**The conducting and processing capabilities of human lumbar spinal cord network and "spinal brain". Presenter: Milan R. Dimitrijevic. Baylor College of Medicine, Houston. TX. USA.**

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There are evidences that human lumbar cord isolated from brain control can respond to external sustained electrical epidural spinal cord stimulation with variety of tonic and rhythmical activity resembling "brain of the lumbar cord" (1). Moreover, the spinal brain is also involved in the interpretation of complex descending input through intact or injured spinal cord in order to generate movements controlled by the head brain, EMG outputs following various epidural stimulation parameters, applied to T11-L1 vertebral level of posterior roots in supine position in 10 individuals with clinically motor complete SCI (ASIA A and B) but neurophysiologic "discomplete", were recorded. Studied individuals didn't have volitional lower limbs movement but present neurophysiologic findings for modification of brain influence on central state of lumbar network below the lesion ( 2).

Motor outputs differed in their size and quality between muscle groups. A variety of different tonic and rhythmical motor responses were produced. Rhythmic motor output, although present in all subjects occurred only in part of the lower limbs. Stimulation frequency not intensity was the strongest predictor for rhythmic motor outputs.(3). Therefore, the human lumbar spinal cord is more than a relay system by providing modulator actions, reconfiguration, flexible operation as a common spinal network, "spinal brain", before common final pathway activity.

Significance of this finding is that in strategy for restoration of injured spinal cord function it is not essential to provide end-to-end anastomosis between injured axons but codonduction sufficient cranial-spinal modification of central state below the level of injury can contribute to the restored brain control of movement by neuromodulation of intact spinal cord processors, below spinal cord injury. [4]

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**Traumatological, Neurophysiological and Neurobiological Contributions to the Future of Neurorehabilitation**

**Milan Dimitrijevic, MD**
External control of conducting and processing

Using spinal cord injury as a model, we shall outline contemporary treatment and neurorehabilitative methods and discuss the role of external control of conducting and processing capabilities in the enhancement of residual motor control function during the recovery process.

Veterans of contemporary medicine

Treatment of spinal cord injury consists of medicine, surgery, and neurorehabilitation. It is remarkable that specialized medical units for the treatment and rehabilitation of people with spinal cord injuries with very similar programs and outcomes exist all around the world. Some individuals enjoy a life expectancy as if they didn’t have a spinal cord injury; others, like quadriplegics, have an approximate 10% decrease of life expectancy in comparison with the healthy population. These statistics are also consistent around the world. However, up to 90% of graduates from neurorehabilitation programs for individuals with spinal cord injury are wheelchair bound or have some limited mobility with assistive devices, limiting their quality of life. Thus, professional organizations are pursuing the development of minimally invasive and noninvasive surgical procedures alongside the development of functional neurosurgical interventions for the modification of brain and spinal motor control. Many individuals with
neurological disorders like brain and spinal cord brain injuries, stroke, multiple sclerosis, cerebral palsy, and many others that impair volitional movement can benefit from treatment and rehabilitation programs that ultimately result in an independent and self-sustaining life. Others live confined and dependent lives in special care facilities or other homes. They are indeed "veterans of contemporary medicine.”

Building motor control through new network design

Clinical procedures for the external control of movements of the paralyzed and paretic parts of the body due to upper motor neuron dysfunction are evolving, successfully enhancing and improving neurocontrol of volitional, postural, and complex reflex movements. Advanced clinical practice of physical therapy of upper motor neuron dysfunctions is continuously enriched by the human neurophysiology of neurocontrol based on external processing of the CNS and by building motor control through new network designs.

Human neurophysiology of motor control = prospect of neurorehabilitation of movement.

We can conclude that our methods of neurorehabilitation for movement recovery are advancing through a deeper understanding of the human neurophysiology of motor control.