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# **Vestibular Evoked Myogenic Potentials in Multiple Sclerosis**

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In this issue of the Journal, Gazioglu and Boz (2012) report findings using vestibular evoked myogenic potentials (VEMPs) evoked by clicks and recorded from both the eyes (oVEMPs) and neck (cVEMPs) in a group of clinically definite Multiple Sclerosis patients. Despite using conservative criteria for abnormalities, they found overall abnormality rates of 45% using oVEMP measurements and 18% using cVEMPs. The combined abnormality rate was 50%, similar to abnormality rates reported for the brainstem auditory evoked potential (BAEP).

VEMPs are short latency manifestations of vestibulo-ocular and vestibulocollic reflexes that appear to originate from the otoliths (e.g. Rosengren et al., 2010). They have many similarities with conventional evoked potentials but differ fundamentally in that the signals originate from modulated EMG activity (Colebatch and Rothwell, 2004). As a consequence, the responses recorded may have substantially higher amplitudes than conventional evoked potentials which represent neural depolarisation and discharge (Ebersole JS, 2003). The pathways responsible – the medial vestibulospinal tract for the cVEMP and probably the medial longitudinal fasciculus for the oVEMP, descend and ascend the brainstem from the vestibular nuclei which lie in the pons. The cVEMP is uncrossed while the oVEMP is a crossed response (Iwasaki et al., 2007). While mainly applied as an investigation of peripheral vestibular function there was early recognition that central abnormalities might also affect the responses. Shimizu et al. (2000) reported 3 patients with established multiple sclerosis (MS) all of whom had radiological evidence of pontine disease and who all showed delay in one or both cVEMP responses. Since then a number of studies of cVEMPs in patients with definite MS have appeared in which abnormality rates have varied from 31 to 70% (Alpini et al., 2004; Bandini et al.,

2004; Eleftheriadou et al., 2009; Patkó et al., 2007; Versino et al., 2002), a frequent abnormality being delay of the response and abnormalities in most studies showing little correlation with radiological findings.

Short latency vestibular pathways ascending the brainstem can now be investigated using oVEMPs. Rosengren and Colebatch (2011) studied patients with internuclear ophthalmoplegia, most of whom had MS, and found high rates of abnormalities of oVEMPs (69%). The abnormalities were significantly more frequent than for cVEMPs (8%) as might be expected for a lesion lying in the upper brainstem and affecting the medial longitudinal fasciculus. Gazioglu and Boz have now shown that there is also a higher rate of abnormalities of oVEMPs than cVEMPs in a group of unselected MS patients. They found a relationship with EDSS but not with duration of disease suggesting the VEMP abnormalities were related to the overall burden of disease. Higher rates of abnormalities were found for patients with current or previous clinical brainstem involvement, although these differences were not statistically significant. These findings raise the possibility of asymptomatic involvement of central vestibular pathways in at least some patients.

What then is the role of ocular and cervical VEMPs in MS? The patients are generally young so responses should be obtainable in most with conventional air conducted (AC) sound stimuli and thus readily available evoked potential equipment is suitable. Thresholds for the oVEMP are higher than for the cVEMP (Welgampola et al., 2008; Park et al., 2010) and responses may be absent in some normal subjects. Ocular VEMPs appear to be more likely to show abnormalities than cVEMPs. Abnormalities may be more likely to be found in patients presenting with symptoms suggesting brainstem or vestibular involvement and the techniques are likely to be useful in confirming this, particularly if MRI does not show a relevant lesion. Delay

in the response is the finding most suggestive of demyelination and may at times provide important evidence for this (Rosengren et al., 2007). The pathways subserving otolith-ocular pathways in man are not known with certainty and more studies are needed to correlate abnormalities of oVEMPs with the sites of isolated lesions within the upper brainstem to determine whether these do indeed cluster in the region of the MLF. Ocular VEMPs may also prove useful in stratifying patients and to demonstrate involvement of brainstem structures. It is likely that oVEMPs will become an important method for assessing central vestibular pathways in MS.

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