ECoG and cVEMP in definite Meniere's Disease

Otorhinolaryngology Research Center
Otorhinolaryngology - Head & Neck Surgery Department
Amir Alam hospital
Tehran University of Medical Sciences
Tehran, Iran
Background

• Meniere was described a series of similar patients in 1861 and changed mentality from cerebral to inner ear etiology. Baloh RW. Arch Neurol 2001; 58(7):1151-6

Background

• Electrocochleography (ECoG) which is a measurement of the electrical potentials generated by cochlea and auditory nerve, has very long developmental history and applied after about 50 years for first time in patients with Meniere’s disease.  *Coats AC. Arch Otolaryngol 1981; 104(4):199-208*

• Because of some normal results, it is not a diagnostic modality by itself.  *Oh KH, et al. Arch Otolaryngol 2014; 134(8):771-5*
Background

- Vestibular evoked myogenic potential (VEMP) which originally was applied in clinical settings in 1992, is a response in muscles to sound or electric stimulation.  
  Colebatch JG, Halmagyi GM. Neurology 1992; 42(8):1635-6

- Saccular involvement as a second frequent site after cochlea in Meniere’s disease leads to common use of this test.  

- Nevertheless, VEMP cannot be an effective diagnostic test.  
Purpose of Study

Presence of a few studies about both these tests in the same patients with Meniere’s disease

Lack of evidence with main purpose of evaluation of diagnostic correlation of these two tests
Methods
Patient enrollment

- **Study Design:**
  - Prospective observational study

- **Population:**
  - Patients with Meniere’s Disease in ENT clinic at tertiary hospital

- **Inclusion Criteria:**
  - definite Meniere’s disease (AAO-HNS criteria)

- **Exclusion Criteria:**
  - Other otologic disorders or surgery or intervention
  - Neurologic disorder
  - Musculoskeletal disorder
Test Setup

• Electrocochleography

Extratympanic electrode with click stimulus sound

• Elevated or abnormal:
  • SP to AP amplitude ratio greater than 0.4

• not-elevated:
  • Ratio equal or less than 0.4
  • Patients without any wave due to significant SNHL
Test Setup

• **Cervical Vestibular Evoked Myogenic Potential Test**

  Tone burst stimulation sound (500 Hz and 95 DB)

• Negative or abnormal:
  • No wave
  • Increased stimulation threshold
  • Decreased amplitude
  • Abnormal morphology
Statistical Methods

Descriptive
- Mean ± SD
- Median
- Frequency

Analytic
- Difference
  - Chi square
  - Fisher exact

Analytic
- Correlation
  - Pearson
  - Spearman rho
Results
Descriptive Findings

- **62 patients,**
- **Mean age:** 44 ± 13 years
- Duration of disease: **Mean:** 47 months, **Median:** 30 months

**Gender**
- Female: 58%
- Male: 42%

**Site of Lesion**
- Right Ear: 29
- Left Ear: 27
- Both Ears: 6
Analytic Findings

<table>
<thead>
<tr>
<th>Test Battery Results</th>
<th>cVEMP (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>6</td>
</tr>
<tr>
<td>Abnormal</td>
<td>23</td>
</tr>
</tbody>
</table>

No statistically significant difference between two tests (p-value: 1.00)
### Test Battery Results

<table>
<thead>
<tr>
<th>ECoG (%)</th>
<th>Normal</th>
<th>Abnormal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>6</td>
<td>23</td>
</tr>
<tr>
<td>Abnormal</td>
<td>18</td>
<td>53</td>
</tr>
</tbody>
</table>

**Overall Abnormal: 76%**

<table>
<thead>
<tr>
<th>cVEMP (%)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>6</td>
</tr>
<tr>
<td>Abnormal</td>
<td>18</td>
</tr>
</tbody>
</table>

**Overall Abnormal: 71%**
**Analytic Findings**

<table>
<thead>
<tr>
<th>Clinically Ear involved (n)</th>
<th>Abnormal ECoG results (%)</th>
<th>Abnormal cVEMP results (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Right</td>
<td>Left</td>
</tr>
<tr>
<td>Right side (29)</td>
<td>62</td>
<td>0</td>
</tr>
<tr>
<td>Left side (27)</td>
<td>7</td>
<td>63</td>
</tr>
<tr>
<td>Both side (6)</td>
<td>17</td>
<td>0</td>
</tr>
</tbody>
</table>

No statistically significant difference between subgroups of two tests

Sasan Dabiri et al., ORL-HNS Dept., Amir Alam hospital, TUMS, Tehran, Iran
**Analytic Findings**

<table>
<thead>
<tr>
<th>Clinically Ear involved (n)*</th>
<th>Ipsilateral Abnormal ECoG (%)</th>
<th>Ipsilateral Abnormal cVEMP (%)</th>
<th>Ipsilateral Abnormal ECoG and cVEMP (%)</th>
<th>Ipsilateral Abnormal ECoG or cVEMP (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right side (35)</td>
<td>77</td>
<td>66</td>
<td>46</td>
<td>97</td>
</tr>
<tr>
<td>Left side (33)</td>
<td>64</td>
<td>73</td>
<td>48</td>
<td>88</td>
</tr>
</tbody>
</table>

* Patients with unilateral each side or bilateral involvement were included for each side.
Analytic Findings

Correlation

- ECoG & cVEMP test: not significant (p-value: 0.82)
- ECoG & gender: not significant (p-value: 0.31)
- ECoG & age: not significant (p-value: 0.83)
- ECoG & duration: not significant (p-value: 0.80)
- cVEMP test & gender: not significant (p-value: 0.86)
- cVEMP test & age: not significant (p-value: 0.30)
- cVEMP test & duration: not significant (p-value: 0.82)
Discussion
Main Outcomes

- ECoG and cVEMP test are two audiovestibular tests proposed as complement for diagnosis of Meniere’s disease. Semaan MT, Megerian CA. Otolaryngol Clin N Am 2011; 44(2):383-403

- Probability of abnormal findings in any of both tests (when both considered as one test) in definite Meniere’s disease is noticeable (Right side: 97%, Left side: 88%)

- Lack of correlation between the results of two tests may enhance the mentioned diagnostic application.
Literature Review

- **Murphy et al.** *Otolaryngol Head Neck Surg 2007; 137(2 suppl):P144*

  ➢ **Objective:** Superiority of ECoG to VEMP in Meniere’s disease

<table>
<thead>
<tr>
<th>Parameters for comparison</th>
<th>Murphy et al.</th>
<th>Current study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of participants (n)</td>
<td>117</td>
<td>62</td>
</tr>
<tr>
<td>Abnormal ECoG and cVEMP (%)</td>
<td>27</td>
<td>53</td>
</tr>
<tr>
<td>Abnormal ECoG with Normal cVEMP (%)</td>
<td>73</td>
<td>23</td>
</tr>
<tr>
<td>Abnormal cVEMP with Normal ECoG (%)</td>
<td>0</td>
<td>18</td>
</tr>
<tr>
<td>Normal ECoG and cVEMP (%)</td>
<td>? (0)</td>
<td>6</td>
</tr>
</tbody>
</table>
Literature Review

• Murphy et al. *Otolaryngol Head Neck Surg* 2007; 137(2 suppl):P144
  ➢ Objective: Superiority of ECoG to VEMP in Meniere’s disease

• Comparative Analysis and Interpretation:
  • Differing study population
    • Only definite Ménière’s disease
    • Phase of disease
    • Different pathophysiologic states in Meniere’s disease
  • Difference in test setup
    • Various stimulus types
    • Multiple ways for performing tests
    • Diversity in defining abnormality
  
  **Objective:** Vestibular test battery & ECoG in Meniere’s disease

<table>
<thead>
<tr>
<th>Parameters for comparison</th>
<th>Wu et al.</th>
<th>Current study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of participants (n)</td>
<td>?</td>
<td>62</td>
</tr>
<tr>
<td>Abnormal overall ECoG (%)</td>
<td>76.9</td>
<td>75.8</td>
</tr>
<tr>
<td>Abnormal overall VEMP (%)</td>
<td>58.0</td>
<td>71.0</td>
</tr>
<tr>
<td>Canal paresis with caloric test (%)</td>
<td>50.0</td>
<td>---</td>
</tr>
<tr>
<td>Correlation between any of tests and duration of Meniere’s disease</td>
<td>Not significant</td>
<td>Not significant</td>
</tr>
</tbody>
</table>
Introduction

Methods

Results

Discussion

Conclusion

**ECoG and cVEMP in definite Meniere’s Disease**

Literature Review

  - Objective: Vestibular test battery & ECoG in Meniere’s disease

- Comparative Analysis and Interpretation:
  - Differing study population
    - Only definite Ménière’s disease
    - Age effect on cVEMP results (false positive in patients older than 60 yrs)
      - However, specific analysis in the study rejected age effect
  - Difference in VEMP test setup
    - Various stimulus types
    - Multiple ways for performing tests
    - Diversity in defining abnormality

*Sasan Dabiri et al., ORL-HNS Dept., Amir Alam hospital, TUMS, Tehran, Iran*
Limitations of Study

• Selection bias

• Participants included were from a tertiary center; so, they may have different severity and extension of disease compared to overall patients with Meniere’s disease in the community

  ➢ This point may affect the results
  ➢ This result may have limited generalizability (external validity)
Limitations of Study

• Selection bias

• Participants included were from a tertiary center; so, they may have different severity and extension of disease compared to overall patients with Meniere’s disease in the community

Larger study in various centers could clarifying this haze deduction
Further Research

- Their results could be helpful to predict progression to definite disease or contralateral involvement.

- In addition, they may have the potency to include in the diagnostic criteria of Meniere’s disease with further research on various vestibulocochlear tests.

- Test results may be assessed for use in follow up especially after interventions like intratympanic injection or endolymphatic sac surgery.
Despite of some beneficial helps for diagnosing Meniere’s disease, neither ECoG nor cVEMP cannot be used as a diagnostic modality.

Combination of both tests for diagnosis may be helpful:
- High positive findings when applying both as one test
- No significant correlation between tests
Thanks a lot for Your Attention