



UNDERSTANDING EMG/NCS

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DISCLOSURES

- **Financial:**

- Employed by Spokane Spine Center
- Compensation for medicolegal work as an expert witness
- Adjunct faculty and student preceptor for PNWU
- Conference attendance and small stipend

- **Non-financial:**

- Go Cyclones!



OBJECTIVES-

UNDERSTANDING THE IMPORTANCE OF:



EMG/NCS Studies



Referring Patients



Risks and Considerations



Usefulness in Clinical Practice



Performance and Interpretation

WHAT IS NERVE CONDUCTION/EMG



Nerve Conduction Study (NCS), sometimes called NCV - evaluates the electrical conduction of the motor and sensory nerves.



Electromyography (EMG)- diagnostic procedure to assess the health of muscles and the nerve cells that control them.



Purpose- Diagnose conditions affecting muscle and nerve function.

REFERRING PATIENTS

- Signs and Symptoms to refer for NCS/EMG?
 - Tingling or numbness in the arms, legs, hands or feet.
 - Muscle weakness, stiffness
 - Functional issues: difficulty buttoning clothes, handling objects, or walking
 - Radiating pain or burning
 - Muscle atrophy

REFERRING PATIENTS

- Preparing the Patient:
 - Testing initiated with nerve conduction study (NCS), followed by electromyography (EMG)
 - Procedure Time= 30:00 for a single upper & up to 90:00 for a bilateral lower
 - Test completed on 2 limbs max (may include uninvolved-limb & paraspinal muscles)
 - Exception for high suspicion for ALS
 - Considerations- Severe Needle Phobia
 - EMG may (will) cause discomfort... consider other evaluation options

RISKS AND CONSIDERATIONS



PAIN AND DISCOMFORT:
POSSIBLE (LIKELY)
DURING PROCEDURE



COMPLICATIONS: RARE
BUT MAY INCLUDE
BLEEDING OR INFECTION



PACEMAKER: OK TO DO
NCS, NEED TO LIMIT
CURRENT IN LUE



SERIOUS BLEEDING
DISORDER



AUTOMATIC CARDIAC
DEFIBRILLATOR

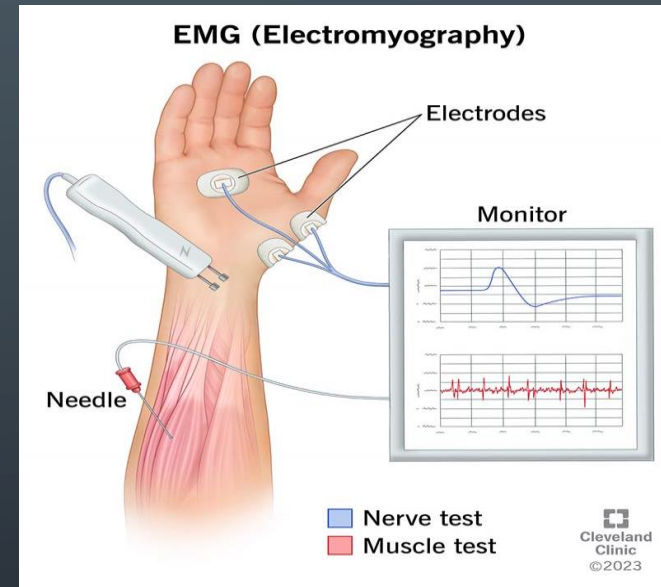


LYMPHEDEMA – RISK OF
INFECTION

HOW EMG/NERVE CONDUCTION STUDY WORKS



Process- Involves inserting a needle electrode into the muscle to record electrical activity



Components: Motor Neurons, electrical signals, muscle response

USEFULNESS IN CLINICAL PRACTICE



Diagnosis



Treatment



Progress and
Prognosis

BENEFITS OF EMG/NCS

ACCURATE DIAGNOSIS: HELPS IN
DIAGNOSING NEUROMUSCULAR DISORDERS



EARLY DETECTION: FACILITATES EARLY
INTERVENTION AND TREATMENT



MONITORING: ASSISTS IN MONITORING
MUSCLE ACTIVITY AND REHABILITATION

CONDITIONS DIAGNOSED BY EMG/NCS

Peripheral Neuropathy

Peripheral Nerve
Entrapment Syndromes
eg.: Carpal Tunnel
Syndrome, Cubital
Tunnel Syndrome, etc.

Radiculopathy

Myopathy

ALS (Amyotrophic
Lateral Sclerosis)

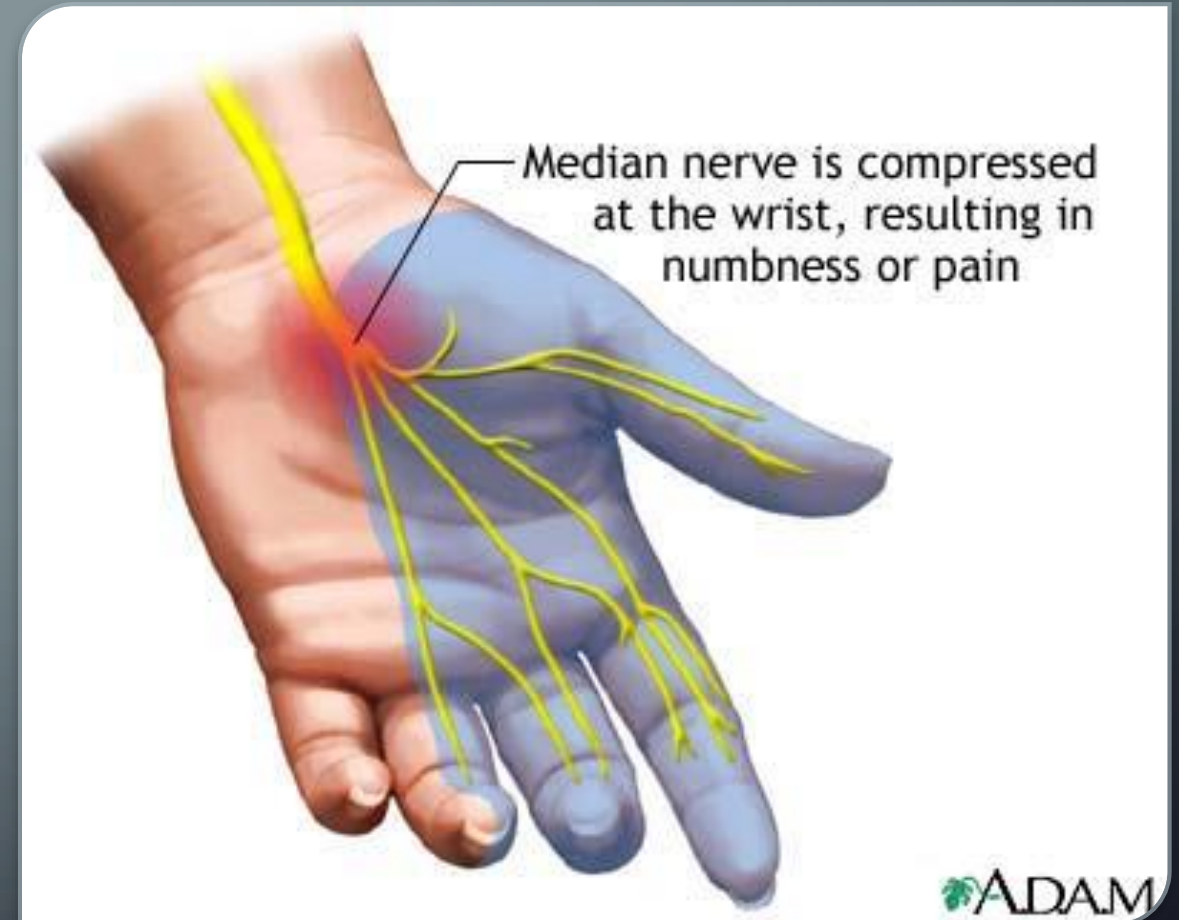
Myasthenia Gravis

Guillain-Barre
Syndrome

Chronic Inflammatory
Demyelinating
Polyneuropathy

DIAGNOSED CONDITIONS

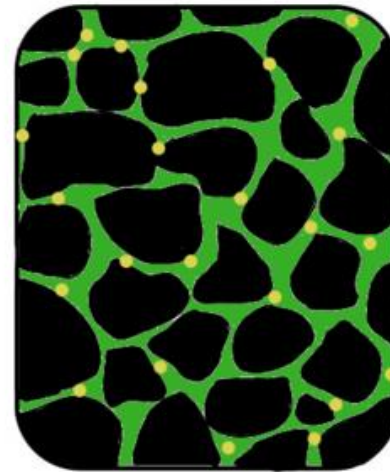
- Issues that affect peripheral nerves:
 - Peripheral neuropathy
 - Nerve compression syndromes:
 - Carpal tunnel syndrome
 - Cubital tunnel syndrome
 - Radial tunnel syndrome
 - Guyon canal syndrome
 - Tarsal tunnel syndrome
 - Sciatic neuropathy



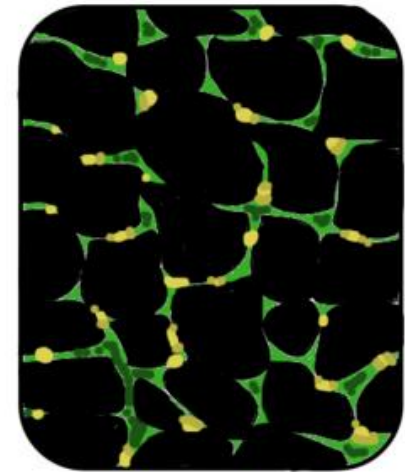
CONDITIONS

- Muscle Disorders (Myopathies):
 - Muscular Dystrophy
 - Polymyositis
 - Dermatomyositis

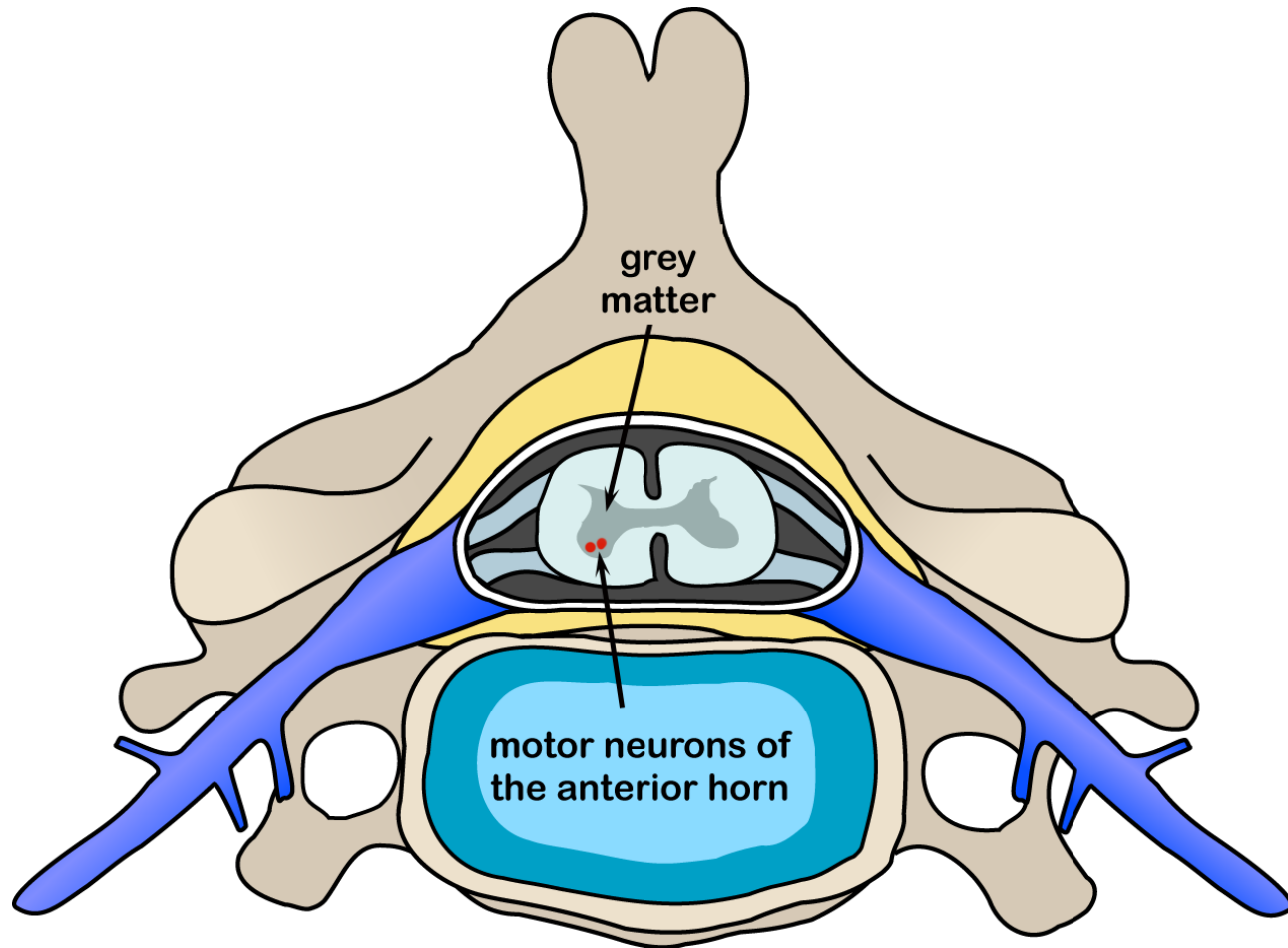
Muscular Dystrophy



Normal Muscle Tissue



Affected Muscle Tissue



OTHER CONDITIONS

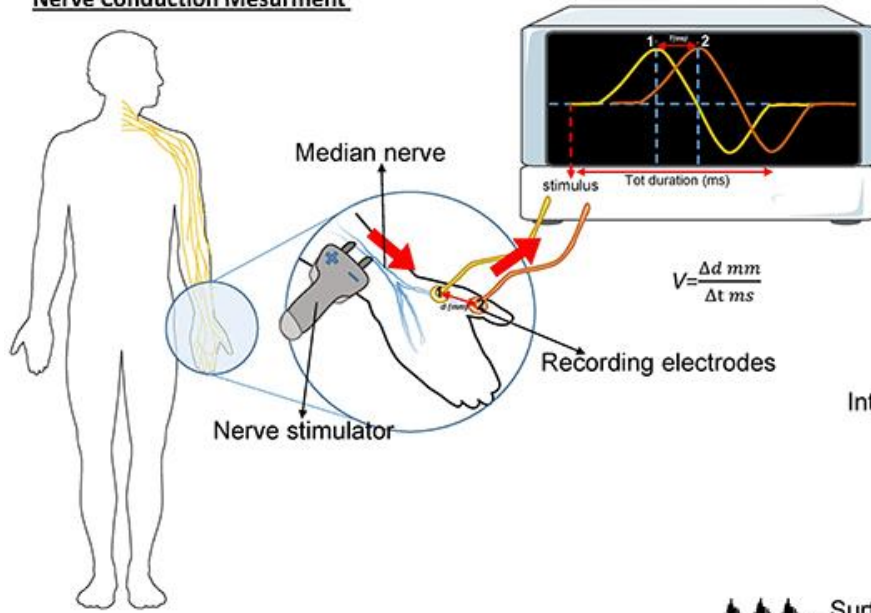
- Motor Neuron Disease
 - ALS most common
- Post-Polio Syndrome
- Myasthenia Gravis



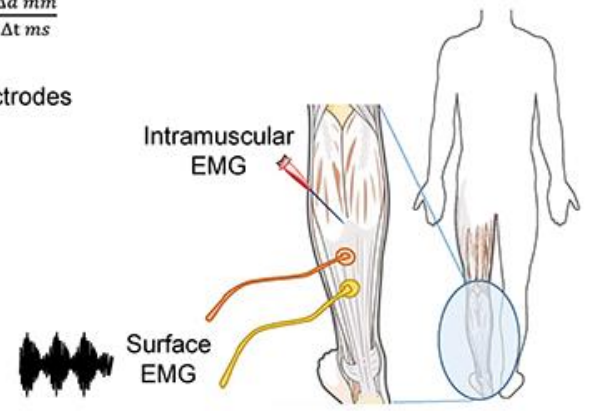
PERFORMANCE AND INTERPRETATION

NERVE CONDUCTION STUDY

Nerve Conduction Mesurment



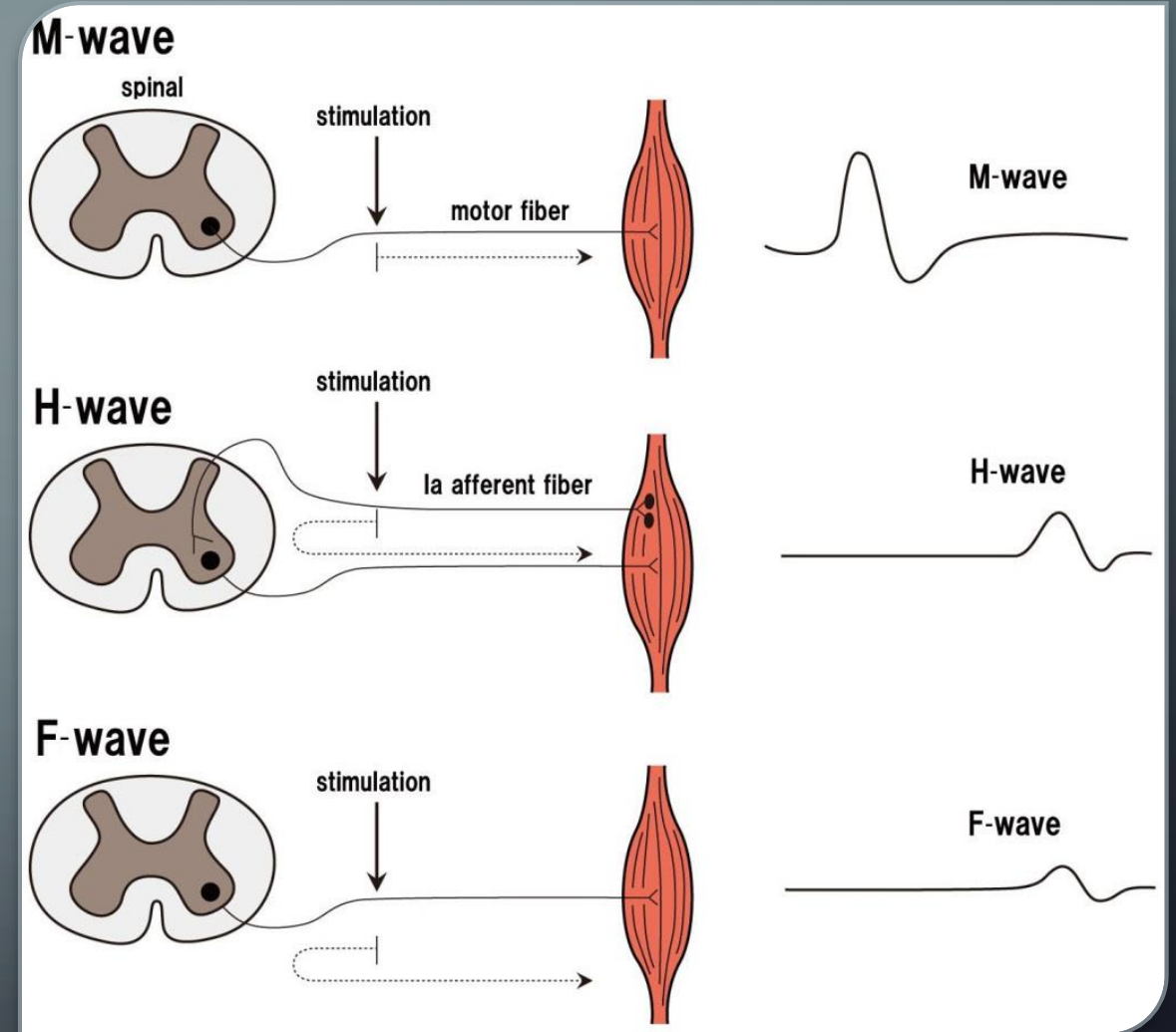
Electromyogram (EMG)



NERVE CONDUCTION STUDY

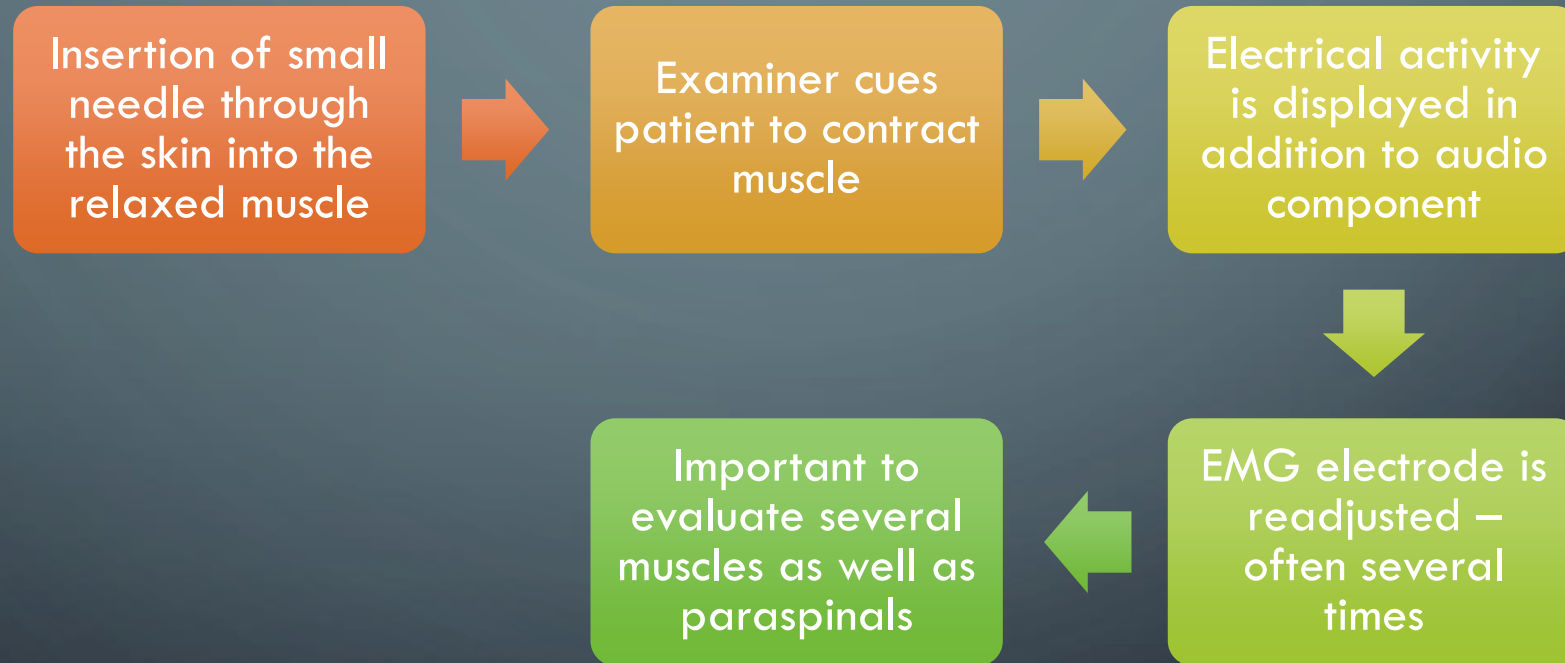
NCS

- Sensory nerves – antidromic vs orthodromic
- Motor nerves
- Mixed nerve studies – helps with carpal tunnel or cubital tunnel diagnosis
- F-waves – measures entire length of the nerve
 - Important in GBS -abnormalities in 92% of patients
- H-Reflexes – measures the S1 reflex



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NEEDLE ELECTROMYOGRAPHY



EMG INTERPRETATION

Observe resting muscle activity
normal = no activity

- Insertional activity, fibrillation potentials, positive sharp waves, fasciculations
- Complex repetitive discharges, myotonic discharges, myokymic discharges



Evaluating motor unit action potentials during muscle contraction.

- Amplitude, Duration, Polyphasic Potentials

UNDERSTANDING AN NCS/EMG REPORT

SPONTANEOUS ACTIVITY

- Can be a sign of muscle denervation.
- **Fibrillation potentials** are the action potentials of single muscle fibers firing spontaneously in the absence of innervation.
- Graded from 1+ to 4+
- Occur in muscle fibers that have lost innervation, transected nerves, regenerating nerves

UNDERSTANDING AN NCS/EMG REPORT

FIBRILLATION POTENTIALS

- Neurogenic disorders:
 - Radiculopathies
 - Mononeuropathies
 - Motor neuron disease
 - Loss or degeneration of axons*
 - Other causes of radiculopathy besides nerve root compression; Inflammatory mediator cytokines, perhaps from regional disk disease of other factors can be a source of neuropathic pain and a "chemical radiculitis" without evidence of nerve root compression.

IMPORTANT!

- There are other causes of radiculopathy besides nerve root compression and **MRI may not be helpful in the diagnosis of these types of radiculopathies.** Inflammatory mediator **cytokines**, perhaps from regional disk disease or other factors can be a source of neuropathic pain and a "**chemical radiculitis**" without evidence of nerve root compression.

CASE STUDY

- 61-yo female presents with bilateral hand paresthesia. Further history reveals neck pain that radiates into her shoulders. She experiences radiating symptoms down the posterior aspect of the arms, more on the left.
- **Static** neck x-ray reveals anterolisthesis of C3 on C4 and C4 on C5 (2 mm).
- Examination demonstrates positive Phalen's bilaterally, no atrophy of the thenars, grip weakness bilaterally, neck pain with Spurling's.

CASE STUDY

- NCS evaluation of the left median sensory and the right median sensory nerves showed prolonged peak latency and decreased conduction velocity.
- Ulnar and radial sensory findings were normal.
- Median and ulnar motor studies were normal.
- Median/radial (dig I) comparisons confirmed carpal tunnel syndrome.
 - Looks like bilateral demyelinating CTS affecting the sensory components



CASE STUDY

- CARPAL TUNNEL SYNDROME?

BUT WAIT, THERE'S MORE....



CASE STUDY

- SHOULD THEY BE REFERRED FOR CARPAL TUNNEL TREATMENT?
- SHOULD FURTHER TESTING BE COMPLETED?

STAY TUNED....

CASE STUDY

- EMG was performed on both upper extremities and the cervical paraspinal muscles.
- EMG showed spontaneous activity in C7 innervated muscles as well as the lower cervical paraspinals.
- Study is consistent with cervical radiculopathy/radiculitis, affecting the bilateral C7 nerve roots.

Now what?

CONCLUSION

- EMG/NCS should be considered before sending patients to surgery.
- EMG/NCS should be considered before sending patients for advanced imaging.
- Extension of the clinical examination.
- One piece of the puzzle – please don't rely on imaging studies alone!



Q & A

CONTACT DETAILS

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