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Hands-on Course 1/5

Conventional needle EMG (Level 1)

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Needle EMG

Electromyography - conventional

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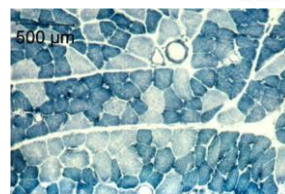
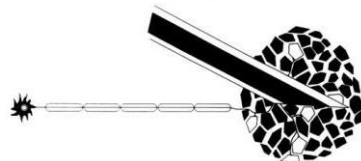
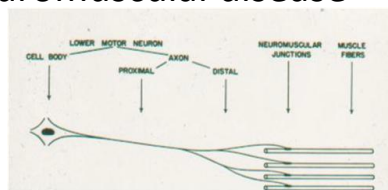
The hands-on course

- Needle EMG
 - Short theoretical introduction
 - Demonstration of practical recording
 - Discussion with audience
 - If time permits – discussion of cases

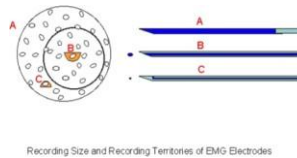
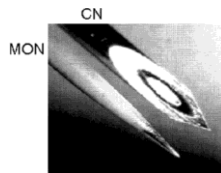


EMG is a central method to differentiate weakness due to neuromuscular disease

- Diagnose weakness as being due to:
 - Myopathy
 - Neurogenic lesion
 - Neuromuscular transmission
 - (CNS affection)
- Specific diagnosis of disease:
 - *e.g.* ALS, myotonic dystrophy
- Evaluate course of disease:
 - Acute
 - Chronic, sequelae
 - Progressive
 - Regeneration



Electrodes for recording EMG signals determine the parameters that can be evaluated



Different electrodes record from different areas of the motor unit: A) macroelectrodes record from the whole motor unit, B) concentric needle (CN) electrode from selected areas, and C) SFEMG from an individual fiber

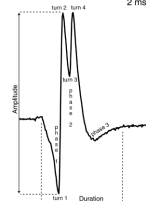
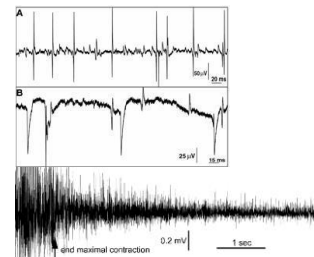
Equipment set-up should be considered:

1. Frequency range: 2 (or 20Hz) – 10 kHz
2. Trigger function
3. Display: raw, superimposed, averaged MUP signals



Elements of the EMG examination

- **Activity at rest (stability & excitability of the muscle or axonal cell membrane):**
 - Denervation activity
 - Fasciculations
 - Myotonia
 - Complex repetitive discharges
- **Activity during weak effort (structure and function of motor units)**
 - Motor unit potentials
- **Activity during maximal voluntary effort**
 - Recruitment pattern

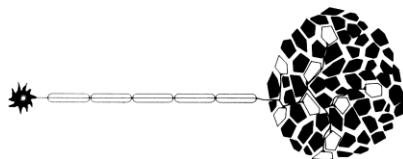
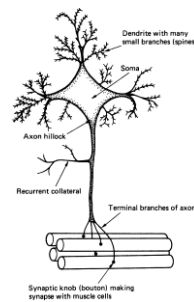


End-plate potentials (EPP), miniature end plate potentials (MEPP), fibrillation activity

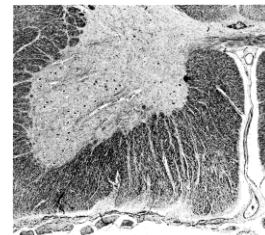


The motor unit

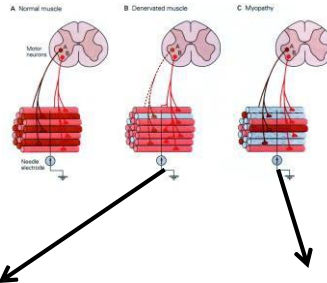
- Anterior horn cell, nerve fiber, muscle fibers
- Anterior horn cell in the CNS
- Great variation in "innervation ratio"



Clin. Neurophysiol.



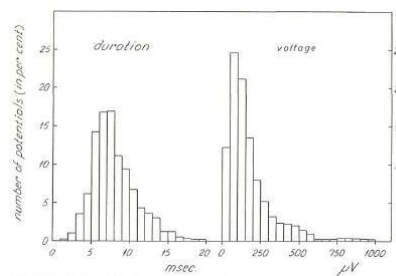
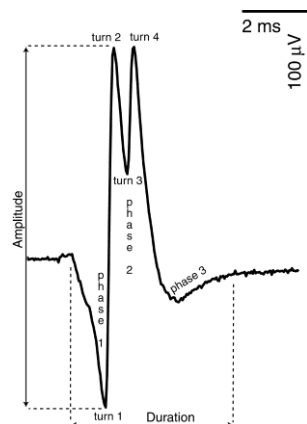
Basic muscle pathophysiology



- Neurogenic disorders
 - denervation
 - loss of function of M.U. - weakness
 - collateral sprouting and reinnervation
 - incorporation of muscle fibers in remaining M.U. – recovery of function and preserving strength
 - final result
 - fewer and larger M.U.
- Muscle disease
 - degeneration/failure of muscle fibers
 - loss of function of muscle fibers – weakness
 - regeneration of muscle fibers
 - incorporation in M.U. – preserving strength
 - final result
 - Normal number but smaller M.U.



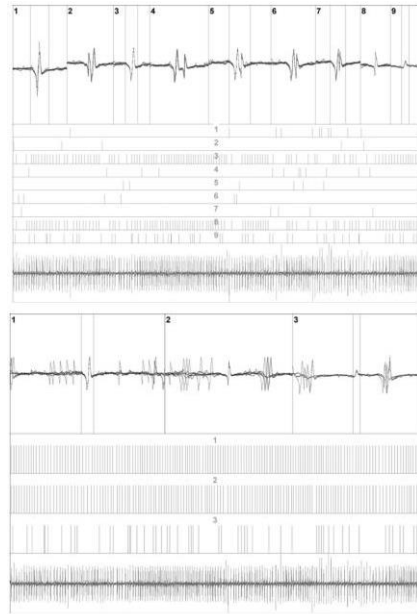
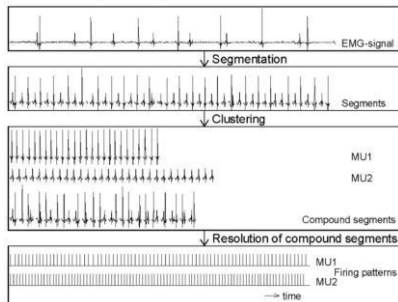
Motor unit potential variability



Measurements of durations and amplitudes of 1268 MUPs from the brachial biceps muscle of a normal man, aged 21 years. The durations ranged from 3 to 15 ms at different recording sites, from Buchthal



Analysis of motor unit potentials



EMG: maximal effort

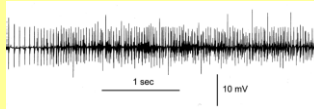
M. extensor digitorum communis – normal muscle



M. biceps brachii - myopathy



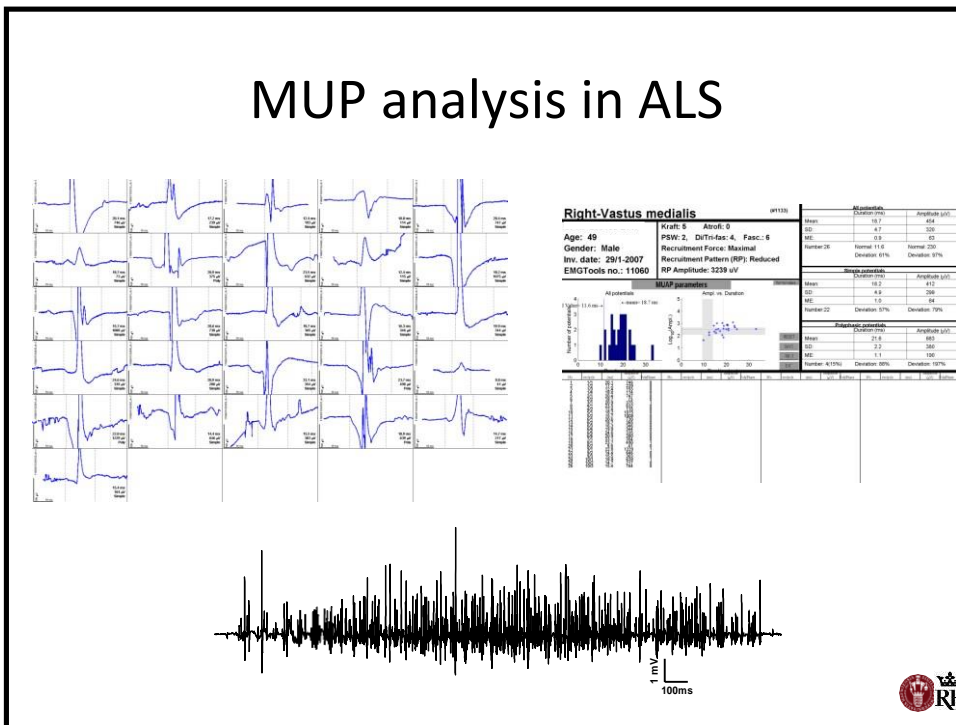
M. vastus medialis – motor neuron disease (Kennedy)



M. tibialis anterior – functional paresis



MUP analysis in ALS



Development of EMG changes in neurogenic disorders

Stage	Den	MUP	MVC
Acute	-/+	-	+
Intermediate	+	-	+
Chronic	(+)	+	+

Timeline: Days/week (Acute), weeks (Intermediate), months (Chronic)

The timing of EMG should be carefully considered in connection with the clinical problem

Summary

- Standardized approach
- Timing of study
- Denervation activity: mainly in neurogenic disorders but also in some myopathies
- MUP shape, amplitude and duration: distinguish between myopathy and neurogenic lesions
- Recruitment pattern: important and difficult!

