

Feasibility of Surface Electromyography and Electrodermal Activity for Assessment of Neuraxial Blockade

Sofia Nicolls¹, Ana Sjaus,^{2 3} MD FRCPC

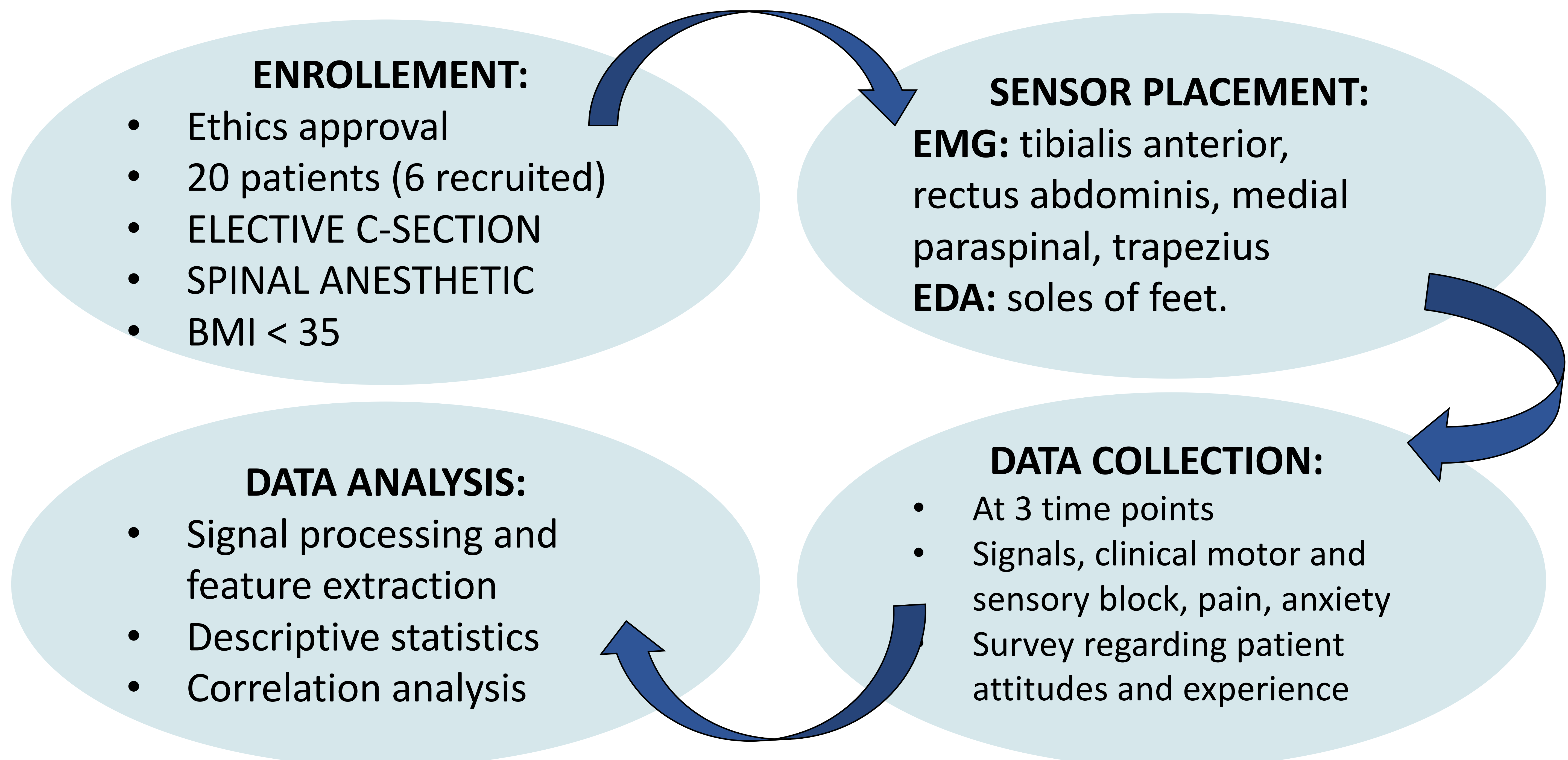
¹ Dalhousie University, ² Dalhousie University Department of Anesthesiology, Pain Management and Perioperative Medicine, ³ IWK Health Sciences Center, Halifax, Nova Scotia, Canada

INTRODUCTION

- Direct clinical testing of sensory and motor function is currently the only technique to assess neuraxial anesthesia.
- Wearable sensors are available that can detect a range of biological signals :
 - Surface electromyography (**sEMG**) is used to measure muscle contractions.
 - Electrodermal activity (**EDA**) measures changes in skin conductance that correlate with the level of sympathetic arousal.
- These technologies may have the capability to provide information for automatic assessment of block. However, optimal sensor placement, feasibility of recording and the impact on parturients' experience are unknown.

OBJECTIVE: To assess the feasibility and acceptability of EMG and EDA in obstetrical setting.

METHODOLOGY: Observational feasibility study.



RESULTS

Acceptability:

- None of the patients reported sensor related skin irritation, discomfort, restricted movement or impaired ability to hold and bond with the newborn.
- 5 out of 6 patients agreed that they would wear the sensors as a routine part of the procedure (one was neutral).

Feasibility:

- Of the 90 planned wireless signal recordings, 73 (81%) were completed. Reasons for failure were sensor detachment (3), a computer failure (11), and emesis (3). Recordings had sufficient signal quality to allow feature extraction and detailed analysis.

Signal findings:

- Tibialis anterior (TA) max. voluntary contraction amplitude correlated best with Bromage scale (Spearman’s rho = -0.62, p=0.01).
- Median TA recovery was 31% of baseline MVC despite full recovery by clinical assessment.
- EDA recordings showed consistent and progressive loss of phasic activity and decrease in tonic activity during block onset in 5/6 patients. These changes reversed during recovery. EDA signal features correlated with sensory block level and anxiety scores.

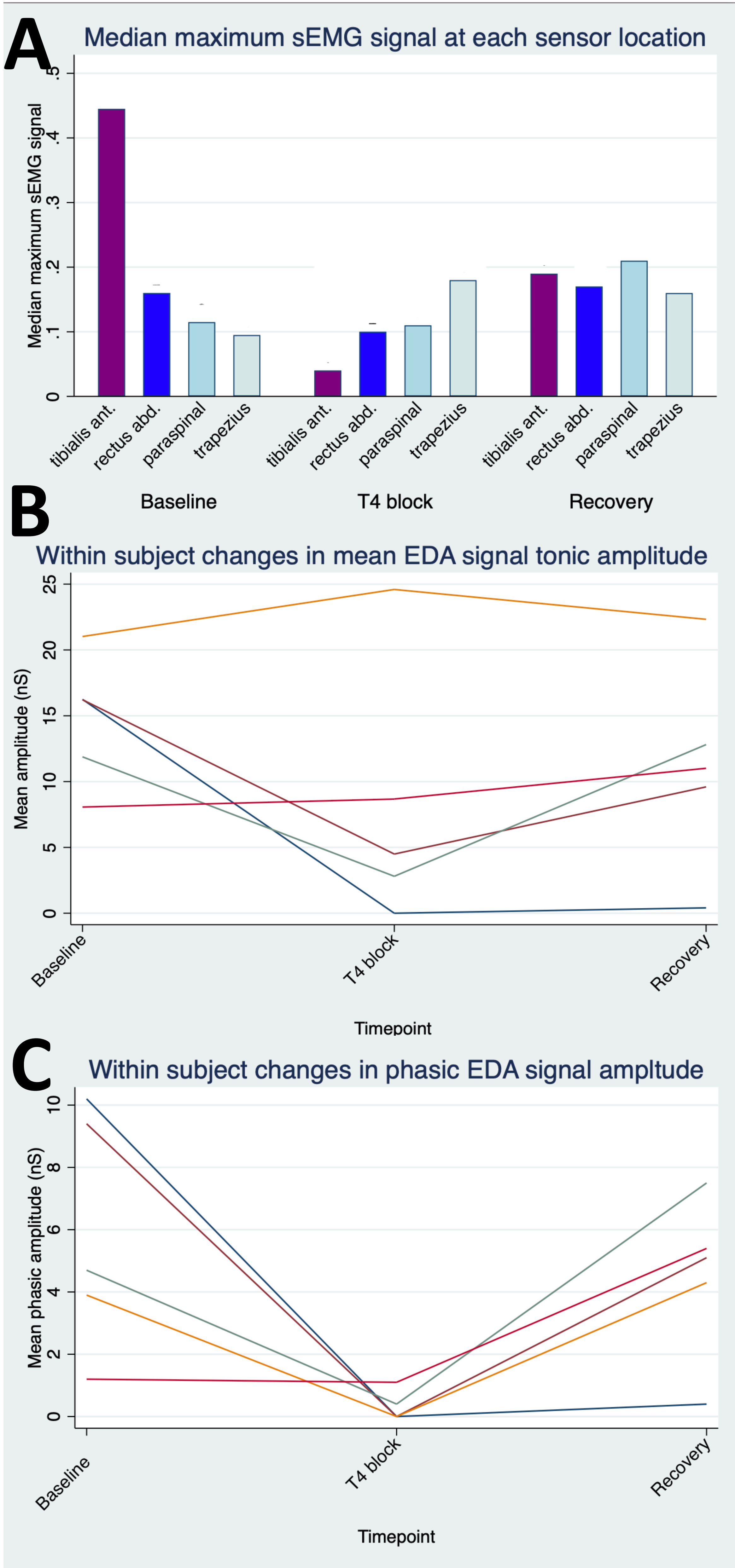
sEMG maximal amplitude (mV) median (IQR)	Baseline N=6	T4 block N=5	Recovery N=5	Contraction Amplitude Recovery (fraction of baseline)	Correlation with Bromage score (Spearman’s rho)
Tibialis anterior	0.45 (0.18-0.95)	0.04 (0.03-0.05)	0.19 (0.11-0.5)	0.31 (0.13-0.53)	-0.62 (p=0.0112)
Rectus abdominis	0.16 (0.10-0.35)	0.10 (0.08-0.13)	0.17 (0.13-0.26)	0.72 (0.70-2.13)	-0.40 (p=0.136)
Lumbar paraspinals	0.12 (0.1-0.67)	0.11 (0.10-0.12)	0.21 (0.11-0.45)	1.01 (0.62-1.10)	-0.25 (p=0.3709)
Trapezius	0.1 (0.06-0.15)	0.18 (0.04-2.87)	0.16 (0.12-0.22)	0.80 (0.66-2.00)	0.11 (p=0.713)

EDA mean amplitude (nS) median (IQR)	Baseline N=6	T4 block N=6	Recovery N=5	Correlations (Spearman’s rho)
Tonic	14.05 (10.47-16.25)	4.50 (2.81-8.68)	11.02 (9.6-12.82)	
Phasic	4.30 (1.20-9.40)	0.00 (0.00-0.40)	5.10 (4.30-5.40)	Sensory block level -0.61 (p=0.016) Anxiety -0.54 (p=0.036)

Figure 1: Table of numeric values for sEMG and EDA signal amplitudes with significant correlations.

Figure 2 (right):

A - Maximum voluntary contraction amplitude of sEMG signal at each of the time-points
B and C - Changes in tonic and phasic features of EDA signal throughout the perioperative period



CONCLUSIONS

- Peripartum application of sEMG and EDA sensors was feasible and positively experienced by patients undergoing cesarian section.
- sEMG and EDA signals contained information that could be correlated with clinical findings.
- The findings can be used to facilitate further research into wearable sensors for monitoring of neuraxial blockade.

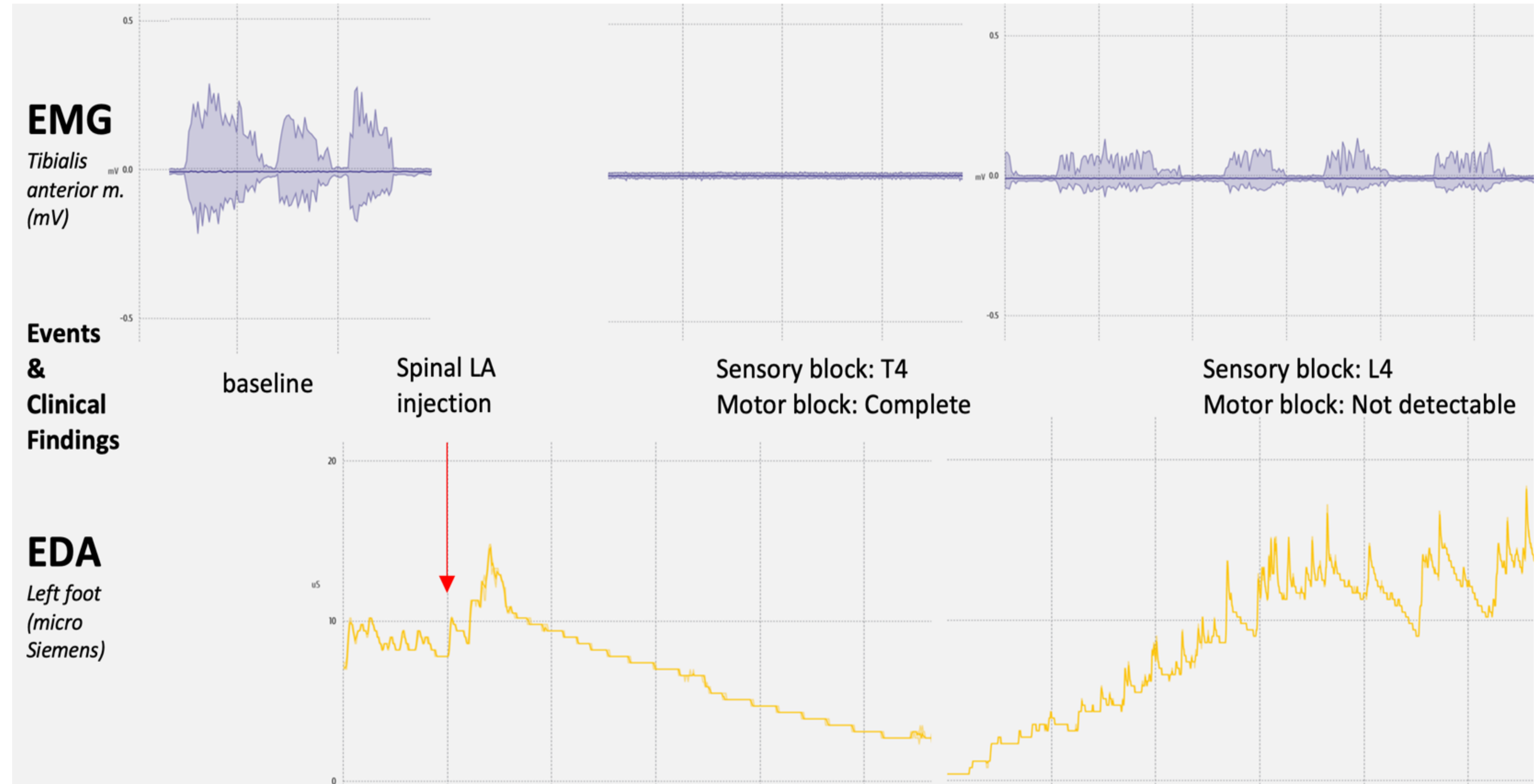


Figure 3: Typical sEMG and EDA signal changes recorded in one subject throughout the perioperative period

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References:

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