

Resection of Primary Brachial Plexus Tumor via a Modified Supraclavicular Approach

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Abstract

Benign peripheral nerve sheath tumors are generally considered curable lesions, and surgical resection is recommended as the primary line of treatment. When these tumors occur in the brachial plexus, they are most frequently accessed via the supraclavicular approach. Traditional descriptions of this approach have included either transection of sternocleidomastoid (SCM) muscle fibers or disarticulation of the clavicular head of the SCM muscle. This report presents a simple and easy-to-adapt modification of the supraclavicular approach that offers greater preservation of the SCM muscle. The modification primarily consists of the creation of an intramuscular window between the sternal and clavicular heads of the SCM via the splitting and dilation SCM muscle fibers. This technique minimizes the disruption of SCM muscle tissue compared with previous descriptions and may be associated with improved postoperative pain and return to function.

Keywords

- ▶ brachial plexus tumor
- ▶ supraclavicular approach
- ▶ sternocleidomastoid muscle
- ▶ intramuscular window

Introduction

Brachial plexus tumors are relatively rare and constitute < 5% of upper extremity tumors.¹ Surgical management of brachial plexus tumors requires a thorough understanding of the regional anatomy. Approaches to the brachial plexus are typically anterior and named in relation to the clavicle. They include the supraclavicular,² infraclavicular,³ and the transclavicular⁴ approaches. The choice of approach is influenced by the location and size of the lesion. The supraclavicular and infraclavicular approaches may be easily combined.⁵ In selected patients with conditions such as morbid obesity, previous neck surgery and radiation, among others, a posterior subscapular approach may also be an option.⁶ However, most frequently used is the anterior supraclavicular approach.⁷ Advantages of this approach include the extent of access to the plexus and C5 to T1 nerve roots, nerves, and trunk; disadvantages include difficulty with visualization of lesions in proximity of the clavicle.⁸ This approach may involve retraction of the clavicle, and previous descriptions also include the transection of some sternocleidomastoid

muscle (SCM) fibers and/or disarticulation of the clavicular head of the SCM muscle from the clavicle.^{2,9}

This case report describes a unique technical variation of the supraclavicular approach whereby an intramuscular window was created between the sternal and clavicular heads of the SCM to access the supraclavicular fossa. This technique provided excellent visualization of a proximal brachial plexus lesion in relatively close proximity to the clavicle with minimal disruption of the native SCM anatomy. The patient reported excellent pain control and had a rapid return to function.

Case Report

This patient was a 47-year-old man with no significant past medical history who presented with left-sided neck and shoulder pain accompanied by left upper extremity intermittent burning pain and numbness in the C7 dermatomal distribution. On examination, the patient had full motor strength in his left upper extremity and no sensory deficits. A positive Tinel sign was elicited with deep palpation in the

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left supraclavicular fossa. However, there was no obvious mass to palpation. Magnetic resonance imaging with and without contrast of the brachial plexus demonstrated a 4- to 6-cm homogeneously enhancing lesion arising from the C7 nerve root at the middle trunk of the brachial plexus, consistent with a benign peripheral nerve sheath tumor (**Fig. 1**).

The patient elected to undergo resection of the tumor. A supraclavicular approach was chosen. Skin incision was marked along the posterior margin of the left SCM, coursing toward the clavicle. It was extended down into the deltopectoral groove, to allow for additional infraclavicular exposure as necessary. After incision, the posterior edge of the SCM was identified and dissected from the surrounding tissue to the level of the clavicle. A globular mass could be palpated along the medial aspect of the anterior scalene muscle, in close proximity to the clavicle, but it could not be visualized. We then separated and dilated the muscle between the sternal and clavicular heads of the SCM using Metzenbaum dissecting scissors, thereby creating an intramuscular window (**Fig. 2**). Once the intramuscular window was created and maintained with Weitlaner retractors, a violaceous mass attached to the C7 nerve root was easily visualized. The mass was removed in toto with care not to damage to the nerve root itself or surrounding plexal elements.

The patient tolerated the procedure well. Postoperatively, the patient reported an improvement in pain and tingling, and he had no postoperative deficits. Pathology was consistent with a benign neurofibroma. By his first postoperative follow-up visit as an outpatient, the patient had already returned to work full time without any difficulties.

Discussion

Benign peripheral nerve tumors are considered curable lesions.^{1,10} Good surgical outcomes with acceptable levels of neurovascular complications has led to the recommendation of surgical resection as the primary treatment for brachial plexus tumors.^{1,10} This makes it important to continue exploring potential enhancements to currently described surgical techniques to expand the surgical armamentarium. To this end, we have presented a simple and easy-to-adapt modification to the supraclavicular approach for brachial plexus tumors, namely the creation of an intramuscular window between the sternal and clavicular heads of the SCM muscle.

The intramuscular window is produced by muscle fiber separation and dilation, a technique in keeping with the concept of minimizing tissue destruction. This technique entirely preserves SCM muscle integrity, and in turn, it may be associated with decreased pain and improved muscle function. In addition, the intramuscular window may improve visualization of lesions in close proximity to the clavicle that may be helpful in minimizing the necessity of a transclavicular approach and preserving bony integrity of the clavicle. The transclavicular approach, although yielding excellent visualization, disrupts bony anatomy of the clavicle that can be associated with several potential morbidities such as difficulty with bone healing, nonunion, and hardware failure.⁴

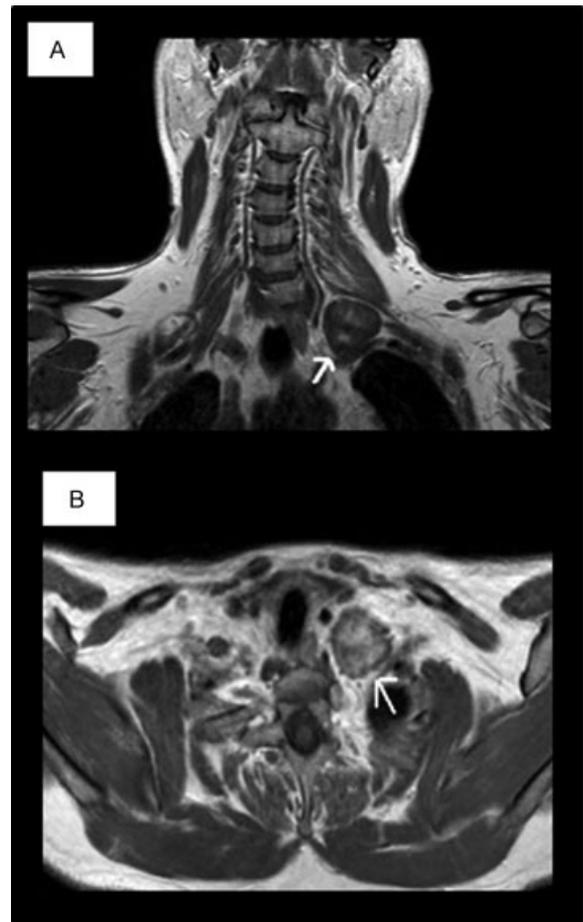


Fig. 1 Magnetic resonance imaging with and without contrast of the brachial plexus demonstrated a 4- to 6-cm homogeneously enhancing lesion (white arrow) on (A) T1-weighted coronal and (B) axial images. The lesion appeared to arise from the C7 nerve root at the middle trunk of the brachial plexus. Imaging was consistent with a benign peripheral nerve sheath tumor, and pathology confirmed it to be a neurofibroma.

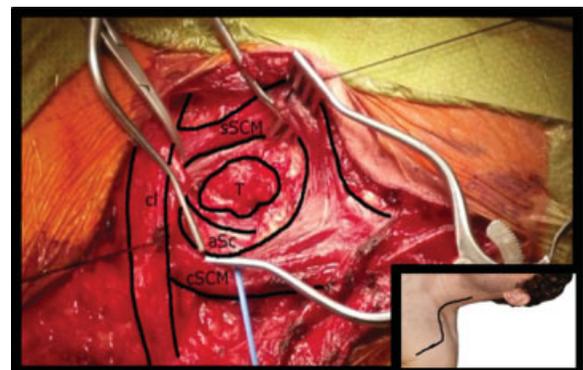


Fig. 2 Intraoperative photograph demonstrating the separation and retraction of the sternal (sSCM) and clavicular (cSCM) heads of the sternocleidomastoid (SCM) muscle. The tumor (T) is easily visualized, just superior to the clavicle (cl). A portion of the anterior scalene (aSc) is visible underneath the SCM. As represented in the inset, the patient was placed in the supine position with the head turned toward the right, and the skin incision ran along the posterior margin of the SCM toward the clavicle and into the deltopectoral groove.

Potential limitation to the widespread applicability of this technique lies in the very rare, but not nonexistent, anatomical variations of the clavicular head of the SCM.^{11,12} In particular, one report describes supernumerary SCM clavicular heads with consequent narrowing of the supraclavicular fossa.¹¹ This specific anatomical variation of normal would make the separation and dilation technique described in this report much more difficult, if not impossible. In this case, it would be very straightforward to revert to SCM muscle transection and/or disarticulation.

Conclusion

This case illustrates a variation of the supraclavicular approach offering excellent exposure with minimal disturbance of native anatomy. This may have a positive impact on the patient's pain and return to baseline function postoperatively. The use of this technique is most applicable in patients who present with small to medium size brachial plexus tumors accessible via the supraclavicular approach.

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