Brain Stem Function Monitoring

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Coma Protocol

- Patients admitted to ITU
- Head injury or SAH
- Over 18 years
- Coma > 6 hours
- First OMT measurement within 24 hours of admission
- Consent of next of kin
- OMT and Clinical data independent

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Coma Results

- 94 patients 70 H1 24 SAH
- 46 years (+/- 18) range 18-77
- Age and sex matched with normals
Coma Results

- Normal: 85.9 (+/- 6) Hz
- Coma: 54.7 (+/- 16) Hz

- Sedation propofol 1% (n=22)
  - Normal: 60 Hz (+/- 5)
  - Coma: 46 Hz (+/- 10)

p<0.0004
# Coma Depth

## OMT vs Caloric Stimulation

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Absent</th>
<th>Dyscon</th>
<th>Con</th>
<th>Nystag</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;50</td>
<td>13</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>&gt;50</td>
<td>1</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

\[ \chi^2 = 15.6 \quad p = 0.0014 \]
## Serial Recordings

<table>
<thead>
<tr>
<th></th>
<th>Improved</th>
<th>Deteriorate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increase Frequency</td>
<td>21</td>
<td>1</td>
</tr>
<tr>
<td>Decrease Frequency</td>
<td>0</td>
<td>10</td>
</tr>
</tbody>
</table>

$$X^2 = 27.78, \ p = 0.0000$$

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Coma Depth

OMT vs GCS

Frequency (Hz)

GCS

r = 0.818  t = 10.339  p = 0.0000

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Coma Prognosis

- Survived: 61.7 (± 2.3) 58
- Died: 36.8 (± 3.9) 36

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Coma Prognosis

- All patients initial OMT Frequency
  > 40Hz Survived

- All patients initial OMT Frequency
  < 40 Hz Died
Coma Prognosis
How Good?

Taking a predetermined level of 50Hz

<table>
<thead>
<tr>
<th>Sensitivity</th>
<th>94%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specificity</td>
<td>100%</td>
</tr>
</tbody>
</table>

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Coma Prognosis
How Good?

- 36/36 initial OMT < 50 died
- 54/58 initial OMT >50 survived

But ALL that died did so after leaving ITU

Sen and Spec 100% for surviving ITU
Conclusion

- There is a difference in mean OMT activity in normal subjects and coma patients
  \[ p < 0.0001 \]

- There is a difference between normal sedated and coma patients
  \[ p < 0.0004 \]

- OMT activity < 50 Hz carries a poor prognosis
Conclusion

- There is a linear relationship between OMT activity and GCS
- There is a significant correlation between VOR and OMT activity
  \[ p < 0.000001 \]
Brain Stem Death

- Clinical criteria alone
- Two independent observers
- No objective test
  - Angiography
  - EEG

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Brain Stem Death

- 42 patients
- 15 male
- 43.3 +/- 19 years
- 47 records

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Brain Stem Death

- 39/42 Brain dead 1st assessment
  38/39 OMT flat

- 3 initial assessment respiratory movement
  3/3 active OMT

- 3/3 later died (1-5 days) all flat OMT

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Brain Stem Death

- 1 patient Brain Dead OMT active
- 24 hours later OMT still active
- 72 hours OMT flat
- 6 hours later cardiac arrest
- PM encephalitis
Figure 16.4: Simultaneous recording of OMT from both eyes and ECG from a patient with brain stem death.
### Table: Mean Estimates for OMT Parameters Based on 5 Second Record Duration from 10 Subjects

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>FREQUENCY (Hz)</td>
<td>84.99</td>
<td>8.6</td>
</tr>
<tr>
<td>% BASELINE</td>
<td>55.53</td>
<td>14.5</td>
</tr>
<tr>
<td>f BASELINE (Hz)</td>
<td>88.94</td>
<td>15.7</td>
</tr>
<tr>
<td>Dur BASELINE (msec)</td>
<td>71.34</td>
<td>31.1</td>
</tr>
<tr>
<td>No. BURSTS per sec</td>
<td>8.24</td>
<td>1.9</td>
</tr>
<tr>
<td>f CONTENT BURST (Hz)</td>
<td>82.14</td>
<td>5.1</td>
</tr>
<tr>
<td>Dur BURST (msec)</td>
<td>53.22</td>
<td>9.4</td>
</tr>
</tbody>
</table>
Figure 7.4: OMT record (2 seconds) from a patient with multiple sclerosis.
MS

- 50 patients
- Duration disease 9.32 +/- 6.25 years
- MS 71 +/- 10 Hz
  Normal 86 +/- 6 Hz
- Clinical evidence brain stem disease (36)
  67 +/- 9 Hz

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• Abnormal pattern or frequency (norm – 2Sd) in 78% patients
  If brainstem disease 89%