Facial nerve monitoring in vestibular schwannoma surgery

Alexis Bozorg Grayeli 1, Isabelle Bernat 1, Michel Kalamariades 2 & Olivier Sterkers 1, Otolaryngology (1) and Neurosurgery (2) departments, Hôpital Beaujon, Université Paris 7, France

Introduction

- Intra operative monitoring of the facial nerve has become mandatory in CPA and temporal bone surgery.
- It allows the identification and the preservation of the nerve in the majority of the cases.
- Does it provide prognostic information?
Introduction

- Inspite of integrity of the nerve sheet, dissection may lead to axonal lesions.
- Several possible mechanisms:
  - Ischemia
  - Edema
  - Inflammation
- How to identify:
  - Neurapraxis
  - Axonotmesis
  - Neurotmesis

Objective

- Evaluation of the prognostic value of a four-channel EMG device in VS surgery

Frontal
Orbicularis oculi
Orbicularis oris
Platysma
NIM response 2, Medtronic Xomed
Material and Methods (1)

- From October 2002 to September 2003, among 103 VS operated on 89 included in this prospective study
- 45 females, and 44 males (sex ratio: 1)
- Mean age: 52 years (range: 16-84)

![Graph showing VS stage distribution]

Stage 4 (> 30 mm in CPA)
Stage 3 (16-30 mm in CPA)
Stage 2 (≤ 15 mm in CPA)
Stage 1 (intracanalicular)

Material and Methods (2)

1. NIM responses
- Elicited intensity threshold > 100 µV in at least one channel
- Stimulation intensities from 0.01 to 3 mA with increments of:
  - 0.01 between 0.01 to 0.1 mA
  - 0.05 between 0.1 and 3 mA

2. Facial nerve function evaluation (House and Brackmann) at Days 1, 8, 30, and 180
Location of the maximal response

Channel 1 (frontal): 17%
Channel 2 (orbicularis oculi): 27%
Channel 3 (orbicularis oris): 46%
Channel 4 (platysma): 10%

Stimulation at brainstem at lowest intensity after tumor removal


Postoperative facial function

- Delayed postoperative facial paresis:
  - Between days 1 and 8: 21 cases (24%)
  - Between days 8 and 30: 2 cases of continuing deterioration and 7 new cases (10%)
  - Between days 30 and 180: 2 new cases of deterioration (3%)
Facial function and stimulation thresholds

**Stimulation threshold at the adhesion zone**

**Stimulation threshold at the brainstem**

---

Delayed deterioration of the facial function

- No difference in brainstem thresholds in patients with stable function and those with deterioration between D1 and D8.
- Between D8 and D30:

---

No difference in brainstem thresholds in patients with stable function and those with deterioration between Day 1 and Day 8.
## Predictive values

<table>
<thead>
<tr>
<th></th>
<th>Threshold at Brainstem ≤ 0.04 mA</th>
<th>Proximal/distal threshold ≤ 1</th>
<th>Threshold adhesion zone ≤ 0.04 mA</th>
<th>Adhesion/distal threshold ≤ 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>n</td>
<td>67</td>
<td>64</td>
<td>69</td>
<td>67</td>
</tr>
<tr>
<td>Sensitivity</td>
<td>57%</td>
<td>53%</td>
<td>51%</td>
<td>43%</td>
</tr>
<tr>
<td>Specificity</td>
<td>66%</td>
<td>75%</td>
<td>66%</td>
<td>78%</td>
</tr>
<tr>
<td>PPV</td>
<td>92%</td>
<td>94%</td>
<td>91%</td>
<td>93%</td>
</tr>
<tr>
<td>NPV</td>
<td>19%</td>
<td>19%</td>
<td>17%</td>
<td>18%</td>
</tr>
</tbody>
</table>

## Conclusions

- Response at minimal stimulation is maximal in frontal and plathysma regions in 27% of cases.

- A low stimulation threshold at the adhesion zone seems related to a good immediate facial outcome.

- A low stimulation threshold at the brainstem seems related to a good mid-term facial outcome.
Supramaximal stimulation and mentalis muscle recordings

**Rational**

- Mentalis muscle generates high amplitude responses easier to detect than plathysma
- The amplitude of response after supramaximal stimulation is related to the number of functional axones.

**Aim**

- Evaluate the mentalis muscle as one of the recording sites for intra operative monitoring
- Prognostic value of mentalis muscle recordings after supramaximal stimulation of the nerve
Population

- Nov. 2005-March 2006:
  - 57 CPA tumors included in this prospective study
  - 34 females et 23 males (sexe ratio: 0.7)
  - Mean age: 48 years (range: 16-70)

Methods

- Facial nerve stimulations
  - Before dissection at pontomedullary junction (PMJ)
  - After dissection: MAI, Tumor adhesion zone, and PMJ
  - Threshold determination: (0.01 to 0.1 mA)
  - Supramaximal intensity determination (1 to 3 mA)

- Muscular response recordings:

- Facial function grading at days 1, 8 and 30
Results
Location of maximal response

Mentalis 61%
Orbicularis oris 26%
Orbicularis oculi 8%
Frontalis 5%

• Absolute values not correlated to facial function

Results
Mentalis muscle response after supramax stimulation at brainstem (2 mA)

PMJ (Before dissection - after dissection) / Before dissection

PMJ (IAM - IAM) / IAM
After dissection

facial function at day 30

*** P<0.001, test t non pairé
Conclusions

- Mentalis muscle recordings more interesting than plathysma recordings
- Mentalis response to supramaximal stimulation: Prognostic value of proximal/distal stimulation ratios
- Anatomical factors (size, adhesion, nerve position) are independent prognostic factors
- Can EMG values help to decide for a postoperative corticoid therapy?