The Journal of Laryngology & Otology
November 2005, Vol. **119,** pp. 906–908

Upper neck spinal accessory nerve identification during neck dissection

T TATLA, J KANAGALINGAM, A MAJITHIA, P M CLARKE

Abstract
Iatrogenic injury to the spinal accessory nerve (SAN) during neck dissection may result in significant and avoidable morbidity in the form of 'shoulder syndrome'. The authors describe a simple method, based on the anatomy of the sternocleidomastoid muscle (SCM), which allows consistent and rapid identification of the SAN in the upper neck during dissection, thereby facilitating its preservation.

Key words: Accessory Nerve; Anatomy; Regional; Neck Dissection; Postoperative Complications

Introduction

Preserving the spinal accessory nerve (SAN) during neck dissection minimizes morbidity, specifically the avoidance of 'shoulder syndrome',[1] which is characterized by shoulder pain, restricted movement and drooping of the shoulder. Where oncological clearance is unlikely to be compromised, careful identification and preservation of the SAN preserves the innervation of the sternocleidomastoid (SCM) and trapezius muscles.

Accurate and rapid identification of the SAN is dependent on consistent surgical landmarks. Literature review reveals a number of papers attempting to address this issue.[2–12] Most describe preservation of the SAN through its identification in the lower neck, near its entry at the anterior border of the trapezius muscle, with a description of subsequent retrograde dissection.[5,8–10] With the increasing use of selective neck dissection, a consistent method of identifying the nerve anterior to the SCM is needed. Only a few papers emphasize this point and allude to the importance of superior dissection, finding the nerve high in the neck with anterograde dissection.[2,6,7]

We present a previously undescribed simple method, used routinely in our department, that provides consistent, accurate and quick identification of the SAN superiorly in the neck during the early stage of neck dissection, thereby facilitating its preservation.

Relevant anatomy

The SCM is divided into four parts, each defined by the origin and insertion of the relevant muscle fibres.[13] The sternomastoid, sterno-occipitalis and cleido-occipitalis together form a continuous sheet on the surface of the muscle. The remaining fibres, the cleidomastoid, lie deep to these. Superiorly, the cleido-occipitalis provides a mainly tendinous origin. The SAN enters the SCM between the cleidomastoid and the superficial sheet, running down within the SCM to emerge in the posterior triangle, about halfway down the posterior border of the muscle.

Surgical technique

The patient is placed supine with a roll under the shoulder blades and the head rotated away from the side of dissection. The superior extent of the cervical incision is extended to the mastoid tip. Superior and inferior subplatysmal skin flaps are elevated, preserving the greater auricular nerve and external jugular vein whenever possible. The anterior border of the SCM is then defined and followed anteromedially.

As the superior aspect of the SCM is followed at its anteromedial surface, the silvery white tendinous part (upper third of cleido-occipitalis) is seen (Figure 1). At this point, immediately deep to the tendinous portion, one or more vessels are noted. These originate from the occipital artery and supply the SCM segmentally. With great care, these vessels are picked up with fine diathermy forceps and diathermized laterally, prior to being cut. Immediately deep to this point, the SAN is noted consistently passing into the SCM between the superficial sheet and the deeper cleidomastoid fibres (Figure 2). Further superior dissection along the nerve's length towards the skull base allows its preservation and protection as it disappears beneath

From the Department of Otorhinolaryngology - Head & Neck Surgery, Charing Cross Hospital, London, UK.
Accepted for publication: 28 April 2005.

FIG. 1

Right upper neck dissection with the anterosuperior border of the SCM retracted to reveal the tendinous SCM (cleido-occipitalis) and the segmental branch of the occipital artery supplying the SCM.

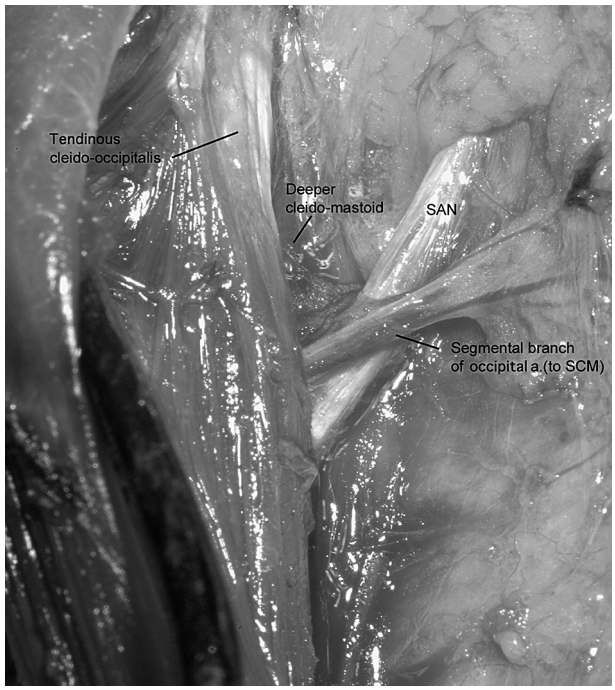

FIG. 2

Deeper plane of dissection in the same neck, revealing the SAN running immediately deep to the segmental occipital artery branch, to pass with it between the superficial sheet and the deeper cleidomastoid fibres of the SCM.

the posterior belly of the digastric muscle, passing usually lateral (50–70 per cent), but occasionally medial (40-50 per cent), to the internal jugular vein (IJV).[2,11] If required, the nerve may be followed in an anterograde fashion, traversing through the SCM fibres prior to its exit at the posterior border of the SCM and then continuing an angled descent through the posterior triangle. Once the SAN is located and preserved in this way, the surgeon may proceed with the remainder of the neck dissection and lymphadenectomy.

Discussion

In 1906, Crile[14] first described the radical neck dissection (RND) encompassing en bloc removal of lymphatic tissue from one side of the neck, from the inferior border of the mandible to the clavicle and from the lateral border of the strap muscles to the anterior border of trapezius. Included in the resection were the SAN, the IJV and the SCM.

Modified and selective neck dissection has developed over the last 40 years, mainly as a consequence of the morbidity associated with RND, particularly sacrifice of the SAN. The 'shoulder syndrome', as described by Nahum *et al.*[1] in 1961, develops in a certain proportion of patients after RND as a result of SAN denervation of the trapezius muscle, resulting in shoulder pain and drooping, as well as restriction of shoulder movements and a 'frozen shoulder'.

In an attempt to define consistent anatomical landmarks and pointers and thus facilitate easy and safe identification and preservation of the SAN, a number of studies have been reported. Cadaveric descriptive studies[2,6,11] have mapped out the observed course of the SAN in the neck and, through the measurement of various reference points and lines, analyses have been performed to show the predictive value of these measurements in locating the SAN. Similar studies based on measurements taken per-operatively during neck dissections have also been published.[5,9] Radiological imaging has also been used to help define useful anatomical landmarks.[12]

In the posterior triangle[2,6,9] proposed useful landmarks include (a) the distance between the clavicle and the point where the SAN passes under or pierces the anterior border of trapezius (locates to within 2–5 cm of the clavicle in the majority), and (b) the relationship of the SAN to the point of emergence of the greater auricular nerve at the posterior border of the SCM (greater auricular point) (the SAN is always located above this point, usually within 2 cm of it).

In the superior neck, the transverse process of the atlas (C1) is proposed as a key landmark.[12] This is easily palpable and the IJV consistently sits anterior to it. Both the internal carotid artery and the SAN are intimately associated with the IJV at this point, deep to the posterior belly of digastric but anterior to the transverse process of C1. Other authors have proposed finding the SAN by careful dissection on the medial surface of the SCM in the upper part of the neck.[7] We have expanded on this, thereby allowing accurate and rapid identification.

The method outlined in this paper provides a more specific and, in our experience, more consistent approach to rapid location of the SAN in the upper

neck, prior to its crossing the anterior border of the SCM to continue its distal course. In the senior author's experience of over 300 neck dissections, the technique described has proved an easy, reliable, safe and time-efficient method of delineating and safeguarding the SAN during conservative neck dissection.

- **Iatrogenic SAN injury during upper neck dissection may result in 'shoulder syndrome'**
- **Anatomical knowledge of the SCM facilitates the rapid identification and preservation of the SAN**
- **The authors describe a dissection method that has produced consistent results in over 300 neck dissections**

References

1 Nahum AM, Mulhally W, Manmoor L. A syndrome resulting from radical neck dissection. *Arch Otolaryngol* 1961;**74**:424
2 Soo KC, Hamlyn PJ, Pegington J, Westbury G. Anatomy of the accessory nerve and its cervical contributions in the neck. *Head Neck Surg* 1986;**9**:111–15
3 Deschler DG, Singer MI. Preservation of the spinal accessory nerve in modified neck dissections. *Laryngoscope* 1996;**106**:664–6
4 Stearns MP, Shaheen OH. Preservation of the accessory nerve in block dissection of the neck. *J Laryngol Otol* 1981;**95**:1141–8
5 Brandenberg JH, Lee CYS. The eleventh nerve in radical neck surgery. *Laryngoscope* 1981;**91**:1851–9
6 Hill JH, Olsen NR. The surgical anatomy of the spinal accessory nerve and the internal branch of the superior laryngeal nerve. *Laryngoscope* 1979;**89**:1935–42
7 Eisele DW, Weymuller EA, Price JC. Spinal accessory nerve preservation during neck dissection. *Laryngoscope* 1991;**101**:433–5
8 Pathak KA, Gupta S, Agarwal R, Sanghvi VD. A novel approach to the spinal accessory nerve. *J Surg Oncol* 2002;**81**:213–14
9 Hone SW, Ridha H, Rowley H, Timon CI. Surgical landmarks of the spinal accessory nerve in modified radical neck dissection. *Clin Otolaryngol* 2001;**26**:16–18
10 Becker GD, Parell GJ. Technique of preserving the spinal accessory nerve during radical neck dissection. *Laryngoscope* 1979;**89**:827–31
11 Kierner AC, Zelenka I, Heller S, Burian M. Surgical anatomy of the spinal accessory nerve and the trapezius branches of the cervical plexus. *Arch Surg* 2000;**135**:1428–31
12 Sheen TS, Chung TT, Snyderman CH. Transverse process of the atlas (C1) - an important surgical landmark of the upper neck. *Head Neck* 1997;**19**:37–40
13 McMinn RMH. Head and neck and spine. In: McMinn RMH, ed. *Last's Anatomy. Regional and Applied*, 9th edn. London: Churchill Livingstone, 1994; 424–5
14 Crile G. Excision of cancer of the head and neck with special reference to the plan of dissection based on one hundred and thirty-two operations. *J Am Med Assoc* 1906;**47**:1780–6

Address for correspondence:
Mr T Tatla,
Department of Otorhinolaryngology - Head & Neck Surgery,
Northwick Park Hospital,
Watford Road,
Harrow HA1 3UJ, UK.

Fax: +44 208 869 2946
E-mail: tarantatla@hotmail.com

Mr T Tatla takes responsibility for the integrity of the content of the paper.
Competing interests: None declared