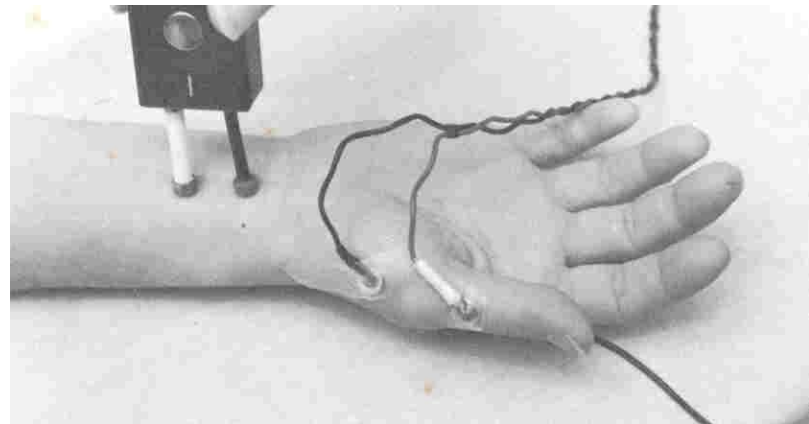


Nerve Conduction Studies and EMG

Limitations of other methods of investigations of the neuromuscular system

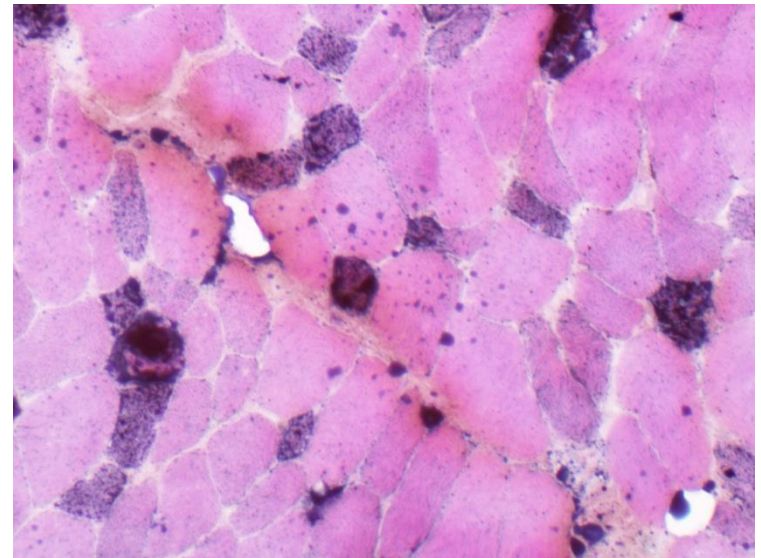
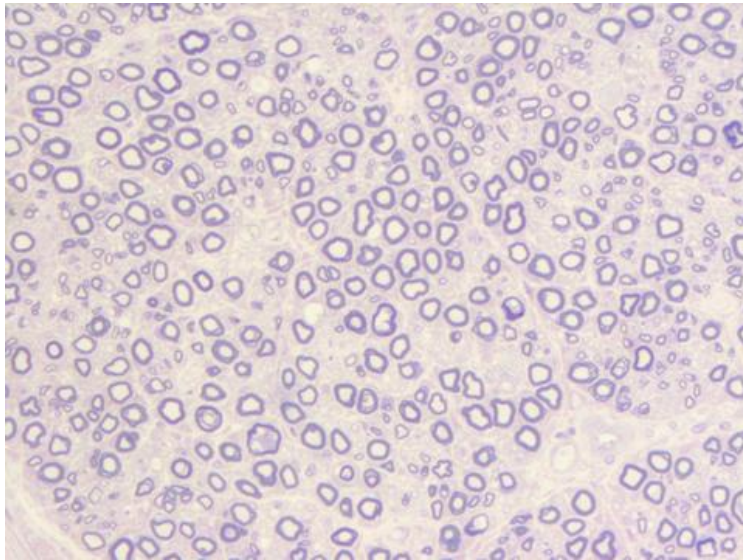
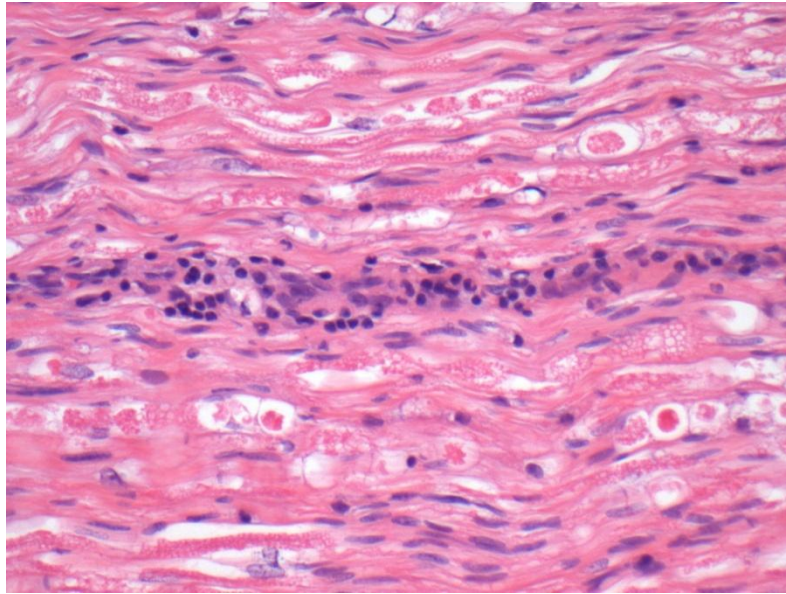
- Dr Rob Henderson, Neurologist



Assessment of Weakness



Thanks Peter Silburn

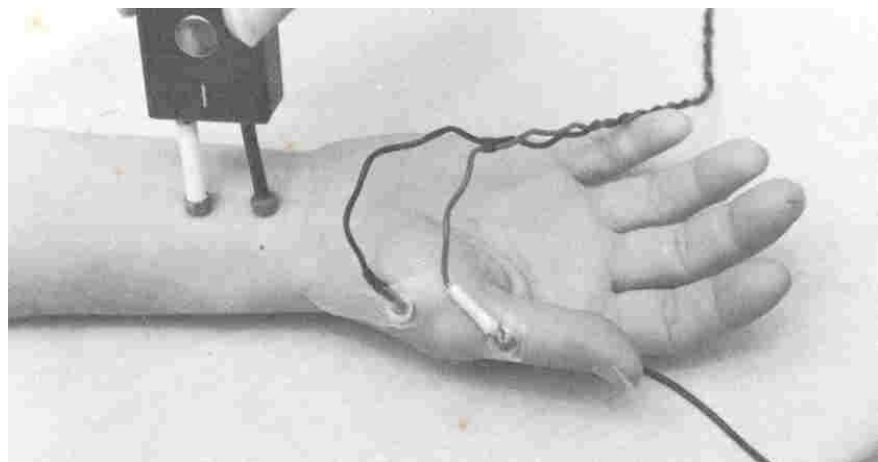


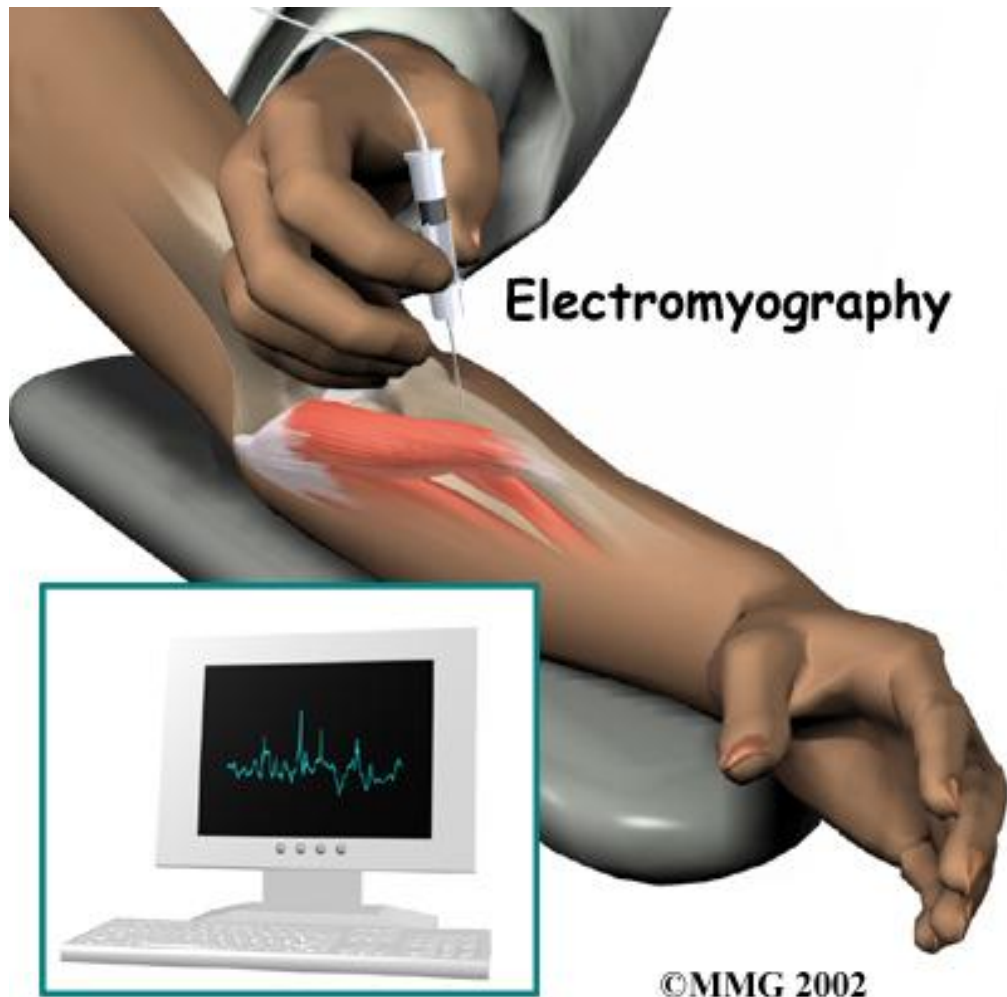
PERIPHERAL NEUROPATHY - NCS

- **Localisation**
 - sensory/ sensorimotor/ motor
 - length dependent vs plexoneuropathy vs polyradiculopathy
- **Specific diagnosis**
 - motor neuropathies (MMNCB, MND, distal myopathies)
 - sensory neuropathies (ganglionopathies)
- **Underlying Pathology**
 - demyelinating vs axonal
 - inherited vs acquired

PERIPHERAL NEUROPATHY - NCS

- **Assess for subclinical disease**
 - evidence for diabetic PN, drug side effects
- **Severity**
 - balance of denervation vs reinnervation
 - objective measures (amplitude)
- **Response to treatment and prognosis**
 - objective assessment with serial studies eg CIDP
- **Complement other investigations**
 - MRI, nerve and muscle biopsy



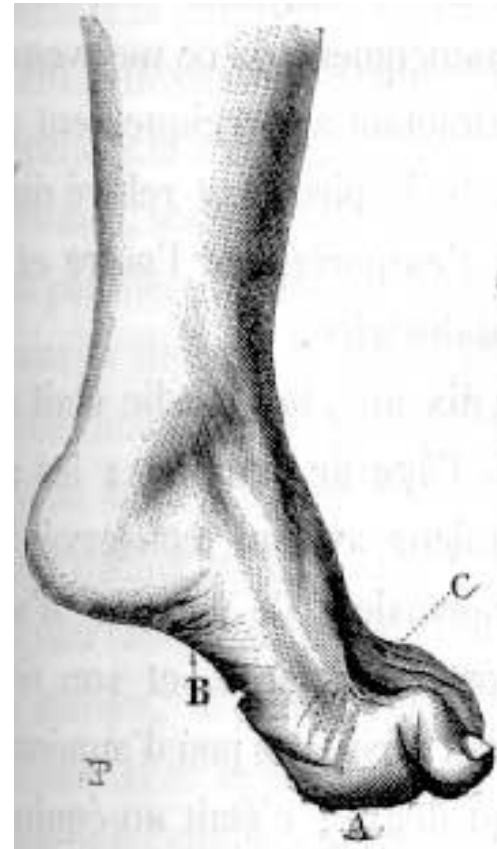


Electromyography

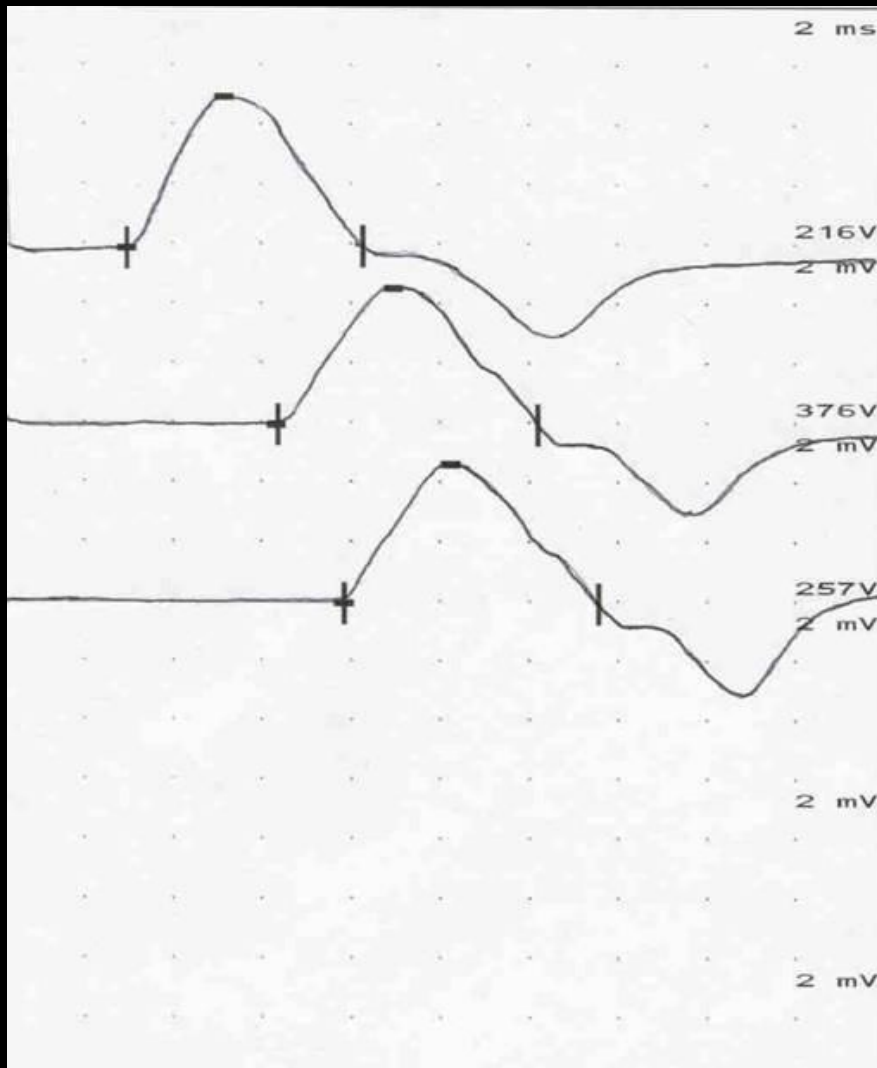
EMG Sounds

©MMG 2002

Brief Physical Examination







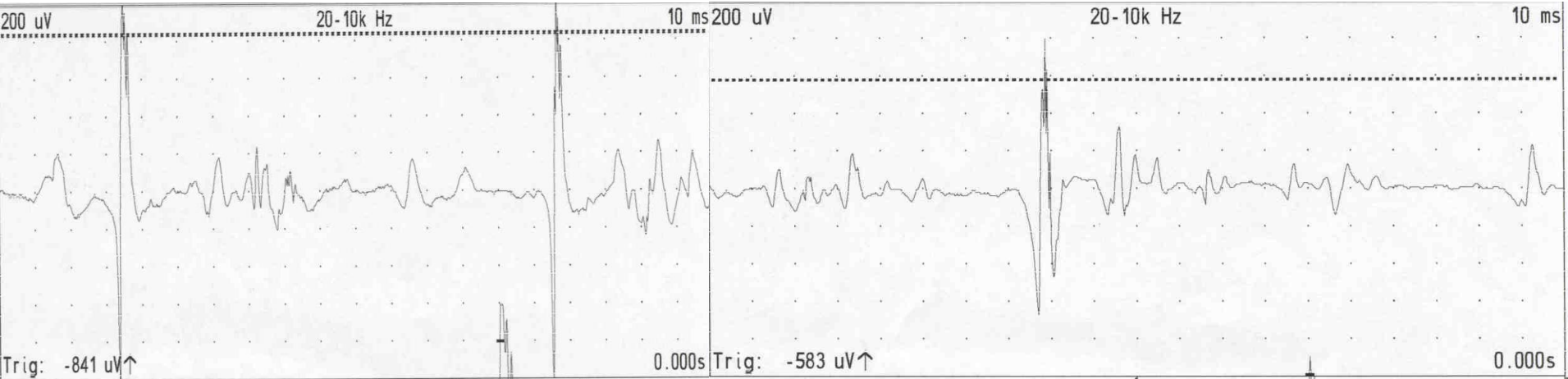
Trace Delay: 0 ms
 Birth Date: 14 DEC 76
 Exam. Date: 9 JAN 02 Age: 25Y 26D

Recording Site : ADM

STIMULUS SITE	LAT1 ms	DUR ms	AMP mV	AREA mVms
A1: Wrist	2.9	5.4	5.143	15.57
A2: Below elbow	6.3	5.8	4.609	15.16
A3: Above elbow	7.8	5.7	4.661	14.77
A4: Axilla				
A5: Erb's point				

SEGMENT	DIST mm	DIFF ms	CV m/s	TEMP °C
Wrist-Below elbow	200	3.4	59	
Below elbo-Above elbo	90	1.5	60	
Above elbow-Axilla				
Axilla-Erb's point				

EMG



Switch: Collect / Analyze

- Fibrillation
 - Pos. Waves
 - Fascics.
 - Polyphasics
 - MUP Amp uV
 - MUP Dur ms
- Max Amp mV
- MUP Pattern
- Max Effort

Polyphasic: 1 of 7 (14.3%)

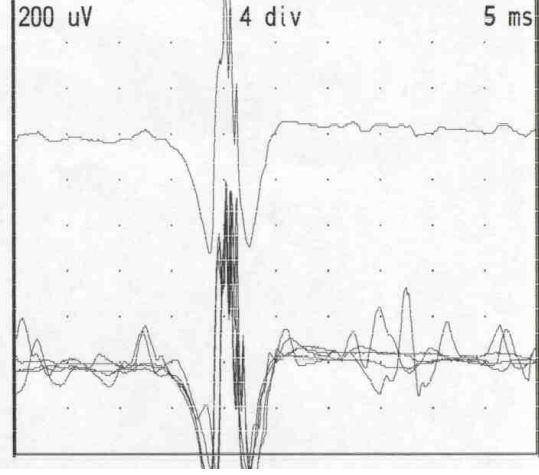
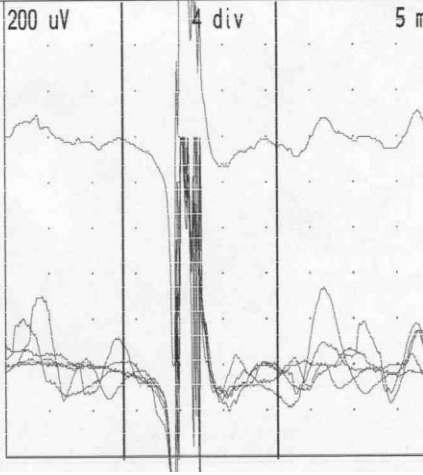
QMUP Data	Mu 7	All MUPs		NonPolyph.	
		Mean	SD	Mean	SD
Duration ms	17.7	32.2	20.4	17.7	0.0
Amplitude uV	OVFL				
Phases	3	4.5	2.1	3.0	0.0
Spike Dur ms	12.0	26.2	20.1	12.0	0.0
Risetime ms	0.2	0.3	0.1	0.2	0.0
Area uVms	3530	3920	551	3530	0
Size Index					

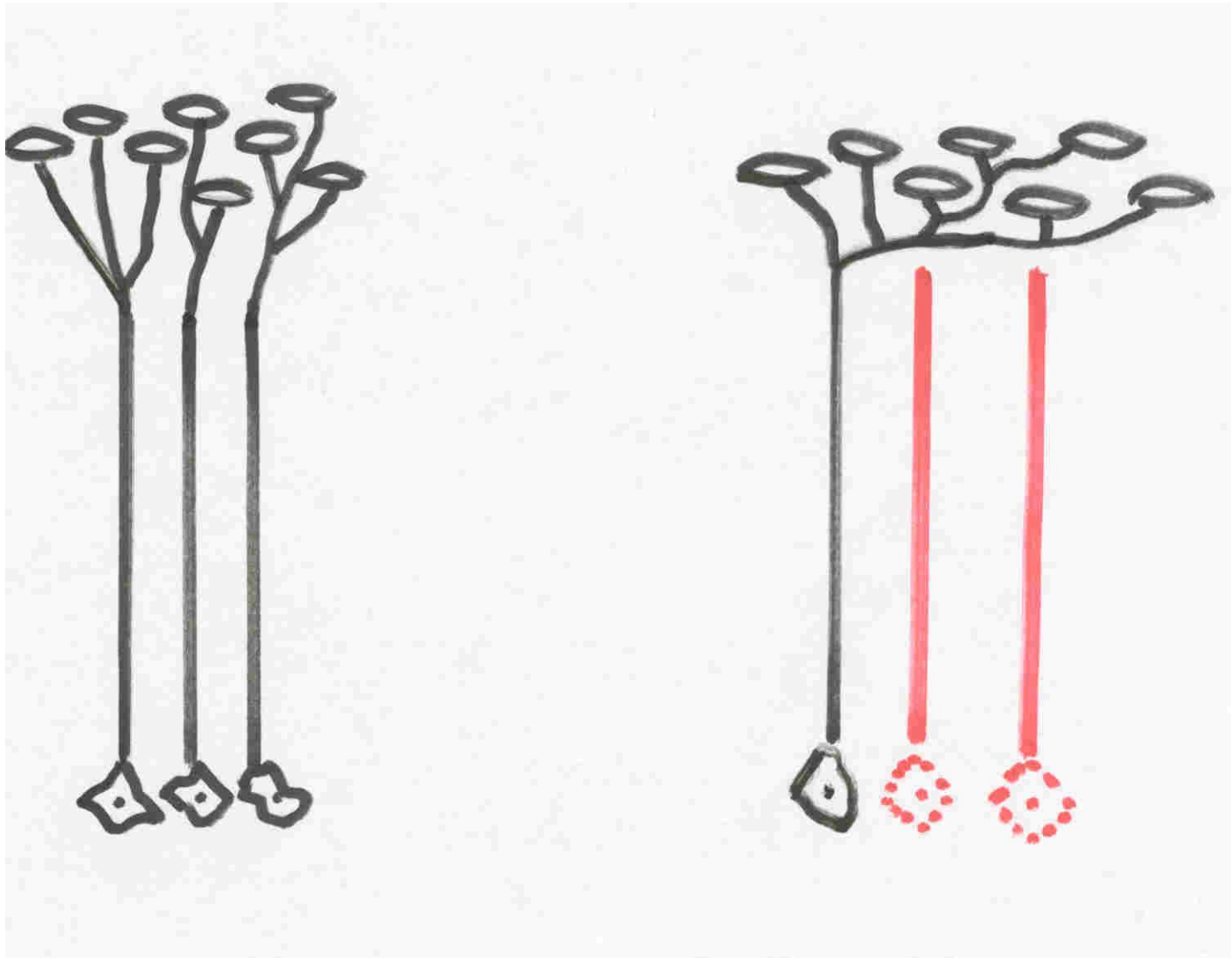
Switch: Collect / Analyze

- Fibrillation
 - Pos. Waves
 - Fascics.
 - Polyphasics
 - MUP Amp uV
 - MUP Dur ms
- Max Amp mV
- MUP Pattern
- Max Effort

Polyphasic: 1 of 4 (25.0%)

QMUP Data	Mu 4	All MUPs		NonPolyph.	
		Mean	SD	Mean	SD
Duration ms	13.8	1.2	14.7	0.0	
Amplitude uV	325	0			
Phases	4.5	0.7	4.0	0.0	
Spike Dur ms	10.9	1.0	11.6	0.0	
Risetime ms	0.6	0.0	0.6	0.0	
Area uVms	1960	1813	3242	0	
Size Index	1.11	0.00			





Know your muscle innervations

Debatable ones –

- Triceps
- Iliopsoas
- Medial Gastrocnemius

Differentiating –

- C5 from C6
- C6 from C7
- C8 from T1

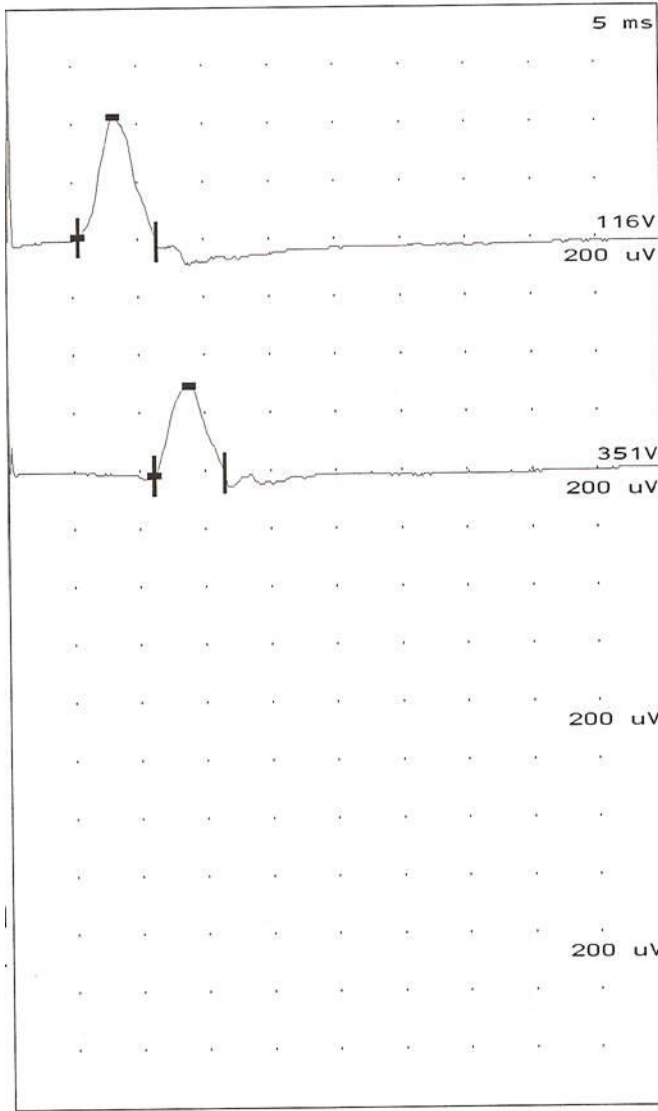
- L2 vs L3 vs L4



NCS

- 23 yo male engineering student. Background ADD.
- 6 weeks ago “escorted” from “The Family” nightclub at 5 am
- Lost feeling in left 1-3 fingers
- Went to RBWH DEM – urgent CTS decompression at 9pm
- Follow-up Hand Clinic – referred for NCS

3/52 after the event



Trace Delay:	0 ms
Birth Date:	10 DEC 85
Exam. Date:	27 AUG 07 Age: 21Y 260D

Recording Site : APB

STIMULUS SITE	LAT1 ms	DUR ms	AMP mV	AREA mVms	TEMP °C
A1: Wrist	5.3	6.0	0.419	1.209	
A2: Elbow	11.0	5.4	0.317	0.963	
A3: Axilla					
A4: Erb's poin					

SEGMENT	DIST mm	DIFF ms	CV m/s	TEMP °C
Wrist-Elbow		5.7		
Elbow-Axilla				
Axilla-Erb's point				

Median SNAP absent

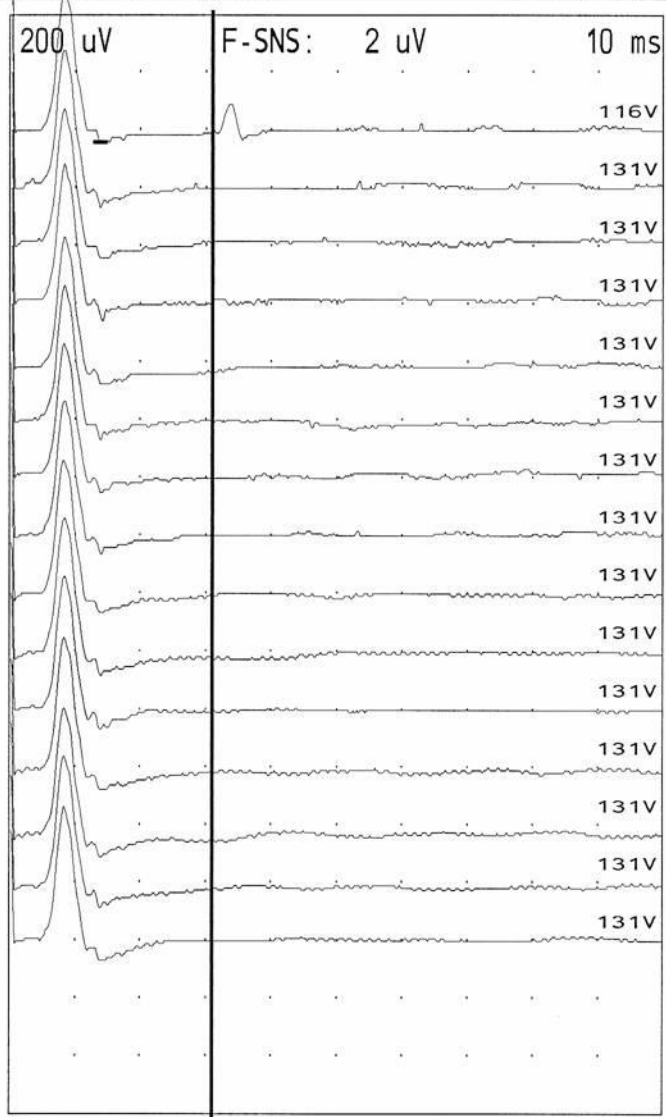
F-WAVES RECORD

1 Drew Ezzy

Median nerve .R
APB.R

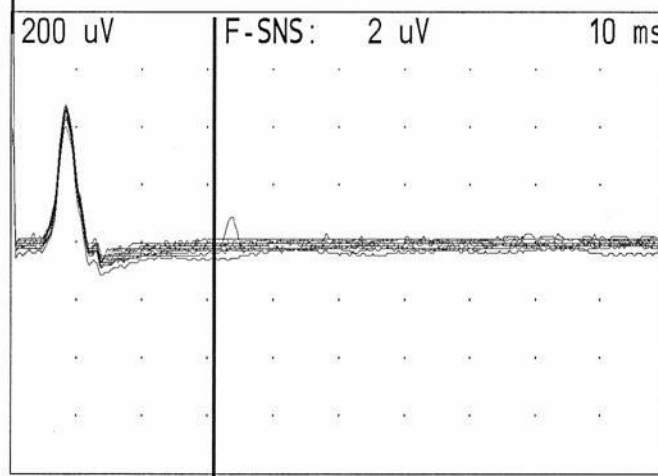
08:35:42

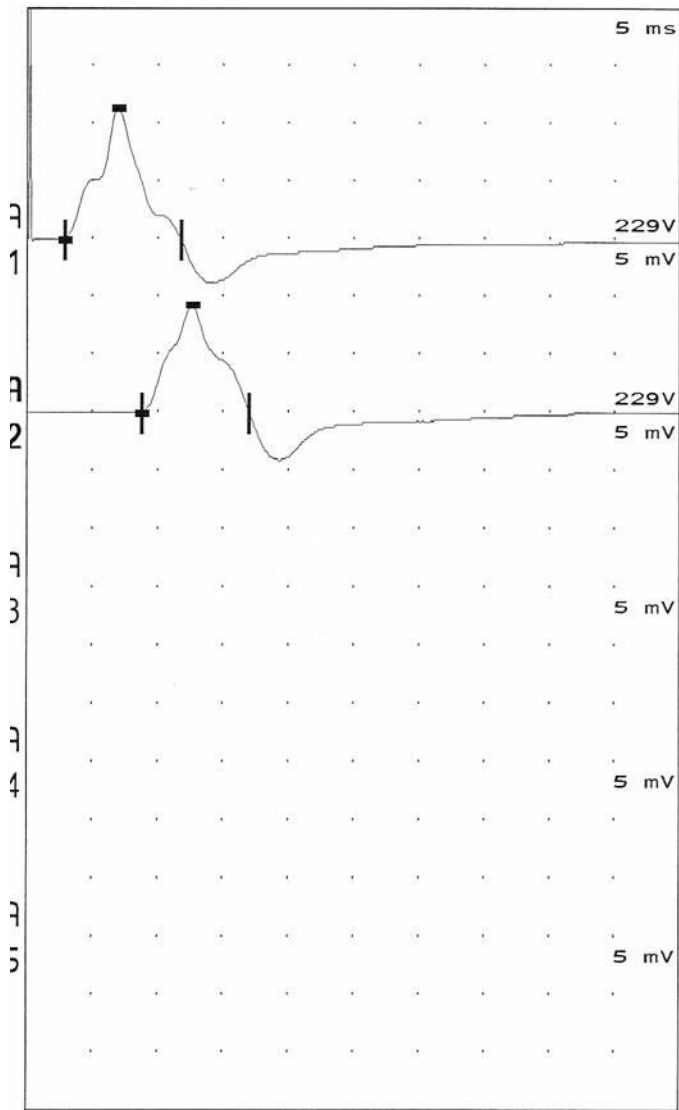
Switch: STOP
Stim: 1 Rate: 1.0 Hz Level: 131 V Dur: 0.1 ms Single



Trace: 16/16 Distance:
Stim: Wrist
Birth Date: 10 DEC 85
Exam. Date: 27 AUG 07 Age: 21Y 260D

M-LAT: 0.0 ms M-Amp: 0.521 mV
F-LAT: 30.9 ms





Step: 2	Average: Off	Rectify: Off
Trace Delay: 0 ms		
Birth Date: 10 DEC 85		
Exam. Date: 27 AUG 07 Age: 21Y 260D		

Recording Site : ADM

STIMULUS SITE	LAT1 ms	DUR ms	AMP mV	AREA mVms
A1: Wrist	2.8	8.9	11.38	40.94
A2: Below elbow	8.7	8.2	9.245	37.28
A3: Above elbow				
A4: Axilla				
A5: Erb's point				

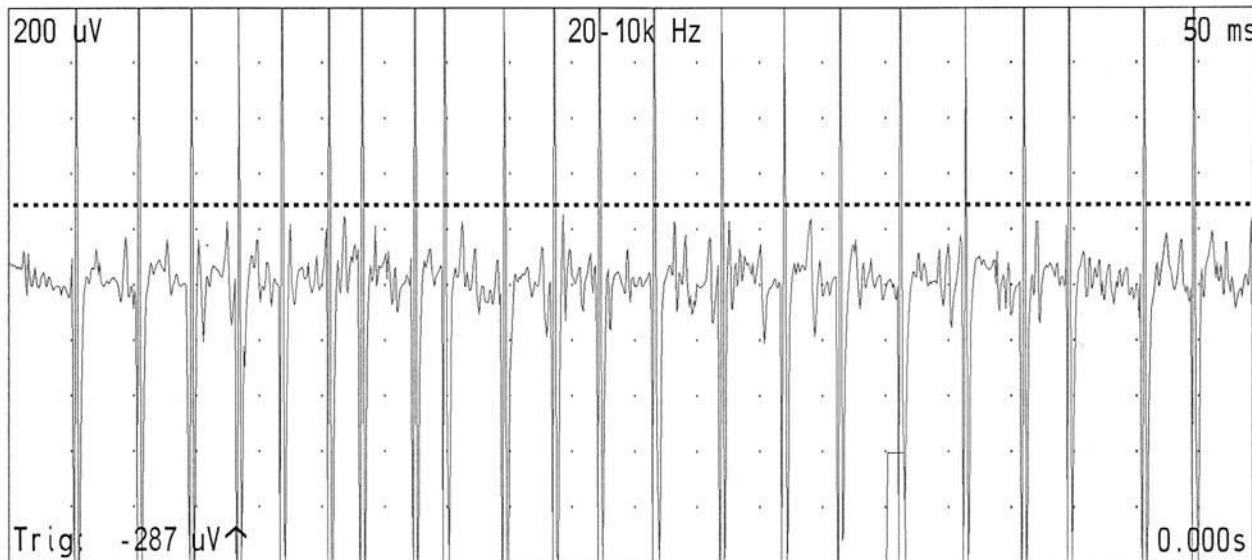
SEGMENT	DIST mm	DIFF ms	CV m/s	TEMP °C
Wrist-Below elbow	360	5.9	61	
Below elbo-Above elbo				
Above elbow-Axilla				
Axilla-Erb's point				

Ulnar SNAP 22 uV at wrist

QMUP RECORD

1 Drew Ezzy

08:57:11



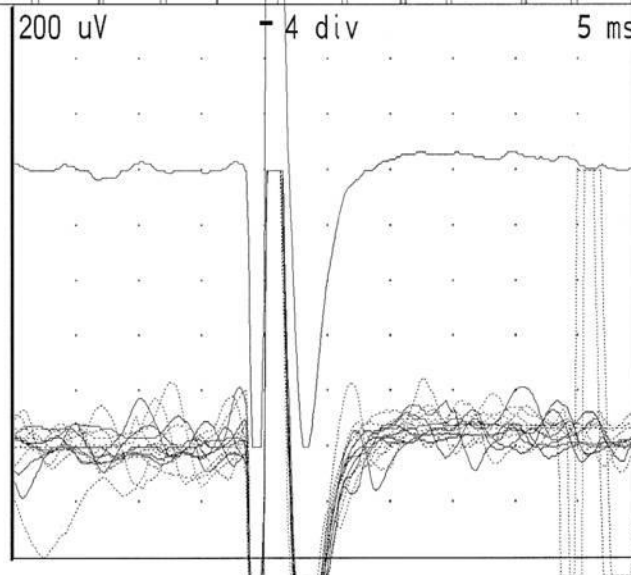
Switch: Collect / **Analyze**

- Fibrillation
- Pos. Waves
- Fascics.
- Polyphasics
- MUP Amp uV
- MUP Dur ms

- Max Amp mV
- MUP Pattern
- Max Effort

Polyphasic: 0 of 1 (0.0%)

QMUP Data	Mu 1	All MUPs		NonPolyph.	
		Mean	SD	Mean	SD
Duration ms					
Amplitude uV					
Phases					
Spike Dur ms					
Risetime ms					
Area uVms					
Size Index					

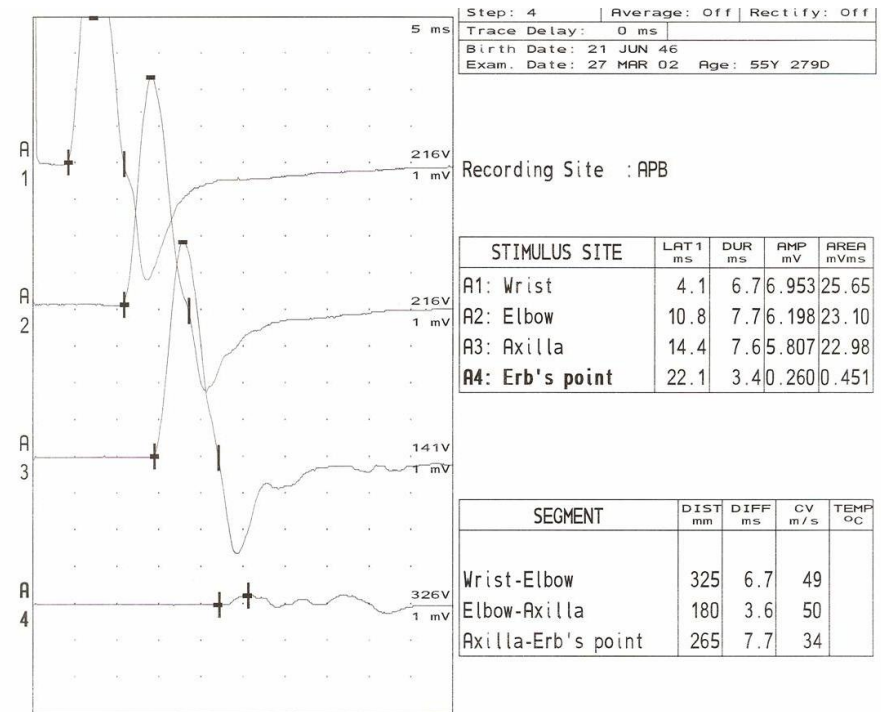


MRI



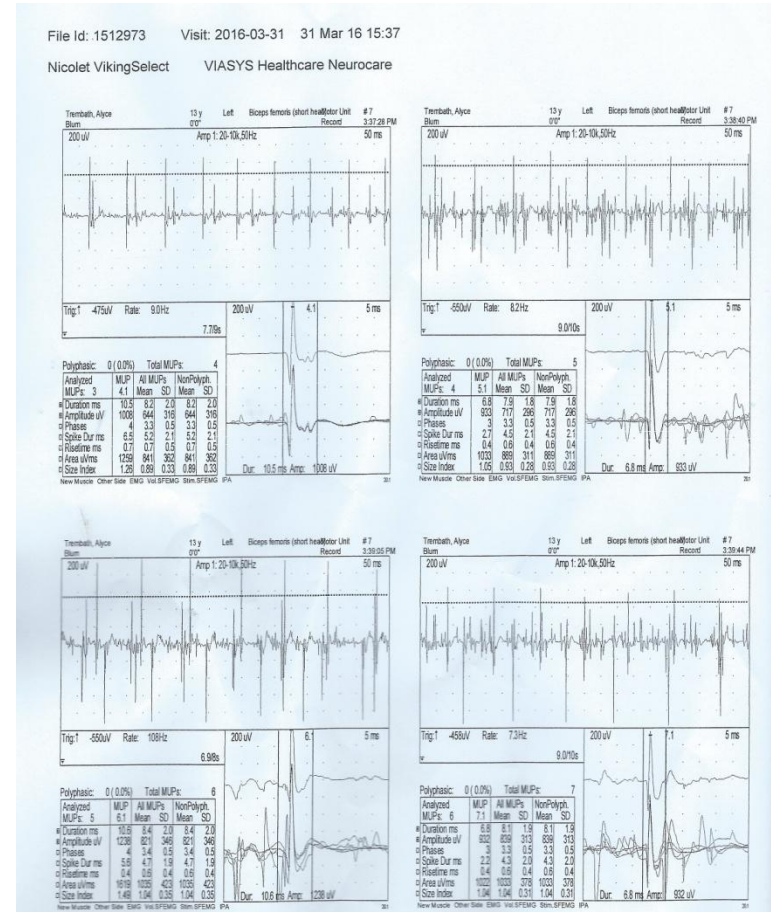
Interpreting NCS

- Amplitude
 - Motor
 - Sensory
- Conduction Velocity
 - Latency
 - CV
 - F-wave
- Other eg Decrement



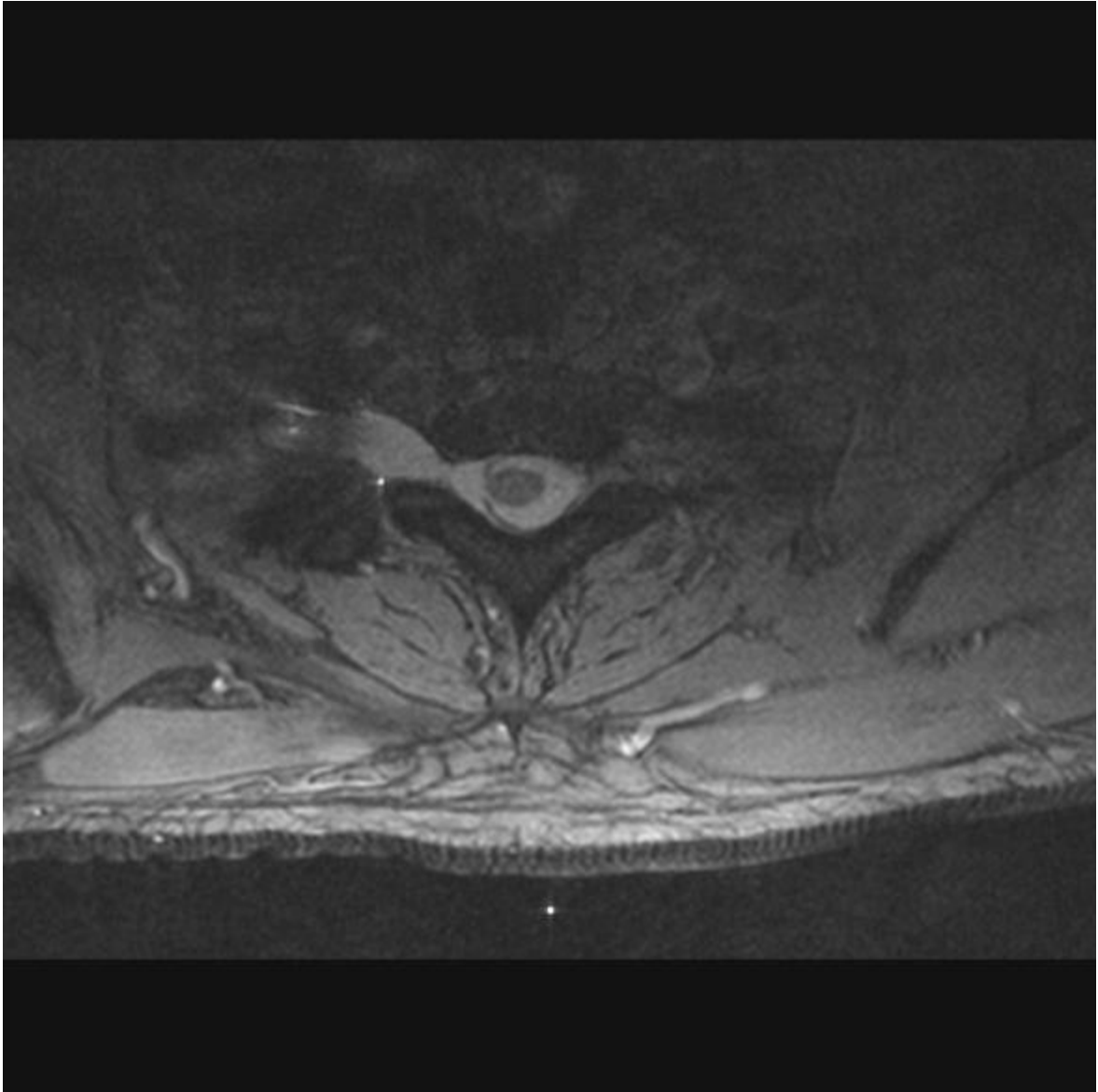
Interpreting EMG

- Insertional Activity
 - Fibrillations
 - Other
- Motor Units
 - Recruitment/Activation
 - Size
 - Polyphasia



Case 2

- 17 year old F-grade footballer
- Unremarkable Rugby Union tackle
- Sudden shoulder pain and near-complete right upper limb weakness and numbness
- Urgent MRI - “fluid in the brachial plexus with root avulsion”



Case 2

- O/E (10 days later):
 - mildly overweight
 - no movement of right shoulder or elbow;
?rhomboids
 - slight right finger extension; some finger abduction and wrist flexion and thumb movements relatively normal
 - absent right upper limb reflexes
 - loss of sensation along lateral shoulder/upper arm and forearm extending into thumb

Clinical Questions

- Root avulsions or damage to plexus as well?
- Apparent C5-C7 involvement, (sparing of ?C5, ?C8/T1)
- Any subclinical recovery?

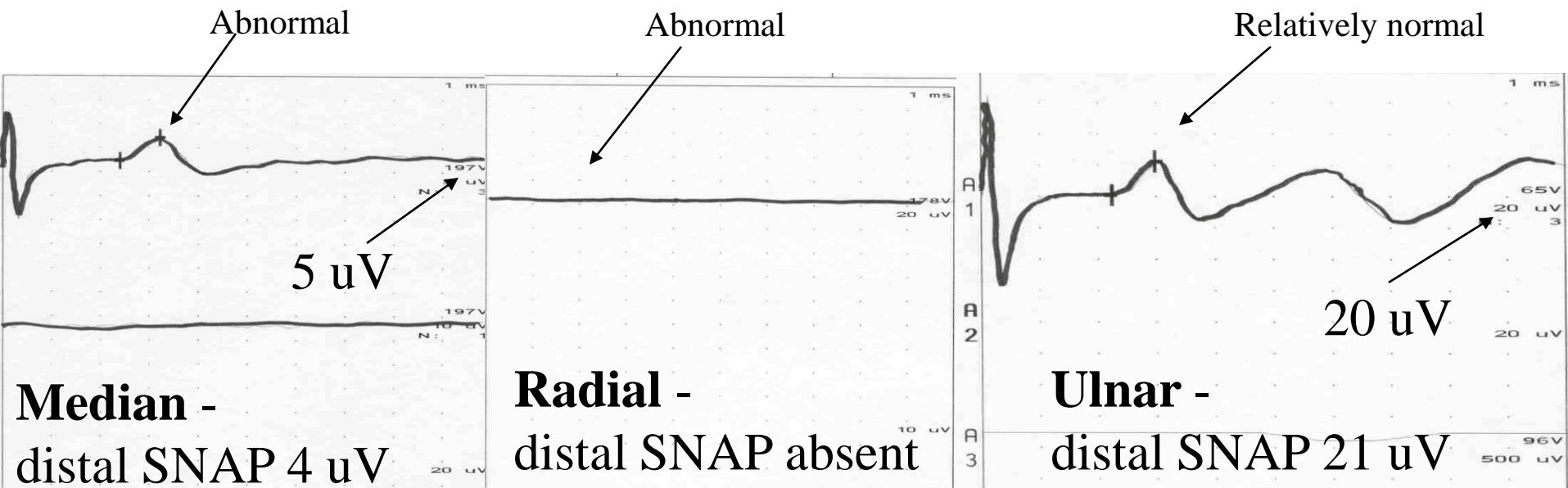
Case 2: EMG (10 days)

- EMG- no fibrillations; no recruitment in muscles of shoulder and elbow (C5,6,7) but preserved recruitment in finger abduction and flexion. Rhomboids difficult to determine- possibly preserved.

Case 2: EMG 6 weeks later

Median motor: Median motor 18.5 mV

F-waves : Median F-wave latency 29 m/s



Case 2: EMG 6 weeks later

- EMG:
 - Fibrillations in the right biceps, triceps, deltoid, extensor digitorum communis, brachioradialis, infraspinatus, pronator teres with no recruitment in these muscles.
 - Right first dorsal interosseous, flexor pollicis longus and rhomboids were normal.
 - Mid-cervical paraspinal - profuse fibrillations.

Case 2

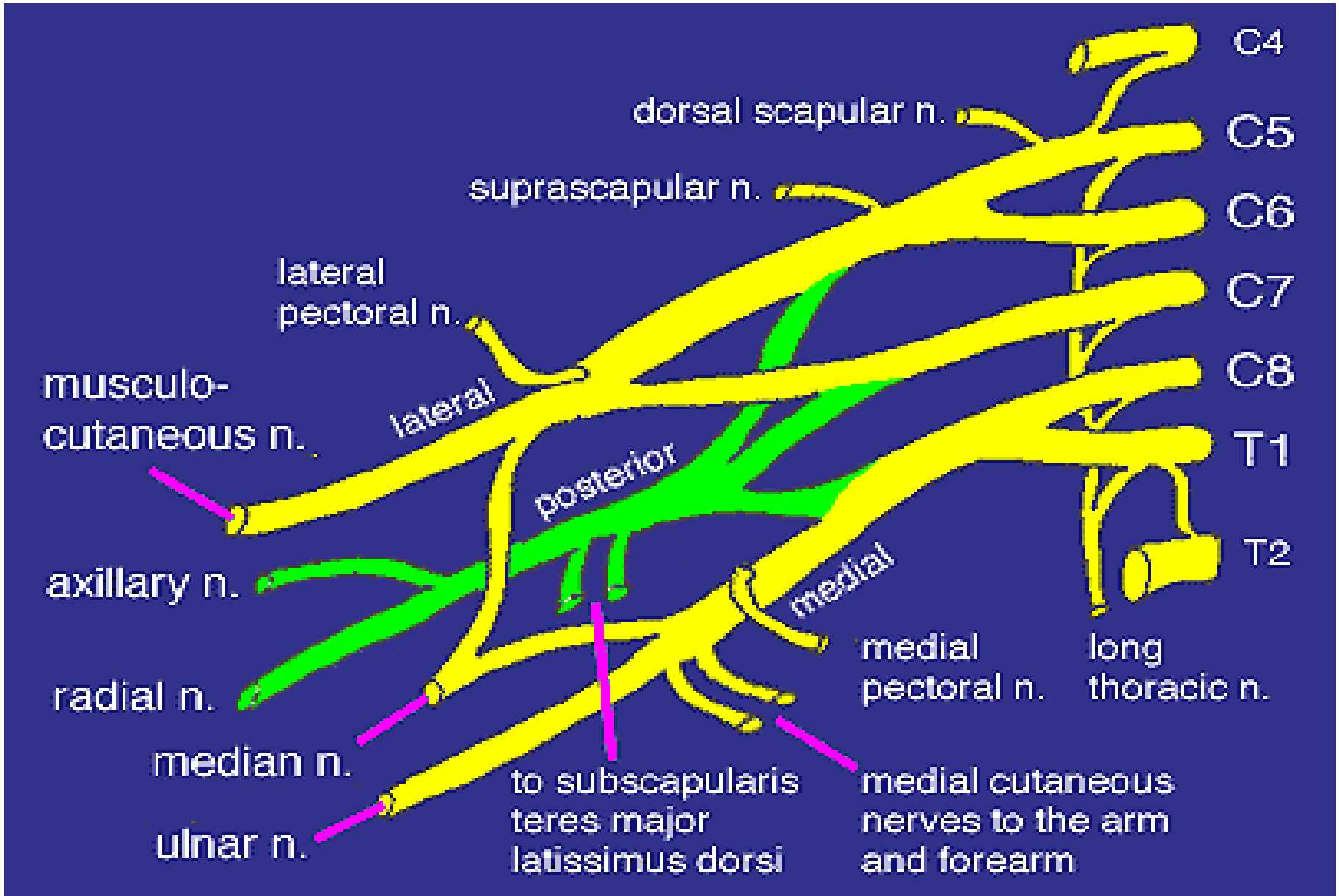
- Clinical/Electrophysiological relevance:
 - likely intact C4 nerve root
 - evidence of significant plexus involvement (upper and middle trunk) (potentially reversible) but unfortunately root avulsion (C6,7) is irreversible
 - further role in this patient will be to see if evidence of re-innervation following nerve grafts

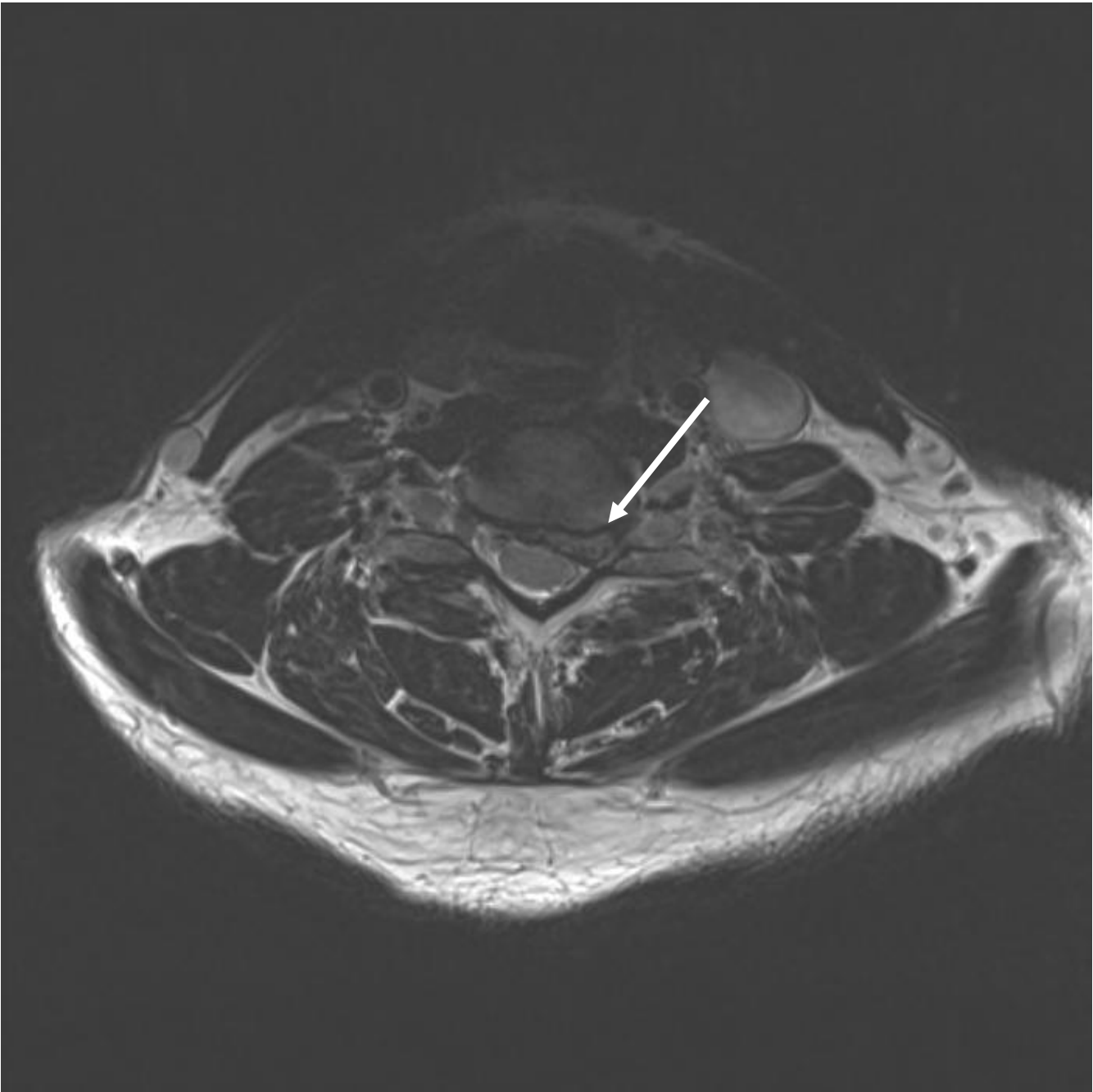
Case 2

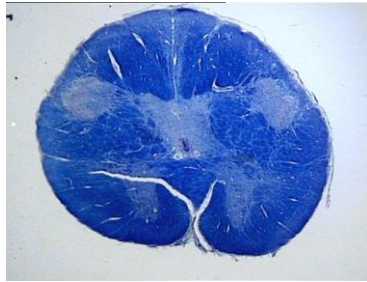
- Surgery 10 weeks following injury:
 - intact C5 nerve root ending in a large neuroma mass lateral to the scalenus anterior muscle, suprascapular nerve exited from the mass.
 - avulsion of C6 and C7.
 - Sural nerve graft from C5 to suprascapular nerve.
 - Medial pectoral to musculocutaneous nerve transfer.

Radiculopathy Pearls

- Radiculopathy common - Plexopathy uncommon!
- Nerve roots in C-spine named for disc above eg C6/7 disc will affect C7 root.
- Nerve roots in L/S-spine eg L4/L5 will affect L5 but can also affect S1.
- Some variability exists (5%) and proportion of nerve root contribution to different muscles varies in texts.







MND



- NCS/EMG remains the only diagnostic test for MND and the only wide-used criteria are based on NCS/EMG
- Update -
 - C9orf72
 - Clinical trials
 - Research
 - Multi-disciplinary Care

