Monitoring MEPs and SSEPs in neuromuscular scoliosis patients

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Goals

1. To assess and predict feasibility of IONM in neuromuscular scoliosis (NMS) patients
2. To summarize stimulation and acquisition parameters during scoliosis surgery in NMS

Introduction

- Intraoperative neuromonitoring (IONM) is advised to reduce the risk of neurological damage during scoliosis surgery.
- Neurological deficits, such as cerebral palsy (CP) can hinder the feasibility of motor evoked potentials (MEPs) and somatosensory evoked potentials (SSEPs).

Methods

- Retrospective cohort study
- **Feasible monitoring** was defined by:
  1] MEPs in ≥ 1 leg/sphincter muscle **and/or** SSEPs in ≥ 1 channel
  2] MEPs in ≥ 1 leg/sphincter muscle **and** SSEPs in ≥ 1 channel
- Patient characteristics: age, height, weight, voluntary motor function lower extremities, diagnosis, GMFCS
- Stimulation paradigms are described
- Predictors were tested using binary regression analysis

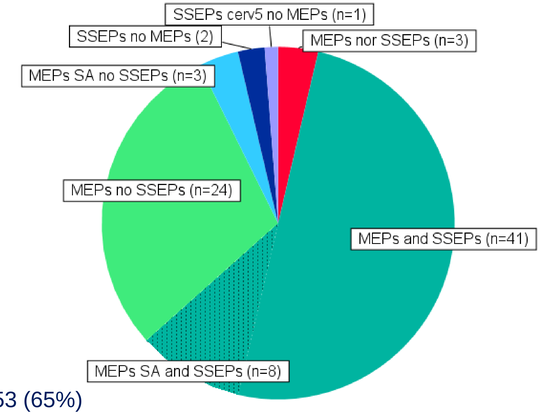
Results

SSEP stimulation parameters

- Lower limbs: CPz-Fz (n=37) / CPc-Fz (n=7) / cerv5-Fz (n=9)
- Stimulation parameters: current: 30.6mA±8.7
- Pulsewidth: 223ms±62.6
- Frequency: 4.5Hz±0.6

Results

N=82 patients (51 CP; 31 other)
2 patients with cochlear implants, only SSEP monitoring



Feasible monitoring
1] **n=79 (96%)** MEPs **and/or** SSEPs
MEPs: n=76 (93%), SSEPs: n=53 (65%)
Patients in whom IONM not feasible (n = 3) GMFCS 5

2] **n=51 (62%)** MEPs **and** SSEPs
Body weight higher in patients with feasible monitoring versus not feasible monitoring (p=0.026)
More patients with feasible monitoring had voluntary motor function in the lower extremity (p=0.01)

MEP only SA: n=5
SSEP only cerv5: n=9

No significant predictors were found

MEP stimulation parameters

- m. abductor digiti minimi/m. abductor pollicis brevis, m. obliquus abdominis, m. rectus femoris, m. tibialis anterior, m. gastrocnemius, m. abductor hallucis, m. sphincter ani (SA) (n=18)

- **Voltage stimulation biphasic (C3-C4)**: **438V±130** (175-700)
- Pulsewidth: **75µs**
- Interpulse interval: **1.18**ms±0.44 (1.0-3.0)
- Intertrain interval (n=36): **16.1**ms±15.3 (8-100)
- number of pulses: **8**

Table: patients' characteristics

	MEPs **and/or** SSEPs feasible vs not feasible	MEPs **and** SSEPs feasible vs Not feasible
Patients (n)	79 (39 female) 3 (2 female)	52 (26 female) 26 (13 female)
Mean age (years)	14.4 ± 3.3 13.7 ± 5.7	14.1 ± 2.9 14.7 ± 4.2
Body height (cm)	151 ± 12.4 153 ± 32	152 ± 13.2 149 ± 12.4
Body weight (kg)	41.1±10.8 34.6± 9.9	41.8 ± 11.8 ***** 38.3 ± 8.3
Voluntary motor function (yes / no / missing)	47 / 19 / 13 0 / 2 /1	35 / 10 / 7 * 9 / 11 / 6
Diagnosis	CP: n=49; other: n=30 CP: n=2, other: n=1	CP: n=30; other: n=22 CP: n=19; other: n=7

Values are n or mean ± SD, * $p < 0.05$ according to t-test

Conclusion

IONM using both MEPs and SSEPs should be considered in **all neuromuscular scoliosis patients**

- In **96% of NMS patients** IONM is feasible
- IONM feasibility is associated with voluntary motor function and higher body weight
- Recommendations MEP: biphasic stimulation at C3-C4, pulsewidth 75µs, include MEP m. sphincter ani
- Recommendations SSEP: include cervical derivation (cerv5)