Musculoskeletal trauma
- 85% of blunt trauma patients end up with some sort of musculoskeletal injury

### PRIMARY SURVEY:
- **AIRWAY** may be compromised by a posteriorly dislocated clavicle
- **CIRCULATION** is really the key issue:
  - Long bone fractures and pelvic fractures bleed a lot:
    - 3 litres from pelvis
    - 2 litres from femur
    - 750ml from tibia or humerus

### ADJUNCTS TO PRIMARY SURVEY:
- Xray the fractures
- **IMMOBILIZE THE FRACTURES:**
  - Reduce, apply in-line traction, and immobilize in a plaster or splint
  - If the fracture is open, don’t be shy about poking bits of bone back into the wound - its going to theatre for washout anyway
  - Some immobilizations and reductions can effectively control hemorrhage

### SECONDARY SURVEY:
- **MECHANISM OF INJURY** is the key issue:
  - Position in the car- driver, passenger?
  - Ejected from vehicle?
  - Seat belt in use?
  - Airbag deployed?
  - Deformation to the vehicle
  - Internal damage to the vehicle eg. bent steering wheel
  - Distance of the fall (if they fell)
  - Were they crushed? Where, for how long?
  - Was there any explosion?
  - If pedestrian: what kind of car hit them?

- **ENVIRONMENT**
  - EXPOSURE TO TEMPERATURE EXTREMES
  - EXPOSURE TO TOXIC FUMES
  - Glass fragments
  - Sources of contamination, eg. fell into open sewer
  - Position the patient was found in
  - How much blood was at the scene
  - Delays in extrication process

- **PHYSICAL EXAMINATION**
  - **THE USUAL STUFF;** wounds, gross distortion, pulses of all limbs
  - Loss of sensation in a glove or stocking distribution is an early sign of vascular compromise
  - Xray everything.

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MAJOR PELVIC DISRUPTION:
- Hypotension + pelvic fracture = higher mortality; 5-30%
- The only sign of pelvic hemorrhage may be otherwise unexplained hypotension
- Xray of the pelvis needs to happen quickly in a major pelvic trauma, especially pedestrian
- Hemorrhage control is the primary goal
- This is achieved with pelvic compression devices and slings

MAJOR ARTERIAL HEMORRHAGE:
- Pulseless limb is your main guide to an internally disrupted artery
- A tourniquet may be applied to any severed limbs
- Direct pressure should be applied to all external wounds
- If you can see a vessel, you can try to clamp it with artery forceps

CRUSH INJURY:
- Crush injury of a significant muscle mass, eg. a thigh or a calf, can produce rhabdomyolysis
- Some recommend to alkalinize the urine to reduce the precipitation of myoglobin

VASCULAR INJURY
- Muscle does not tolerate an interruption to blood flow longer than 6 hours.
- Nerves die even sooner
- AMPUTATED BODY PARTS:
  - Wash with isotonic solution
  - Wrap in sterile gauze
  - Gauze should be soaked in penicillin
  - Wrap whole thing in sterile towel
  - Transport with the patient in a plastic bag, in a cooling vessel

COMPARTMENT SYNDROME:
- Injuries at risk of developing this include
  - Tibial fracture
  - Forearm long bone fracture
  - Severe muscular crush injury
  - Localized, prolonged pressure on an extremity
  - Oedema which forms as part of reperfusion injury
  - Burns
- SIGNS:
  - Increasing pain out of proportion to the stimulus
  - Palpable tenseness of the compartment
  - Asymmetry of the muscle compartment
  - Pain on passive stretch of the muscle compartment
  - Altered sensation
  - ABSENCE OF A DISTAL PULSE IS UNCOMMON IN COMPARTMENT SYNDROME
    - i.e. don’t wait for the limb to get pulseless
    - THE LOWER THE SYSTOLIC PRESSURE, THE SOONER THE COMPARTMENT BECOMES A PROBLEM

MANAGEMENT
- release any binding splints or casts
- monitor for about 30-60minutes
- if no improvement in the limb occurs, you need to do a fasciotomy
- this is a time dependent injury: the longer you wait, the worse the damage
NEUROLOGICAL INJURY SECONDARY TO FRACTURE-DISLOCATION

- Dislocations cause this more frequently than fractures; eg. sciatic nerve injury with pelvic fracture dislocation, or axillary nerve injury due to anterior shoulder dislocation

**IF YOU DON’T KNOW WHAT YOU'RE DOING,**
- Immobilize the limb IN THE DISLOCATED POSITION and call a surgeon

**IF YOU THINK YOU KNOW WHAT YOU'RE DOING,**
- Try to carefully reduce the fracture. Call the surgeon anyway.

**FRACTURE ➔ NERVE INVOLVED ➔ MOTOR LOSS ➔ SENSORY LOSS**

- Elbow ➔ ulnar nerve ➔ index finger abduction ➔ little finger sensation
- Wrist dislocation ➔ median nerve ➔ thenar contraction ➔ index finger sensation
- Anterior shoulder dislocation ➔ musculocutaneous ➔ elbow flexion ➔ lateral forearm
- Distal humeral shaft ➔ radial nerve ➔ finger extension ➔ first dorsal web space
- Proximal humeral shaft ➔ axillary nerve ➔ deltoid ➔ lateral shoulder

- Pubic ramus ➔ femoral nerve ➔ knee extension ➔ anterior knee
- Obturator ring ➔ obturator nerve ➔ hip adduction ➔ medial thigh
- Knee dislocation ➔ posterior tibial ➔ toe flexion ➔ sole of foot
- Knee dislocation or fibula neck fracture ➔ superficial peroneal ➔ ankle eversion ➔ lateral dorsum of the foot
- Fibular neck fracture ➔ deep peroneal ➔ ankle dorsiflexion ➔ dorsal first web space
- Posterior hip dislocation ➔ sciatic nerve ➔ dorsiflexion ➔ foot sensation
- Acetabular fracture ➔ superior gluteal nerve ➔ hip abduction ➔
- Acetabular fracture ➔ inferior gluteal ➔ gluteus maximus, hip extension

**CONTUSIONS AND LACERATIONS:**

- A laceration extending through the fascia requires surgical repair
- Contusions usually just need ice packs
- Everyone gets a tetanus shot

**JOINT INJURIES:**

- Unless its dislocated, its probably not limb threatening
- If the limb is neurovascularly normal, this can wait

**FRACTURES:**

- Immobilise the joint above and below
- If the limb is neurovascularly intact and the fracture is not displaced, this can wait. Otherwise, it may need to be reduced

**Principles of immobilisation:**

- **SPINE** ➔ Long spine board = whole body splint
- **FEMUR** ➔ traction splint; pulls on the ankle
- **KNEE** ➔ immobile in 10 degrees of flexion; long leg cast

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