Linked Quadri-Polar (LQP) TceMEP Technique During a Scoliosis Procedure

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Introduction: A 13 year old female underwent an elective surgery for spinal deformity (scoliosis, T3 – L1). No history of neuromuscular disease or contraindication for intraoperative neurophysiological monitoring (IONM).

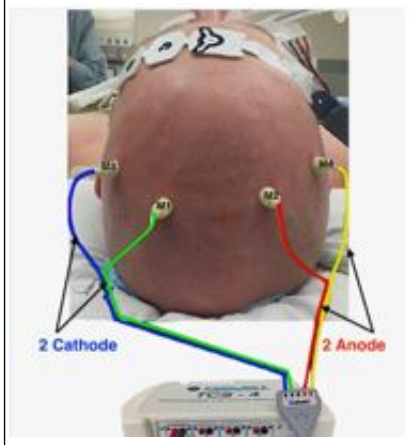
IONM Protocol Details

- The case was monitored by a certified technologist and supervised by a certified neurophysiologist present on site.
- The IONM system used in the case was a Cadwell Elite.
- (LQP) TceMEP screw stimulating electrodes were placed using the modified 10-20 system, one centimeter anterior to the central location (M1-M3, M2-M4), (Fig 1a).
- (LQP) TceMEP parameters: Train of 4, ISI:1.5, PW:75, Left V:100 (308 mA), Right V:110 (334 mA)
- Compound muscle action potentials were recorded using subdermal 13mm needle electrodes placed bilaterally into the muscle belly of the abductor pollicis brevis, abdominals, vastus lateralis, anterior tibialis, gastrocnemius, abductor halluces, and extensor digitorum brevis.
- SSEPs were monitored bilaterally using posterior tibialis and peroneal nerves at the ankles for lower extremity and median nerve at the wrists for upper extremity.
- H-Reflex, EMG (free and triggered), TOF
- Total intravenous anesthesia (TIVA), propofol and remifentanil was implemented for this case.
- Baselines were obtained prior to incision, SSEP, (LQP) TceMEP and H-Reflex.
- Reference below the pre-operative X-Ray, (Fig 1b), the post-operative X-Ray, (Fig 1c) and (Fig 1d)

Intraoperative Course 1

After placement of screws the surgeon started performing the correction on the concave side (L), which is when we saw the first (LQP) TceMEP change (Fig 2a, the patient's L side) and (Fig 2b, the patient's R side). The pink waveforms in the red box at 13:12pm are the significant changes in amplitude of the lower extremities, as seen against the red line representing the initial baseline recordings (Fig 2a, 2b). No changes in the SSEPs and H-Reflex were seen at this time.

Figure 1A



IONM System Set up

Figures 1b, 1C and 1D

Figure 1b Figure 1c Figure 1d

Intraoperative Course 2

After the first MEP change the surgical correction was performed segment-by-segment with continuous MEP testing, made possible by the low threshold applied. However, as seen In (Figure 3a, red box), the right side (LQP) TceMEP showed significant changes in amplitude with delay changes on the L side (LQP) TceMEP (Figure 3b, red box). During this part of the procedure gradual increases in stimulation intensity to 140V, 170V and 200V and no lower extremitiies (LQP) TceMEP were able to be evoked. The surgeon was notified immediately, the surgeon released the correction by removing the rod on the concave side (L). No changes in the SSEPs and H-Reflex were seen at this time. The spinal correction was aborted from the L side (concave) and correction of the spine from the R side was started (convex). No further changes in any IONM modalities were seen during correction of the spine from the convex side.

Figures 2a and 2b

Figure 2a

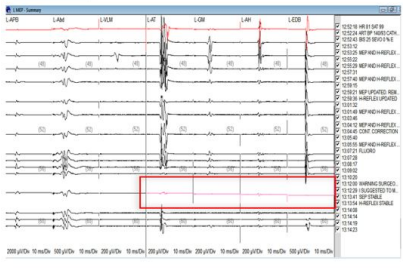
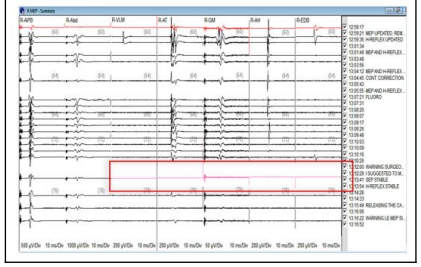


Figure 2b



Figures 3a and 3b

Figure 3a

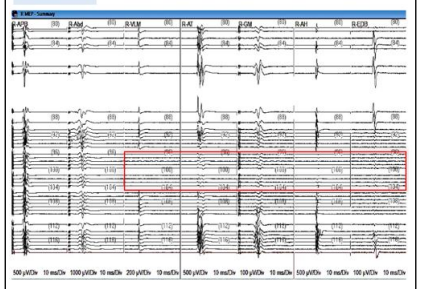
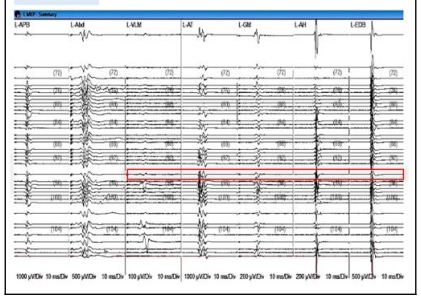


Figure 3b



Movie

Movie

Conclusion

The threshold technique combined with (LQP) TceMEP technique effectively detected the smallest change before the signal disappeared and permanent injury occurred. The minimal patient movement produced when using this technique allowed us to monitor the motor tract continuously with no interruptions to the surgical procedure. Three alarm criteria to interpret (LQP) TceMEP changes were evaluated in this case and resulted in a successful outcome: amplitude, threshold level and morphology criterion. The details for each of these include: A threshold level of 50V, A 50% decrease in amplitude, From multi-phasic to bi-phasic to monophasic change in morphology

Key Takeaway: in two instances we immediately detected spinal cord distress in a very young patient with continuous motor tract monitoring using the low threshold (LQP) TceMEP technique. By minimally activating the patient's motor function, thus resulting in less movement, we analyzed the patient's neurophysiological status at more frequent intervals throughout this lengthy surgical procedure. The presence of qualified IONM personnel well educated in IONM biomechanics and surgical intervention methodology, both technically and professionally, in the OR provided the highest quality care team for this patient.

References

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