Evaluation, Prevention and Treatment of Compartment Syndrome

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Objectives:
• Describe the basic pathophysiology of compartment syndrome
• Identify common locations for compartment syndrome
• Review the signs, symptoms, and diagnostic techniques for compartment syndrome
• Discuss basic differences between compartment syndrome, reperfusion syndrome, crush syndrome, and hematoma compression
Compartment Syndrome

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WHAT IS IT?

Interstitial pressure elevation in a muscular closed space which compromises microcirculation and thus tissue oxygenation
Vicious Circle

1. Compromised microcirculation results in cellular hypoxemia
2. Which leads to break down of cell wall function and increased permeability
3. Which results in increased interstitial fluid and pressure
4. Causing decreased microcirculation
5. And a further decrease in tissue oxygenation
From the standpoint of trauma…

Which fractures are more commonly associated with compartment syndrome?
Fractures of the Tibia and Fibular shafts
Displaced Bicondylar Tibial Plateau Fractures
Pilon Fractures
Fractures of the Radial and Ulnar Shafts
Other contributing conditions and factors

1. Tight casts and wraps
2. Traction
3. Burns
4. Sepsis
5. Snake bites
DIAGNOSIS
The Most Common Muscle Groups Involved

Anterior Compartment of the Leg

Volar Compartment of the Forearm
The anterior compartment muscles of the leg are predominantly made of type I fibers, and primarily use oxidative metabolism.

Thus they are more vulnerable to oxygen deprivation than type II fibers in the gastrocnemius muscles, which rely more on anaerobic glycogen metabolism.
Locations less commonly diagnosed with compartment syndrome

Thigh
Foot
The two bones in these areas are joined by a very tough interosseus membrane.

Together they form a very rigid boundary to the muscle compartments.
CLINICAL DIAGNOSIS

Awake and Cooperative Patients

1. Pain out of proportion to the injury
   • How do you know?
     a. Can’t give enough analgesic
     b. Practitioner experience
2. Loss of function of muscles traversing the compartment
   • How do you know?
     a. Test the strength of the deepest muscles in the compartment
     b. Repeated testing by the same examiner
     c. Practitioner experience
2. Loss of function of muscles traversing the compartment

- Pitfalls
  a. “Wiggles toes”
  b. Confusing “recoil” after toe flexion mistaken as evidence of dorsiflexion
  c. Traumatic peroneal nerve injury
3. Increased pain with passive stretch of the muscles in the compartment.
   - Extensor hallucis longus
   - Flexors of the fingers
   - Practitioner experience
CLINICAL DIAGNOSIS

4. Loss of sensory function of nerves traversing the compartment
5. Diagnosis fits the injury and timing
6. Fracture blisters
7. Pulses?
CLINICAL DIAGNOSIS

Comatose or Uncooperative Patients

1. Suspicion
2. Compartment pressure measurement
   • Measurement at one time
     a. One “stick”
     b. Multiple “sticks”
   • Continuous
3. What Pressure?

- Diastolic pressure minus compartment pressure <30mm Hg
- One of the problems is that we are trying to assess muscle viability in an indirect way.
1. Reperfusion Syndrome

- When is it seen?
  a. Revascularization or replantation of an extremity

- What is it?
  a. Because of ischemia, changes in microcirculation after blood flow is reestablished, result in increasing vascular permeability to plasma proteins leading to progressive interstitial edema.
ALLIED DIAGNOSIS

2. Crush Syndrome

• When is it seen?
  a. Overdoses resulting in patients lying in one position for an extended time
  b. Patients buried by building rubble after earthquakes

• What is it?
  a. An external force applied to an extremity, acting continuously above the diastolic pressure for sufficient time to produce myonecrosis
ALLIED DIAGNOSIS

2. Crush Syndrome continued…

- Develops rapidly after extrication of the patient as a type of reperfusion syndrome.
- Crushed vasculature allows the rapid seepage of fluid and plasma proteins into the dead muscle causing swelling
ALLIED DIAGNOSIS

Bleeds from anticoagulation

- Extrafascial
- Subfascial
Bleeds from Anticoagulation
TREATMENT

- Compartment syndrome associated with fracture
- Fasciotomy
TREATMENT

1. Reperfusion syndrome
   • Fasciotomy

2. Muscle crush syndrome
   • ?

3. Bleeds
   • Based on location, exam, and skin condition
UNTREATED COMPARTMENT SYNDROME

- Possible rhabdomyolysis with renal compromise
- Muscle and nerve necrosis
- Fibrotic replacement of necrotic muscle leading to joint contracture and paralysis
TAKE HOME POINTS

- Think of the possibility of compartment syndrome
- Know how to examine the patient
- Repeat the exam
- Act, or call, especially when inconvenient for you or the person with responsibility
THANK YOU