DETECTION OF HYPERREFLEXIA-LIKE INCREASES IN BLADDER PRESSURE BY RECORDING OF SENSORY NERVE ACTIVITY IN HUMAN SPINAL CORD INJURY

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Bladder hyperreflexia often develops after spinal cord injury and leads to significant medical complications. The purpose of these experiments was to determine whether electrical recordings of sensory neural activity could detect changes in bladder pressure associated with hyperreflexia in humans with spinal cord injury. All protocols were reviewed and approved by the Institutional Review Board of MetroHealth Medical Center, and subjects gave informed consent. Split-cylinder cuff electrodes with two internal electrodes and 1 external reference electrode were implanted on the S3 dorsal root during surgical procedures in which the roots were thereafter transected. Nerve signals were amplified, filtered (100Hz-10kHz), and digitized (40kHz). For analysis, signals were rectified and time averaged. Robust ENG responses were evoked by stroking the S3 dermatome, weaker responses were evoked by manual flexion and extension of the ankle, and no responses were evoked by stroking the skin of the foot. During slow bladder filling there was an increase in the S3 ENG at the onset of filling, but not during the fill. Volume evoked hyper-reflexive contractions of the bladder were not evoked under general anesthesia. Therefore rapid injections of saline into the bladder were used to evoke hyperreflexia-like increases in bladder pressure. These rapid increases in bladder pressure led to robust increases in the S3 ENG. The ENG exhibited a large onset response, during the initial increase in bladder pressure, followed by decay to an increased baseline value during the maintained pressure. There was no apparent off-response during decreases in pressure induced by removal of saline, only a return to the pre-injection baseline ENG. These results demonstrate that electrical recording of sensory nerve activity can detect hyperreflexia-like increases in bladder pressure in human SCI. These results parallel earlier results from our laboratory demonstrating that sensory nerve recordings could reliably detect hyperreflexia-like bladder contractions in cats.