ABSTRACT

Vestibular-evoked myogenic potential (VEMP) testing has been used to evaluate presence of superior canal dehiscence syndrome (SCDS). The most commonly used indication of a positive VEMP test is an abnormally low threshold response. VEMP threshold can vary substantially in normal subjects preventing use of an absolute threshold as an indicator of an abnormal response.

Objective: To evaluate VEMP amplitude intensity function as a method to select patients with higher suspicion with SCDS

Methods: We performed a retrospective chart review on 216 consecutive patients (432 ears). The slope of decay between cVEMP amplitudes at 100 decibels (tone-burst, air-conducted, 500 Hz) and threshold levels were evaluated. VEMP amplitude intensity function was compared for patients with SCDS, benign paroxysmal positioning vertigo (BPPV), Menière’s disease, those with unilateral caloric weakness from a vestibular origin and those with no evidence of vestibular pathology.

Results: Ears with SCDS and those without vestibular pathology revealed an average amplitude intensity function of -9.57mA/dB vs. -18.25mA/dB (p = 0.028). Ears with unilateral caloric weakness had -11.98mA/dB (p = 0.03). No significant difference was noted in patients with BPPV and Menière’s disease. In addition, using a criterion of the threshold less than 70dB and slope of decay less than -16, SCDS can be predicted with sensitivity and specificity of 90.9% and 96.1%.

Conclusion: VEMP amplitude intensity function is an additional measure that can be applied to more accurately diagnose SCDS.

INTRODUCTION

Vestibular-evoked myogenic potential (VEMP) testing assesses vestibular function through the vestibulocollic reflex. Many studies have been published correlating the VEMP response to benign paroxysmal positional vertigo, Menière’s disease, vestibular neuritis, and superior semicircular canal dehiscence syndrome (SCDS). VEMP measuring has been used as an adjunctive to aid in the diagnosis of SCDS. As noted by several authors, a threshold <70dB is commonly used as an indication of a positive VEMP suggesting SCDS. Most of these findings are due to the increased sensitivity of the vestibule secondary to the increased effectiveness of sound transmission in those patients with SCDS. However, many patients undergoing the CT scan for confirmation will show no radiographic evidence of a superior canal dehiscence. Therefore, VEMP threshold can vary substantially in normal subjects preventing use of an absolute threshold as an indicator of an abnormal response.

To date, many authors have suggested the use of VEMP amplitude as another tool of diagnosis; however, it has been with poor reproducibility. While we were examining VEMP amplitudes in patients with SCDS we noticed a trend of high amplitude in patients with SCDS as in accordance with other authors.

METHODS AND MATERIALS

A retrospective chart review was performed on 216 consecutive unique patients (432 ears) with various vestibular complaints from 12/06-5/12. Exclusion criterion were ears requiring bone VEMP conduction, previous SCDS repair, or those without a VEMP response.

Patient’s underwent a cervical VEMP testing beginning 100dB NHL (tone-burst, air-conducted at 500Hz). The minimal threshold for a VEMP response was elicited as recorded as well as the average amplitude (mA) for every stimulus. If the patients underwent caloric testing, their response was also recorded.

A paired t-test was performed for statistical analysis. A p value <0.05 was considered statistically significant. Sensitivity and specificity was calculated.

RESULTS

Table 1 represents the range values obtained for amplitudes of responses measured at 100dB and the slope or amplitude intensity function between 100dB and threshold.

<table>
<thead>
<tr>
<th></th>
<th>Meniere</th>
<th>SCDS</th>
<th>BPPV</th>
<th>Unilateral weakness</th>
<th>Non pathologic</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>32</td>
<td>11</td>
<td>25</td>
<td>157</td>
<td>22</td>
</tr>
<tr>
<td>Amplitude @100dB</td>
<td>50.7+95.9</td>
<td>274+983</td>
<td>54.3+599</td>
<td>86+541</td>
<td>73.5+1051</td>
</tr>
<tr>
<td>Slope</td>
<td>10.2+45.7</td>
<td>2+17.5</td>
<td>0.8+104.2</td>
<td>0.97+22.7</td>
<td>2.72+42.3</td>
</tr>
</tbody>
</table>

Table 1. Range of values

Table 2 lists the average amplitudes at 100dB and as a threshold. In addition there is the amplitude intensity function (slope) calculated between 100dB and 2nd measurement as well as one between 100dB and threshold. Ears with SCDS and those without vestibular pathology revealed an average amplitude intensity function of -9.57mA/dB vs. -18.25mA/dB (p = 0.028, power 99.5%). Ears with unilateral caloric weakness had -11.98mA/dB (p = 0.03). No significant difference was noted in patients with BPPV and Menière’s disease. In addition, using a criterion of the threshold less than 70dB and slope of decay less than -16, SCDS can be predicted with sensitivity and specificity of 90.9% and 96.1%.

<table>
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<th>SCDS</th>
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<th>Unilateral weakness</th>
<th>Non pathologic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average amplitude at 100dB</td>
<td>209.5</td>
<td>149.1</td>
<td>273.9</td>
<td>272.2</td>
<td>342.0</td>
</tr>
<tr>
<td>Average amplitude at threshold intensity</td>
<td>119.7</td>
<td>154.7</td>
<td>97.85</td>
<td>121.6</td>
<td>127.69</td>
</tr>
<tr>
<td>Average slope between 100dB and 2nd measurement</td>
<td>-17.82</td>
<td>-9.83</td>
<td>-17.3</td>
<td>-13.29</td>
<td>-18.99</td>
</tr>
<tr>
<td>Average slope between 100dB and threshold (Amplitude intensity function)</td>
<td>-17.87</td>
<td>-9.57</td>
<td>-20.86</td>
<td>-11.98</td>
<td>-18.25</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>13.25</td>
<td>4.84</td>
<td>20.8</td>
<td>12.89</td>
<td>9.43</td>
</tr>
</tbody>
</table>

Table 2. Average slope compared between non pathologic and pathologic ears

DISCUSSION

As what many authors have suggested, the use of a 70dB threshold when performing a VEMP is a useful screening tool for SCDS; however, it is not absolutely reliable. Within our analysis, we noted a significant difference in the average amplitude at 100dB between ears with SCDS and nonpathologic ears. However, since the range of amplitude for nonpathologic can go as high as 1061mA compared to 893mA in ears with SCDS, we believe that the amplitude alone is not a useful measure to help diagnose SCDS.

A significant difference between the SCDS and non pathologic ears was present when analyzing the amplitude intensity function. The significance validated our original observation that VEMP amplitude intensity function diminish at a lower rate compared to non pathologic ears. Moreover, the rate of decline appears to have an opposite effect in ears with BPPV and/or Menière’s disease. Ears with unilateral caloric weakness also tend to have a lower decay of amplitude intensity. This may be explained by the increased sensitivity of the saccule with SCDS and unilateral caloric weakness.

Diagnosing SCDS require a clinical and audiometric suspicion. Using the amplitude intensity function of -16 in addition to the 70dB threshold will allow the VEMP testing to be more helpful in selecting patients with concerns of SCDS and decreasing the amount of CT temporal scans ordered.

CONCLUSIONS

1. VEMP amplitude intensity function is an additional measure that can be applied to more accurately select patients suspicious for SCDS.
2. We suggest the use of the amplitude intensity function being less than -16 in addition to the 70dB threshold.
3. Patients with SCDS tend to have a larger amplitude at 100dB compared to nonpathologic ears.

REFERENCES


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