Gluteal Compartment Syndrome
AND other common compartment syndromes

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Outline

• Case Presentation
• Anatomical Considerations
• Presentation
• Diagnostics
• Treatment
Case

- Level III Trauma Activation
- Chief Complaint: Right Hip Pain
- HPI: 45 y/o male 24 hr history of intoxication, assault, and subsequent prolonged immobilization. Presented to ED ~24 hours later with R hip pain, LLE lack of sensation & paralysis
- PMHx: HTN, Snakebite, MVC
- SHx: burr holes
- Medications & Allergies: none
- SoHx: Tobacco 1 PPD, EtOH 6 pack every other day, History of IV drug use
Physical Exam

- Vitals: T: 97.8°F, BP: 140/103, HR: 124, RR 20, O₂: 93% (RA)
- Labs
  - Urine: Hb +, myoglobin +
  - Serum myoglobin: 13500 (Normal <223)
  - CPK: 43600 (normal <5000)
  - CKMB: 300 (normal <6)
- GCS 15
- Pulses 2+ Bilateral Radial & Pedal
- RLE Hip Ecchymosis
- LLE
  - Buttock tense, ecchymotic, shiny skin
  - Insensate Sciatic distribution
  - Extremity Paralysis
  - Pain with Passive ROM Hip adduction, extension
Physical Exam

Compartment Measurements

• Arterial line
• Stryker needle
• Gluteus maximus compartment: 50 mmHg
• Gluteus medius & minimus Compartment: 70 mmHg
• Diastolic BP 100, ΔP=30
Imaging

- MRI
  - Mild Spinal Stenosis L4-S1

- CT Abdomen Pelvis
  - Significant Edema in Left Buttock
  - Enlargement of Gluteus Maximus, medius, minimus
Diagnosis

Gluteal Compartment Syndrome
Plan: Emergent Gluteal Fasciotomy
Anatomy

• What is a Compartment?
• Compartment Syndrome
  • “Compartment syndrome is the excessive swelling of tissue within a closed space, to the degree that the pressure exceeds the capillary bed perfusion pressure and effective blood flow is cut off.”
  
  –Cameron’s Current Surgical Therapy
Known Locations

Common
• Lower Extremity
• Upper Extremity
• Abdomen

Uncommon
• Thigh
• Hand
• Foot
• Gluteal
• Eye
• Chest
Causes

- Trauma
- Crush injuries
- Bleeding
- Insect/snake bites
- Constrictive dressings
- Prolonged immobilization
- Reperfusion
- Burns
Pathophysiology

- Local swelling
- Blood flow decreases as compartment pressure approaches diastolic pressure
- Early: venous outflow
- Late: arterial inflow
- Tissue hypoperfusion, ischemia, and necrosis
- Worsening edema
Diagnosis

Subjective
- Early
  - Pain with Passive stretch
  - Pain out of proportion
- “6 Ps”
  - Pain
  - Pallor
  - Poikilothermia
  - Paresthesias
  - Paralysis

Objective
- Compartment Pressure > 30 mmHg
- $\Delta P < 30$
  - $\Delta P = \text{Diastolic Pressure} - \text{Measured Pressure}$
- Laboratory Abnormalities
  - CPK: > 1000-5000
  - Renal function
  - Urine myoglobin
  - Potassium
  - Lactic acid
Treatment

- Fasciotomy
  - Full thickness incision through skin and deep fascia confining muscle
- Viability Assessment
  - “4 Cs”
    - Color: (red vs dusky)
    - Contractility
    - Consistency (intact vs friable)
    - Capacity to bleed
- Debridement
- 2nd Look
- Delayed Primary Closure vs Grafting
- Delayed Presentation (>48 hrs)
  - Increased infective risk with fasciotomy
  - Unlikely functional recovery
- Supportive Management
  - Rhabdomyolysis
  - Renal injury
  - Myonecrosis
Contraindications

- Non-viable extremity
- Crush injury
Upper Extremity

• Forearm
  • 2nd most common location
  • Crush injury, fracture
• 3 Compartments
  • Volar, Dorsal, Mobile Wad
• Fasciotomy
  • Release of deep flexors
  • Carpal tunnel, Guyon canal release
  • Extensors
• Upper Arm
  • Uncommon
  • Anterior, Posterior, Deltoid
  • Anterior & Posterior or Single lateral incision
Hand

- 10 Compartments
- **Cause**
  - Crush injuries
  - Fractures
- **Presentation**
  - Swollen
  - IP flexion, MCP extension
  - Increased pain with passive stretch of intrinsic muscles
Lower Extremity

- Lower Leg
  - Most common location
- Treatment
  - 4 compartment fasciotomy

Double Incision

Single Incision
Thigh

- Uncommon
- Anterior, Medial, Posterior
- Anterior compartment most common
  - Femur, vascular trauma
  - Iatrogenic: post intramedullary nailing
Foot

- Uncommon
- Fractures
  - Calcaneus, Lisfranc
  - Crush injuries, trauma
- Clinical Diagnosis
  - +/- elevated ICP
Gluteal Compartment Syndrome

- Common Etiology
  - Prolonged Immobility
  - Intoxication
  - Local Trauma
- Pain out of proportion
- Sciatic nerve distribution deficits
- Dx: $\Delta P < 30$
Gluteal Compartment Syndrome

Treatment

• Gluteal Fasciotomy
  • Kocher-Langenbeck
  • Modified Gibson
Literature Reviewed

- **Documented Causes:**
  - Trauma
  - Hip arthroplasty
  - Iatrogenic vascular injury
  - Pelvic fractures
  - Lateral decubitus or lithotomy positioning in the operating room
  - Overuse or exertion
  - Epidural analgesic infusion
  - Anticoagulation
  - Bone marrow biopsy

- **Associations**
  - Alcohol & drug use
  - Immobilization
Our Treatment

• Day 1
  • Modified Gibson Fasciotomy
    • Color: Dusky
    • Contractility: minimal at inferior aspect
    • Consistency: non-friable
    • Capacity to bleed: none
    • Packed wet
  • Day 3
    • Wound check
  • Day 4
    • Able to flex LLE at knee
    • No movement/sensation distally
Our Treatment

- **Day 5**
  - Wound check

- **Day 7**
  - Ambulating
  - Operation: Primary Closure
  - Discharged Home
Compartment Syndrome vs Crush Injury

**Crush Injury**
- Continuous or prolonged pressure
  - Natural disasters
  - Prolonged immobilization under the influence
- Examination
  - Initial paralysis
  - Rapidly ensuing swelling
- Treatment
  - Supportive care
  - Surgical release < 6-12 hrs

**Compartment Syndrome**
- Compartment syndrome
  - Elevated pressure $\rightarrow$ muscle damage
- Crush Syndrome
  - Muscle damage $\rightarrow$ elevated pressure
Compartment Syndrome Triaging

**Mechanism**
- Trauma
- Crush injuries
- Bleeding
- Prolonged immobility
- Burns

**Physical Exam**
- Tense Compartments
- Early
  - Pain with Passive stretch
  - Pain out of proportion
- “6 Ps”
  - Pain
  - Pallor
  - Poikilothermia
  - Pulseless
  - Paresthesias
  - Paralysis
Compartment Syndrome Triaging

- **Pre-Hospital**
  - IV Fluids
  - Communication

- **Hospital Period**
  - Changes in clinical exam
  - Lab abnormalities
    - Elevated Creatinine
    - Hyperkalemia
    - Elevated CPK
    - UA positive for hemoglobin/myoglobin
References

  Published online 2014 Jun 7. doi: 10.1007/s11420-014-9386-8
  Published online 2012 Dec 17. doi: 10.1136/bcr-2012-007710.
  http://kingsleyphysio.com/common-conditions/chronic-compartment-syndrome/
- CPT Brendan Masini, MD. http://www.wheelessonline.com/ortho/12797
- Yadav, Umesh. https://www.slideshare.net/umeshyadav5682/approach-to-hip-joint
- Compartment Syndrome Of The Gluteal Region - Everything You Need To Know - Dr. Nabil Ebraheim, https://www.youtube.com/watch?v=qQuZnxySxOA
Thank You