TITLE: Bladder manometry and multiple modalities of intraoperative neurophysiological monitoring in a tethered cord release surgery

AUTHOR: Shuiping Dai PhD, CNIM IONM/EEG LAB, DEPARTMENT OF NEUROLOGY, UNIVERSITY OF WISCONSIN HOSPITAL AND CLINICS, WISCONSIN, USA

A 16 year old female who had a lipomyelomeningocele and split cord malformation with several tethered cord releases (at birth, 2009, 2013), presented to hospital with progressive sensory and motor dysfunction of the lower extremities. She had bilateral lower extremities weakness, fatigue, gait changes, and neurogenic bladder and neurogenic bowel. Imaging studies indicated that lower thoracic segmentation and fusion anomalies and multilevel lumbosacral spina bifida. Her thoracic spinal cord at the level of the split was tethered on the left side with arachnoiditis. She was admitted for repeat tethered cord release, due to neurogenic bladder in this patient, surgeon requested to monitor bladder function during procedure. Bladder pressure monitoring was conducted by the placement of a urinary catheter. The urinary catheter has multiple ports, a port was connected to patient's Foley catheter, a port was connected to manometric transducer. After placing the catheter, filling the bladder with 250 cm^3 of normal saline solution and clamping the catheter to avoid emptying of the bladder is needed. A standard pressure monitor transducer is attached to the catheter; the pressure waveform is displayed on the vital sign monitor.

The procedure was continuously monitored by the interpreting neurophysiologist and an intraoperative practitioner via a live on-line network connection. The intraoperative neurophysiological monitoring consisted of bilateral lower limb free and triggered EMG and upper and lower limb SSEPs, bladder manometry. Baseline SSEPs showed good morphology and reproducibility except left lower SSEP was not present. Spontaneous EMG from anal sphincter and lower extremity monitored muscles did not show any neurotonic discharges at baseline. When surgeon identified the spit cord and untether the segment to the cord, several brief runs of neurotonic discharges occurred in EMG on the right and left, surgeon was informed in real time. Triggered EMG was used to characterize nerve roots and to ensure that surgeon were not cutting any neural structures, surgeon was informed of the results at time of stimulation. At the end of the procedure, the free-run EMG returned to a quiet baseline and SSEPs were unchanged from baseline. Patient's bladder pressure were continuously monitored and updated, there were not significant changes in pressure number. The patient was slowly woken up without any complications in PACU.

Fig 1. Baseline SSEPs

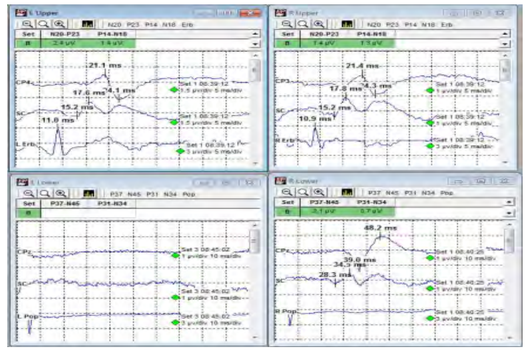

Fig2. dura open

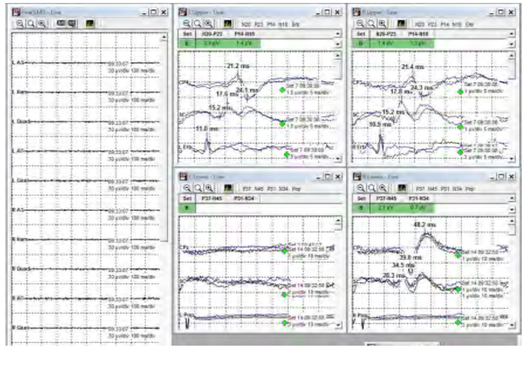

Fig 3. free-run EMG activities

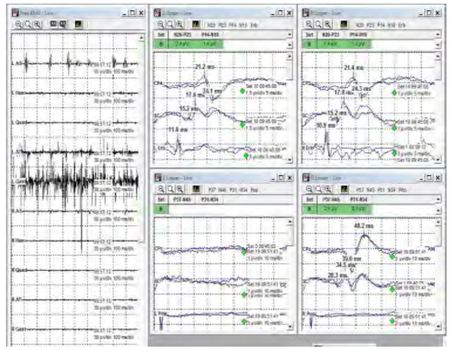

Fig 4. triggered EMG activities

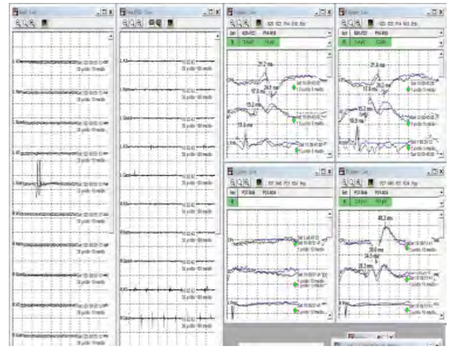

Fig 5. Bladder manometer

Discussion Points:

Tethered spinal cord syndrome is a neurological deficit caused by tissue attachments that limit the movement of the spinal cord, which cause an abnormal stretching of spinal cord. Neurogenic bladder is a urinary tract dysfunction in which the bladder does not empty properly due to tethered spinal cord and spinal bifida or a complication of spinal cord trauma, tumors and pelvic tumors.

This patient has a lipomyelomeningocele and split cord malformation which causes tethered cord and stretches the spinal cord. Due to worsened sensory and motor dysfunction, surgery to untether spinal cord is the reasonable option. Surgery complications include infection, bleeding, damage to the spinal cord or myelomeningocele, which may result in decreased muscle strength or bladder or bowel function. Intraoperative neurophysiological monitoring provides a standard practice for tethered cord release (1,2,3,4). Bladder manometry with multiple neurophysiological modalities were applied for to reduce risks of injuring neighboring sensory and motor nerve roots. IONM assess the nervous systems functional integrity in real time during surgical procedure. In addition, transcranial electrical evoked potential (4) can be used as additional standard practice for motor function monitoring in tethered cord release. To summarized, multiple neurophysiological monitoring with bladder manometry provide a real time monitoring for nervous system and may effectively prevent neurological complication postoperatively.

References:

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3 Hoving et al, Childs Nerv Syst 2011; 27(9):1445-1452
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