EMG analysis of MUP and IP

Stålberg

2 normal motor units

Myopathy
Parameters used in MUP analysis

<table>
<thead>
<tr>
<th>parameter</th>
<th>significance</th>
<th>measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>amplitude</td>
<td># fibres/0.5mm</td>
<td>peak-peak</td>
</tr>
<tr>
<td>area</td>
<td># fibres/2 mm</td>
<td>within dur</td>
</tr>
<tr>
<td>duration</td>
<td># fibres in 2.5 mm</td>
<td>slope criteria</td>
</tr>
<tr>
<td>phases</td>
<td>temp dispersion</td>
<td>0-cross + 1</td>
</tr>
<tr>
<td>turns</td>
<td>“</td>
<td>change in dir</td>
</tr>
<tr>
<td>rise time</td>
<td>closeness to fibre</td>
<td>neg-pos peak</td>
</tr>
<tr>
<td>satellites</td>
<td>extreme delay</td>
<td>late spike</td>
</tr>
<tr>
<td>jiggle</td>
<td>n-m transm</td>
<td>shape stability</td>
</tr>
</tbody>
</table>

Decomposition;
techniques to decompose a mixed signal into its constituents

This example: Multi MUP analysis
Multi-MUP, result

Multi-MUP analysis in different disorders
- Normal
- Neuropathy
- Myopathy

Dynamics of reinnervation
- Normal
- Ongoing reinnervation
- Late stage
Parameters to quantify

- shape of individual MUPs
- jiggle
- fullness
- recruitment (early, reduced)
- dynamic changes with time (fatigue)

Reference values - log amp

Stålberg
Summary of ref values - log amp

Interference pattern
EMG - interference pattern

Normal

Myopathy

Neuropathy
Interference pattern analysis in normal, neuropathic and myopathic conditions

A: NORMAL
B: NEUROPATHY
C: MYOPATHY

Envelope:
maximal amplitude after removing 4 highest and 4 lowest peaks/500 msec

Activity:
fulness of recruitment pattern
N3S, # of short segments related to MUP shape

Interference pattern analysis in a patient with polymyositis

SLIGHT MYOPATHY
MODERATE NEUROGENIC

CENTRAL WEAKNESS

SLIGHT MYOPATHY (TYPE 2 ?)
**Myopathy**

- spont (m) fib/psw myotonic CRD
- spont (n) MUP ↓ ampl ↓ dur
- shape poly
- jitter
- recruitment early
- TA/FFT myopathic
- fullness normal
- FD ↑
- jitter normal

**Inactive neurogenic**

- spont (m)
- spont (n) MUP ↑ ampl ↑ dur
- shape
- jitter
- recruitment late
- TA/FFT neurog.
- fullness ↓
- FD ↑
- jitter

**Subacute neurogenic**

- spont (m) fib/psw CRD
- spont (n) neuromyot myokymia
- MUP ↑ ampl ↑ dur
- shape poly
- jitter
- recruitment late
- TA/FFT neurog.
- fullness ↓
- FD ↑
- jitter ↑
**Myasthenic pattern**

- spont (m) (fib/psw)
- spont (n)
- MUP
- shape
- jiggle
- recruitment
- TA/FFT
- fullness
- FD normal
- jitter ↑

**Central weakness**

- spont (m)
- spont (n)
- MUP normal
- shape normal
- jiggle normal
- recruitment irregular
- TA/FFT
- fullness ↓
- FD normal
- jitter

**Comparison of electrophysiological parameters**

<table>
<thead>
<tr>
<th>Parameters</th>
<th>normal</th>
<th>myopathy</th>
<th>denervation</th>
<th>axon loss</th>
<th>CB</th>
<th>central</th>
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<tbody>
<tr>
<td>SFEMG FD</td>
<td>n</td>
<td></td>
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<td>n</td>
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<tr>
<td>Con MUP</td>
<td>n</td>
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<td></td>
<td>n</td>
<td>n</td>
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<tr>
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<td></td>
<td>n</td>
<td>n</td>
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<td>Macro</td>
<td>n</td>
<td></td>
<td>near</td>
<td>i</td>
<td>n</td>
<td>i</td>
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<tr>
<td>MUNE</td>
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<td></td>
<td></td>
<td></td>
<td>n</td>
<td>n</td>
</tr>
<tr>
<td>TMS</td>
<td>n</td>
<td></td>
<td></td>
<td></td>
<td>n</td>
<td>i</td>
</tr>
</tbody>
</table>

Stålberg
Reasons for performing QEMG

- standardized way of measuring
- improved sensitivity
- new parameters
- results can be transferred
  - from one time to the other - follow up
  - from one physician to the other
  - from one lab to the other
- reliable results also from less experienced EMGers
- good for training