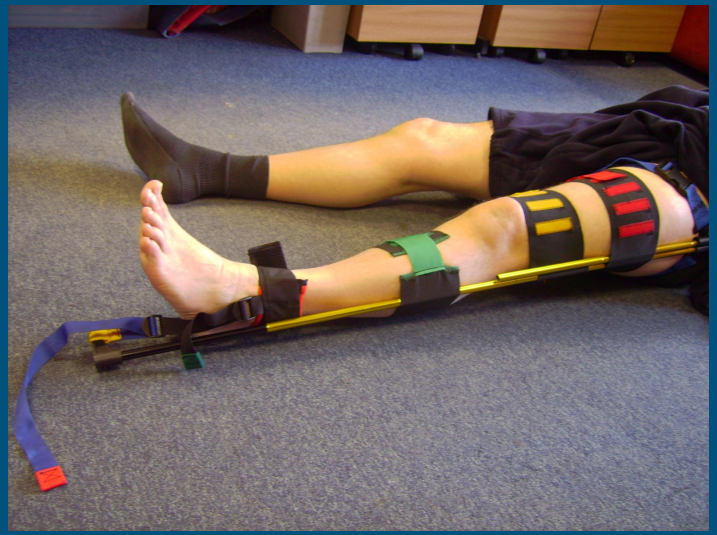
- Analgesia
- Prevents further damage
- Reduces haemorrhage
- Facilitates transport

Upper Limb Stabilisation

- Self-splinting often adequate
- Sling
  - Clavicle fractures
  - Humeral fractures
- Vacuum splints/Short box splints
  - Forearm fractures

Lower Limb Stabilisation

- Box/Vacuum splints
  - Ankle/tibia fractures
  - Fractures around the knee
- Traction splints
  - Femoral fractures
    - Muscle spasm causes overriding of bony fragments
      - Pain
      - Nerve/vessel damage
      - Excessive bleeding
  - Avoid in presence of overt pelvic fracture



Pelvic Binding

Pelvic injury common in RTCs

Associated with significant blood loss

If pelvic fracture is suspected:

- Apply pelvic splint
- Avoid log rolling
- Do not attempt to “play” the pelvis

The latter two can disrupt a clot, exacerbating bleeding

Objectives (for reference)

Assessment

1. Identify the correct sequence of priorities of emergency medical care to be followed in assessing the multiply injured patient, including: Primary survey, Parallel resuscitation, Secondary survey, The use of near-patient testing, The role of X-ray and CT imaging
2. Describe/conduct an initial assessment and management survey on a patient with multiple injuries, using the correct sequence of priorities and explanation of the management techniques for primary treatment and stabilisation
3. Recognise severe/multiple trauma
4. Describe the common causation, types, assessment and management of the following types of injury: Head, Chest, Abdomen and pelvis, Limbs, Spine
5. Describe the common causation, types, assessment and management of more linor injuries including: Bony injury to the upper and lower limbs, Soft tissue injury to the upper and lower limbs, injuries to the ankle, knee, hip, wrist, elbow and shoulder
6. Identify each of the following common life-threatening chest injuries (ATOMFC) and discuss their pathophysiology: Airways injuries, Tension pneumothorax, Open pneumothorax, Massive haemothorax, Flail chest, Cardiac tamponade
7. Identify risk factors for critical illness such as mechanisms of injury, comorbidities, past medical and surgical history
8. Describe the use and limitations of risk scoring systems for common critical illnesses such as… ...trauma
9. Outline the general principles of management in the transportation or transfer of the trauma patient

Objectives (for reference)

Specific Issues

9. Discuss the general management and initial investigation of the unconscious traumatised patient
10. Describe the main causes, pathophysiological mechanisms and effects of increased intracranial pressure
11. Outline the therapeutic interventions that, when initiated in the early phases of management, can help to reverse or delay undesirable effects of raised intracranial pressure
12. Specify the principles of acute management of the patient with spine or spinal cord injury
13. Given a patient with spine or spinal cord injury, describe how to stabilise the injury
14. Demonstrate the ability to immobilise the spine in a patient with a back injury
15. *Identify the various types of limb injuries and list the priorities of assessment and management of each*
16. *Describe the clinical features and management of acute soft tissue injuries including neck, wrist/hand, knee and ankle sprains, and animal and human bites; and specify the indications for tetanus prophylaxis*
17. *Discuss the principles of limb immobilisation*
18. *Demonstrate the ability to immobilise a fractured limb*

Trauma Recap

- Assessment
  - Scene
  - Recognition & Prioritisation
  - Risk Scores
  - Transfer/Transport
- Specific Issues
  - Neurological
  - Limb/Soft Tissues (MDD Overlap)

Sources/Further Reading

- RCEM Clinical Guidance (Local Guidance) https://www.rcem.ac.uk/RCEM/Quality_Policy/Clinical_Standards_Guidance/Local_Guidance/RCEM/Quality-Policy/Clinical_Standards_Guidance/Local_Guidance.aspx?hkey=3765ca3b-617c-427c-a4af-57fca689a0de#Adult%20Guidelines%20%2F%20Protocols
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- Trauma Scoring (II) https://emedicine.medscape.com/article/434076-overview
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- Medical Management of closed head injury (ICP): https://emedicine.medscape.com/article/251834-treatment