

MUSCULOSKELETAL COMPARTMENT SYNDROME

- (Acute) compartment syndrome occurs due to a rapid pressure rise in an anatomical compartment
- Compartments are bounded by inelastic fascia
- Increased pressure is such that interstitial pressure is greater than capillary perfusion pressure (CPP usually <10mmHg)
- Resultant ischaemia → soft tissue oedema, compromising venous & lymphatic drainage
- Pressure continues to rise exponentially, eventually reducing arterial supply
- Ischaemic injury to muscles and nerves occurs at 4 hours of complete ischaemia and is irreversible at some point between 4- 8 hours.
- Complete tissue ischaemia can occur while pulses are present.
- Results in rhabdomyolysis & neuropraxis, progressing to axonotmesis

Causes

- **Most commonly associated with traumatic limb injuries**
- **Anterior compartment of lower leg & volar compartment of forearm most commonly affected**
75% are caused by a fracture
Occurs in both open & closed fractures
- Other causes include
 - Crush & reperfusion injuries
 - Burns eschars
 - Soft tissue infection
 - Prolonged immobilisation
 - Constrictive dressings
 - Vascular injury/ haemorrhage
 - Extravasation of fluids/ medications
 - Seizures
- **Initial injury may seem innocuous**

Symptoms & signs

Classically the '6 Ps'

By the time all 6 occur irreversible damage is probable

- **Pain**- out of proportion, undifferentiated
Early & universal symptom
- **Paraesthesia**- also early feature
- **Pallor**- compromised blood supply
- **Paralysis**- lack of muscular blood supply
- **Pulseless**- rare due to required pressures
- **Perishing cold**- severe compromise

REMEMBER: Complete tissue ischaemia can occur while pulses are present

- Pain on passive stretching of muscles in affected compartment is a highly sensitive clinical sign of compartment syndrome, it is often unbearable
- Also severe pain on active flexion of the muscle groups contained in the compartment

Diagnosis

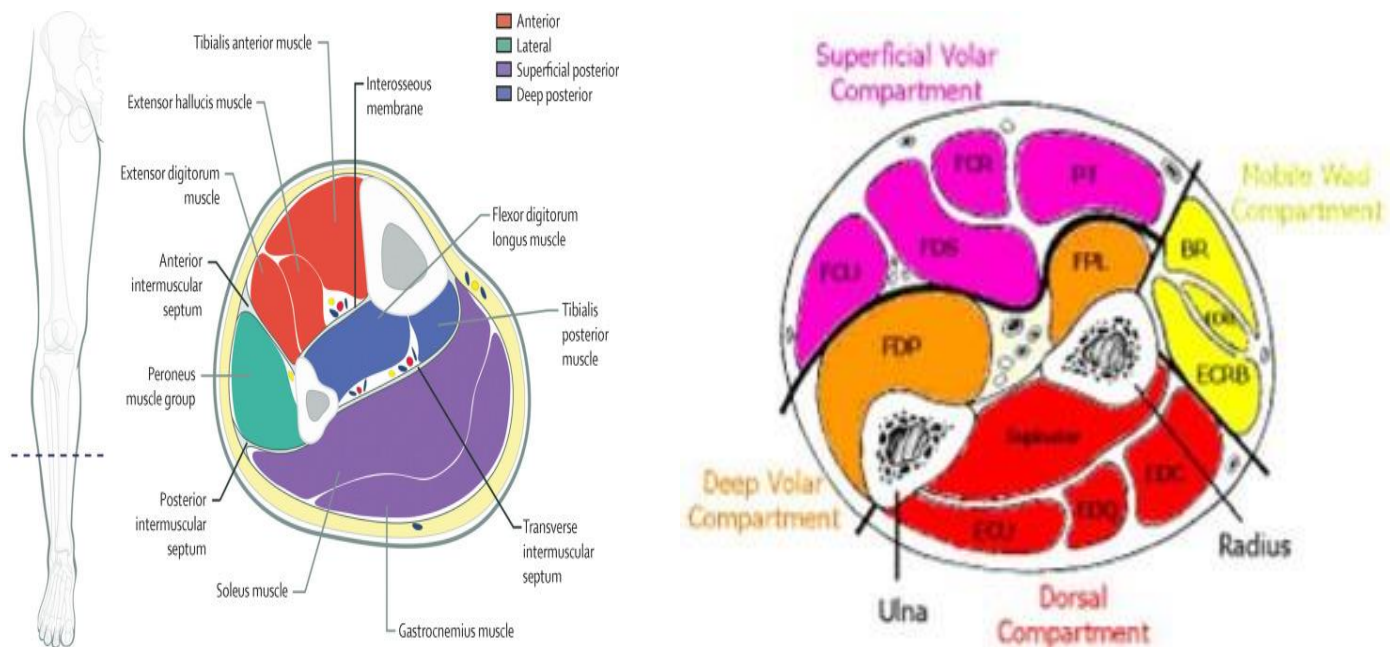
- Previously definitively diagnosed as a compartment pressure of 30mmHg requiring intervention
- However, in some cases, depending on perfusion pressure this may be tolerated
- Recent trend towards using the delta pressure.
- Delta pressure <20mmHg is a definite indication for fasciotomy
- Delta pressure <30mmHg as a relative indication
- Measuring delta pressure involves invasive measurement using a STIC Catheter



Management

- The treatment for suspected or confirmed compartment syndrome is emergent fasciotomy by orthopaedics. In ED:
 - **Remove constrictive dressings/ cast**
 - **Elevate the limb** to the level of the heart (helps venous return potentially reducing interstitial oedema and relieving pressure)
 - **Analgesia**
 - **Keep hydrated**
- Although not diagnostic of compartment syndrome measuring CK, U&Es and Urinalysis can indicate if rhabdomyolysis is occurring.

Compartment Anatomy



Lower leg				
Compartment	Anterior	Lateral	Superficial posterior	Deep posterior
Muscles	Tibialis anterior EHL EDL Peroneus tertius	Fibularis longus Fibularis brevis	Gastrocnemius Soleus Plantaris	FHL FDL Tibialis posterior Popliteus
Test	Plantar flex the ankle or flex the big toe			Extend the big toe

Forearm				
Compartment	Superficial volar	Deep volar	Mobile wad	Dorsal
Muscles	Flexor carpi radialis FC ulnaris Palmaris longus Pronator teres Flexor digitorum superficialis	Flexor digitorum profundus FPL Pronator quadratus	Brachioradialis Extensor carpi radialis longus ECR brevis EC ulnaris Extensor digitorum	Abductor Pollicis Longus EPL EPB Extensor indicis Supinator