INTRODUCTION

The VEMP test represents an opportunity to expand our ability to examine the vestibular system, but there is little information on its clinical usefulness. Electromyography (ENG) is the gold standard for vestibular testing, and it measures superior vestibular nerve function with caloric irrigation.1 We hypothesized that ENG testing would be more clinically useful than VEMP testing in the diagnosis of vestibular disorders.

The VEMP response produces a reliable modulation of the electromyogram (ENG) showing a biphasic positive (P1) and negative wave (N1) that occurs at approximately 14 ms and 23 ms at the sternocleidomastoid (SCM) muscle. Figure 1 shows a normal VEMP recording for both ears. A decrease in amplitude, or creating an asymmetry, is an essential in peripheral vestibular parietic lesions such as vestibular neuritis and Meniere’s disease.

An increased amplitude, decreased latency, and decreased threshold are seen in peripheral vestibular irritative lesions such as Meniere’s disease (recovey phase) and superior canal dehiscence syndrome. Increased latency of P1 and N1 is noted in central vestibular dysfunction.1

MATERIALS AND METHODS

We evaluated 160 patients complaining of dizziness with a complete neurologic history and physical examination with evaluation for spontaneous nystagmus, head-shake nystagmus, gaze nystagmus, and the Hallpike maneuver. ENG testing and MRI scanning were done when clinically indicated and used to determine a diagnosis. We completed VEMP and ENG testing on 160 of these patients. We utilized either a head lift (Figure 2) or head turn (Figure 3) protocol to obtain SCM contraction for VEMP testing.

VEMP testing was done with a 500 Hz Blocken pip stimulus at a level of 105 dBnHL and a rate of 8.3/4 using an evoked potential unit (Girasan-Stadler, Madison, WI). Two repetitions of 100 sweeps were completed for each side. The peak to peak amplitude (P-p; V) and latency of P1 and N1 were recorded for each waveform, and the values of the two waves were averaged. AR was calculated using the formula: (A1-A2)/(A1+A2)*100, where A1 and A2 are the average of the amplitudes from the left and right ears, subtracting the smaller from the larger side. The AR was considered normal if <30% (negative test), and abnormal if >30% (positive test). If the latency of P1 was >17 ms we considered it positive for central vestibular dysfunction (CVD). Computerized ENG testing was done with a calibrated air irrigator and the CHARRT ENG system (ICS Medical, Schaumburg, IL) using surface electrodes in the standard montaje and using bilateral caloric irrigation.1

RESULTS AND DISCUSSION

Fourty-four of the 160 patients tested had no VEMP response (Figure 4) and were excluded from the study. Analysis of the remaining 116 patients revealed 7% (64%) patients had a peripheral vestibular disorder, 10% (9%) had central vestibular disease, and 31% (27%) had a non-vestibular diagnosis. Some of the patients had more than one vestibular condition (eg., BPPV and VN), therefore the number of cases is larger than the number of patients. We compared the clinical diagnosis of four commonly seen vestibular conditions (see Table 1) to the VEMP test result and separated the ENG test result to see if either test showed a greater sensitivity or specificity for these disorders.

The data for the VN group are shown in Tables 2a and 2b. Only the ENG test results achieved a high statistical confidence level in the diagnosis of VN. Also, the ENG test (95% sensitivity) was more sensitive than the VEMP (40% sensitivity) in diagnosing VN. This is in great part due to our current definition of VN which relies on a unilateral caloric weakness to establish the diagnosis. Both tests, however, display a high specificity (85% and 88%). There were only a few patients who were diagnosed with VN by the VEMP test and had normal caloric responses (10%), which may be, in part, due to our inexperience with the test. It may also be because VN affects the superior division of the vestibular nerve more often than the inferior division. Mawlesi and colleagues also found a low incidence of abnormal VEMP responses (5%) in the presence of normal caloric responses (5%).4

There were 22 cases of BPPV and 10 of these patients had a positive ENG and 6 had a positive ENG. A positive VEMP is not the gold standard for BPPV, though the VEMP did better than the ENG test. The ENG test had a higher sensitivity than the ENG test (45% vs. 27%) for diagnosing BPPV. Since the Hallpike maneuver is the only part of the ENG test that is diagnostic for BPPV, the ENG was negative if the patient was in remission (temporally asymptomatic), but 50% of our patients who were in remission at the time of the test still had a positive ENG on the isolated side. There were 19 cases of Meniere’s Disease in this study, 10 of these patients had a positive ENG and 14 had a positive ENG. Statistical confidence levels were high for the ENG (p<0.0001) test but not for the ENG (p=0.0039) test in the Meniere’s cases. The ENG was also more sensitive (94%) than the ENG test (53%) in this patient group. All Meniere’s patients who had a positive ENG also had a positive ENG (unilateral caloric weakness). Further study is needed to determine if this is due to inherent test differences or if Meniere’s disease affects the superior division of the vestibular nerve (ENG test) more often than the inferior division (ENG test).

When all our peripheral vestibular disorder (PVD) cases were taken together, the ENG test (64%) was less sensitive than the ENG test (77%) (see Tables 3a and 3b). Statistical confidence levels were much greater for ENG than for the ENG test when evaluating all PVD cases. Some of this difference may be due to our current diagnostic criteria that rely on caloric testing, especially in the diagnosis of VN and Meniere’s disease. Further experience with the ENG test may change this finding.

There were only 13 CVD cases in our study group. Ten patients had only CVD and 3 patients had CVD and a peripheral vestibular disorder. The summarized data are shown in Tables 4a and 4b. VEMP results achieved a greater confidence level for CVD patients. The ENG test (54%) was more sensitive than the ENG test (39%) for CVD, but both tests had a high specificity (99%) which is as a value clinically if we want to exclude CVD in a normal patient, or identify it with greater certainty in a clinically positive patient. We did not consider abnormal OPK at 40 deg/sec a central finding for ENG testing in older patients.

COMPARING THE VEMP AND ENG TESTS IN VESTIBULAR DIAGNOSIS
Sanjay A. Bhansali, M.D., Toni M. Landau, M.A., CCC-A
Ear Consultants of Georgia, Atlanta, Georgia, USA

REFERENCE


