Acute Compartment Syndrome: Common Fasciotomies

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Disclosures

- **Scientific Advisory Committee**
  - Osteoporosis Canada
- **Institutional Research Funding**
  - Johnson & Johnson
- **Educational Engagements**
  - Stryker
- **Associate Editor**
  - Canadian Journal of Surgery

Objectives

FOOTHILLS MEDICAL CENTRE OTS ORTHOPAEDIC TRAUMA SERVICE

- Define Acute Compartment Syndrome (ACS)
- Review Pertinent Extremity Anatomy
- Describe Common Fasciotomy Approaches
- Tips and Tricks to Reduce Complications

Acute Compartment Syndrome (ACS)

Acute compartment syndrome (ACS) is an **emergency**

Pathophysiology

- Increased compartment pressure -> Venous outflow obstruction -> Arterial inflow compromise -> Tissue ischemia
  - Muscle and nerve necrosis can occur **within hours** if untreated

Goal of Treatment

- Immediate surgical decompression via fasciotomy to restore perfusion

Diagnosis and treatment can be **subjective**

Shuler FD, Dietz MJ. J Bone Joint Surg. 2010;92:361–367.
Ulmer T. J Orthop Trauma. 2002;16:572–577.

Acute Compartment Syndrome (ACS)

JB&JS OPEN ACCESS

Rethinking the Paradigm of Using Ps for Diagnosing Compartment Syndrome

Yasser Bouklouch, BSc, MPH, July Agel, MA, ATC, William T. Obremskey, MD, MPH, MMHC, Andrew H. Schmidt, MD, Kathy Liu, MB, ChB, Jerald R. Westberg, MPH, Matthew Zakariah, BSc, Eli Bunzel, MD, Greer Henry, MSc, Andres Fidel Diaz, MD, Thierry Bégué, MD, Mitchell Bernstein, MD, and Edward J. Harvey, MDCM, MSc

Investigation performed at Central Site of McGill University Health Center, Montreal, Canada

JBJS Open Access • 2025:e24.00065.

- Poor predictive power with any single “P” for ACS diagnosis
  - Combining up to 4 of the “Ps” can improve likelihood of ACS diagnosis, but still has limited predictive power
- **Pressure on palpation** was the strongest clinical predictor of ACS, but often late presentation

ACS Diagnosis

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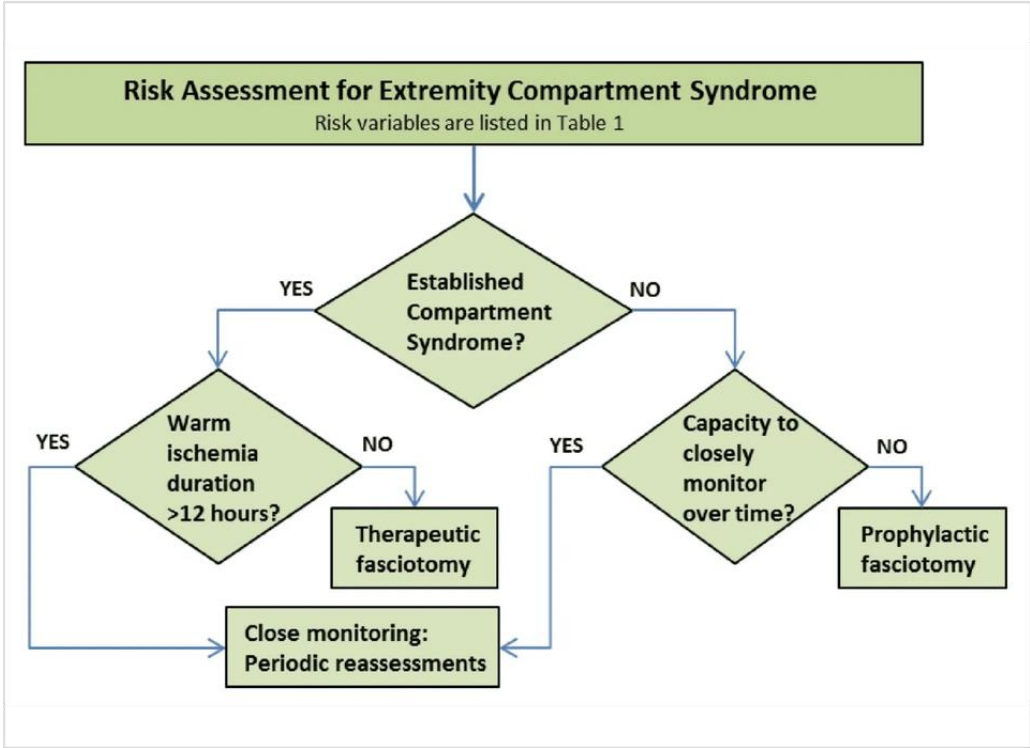
Pressure Monitoring

- Absolute Pressure: **> 30 mmHg**
- Delta Pressure (Δp) formula:

Δp = Diastolic BP - Compartment Pressure

  - Positive if **Δp < 30 mmHg**

- ACS is continuously evolving
  - Thresholds should be individualized



AAOS Clinical Practice Guideline on the Management of ACS (Update 2025)

ACS Diagnosis

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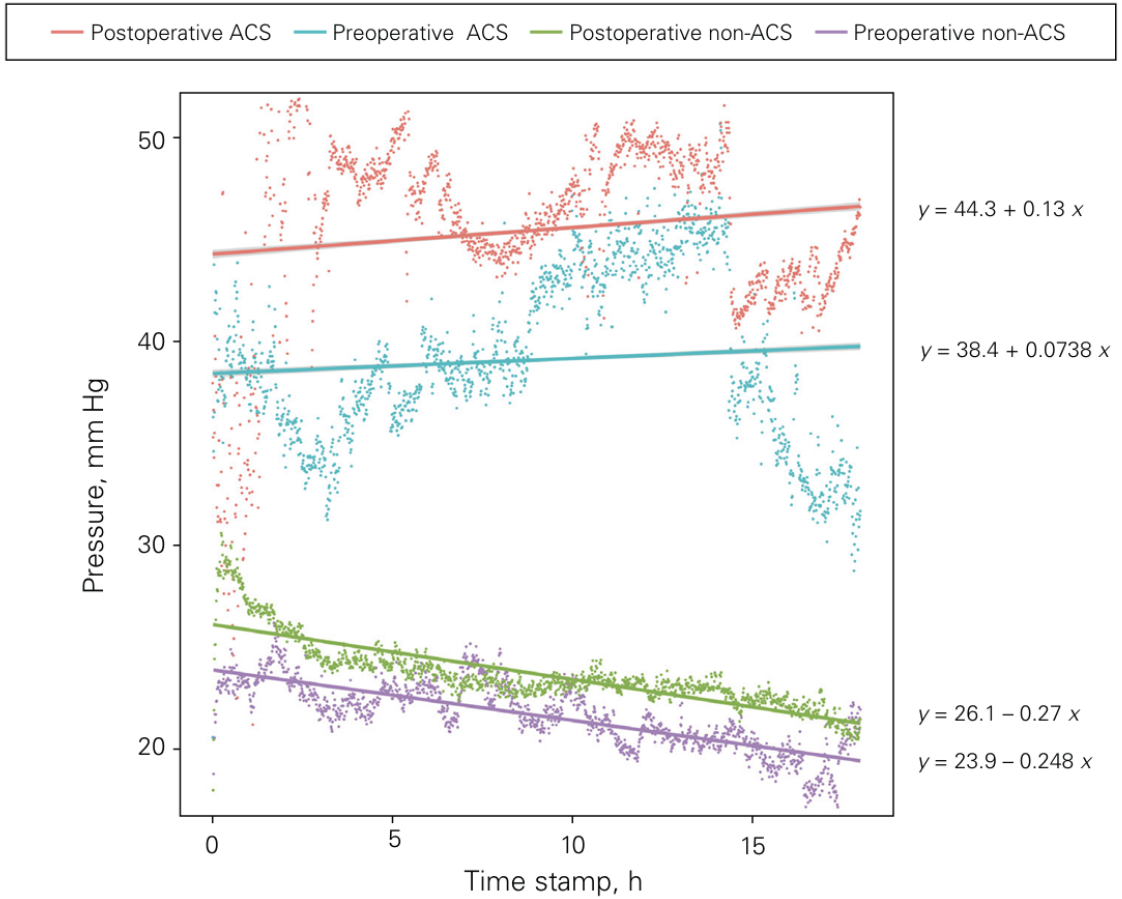
Continuous Pressure Monitoring



Can J Surg 2026 January 6; 69(1).

Lower Extremity ACS

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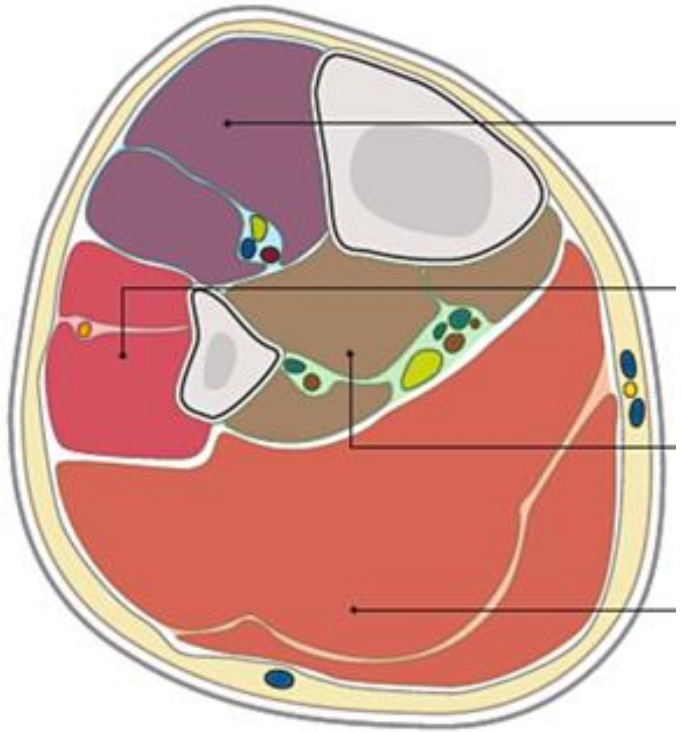
Anatomy of the Lower Leg (4 Compartments)

ANTERIOR
- Tibialis anterior, EHL, EDL
- Anterior tibial artery
- Deep peroneal nerve

LATERAL
- Peroneus longus and brevis
- Superficial peroneal nerve



DEEP POSTERIOR
- Tibialis posterior, FDL, FHL
- Posterior tibial artery
- Tibial nerve

SUPERFICIAL POSTERIOR
- Gastrocnemius, Soleus, Plantaris
- Sural Nerve

Clinical Pearl: Open fractures are twice as likely to be associated with ACS

Lower Extremity ACS

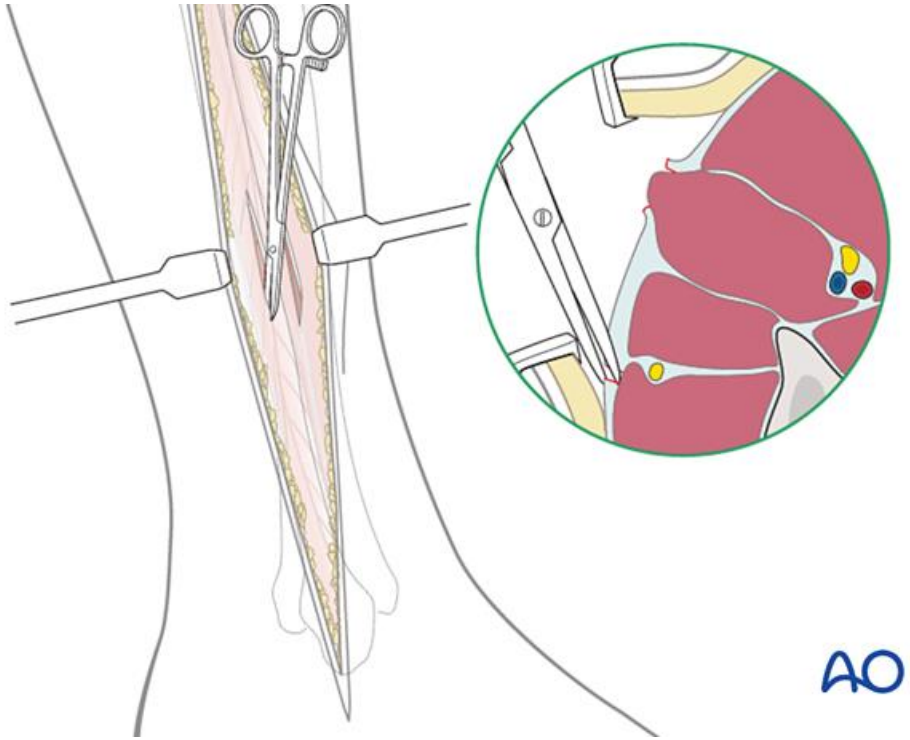
Double Incision (Mubarak) Surgical Technique

Anterolateral Incision:

- Longitudinal incision between the tibial crest and fibula – up to 20cm
- Decompresses anterior and lateral compartments

Posteromedial Incision:

- 2cm posterior to the medial border of the tibia
- Decompresses superficial and deep posterior compartments



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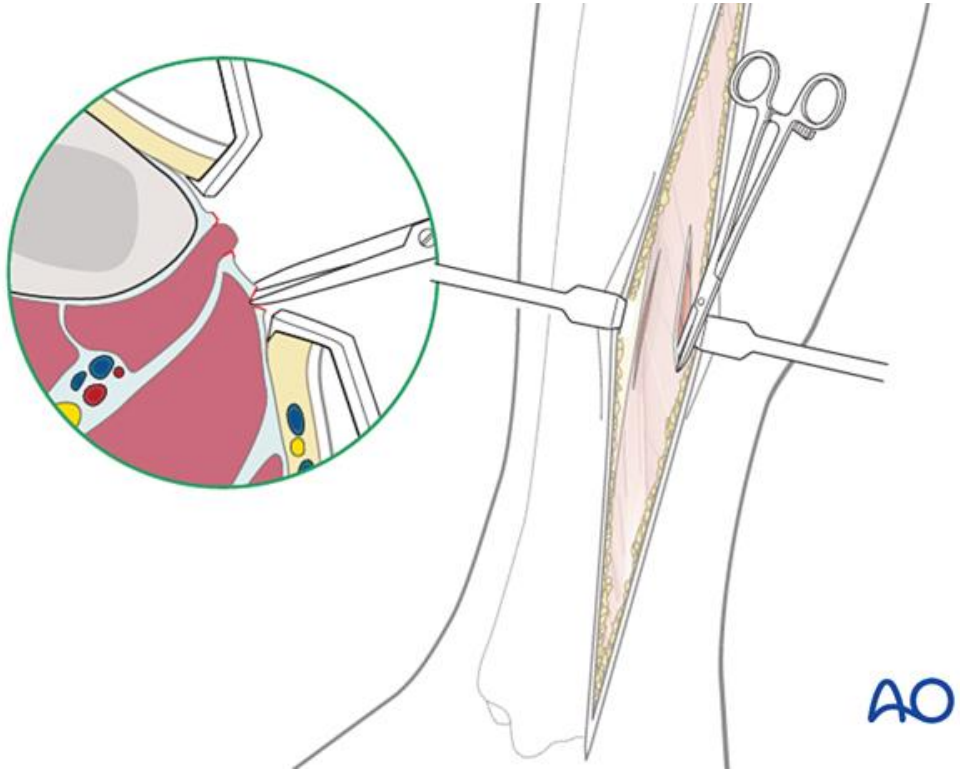
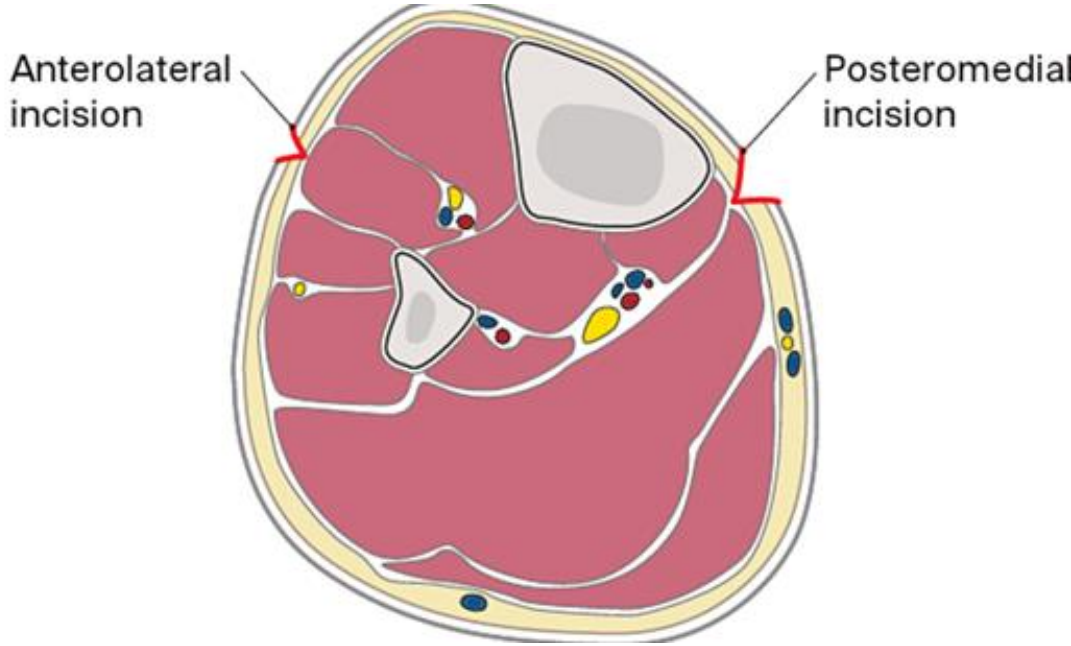


Lower Extremity ACS

Double Incision (Mubarak) Surgical Technique

Critical: Maintain a minimum 7cm skin bridge between incisions

Caution: Avoid injury to superficial peroneal nerve and saphenous vein/nerve



Clinical Pearl: All four compartments must be decompressed to ensure complete treatment

Lower Extremity ACS

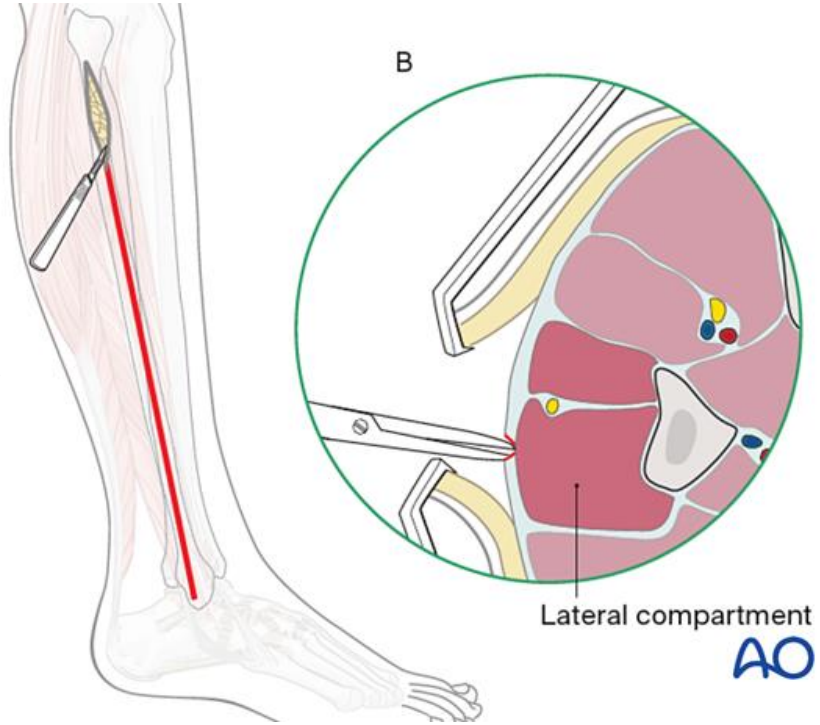
Single Incision (Davey/Rorabeck) Surgical Technique

Approach:
Single lateral incision along the length of the fibula

Pros: Single wound/scar, potentially faster closure

Cons: Technically demanding; **higher risk of incomplete deep posterior decompression**

Risk: Increased potential for **peroneal nerve injury** during extensive retraction



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Lower Extremity ACS

J Bone Joint Surg Am. 2022 May 4;104(9):813-820. doi: 10.2106/JBJS.21.00291.
Epub 2022 Jan 18.

Acute Compartment Syndrome Modeling with Sequential Infusion Shows the Deep Posterior Compartment Is Not Functionally Discrete

Drew Schupbach [1,2], Yazan Honjol [2], Yasser Bouklouch [1], Geraldine Merle [1], Edward J Harvey [1]

- Cadaveric model of ACS using multicompartment sequential pressurization
- Continuous pressure monitoring was used to measure pressure changes in all 4 compartments when treated with sequential fasciotomies
- **Release of the anterior or lateral compartments was sufficient for decompression of the deep posterior compartment**

Lower Extremity ACS

Single incision fasciotomy for acute compartment syndrome of the leg: A systematic review of the literature

Ali Etemad-Rezaie [a,*], Sophia Yang [b], Marit Kirklys [b], Devan O. Higginbotham [c], Leo Zalikha [c], Kerellos Nasr [c]

Journal of Orthopaedics 31 (2022) 134–139

- Systematic review of 3,040 combined results from 11 studies
- Adequate compartment release was achieved with a single incision technique
- **No difference in infection or nonunion rates**
- Operative timing, closure, and fixation techniques can significantly impact patient outcomes

Upper Extremity ACS

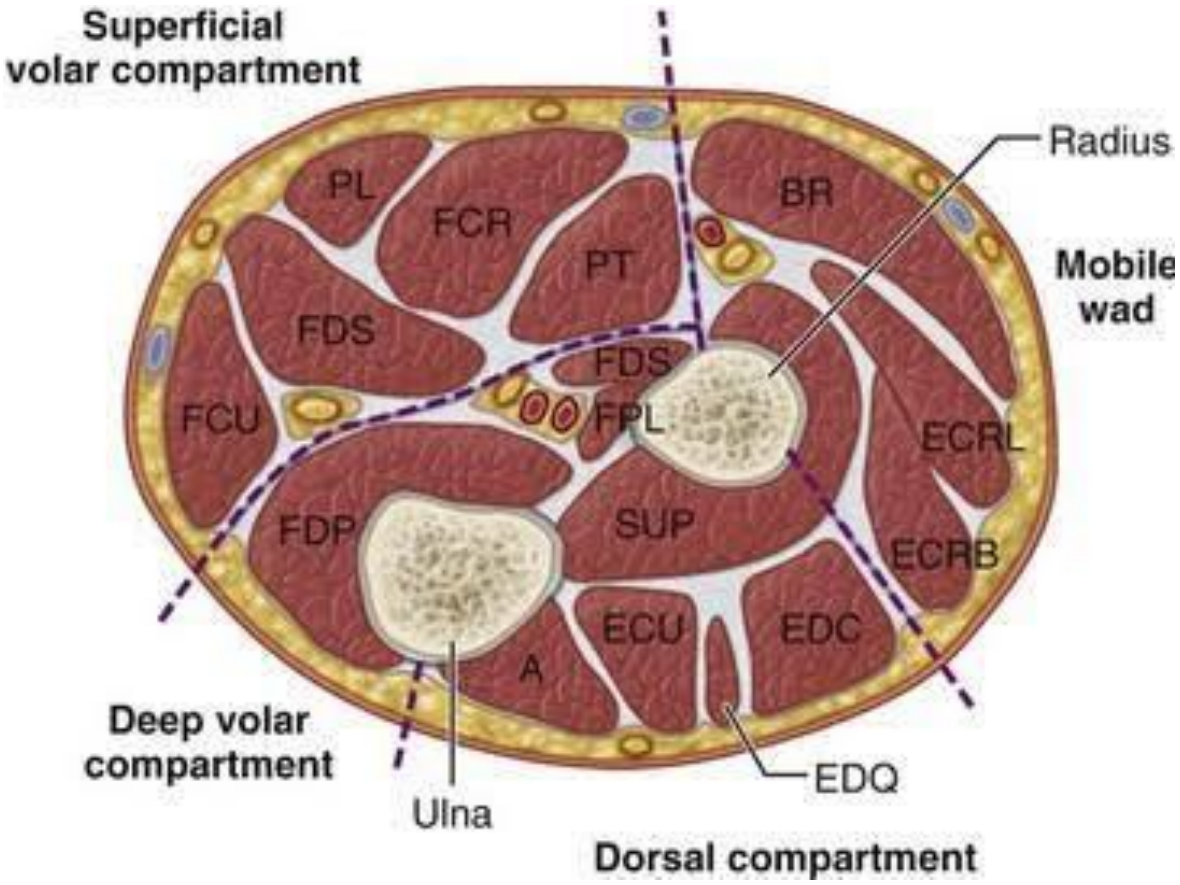
Anatomy of the Forearm

Volar (Flexor) Compartment

- **Superficial:** Pronator Teres, Flexor Carpi Radialis, Palmaris Longus, Flexor Carpi Ulnaris, Flexor Digitorum Superficialis

- **Deep:** Flexor Digitorum Profundus, Flexor Pollicis Longus, and Pronator Quadratus

- **Neurovascular:** median, ulnar, radial, ulnar



Upper Extremity ACS

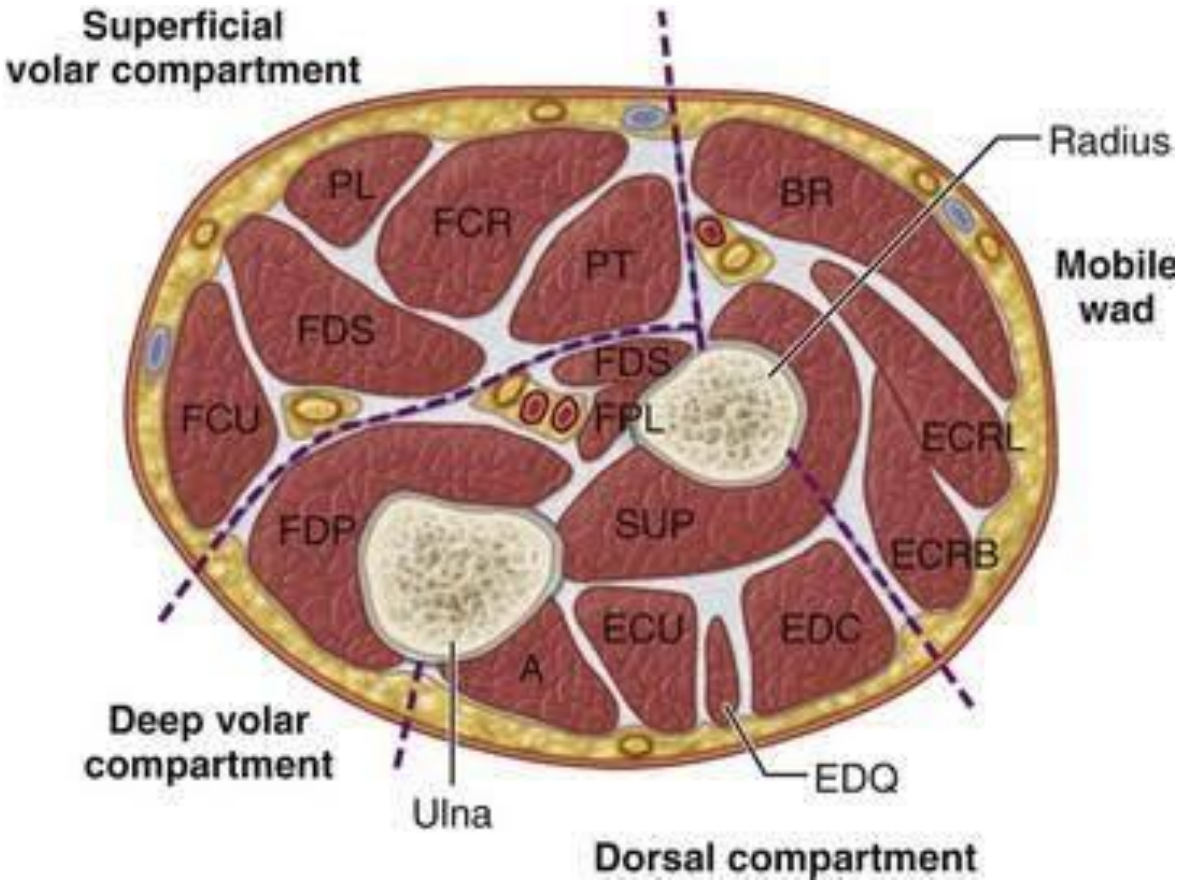
Anatomy of the Forearm

Dorsal (Extensor) Compartment

- Extensor digitorum, EDQ, ECU, Supinator, APL, EPB, EPL, EIP
- **Neurovascular:** Posterior interosseous nerve and artery

Mobile Wad of Henry Compartment

- Brachioradialis, Extensor Carpi Radialis Longus, Extensor Carpi Radialis Brevis
- Radial nerve and artery lie deep to this wad



Upper Extremity ACS

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Dual Incision

Volar Incision: Curvilinear incision begins medial to the distal biceps tendon crosses the mid forearm, then extends to the wrist

- Consider carpal tunnel release

Dorsal Incision: Straight, longitudinal incision from lateral epicondyle to midline of the wrist

- Used to decompress the extensor compartment and mobile wad

Clinical Pearl: Volar decompression is the priority, but dorsal & mobile wad must be assessed

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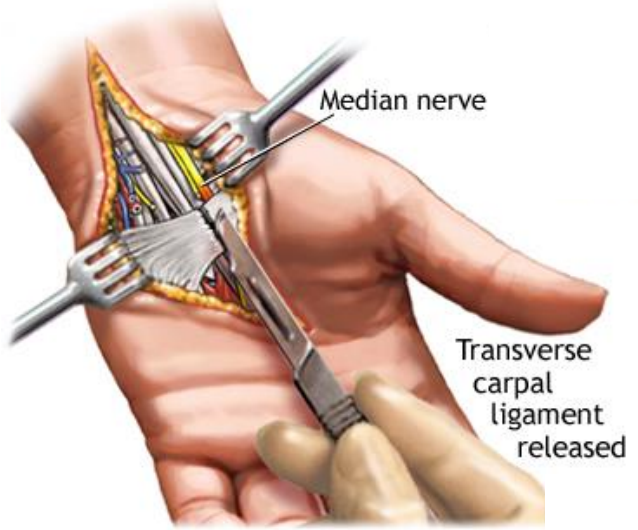

Clinical Pearl: Volar decompression is the priority, but dorsal & mobile wad must be assessed

Post-operative Management

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Initial Management

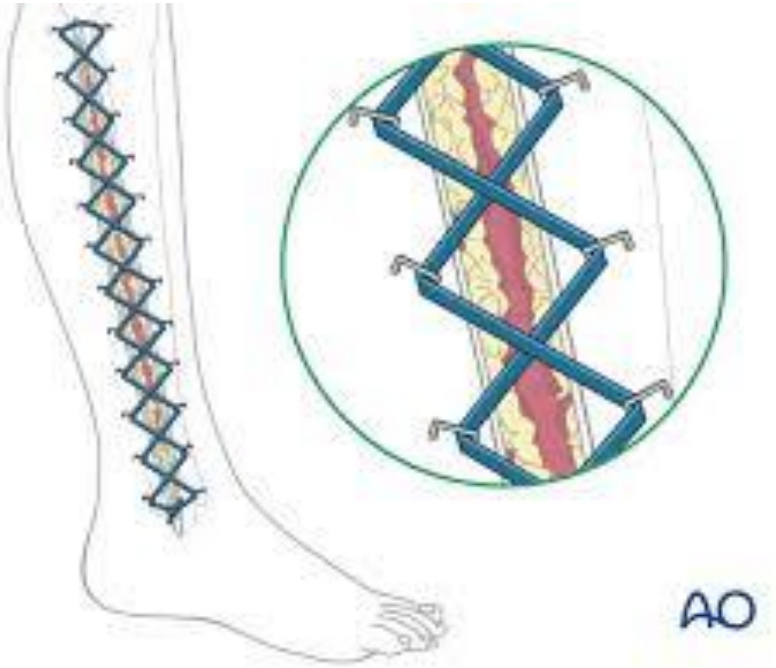
- **Wound Care:** Leave wounds open; apply bulky sterile dressings
- **Splinting:** Maintain neutral position to prevent contractures
- **Positioning:** Keep limb at heart level; **avoid excessive elevation**

Clinical Pearl: Re-assessment at 48 to 72 hours for repeat debridement

Wound Closure

Initial Techniques

- **Delayed Primary Closure:** "Shoelace" technique with vessel loops
- **Negative Pressure (VAC):** Manages edema and prepares wound bed
- **Skin Grafting:** Often required
  - Split-thickness Skin Graft



Clinical Pearl: Immediate wound closure is contraindicated in ACS

Complications and Prognosis

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Prognosis

- **< 6 Hours:** Excellent recovery (~100%)
- **6 to 12 Hours:** Variable; high risk of permanent deficit
- **> 12 Hours:** Poor prognosis (~8% recovery)

Complications

- Infection, wound dehiscence, delayed fracture healing
- Volkmann's Ischemic Contracture
- Acute Renal Failure (Rhabdomyolysis)
- Amputation

Clinical Pearl: Repeat debridement and gradual closure recommended

Take Home Messages

- ACS is a surgical emergency
  - Defining ACS is improved with continuous pressure monitoring
  - Clinical assessment alone is subjective
- Decompression of all affected compartments is critical
  - Don’t forget the carpal tunnel
- Re-assessment at 48 to 72 hours for repeat debridement
- Meticulous soft tissue management and wound closure to help reduce complications

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