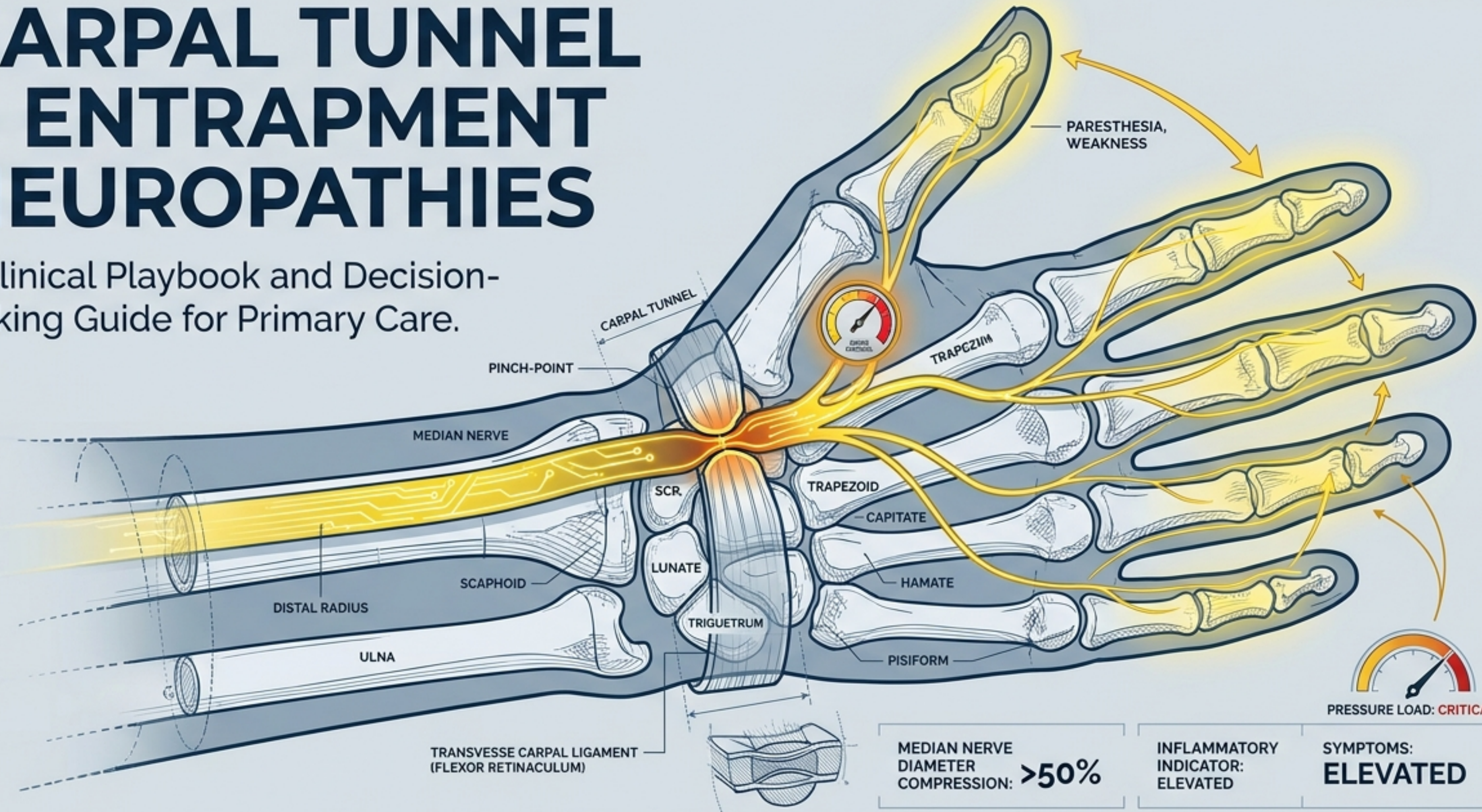


CARPAL TUNNEL & ENTRAPMENT NEUROPATHIES

A Clinical Playbook and Decision-Making Guide for Primary Care.



PARESTHESIA, WEAKNESS

CARPAL TUNNEL

PINCH-POINT

MEDIAN NERVE

SCR.

TRAPEZOID

CAPITATE

LUNATE

HAMATE

TRIGUETRUM

PISIFORM

DISTAL RADIUS

SCAPHOID

ULNA

TRANSVERSE CARPAL LIGAMENT (FLEXOR RETINACULUM)

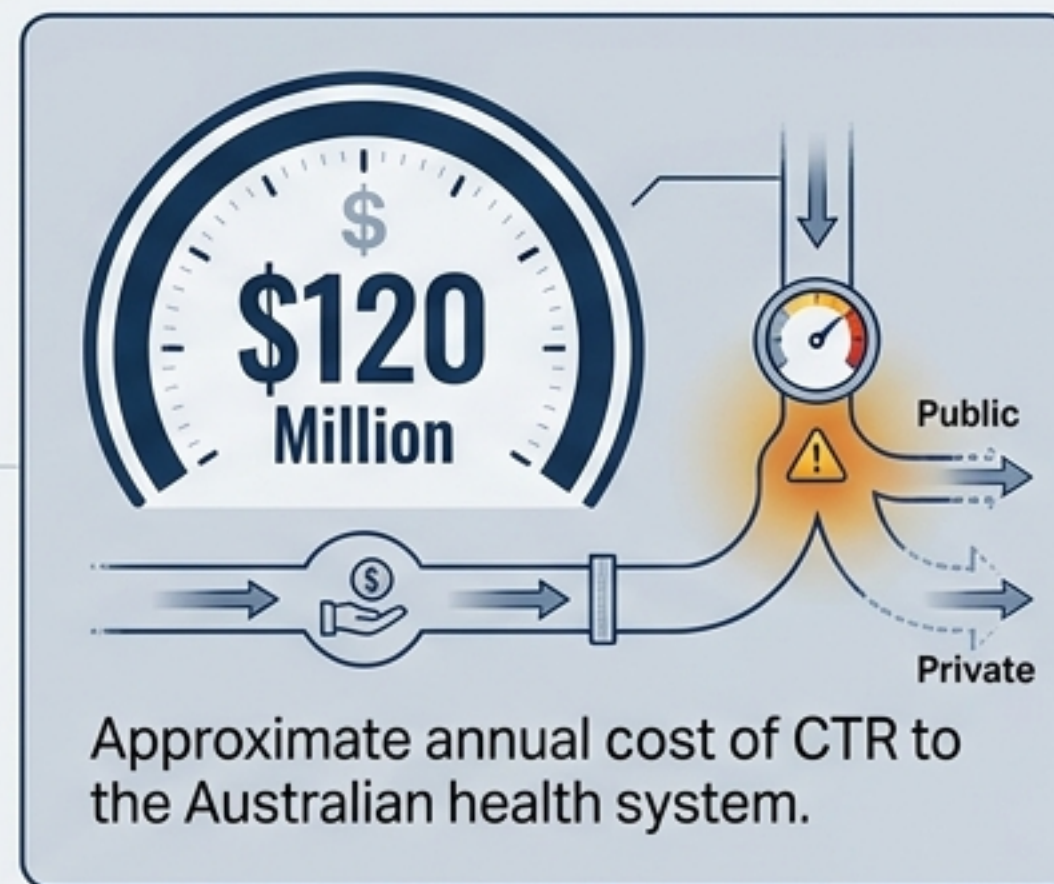
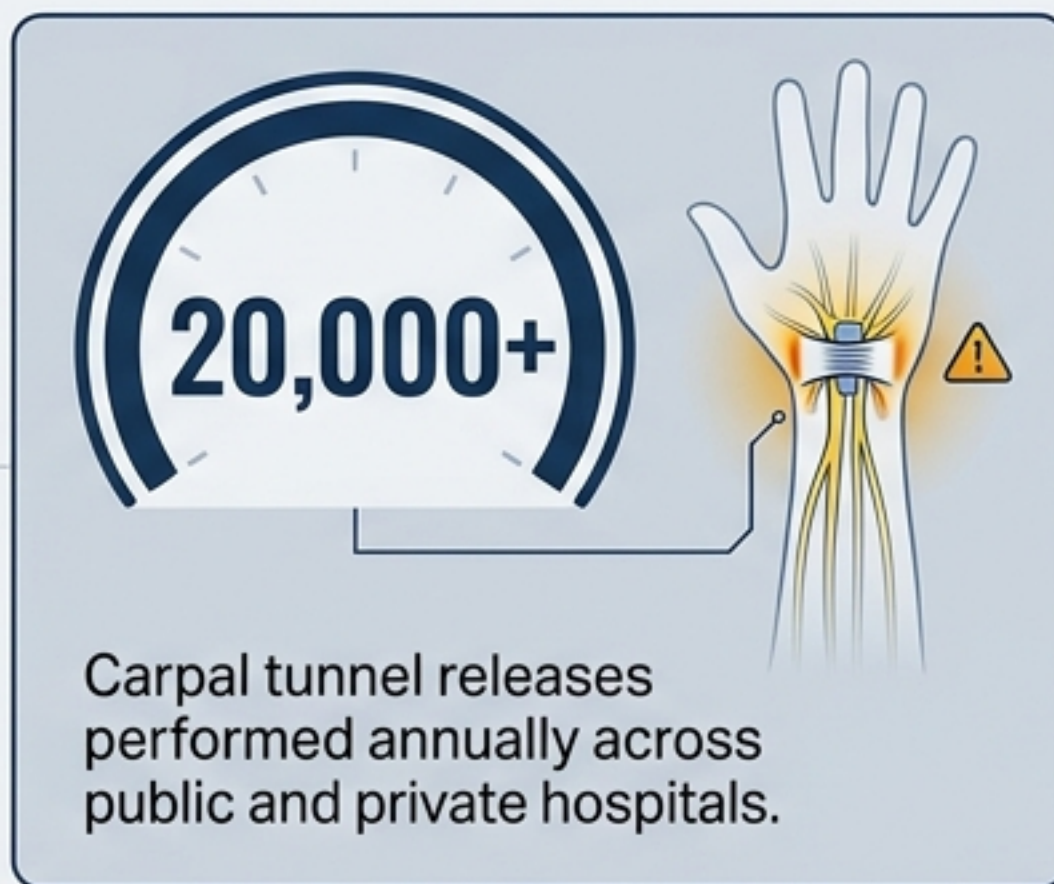
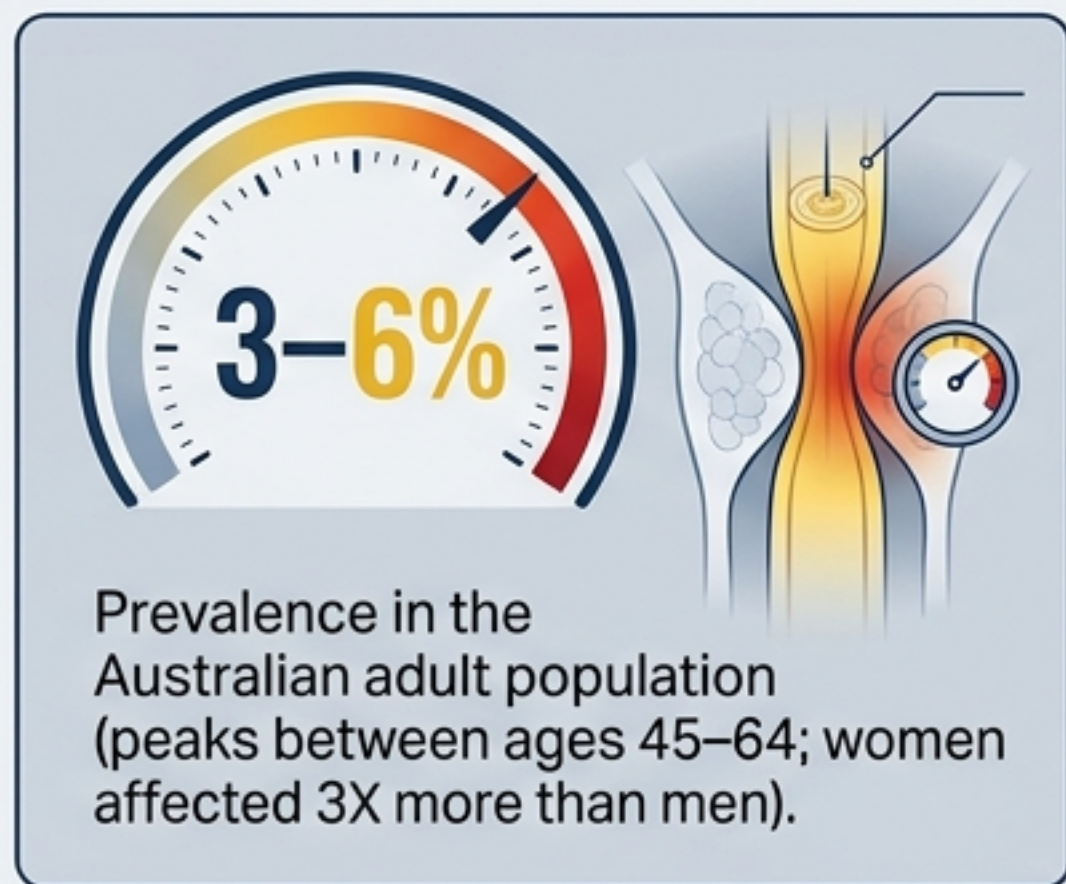
MEDIAN NERVE DIAMETER COMPRESSION: **>50%**

INFLAMMATORY INDICATOR: ELEVATED

SYMPTOMS: **ELEVATED**



The Australian Burden of Entrapment Neuropathies



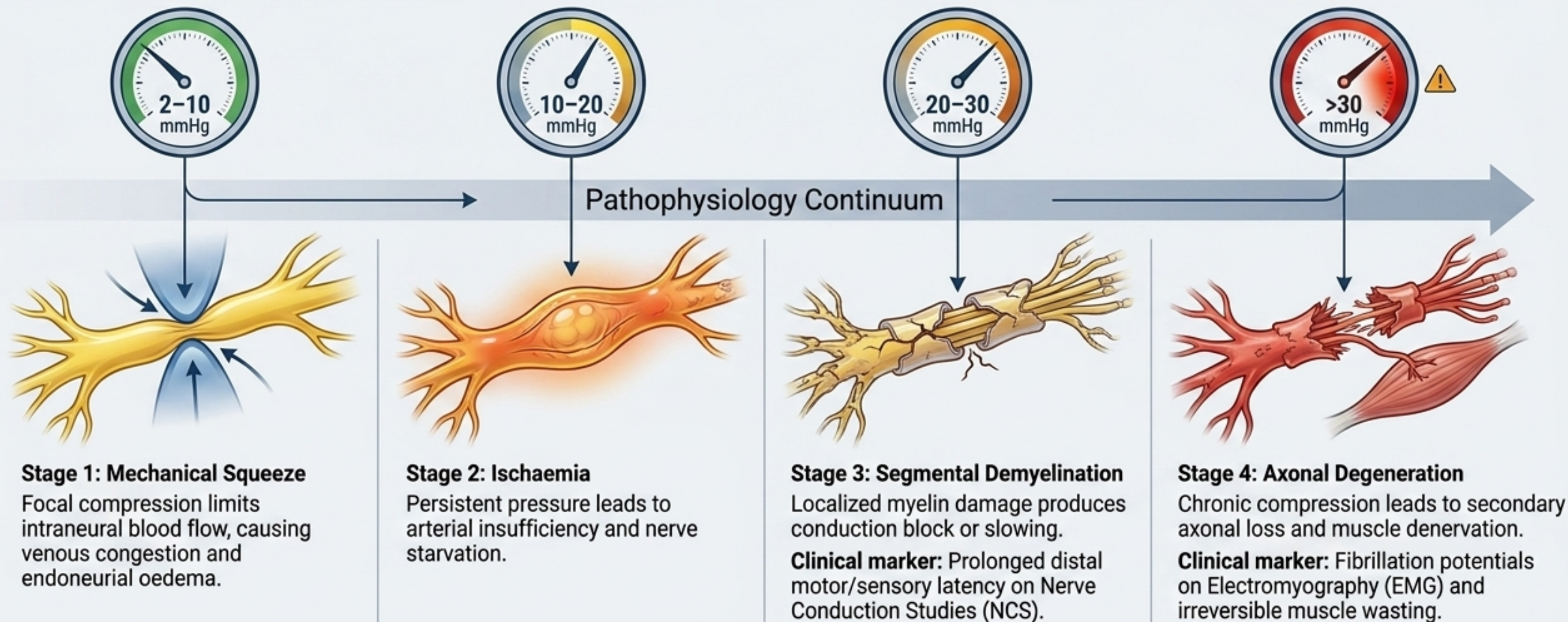
The Aetiology Shift.

While repetitive manual work and vibration remain relevant, population studies now show that systemic metabolic factors (diabetes, obesity, thyroid disease) play an equally critical, if not greater, role than occupational hazards. Early conservative care reduces surgical referral rates and health system costs.



The Pathophysiology of Nerve Compression

Pathophysiology Continuum



The Classic Clinical Presentation of Carpal Tunnel Syndrome

Nocturnal Waking

The absolute hallmark. Patients wake with a dead or tingling hand, relieved by shaking or hanging the hand over the bed edge.

Activity-Related Provocation

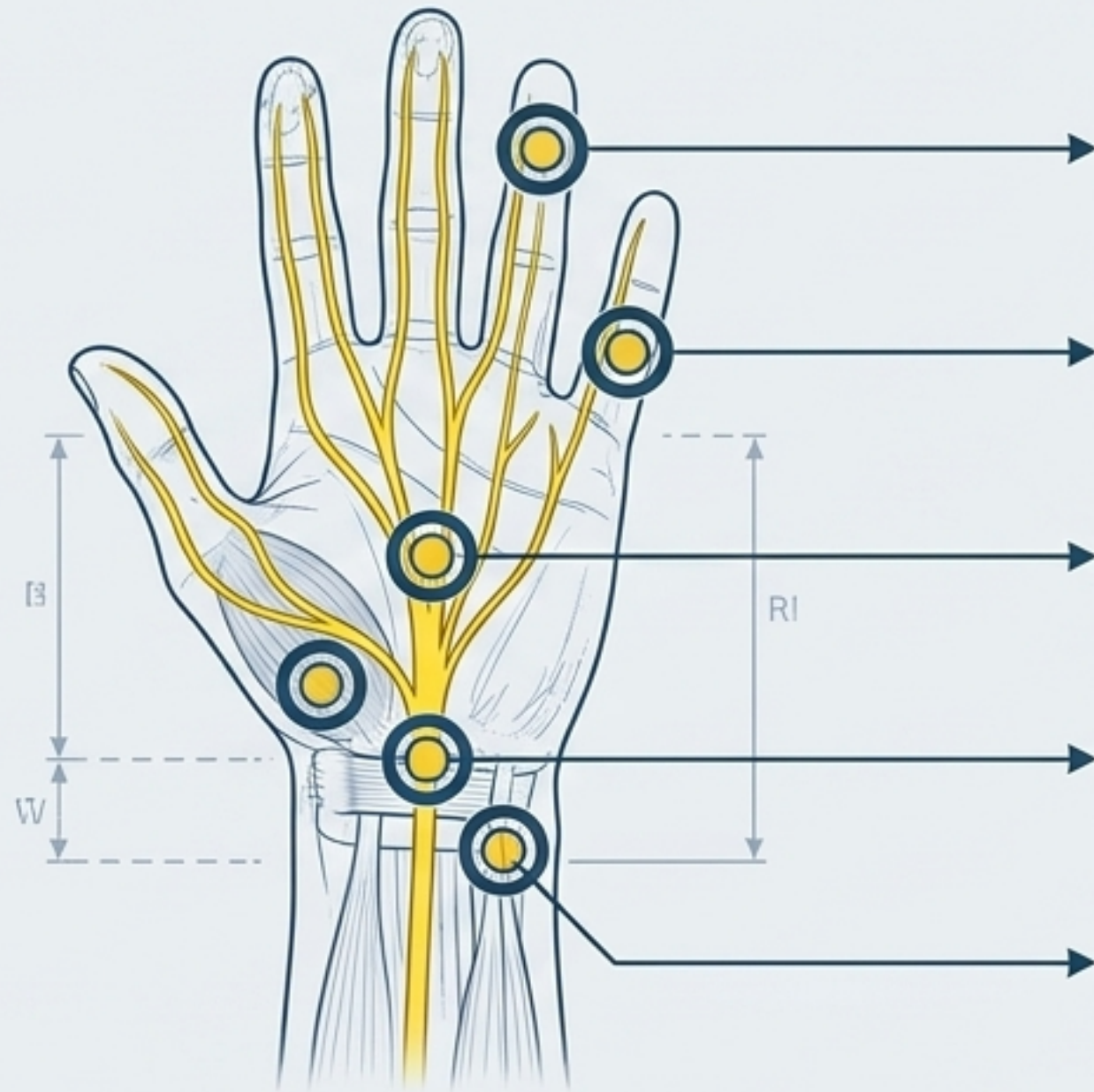
Paraesthesiae provoked by gripping, driving, holding a phone, or repetitive wrist flexion.








Motor Weakness & Clumsiness

Dropping objects or struggling with buttons indicates thenar muscle (abductor pollicis brevis) involvement and advanced disease. Pain may radiate proximally, but isolated arm pain without digital numbness is atypical for CTS.

The Bedside Diagnostic Toolkit for CTS



	Phalen's Test: Wrist flexion for 60s. Sens 68–83% / Spec 40–73% .
	Reverse Phalen's: Wrist extension for 60s. Sens 48–67% / Spec 56–75% .
	Tinel's Sign: Percussion over the volar wrist crease. Sens 38–67% / Spec 60–83% .
	Compression Test: Direct thumb pressure for 30s. Sens 64–87% / Spec 50–73% .
	Thenar Wasting: Visual inspection. Low sensitivity, but highly specific for severe axonal loss.

Clinical Pearl: Combine for Accuracy. No single test is definitive. Combine history with multiple tests. Bilateral symptoms occur in 50–70% of cases and do not exclude CTS.

Clinical Severity Stratification and Triage (Bland Classification)

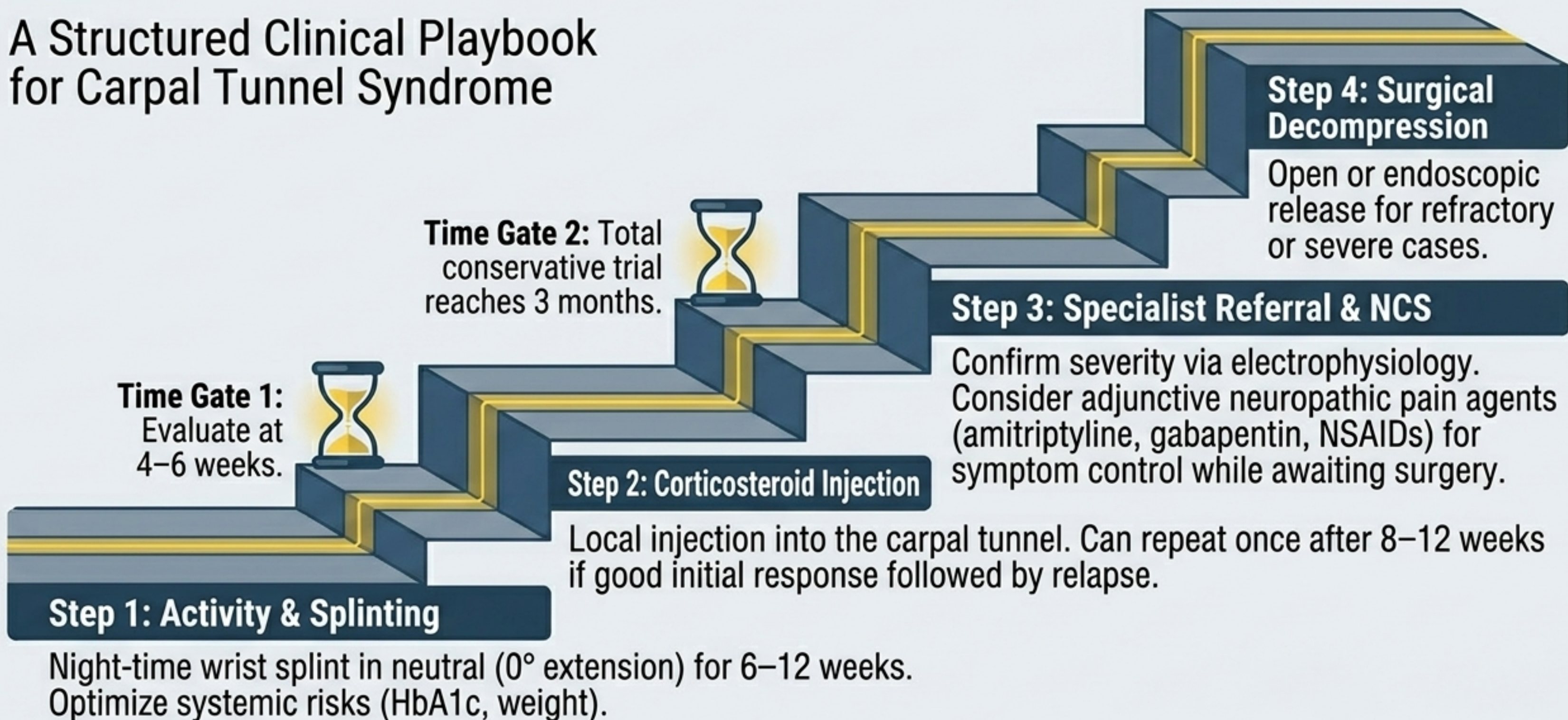
Mild	Moderate	Severe
Signs: Intermittent paraesthesiae only (night or activity). No motor deficit or constant numbness.	Signs: Frequent daily symptoms, mild thumb abduction weakness, no wasting.	Signs: Constant numbness (>6mm 2-point discrimination), thenar wasting, significant APB weakness.
Action: GP management. Night splinting ± ergonomic modification. Reassess in 6–8 weeks.	Action: Splinting + corticosteroid injection. Refer if no improvement in 8–12 weeks.	Action: Urgent specialist referral for surgical decompression. Pre-operative NCS recommended. Conservative therapy unlikely to reverse axonal loss.



Red Flags: Acute-onset symptoms (compartment syndrome), progressive motor deficit, or bilateral severe CTS in youth (consider HNPP).

The Stepwise Management Escalation Staircase

A Structured Clinical Playbook for Carpal Tunnel Syndrome



Corticosteroid Injection Guidelines and Technique

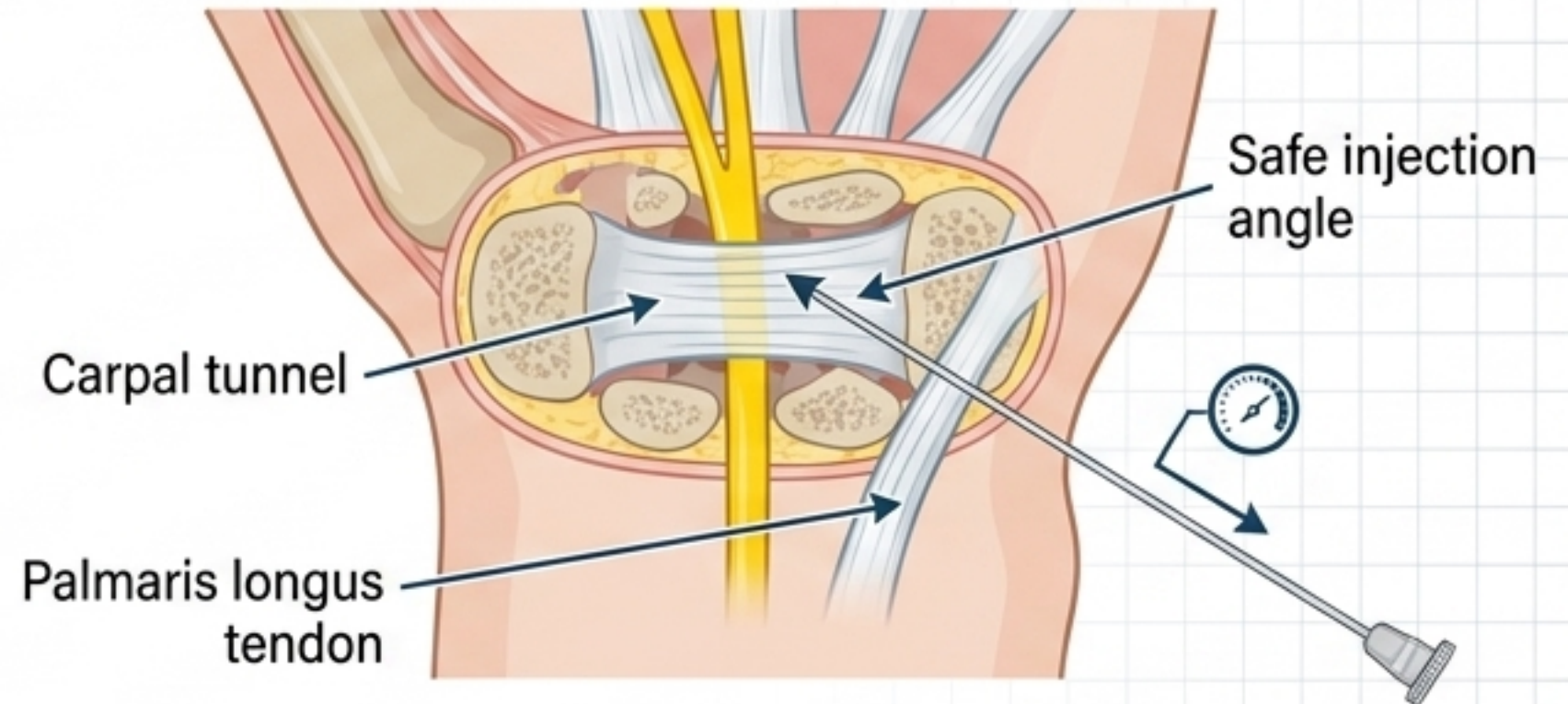
Pharmacology

AGENT	DOSAGE & FORMULATION	STATUS
Methylprednisolone acetate	40 mg (1 mL)	PBS General Benefit
Triamcinolone acetonide	10–20 mg (0.25–0.5 mL)	PBS General Benefit

FREQUENCY & CONSIDERATIONS

Single injection, repeat once if needed after 8-12 weeks. No renal adjustment required.

Anatomical Technique



Technique Callout

Guidance:

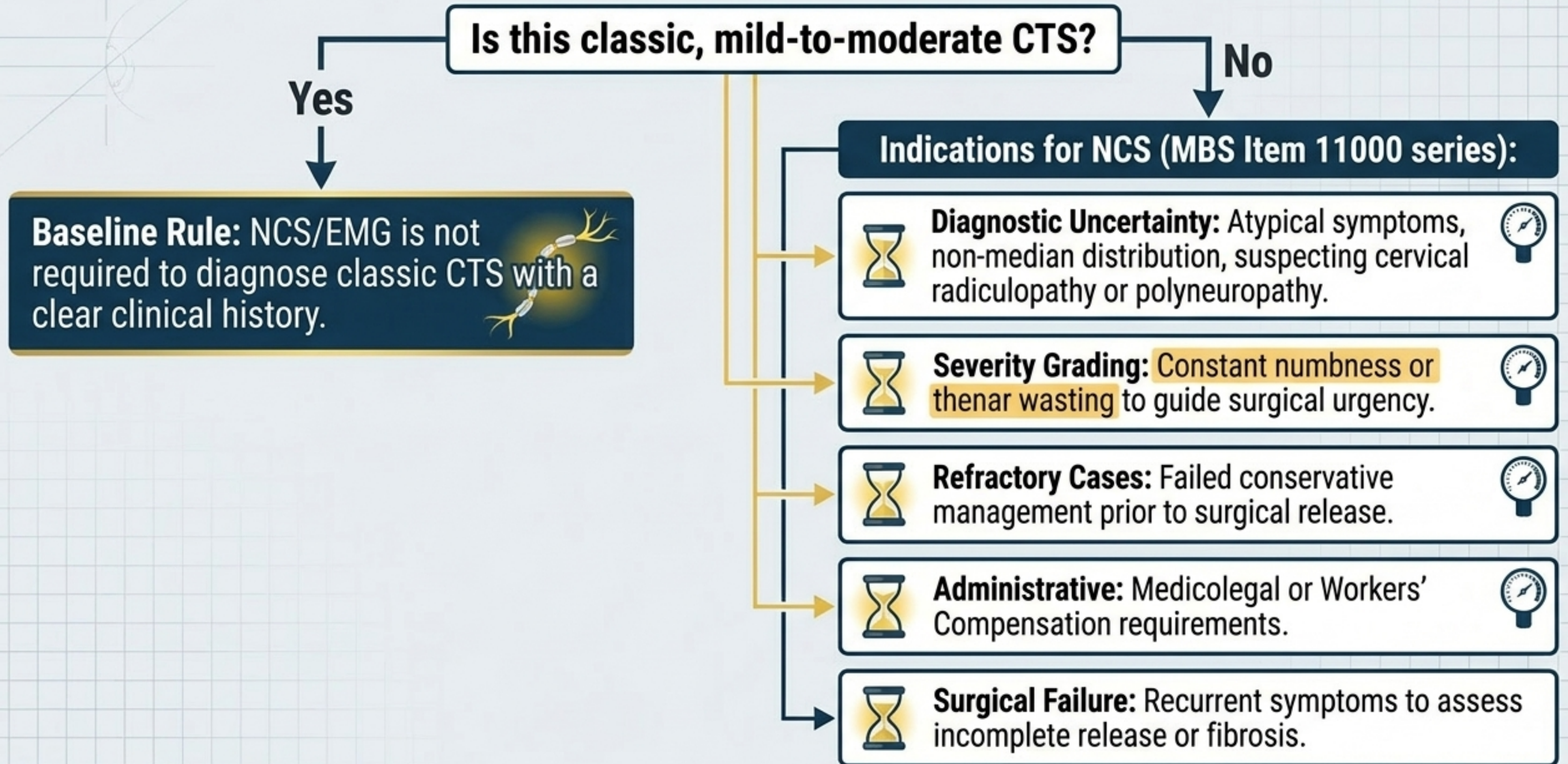
Ultrasound-guided is preferred to avoid intraneural injection.

Technique Callout

Landmark Approach:

Inject at the proximal wrist crease, ulnar to the palmaris longus tendon, directed distally at 30–45°. Aspirate before injecting. Do not inject directly into the nerve.

The Targeted Application of Nerve Conduction Studies (NCS)



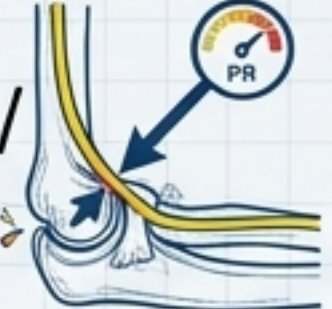

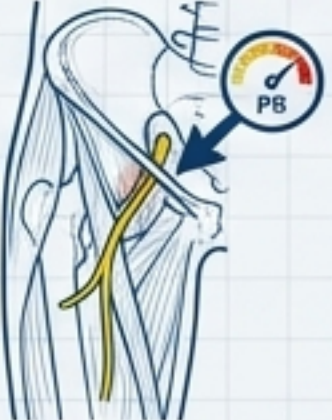
Surgical Decompression and Post-Operative Rehabilitation

Open Release		Endoscopic Release	
Incision:	3–4 cm palmar	Incision:	1–2 small portals
Return to Work (Light/Desk):	2–3 weeks	Return to Work (Light/Desk):	1–2 weeks
Return to Work (Heavy/Manual):	4–6 weeks	Return to Work (Heavy/Manual):	3–4 weeks

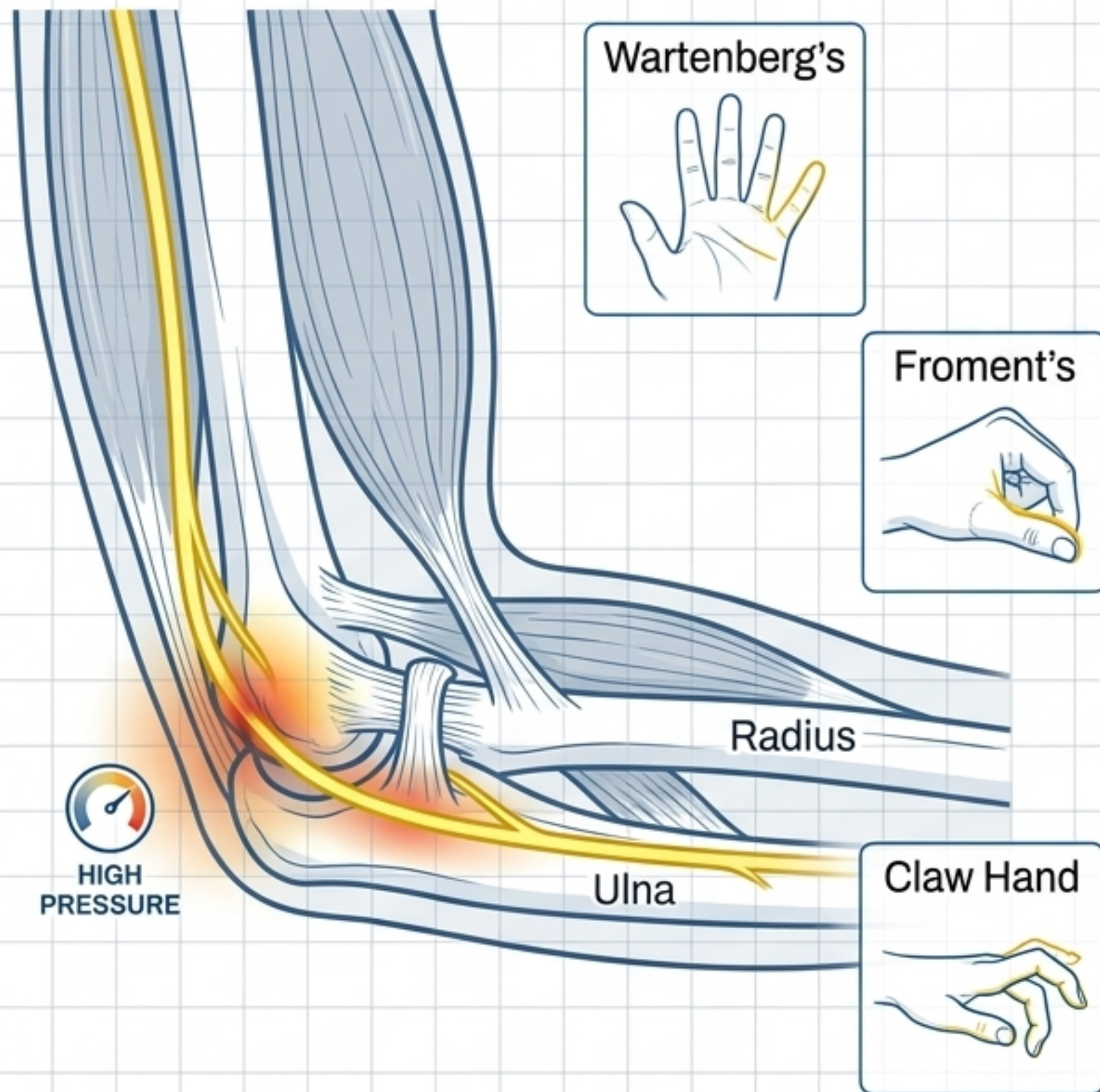
Outcomes: Comparable excellent long-term relief (85–95%).
Private cost ~\$1,500–\$3,000.



Beyond the Wrist: The Entrapment Diagnostic Matrix

Condition	Nerve / Bottleneck	Key Symptoms	Distinguishing Sign
Cubital Tunnel Syndrome	Ulnar Nerve. Medial Epicondyle / Osborne's Ligament 	Numb ring/little finger , grip grip weakness.	Froment's Sign / Claw Hand
Radial Tunnel Syndrome	Posterior Interosseous Nerve. Arcade of Frohse (Supinator) 	Deep proximal forearm pain. No paraesthesiae.	Pain on resisted middle finger extension / supination.
Meralgia Paraesthetica	Lateral Femoral Cutaneous Nerve. Inguinal Ligament / ASIS 	Burning/numbness anterolateral thigh.	Pain relieved by sitting , worsened by standing/hip extension.

Cubital Tunnel Syndrome (Ulnar Nerve at the Elbow)



Presentation:

- **Paraesthesiae** in the **ulnar 1½ fingers**, worsened by **sustained elbow flexion** (e.g., sleeping with bent arms).
- **Signs of Denervation (Severe)**: Intrinsic hand wasting, ulnar claw hand, **Wartenberg's sign** (abducted little finger), **Froment's sign** (IP flexion of thumb on pinch grip).

Management Pathway:


Mild:

- GP management. Night splinting in 45° flexion, avoid leaning/padding.

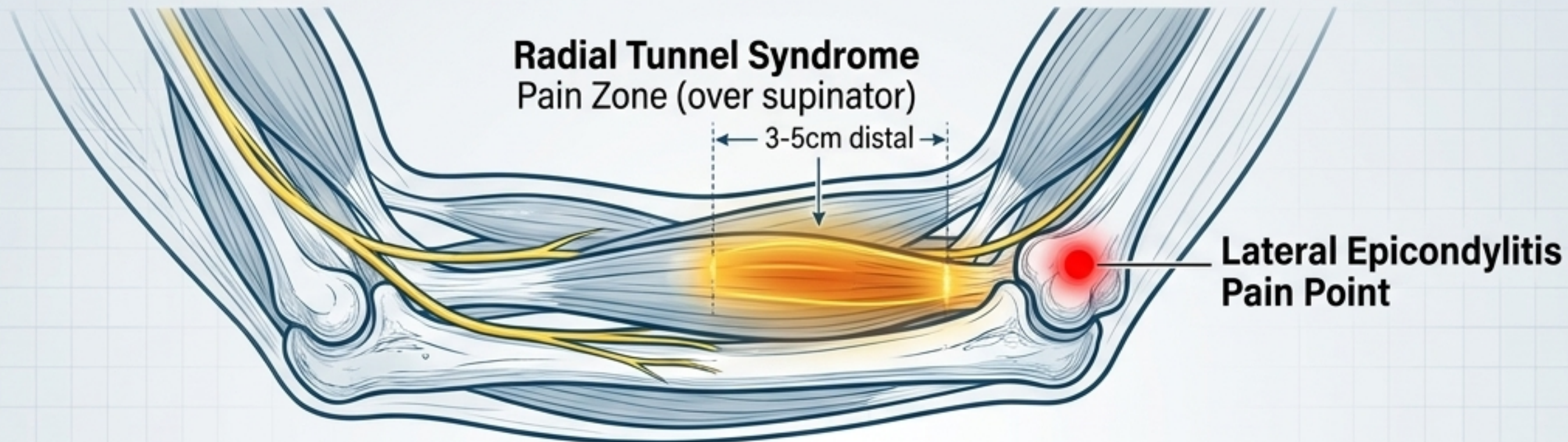
Moderate:

- GP + Specialist. NCS, gabapentinoids, consider corticosteroid injection around (not into) the nerve.

Severe:

- **Urgent surgical referral for in situ decompression or anterior transposition.** Delay risks irreversible motor loss. 

Diagnostic Differentiation: Radial Tunnel vs. Lateral Epicondylitis



Radial Tunnel Syndrome:

Pain Location: Deep aching 3–5 cm distal to the lateral epicondyle (over the supinator).



Aggravating Factor: Forearm supination against resistance.

Neurology: Pure motor/sensory deep branch—usually no paraesthesiae. Late-stage finger drop.

Treatment: Activity mod, physio, NSAIDs. Surgery variable (60-80% improvement).

Lateral Epicondylitis:

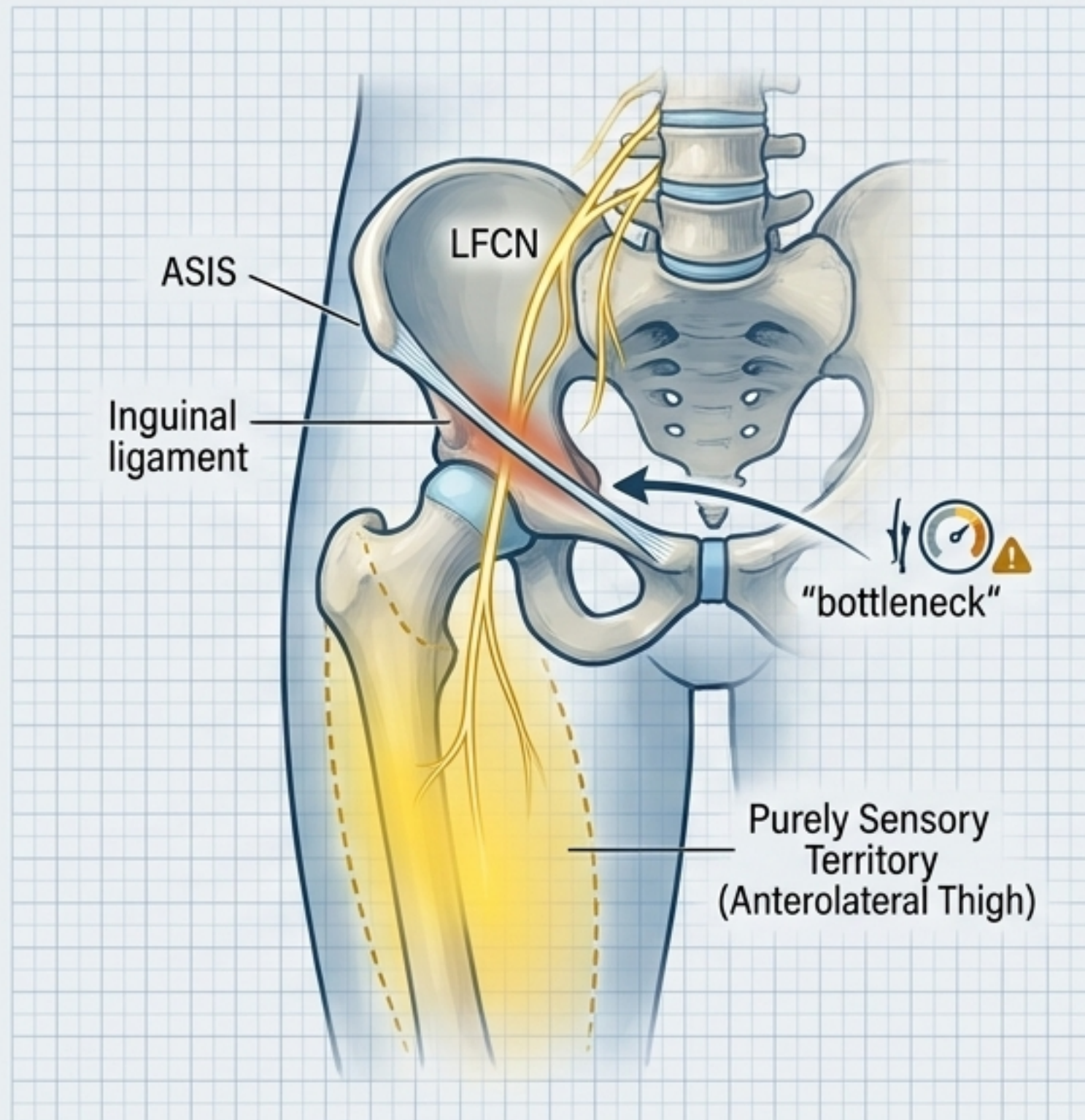
Pain Location: Exact point tenderness at the lateral epicondyle.

Aggravating Factor: Wrist extension against resistance.

Neurology: No neurological deficits. Weakness is purely secondary to pain.

Treatment: Physiotherapy, counterforce bracing, wait-and-see (often self-limiting).

Meralgia Paraesthetica (Lateral Femoral Cutaneous Nerve)



Presentation:

Burning, tingling, or numbness over the anterolateral thigh.
Purely sensory—no motor involvement.
Worsened by standing/hip extension; relieved by sitting.

Primary Risk Factors:

Obesity (BMI >30 is the strongest modifiable risk), tight clothing/belts, pregnancy, diabetes, or post-surgical direct injury.

Management Options:

First-line: Weight loss, looser clothing. 80–90% resolve without medication.

Second-line (PBS Authority for neuropathic pain): Gabapentin (300 mg OD up to 1800 mg/day max; requires renal dose adjustment) or Pregabalin (75–150 mg BD; renal adjustments apply).

Refractory: Surgical decompression of the inguinal ligament or neurectomy (causes permanent numbness).

Systemic Priming: Recommended Baseline Laboratory Screening

The Paradigm: Nerves are primed for mechanical entrapment by underlying **metabolic or microvascular disease**. Do not treat the tunnel while ignoring the system.

Fasting Glucose / HbA1c

Screen for **diabetes mellitus**—present in up to 20% of CTS patients. Endoneurial microangiopathy increases nerve vulnerability.

Inflammatory Markers (CRP, ESR)

For suspected inflammatory arthropathy (Rheumatoid Arthritis) causing synovial hypertrophy.

Thyroid Function Tests (TSH, fT4)

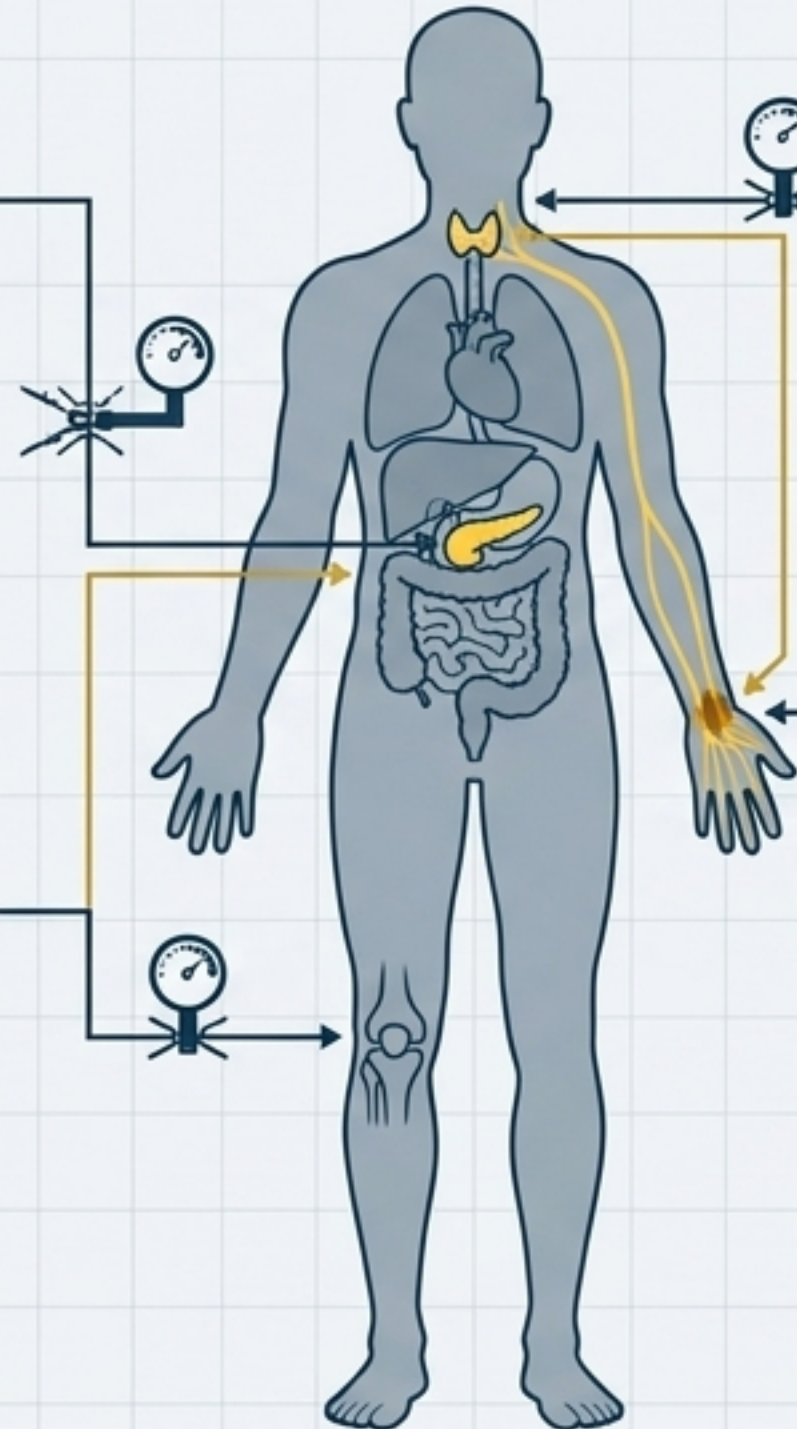
Hypothyroidism causes mucopolysaccharide deposition in the flexor tenosynovium, raising carpal tunnel pressure.

Imaging Role



High-resolution **ultrasound** (MBS 55800 series) can measure nerve swelling (>10-12mm² cross-sectional area).

MRI/X-ray reserved for atypical cases or suspected bony pathology.



Aboriginal and Torres Strait Islander Health Considerations

The Burden



Disproportionate rates of underlying risk factors. **Type 2 diabetes** affects ~8% of adults (frequently undiagnosed and masking entrapment symptoms). **Obesity** rates are 37%.

Access Barriers



Remote geography limits access to **neurophysiology** (NCS) and **hand surgeons**. **Manual labor** occupations compound mechanical risk.

Actionable GP Interventions:

- **Proactive Screening:** During **MBS Item 715** health checks, specifically ask about hand numbness, nocturnal waking, and grip weakness—often unreported unless directly asked.
- **Telehealth & Care Plans:** Utilize **MBS Items 99–113** for remote specialist assessment and **Items 721/723/732** for multidisciplinary weight and diabetes management.
- **Culturally Safe Care:** Involve Aboriginal Health Workers, support ACCHS point-of-care ultrasound where available, and respect patient timelines.

Clinical Adjustments for Special Populations



Pregnancy:

Occurs in **20–45%** (3rd trimester).
Most resolve 3 months postpartum.

Action: Night splinting only. Avoid gabapentinoids (Category B3/C) and defer surgery unless severe motor deficit develops.



Elderly:

Higher prevalence, often atypical (more pain, less classic tingling).

Action: Trial conservative therapy, but note polypharmacy risks (anticoagulants for injections/surgery). Extreme caution with **Amitriptyline** (falls, confusion).



Renal / Dialysis:

10–30% prevalence due to amyloid deposition and fistula fluid shifts.

Action: Assess fistula limbs for steal syndrome. Mandatory dose reductions for Gabapentin/Pregabalin. Avoid NSAIDs if **eGFR <30**.



Immunocompromised / RA:

Synovitis-driven CTS.

Action: Corticosteroid injection highly effective, but use caution with high-dose immunosuppressants. Optimize primary **DMARD** therapy to reduce tenosynovitis.