

## Identification of the accessory nerve by its relationship to the great auricular nerve

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### Abstract

**Objectives:** To describe the use of the great auricular nerve as a 'road map' for locating the accessory nerve in the anterior and posterior triangle, in comparison with other methods described in the literature.

**Design:** A review of the literature using Medline and Embase searches was performed. Illustrative photographs were taken from consenting, elective patients.

**Results:** Various methods have been described, using different anatomical landmarks. We describe a new method, based on the fact that the great auricular nerve runs, with relation to the edges of the sternocleidomastoid muscle, 1 cm superior to the accessory nerve anteriorly and 1 cm inferior posteriorly.

**Conclusions:** This is a reliable and safe method, used by the senior authors in their extensive work as head and neck and skull base surgeons. It allows the accessory nerve to be located in both the anterior and posterior triangle. This avoids the inherent dangers of following the nerve's tortuous course through the sternocleidomastoid.

**Key words:** Anatomy; Great Auricular Nerve; Accessory Nerve; Neck Dissection

### Introduction

The accessory nerve is encountered during much of head and neck surgery. In modified radical neck dissection, the accessory nerve is the boundary between levels II A and II B and therefore requires identification during adequate clearance of level II B. In the surgical approach to the jugular fossa, it is usually the first cranial nerve which requires identification and proximal tracing. Injury to the accessory nerve causes significant disability due to denervation of the trapezius, resulting in pain and a decreased range of shoulder movement.<sup>1,2</sup> The best way to avoid its damage is by accurate identification and exposure.

We describe a step-by-step method of identifying the accessory nerve by first locating the course of the great auricular nerve and then using its course as a 'road map' to the accessory nerve. This is the method consistently used by the senior authors as a safe and reliable approach in their extensive experience of head and neck and skull base surgery.

### Methods

A literature review was conducted using Medline and Embase databases, searching for 'anatomy', 'accessory nerve', 'neck dissection' and 'great auricular nerve' as starting points. Photographs were obtained during elective cases performed at Monklands District General Hospital, Airdrie (written consent for photograph publication was obtained from these patients).

#### *Great auricular nerve*

The great auricular nerve is a sensory nerve with an anterior branch supplying the facial skin over the parotid

and a posterior branch supplying the skin over the mastoid and posterior aspect of the auricle; it also gives off a small slip to the concha and lobule.<sup>3</sup> These branches join, forming the main trunk, which then passes inferiorly between the platysma and the superficial surface of the sternocleidomastoid. It then perforates the deep cervical fascia and encircles the posterior border of the sternocleidomastoid at the junction of its upper and middle third. This is described as the great auricular point.<sup>4</sup> (The great auricular point should not be confused with Erb's point, which is the surface marking of the upper trunk of the brachial plexus, found two finger widths above the clavicle and one finger width lateral to the posterior border of the sternocleidomastoid.)<sup>5</sup>

A simple and reliable method of identifying the surface marking of the course of the great auricular nerve is described below, and shown in Figure 1, namely: (1) draw a line (A) between the angle of the mandible and the mastoid process; (2) draw a line (B) inferiorly from and perpendicular to the midpoint of line A; and (3) line B then marks the course of the great auricular nerve as it passes over the superficial surface of the sternocleidomastoid.

#### *Accessory nerve*

The accessory nerve leaves the jugular fossa between the internal carotid artery and the internal jugular vein. It then passes either posterolateral to (54–80 per cent), medial to (20–46 per cent) or, rarely, through (3 per cent) the jugular vein.<sup>6,7</sup> The accessory nerve always passes medial to the styloid process and the posterior belly of the digastric muscle. It then crosses the floor of the apex of the carotid triangle before passing deeply

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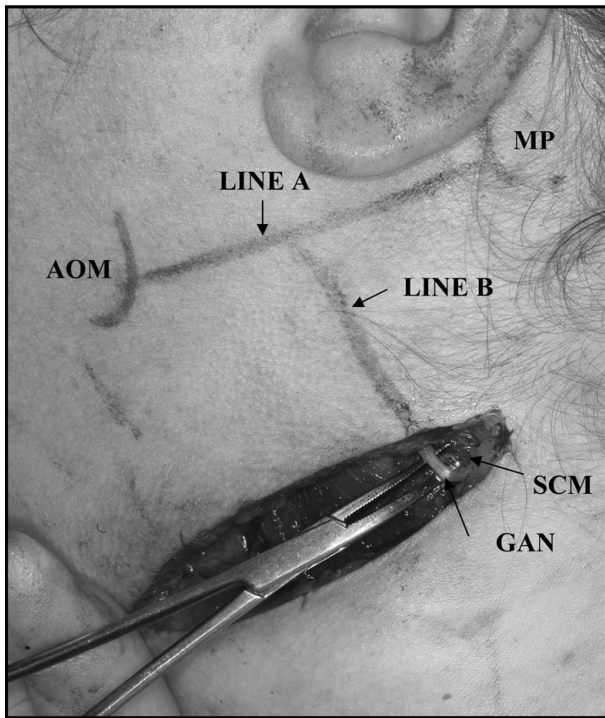


FIG. 1

Locating the great auricular nerve. AOM = angle of mandible; line A = line between AOM and mastoid process; MP = mastoid process; line B = line dropping perpendicular to line A; SCM = sternocleidomastoid muscle; GAN = great auricular nerve

through the sternocleidomastoid. While doing so, it gives off branches to supply the muscle before reappearing just above the midpoint of the posterior border. It then crosses the posterior triangle on the surface of the levator scapulae before passing deep to the anterior border of the trapezius, which it supplies.<sup>8</sup>

*Locating the accessory nerve using the great auricular nerve*

Our simple, reliable method involves exposing the course of the great auricular nerve as it crosses over the superficial surface of the sternocleidomastoid. The great auricular nerve has a constant relationship to the accessory nerve as it runs deep to the sternocleidomastoid. The great auricular nerve has a more vertical course than the accessory nerve. This means that the accessory nerve is found approximately 1cm superior to the great auricular nerve at the posterior border of the sternocleidomastoid.<sup>4,9,10</sup> Conversely, at the anterior border of the muscle, this relationship is reversed and the accessory nerve is approximately 1cm inferior to the great auricular nerve (see Figure 2).

The course of the two nerves as they cross in relation to the sternocleidomastoid form a tilted 'St Andrew's cross', with the great auricular nerve superior to the accessory nerve in the anterior triangle and inferior to it in the posterior triangle (Figure 3).

**Discussion**

A number of methods have been described to locate the accessory nerve during surgery.

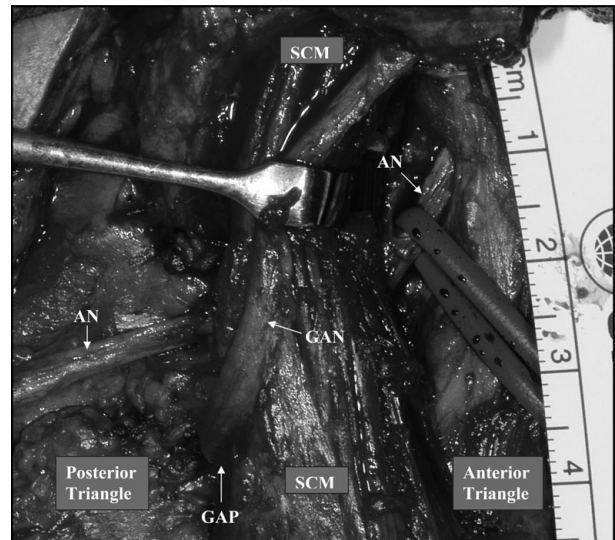


FIG. 2

The accessory nerve in the anterior and posterior triangles (right side). SCM = sternocleidomastoid muscle; AN = accessory nerve; GAN = great auricular nerve; GAP = great auricular point

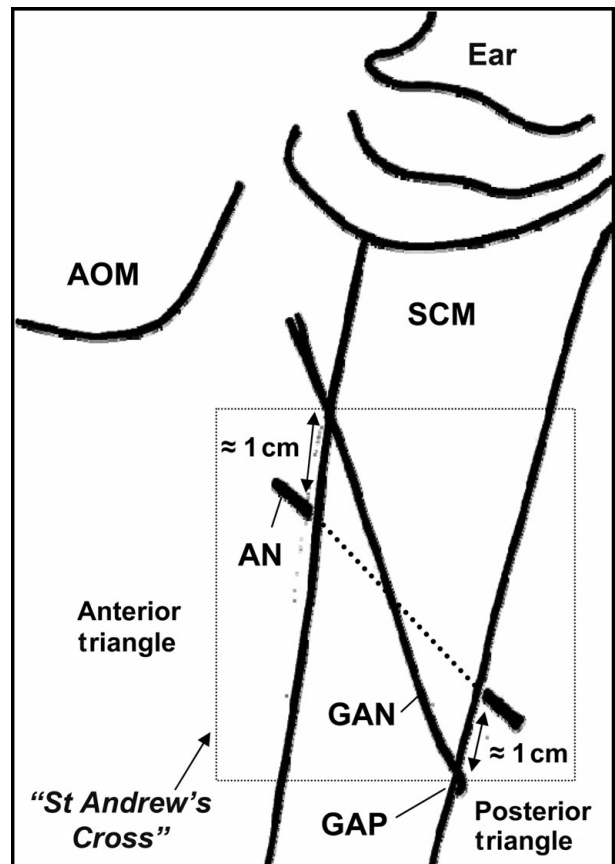


FIG. 3

The 'St Andrew's Cross', with the great auricular nerve (GAN) anterior and the accessory nerve (AN) posterior to the sternocleidomastoid muscle (SCM). AOM = angle of mandible; GAP = great auricular point

### *In the anterior triangle*

The superior branch of the occipital artery has been described as a reliable marker of the accessory nerve as it has a close relationship, lying 1 cm inferior to the accessory nerve.<sup>11,12</sup> However, this is a relatively deep landmark, and we would suggest that the great auricular nerve is usually identified much earlier. Dissection along the internal jugular vein to the skull base to find the accessory nerve as it exits the jugular foramen between the carotid artery and the jugular vein has been advocated.<sup>2</sup> This is difficult if the nerve passes medial to the vein.

### *In the posterior triangle*

Dissecting 1 cm above the great auricular nerve as it crosses the posterior border of the sternocleidomastoid is a reliable method of finding the accessory nerve in the posterior triangle.<sup>4,10</sup> However, this method does not reveal the accessory nerve's location in the anterior triangle without the inherent risks of following its tortuous course through the sternocleidomastoid.<sup>6</sup> Other methods described rely on the anatomical relationships of relatively distant landmarks, which are subject to variation due to differing patient proportions. At the posterior border of the sternocleidomastoid, the accessory nerve is quoted as being 8 cm from the clavicle,<sup>6</sup> 6 cm from the angle of the mandible and 5 cm from the mastoid process.<sup>13</sup> The point at which the accessory nerve crosses the anterior border of the trapezius ranges from 2 to 10 cm from the clavicle.<sup>14</sup>

### Conclusion

Knowledge of the surface markings and the course of the great auricular nerve permits accurate identification of the accessory nerve in both the anterior and posterior triangles. This removes the need to follow the accessory nerve's tortuous course deep to the sternocleidomastoid<sup>6</sup> and thus reduces the risk of surgical injury. Despite meticulous identification, delicate handling of the accessory nerve is mandatory due to the length of the nerve and its fragile blood supply, which can result in injury without division.<sup>15</sup> The use of accessory nerve monitoring during surgery has been advocated,<sup>16</sup> and, in an increasingly litigious society, this is something to be considered.

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Mr D Baring takes responsibility for the integrity of the content of the paper.

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