Fractures and Complications

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Trauma

- 1/3 commonest cause of death in UK

- Main cause of death in 15 – 40 ages
Summary

- Mechanisms
- Effects
- Treatment
- Complications
- Skeletal trauma
Mechanisms of Injury

- Energy exchange \( (\frac{1}{2}mv^2) \)
  - High energy (high velocity, large mass)
  - Low energy

- Compare:
  - Road traffic accident vs. Simple fall
  - Restrained vs. unrestrained
  - Pistol vs. automatic rifle
Mechanisms of Injury

RTA – blunt trauma
Effects

- Injury depends on:
  - Mechanism (energy exchange)
    - Shock waves, cavitation, blunt, penetrating etc
  - Environment
    - Temperature, contamination
  - Affected tissue / anatomy
  - Host factors
    - Age, co-morbidity
Effects

- Outcomes depend on:
  - All of the above
  - Treatment

We can’t control the initial injury.
We CAN influence the outcome.*

*At least, we can try
Treatment

- Time is of the essence

- Skills are based on common sense and a standardised approach
  - ATLS

SAVE LIFE
SAVE LIMB
Complications

- Acute
- Systemic / Physiological
- Delayed
- Local / Anatomical

WHO: Estimated 1.2 mil deaths / year worldwide

CDC: 47431 transport-related deaths in 2003, 109277 all-cause deaths (unintentional) in total (37.5:100 000)
Skeletal Trauma

- Axial skeleton
  - Death and disability

- Appendicular skeleton
  - Disability

- The contents and surrounds of the above

Fracture = soft tissue trauma with a broken bone in the middle
Advanced Trauma Life Support

- “The golden hour”

Trimodal distribution of death after trauma
Advanced Trauma Life Support

- Optimal management requires a team
- Multiple injuries = multiple disciplines
- Management based on treating life threatening injuries first

- Team approach starts at the scene and continues:
  - Via ambulance / helicopter / emergency department / theatre
  - To the ward
Advanced Trauma Life Support

- A standardised approach
- To identify and treat immediately life threatening injuries in a logical hierarchy

- A irway and cervical spine control
- B reathing
- C irculation
- D isability
- E xposure

- Secondary survey
- Repeated assessment
“Top to toe” of Trauma

- Head / brain injury
- Chest injury
- Abdominal / visceral injury
- Axial injury:
  - Spine, pelvis
- Limb injury
- Delayed complications
- Specific conditions:
  - Shock
  - SIRS / ARDS
  - Compartment syndrome
Intracranial haematoma

Acute subdural

Chronic subdural

Acute extradural
Flail segment with haemothorax
Diaphragm rupture
Liver laceration

Bowel rupture
Bladder rupture

Splenic laceration
Cervical Injury
Thoracolumbar spine injury
Pelvic injury
Upper Limb injury

- Clavicle fracture
- Shoulder dislocation / fracture
  - Axillary palsy, recurrent dislocation
- Plexus injury / nerve palsies
- Elbow / forearm fractures
  - Volkmanns
- Hand injuries
  - Bone, tendon, nerve

Stiffness, instability, weakness = disability
Hand injuries
Upper limb injuries
Lower limb injuries

- Hip fracture
  - Elderly, mortality, rehabilitation
- Femoral fracture
  - Life threatening, fat embolus
- Knee dislocation
  - Vascular injury, instability
- Tibial plateau fracture
  - Deformity, arthritis
- Tibial fracture
  - Open fractures, delayed healing
- Ankle fracture
  - Arthritis
Hip fracture - failure
Hip fracture - success
Ankle fracture
Distal femoral fracture
Tibial fracture
Delayed complications

- Delayed / nonunion
  - High energy, soft tissue injury
- Infection
  - Open fractures
  - Surgery
- Malunion
- Arthritis
- Arthrofibrosis
- Instability
- Pain / RSD /CRPS
Delayed complications
Specific conditions

- Shock
  - Hypovolaemic
    - ↓Pulse pressure, ↑PR, ↓BP, ↓UO, ↓consciousness, pallor etc
    - Grades 1-4 based on blood loss
  - Neurogenic
    - Paradoxical bradycardia
  - Spinal
    - Acute, flaccidity, retention, recovers

Treat with fluid resuscitation / blood transfusion / control bleeding
Specific conditions

- Systemic inflammatory response syndrome
  - $T^\circ >38$ or $<36$
  - PR >90
  - RR >20 (or PaCO$_2$ <4.3 KPa)
  - WCC > 12

- 2 or more of the above required
Systemic inflammatory response syndrome

- Complex pathophysiology

Trauma / fat embolism / shock

Pro-inflammatory mediators
(Cytokines, vasoactive mediators, adhesion molecules, reactive oxygen species)

Endothelial injury + End organ damage

Acute respiratory distress syndrome, multi-organ failure, sepsis
Specific Conditions

Infection

- Greater risk in open fractures
- Wound surgery is best defence
- Antibiotics can help prevent it
- Dead tissue/bone promotes it
- Stability helps prevent it
Specific conditions

- **Compartment syndrome**
  - Compartment pressure > capillary filling pressure
  - <30mm difference between compartment and diastolic pressure
  - Clinical diagnosis
  - Multiple causes, trauma most common
  - Leg, forearm, thigh
  - Requires urgent decompression (fasciotomy)
Specific conditions

DVT

- Especially in pelvic fractures
- Consider in lower limb fractures
- Balance bleeding complications with prophylaxis
Specific conditions
Soft tissue breakdown
Specific conditions

- Failure of fixation
  - Wrong implant
  - Wrong geometry
  - Poor fixation
  - Poor bone
Summary

- Trauma is a huge health and economic burden worldwide
- Appropriate management saves lives, limbs and money
- Complications (due to injury or treatment) are potentially devastating
- Use the window of opportunity.