OMICS Group Conferences
Accelerating Scientific Discovery

2nd International Conference and Exhibition on
Neurology & Therapeutics
June 17-19, 2013 Hilton Chicago/Northbrook, Chicago, USA

Multisegmental motor responses with spinal cord stimulation: A new approach of testing nervous system circuitries

Mohamed A. Sabbahi[1], Fikreye Ovak-Bittar[2], Selda Uzun, Yesim Sengul[3] and Ambia Abdilahi[4]
[1]Texas Woman's University
[2]School of Physical Therapy
[3]Texas Electrophysiology Services, USA

Testing nervous system circuitries has been a goal for neurologists and neuroscientists. Imaging studies could not fulfill these needs and does not evaluate the nervous system during activities or functions. Functional MRI could cover some of the objectives although it is limited in its testing procedures. Electrophysiologic studies may answer many questions regarding these CNS circuitry testing although evoked potentials may test one circuit/system at a time and could be time consuming. A new approach has recently been developed called Multisegmental Motor Responses (MMR) that can evaluate several CNS circuitries simultaneously using percutaneous electrical spinal cord stimulation. This presentation will discuss the approach of testing MMR for upper and lower limb muscles, pelvic floor muscles and facial muscles with cervical and lumbosacral spinal stimulation. C7 and T11-12 vertebral segments were electrically stimulated using surface electrodes (0.5- 1 msec, 0.2 PPS at response max) and muscular responses were recorded from lower limb muscles (Soleus, Tibialis Anterior. TA, Vastus Medialis Obliquis,VMO, Medial Hamstrings, MH), and upper limb muscles (ADM, FDI, FCR, Triceps) of both right and left side simultaneously. Surface EMG recording were carried out using 4 channels EMG unit and test were carried out in 20 healthy subjects during lying, sitting and standing postures. Tests were carried out at two different days in order to evaluate test re-test reliability. In a different testing sessions C7 & T11-12 vertebral segments were electrically stimulated during recording EMG evoked responses of the bulbocavernosus and adductor muscles of the right and left sides during lying, sitting and standing postures of 10 healthy subjects. In a third testing protocol, C7 and T11-12 vertebral segments were electrically stimulated during recording EMG evoked responses on the facial muscles (Frontalis, F; Masseter, Mass., Orbicularis Occuli, Oo and Orbicularis Oris , Oor) in 10 healthy subjects. In all testing protocols signal analyses were carried out using the peak-t-peak amplitude and deflection latency as the outcome measure. Results showed that evoked responses of limb muscles, pelvic floor muscles and facial muscles are robust with large amplitudes and latency commensurate with the distance between the stimulation and recording sites. Signal amplitude was smaller in the pelvic floor and facial muscles when compared to limb muscles.Muscular signal could recorded in any of the four body segments (lower limbs, upper limbs, pelvic floor and facial) during electrical stimulation of either C7 or T11-12 vertebral segments. Muscular signal from limb and pelvic floor muscles were recrorded during relaxation and during muscular contractions. Signal amplitude were higher during contraction as compared to relaxation and was posture dependent. Signal amplitude was higher with the more closer stimulation site than those of further site i.e. BC signal was larger with T11 more C7 stimulation and facial MMR were larger with C7 more than T11 stimulation. This indicates signal transmission for short and longer spinal pathways although the richness of those pathways are decreased with more remote spinal centers. Muscular signal in the upper and lower limbs can be recorded in the upward (cephalic) direction e.g. T11 stimulation could evoke upper limb signal or in the downward (spinal) direction e.g. C7 stimulation could evoke lower limb signal. It is suggested that these signal is transmitted via the propriospinal pathways with activation in the ascending or descending pathways that might reach the brain stem (for facial muscle signal) or the lumboscarl region (for pelvic muscle signal). For facial muscle testing signal was recorded from muscles supplied by cranial nerve V and VII via its nuclei in the brain stem. These results indicate the validity of testing several neural system circuitries with focal spinal stimuli of the spinal cord. These MMR approach could useful for testing patients with spinal cord dysfunctions and trauma, brain stem disease and trauma during rest and during activity.

msabbahi@mail.twu.edu