Compartment Syndrome

Definition:
Compartment syndrome is a condition in which blood flow into a limited space (the compartment, usually the enveloping fascial covering of a muscle or group of muscles) is compromised by rising pressure (typically greater than 30 mm Hg) within that space, such that hypoperfusion, ischemia, and necrosis develop (Elsevier Point of Care, 2018)

Classesifications

Acute compartment syndrome
- Direct trauma to bone or muscle = edema or hemorrhage
- Ocular trauma
- Ocular infection, neoplasm
- Medical conditions such as systemic thrombolysis

Orbital compartment syndrome
- Abdominal surgical procedures
- Specific medical conditions
- Pancreatitis
- Intestinal obstruction
- Massive edema

Abdominal compartment syndrome
- Reabsorption after ischemia

Chronic exertional compartment syndrome
- Repeated vigorous exercise

Objective & Disclosure

Objective:
Name signs and symptoms of compartment syndrome

Disclosure:
I have nothing to disclose

Acute Compartment Syndrome

Pathophysiology:
Increased edema, blood, or fluid creates pressure within a space resulting in impaired perfusion causing tissue ischemia.

Causes of Acute Compartment Syndrome

Internal:
- Internal Applied Force, Increased Content within the Compartment
  - Long bone fractures
  - Vascular Injury
  - Overexertion
  - Hemorrhage/coagulopathy
  - Injection of fluid into the compartment
  - Massive intravenous infusions
  - Envenomations
  - DVT/ruptured Baker Cyst
  - Reperfusion after ischemia
Acute Compartment Syndrome: Incidence

- 50% of cases are related to tibia fractures
- 1.2% in closed tibia fractures
- 6% with open tibia fractures
- 19% with vascular injury
- 2nd most common site = forearm

(Peak, 2013)

2000 study by McQueen, Gaston, & Court-Brown in England
164 cases of acute compartments syndrome treated over 8 years
- 69% associated with a fracture
  - 50% tibial
  - 9.8% distal radius
- 23% soft tissue injury, no fracture
- 149 were men, 15 women
- Mean age 32
  - Mean age men = 30
  - Mean age women = 44

Compartment Syndrome

Usually develops hours after the inciting event and rarely more than 48 hours after the event

Causes of Acute Compartment Syndrome
External:
- Externally Applied Force, Decreased Volume of the Compartment
  - Burns
  - Tight casts, dressings
  - Prolonged awkward positioning
  - Closure of fascial defects

Signs and Symptoms

PAIN
- Severe pain out of proportion to the injury
- Pain aggravated by active or passive stretching of the muscles of the affected compartment
- Severe pain while at rest
- Need for increased analgesia med dosage
Signs and Symptoms

As compartment syndrome progresses:

• Continued severe pain
• Decreased sensation
• Decreased strength
• Paralysis of limb

“Five P’s”

• Pain
• Paresthesia
• Pallor
• Pulselessness
• Poikilothermia

**These can be misleading, more relevant for arterial injury or occlusion.**

Differential Diagnosis

• Fracture
• Contusion
• Hematoma

Initial treatment

• Place limb at the level of the heart
  • Do not elevate = decreased arterial flow
• Remove bandages/cast/splints/dressings
• Supplemental oxygen

Interventions

• Consult/notify orthopaedic or general/vascular surgeon
• Correct any hypotension and/or anemia
  • Crystalloid
  • Blood products
• Reverse coagulopathy if present
• Measure intercompartmental pressure if indicated (not required)
  • Normal: 0-10 mm Hg
  • Pain/paresthesia’s: 20-30 mm Hg
  • Ischemia: > 30 mm Hg
  • Continuous pressure monitoring, for unconscious patients

Intra-Compartmental Pressure Monitor
Treatment

• Identify and remove the external force
  • Cast, dressings
• If internal - surgical decompression or fasciotomy
  • Early fasciotomy can avoid myonecrosis or ischemic neuropathy
  • Release all involved compartments
  • Two-incision technique is recommended (British Orthopaedic Association and British Association of Plastic Reconstructive and Aesthetic Surgeons)
  • Preserve vital structures
  • Debridement
  • May do skin coverage later ~ 7-10 days
  • Amputation

Fasciotomy - Tibia

Fasciotomy - Femur

Fasciotomy - Forearm

Treatment considerations

Early identification is key
• Prognosis is dependent on:
  • Injury severity
  • Duration of ischemia
  • Pre-injury status/comorbidities
  • Time to fasciotomy

Fasciotomy performed:
Within 6 hours = almost complete recovery of limb
Within 12 hours = 68 % normal function of limb
After 12 hours = 8% normal function of limb
(Rorabeck 1975)

Within 6 hours = almost 100% recovery of limb function
After 6 hours = may be residual nerve damage
Within 12 hours = 2/3 have normal limb function
(Torlincasi, Lopez, & Waseem 2020)
Additional considerations

• Full trauma evaluation
• Rhabdomyolysis
  • Muscle necrosis
  • Elevated Creatine Kinase levels
  • Elevated enzyme levels and myoglobin
  • Electrolyte imbalances
• Acute renal failure
• Infection
• Limb loss

References

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