How I Do It

Enucleation of Vagal Nerve Schwannoma Using Intraoperative Nerve Monitoring

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Vagal nerve schwannomas are rare, benign, neural sheath tumors. The treatment of enlarging or symptomatic vagal nerve schwannomas is surgical resection. Transecting the vagus nerve results in significant morbidity, and attempts at nerve preservation should be made whenever possible. We introduce a nerve-sparing technique using meticulous microsurgical dissection and intraoperative nerve monitoring for vagal schwannomas. A 61-year-old patient presented with an enlarging 2-cm right vagal nerve schwannoma. She underwent resection via a transcervical approach. The patient was intubated with an electromyographic (EMG) endotracheal tube that allowed for monitoring of the recurrent laryngeal nerve intraoperatively. A microsurgical subcapsular dissection was performed after branches of the vagus nerve were identified using a nerve probe and preserved. At the conclusion of the resection the nerve was intact and stimulated along its entire course. Postoperatively, the patient had normal vagal nerve function. We introduced the role of intraoperative nerve monitoring using an EMG endotracheal tube for successful enucleation of vagal schwannomas. In conjunction with meticulous microsurgical dissection, nerve monitoring allows for successful preservation of the vagus nerve and decreased postoperative morbidity.

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INTRODUCTION

Vagal nerve schwannomas are rare neural sheath tumors. Although schwannomas are generally benign lesions, they are known to enlarge at a rate of 2.5 to 3 mm per year according to published reports.1,2 The most common presenting symptoms are hoarseness, dyspnea, dysphagia, cough, aspiration, tongue weakness, and vocal cord paralysis. However, it is not uncommon for this tumor to present as an enlarging asymptomatic neck mass.

The treatment options of vagal nerve schwannomas are wide ranging. Asymptomatic tumors can be observed closely due to their benign nature and indolent course. Surgical resection is the standard of care for symptomatic schwannomas, and there are differing opinions on what surgical procedure should be performed. Some authors believe that the close adherence of the vagus nerve to the tumor capsule renders preservation of the nerve impossible,3 and thus advocate complete excision with nerve transection. This is often performed in conjunction with immediate reanastomosis and/or vocal cord medialization. Other authors claim that careful dissection can separate these tumors from their associated nerves,4 and favor nerve-sparing techniques including enucleation, extracapsular removal, and shelling out the majority of the tumor while leaving gross disease behind. A literature review performed by Valentino et al. shows that these procedures increased the chances of nerve preservation ranging in success based on the procedure performed.5 The technique of enucleation of vagal nerve tumors has been described by several authors with moderately good results.5,6 A series of five cases described by Araujo et al. using the enucleation technique showed a 60% success rate in preserving nerve function postoperatively.

The use of intraoperative electrophysiological monitoring has been described in the neurosurgical literature as a valuable tool in aiding surgeons during the resection of brachial plexus schwannomas.7 However, there have been no reports in the literature of the use of intraoperative nerve monitoring to aid the dissection of vagal nerve schwannomas.

CASE REPORT

A 61-year-old female with a history of papillary thyroid carcinoma and total thyroidectomy performed 12
years prior presented to our institution for a routine screening visit. During routine physical examination she was noted to have an asymptomatic right neck mass. Computed tomography and magnetic resonance imaging (MRI) of the neck showed a 16 × 12-mm lesion in the right juxtahyoid neck directly apposing the right carotid sheath (Fig. 1). The lesion was noted to be deep to the sternocleidomastoid muscle. Fine-needle aspiration of the lesion revealed spindle cells consistent with a nerve sheath tumor. She underwent a period of observation, and a repeat MRI at 6 months demonstrated tumor growth. Given her history of thyroid cancer, the patient was concerned about the possibility of metastatic disease, despite the cytologic findings. Thus, the decision was made to remove this lesion via a transcervical approach.

Intraoperatively, a transcervical approach was performed with careful layer-by-layer dissection down to the level of the tumor. The tumor was well circumscribed and noted to arise from the right vagus nerve (Figs. 2–4). Intraoperative nerve monitoring was used with the NIM electromyographic endotracheal tube (Medtronic, Minneapolis, MN) to confirm that the nerve identified with the dissection was the vagus nerve. The nerve monitor probe was placed on the identified structure and a positive response was elicited. By vigilantly identifying all nerve fibers with the aid of the operating microscope and the nerve monitor probe, strategic entry through the tumor capsule was able to be performed without harm to the nerve itself. After the capsule was delicately entered, the tumor was meticulously dissected in a circumferential fashion to free it from its connective tissue. After the tumor was completely excised from its surrounding tissue, it was delivered via the capsular incision and removed from the neck. After enucleation was performed, the nerve was stimulated along its entire course and was shown to be fully intact.

Postoperatively, the patient did very well; her voice was intact and she did not have dysphagia or aspiration. Flexible laryngoscopic exam performed in the clinic 1 week postoperatively revealed normal vocal cord function.

**Fig. 1.** T2-weighted magnetic resonance imaging in axial view showing a mass arising from the right vagus nerve.

**Fig. 2.** Retraction of the internal jugular vein revealing a schwannoma arising from the distal aspect of the vagus nerve. [Color figure can be viewed in the online issue, which is available at wileyonlinelibrary.com.]

**Fig. 3.** Black nerve probe identifying the vagus nerve with well-circumscribed schwannoma arising from the nerve. [Color figure can be viewed in the online issue, which is available at wileyonlinelibrary.com.]

**Fig. 4.** Postexcision photo of vagal nerve schwannoma after careful dissection using intraoperative nerve monitoring. [Color figure can be viewed in the online issue, which is available at wileyonlinelibrary.com.]
DISCUSSION

Vagal nerve schwannomas present a challenging problem for head and neck surgeons. Multiple treatment options exist including observation, complete tumor excision with nerve transection, and excision with nerve preservation. Given the neurological sequelae associated with vagal nerve transection, nerve-sparing techniques should be performed whenever feasible. The intimate relationship between the vagus nerve fibers and tumor capsule requires meticulous subcapsular dissection to optimize the chances of preserving nerve function.

The benefit of microsurgical nerve-sparing dissection of vagal nerve schwannomas has been demonstrated. Torossian et al. reviewed postoperative neurological outcomes in 15 head and neck schwannomas undergoing enucleation with nerve preservation. Only two tumors recurred, and these recurrences were attributed to the lack of microscopic dissection. However, despite the use of microsurgical techniques there are still a number of cases in the literature of failure to preserve nerve viability.

Recurrent laryngeal nerve monitoring using an electromyographic endotracheal tube has been advocated in patients undergoing complex thyroid surgery or central neck lymph node dissection. This technology allows for intraoperative monitoring of nerve function and potentially results in a decreased risk of recurrent laryngeal nerve injury. In this article we introduce the use of electromyographic endotracheal monitoring for dissection of vagal nerve schwannomas. We have found that the ability to identify vagal nerve fibers using the nerve probe results in a more precise subcapsular dissection. This relatively noninvasive technique did not add significant time to the operative procedure and resulted in an excellent postoperative outcome.

CONCLUSION

The purpose of this report is to present our technique for enucleation of vagal nerve schwannomas with nerve preservation. In conjunction with meticulous microsurgical dissection, nerve monitoring allows for successful preservation of the vagus nerve and decreased postoperative morbidity.

BIBLIOGRAPHY