Compartment Syndrome

Recognition and Care

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Compartment Syndrome

- Definition
- Etiology
- Pathophysiology
- Recognition
- Diagnosis
- Treatment
Compartment Syndrome

♦ Definition
  – An area of the body where the interstitial pressure exceeds the capillary perfusion pressure

♦ Etiology
  – Increase in mass in a fixed volume compartment
    • Edema, venous obstruction due to fracture, burns, inflammation, tight surgical closure, fluid infiltration, reperfusion after temporary ischemia, snake envenomation, electrical burns
  – Extrinsic pressure
    • Circumferential burns, tight casting
    • Crush syndrome (similar but different)
Pathophysiology

- Micro-vascular collapse at the level of the venous capillaries initially
- Normal interstitial pressures around 4 mmHg
- Normal capillary perfusion pressures is around 30mm Hg
- As the interstitial pressure exceeds capillary pressure you get shunting within the compartment
- Ischemia of the muscle
  - Leading to inflammation and leakage of fluid
- Poor drainage as venous pressure is exceeded
- More edema, extravasization leading to increased pressures
- ‘vicious circle’
Vicious Cycle

- Increased Pressure
- Venous obstruction
- Leaky Vessels
- Shunting
- Ischemia
- Necrosis
- Edema
Compartment Syndrome

❖ The result
  – If left unchecked for more than just a few hours, irreversible damage will occur
  – Massive tissue necrosis, usually muscle, nerves in that area
  – If in a fascial compartment, nerves running through are affected
  – If large vessel arterial compromise – loss of distal circulation – loss of limb
Compartment Syndrome

 Recognition
  - Easy in an awake patient, hard if intubated
    • Pain out of proportion to findings
    • Pain with passive stretch
    • Pain with palpation along compartment away from fracture
    • Loss of vibration sense
    • Rigid, woody compartment
    • Blisters
    • Pallor – Late
    • Paresthesias – Reliable but late sign
      - Must be specific to nerve in compartment
    • Paralysis – Very late sign
    • Pulselessness – Very late and ominous sign
Compartment Syndrome

- Unresponsive patients, burns, intubated
  - Good history and suspicion
  - Exam – examine limbs, palpate, look for circumferential burns
  - Compartment monitoring
  - Stryker Needle
  - Whiteside Technique and variants
  - Art line transducer & 16g
Compartment Syndrome

♦ Numbers
  – Normal Tissue 4-10mm Hg
  – Criteria for Compartment Syndrome
    • Absolute pressure >32mm Hg
    • Diastolic BP – Compartment BP < 30 mm Hg
  – Not absolute, lots of controversy
  – Note: Zone of peak pressure must be measured
    • Must be in correct compartment
    • Must be near fracture
Treatment

♦ Elevate to heart level
♦ Loosen bandages (30-50% reduction in pressure)
  – Loosen Casts, cut casts AND cut webril
♦ Surgical intervention
  – For burns this means escharotomy
  – For everything else including burns with deep injury fasciotomy
Escharotomy

- Limbs – Medial and lateral incisions
  - Crossing joints
  - Extensive release necessary
  - Caution for subcutaneous structures
- Chest – for ventilations as well
  - Anterior axillary line +/- Chevron
Escharotomy

- Scalpel or Electrocautery
- Local with epi - hemostasis
- Through eschar and dermis to expose fat
- Be generous - must be large enough not to have any residual pressure
- Dress as any open wound, but very light circumferential dressings
Escharotomy
Fasciotomy

- Compartment syndrome is documented to occur in almost any muscular area
  - Anterior lower leg, forearm, most common. Hand, foot, upper arm, thigh, scapula, gluteal region rare

- Principles
  - Release ALL compartments in a limb
  - Leave all layers open, or loose approximation of skin
  - Be extensive
  - Stabilize rigidly fractures underneath
  - Debride obviously necrotic tissue
  - Second look in 48h for more necrotic tissue
Forearm

- Three Compartments – Superficial Flexor, Deep Flexor and Extensor
- Need two incisions volar and dorsal
  - Volar: Henry’s vs Ulnar approach equally effective
  - Dorsal: Between Extensor Carpi Radialis Brevis and Extensor Digitorum Superficialis
Henry’s Approach

- Skin incision medial to biceps tendon proximal to elbow, crossing at an angle
- Extend gently laterally to medial border of brachioradialis, then cross wrist at an angle
Henry’s Approach

Figure 4-11 Superficial layer of the forearm muscles and vessels.
Henry’s Approach

- Incise superficial fascia
- Inter-nervous plane between Radial and Median – Brachioradials (laterally) and Flexor Carpi Radialis (medially)
  - Take radial nerve with brachioradials
  - Take radial artery with FCR
Figure 4-6  Deep to the brachioradialis and the flexor carpi radialis are the supinator muscle, the pronator teres, the flexor digitorum superficialis, and, most distally, the pronator quadrants.
Henry’s Approach

♦ Expose muscle bellies of:
  – Flexor Digitorum Superficialis
  – Flexor Digitorum Profundus
  – Flexor Policis Longus
  – Pronator Teres
  – Pronator Quadratus

♦ And incise their fascia
Dorsal Approach

- Pronate the forearm
- Incision from lateral epicondyle to midline wrist
Dorsal Approach

- Inter-nervous plane between Extensor Carpi Radialis Brevis and Extensor Digitorum Communis – Incise fascia
Lower Leg

♦ Four Compartments
  – Lateral
  – Anterior
  – Superficial Posterior
  – Deep Posterior

♦ Single or Double incision Technique
Lower Leg Fasciotomy

- Two Incision Technique
Lower Leg Fasciotomy

◆ Single Incision Technique