



#### ELECTROMYOGRAPHY EVOKED POTENTIALS

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## DEFINITION OF ELECTROMYOGRAPHY (EMG)

– EMG is an electrodiagnostic method aimed at the diagnosis of neuromuscular disorders (i.e., involvement of peripheral motor, sensory, and autonomic neurons, neuromuscular transmission and voluntary muscles).

- Methodologically it comprises two groups of techniques:
- Needle EMG using needle recording electrodes for registration of bioelectrical potentials from voluntary muscles;
- Conduction studies using artificial electrical stimulation of nerves and recording evoked responses from muscles or nerves with surface recording electrodes

#### **NEEDLE EMG I**

1. Insertion activity:

- Example of abnormal insertion activity: myotonic discharges



# **NEEDLE EMG II**

- ("end-plate noise")

- ("end-plate spikes")





#### NEEDLE EMG III

- -2. Abnormal spontaneous activity:
- fibrillation potentials and positive sharp waves





## **NEEDLE EMG IV**

- 2. Abnormal spontanneous activity:
- tetanic discharges
  (dublets, triplets, multiplets)



#### **NEEDLE EMG V**

#### 2. Abnormal spontaneous activity: neuromyotonic discharges



## **NEEDLE EMG VI**

3. Physiological activity at rest(no potentials)

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## **NEEDLE EMG VII**

- 3. Quantification of parameters of motor unit potentials (MUPs)
- indicator of microarchitecture of motor unit
- $\rightarrow$  Signs of chronic reinnervation



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## NEEDLE EMG VIII

3. Quantification of parameters of motor unit potentials (MUPs)

 indicator of microarchitecture of motor unit

 → Signs of myogenic lesion (decreased number of muscle fibers)



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#### **NEEDLE EMG IX**

3. Quantification of parameters of motor unit potentials (MUPs) – indicator of microarchitecture of motor unit

-  $\rightarrow$  Signs of myogennic lesion (decreased number of muscle fibers)



#### **NEEDLE EMG X**

#### 4. Assessment of recruitment of motor units and interference pattern



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### **CONDUCTION STUDIES I**

1. Motor conduction studies: diffuse conduction slowing



## **CONDUCTION STUDIES II**

1. Motor conduction studies : focal conduction slowing + conduction block



#### **CONDUCTION STUDIES III**

1. Motor conduction studies : focal conduction slowing + axonal loss

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## **CONDUCTION STUDIES IV**

1. Motor conduction studies : focal conduction slowing ("inching" technique)



## **CONDUCTION STUDIES V**

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1. Motor conduction studies : focal parcial conduction block

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## **CONDUCTION STUDIES VI**

1. Motor conduction studies : multifocal conduction slowing + conduction block



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## **CONDUCTION STUDIES VII**

1. Motor conduction studies : repetitive stimulation of motor nerve

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## **CONDUCTION STUDIES VIII**

#### 2. Sensory conduction studies



# **EVOKED POTENTIALS (EP): DEFINITION**

- Evoked potentials represents bioelectrical response of the brain (or spinal cord and peripheral nerves) to external stimuly (mostly of sensory character) – sensory EP.
- Evoked potentials (as a diagnostic method or tool) are electrodiagnostic methods that register and evaluate bioelectrical potentials triggered by visual (VEP), auditory (BAEP) and somatosensory stimuli (SEP).
- Motor evoked potentials (MEP) use magnetic (originally electrical) stimulation to excitate motor cortex (transcranially) and to register response from a muscle.
- Endogenous or congitive potentials are long-latency responses related to cognitive processes or iniciation of voluntary movement; it is mostly research tool.

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#### **EVOKED POTENTIALS: TECHNICAL PRINCIPLE**

Evoked potentials generated in the cortex or spinal cord and recorded over the scalp or the spine have the magnitude in order of microvolts (therefore lower than EEG or artifacts). Extraction of these EP "burried" in other electrical activity at the recording areas is enabled by the "averaging" method performed by a computer. EP appears in a constant time interval from the stimulus (in contrast to otherwise accidental other electrical activities).

#### **EVOKED POTENTIALS: CLINICAL IMPORTANCE**

They:

- Objectify clinical data and offer quantitative information;
- Capture subclinical lesion or dysfunction
- Offer precision of localisation of the lesion;
- Could monitor function of the system or pathway during surgery

#### **VISUAL EVOKED POTENTIALS**

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#### **BRAINSTEM AUDITORY EVOKED POTENTIALS**



#### **SOMATOSENSORY EVOKED POTENTIALS**

Cortex

Electrical stimulation of the median nerve at the wrist

**Cervico-medullar junction** 

**Cervical posterior horns** 

**Erb's point** 



### SOMATOSENSORY EVOKED POTENTIALS



#### **MOTOR EVOKED POTENTIALS**

Magnetic stimulation of the cervical or lumbar roots (RL) and cortex (CL)



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