Detection of Brachial Plexopathy during Transaxillary Robotic Thyroidectomy

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INTRODUCTION

Injury to the brachial plexus is among the most frequent complications of surgery and often the primary reason for anesthesia-related malpractice claims.[1] While such positional-based nerve injuries have been noted in both spine and cardiothoracic surgery, there are no such reports in head and neck surgery. The recent introduction of transaxillary robotic thyroidectomy, however, presents a unique patient positioning challenge in that the upper extremity is placed in 180 degrees of abduction. Because the brachial plexus, which is responsible for the motor innervations to the muscles of the upper limb, passes in contact with the clavicle anteriorly, first rib inferiorly and the humeral head posteriolaterally, proximity to these movable bony structures predisposes the neural elements to stretch or compression injury with the arm and shoulder in such extreme abduction (figure 1).

In a series of 338 patients who underwent transaxillary robotic thyroidectomy, Kang et al. reported 1 transient ipsilateral arm paralysis as well as 3 permanent recurrent laryngeal nerve injuries, 6 seromas, 2 hematomas, and 1 case of Horner’s syndrome. [6]

Given its widespread use and success in spine surgery, intraoperative neuromonitoring (IONM) should help identify emerging brachial plexopathy such as that noted by Kang and co-workers and, thereby, assist in determining the need to convert the transaxillary approach to a conventional open thyroidectomy.

We present the first known case report detailing multimodality intraoperative neurophysiologic monitoring detection of evolving positional brachial plexus injury during transaxillary robotic thyroidectomy.

SETUP

- A 54-year-old morbidly obese, diabetic female with a 1cm left thyroid nodule was consented for transaxillary left thyroidectomy.
- A commercially available portable neuromonitoring system was used for stimulation and recording of all monitoring modalities.
- A tailored anesthesia protocol was used to optimize multimodality intraoperative neurophysiologic monitoring response amplitudes.
- Incisions were made and dissection proceeded in a traditional manner. Adequate visualization of the thyroid was obtained, the da Vinci Robot was docked, recurrent laryngeal nerve identified and the superior pole was divided.

Figure 1: Patient position – Supine with the neck slightly extended. Arm was rotated to full abduction at 180 degrees and supported on an armrest rapped in protective gel pads.

Figure 2: Upper extremity multi-myotomal transcranial electric motor (tceMEPs) and ulnar nerve cortical somatosensory evoked potentials (UNSSSEPs) were elicited according to principal of practice described by Schwartz et al.[4] The multipulse stimulus was delivered between two subdermal needle electrodes inserted subcutaneously over motor cortex regions and recorded by electrodes placed in the upper extremity.

The left arm was subsequently repositioned several times in an effort to reduce brachial plexus compression. Mean arterial pressure also was elevated from 75 to 96 mm Hg in an effort to optimized peripheral perfusion. Despite repeated attempts at adjusting arm position with the robotic guidance system in place, tceMEPs from the left upper extremity remained highly attenuated across all myotonal recording sites on the left with no such changes on the right upper extremity.

As a result of the clear neurophysiologic evidence of evolving left brachial plexopathy with the arm abducted even at 90 degrees, the decision was made to remove the robotic guidance system to allow for placement of the left arm in a neutral position by the patient’s side. At this time, the surgical strategy was changed and the thyroid was exposed via a direct open approach to complete resection of the left lobe.

Figure 3: Before start of the case baseline transcranial electrical motor evoked potentials (tceMEPs) were recorded successfully from left deltoid, biceps, extensor carpi radialis, triceps and first dorsal intersosseous muscles. There were no remarkable changes in the evoked potentials following patient left arm abduction to 180 degrees.

Figure 4: During the early stages of thyroid dissection, the transcranial electrical motor evoked potentials from the left upper extremity showed remarkable amplitude attenuation across all recording sites, prompting a surgical and anesthesia alert for evolving positional injury to the left brachial plexus. Note that there was no such amplitude loss on the non-operative right side tceMEP responses. While not as dramatic as the left tceMEP amplitude attenuation, the ulnar nerve somatosensory evoked amplitude decreased by 50% relative to baseline. Here again, the right side control remained unchanged.

Figure 5: Approximately 40 minutes thereafter, left tceMEP and ulnar nerve SSEP amplitudes began to show remarkable recovery with almost complete resolution by the end of closing. Post-operatively the patient had full range of motion, normal sensation and 5/5 upper extremity muscle strength on neurologic examination.

We demonstrated the first case of intraoperative neuromonitoring of the brachial plexus during transaxillary robotic thyroidectomy resulting in the elimination of a potentially debilitating complication. Given the potential for brachial plexus injury, we recommend that continuous tceMEP and SSEP monitoring be considered during such procedures.

CONCLUSIONS

REFERENCES