Neuromonitoring During Surgical Treatment of Thoracic Outlet Syndrome

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Purpose

- To retrospectively review intraoperative neuromonitoring changes during the surgical treatment of Thoracic Outlet Syndrome (TOS) in an effort to reveal the nature, pattern and timing of neurologic injuries that may occur during these procedures.
- To describe the efficacy, sensitivity and specificity of neuromonitoring with respect to detection of post-operative neurologic injuries associated with these procedures.

Methods

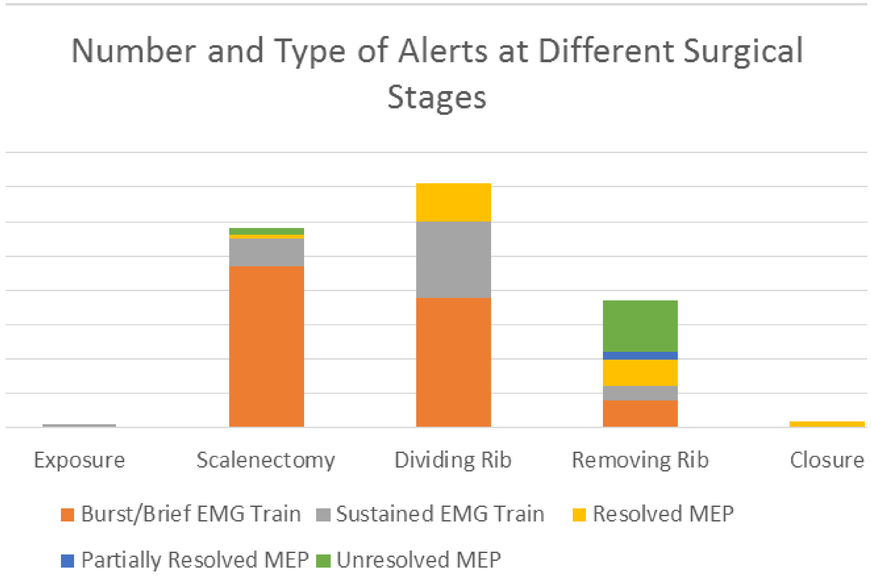
- 122 procedures monitored for 115 patients. 7 patients received bilateral procedures. Ages ranged from 15 to 65 years with a mean of 35.
- Surgical treatment was performed through the supraclavicular approach and involved anterior scalenectomy, first rib resection and neurolysis.

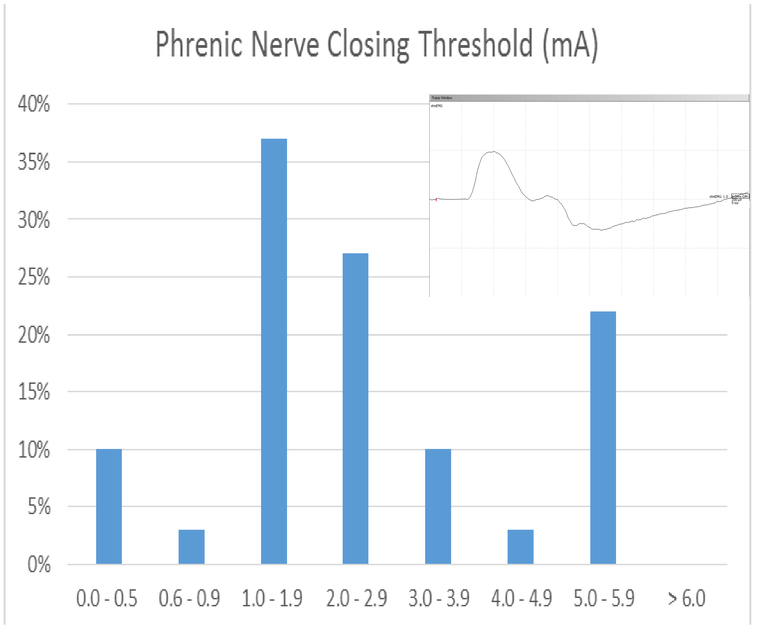
Neuromonitoring Plan:

- Spontaneous EMG, stimulated EMG and motor evoked potentials (MEP) recorded from upper extremity muscles innervated by the brachial plexus
- Spontaneous and stimulated EMG as well as motor evoked potentials recorded from serratus anterior muscle innervated by the long thoracic Nerve.
- Spontaneous and stimulated EMG recorded far field at xyphoid from diaphragm innervated by phrenic nerve
- Ulnar nerve somatosensory evoked potentials

Results

- Alerts occurred in 82 (67%) of the procedures.
- 169 isolated or concurrent "alert events" were noted.
- 97% of the alerts involved the brachial plexus followed by the phrenic nerve (2%).
- No long thoracic nerve or ulnar nerve SSEP alerts were noted.
- The overall rate of new deficits was 2.4%.





- Stimulated EMG was used in many of these procedures to identify neural elements and to verify conduction in the presence of unresolved MEP changes.
- Phrenic nerve is commonly stimulated immediately prior to closing to verify conduction since it is difficult to isolate and verify Diaphragm function with motor evoked potentials.
- Closing stimulation thresholds of 5.9 mA or below were prognostic of intact phrenic Nerve conduction for the patients involved with this study.

Sensitivity/specificity with Respect to Unresolved Alerts:

- Overall Sensitivity = 33 %. *However, sensitivity has been **100%** since monitoring of long thoracic and phrenic nerves has been added to the neuromonitoring protocol following post-op phrenic and long thoracic nerve deficits.*
- Specificity = 94%

Conclusion

Multimodality neuromonitoring is an efficacious, sensitive and specific adjunct to supraclavicular surgical treatment of TOS.

Intraoperative neuromonitoring can prompt the surgeon to react immediately to early signs of evolving neurologic injury and thereby avoid or mitigate long-term neurologic deficits. Unresolved alerts primarily occur during or immediately after rib removal. Stimulated EMG is a good prognostic indicator of post-operative phrenic nerve function. The post op injury rate associated with this study group (2.4%) compares favorably with other studies which have documented injury rates as high as 37%.

Disclosures

- Clinical Manager, SpecialtyCare, 3100 West End Avenue, Suite 800, Nashville, TN 37203
- The primary author provides intraoperative neuromonitoring for both of the co-authors at Christiana Care Health System in Newark Delaware.