Short Communication

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Use of Evoked Potentials in Testing Diabetic Peripheral Neuropathy

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Abstract

The aim of this short communication was to provide an evidence-informed updated overview for use of evoked potentials in testing diabetic peripheral neuropathy (DPN). Studies had reported use of Heat-evoked potentials (HEP), Laser evoked potentials (LEP), and Multimodal evoked potentials (MmEP), and somatosensory evoked potentials (SSEPs) and Visual evoked potentials (VEPs) in patients with DPN. Reduced amplitude or prolonged latency or reduced velocity was a characteristic finding in one or more of these clinical test measures.

Keywords: Evoked Potentials; Cortical Changes; Somatosensory System; Neuroanalgesia.

Introduction

Heat-evoked potentials (HEP)was researched in two studies: Chao et al [1] investigated the diagnostic role of contact HEP (CHEP) in 32 type 2 diabetic patients and found that CHEP amplitude was reduced in patients compared with age- and sex-matched control subjects, with abnormal CHEP patterns (reduced amplitude or prolonged latency) seen in 81.3%.

Wong and Chung [2] studied the differences in contact heat evoked potential (CHEP) parameters between healthy adults and diabetics with and without lower limb symptoms. There was a significant difference in N1-P1 amplitude in the three groups after stimulation of the dorsum of the foot and the point 10 cm proximal to the lateral malleolus.

Laser evoked potentials (LEP) was researched in two studies: Agostino et al [3] evaluated the usefulness of LEP in assessment of small afferent fiber function and compared the dysfunction of large and small afferent fibers in DPN patients. LEPs were often found to be absent; the mean latency was normal and mean amplitude decreased, as expected in axonopathies.

Ragé et al [4] evaluated 10 type 1 and 13 type 2 diabetes mellitus (DM) patients without conventional symptoms or signs of DNP and compared them with 18 healthy controls and five patients with overt DNP. Intra-epidermal nerve fiber density (IENFd), quantitative sensory testing (QST), and brain-evoked potentials with electrical (SEPs) and CO (2) laser stimulation [laser-evoked potentials (LEPs)]. LEPs with the small laser beam performed best in terms of sensitivity (91%), specificity (83%) and area-under-the ROC curve (0.924) and are unbiased by perceptual factors.

Multimodal evoked potentials (MmEP) was researched in one study: Dolu et al [5] compared the electrophysiological tests (peripheral and cortical latencies of median and tibial somatosensory evoked potentials (SEP), bilateral I-III and I-V interpeak latencies (IPL) of brainstem auditory evoked potentials (BAEP), bilateral P100 latency of visual evoked potentials (VEP) and bilateral cortical latency and central motor conduction time of motor evoked potentials (MEP))in 51 T2DM patients with 30 age and sex matched healthy control subjects. Prolonged latencies suggestive of central neuropathy were found in patients with DM type II which was also related to duration of disorder.

Somatosensory evoked potentials (SSEPs) was reported in one study: Ziegler et al [6] determined the relationship between central nervous

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conduction deficits and tibial nerve somatosensory evoked potentials (SEP) in 51 healthy subjects and 100 insulin dependent diabetic patients. The components of SEP were found to be associated with the indices of peripheral and autonomic function tests.

Visual evoked potentials(VEPs) was reported in three studies: Comi et al [7] investigated Pattern Reversal Visual Evoked Potentials (PRVEP) in 85 type 1 diabetics and found a negative correlation at the 30' check size between P100 latency and motor and sensory conduction velocity in all the examined nerves.

Gregori et al [8] investigated the subclinical visual deficit in type I and II diabetes, and its relationship with peripheral neuropathy in thirty-two healthy volunteers, 20 patients with type I diabetes and 30 patients with type II diabetes, who were tested for Luminance (VEPs) and chromatic visual evoked potentials (CVEPs). The study had following findings: "VEPs were slower in patients with type II diabetes and CVEPs were slower in patients with type I and type II diabetes than in controls. Blue-yellow CVEPs were slower in type II than in type I diabetes. VEPs and red-green CVEPs were slower in patients with diabetes with neuropathy than in those without".

Lövestam-Adrian et al [9] investigated the visual function as measured by mfVEP (multifocal Visual Evoked Potentials) in 32 DPN patients with retinopathy. The mfVEPs of 18 DPN patients were compared to those of 14 diabetic patients without polyneuropathy and to those of 10 non-diabetic control subjects. The study had following findings: "Both groups of patients with diabetic retinopathy had significantly lower amplitudes in the mfVEP than the healthy subjects. In addition the mfVEP amplitudes, which reflect selected areas of the visual function, were significantly reduced in the lower nasal quadrant in patients with neuropathy compared to patients without neuropathy".

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References

1. Chao CC, Tseng MT, Lin YJ, Yang WS, Hsieh SC, Lin YH, et al.Pathophysiology of neuropathic pain in type 2 diabetes: skin denervation and contact heat-evoked potentials. Diabetes Care.2010; 33(12): 2654-9.
2. Wong MC, Chung JW. Feasibility of contact heat evoked potentials for detection of diabetic neuropathy. Muscle Nerve. 2011; 44(6): 902-6.
3. Agostino R, Cruccu G, Romaniello A, Innocenti P, Inghilleri M, Manfredi M. Dysfunction of small myelinated afferents in diabetic polyneuropathy, as assessed by laser evoked potentials. Clin Neurophysiol. 2000; 111(2): 270-6.
4. Ragé M, Van Acker N, Knaapen MW, Timmers M, Streffer J, Hermans MP, et al. Asymptomatic small fiber neuropathy in diabetes mellitus: investigations with intraepidermal nerve fiber density, quantitative sensory testing and laser-evoked potentials. J Neurol. 2011; 258(10): 1852-64.
5. Dolu H, Ulas UH, Bolu E, Ozkardes A, Odabasi Z, Ozata M, et al. Evaluation of central neuropathy in type II diabetes mellitus by multimodal evoked potentials. ActaNeurol Belg. 2003; 103(4): 206-11.
6. Ziegler D, Mühlen H, Dannehl K, Gries FA. Tibial nerve somatosensory evoked potentials at various stages of peripheral neuropathy in insulin dependent diabetic patients. J NeurolNeurosurg Psychiatry.1993; 56(1): 58-64.
7. Comi G, Martinelli V, Galardi G, Medaglini S, Poggi A, Beccaria L, et al.Visual evoked potentials in diabetic teen-agers: influence of metabolic control and relationship with peripheral neuropathy. Metab Pediatr Syst Ophthalmol. 1986; 9(2-4): 85-7.
8. Gregori B, Galié E, Pro S, Clementi A, Accornero N. Luminance and chromatic visual evoked potentials in type I and type II diabetes: relationships with peripheral neuropathy. Neurol Sci. 2006; 27(5): 323-7.
9. Lövestam-Adrian M, Gränse L, Andersson G, Andreasson S.Multifocal Visual Evoked Potentials (mfVEP) in Diabetic Patients with and without Polyneuropathy. Open Ophthalmol J. 2012; 6: 98-103.