Absence of local sign withdrawal in chronic human spinal cord injury essay

Literature, Russian Literature

Absence of Local Sign Withdrawal in Chronic Human Spinal Cord Injury Spinal cord • Main pathway of communication between the brain and the rest of the body. • Soft tube-like structure of nerves that extends downward from the base of the brain. • Protected by the bones of spinal column. – Nerves enter and exits from the spinal cord through its length, passing through small openings between each vertebra.

• It is highly organized. – Anterior motor neuron – transmit information to muscles and stimulate movement. Posterior sensory neuron – transmits information to the brain about sensations such as touch, position, pain, heat and cold. Flexor Reflexes • A. k.

a. withdrawal reflexes. • Reflexes where in the flexor muscles contract due to a cutaneous sensory stimulus. Local Sign • Principle where the integrative centers of the cord cause groups of muscles to contract effectively and remove the pained part of the body from the object that cause pain. Local Sign Withdrawal • A reflex directing the limb away from noxious stimuli. • An indicative of a modular organization of spinal cord.

Windup-Crossover Test Test employing a sequence of stimuli not more than 3 seconds, used to assess whether common neuronal pathways were responsible for the loss of modular organization. Spinal Cord Injury • It is the damage to the nerves to the spinal canal. • Identified as low incidence, high-cost disability requiring tremendous changes in patient’s life-style. Etiology of Spinal Cord Injury 1. Traumatic Injuries ? Most frequent cause of injury. ? Result from damage caused by a traumatic event. e. g.

vehicular accident fall gunshot wound 2. Non-traumatic Injuries ? Result from a disease or pathologic influence. . g.

Vascular malfunctions (thrombosis, hemorrhage). Vertebral subluxations – secondary to rheumatoid arthritis Infection – syphilis, spinal neoplasm etc. Two Types of Lesions 1.

Complete Lesions ? There is no sensory or motor function below the level of the lesion. 2. Incomplete Lesions ? Characterized by preservation of some sensory-motor function below the level of injury. Experimentation • Local sign withdrawal is observed in spinal-intact humans in response to electrocutaneous stimuli applied to the different regions of skin on the foot and leg. After spinal cord injury, this organization of electrocutaneous reflexes was questioned. • The skin regions of the spinal-intact human foot have been mapped in detail regard to the activity of the muscles of the leg, demonstrating a clear pattern of muscle activity consistent with local sign withdrawal from the stimulus. Methods Study Description Session 1 – test for Local Sign Withdrawal 4-6 location of the lower leg and foot. Subject: 10 Spinal Cord Injured Patient 3 Spinal-intact Patient Session 2 – test for Windup-crossover 4 locations on the foot and lower legSubject: 10 Spinal Cord Injured Patient (8 from session 1) Test Apparatus • Each subject was seated in an adjustable chair (Biodex).

The foot was clamped to a fixation plate coupled with a load cell. The load cell was used to measure the isometric joint torque response to electrocutaneous stimuli. • Surface EMG were recorded from the tibialis

anterior, soleus, medial gastrocenemius, vastus medialis, rectus femoris and biceps femoris. Stimulation • Stimulating electrodes were placed at the high point of the medial arch of the foot, on the foot dorsum approximately 3cm distal to the ankle joint.

On the foot dorsum at the base of 1st and 2nd metatarsals. At the ankle posterior to the lateral malleolus (near the sural nerve), and on the posterior and anterior of the lower leg. Procedures Session 1 • Each stimulus as tested using 7 different amplitudes: 5, 10, 15, 20, 30, 40, and 50 mA. • Random and repeated 3x at 20-s intervals. Session 2 • The convergence of electrocutaneous reflex pathways was tested using the Windup Phenomenon. Windup-Crossover Test: 4 test sites were considered: Medial arch Dorsum of foot Anterior surface of lower legPosterior surface of lower leg • Electrocutaneous stimulus was repeated at 1-s intervals, with a total of 6. 3 windup tests were conducted for the arch and dorsum, which were followed by 10 tests in which the stimulus site was switched between 2nd and 3rd stimuli.

E. g. 2 test stimuli were applied to the medial arch at a 1-s interval, which were followed by 1-s later by 4 test stimuli applied to the dorsum of foot. Ten switching trials were conducted, alternating between arch to dorsum and vice versa resulting in 5 trials each. Finally, 3 windup test (single-stimulus site) were repeated for the arch and dorsum to ensure that there were no systemic changes in the response to the electrocutaneous stimuli. Results Session 1 • Stimulation site: arch of foot Spinal Cord Injury – EMG response in TA and smaller recordings in other muscles.

Joint Torque – strong hip and ankle flexion and small extension movement at the knee. • Stimulation site: arch and dorsum of foot Spinal Cord Injury – shows flexion regardless of stimulus site. Spinal-intact – changing stimulation site produced markedly different joint torque responses. Session 2 • The reactions increase from 1st to 3rd stimulation but it is consistent to all subject tested that with the 3rd through 6 responses it is already identical either for windup or windup with preconditioning.

Discussion • Electrocutraneous stimuli applied to different locations on the skin of the leg in human Spinal Cord Injury produced similar joint torque responses. As a result, the interneuronal processing of cutaneous stimuli altered in chronic human spinal cord injury. • While in spinal-intact, they show positive local sign withdrawal. The windup and crossover of stimulus location suggest that musculotopic organization of the flexion reflexes, typically associated with deep dorsal horn interneurons, is lost in chronic Spinal Cord Injury. Comparison of Local Sign Reflex Responses in Spinal-Intact and Spinal Cord Injury Subjects • Spinal Cord Injury – Negative • Spinal-Intact – Positive Spinal Locus of Windup in Chronic Human Spinal Cord Injury • The locus of flexion reflex windup is unknown, but a number of factors suggest that deep dorsal horn neurons and motorneuronal pools may be involved. Implications of a Loss of Local Sign in Human Spinal Cord Injury • As a result of Spinal Cord Injury, microstimulation of the spinal cord may not produce a set of unique basic groupings of muscle activation Plasticity of Spinal Electrocutaneous Reflexes • Absence of local sign in chronic Spinal Cord Injury suggests that either the flexion reflex organization has

undergone significant plastic change in the period after injury, or that the organizational center of local sign is located in supraspinal structures in human. Functional Classification of Spinal Cord Injury Quadriplegia – partial or complete paralysis of all four extremities and trunk, including the respiratory muscles, and results from the lesions of cervical cord.

• Paraplegia – refers to the partial or complete paralysis of all part of the trunk and both lower extremities, resulting from lesion of the thoracic or lumbar spinal cord or sacral roots. Sources: • The Merck Manual of Medical Information • Medical Physiology by Guyton • Physical Rehabilitation Assessment in Treatment by Sullivan and Schmitz • http://highwire. stanford.

edu/lists/freeart. dtl