Multimodal, Intraoperative Monitoring During Paddle Lead Placeent for Cervicothoracic Spinal Cord Stimulation

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Introduction

We investigated the efficacy of combined somatosensory evoked potentials (SSEP) and electromyography monitoring during paddle lead placement through cervicothoracic laminectomy under general anesthesia in a retrospective review of data from 25 patients.

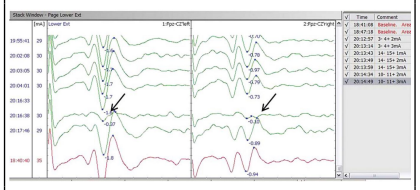
Methods

Muscle motor evoked potentials (MEP) recordings and SSEP monitoring were used for surveillance of the spinal cord. Collision testing of SSEP and threshold amplitudes of compound muscle action potentials (CMAP) in the bilateral upper and lower extremities evoked by electrode contacts of the paddle lead were checked to determine the laterality of the lead in the mediolateral direction.

Demographics and results of the patients

Vertebral level of lead placement	Cervical (n = 11; 44%)		Thoracic (n = 14; 56%)
	C_3–C_5 (n = 6)	Retrograde C_1–C_2 (n = 5)	T_8/T_9 (n = 14)
Patients, n	25		
Age ± SD, years	59.32±11.61		
Males/Females	14/11		
Cause of SCS			
Failed back surgery syndrome	12		
Failed neck surgery syndrome	9		
Peripheral neuropathic pain	3		
Neuralgic amyotrophy	1		
Significant reduction (>50%) in muscle MEP	1	1	0
Significantly asymmetrical SSEP reduction in collision test	0	2	4
Significant difference in threshold amplitude in CMAP (>2 mA)	0	4	4
Successful paresthesia coverage	6	5	14 (100%)
	(total: 11; 100%)		
Success in trial stimulation	5	3	9 (64%)
	(total: 8; 72%)		

Collision Test of SSEP



bilateral reduction(arrows) in the amplitude of SSEP

Results

A significant decrease in amplitudes of muscle MEP in spite of stable SSEP occurred in 2 patients: 1 patient with a retrograde C1–C2 insertion and another patient with an anterograde C4/C5 insertion. Repositioning of leads based on significantly asymmetrical collision testing of SSEP and thresholds of CMAP in bilateral extremities was needed in 6 and 8 patients, respectively. In 22 patients, paresthesia coverage of the painful area was consistently located in the painful side, either unilaterally or bilaterally. There was no episode of revision for suboptimal lead placement.

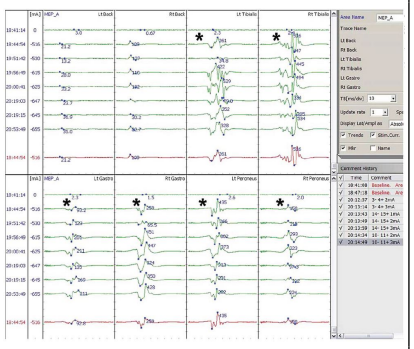
Conclusions

Intraoperative neurophysiological guidance using SSEP and muscle MEP was useful for the safe and accurate placement of paddle leads for cervicothoracic SCS.

References

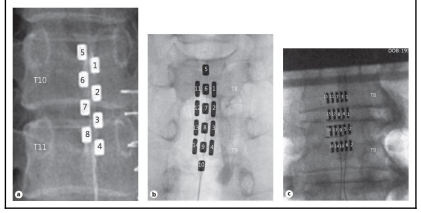
Deletis V, Sala F: Intraoperative neurophysiological monitoring of the spinal cord during spinal cord and spine surgery: a review focus on the corticospinal tracts. Clin Neurophysiol 2008; 119: 248–264.

Demonstration of CMAP



Midline contact of the three-column paddle lead

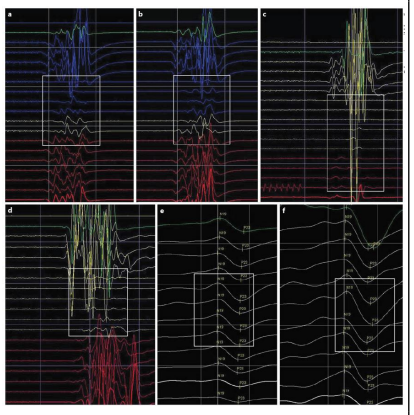
Examples of intraoperative stimulation through electrical contacts of paddle leads



Learning Objectives

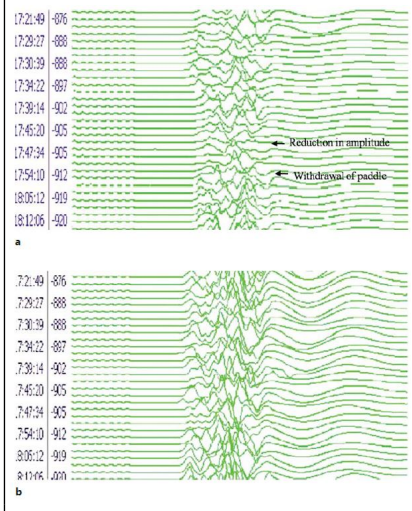
By the conclusion of this session, participants should be able to identify usefulness of SSEP and muscle MEP during paddle lead placement for cervicothoracic SCS

Case Demostration of decreased MEP after lead insertion



Right abductor pollicis brevis (a), left abductor pollicisbrevis (b), right tibialis anterior (c) and left tibialis anterior (d). The amplitudeand latency of SSEP in the right median nerve (e) and the left mediannerve (f) were stable during the period of drop in muscle MEP amplitude.

Demonstration of a case with unilateraldecrease in the amplitude of muscleMEP



The amplitudeof muscle MEP was restored afterwithdrawal of the lead