

Peripheral Nerve Disease: Diagnostic Evaluation

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Electrodiagnostic Evaluation:

Extension of the Neurologic Examination

■ Purpose

- Localize the lesion in the Nervous System
- Determine Severity, Acuity, Physiological mechanisms
- Prognosis

■ Major Tools

- History and Directed Neurologic Examination
- Nerve Conduction Studies (NCS): Motor and Sensory
- Electromyography (EMG)
- **Ultrasound (US)**

■ Minor Tools

- Repetitive Nerve Stimulation, SFEMG, Exercise testing

CHRONIC NERVE COMPRESSION AND ENTRAPMENT

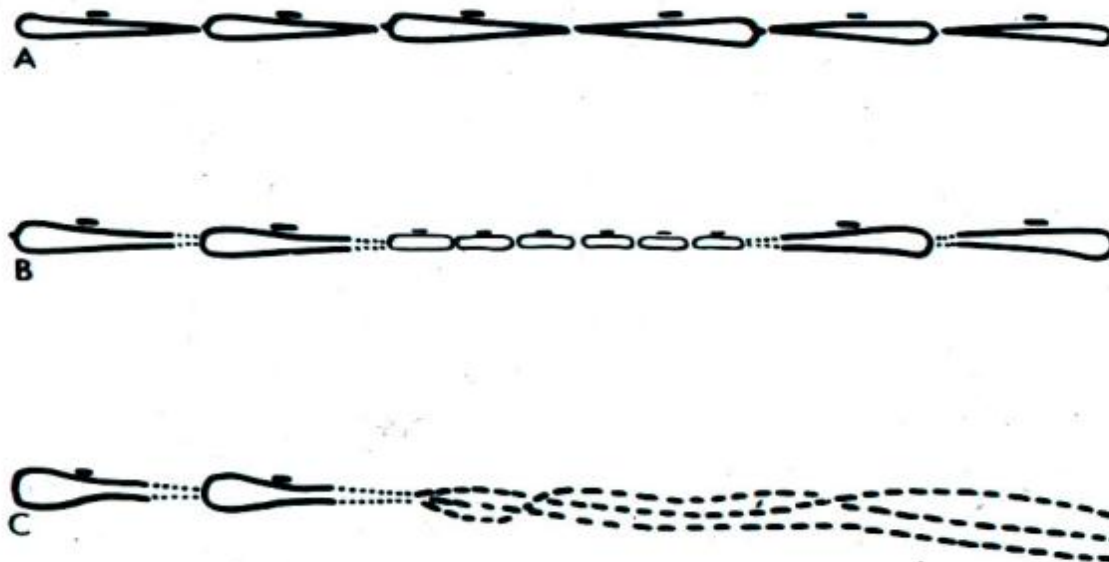
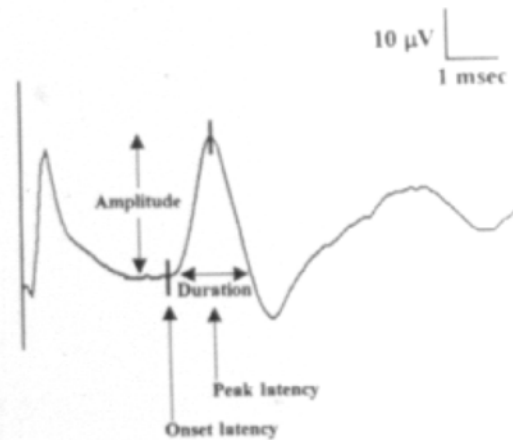
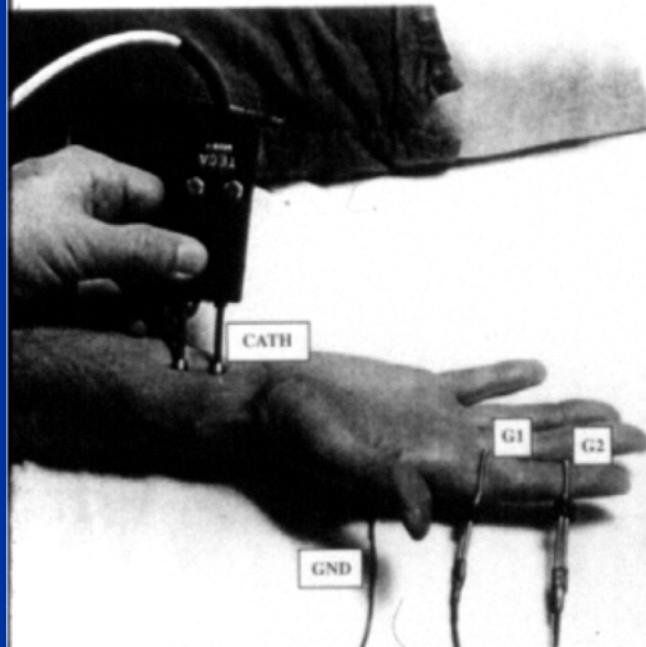
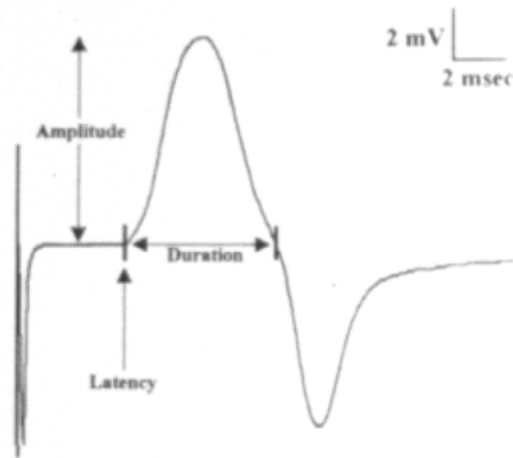
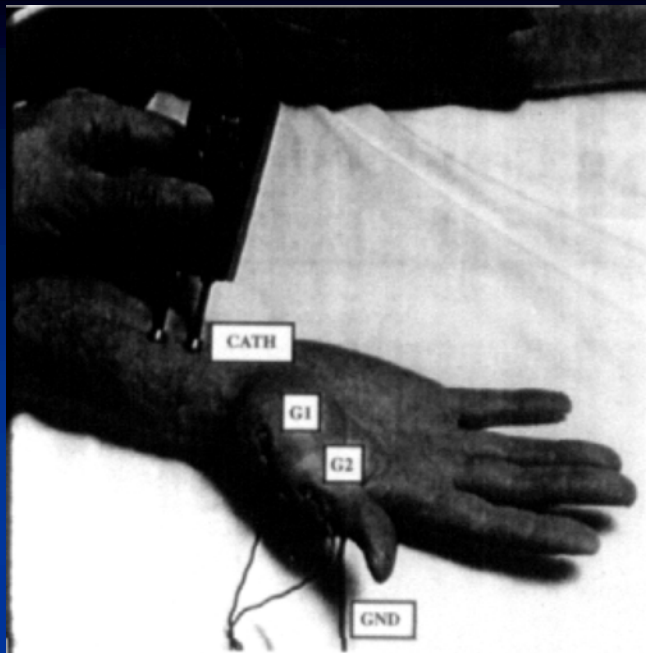


Figure 19.2 The sequence of change in chronic compression and entrapment suggested by Ochoa. (A) Distorted internodal segments in a minimal entrapment lesion, with reversal of polarity at the center. (B) A more severe lesion with paranodal demyelination affecting the distorted internodes at the edges and complete demyelination followed by remyelination in the center. (C) More marked distortion of the internodes on the proximal side of the lesion, with wallerian degeneration distally (113). From Ochoa (103), with permission.



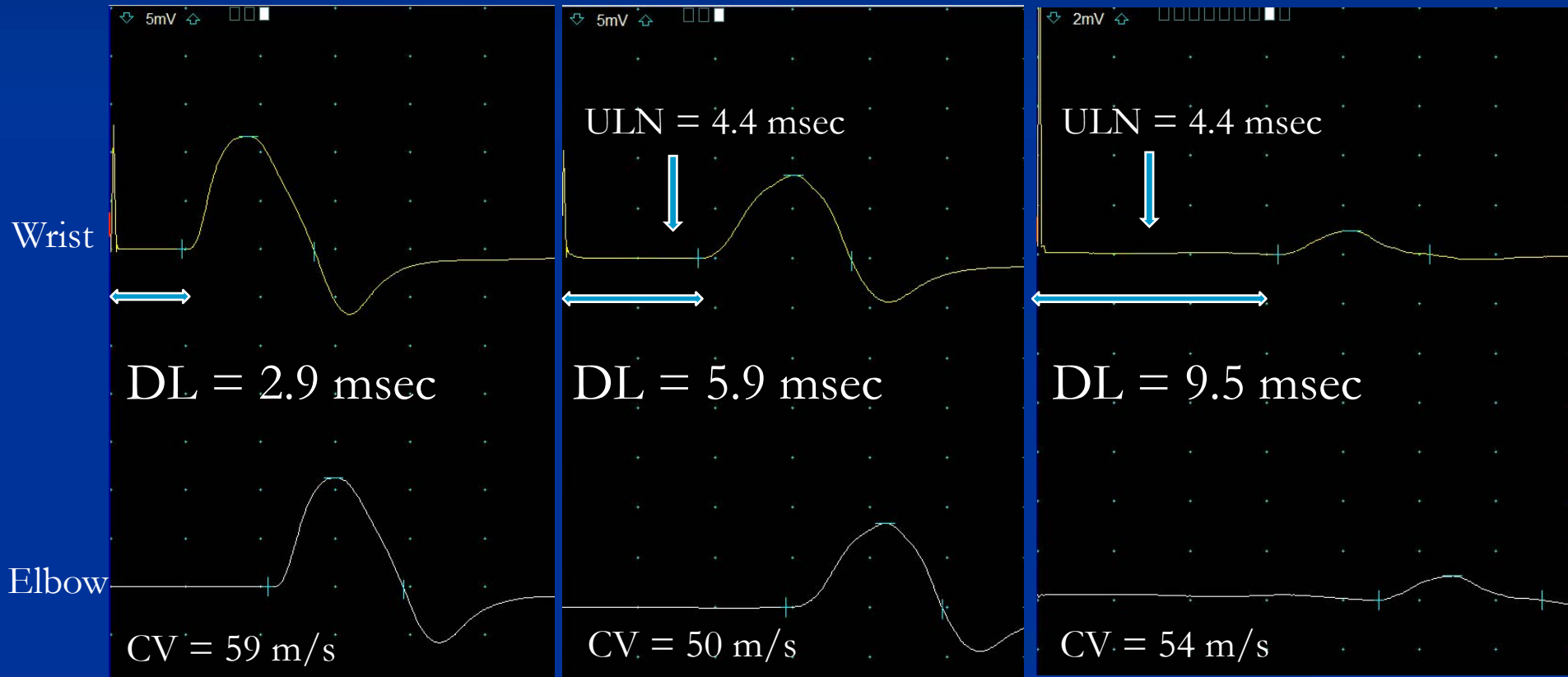
Modified from
Preston and Shapiro, 1997

Carpal Tunnel Syndrome

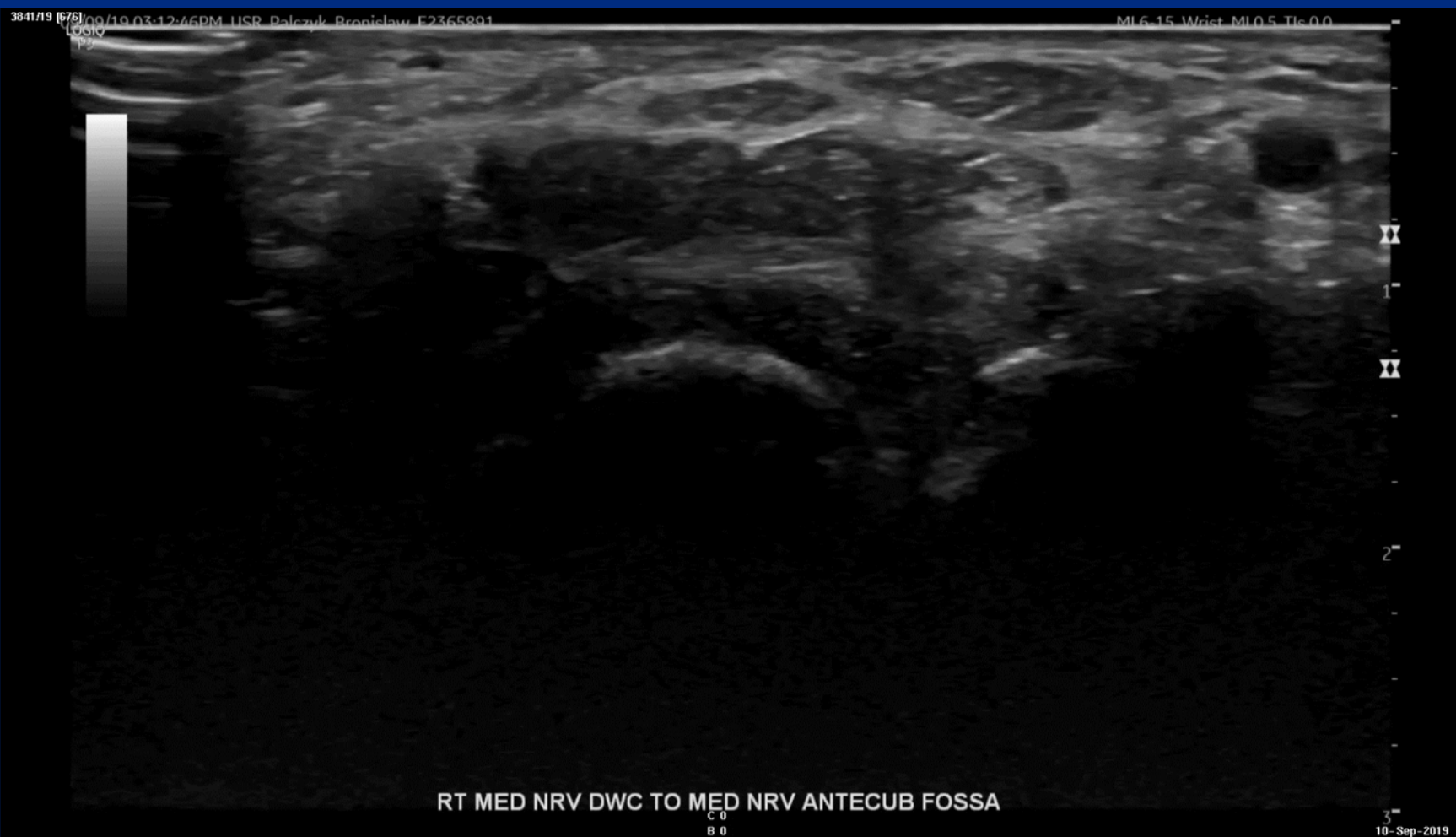
Normal

Moderate

Severe

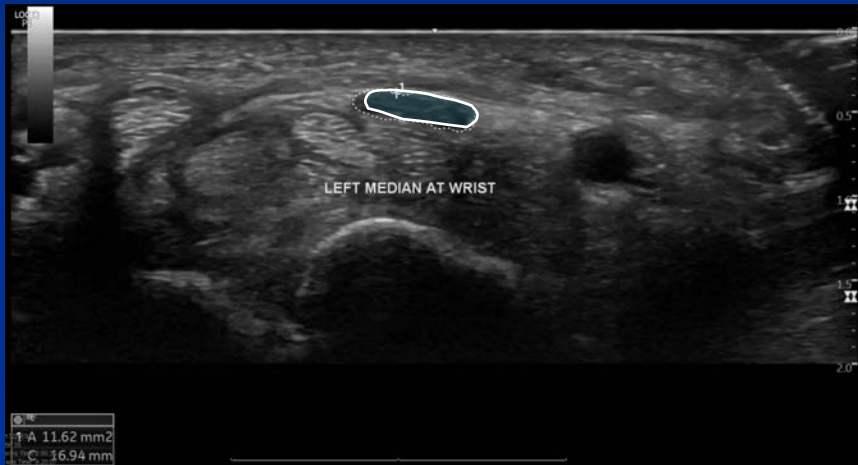


US Video: Median Wrist to Elbow



CTS: US at distal wrist crease

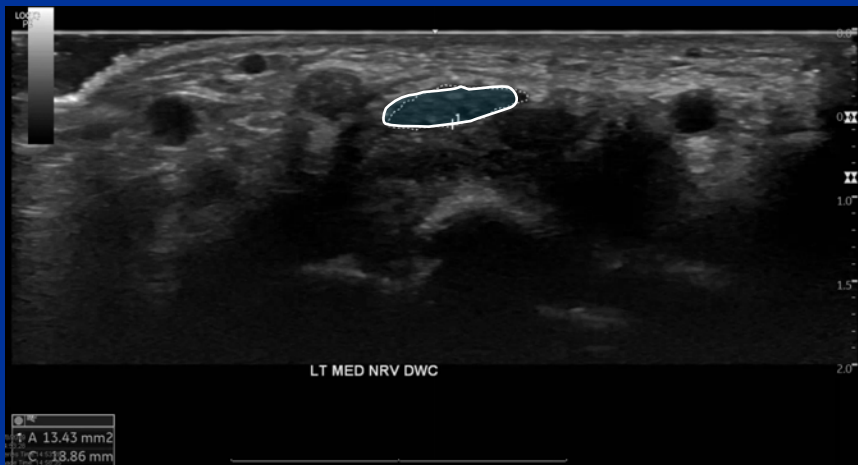
Normal: CSA 11 mm²



Moderate: CSA 17 mm²



Mild: CSA 13 mm²

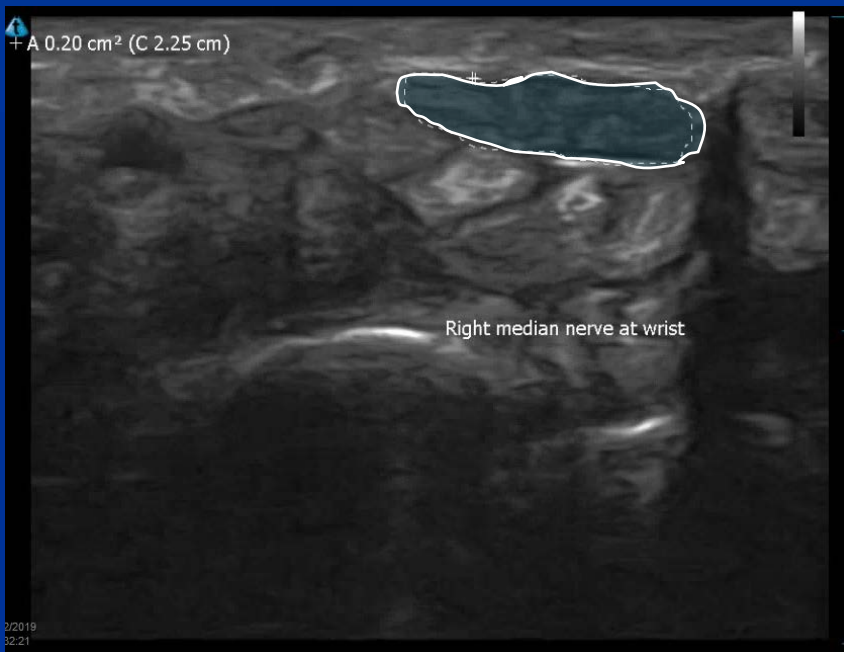


Severe: CSA 25 mm²



CTS: typical symptoms and signs, Negative electrophysiology

Median nerve (wrist)



CSA: 20 mm²
(Normal < 13)

Median nerve (forearm)

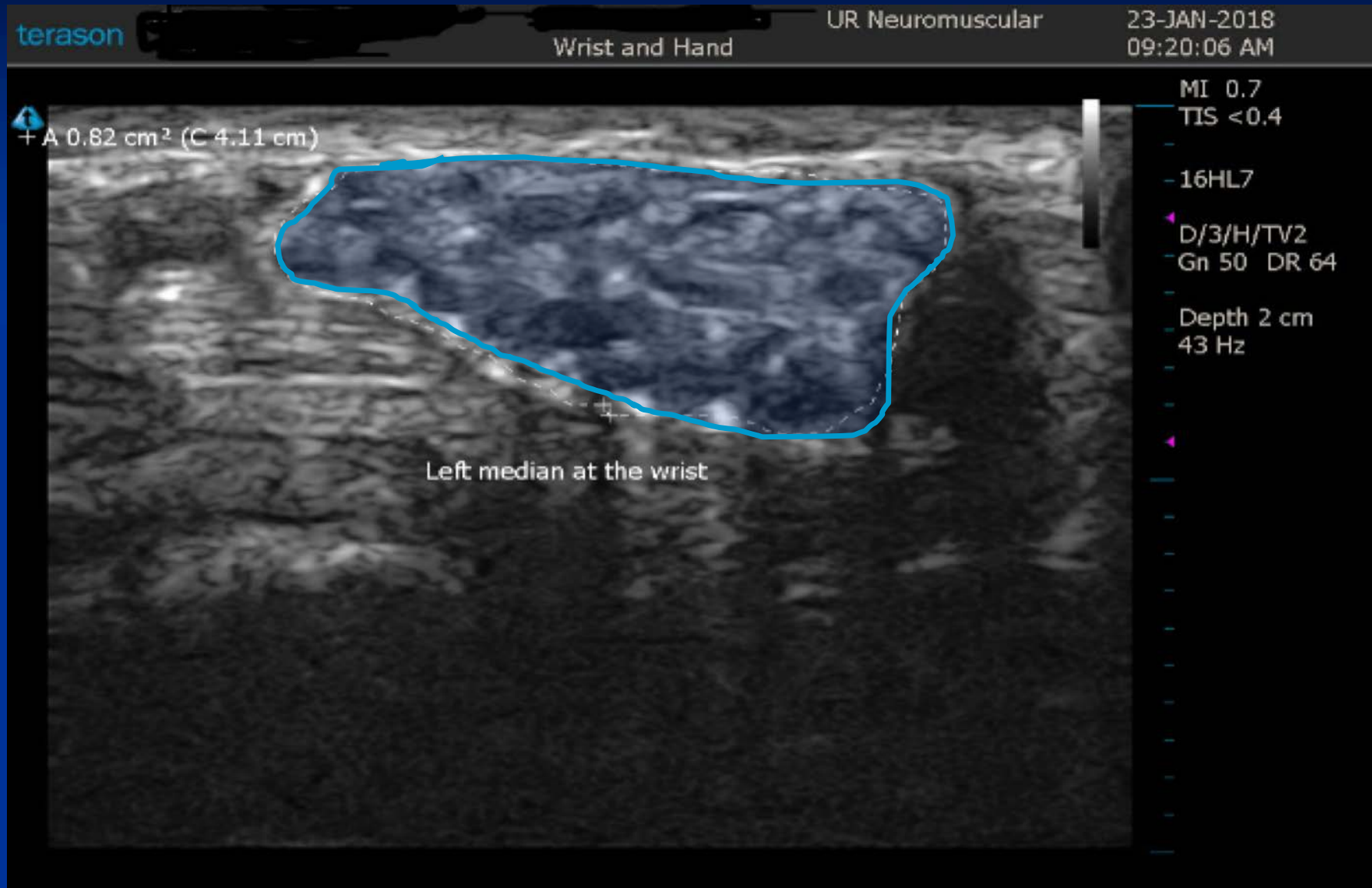


CSA: 6 mm²

Severe CTS: Motor DL 8.2 msec (normal < 4.4 msec)



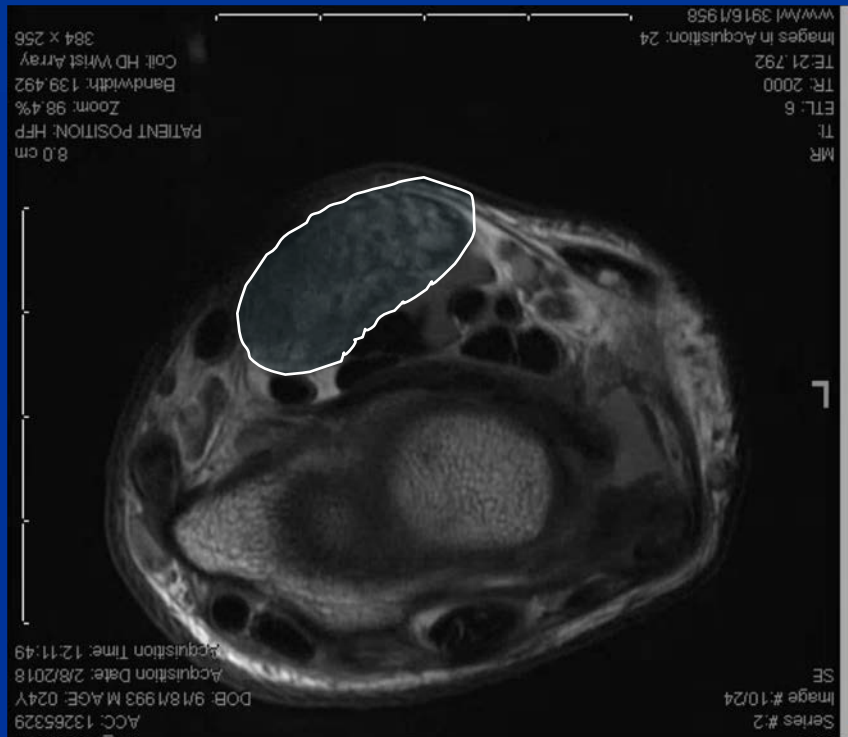
Lipofibromatous hamartoma



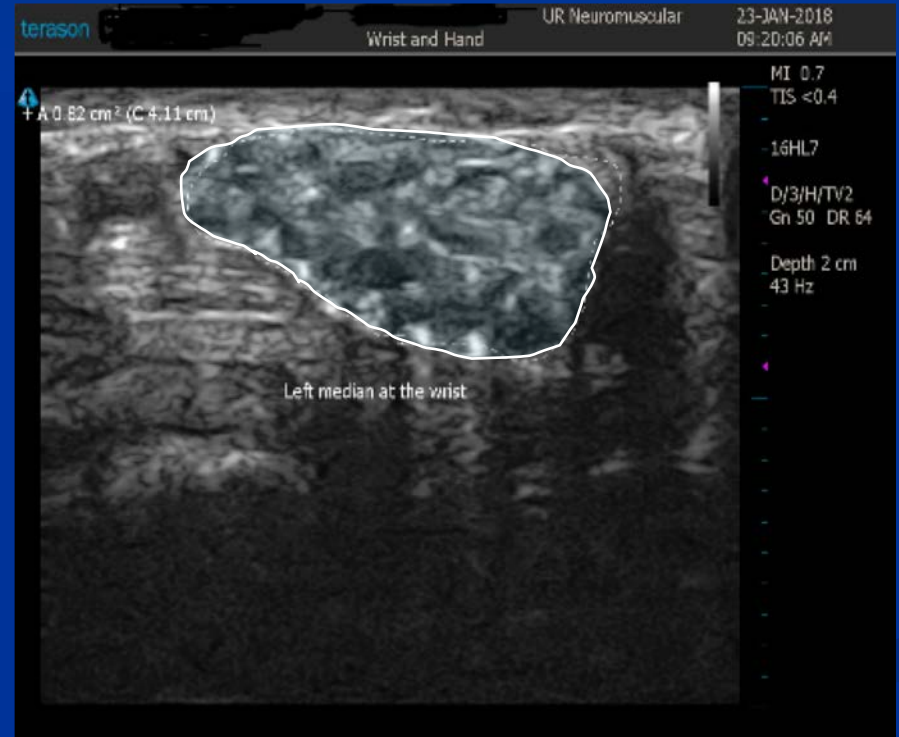
CSA: 82 mm²

MRI and US comparison

LFH: MRI

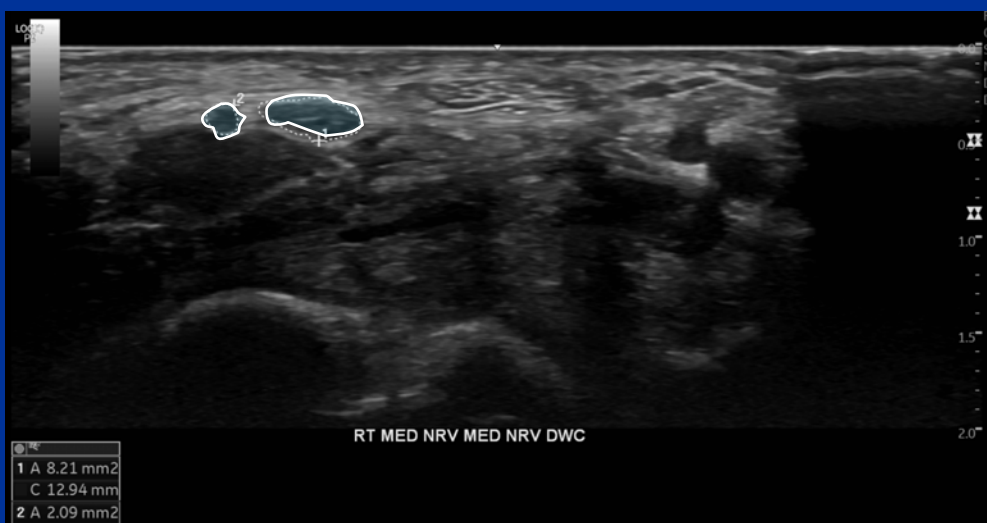


LFH: US



59 yo man with D1-3 numbness

Median nerve: Wrist



CSA: 10.3 mm²

Median nerve: Forearm



CSA: 9.7 mm²

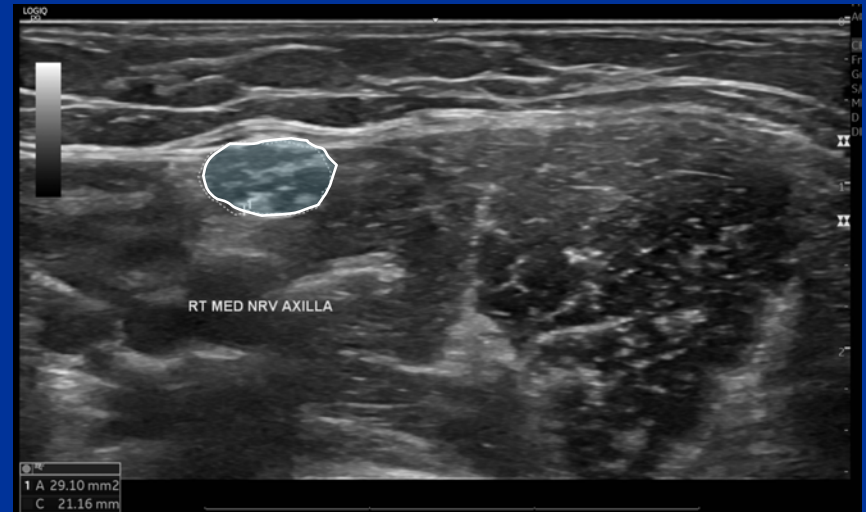
59 yo man with D1-3 numbness

Median nerve: Elbow



CSA: 25.5 mm²

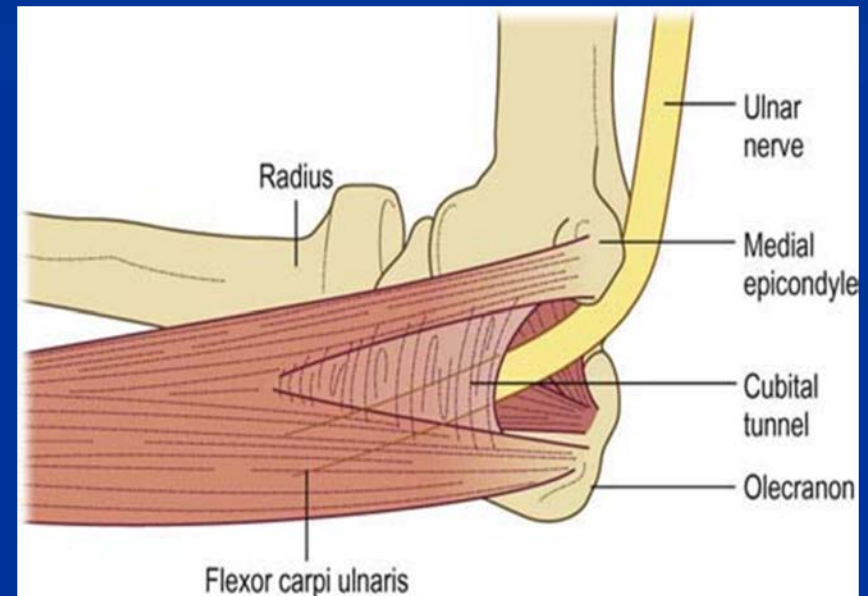
Median nerve: Axilla



CSA: 29.1 mm²

Ulnar Neuropathy at Elbow (UNE)

- Medial Epicondyle-Olecranon Process (Ulnar Groove)
- Humero-ulnar Arcade (Cubital tunnel)
- Deep Flexor Pronator Aponeurosis (DFPA)
- Above epicondyle



58 yo man

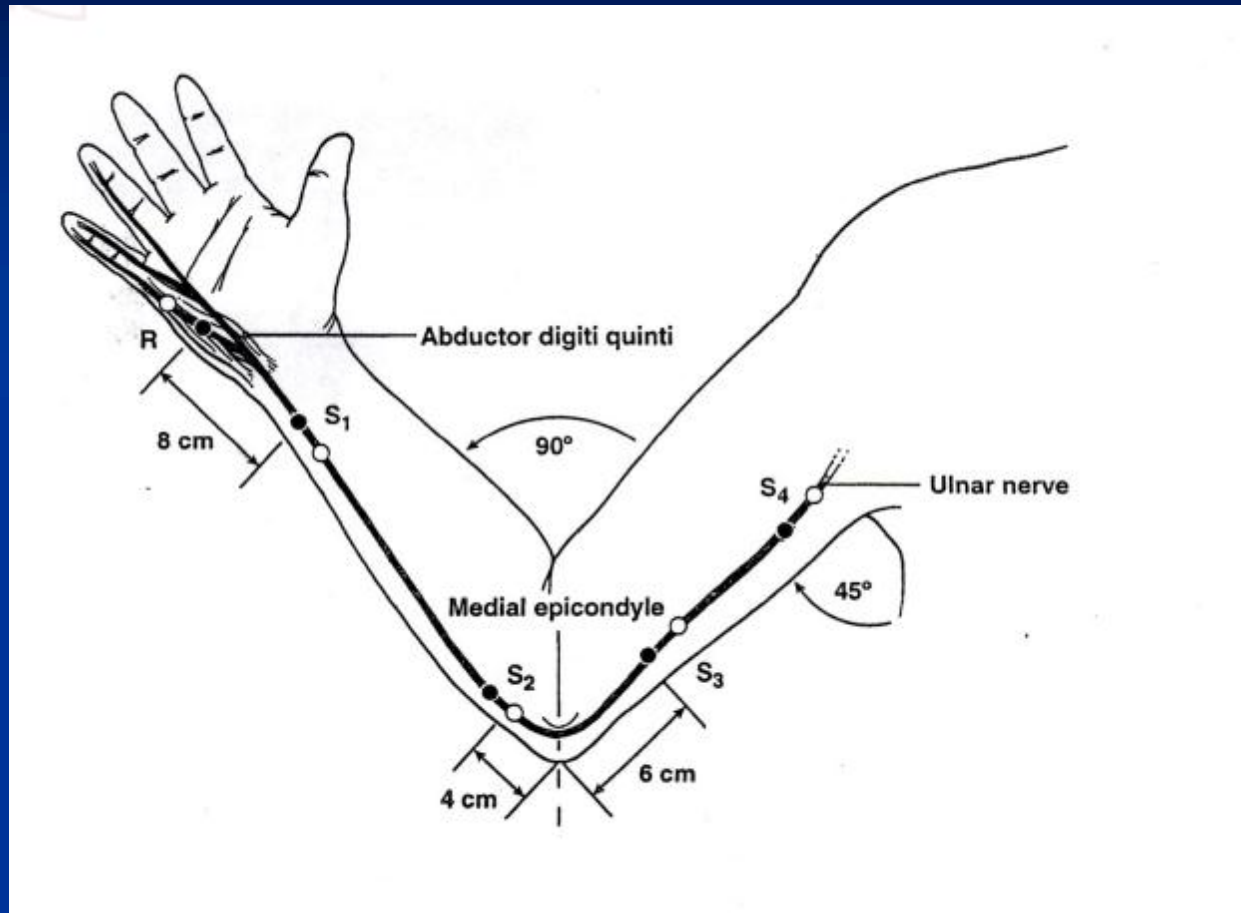
History

- “Numbness:” digits 4,5 bilaterally for one year
- Intermittent “pain”: elbows and medial forearm

Exam

- Atrophy: hypothenar muscles bilaterally, R first dorsal
- Weakness: interossei and deep ulnar flexors bilaterally
- Wartenburg’s sign: bilaterally
- Sensory loss: digit 5, medial aspect digit 4, medial dorsum of hand bilaterally

Ulnar Motor Nerve Conduction



Ulnar.R/Abductor digiti minimi	Wrist	3.3 ms	1.8 mV	70.0 mm	☐
Ulnar.R/Abductor digiti minimi	B.Elbow	6.2 ms	1.2 mV	64.6 m/s 185.0 mm	☐
Ulnar.R/Abductor digiti minimi	A.Elbow	9.3 ms	0.8 mV	32 m/s 100.0 mm	☐

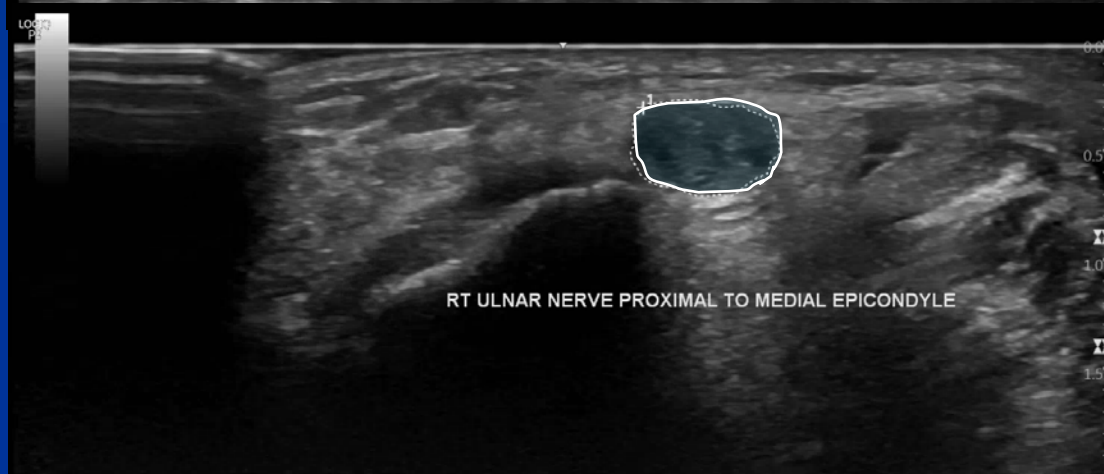
Cubital Tunnel

CSA: 6.7 mm² :



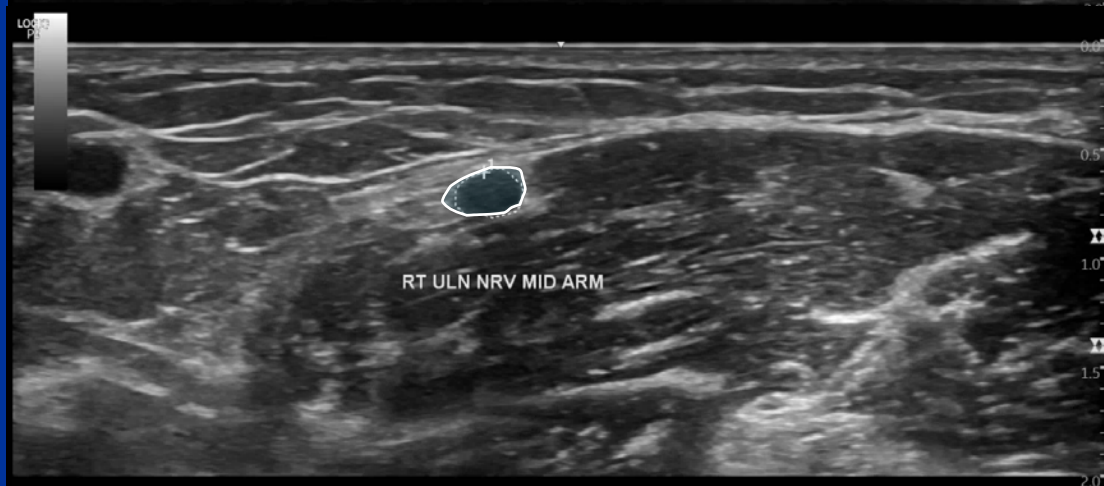
Ulnar Groove

CSA: 24.0 mm² :

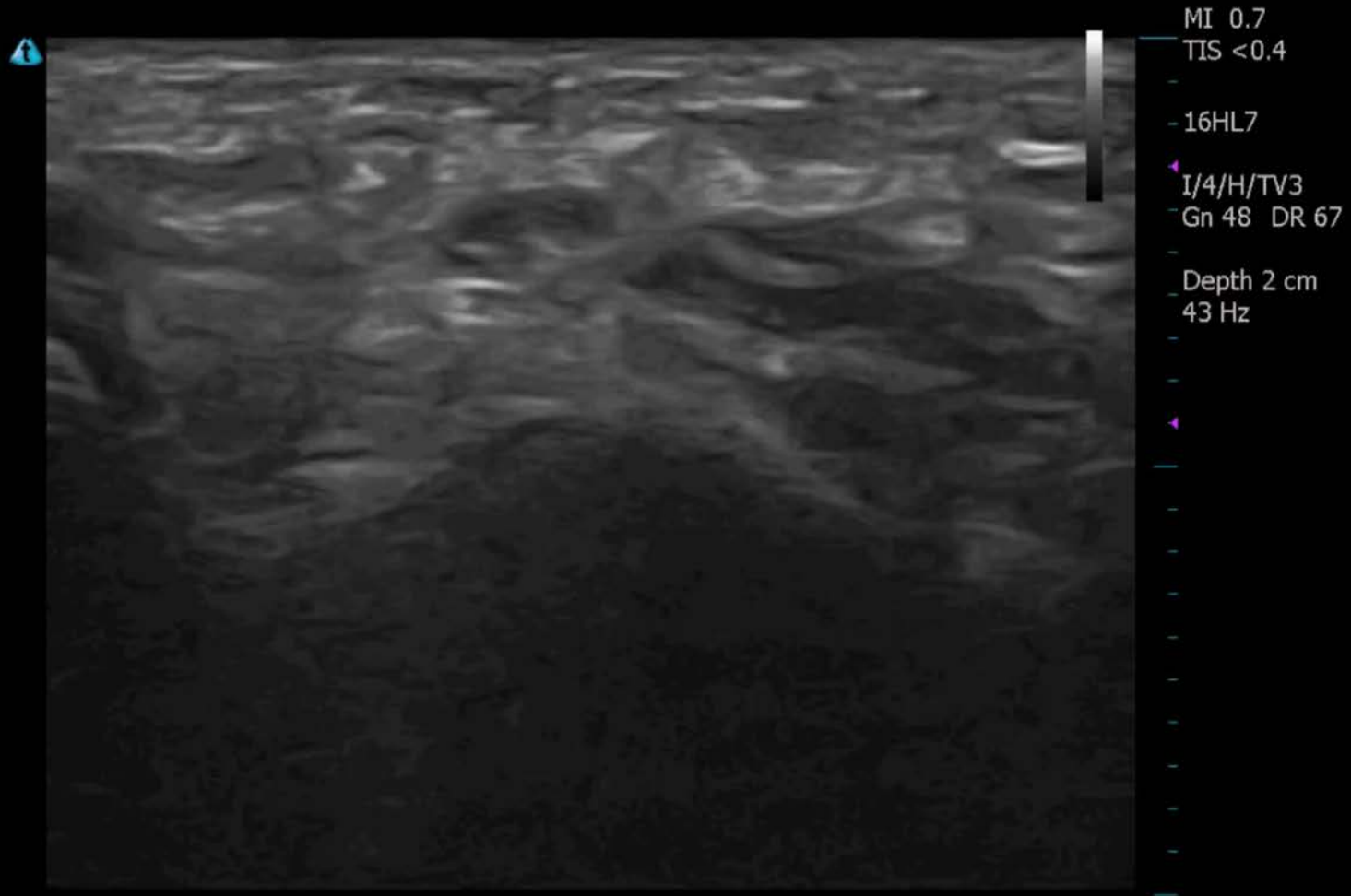


Upper Arm

CSA: 5.4 mm² :



Ulnar Nerve Subluxation: Video



Radial Neuropathies

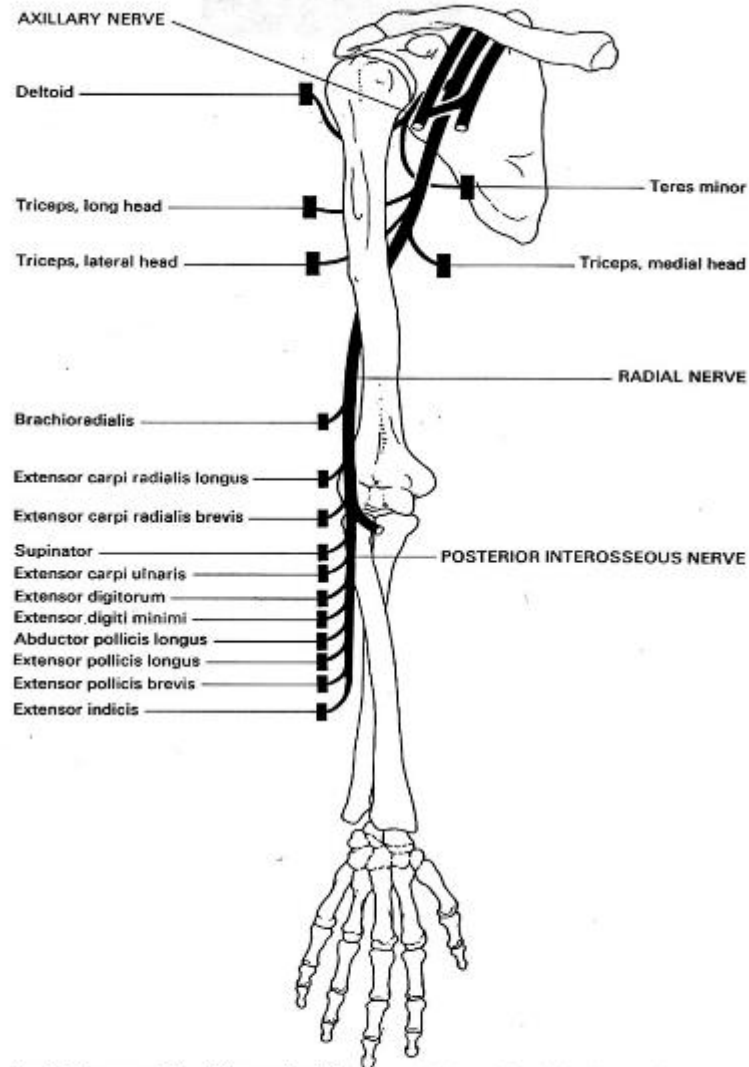
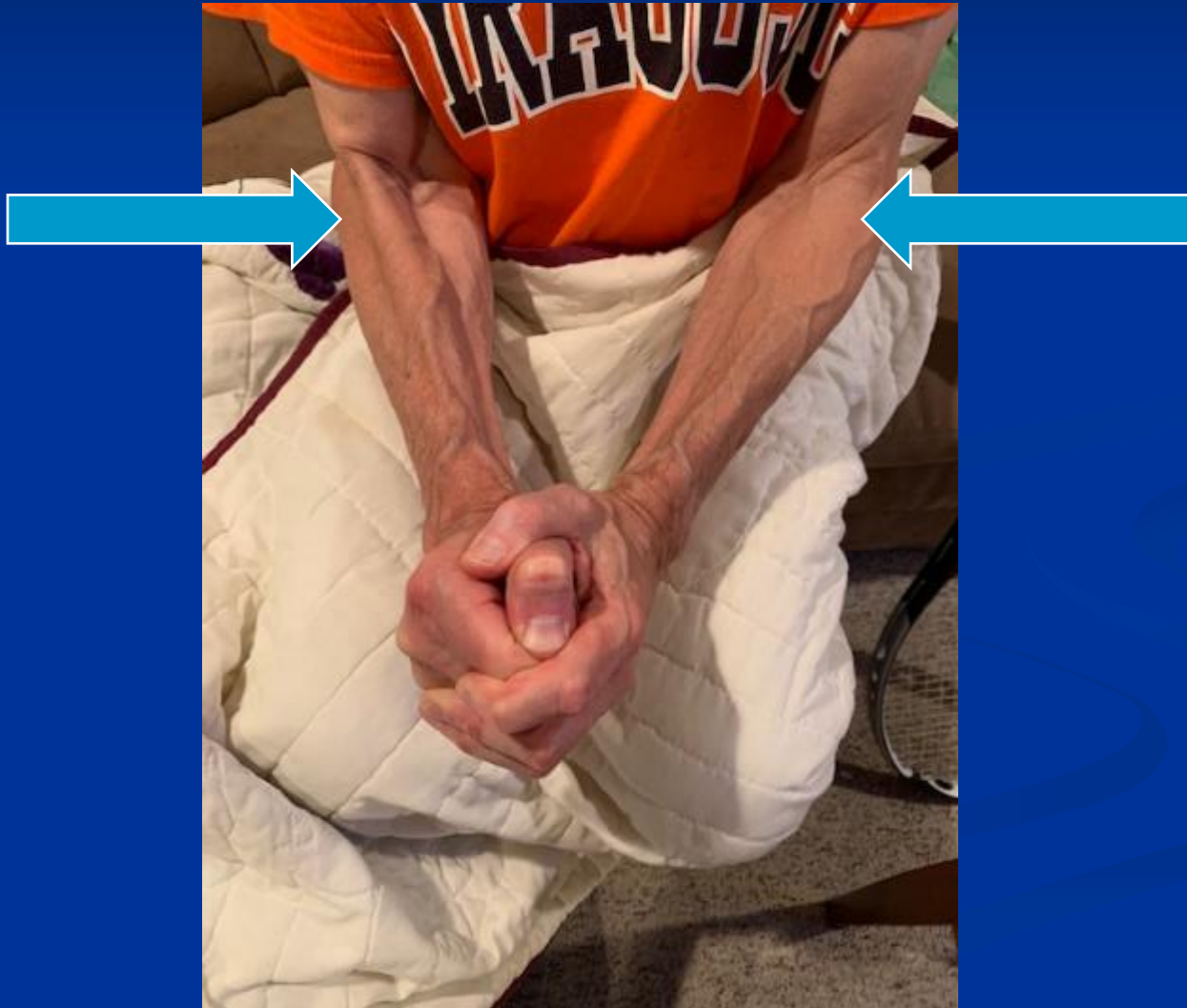


Fig. 15 Diagram of the axillary and radial nerves and the muscles which they supply.
(Modified from Pitres and Testut)

Supracondylar RNP- Importance of Brachioradialis



Radial Neuropathy at the Spiral Groove

Stimulus:

Forearm

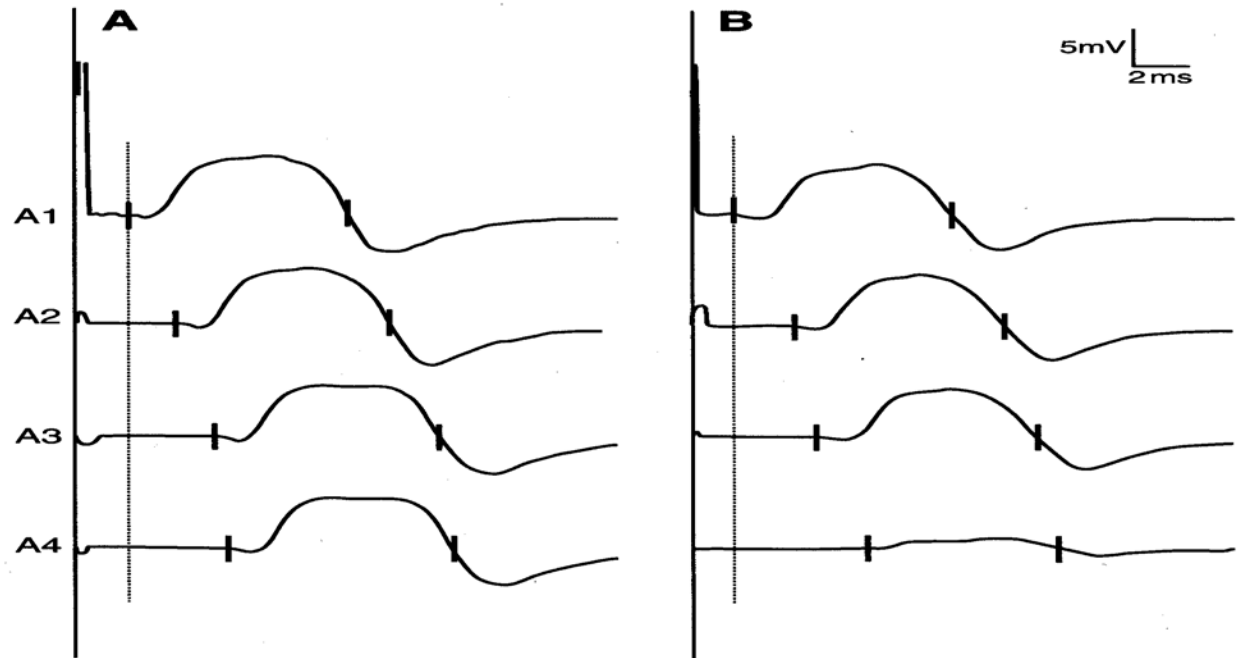
Above Elbow

Below Spiral Gr

Above Spiral Gr

Normal Side

Affected Side



Recording: Ext Indicis Proprius

Radial Neuropathies

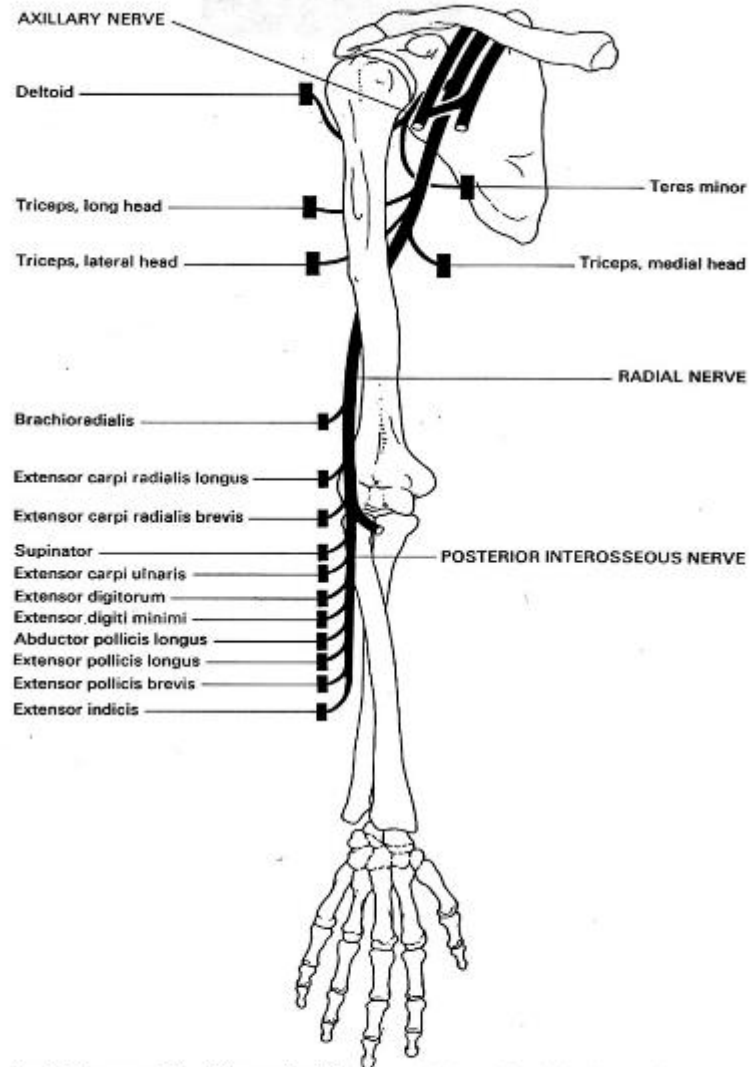
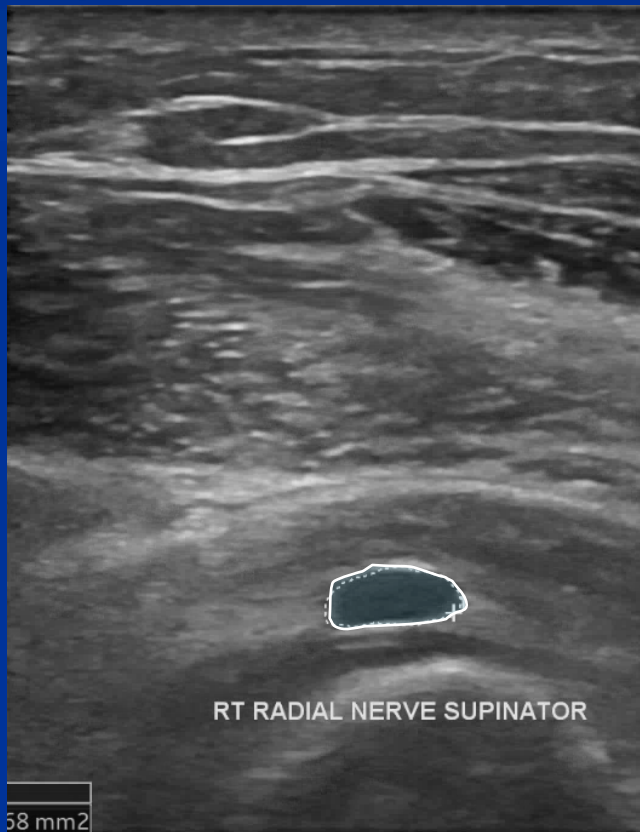


Fig. 15 Diagram of the axillary and radial nerves and the muscles which they supply.
(Modified from Pitres and Testut)

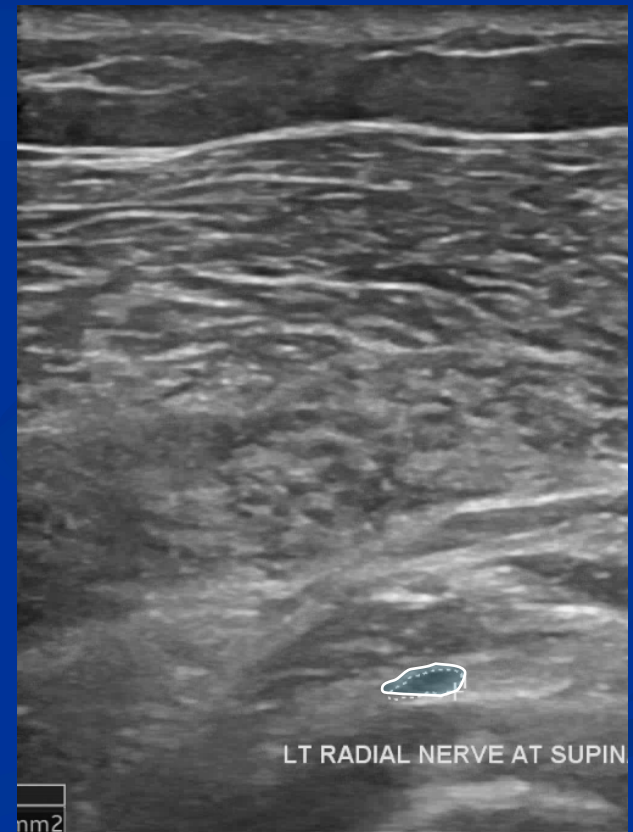
Right Posterior Interosseous Neuropathy (PIN)

Right PIN



PIN CSA: 9.7 mm²

Left PIN



PIN CSA: 2.4 mm²

11 year old girl referred for R radial nerve palsy (RNP)

- Fell from horse sustaining a R supracondylar humeral fracture and RNP after open reduction and percutaneous pinning
- Exam:
 - Well-healed scar above R elbow
 - Complete wrist and finger drop
 - No contraction of brachioradialis
 - Elbow extension full
 - Sensory loss over first dorsal webspace

Electrodiagnostic Studies

■ Motor Nerve Conduction Studies

Motor Nerve Conduction						
Nerve	Stimulus	Latency	Amplitude	Conduction	Distance	Normal
Radial.R/Extensor indicis proprius	Forearm	<Absent>	<Absent>		<Absent>	☐
Radial.R/Extensor indicis proprius	Spiral Gr	<Absent>	<Absent>		<Absent>	☐
Median.R/Abductor pollicis brevis	Wrist	2.8 ms	10.5 mV		70.0 mm	☒
Ulnar.R/Abductor Digiti Minimi	Wrist	2.6 ms	6.8 mV		70.0 mm	☒

■ Sensory Nerve Conduction Studies

Sensory Nerve Conduction							
Nerve	Segment	Stimulus	Latency	Amplitude	Conduction	Distance	Normal
Radial.R	Wrist-Forearm	Forearm	<Absent>	<Absent>	<Absent>	100.0 mm	☐
Median.R	Wrist-Digit II	Wrist	1.4 ms	29.6 uV	0 m/s	70.0 mm	☒
Ulnar.R	Wrist-Digit V	Wrist	1.8 ms	40.4 uV	62.1 m/s	110.0 mm	☒

■ Needle EMG

Needle EMG											
Muscle	Side	Insertional	Fibs/Pos	Fascics	Duration	Amplitude	Phases	Activation	Recruitment	Notes	
Brachioradialis	R	Increase	+3	0						no recruitable motor units	
Triceps	R	Normal	0	0	Normal	Normal	Normal	Normal	Normal		
Extensor Indicis Proprius	R	Increase	+3	0						no recruitable motor units	

Ultrasound: Terminal Neuroma



Ultrasound: Terminal Neuroma

LOGIQ
P9



PROXIMAL RT RAD NRV JUST ABOVE SCAR |

Ultrasound: Distal segment



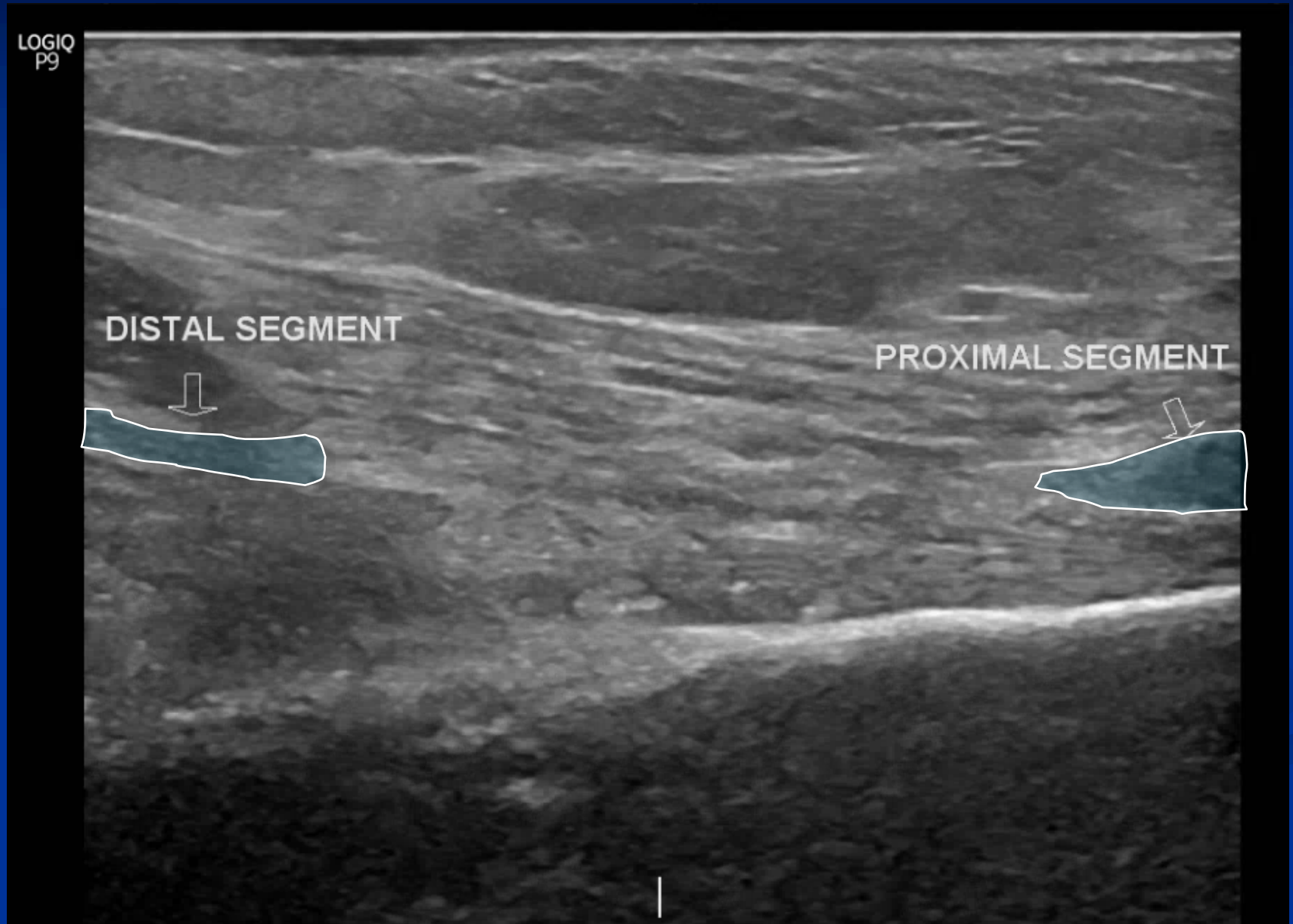
Ultrasound: Distal segment



Ultrasound: Nerve gap



Ultrasound: Nerve gap



Conclusions

- Ultrasound represents a paradigm shift in our assessment of peripheral nerve function providing easy access to anatomy at the point of care in the EMG laboratory.
- It is particularly useful in the diagnosis and management of patients with focal and generalized peripheral neuropathies.