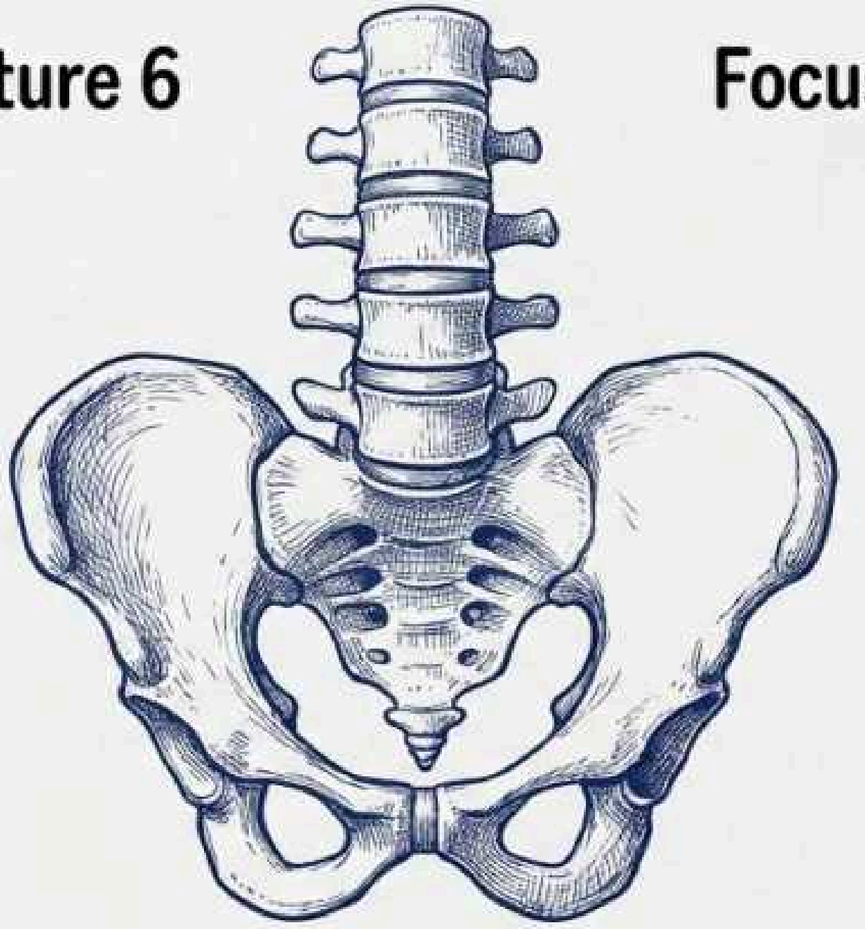
Clinical Principles of the Musculoskeletal System: From Mechanical Wear to Structural Breaks

Course: MED 533 B, Lecture 6

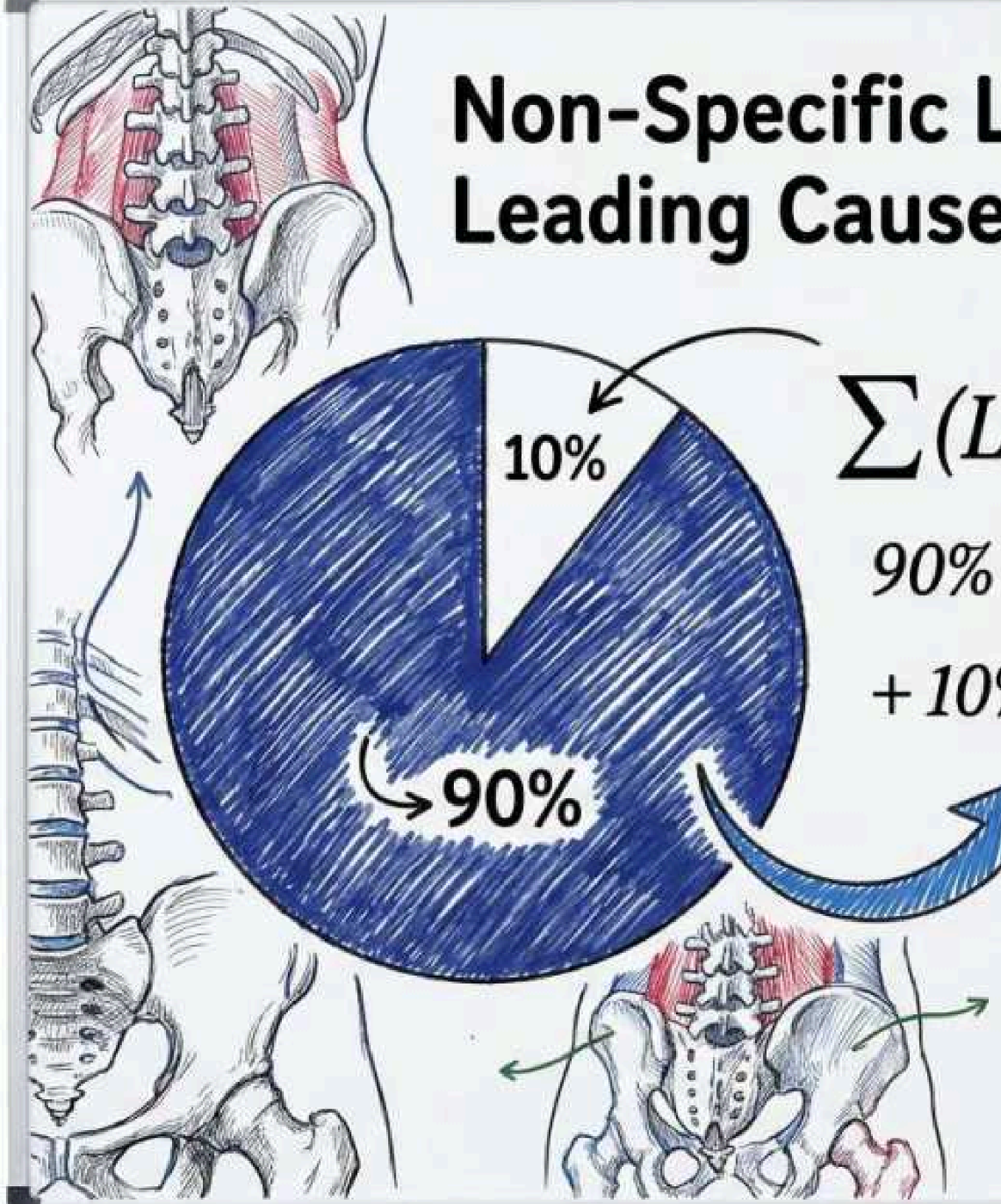
Focus: Back Pain, Fractures, and Injuries



A visual synthesis guide.

¶ 6.1

Non-Specific Low Back Pain is the Leading Cause of Global Disability



$$\sum(LBP) \approx$$

90% (Non-Specific)

+ 10% (Structural)

Ubiquitous, disruptive, yet structurally invisible.

The 9-in-10 Rule

✓ In approximately 90% of low back pain (LBP) cases, no specific structural cause can be identified.

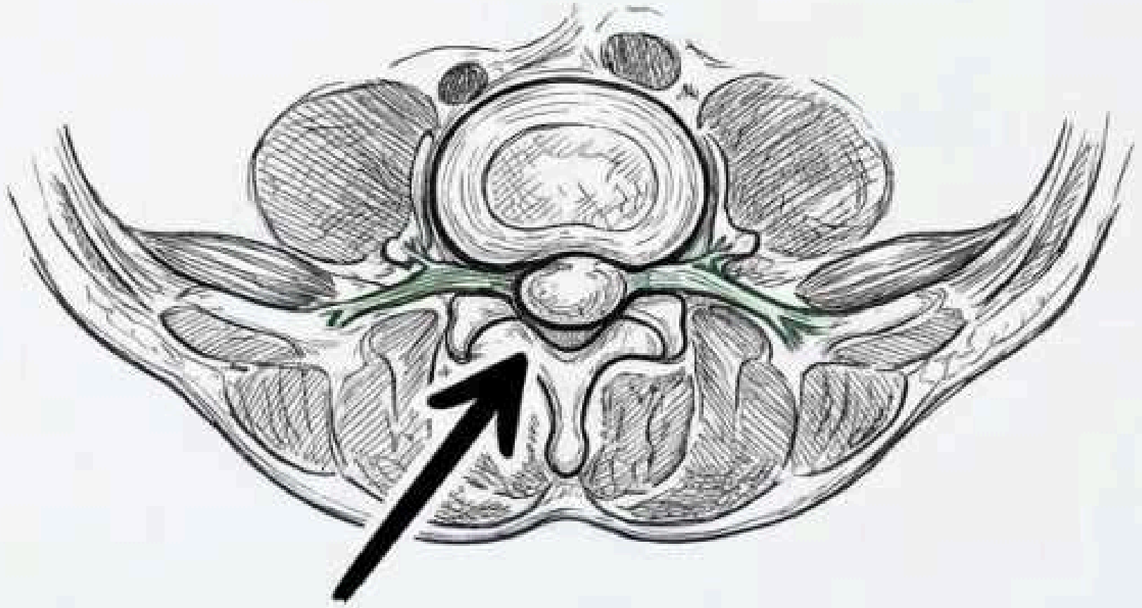
Diagnosis: Classified clinically as non-specific low back pain.

Trajectory Matrix	
Short-term:	Substantial improvement within a few weeks.
Long-term:	Recurrences are highly common.

¶ 6.2

Routine Imaging Frequently Harms Rather Than Helps in Non-Specific Pain

Routine MRI → Unnecessary Findings → Δ Anxiety → Overtreatment



The Baseline Paradox: MRI scans frequently reveal disc bulges and structural wear in individuals with absolutely zero pain.

The Danger of Discovery

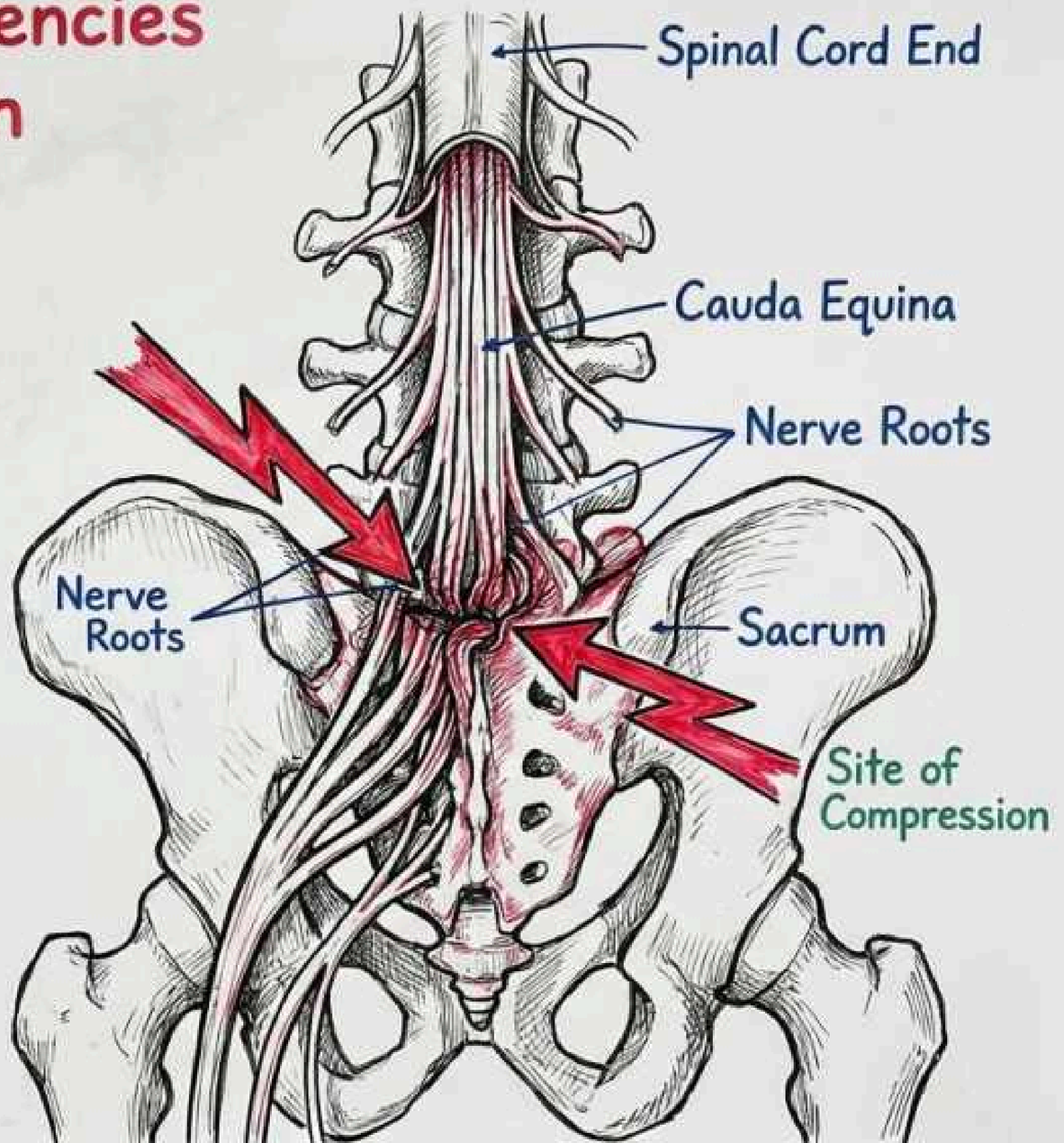
Highlighting incidental wear-and-tear spikes patient anxiety.

Drives unnecessary interventions.

Do NOT order routine scans for non-specific back pain unless specific warning signs are present.

Red Flags and Surgical Emergencies Demand Immediate Escalation

	Warning Matrix
🚨	**Cauda Equina Syndrome** (Surgical Emergency) Compression of nerves at the spine's base. – Numbness around genitals/buttocks (saddle anesthesia). – New bowel or bladder control issues. – Bilateral leg weakness.
	Systemic & Structural Red Flags – History of cancer or unexplained weight loss. – Fever or recent infection. – Significant trauma. – High risk of osteoporotic fracture.



Managing Non-Specific Back Pain Requires Movement, Not Bed Rest

¶ 6.4

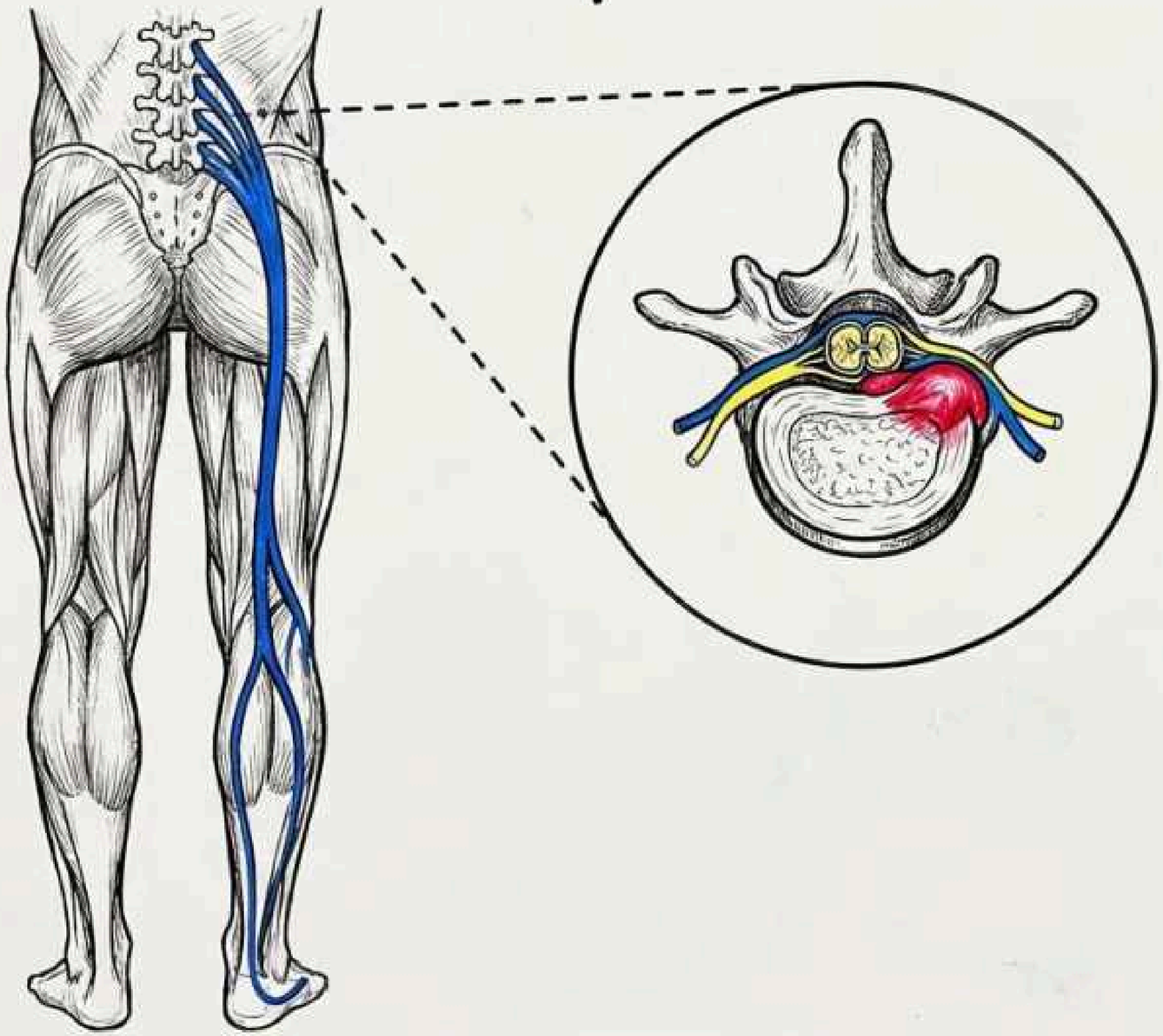
$$[Optimal\ Outcome = (Activity + Reassurance + PT) - (Bed\ Rest + Opioids)]$$

[✓] Best Evidence (Prescribe)	[✗] Harmful or Ineffective (Avoid)
- Stay active; continue normal daily activities. - Clinical reassurance. - Exercise programs & physical therapies (PT). - Psychological approaches (for persistent pain).	- Bed Rest: Clinically harmful; delays recovery. - Opioids: Negligible long-term benefit; high risk of dependence and harm.

(Note: Anti-inflammatory drugs offer modest, short-term relief only).

Sciatica is Driven by Nerve Root Compression and Usually Resolves Naturally

¶ 6.5



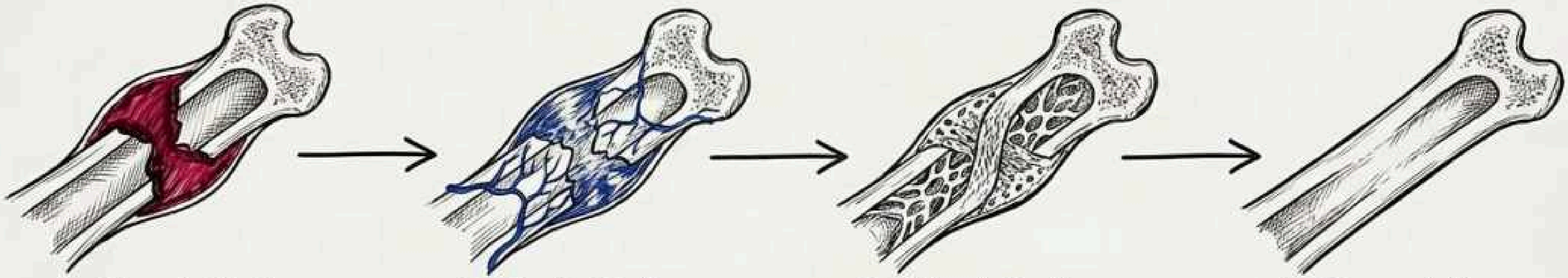
Mechanism: A spinal disc compresses a nerve root in the lower back.

Symptom Pathway: Pain, numbness, or tingling spreading down the leg along the sciatic nerve—classically radiating below the knee.

Recovery Timeline: Most cases improve naturally within weeks to months.

Surgical Role: Removing the disc fragment speeds recovery for severe, persistent symptoms, but long-term outcomes are identical to non-surgical recovery.

Fracture Healing Operates on a Predictable Biological Calculus



1. Blood Clot
2. Soft Callus
3. Hard Callus
4. Remodeling

Gradual return to normal bone architecture over months.

$$Rate(healing) = \frac{Biology}{Inhibitors}$$

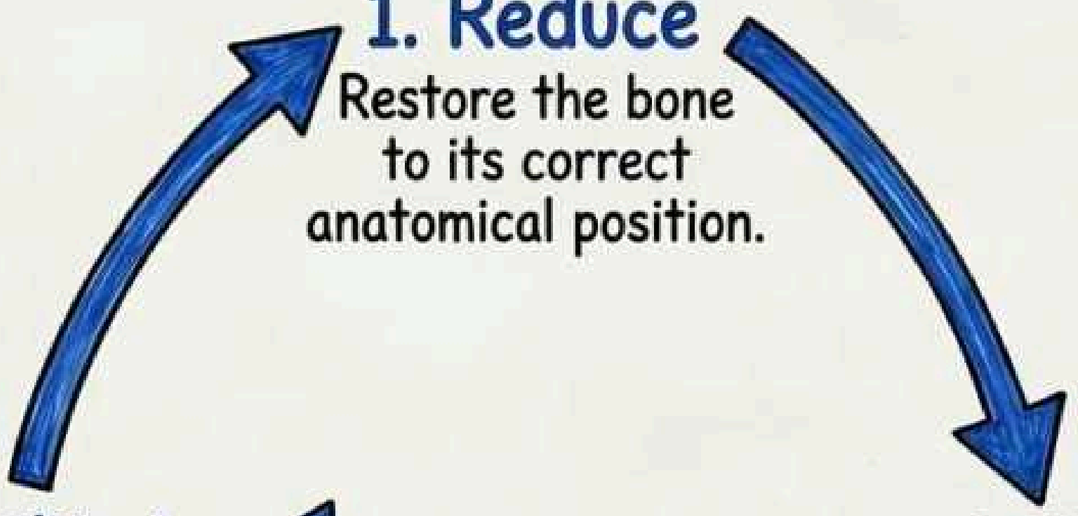
Healing Inhibitors (The Denominator):

- Healing is actively slowed by smoking, diabetes, poor nutrition, poor poor blood supply, and excessive movement at the fracture site.

Three Core Principles Dictate All Fracture Management

¶ 6.7

$$Management(fx) = Reduce + Hold + Rehabilitate$$





The Open Fracture Exception: If (Bone breaks Skin) → P(Infection) ↑↑

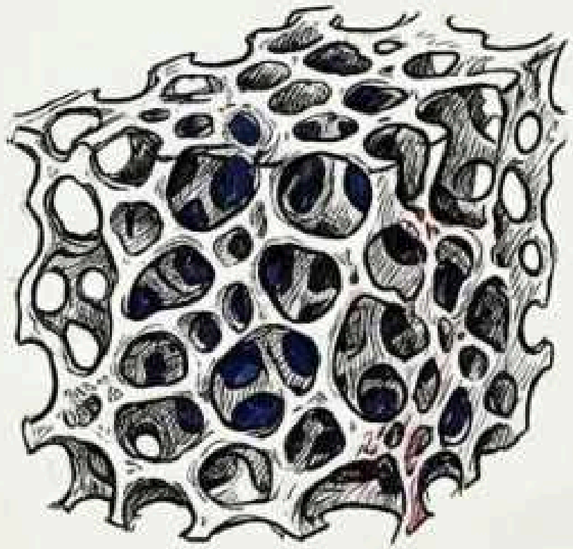
When bone breaks through the skin, the massive risk of infection requires urgent antibiotics and immediate surgery.

Every Fragility Fracture is a Warning Siren for Osteoporosis

Standing Fall

Fracture

Systemic Intervention



Definition: A break resulting from a fall from standing height or less (the hallmark of Osteoporosis, MED 531 B).

Acute Management: Hip fractures in older adults demand surgery within 1-2 days.
Survival significantly improves with co-managed care teams (surgeons + geriatricians).

Systemic Strategy:
Fracture Liaison Services operate on the principle that every fragility fracture is an opportunity to treat the underlying osteoporosis and mathematically prevent the next break.

Soft Tissue Recovery Accelerates with Gradual Loading Over Prolonged Rest

Type	Target Tissue	Common Example
Sprain	Ligaments (bone to bone)	Rolled ankle
Strain	Muscles or Tendons	Pulled muscle



P - Protection
R - Relative rest (short period only)
I - Ice
C - Compression
E - Elevation

Clinical Insight: Gradual return to movement speeds recovery significantly more effectively than prolonged rest.

Distinct Structural Ruptures Require Specialist Surgical or Load Management

¶ 6.10



ACL Tear (Knee)

Mechanism: Twisting sports.
Presentation: Audible "pop," rapid swelling, and joint instability.



Achilles Rupture (Heel)

Presentation: Sudden, sharp pain at the back of the heel; patients describe it as feeling like "being kicked."



Tennis Elbow (Overuse)

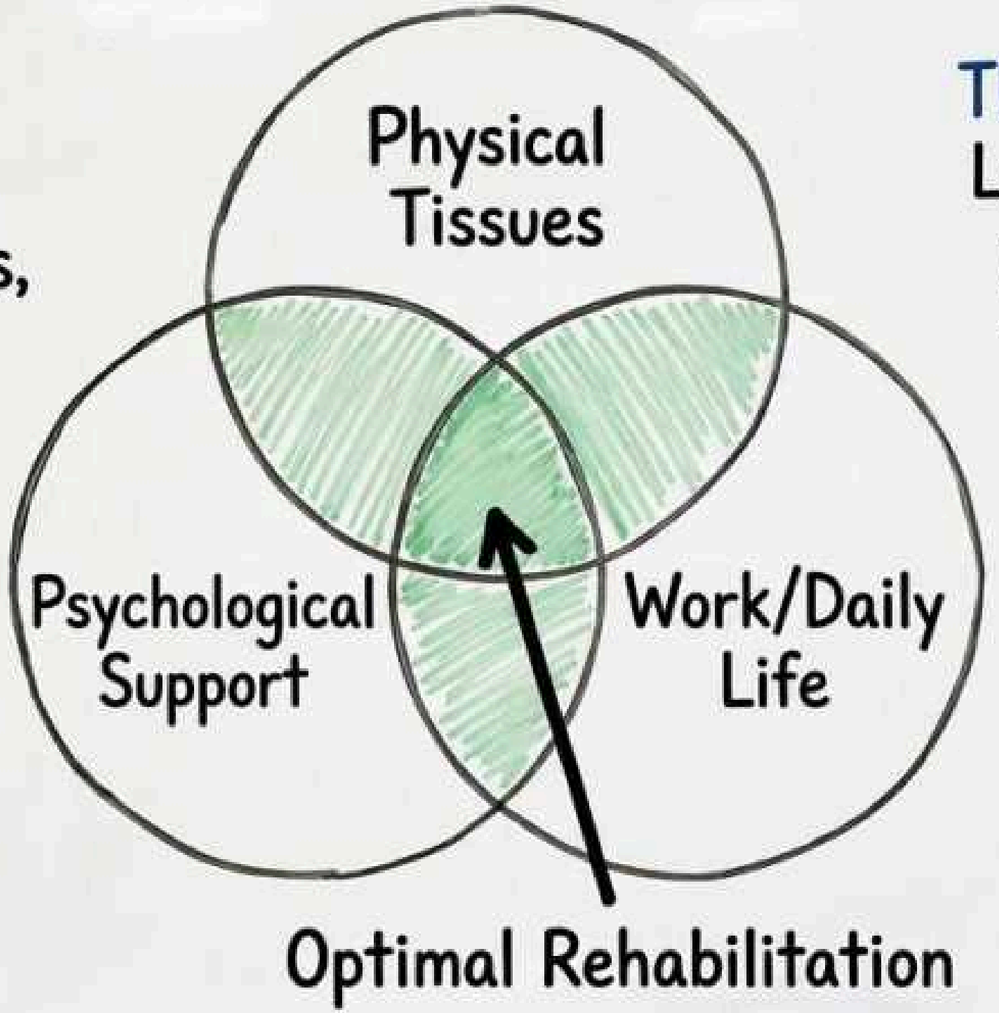
Mechanism: Tendon pathology from repetitive strain.

Treatment Equation: Recovery = Graded Loading Exercises × Months

Effective Rehabilitation Must Integrate Physical, Psychological, and Occupational Factors

The Care Team:
Physiotherapists, occupational therapists, and allied health professionals.

The Core Goal:
Recovering strength, functional movement, and patient independence.



The Biopsychosocial Model:
Long-term musculoskeletal pain cannot be solved at the tissue level alone.

Outcomes maximize when treatments integrate physical activity, mental well-being, and occupational ergonomics simultaneously.

MED 533 B Course Synthesis: The Joint Pain Diagnostic Matrix

Diagnostic Anchor: Joint pain is systematically sorted by: 1) Number of joints, 2) Pattern of joints, 3) Presence of inflammation.

Cheat Sheet	Clinical Description & Management
Osteoarthritis	A whole-joint disease → Treat first with exercise.
Inflammatory Arthritis	Systemic → Treat early to a specific target.
Gout	Uric acid buildup → Curable by lowering urate.
Emergencies	Giant cell arteritis & septic arthritis require immediate action.
Back Pain	Mechanical/Non-specific → Most improve by staying active.

Feedback & Contact:
garyanderson@mail.grokbot.com
@garyanderson