

# Legless

Dr Alexis Selby

Dr Neil Simon

# Case

- 18yo right handed female audio engineering student
- 3 months of symptoms
  - Intermittent, increasing right arm, forearm and shoulder pain
  - Associated with numbness of right fourth and fifth digits
  - Woken at night by symptoms
  - Not provoked by position, although shoulder abduction painful at times
- Previous right shoulder dislocation age 12
- Mild intermittent shoulder pain since childhood years

# Examination

- Motor examination
  - Normal muscle bulk
  - Normal muscle strength including finger abduction
  - Reflexes 2+ and symmetrical
- Sensation
  - Altered sensation over fifth digit but normal in palm
  - Normal sensation elsewhere in both upper limbs
  - Tinel's phenomenon with percussion of the ulnar nerve at elbow
  - Spurling's test negative

# Differential diagnoses?

# Differential diagnoses?

- Ulnar nerve entrapment
- Cervical radiculopathy
- Lower trunk brachial plexopathy

# Investigations - NCS

- Motor NCS

Nerve / Sites	Latency ms	Amplitude mV	Dur. ms	Velocity m/s	Dist. cm
<b>R MEDIAN</b>					
Wrist	3.8	13.5	7.2		8
Elbow	7.7	13.5	7.2	61.4	24
Axilla	9.7	11.8	7.3	60.0	12
<b>R ULNAR ADM</b>					
Wrist	2.7	11.2	6.5		8
B. Elbow	6.0	10.8	6.7	64.0	21
A. Elbow	7.5	10.6	6.8	66.2	10
Axilla	9.1	9.8	7.0	62.5	10

- Right ulnar nerve inching studies normal

# Investigations - NCS

- F waves (Height 1m 80cm)

Nerve / Sites	%F	F lat. ms
R MEDIAN	100	25.9
R ULNAR	100	27.2

# Investigations - NCS

- Sensory NCS

Nerve / Sites	Latency ms	Pk Amp. $\mu$ V	Distance cm	Velocity m/s
<b>R MEDIAN – Dig II</b>				
Wrist	2.6	78.9	14	53.8
<b>R ULNAR – Dig V</b>				
Wrist	2.5	30.3	14	56.0
<b>L ULNAR – Dig V</b>				
Wrist	2.7	53.5	14	52.7
<b>R RADIAL – Median – Thumb</b>				
Forearm (Radial)	2.4	23.7	10	41.7
Wrist (Median)	2.6	19.1	10	38.4
<b>R MEDIAL AB CUT</b>				
Forearm	2.0	9.7	12	60.6
<b>L MEDIAL AB CUT</b>				
Forearm	1.8	5.1	12	65.8

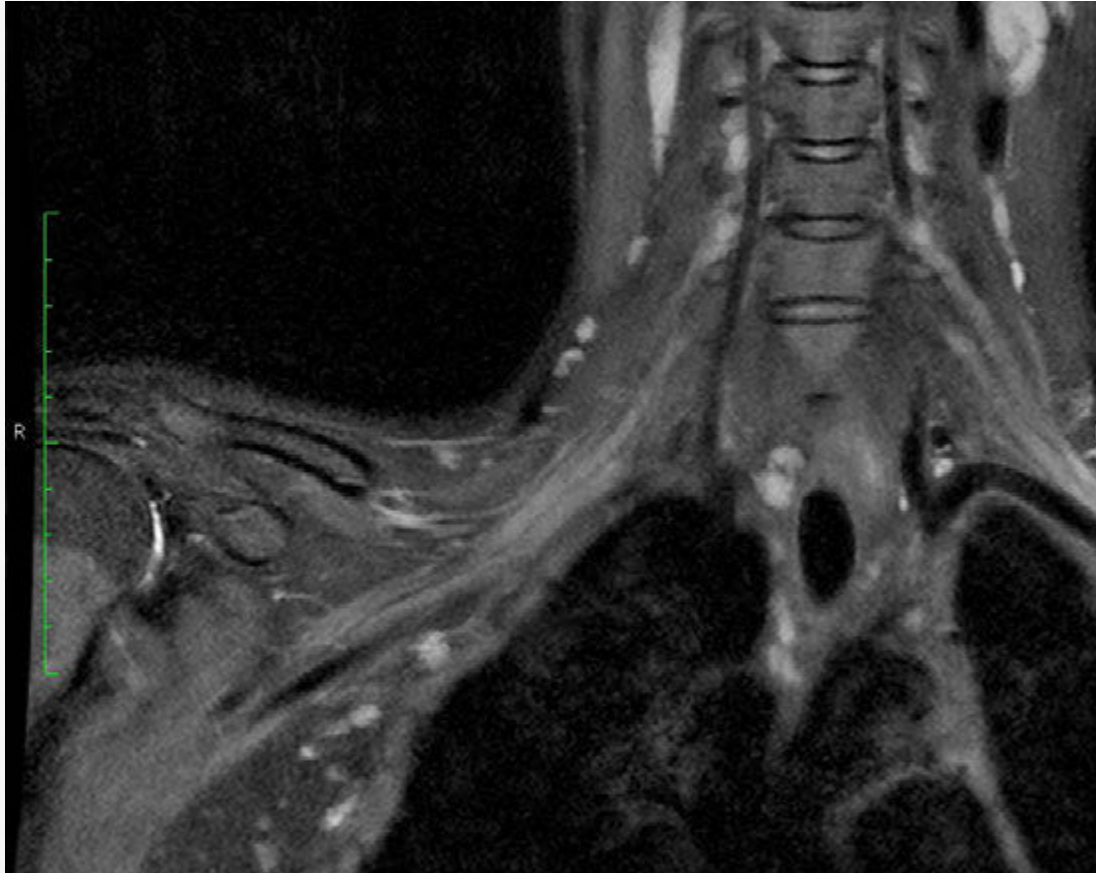


# Investigations - EMG

- EMG

EMG Summary			
	Spontaneous	MUAP	Recruitment
<b>R ABP</b>	No spontaneous activity	MU within normal limits	Recruitment normal
<b>R FDI</b>	No spontaneous activity	MU within normal limits	Recruitment normal

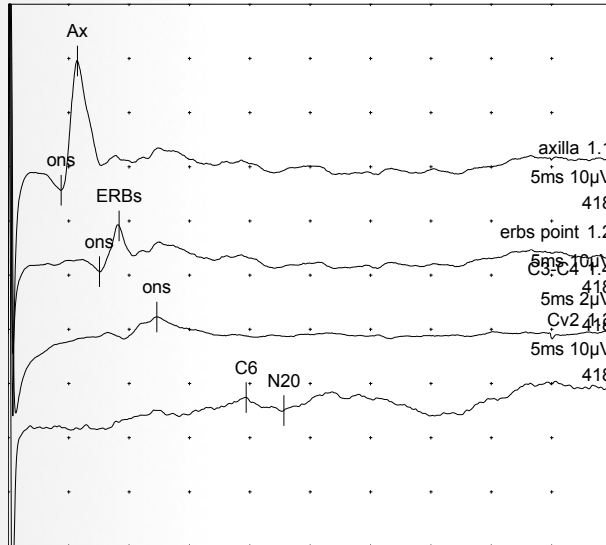
# Investigations - MRI



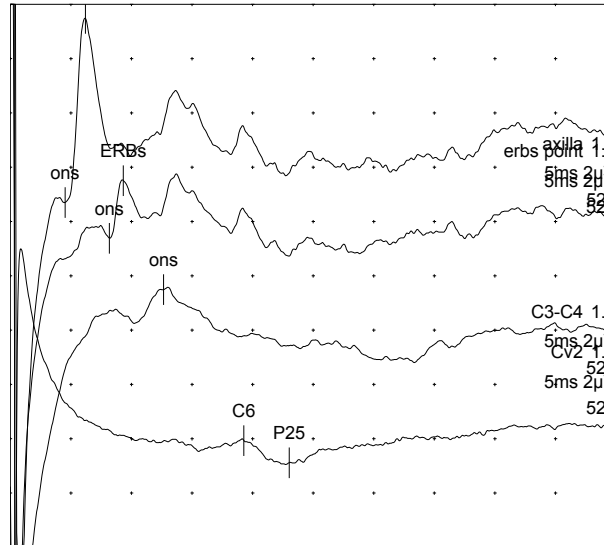
- No evidence of thoracic outlet syndrome

# Median and ulnar SSEPs - Normal

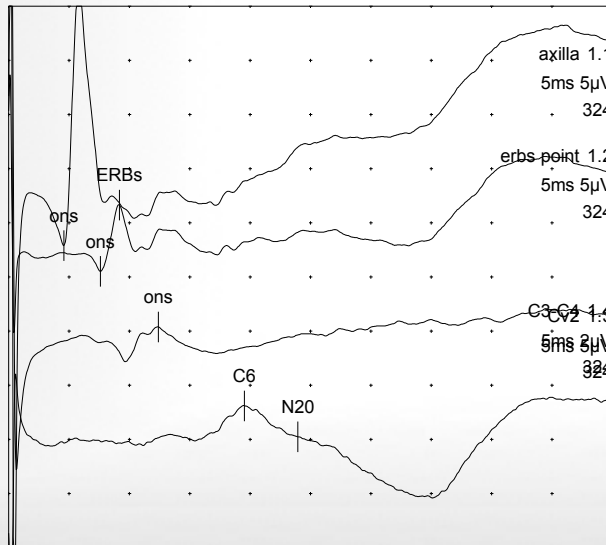
SEP-arm R Median



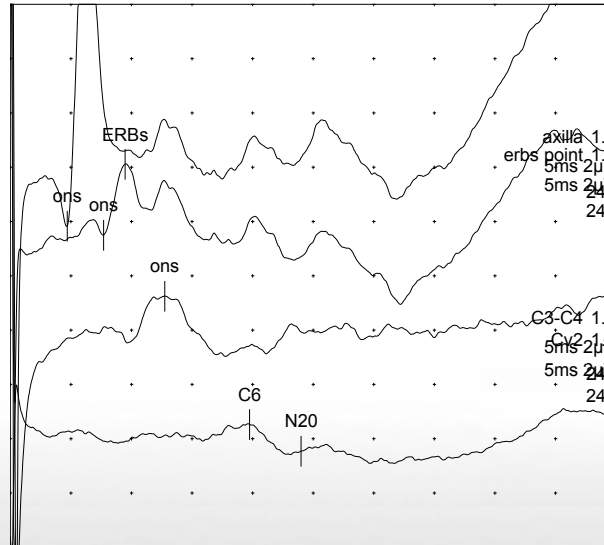
SEP-arm R Ulnar



SEP-arm L Median

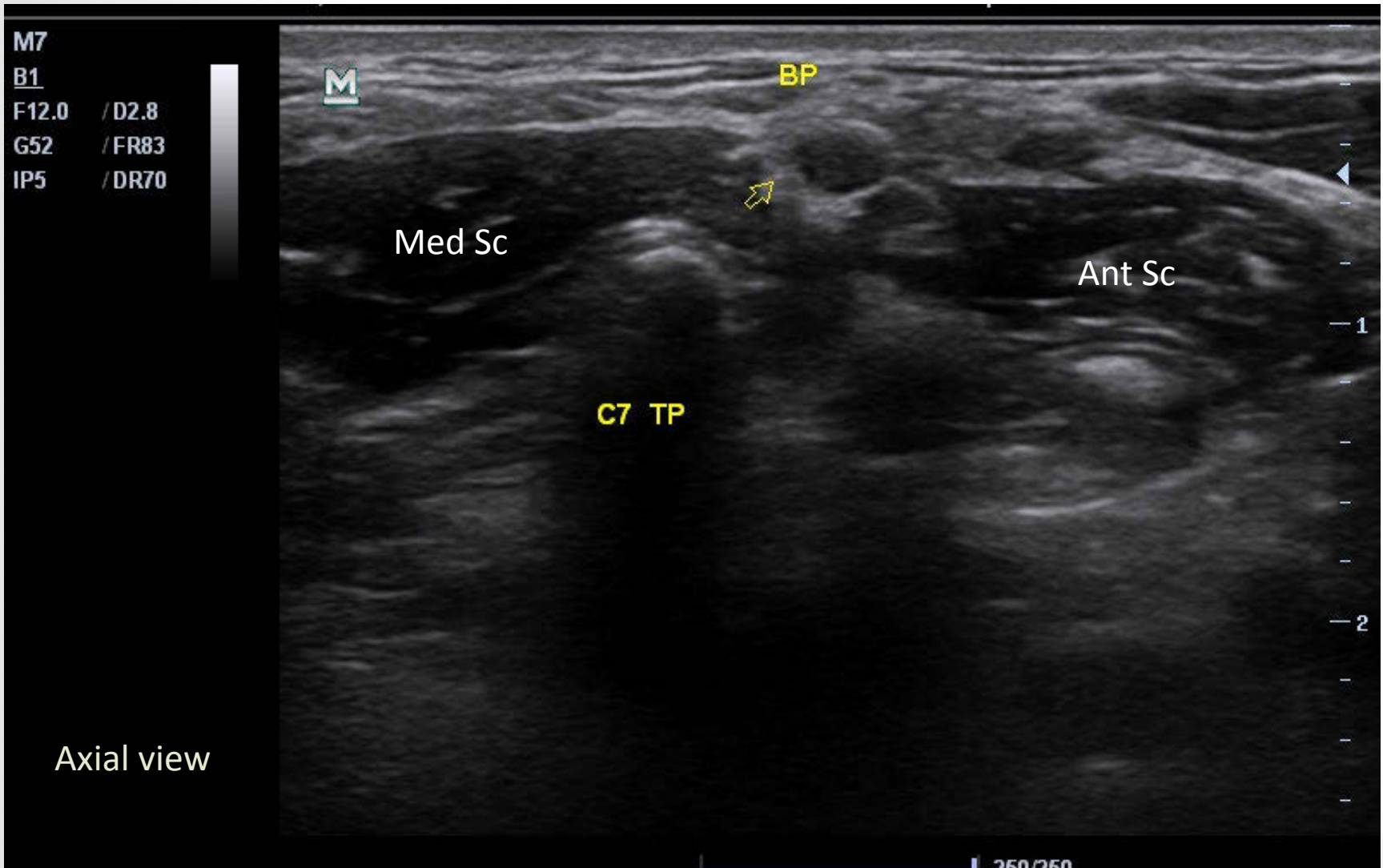


SEP-arm L Ulnar

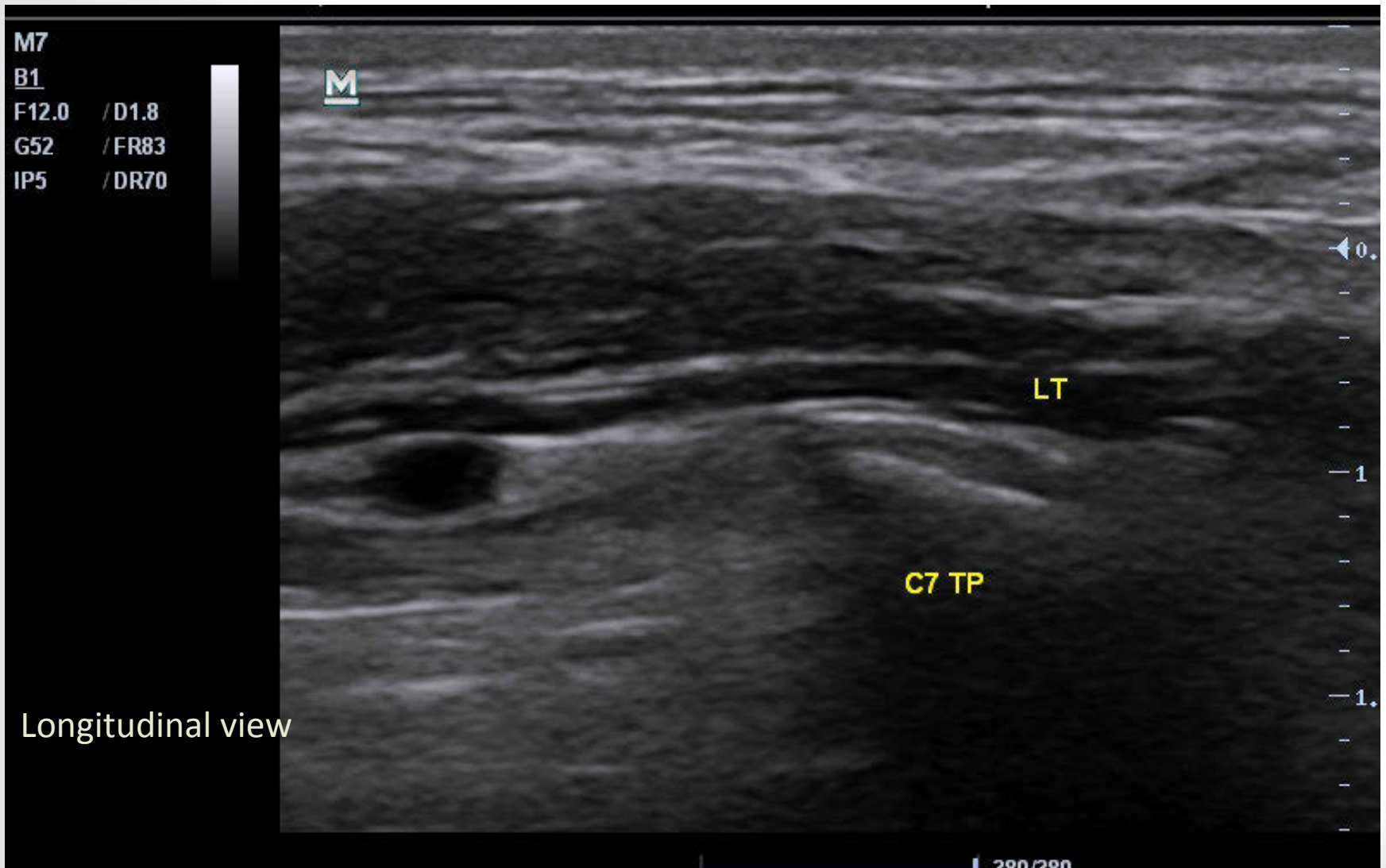


**Next?**

# Ultrasound

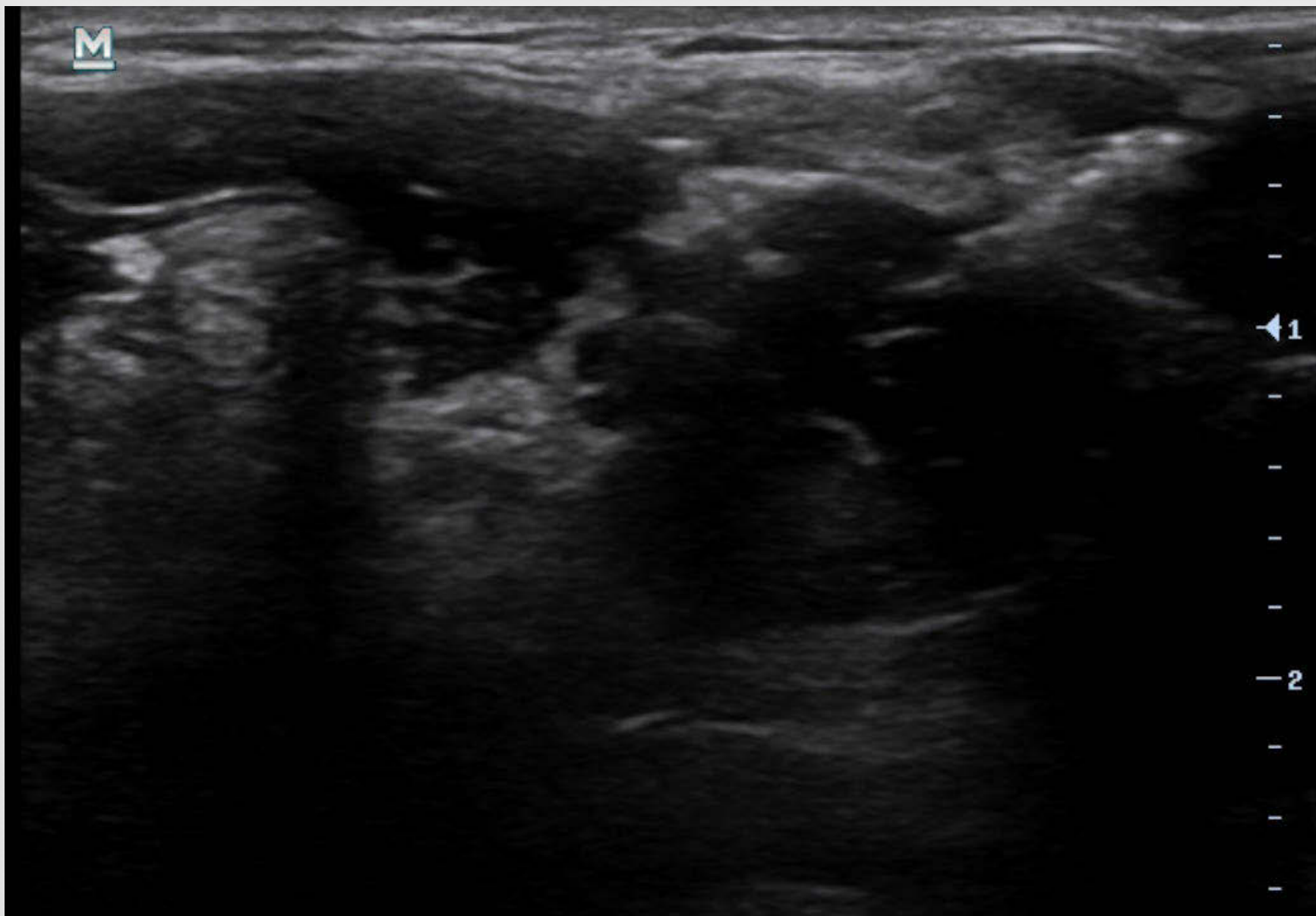


# Ultrasound



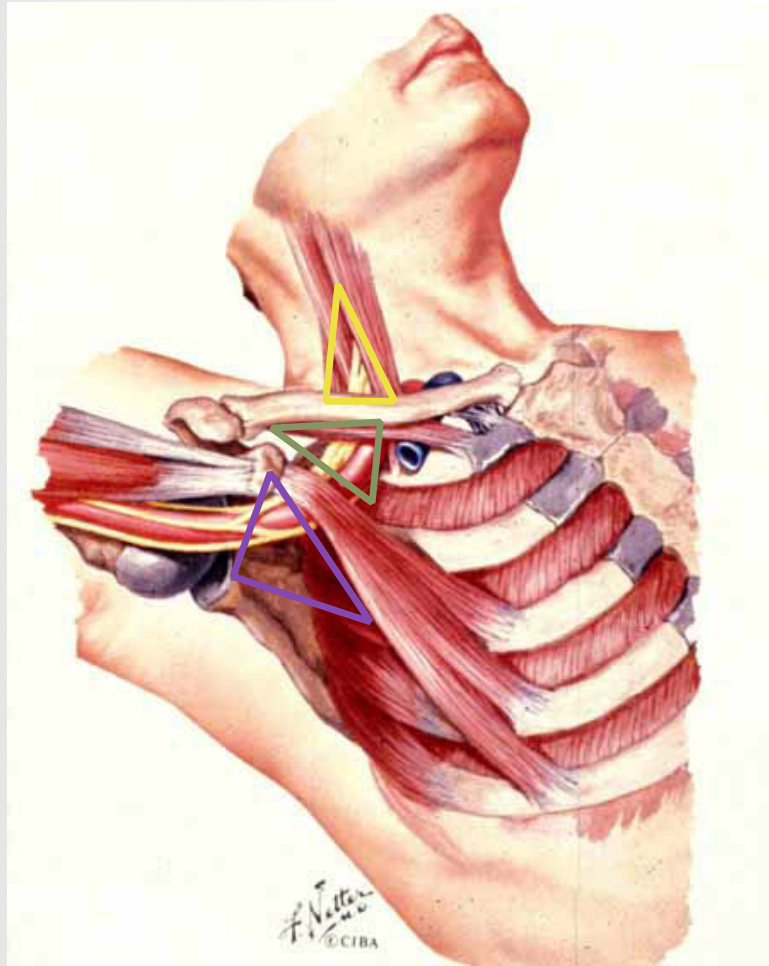
# Progress

- Ultrasound demonstrated elongated C7 transverse process contacting lower trunk
- 30 units botulinum toxin injected into right anterior scalene muscle
  - Aim to increase size of interscalene triangle
  - Some benefit





# Neurogenic thoracic outlet syndrome



- Compression of brachial plexus elements
  - Bony or soft tissue anomaly



**“A table needs at least 3 legs...”**

# Neurogenic thoracic outlet syndrome

- **'4 LEGS' OF THE DIAGNOSIS OF NEUROGENIC TOS**

1. HISTORY

- Shoulder pain, medial hand and forearm tingling

2. EXAMINATION

- C8/T1 sensory abnormalities
- Thenar > intrinsic hand muscle wasting (Gilliat-Sumner hand)

3. ELECTRODIAGNOSTIC STUDIES

- Reduced ulnar SNAP, normal median SNAP
- Reduction median > ulnar CMAP amplitude
- Reduced MAC SNAP
- NOTE – ABOVE ONLY PRESENT IF AXONAL LOSS HAS OCCURRED

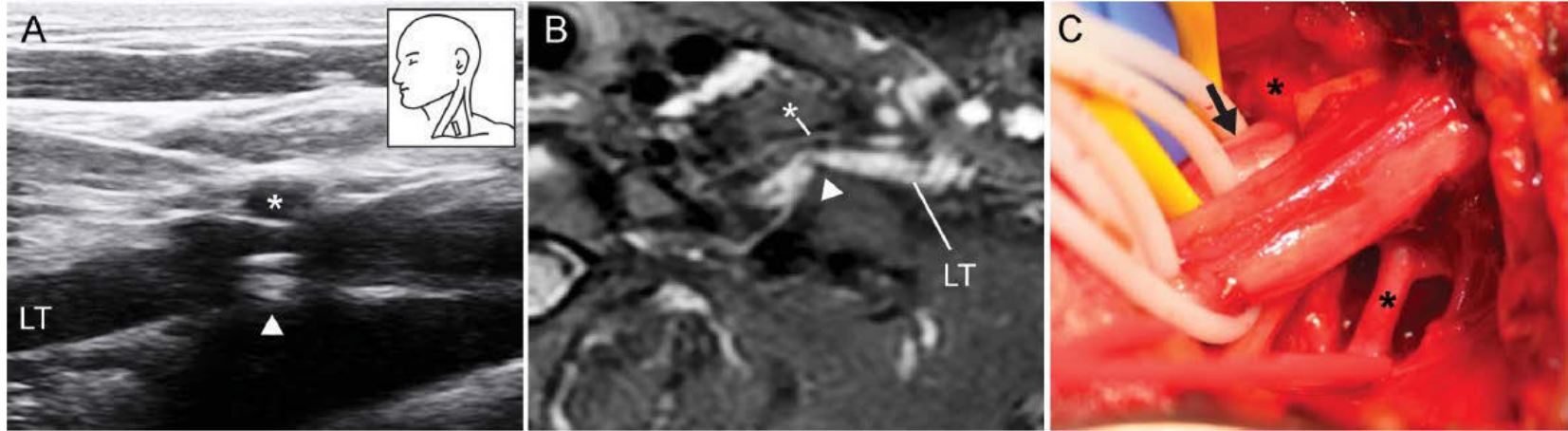
4. IMAGING

- Bony or soft tissue abnormality



# Ultrasound

## – A new leg in the diagnosis of TOS



Correlation between ultrasound (A) and MRI (B) demonstrates compression of the lower trunk (LT) between an artery (\*) and fibrous band (arrowhead) arising from an elongated C7 transverse process. At operation (C), the artery (\*) passed between the middle and lower trunks. Fibrous bands were resected to release the LT (arrow).

### Sonographic diagnosis of true neurogenic thoracic outlet syndrome

Neil G. Simon, Jeffrey W. Ralph, Cynthia Chin, et al.  
*Neurology* 2013;81;1965

# Additional diagnostic tools

1. Response to anterior scalene botulinum toxin injection
  - Relevant if anterior scalene abnormality eg hypertrophy
  - Predictor of response to surgery
    - Some surgeons see response as necessary
  - Ultrasound guided
2. Somatosensory evoked potentials
  - Ulnar nerve SSEPs abnormal only if abnormal NCS/examination
  - Normal examination/NCS = normal SSEPs
  - Adjunctive evidence

## **Somatosensory evoked responses in the diagnosis of thoracic outlet syndrome**

**C YIANNIKAS, JC WALSH**

*From the Department of Clinical Neurophysiology, Royal Prince Alfred Hospital, Sydney, Australia*



# Neurogenic thoracic outlet syndrome

- Are all 'legs' required for a diagnosis of neurogenic TOS?
- If not, how much support is required to make the diagnosis?
- Disputed TOS – neurogenic TOS spectrum?
- Is TOS underdiagnosed?

**The Thoracic Outlet Syndrome Is Overdiagnosed**

Asa J. Wilbourn, MD

# References

- 1. Peet RM, Henriksen JD, Anderson TP, Martin GM. Thoracic outlet syndrome: evaluation of a therapeutic exercise program. *Proceedings of the Staff Meetings. Mayo Clinic* 1956;31(9):281–7.
- 2. Wilbourn 1990 Willbourn AJ. The thoracic outlet syndrome is overdiagnosed. *Archives of Neurology* 1990;47(3): 328–30.
- 3. Thoracic Outlet Syndrome A Review Richard J. Sanders, MD,\* Sharon L. Hammond, MD,† and Neal M. Rao, MD *The Neurologist* Volume 14, Number 6, November 2008
- 4. Junoven 1995 Juvonen T, Satta J, Laitala P, Luukkonen K, Nissinen J. Anomalies at the thoracic outlet are frequently in the general population. *American Journal of Surgery* 1995;170(1):33–7.
- 5. Povlsen B, Belzberg A, Hansson T, Dorsi M. Treatment for thoracic outlet syndrome. *Cochrane Database of Systematic Reviews* 2010, Issue 1. Art. No.: CD007218.
- 6. Current management of thoracic outlet syndrome Mark W. Fugate, Lisa Rotellini-Coltvet, Julie A. Freischlag Current Treatment Options in Cardiovascular Medicine April 2009, Volume 11, Issue 2, pp 176-183
- 7. Edwards DP, Mulkern E, Raja AN, Barker P. Trans-axillary first rib excision for thoracic outlet syndrome. *Journal of the Royal College of Surgeons of Edinburgh* 1999;44(6):362–5.
- 8. Sonographic diagnosis of true neurogenic thoracic outlet syndrome. *Neurology* 2013;81;1965 Neil G. Simon, Jeffrey W. Ralph, Cynthia Chin, et al.
- 9. Electrodiagnostic features of true neurogenic thoracic outlet syndrome. Tsao, Bryan E. Ferrante, Mark A. Wilbourn, Asa J. Shields, Robert W. Muscle & Nerve. 49(5):724-7, 2014 May
- 10. Diagnosis of patients with thoracic outlet syndrome (TOS) using physiological measures of the medial antebrachial cutaneous nerve. Terao, Tohru. Ishii, Takuya. Kawamura, Daichi. Ohashi, Sou. Saito, Emiko. Abe, Toshiaki. Tani, Satoshi. Takahashi, Koichi. *No Shinkei Geka*. 40(8):685-94, 2012 Aug

# References

- 11. Sobey,A.V.F.,Grewal,R.P.,Hutchison,K.J.& Urschel J.D. Investigation of nonspecific neurogenic thoracic outlet syndrome. *J Cardiovasc Surg* 1993, 34: 343-345
- 12. Jordan, S.E.; Machleder, H.I. Diagnosis of thoracic outlet syndrome using electrophysiologically guided anterior scalene blocks. *Ann. Vasc. Surg.* 1998, 12, 260–264.
- 13. Neurogenic thoracic outlet syndromes JohnD.Urschel,S.MoradHameedandRajiP.Grewal *Postgrad Med J* 1994 70: 785-789
- 14. Jordan, S.E.; Ahn, S.S.; Freischlag, J.A.; Gelabert, H.A.; Machleder, H.I. Selective botulinum toxin chemodenervation of the scalene muscles for treatment of neurogenic thoracic outlet syndrome. *Ann. Vasc. Surg.* 2000, 14, 365–369
- 15. A Review of Thoracic Outlet Syndrome and the Possible Role of Botulinum Toxin in the Treatment of This Syndrome Jacqueline Mary Foley, Heather Finlayson and Andrew Travlos *Toxins* 2012, 4, 1223-1235
- 16. Gabriel C. Tender, Ajith J. Thomas, Najeeb Thomas, David G. Kline. Gilliatt-Sumner Hand Revisited: A 25-year experience *Neurosurgery* 55:883-890, 2004
- 17. Wasting of the hand associated with a cervical rib or band R. W. Gilliat, P. M. Le Quesne, Valentine Logue, A.J.Sumner *J. Neurol. Neurosurg. Psychiat.*, 1970, 33, 615-624
- 18. Yiannikis C, Walsh JC. Somatosensory evoked responses in the diagnosis of thoracic outlet syndrome. *J Neurol Neurosurg Psychiatry.* 1983 Mar;46(3):234-240.