



Physiology Team

MEDICAL COLLEGE 433

Applied Nerve & Muscle Physiology : Nerve Conduction Study (NCS) and Electromyography (EMG)

Color Index

Red = important

Purple = Addition

Orange = Explanation



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Objectives :

1. Define what is nerve conduction study (NCS) and electromyography (emg) .
2. Explain the procedure of NCS using Abductor Pollicis Brevis muscle .
3. Define the normal conduction velocity in upper limb and lower limb nerves .
4. Define the motor unit potentials (MUPs) and how they are changed in muscle and nervediseases .

Abbreviation :

- **NCS** = Nerve Conduction Study
- **CMAP** = compound muscle action potential
- **CRO** = Cathode-ray oscilloscope
- **MNCV** = Motor Nerve Conduction Velocity
- **EMG** = Electromyography
- **MUPs** = motor unit potentials

Keywords :

- Electrophysiology test
- Oscilloscope
- Latency

Nerve Conduction Study (NCS)

Definition

nerve conduction study (NCS) is an **electrophysiology test** that commonly used to evaluate the function of **peripheral nerves** of the human body.


It could be :

1. motor nerve conduction study (motor NCS)
2. sensory nerve conduction study.
3. mixed nerve conduction study.

**In the motor test the recorded response is the muscle CMAP
(compound muscle action potential)**

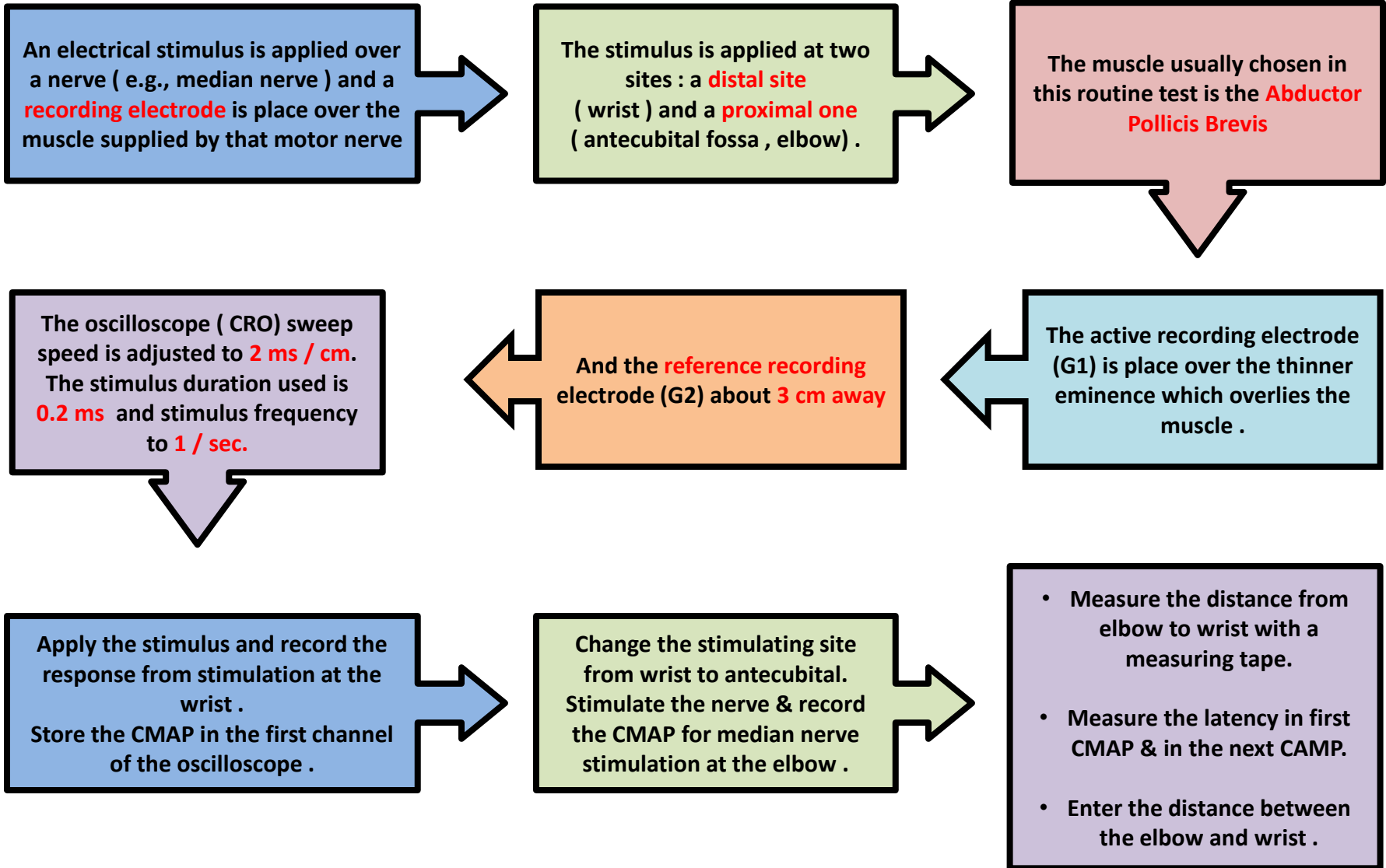
Purposes of nerve conduction study

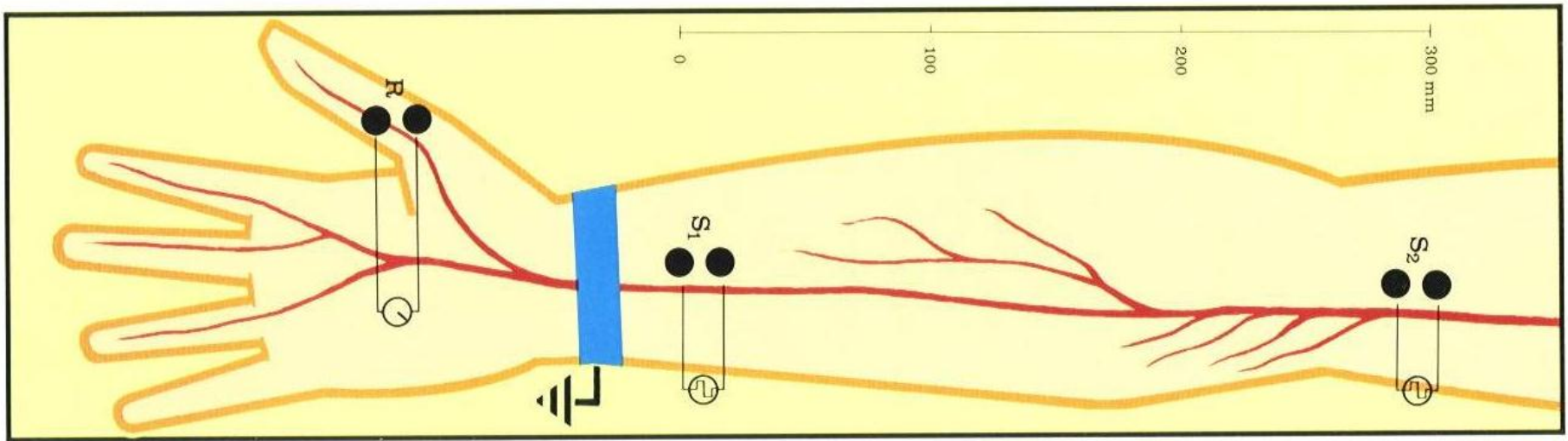
- To diagnose nerve damage or destruction
- To follow up nerve regeneration after damage.
- To evaluate diseases of nerve or muscle.



**To decide what to do
after diagnosing the nerve
damage (surgery,..etc.)**

Procedure :

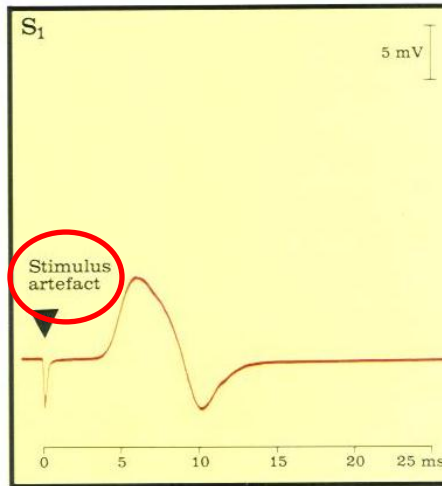




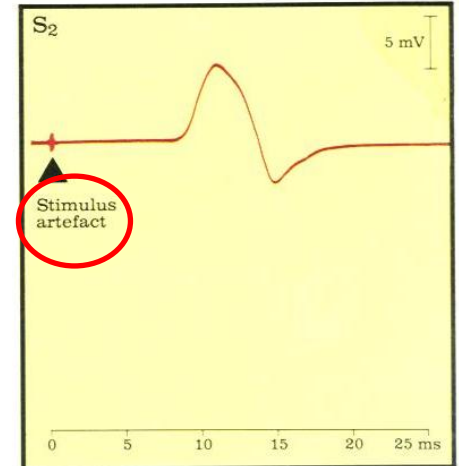
Distance
d = 284 mm



Latency: is the time between the stimulus artefact and the action potential



L1 Latency At wrist
= 3.5 ms



L2 Latency At elbow
= 8.5 ms

MNCV

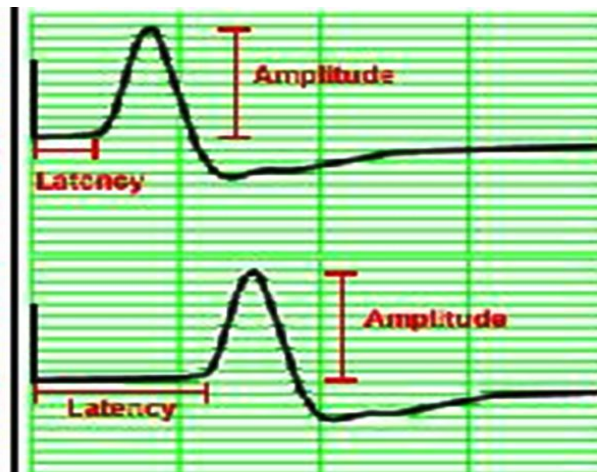
- MNCV will appear.
- It can also be calculated by formula

$$\text{MNCV (m/sec)} = \frac{\text{Distance (mm)}}{\text{L2-L1 (ms)}}$$

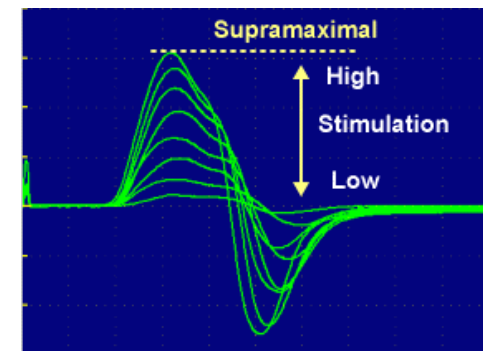
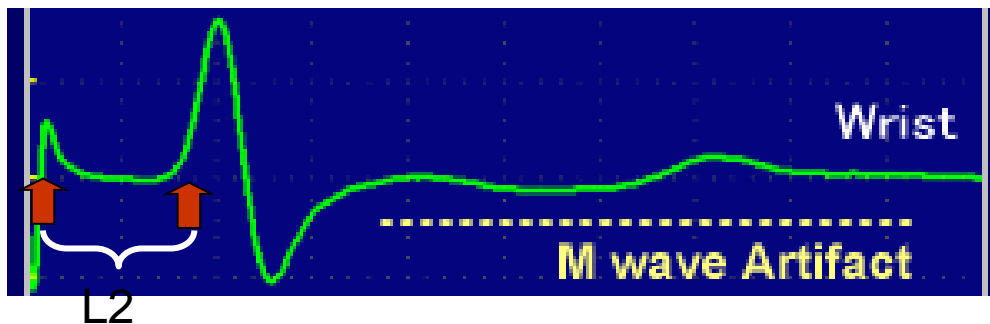
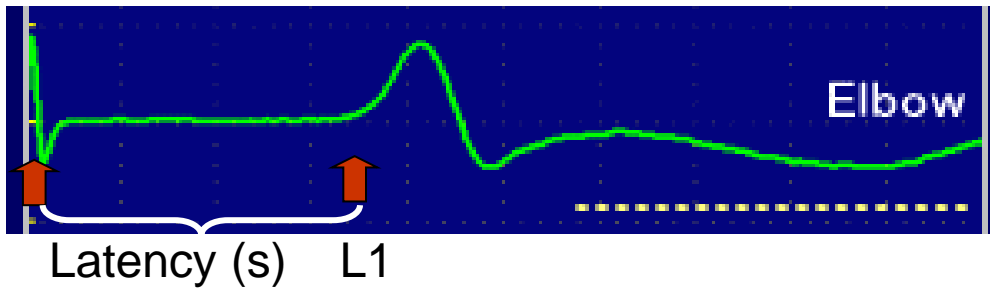
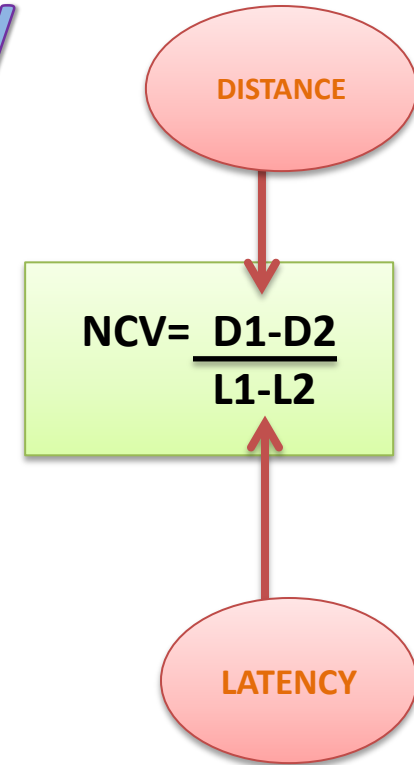
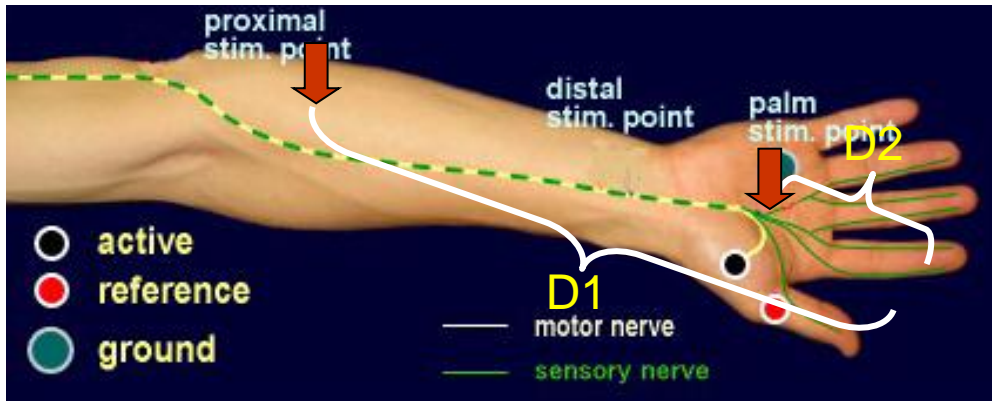
- L1 = latency at wrist
- L2 = latency at elbow

Normal values for conduction velocity

- ✓ In arm
 - 50 – 70 m / sec.
- ✓ In leg
 - 40 – 60 m / sec.



Nerve conduction velocity



Electromyography (EMG)

Definition

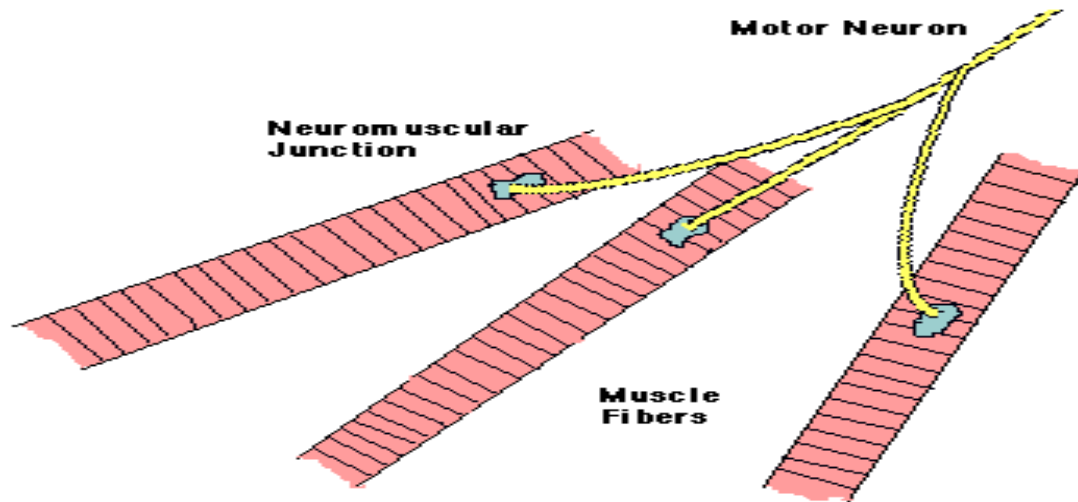
Electromyography (EMG) is a technique for evaluating and recording physiologic properties of muscles at rest and while contracting.

It's a recording of electrical activity of the muscle by inserting needle electrode in the belly of the muscles (needle EMG) **or** by applying the surface electrodes (surface EMG)

The potentials recorded in needle EMG are derived from motor units of the muscle, hence known as motor unit potentials (MUPs).

What is a (motor unit)?

A motor unit is defined as one motor neuron and all of the muscle fibers it innervates.

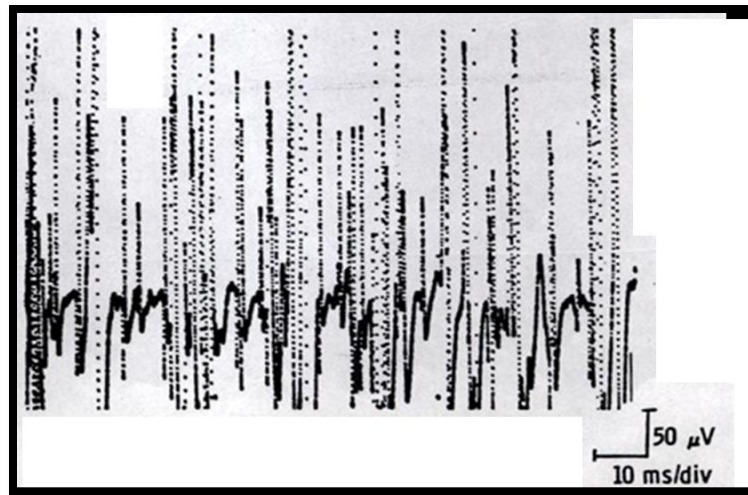


Normal MUPs

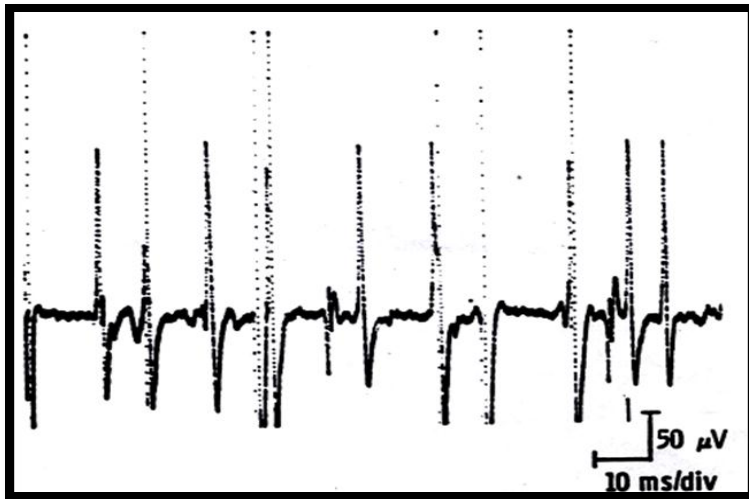
- Amplitude : **300 μ V** (microvolt) – **5 mV** (millivolts)
- Duration : **3 – 15 ms** (milliseconds)

Examples of Abnormalities of MUPs

- In nerve diseases : **Giant MUPs** due to **reinnervation > 5 mV**
- In muscle disease : **Small MUPs < 300 μ V**



During Mild Effort



During Moderate Effort → note recruitment of additional motoneurons



During Full Voluntary Effort . There is full recruitment (you can not see the baseline)

Summary :

1. The (NCS) is an electrophysiology test, used to evaluate the function of peripheral nerves.
2. The muscle which is used in (NCS) IS **abductor pollicis brevis**.
3. The normal values for conduction velocity in arm is (**-50-70 m/sec.**), and in leg is (**-40-60 m/sec.**)
4. motor unit is defined as one motor neuron and all of the muscle fibers it innervates.
5. The potentials recorded in needle EMG are derived from motor units of the muscle, hence known as motor unit potentials (MUPs).
6. In nerve diseases MUPs > **5 mV**.
7. In muscle disease MUPs < **300 μ V**.



What to expect: EMG/Nerve Conduction Study

<https://www.youtube.com/watch?v=xdKwSymCpws>

Basic EMG and NCV

<https://www.youtube.com/watch?v=VWmLAWHlejI>

Multiple Choice Questions

Q1: is an electrophysiology test that commonly used to evaluate the function of peripheral nerves?

- A) Nerve Conduction Study
- B) Conduction Velocity
- C) MNCV
- D) None of them

Q4: is a technique for evaluating and recording physiologic properties of muscles at rest and while contracting.

- A) CAMP
- B) NCS
- C) EMG
- D) MNCV

Q2: In motor nerve conduction study the recorded response is ?

- A) CAMP
- B) NCS
- C) EMG
- D) MNCV

Q5: Amplitude in Normal MUPS is ?

- A) 300 μ V (microvolt)
- B) 5 μ V (microvolt)

Q3: Normal values for conduction velocity in leg is ?

- A) 50 – 70 m / sec
- B) 45 – 65 m / sec
- C) 55 – 75 m / sec
- D) 40 – 60 m / sec

Q6: In muscle diseases, MUPS will be ?

- A) Small MUPS < 5mV
- B) Giant MUPS < 300 μ V
- C) Small MUPS < 300 μ V
- D) None of them