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Division of the spinal accessory nerve in the anterior triangle: a prospective clinical study

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Abstract

The anatomical relation between the spinal accessory nerve and internal jugular vein is well documented, but other variants of the nerve, including the contributions of the cervical plexus to supply motor fibres to the trapezius, are less well known. We have previously described an anatomical variant in which the spinal accessory nerve divided before entering the sternocleidomastoid, and the inferior trunk passed directly under it to supply the trapezius. We now present a prospective study of 133 neck dissections (excluding radical dissections) in which a meticulous search was made for the variant in the anterior triangle of the neck during operation. We found it in 3 necks (2%). One of the 3 patients had a bilateral neck dissection but it was found on one side only, and in 2 cases it communicated with the cervical plexus. In all 3, stimulation of the inferior division resulted in contraction of the trapezius while the upper division was found to supply the sternocleidomastoid only. The finding of this variant, which was more common than first thought, highlights the need for meticulous dissection of the nerve before it enters the sternocleidomastoid to ensure that, when present, the inferior branch is preserved to minimise potential postoperative shoulder dysfunction. Further research including a cadaveric study is needed to understand this important variant more fully.

Keywords: Spinal accessory nerve; Variant; Neck dissection; Trapezius; Sternocleidomastoid

Introduction

A thorough understanding of the anatomy and the anatomical variants of the spinal accessory nerve is essential for surgeons who operate on the neck. While anatomical landmarks for its preservation during neck dissection are well documented,[1] there are conflicting reports regarding its relation to the internal jugular vein.

In a recent clinical study of 207 neck dissections, the spinal accessory nerve was found lateral to the internal jugular vein at the level of the posterior belly of digastric in 96% (198 necks), and it passed medial to the vein in only 6 cases (3%).[2] In a smaller study of 116 necks it was also found laterally in 96% of necks.[3] In contrast, some cadaveric studies have reported a much lower incidence of it crossing lateral to the vein, and a recent study has found a lateral relation in 67% of 84 necks dissected.[4]

The relation of the spinal accessory nerve with the cervical plexus is also known, but is less well understood, and these nerves should be preserved where possible to maximise shoulder function particularly when the spinal accessory nerve is sacrificed.[5–8]

Given the differences in the embryology of the sternocleidomastoid and trapezius muscles, with the former being a neck and the latter a girdle muscle,[9] it is not surprising that they are innervated by many variants of the spinal accessory nerve.

Several years ago, we reported that during a routine selective neck dissection we found that the nerve divided before

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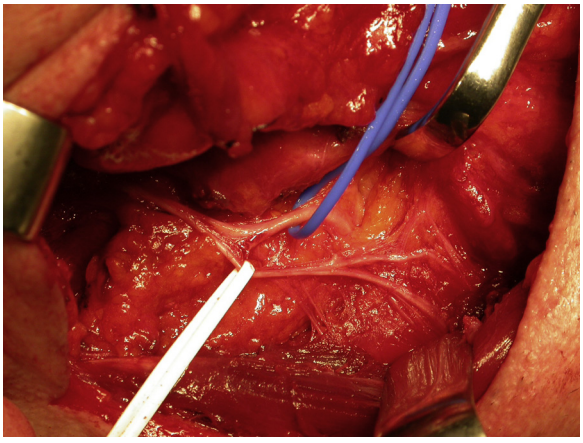

Fig. 1. Division of spinal accessory nerve just after it crossed the internal jugular vein. The superior branch (white sling) is seen entering the sternocleidomastoid, which has been retracted, and the inferior branch is passing deep to the sternocleidomastoid (blue sling).[10]

entering the sternocleidomastoid with one branch entering the muscle and the other passing underneath it to supply the trapezius (Fig. 1).[10] We wanted to find out whether this was an isolated case or whether it was more common so we searched meticulously for examples during subsequent selective and modified radical neck dissections (in which the nerve and the sternocleidomastoid were preserved).

Method

From July 2006–June 2014, all neck dissections done by, or under the supervision of one consultant surgeon (PAB), were included. We excluded radical neck dissections and cases in which metastatic nodal disease made safe dissection of the spinal accessory nerve in the anterior triangle impossible.

We identified the nerve in a standard way by dissecting the sternocleidomastoid on a broad front to find the point at which it entered the muscle. It was then meticulously dissected to look specifically for anatomical variants, and interesting cases were photographed with a high resolution digital camera (Nikon D70, Nikon UK, Kingston upon Thames, UK).

Results

After identification of the original variant, 132 neck dissections (including 16 that were bilateral) were done by, or under the direct supervision of, one consultant surgeon. The types of dissection are shown in Table 1. Six further neck dissections that were done during the study period could not be included (2 radical neck dissections, and 4 in which nodal disease in level II prevented dissection of the nerve).

We found that the nerve divided before it entered the sternocleidomastoid in a further 2 patients (Figs. 2–4), which gave an incidence of 3/133 (2%). In all cases it divided into superior and inferior branches with the superior branch

Table 1
Summary of neck dissections in this study ($n = 133$).

Type of neck dissection	No. (%) ($n = 133$)
Supraomohyoid (I–III)	38 (29)
Selective I–IV	59 (44)
Modified radical (I–V) (preserving spinal accessory nerve and sternocleidomastoid)	36 (27)

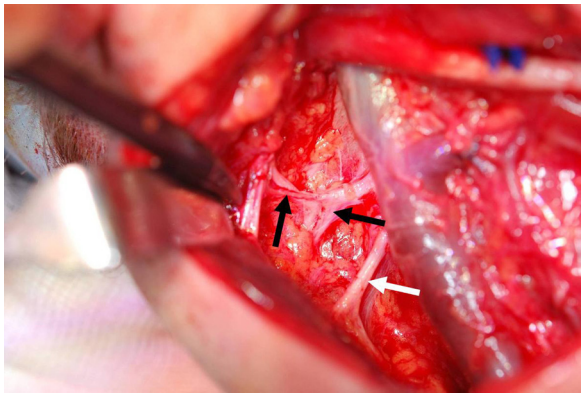

Fig. 2. Division of the spinal accessory nerve with both branches joined by a cervical plexus nerve (black arrows). The root of the great auricular nerve is visible (white arrow).

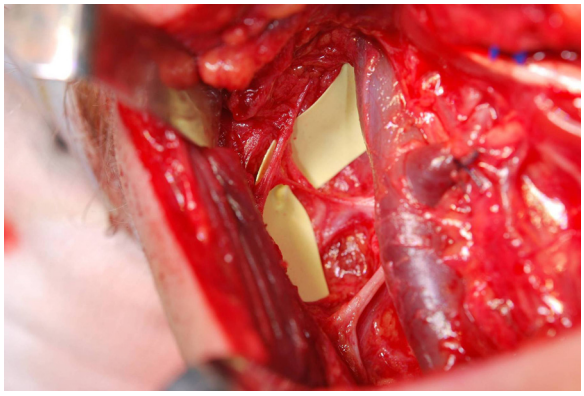

Fig. 3. Yellow background placed in theatre between the 2 divisions of the spinal accessory nerve to show the inferior branch passing under the sternocleidomastoid muscle.

entering the sternocleidomastoid and the inferior branch passing underneath it. In one case, both superior and inferior branches communicated with a C2 cervical plexus nerve, the level based on the relation to the origin of the root of the great auricular nerve (Figs. 2 and 3), while in another, only the superior division was joined by a C2 cervical nerve (Fig. 4). Interestingly, one patient had a bilateral neck dissection but the variant was seen only on the right. We found no communications between the cervical plexus and spinal accessory nerve in the anterior triangle in the remaining 131/133 (98%) neck dissections.

We found that stimulation of the superior division of the nerve resulted in contraction of the sternocleidomastoid in all 3 patients (they were not paralysed) but little or no