SPINAL ACCESSORY NERVE IN SUDANESE SUBJECTS;
A GROSS MORPHOLOGICAL STUDY

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ABSTRACT... Objective: the aim of this article was to study the spinal accessory nerve in Sudanese subjects. **Method:** dissection of formalin-fixed cadavers' necks. **Results:** in Sudanese the SAN exits as one trunk from the jugular foramen anterior to IJV then crosses lateral to it. Rarely SAN exits as two branches. Usually the nerve passes beneath SCMM and supply it by direct or side branch. Muscular branches of SAN have connections from the cervical plexus mainly C2, 3. **Conclusion:** There are some differences in the course, branches and connections of the spinal accessory nerve in Sudanese from what is described in standard textbooks of anatomy.

Key words: Accessory nerve. Internal Jugular Vein. Sudanese. Sternocleidomastoid Muscle. Trapezius Muscle. Cervical Plexus Connections.

Abbreviations used in this paper:
RND: Radical neck dissection, MRND: Modified Radical Neck Dissection, SCMM: Sternocleidomastoid Muscle, TM: Trapezius Muscle, IJV: Internal Jugular Vein, SAN: Spical Accessory Nerve, PBD: Posterior Belly of Digastrics Muscle, CP: Cervical Plexus

INTRODUCTION

Lesions of the SAN are rare. When they occur they often cause considerable morbidity[1,2] and can have medico-legal implications.

Causes of injury are manifold and may be secondary to penetrating trauma, such as a knife wound, or blunt injury such as biting[3,4]. Sports injuries and even an unsuccessful hanging have been reported as causing injury[5].

Iatrogenic injury, however, accounts for the majority of cases of accessory nerve palsy seen. This may be deliberate, as the inevitable result of a classical radical neck dissection[2,6,7,8,9] for the removal of cervical node metastases from head and neck squamous carcinomas. More commonly the nerve is damaged accidentally as a result of minor surgical procedures in the neck, after lymph node biopsy, or benign tumor removal in the posterior triangle[10,11,12]. The number of iatrogenic lesions of the SAN following such procedures is difficult to ascertain, although several studies quote biopsy or excision of cervical lymph nodes in the posterior triangle as the most common cause[10,11,12,13].

Most of the descriptive study's data used in the standard textbooks depends almost on European or American materials. This study aims to focus on the Sudanese material for record.

MATERIALS AND METHODS

Forty-three formalin-fixed cadavers were used. The specimens were obtained from cadavers used for anatomy courses. Dissection of cadavers was done according to the standard textbooks of dissection[14,15]. Data have been collected and analyzed statically.

RESULTS

The course, branches, and relations of the accessory nerve and its connections with the cervical plexus were evaluated by the unaided naked eye.

1. Cranial Root

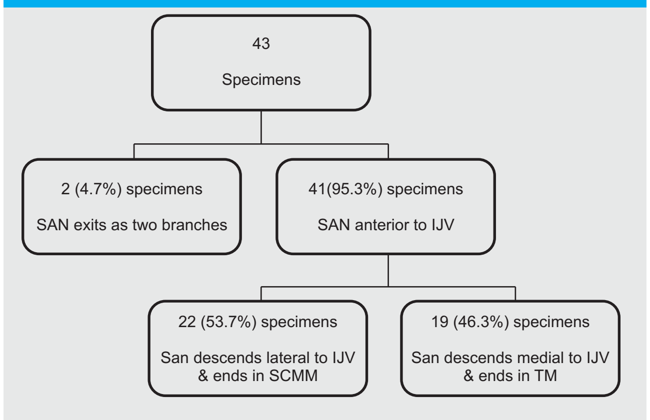
In all the specimens, the cranial root rootlets were quite distinct. They emerged from the posterolateral (postolivary) sulcus of the medulla oblongata in the interval between the lower margin of the olive and foramen magnum. The numbers of these rootlets were three in 15 specimens (34.9%) and four in 28 (65.1%). The rootlets converged laterally to join the spinal root of the accessory nerve just before or at the jugular foramen.

2. Spinal Root

2. 1. Relation to the Internal Jugular Vein (IJV)

In 41 out of 43 specimens (95.3%) the trunk of the spinal root descended for a short-distance prior to the uppermost (first) part of the IJV as that vein emerged from the jugular foramen (Fig.1). The subsequent course of the nerve was variable. After the initial descent anterior to the IJV, the spinal root crossed either lateral to the vein 53.7% (22 specimens) or medial to it 46.3% (19 specimens) before inclining posterolaterally to approach the Sternocleidomastoid (SCMM).

Fig-1. Relation of the spinal accessory nerve to the internal jugular vein

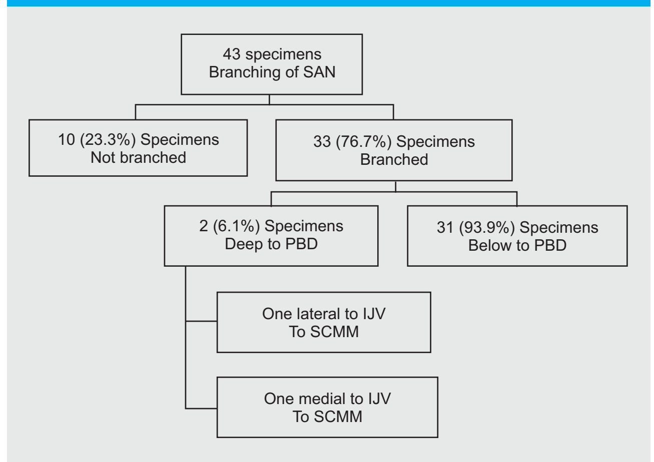


In two out of the 43 specimens (4.7%), the trunk of the SAN appeared to emerge as two branches immediately below the jugular foramen and anterior to IJV. The two branches descended for a short distance anterior to the uppermost part of the IJV. One branch descended lateral to the IJV and passed to SCMM; meanwhile the other branch descended medial to the IJV and ended in Trapezius muscle.

2.2 Branches and Relations to SCMM

In 33 out of the 43 specimens (76.7%) examined, the SAN divided into its terminal branches before approaching the SCMM. The level at which the terminal branches were given off from the nerve before reaching SCMM was, however, variable. In 31 specimens (93.9%), the branches to the SCMM and trapezius muscle (TM) arose just below the posterior belly of the digastric. The SCMM branch pierced the muscle immediately. The branch to the TM passed posteroinferiorly beneath the SCMM, but occasionally (three specimens) pierced the latter muscle. After emerging from the posterior border of the SCMM, the branch to TM traversed the posterior triangle of the neck and terminated in this muscle as a single trunk but occasionally divided into two branches before entering the TM (Fig. 2).

Fig-2. Relation of the spinal accessory nerve to the posterior belly of digastrics muscle and sternocleidomastoid muscle.



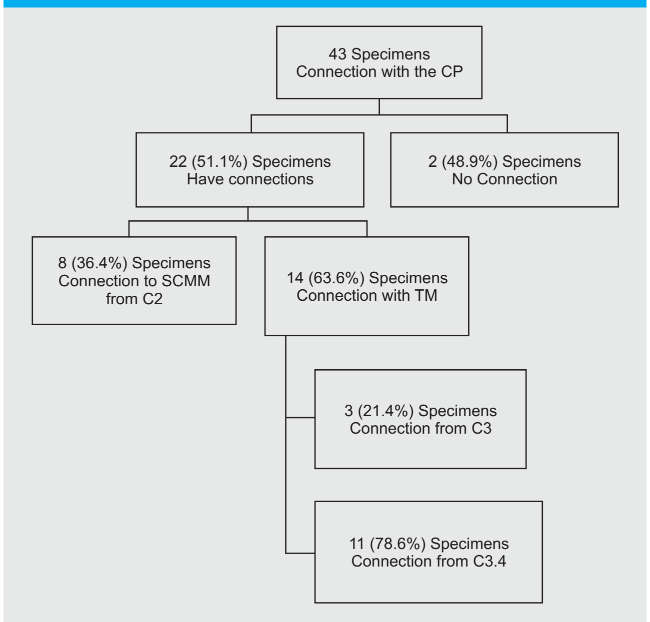
In only two out of the 33 specimens (6.1%), the SAN appeared to divide into two terminal branches immediately below the jugular foramen deep to the posterior belly of digastric. The SCMM branch descended lateral to the IJV and entered the upper part of the muscle. The branch to TM descended medial to the IJV; occasionally sending a branch to SCMM before passing to the latter muscle and crossing the posterior triangle of the neck to enter the TM.

In ten out of 43 specimens (23.3%), the SAN did not appear to give any side branch prior to its entry into the SCMM. Instead, the nerve passed posterolaterally as a single trunk, pierced the deep part of SCMM and emerged from the posterior border of this muscle. Having traversed the posterior triangle of the neck, the SAN ended into the TM.

3. Connections with Cervical Plexus.

In 21 out of 43 cases, no connections were found between SAN and the cervical plexus; meanwhile, in the remaining 22 (51.2%) there were connections. In eight out of the 22 specimens, the SCMM branch of the accessory received a communicating branch from the ventral ramus of the C2. In the remaining 14 specimens, the TM branch of the accessory nerve was joined by a communicating branch from C3 alone (three specimens) or from both C3 and C4 (11 specimens) (Fig.3). In 21 specimens, no connections observed between SAN and the cervical plexus.

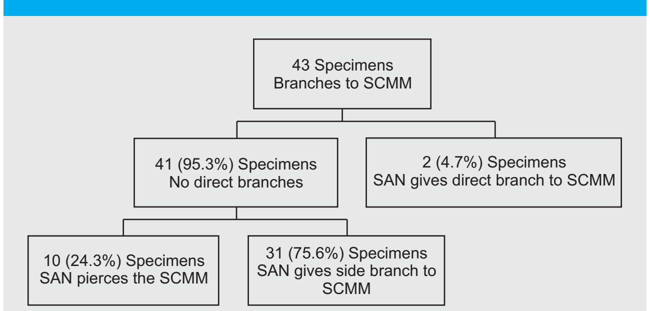
Fig-3. Connections of the spinal accessory nerve cervical plexus.



4. Innervations of SCMM

In two out of 43 specimens (4.7%), the SAN gives direct branch to SCMM. However, in the remaining 41 specimens (95.3%) no direct branches were found but in ten out of 41, the SAN pierced the SCMM (Text-figure 4); in the remaining 31 specimens SAN gives side branch to SCMM.

Fig-4. Branches of the spinal accessory nerve to the sternocleidomastoid muscle.



DISCUSSION

It is generally accepted that the nerve rootlets emerging from the part of the central nervous system between the lower margin of the olive and the foramen magnum as represented by the cranial root of the accessory nerve[16]. This measurement had been adopted in our study. Accordingly, the number of the cranial root rootlets described in our study was in agreement with that reported in the standard textbooks of anatomy[17,18,19]. The rootlets emerged as 3 - 4 rootlets from the portion of the medulla oblongata between the lower margin of the olive and the foramen magnum. Having converged laterally, the cranial rootlets joined the spinal root of the accessory nerve just before or at the level of the jugular foramen.

However, Lachman et al[20] had questioned the existence of a morphologically distinct cranial root of the accessory nerve in man. Using the lower margin of the olive as the lower limit of the medulla oblongata, these researchers considered the part between the olive and the foramen magnum as belonging to the spinal cord rather than the medulla. In the present study, however, the part between the olive and the foramen magnum was considered as a part of the medulla oblongata[16,19].

The literature describing the relation of the SAN to the internal jugular vein yielded somewhat variable results[11,21,22] stated that this nerve descended medial or lateral to the vein or rarely through it, without any reference to the frequency at which each relation might be encountered. Sinnatamby[18] described the nerve as coursing only lateral to the vein[23], however, investigated large sample size; found that the SAN usually crossed lateral to the internal jugular vein; very rarely medial to the vein[21,22,23] were in agreement to some extend as they described that, in the majority the SAN cross's lateral to IJV. Meanwhile, Sinnatamby[18] recorded only the lateral relation. The present findings showed that the SAN might, with almost equal percentage crosses lateral (53.7%) or medial (46.3%) to the IJV before approaching the SCMM.

Berry et al[11] and Hinsley et al[24] described that the SAN rarely passes through IJV or even a confluence of the vein. These finding could not be confirmed in the present study, but reported a high division of SAN above the posterior belly of digastric muscle; that has not been reported before in literature.

Controversial to both Berry et al[11] and Hinsley et al[24] and the present findings[21,25] found that the SAN crossed the IJV either ventrally or dorsally with different percentages.

The SAN has been conventionally described as passing through rather than beneath the SCMM before traversing the posterior triangle of the neck[16,17,18]. Similarly, Soo et al.[26], Bergman et al.,[27] and Caliot et al.,[28] cited that the SAN might never enter the SCMM. The work of Soo et al.[26] and Caliot et al.[28] supported by the present study show that the spinal accessory passes either beneath or through the SCMM, and rarely terminated in SCMM[29]. In the majority of cases so far examined (30 out of 43) (69.8%), the nerve passed beneath the SCMM. It was only in 13 out of 43 (30.2%) that the SAN traversed a small part of the deep portion of the muscle before it reached the posterior triangle of the neck[30] reported that the SAN passes between the sternal and clavicular head of SCMM not through the muscle belly.

It is generally agreed that, the communicating branches, which are the ventral rami of the cervical plexus contributed to the accessory nerve, are sensory (proprioceptive) to the SCMM and TM[8].

The communicating branches of the cervical plexus have been repeatedly described as being derived from the ventral rami of the second to fourth cervical nerves. Moreover, Meckenzie,[31] and Hayward,[32] reported connection from C1 within the vertebral canal. The results of the study are consistent with those reported in the literature. However, the communication between the cervical plexus and the accessory nerve was found in only 50% of the specimens examined. That 50% of the specimens did not apparently reveal any connection between the spinal accessory and the cervical plexus does not exclude the view that the SCMM and TM may be innervated by direct sensory branches from the cervical plexus.

Symes and Ellis,[30] cited that the SAN forms an anastemosis with fibers from C2-4, C3 and rarely C2 and C3-4. These findings have not been confirmed in the present work, but connections were observed between cervical plexus and SCMM and TM.

In 22 (51.1%) specimens out of 43, connections were observed. In eight cases out of 22 there was connection from C2 to SCMM and in 14 (63.6%) with TM. three of them from C3 and the rest from C3-4. The remaining 21 out of 43 have no connections with the cervical plexus.

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