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MONDAY

Enhancing contribution of spinal interneuronal network to movement after chronic spinal cord lesion

Large population of neurons and their larger number of synaptic contacts of vertebral spinal cord gray matter is considered a "black box" of a neuronal network. However, some progress in experimental animal studies has been made with limited interneurones in series and in simple interneuronal networks of mammals, primates (Jankowska et al. 2007, Fetz et al. 2002).

In human studies of "black box" lumbar network there is a long history of input and output studies of lumbar cord by stretch, withdrawal reflexes and recently by afferent inputs of externally controlled locomotor movement and posture (Duysens & Van de Crummert 1998, Van de Crummert et al. 1998). Application of surface polielectromyography (sPEMG) for studies of brain motor control assessment (BMCA) in a large number of people (hundreds) with established posttraumatic spinal cord injury advanced our knowledge on features of the lumbar spinal cord motor nuclei activities. SPEMG across multiple muscle groups serves to describe the spatiotemporal coordination of the activity of motor neuron pools during motor act and task (Sherwood et al. 1996).

Furthermore, neurophysiological studies of "self organizing capabilities of lumbar cord interneuron network" to sustained electrical stimulation of lumbar Posterior Roots Muscle Reflex Responses (PRMRR) become available for studies of external control of interneuron configuration involved in more complex motor outputs i.e. standing, stepping with paralyzed lower limbs (Minassian et al. 2007).

Here we review progress made in the understanding of motor control of human spinal cord after SCI with particular emphasize on studies using the aforementioned techniques. The role of brain motor control, modified by the injury, to the recruitment of the lumbar network motor output and the self-organizing capabilities of the lumbar network to sustained posterior root electrical stimulation is stressed. Finally, we shall discuss importance of these advances in motor control of human spinal cord in role of the interneuron network contribution to neurocontrol of functional muscle synergies.

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SATURDAY

NEUROCONTROL OF GAIT RECOVERED BY THE CORD LOCOMOTOR FUNCTIONS AFTER PARALYSIS OF THE LOWER LIMBS AT THE ONCET OF THE SCI.

There is a segment of initially ASIA A, individual with complete absence of motor and sensory functions below level of the spinal cord injury who will recover gait with assistive or even without any assistive devices.

In this report we shall outline profile of neurocontrol in 16 SCI subjects, five women and 11 men, aged from 20-76 years, level of the lesion from C-2 to T-10, and post-period varied between 3-207 months. [MM Pinter and MR Dimitrijevic: Gait after spinal cord injury and the central pattern generator for locomotion. Spinal Cord 1999, 37, 531-537.]

Result of this study is illustrated in the Fig.1, where we can see the two main features of neurocontrol assessed y Brain Motor Control Assessment [BMCA], neurophysiologicl method of surface polielectromyography according to assessment protocol based on recording of motor task responses of the motor units. BMCA can differentiate between poorly organized patterns in response to motor task and well developed and selective pattern. These two features of neural motor control are present in the “slow” and “fast” walkers. Figure 1

We shall discuss how this finding for “spontaneous repair” from initial complete SCI to ambulatory can be applied in design of biological treatment of the wheel chair bound SCI people.