

Spinal Epidural Stimulation Strategies: Clinical Implications of Locomotor Studies in Spinal Rats

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Abstract

© 2017, © The Author(s) 2017. Significant advancements in spinal epidural stimulation (ES) strategies to enable volitional motor control in persons with a complete spinal cord injury (SCI) have generated much excitement in the field of neurorehabilitation. Still, an obvious gap lies in the ability of ES to effectively generate a robust locomotor stepping response after a complete SCI in rodents, but not in humans. In order to reveal potential discrepancies between rodent and human studies that account for this void, in this review, we summarize the findings of studies that have utilized ES strategies to enable successful hindlimb stepping in spinal rats. Recent clinical and preclinical evidence indicates that motor training with ES plays a crucial role in tuning spinal neural circuitry to generate meaningful motor output. Concurrently administered pharmacology can also facilitate the circuitry to provide near optimal motor performance in SCI rats. However, as of today, the evidence for pharmacological agents to enhance motor function in persons with complete SCI is insignificant. These and other recent findings discussed in this review provide insight into addressing the translational gap, guide the design of relevant preclinical experiments, and facilitate development of new approaches for motor recovery in patients with complete SCIs.

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Keywords

electromyography, epidural stimulation, human locomotion, locomotion, motor training, multisite epidural stimulation, preclinical studies, spinal cord injury, spinal stepping, stimulation configurations

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