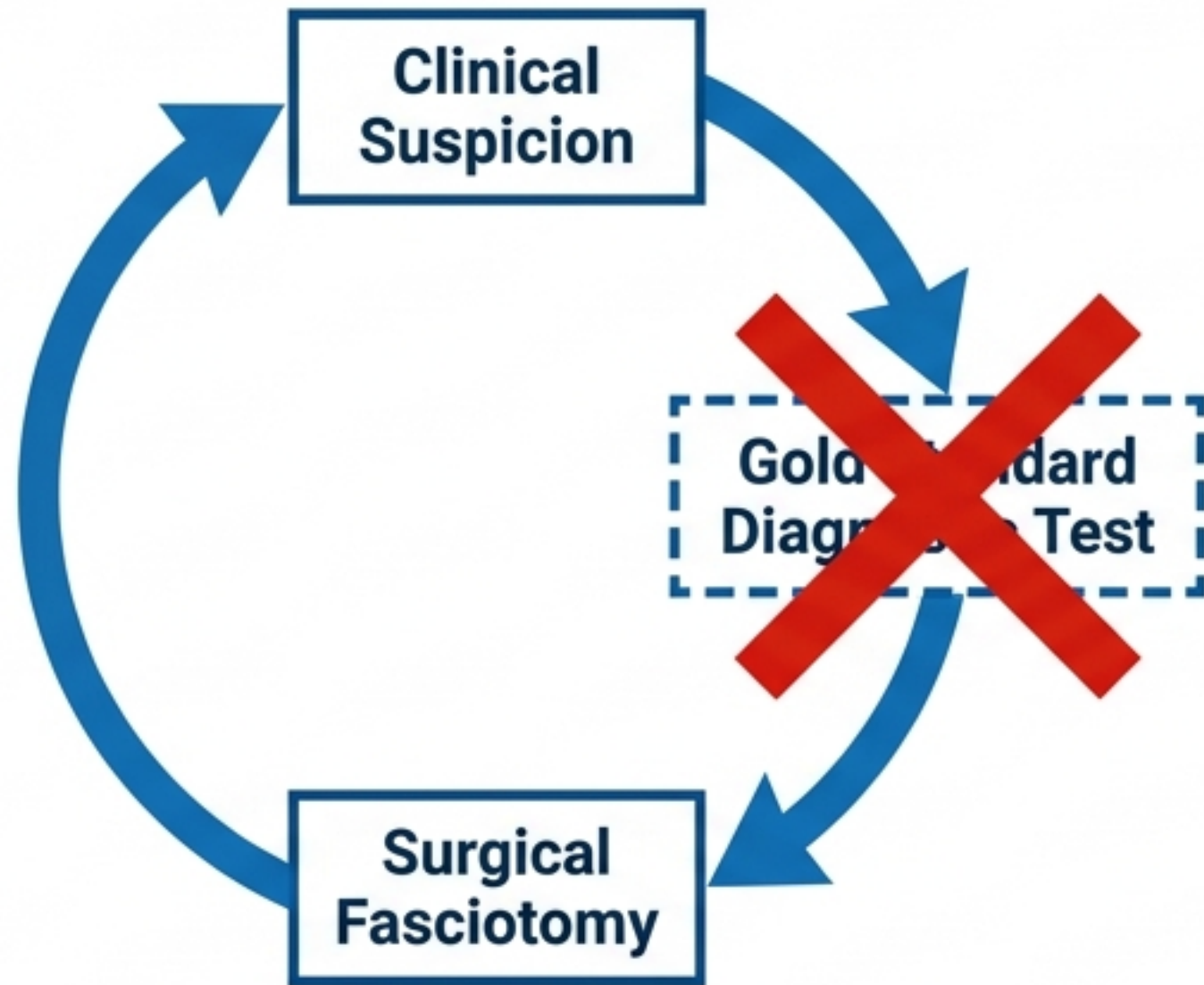




The Acute Compartment Syndrome Playbook

2025 Evidence-Based Clinical Pathway & Diagnostic HUD

The Core Paradox: Treatment as Diagnosis



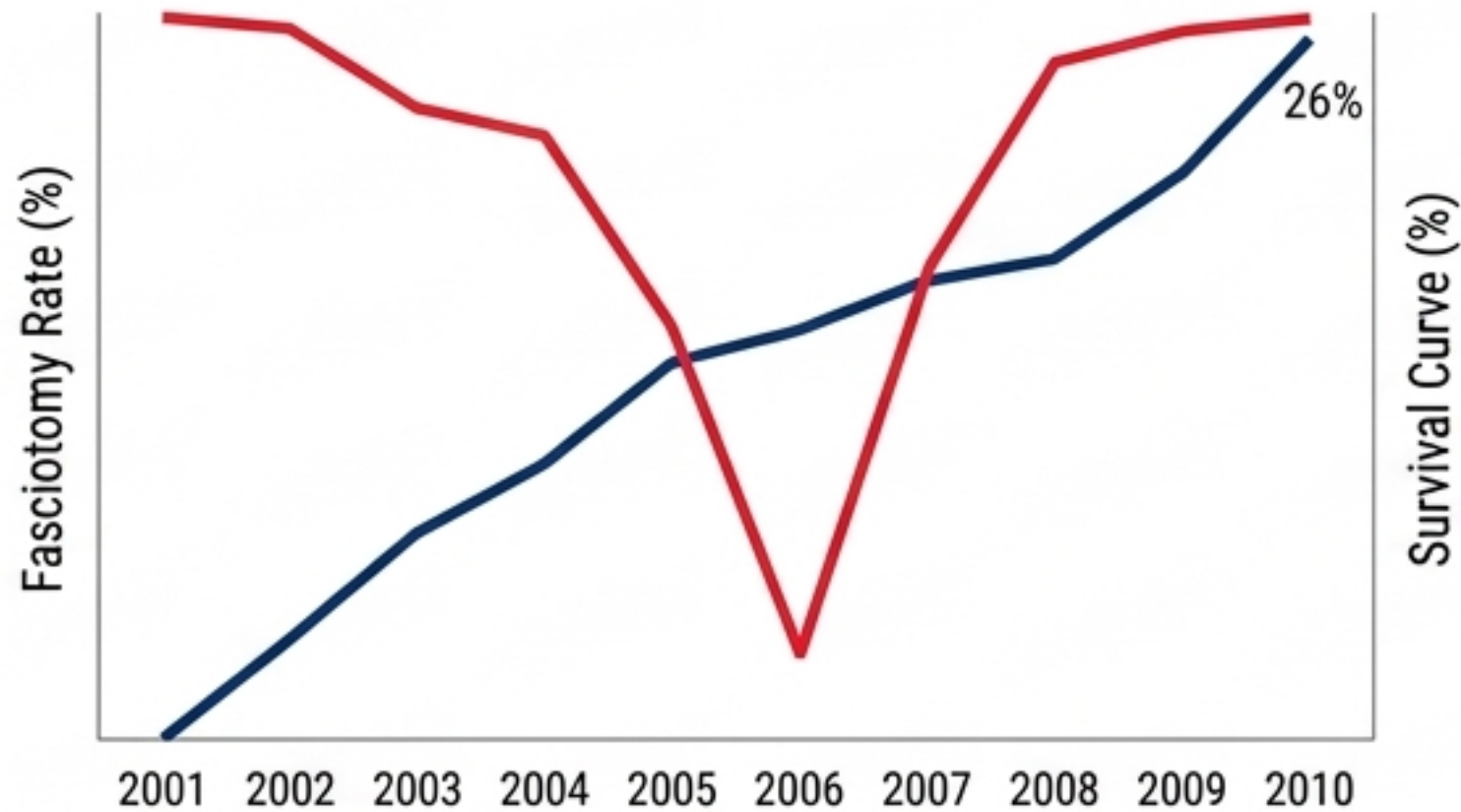
There are no standard diagnostic criteria for **Acute Compartment Syndrome (ACS)**. Because of the catastrophic consequences of a missed case, the surgical treatment (decompressive fasciotomy) is frequently performed as a surrogate for the diagnosis itself.

The Index of Suspicion Framework



This playbook translates the **2025 AAOS Guidelines** into a **sequential clinical pathway**. The goal: synthesize biomarkers, pressure gauges, and serial exams into a composite **Index of Suspicion** to mitigate the bias of unnecessary prophylactic surgery while preventing devastating missed diagnoses.

The Tactical Origin: Combat Data (2001-2010)



17,166

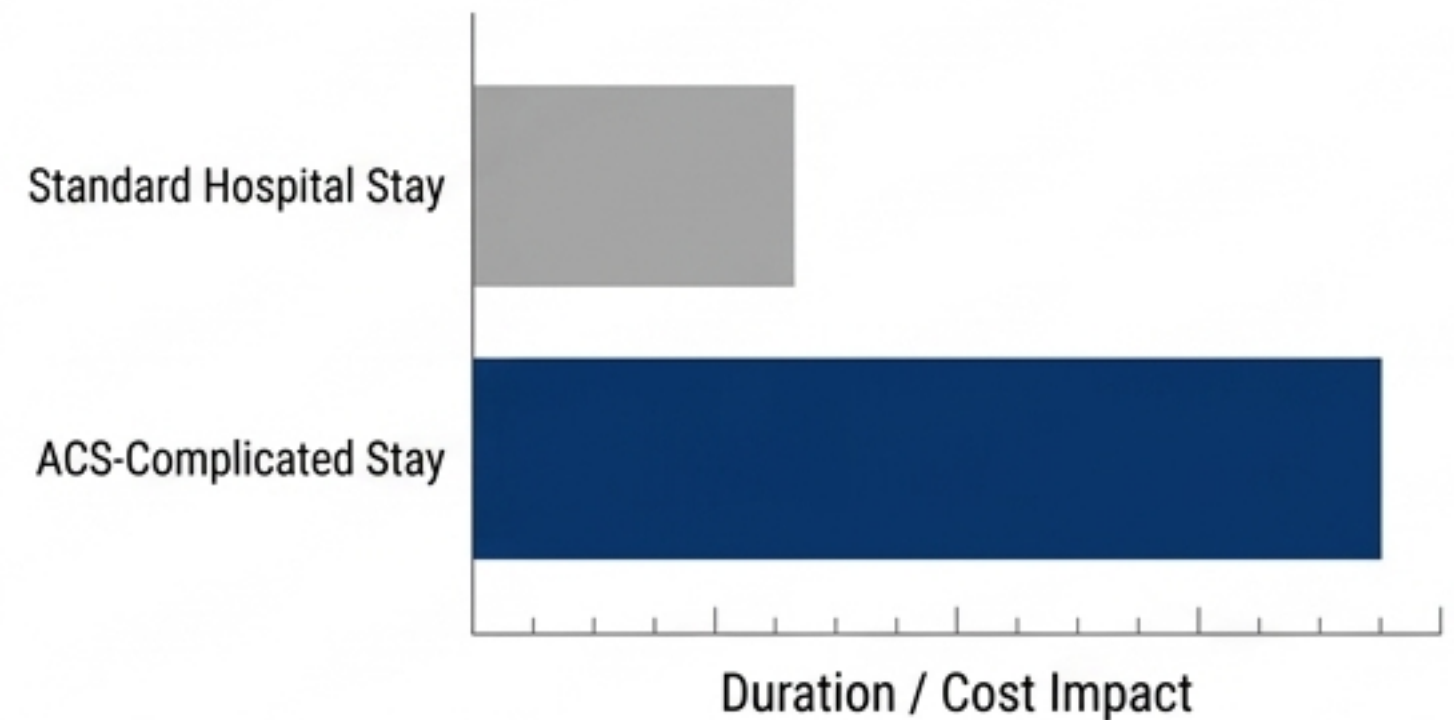
combat casualties observed.

19%

overall fasciotomy rate (3,313 procedures).

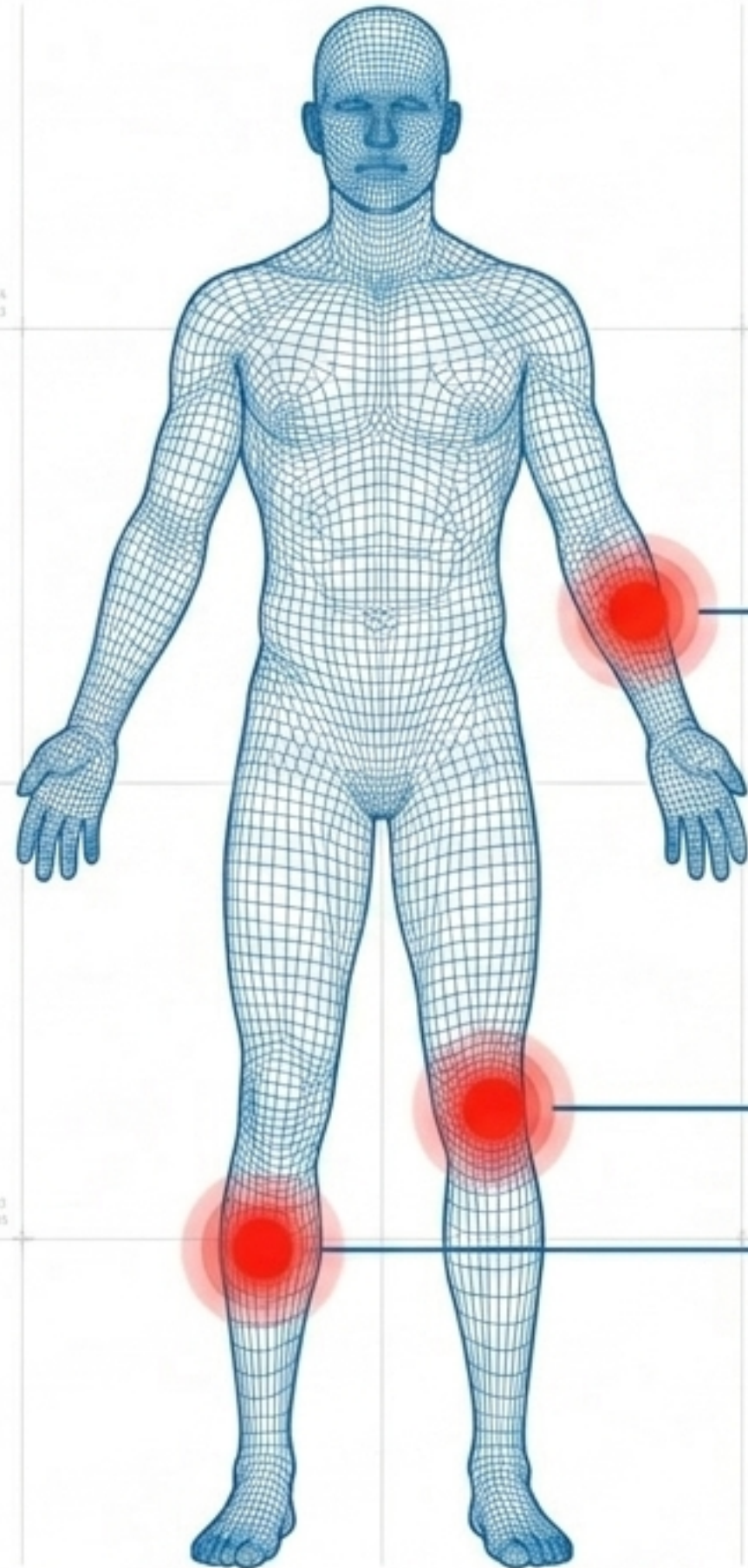
Survival rates tightly correlated with forward-deployed fasciotomy education and tourniquet use.

The Civilian Burden: Hospital Impact



- ACS more than doubles hospital stays and triples treatment costs.
- High incidence in medial knee fracture-dislocations (53%) and bicondylar tibial plateau fractures (18%).
- Long-term quality of life (EQ-5D) severely impacted by swelling, decreased endurance, and need for skin grafting.

Phase 1: Rapid Patient Risk Profiling



Age:

Under 35

Gender:

Male (1.7x more likely in combat data)





Mechanism:

High-energy trauma, crush injuries without fracture, or prolonged limb compression in obtunded states (intoxication/overdose).

Comorbidities:

Bleeding or use of anticoagulant medications (causes 10% of ACS cases).

The Diagnostic Toolkit at a Glance

Diagnostic Utility Matrix			
Modality	Evidence Strength	Applicability	Best Used For
Clinical Exam	Limited 	Awake Patients	Rule-In
Intracompartmental Pressure (ICP)	Moderate 	Obtunded Patients	Rule-Out
Biomarkers	Limited/ Moderate  	Ischemic Non-Trauma	Etiology-Specific

Key Takeaway: No single diagnostic modality acts as a gold standard. Diagnosis requires a composite approach based on patient consciousness and etiology.

Patient Presentation

Patient is Awake & Reliable

Serial Clinical Exams

Action: Use serial clinical exam findings to assist in ruling in ACS.
(Evidence: Limited)

Patient is Obtunded / Unreliable Exam

Direct Pressure Monitoring

Action: Repeated or continuous intracompartmental pressure measurements are recommended until ACS is explicitly diagnosed or ruled out.
(Evidence: Consensus)

Alternative Methods: None. Outside of direct pressure monitoring and clinical exams, no other modalities provide useful information to guide fasciotomy decisions. (Evidence: Consensus)



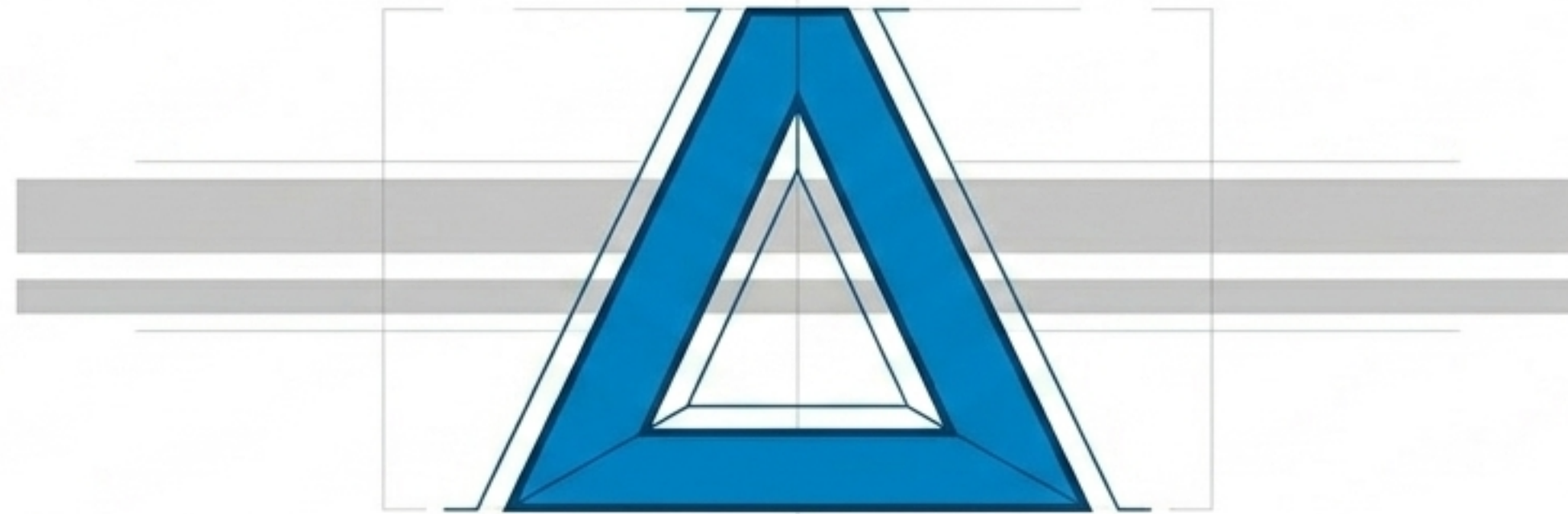
The Anesthesia Blindspot

The Danger of Neuraxial Anesthesia

Neuraxial anesthesia (epidurals/spinals) **completely masks the clinical symptoms of ACS**. If administered, the standard 'Awake' clinical exam is **voided**.

Mandated Action Protocol

Frequent physical examination and/or continuous **direct pressure monitoring MUST** be performed to compensate for the clinical blindspot. (Evidence: Consensus)



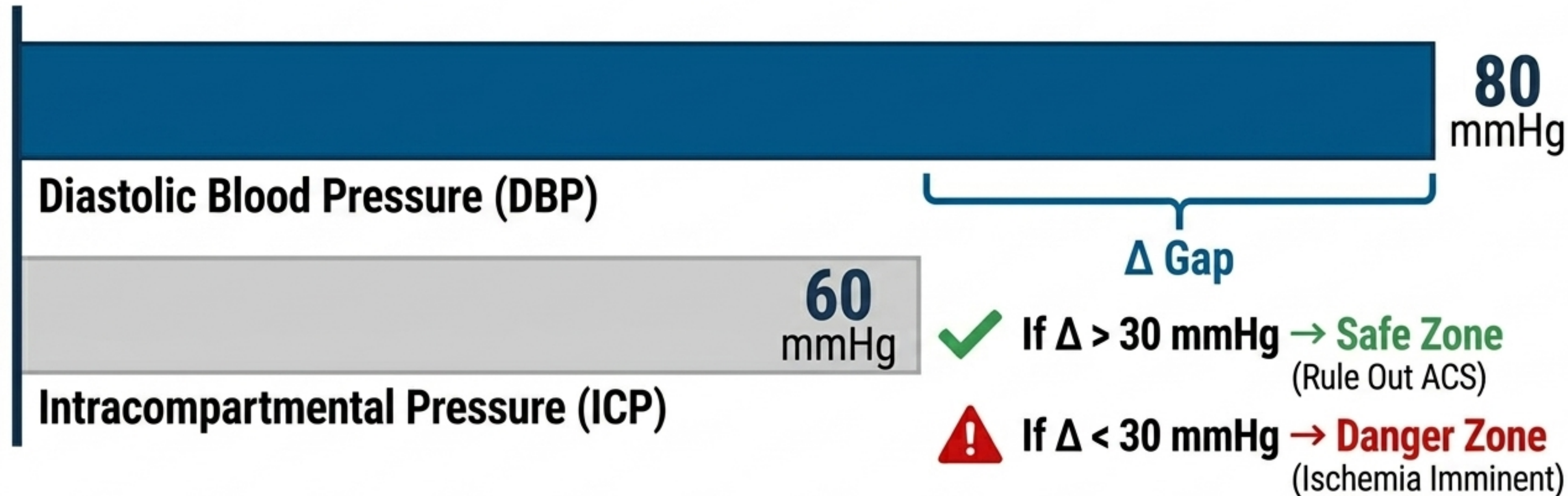
Redefining Pressure: The Perfusion Delta (Δ)

Absolute compartment pressure is less diagnostically relevant than relative perfusion pressure. ACS is a disease of myoneural capillary blood flow cessation.

The critical clinical threshold is defined by the Delta (Δ): Diastolic Blood Pressure (DBP) minus Intracompartmental Pressure (ICP).

Moderate Evidence supports continuous ICP monitoring combined with the Δ 30 mmHg rule to successfully rule out ACS.

The Rule-Out Pressure Gauge



Clinical Note: Maintaining a $\Delta > 30$ mmHg for >2 consecutive hours has **high sensitivity** and specificity for safely ruling out unnecessary fasciotomies.

Biomarker Efficacy by Etiology



Traumatic Lower Extremity

Myoglobinuria & Serum Troponin

Utility: Limited. May assist in diagnosis. Troponin is a strong rule-in test but a poor rule-out test.



Electrical Injury

Myoglobinuria

Utility: Poor / Limited. Does **NOT** assist in diagnosing ACS. High rates of false positives due to generalized muscle damage.



Acute Vascular Ischemia

Femoral Vein Lactate

Utility: Moderate. Highly specific protocol utilized exclusively by vascular surgeons. (Detailed next slide).

The Vascular Ischemia Exception: The Lactate Protocol

Applicable only to non-trauma adults with limb ischemia from acute femoral embolism undergoing surgical embolectomy.

Step 1

Sample femoral vein lactate immediately BEFORE revascularization.

Step 2

Sample immediately AFTER revascularization.

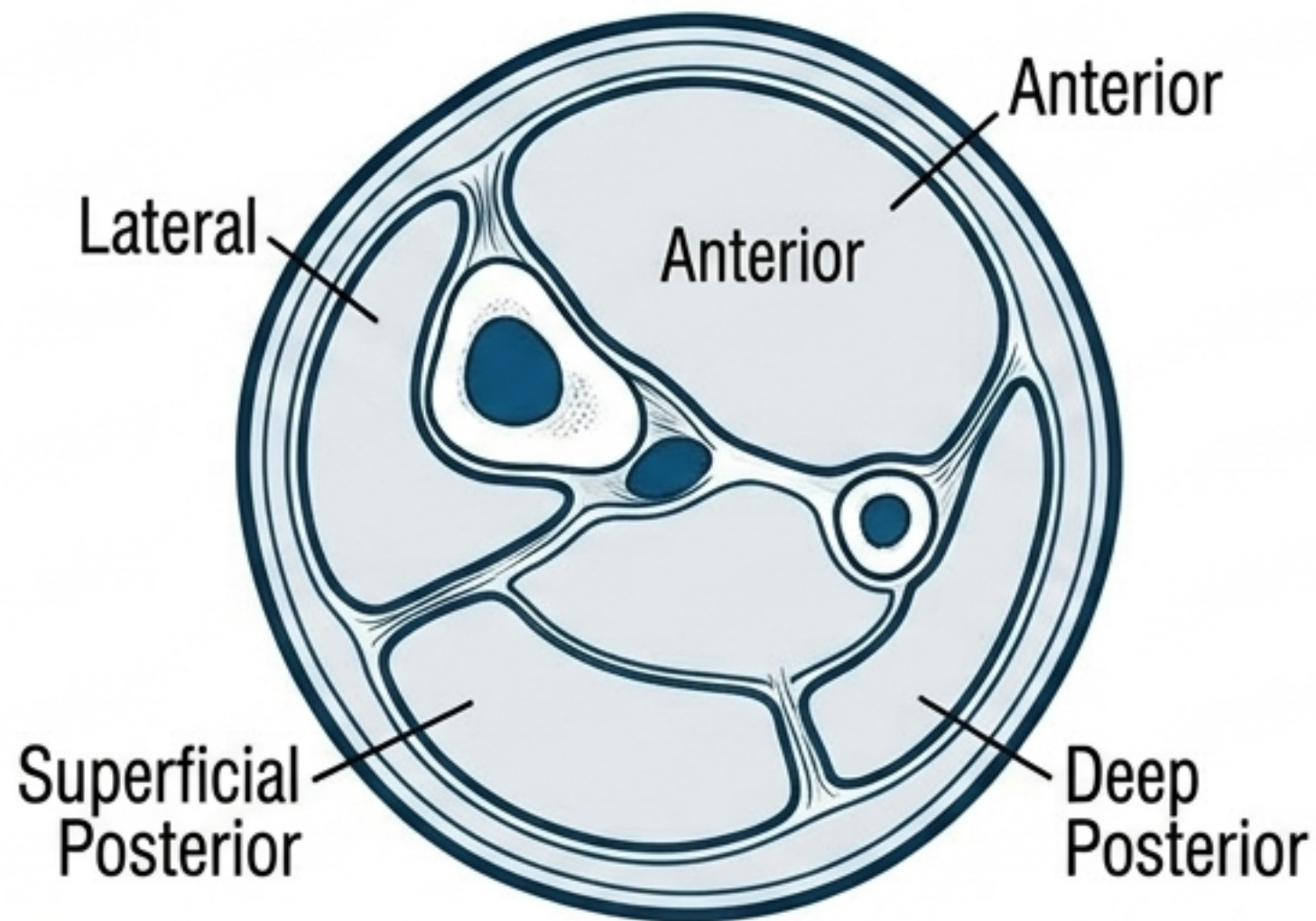
Calculation

Pre-op Lactate minus Post-op Lactate.

THE THRESHOLD: A difference of > 3 mmol/L demonstrates a profound metabolic disturbance strongly associated with the need for fasciotomy.

(High Quality Evidence, Moderate Recommendation)

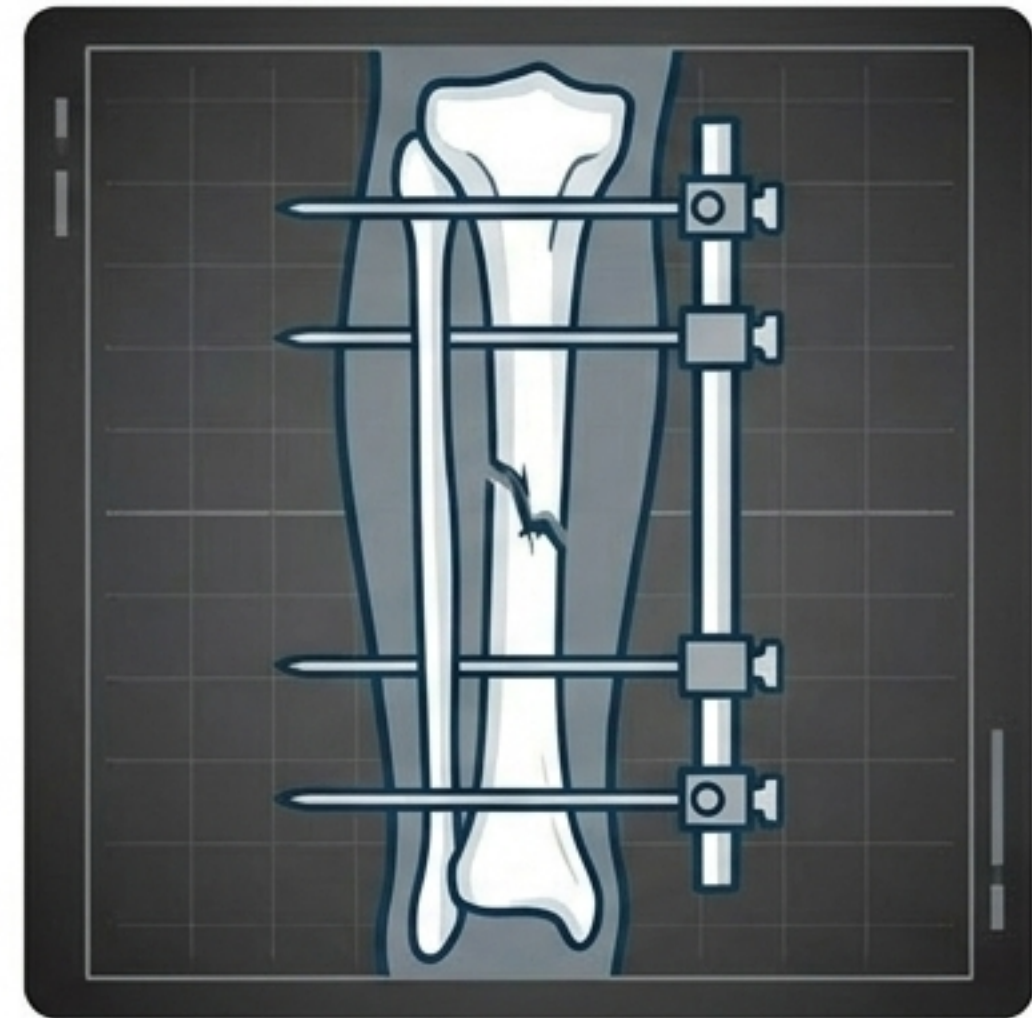
Fasciotomy Execution



Technique is Secondary to Decompression

The guideline dictates that 1-incision vs. 2-incision techniques do not matter. The absolute priority is complete decompression of all affected compartments. (Consensus Evidence)

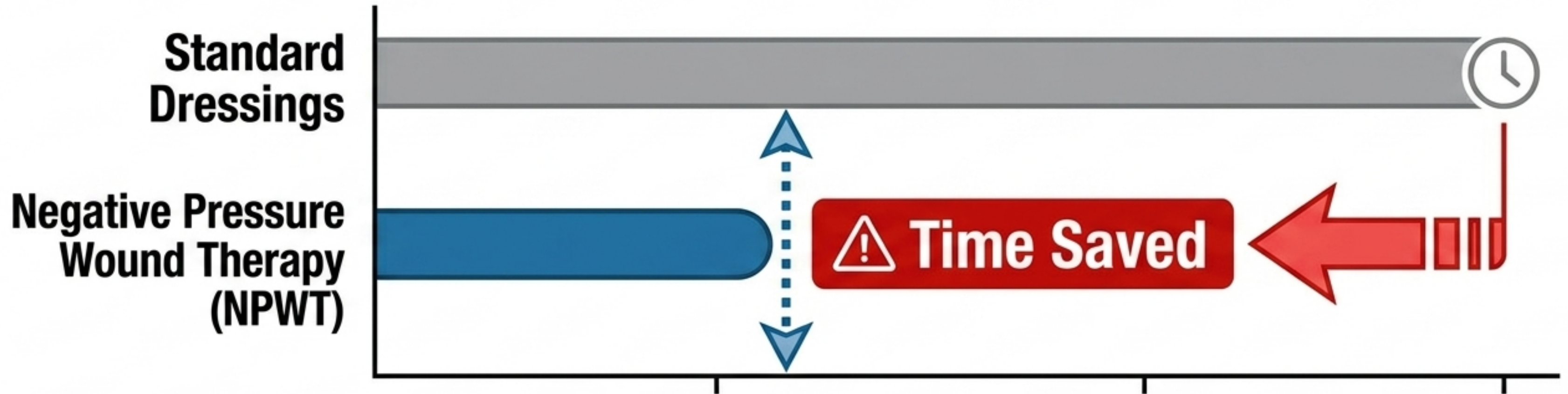
Associated Fractures



Initial Stabilization Mandate

Operative fixation (internal or external) is supported for the initial stabilization of long bone fractures when concomitant ACS requires a fasciotomy. (Limited Evidence)

Wound Management: Accelerating Closure



- **Limited evidence** supports the immediate use of Negative Pressure Wound Therapy (NPWT) for fasciotomy wound management.
- **Primary Clinical Benefits:** Significant reduction in time to definitive wound closure and a drastically reduced need for subsequent skin grafting.

THE POINT OF NO RETURN PROTOCOL

Late/Missed ACS: Adult patient presenting with evidence of irreversible intracompartmental neuromuscular/vascular damage.



Do Not rely on Biomarkers: They provide no useful information to guide decision-making here.



Do Not monitor Pressure: Compartment monitoring is obsolete once damage is irreversible.



Do Not Perform Fasciotomy: Surgery is NOT indicated on a necrotic compartment; it drastically increases morbidity and infection risk.

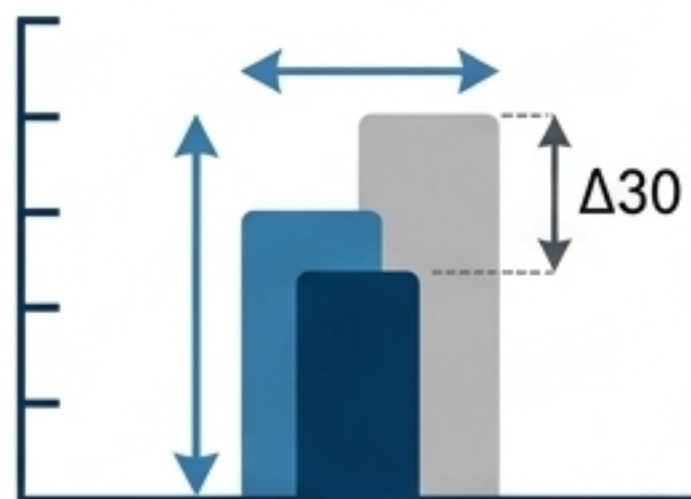


Alternative Action: Fracture Stabilization Only. Utilize external fixation or casting techniques that do not violate the necrotic compartment.

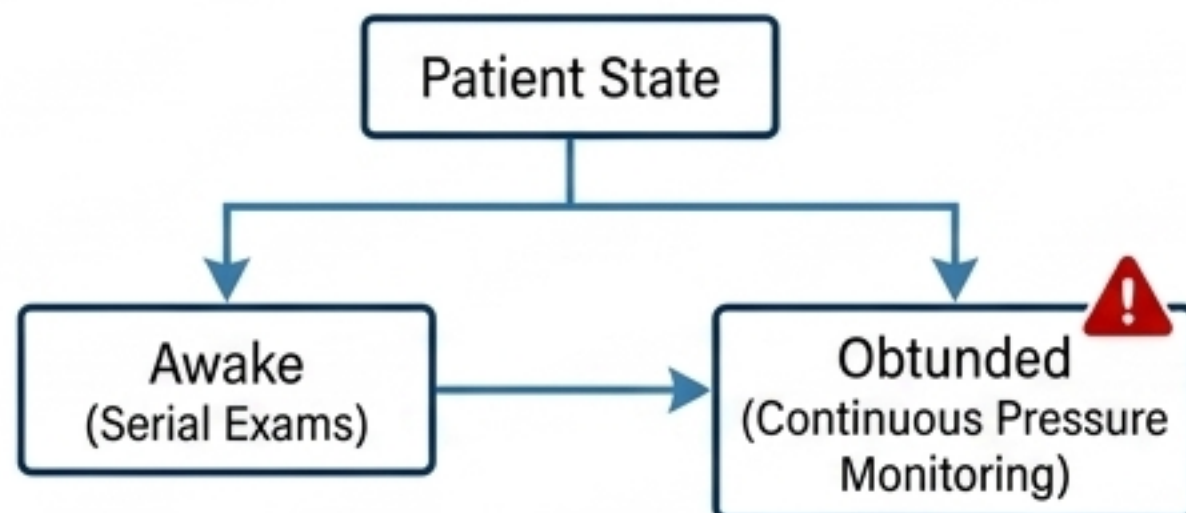
Mastering the Index of Suspicion

HUD Dashboard

Rule-Out Capability



Awake vs Obtunded



Point of No Return



Acute Compartment Syndrome remains a clinical challenge fundamentally governed by pressure and time. By integrating serial exams, continuous Δ pressure monitoring, and etiology-specific biomarkers, clinicians transition from defensive, surrogate-based surgery to precise, evidence-based intervention.