

Variations in the anatomy of ansa cervicalis

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With the emerging utilisation of ansa cervicalis in nerve reconstructive surgery, it is important for surgeons to be conversant with the anatomy of these nerves. This descriptive cross sectional study aimed at describing the morphology and topographic anatomy of ansa cervicalis. We examined 38 adult human formalin-fixed cadavers. The superior root was present in 38 (100%) cases and 37 (97%) cases, on the right and left sides, respectively. More than half (56%) of these roots were located superior to the posterior belly of the digastric muscle. The inferior root, on the other hand, was present in 34 (89.5%) cases on the right side and 31 (81.6%) cases on the left side. Of all the inferior roots, 81.5% were located lateral to the internal jugular vein. The loop was seen in all the cases that had the inferior root, and was mostly (64.6%) located above the superior belly of the omohyoid muscle. Knowledge of the anatomy of ansa cervicalis is not only important for nerve reconstruction surgeries, but also for operations in the neck, so as to avoid injuring the great vessels that are closely related to it. (Folia Morphol 2010; 69, 3: 160–163)

Key words: ansa cervicalis, nerve reconstruction, omohyoid, digastric muscle

INTRODUCTION

The ansa cervicalis (AC) is a union of nerves found in the anterior triangle of the neck, which gives motor innervations to the infra hyoid muscles [5, 11, 22]. The AC is usually used to re-innervate the larynx following recurrent laryngeal nerve paralysis [6, 21]. Thyroid cancer patients may present with paralysed vocal cords due to the disease process, or the recurrent laryngeal nerve may need to be sacrificed because of the invasion of cancer, even if the vocal cords are properly functioning before surgery [13, 14]. Recurrent laryngeal nerve paralysis is also seen in patients with oesophageal cancer following lymphadenectomy along the recurrent laryngeal nerve [15]. The proximity of the AC to the larynx coupled with the fact that when it is sacrificed there is no serious functional loss makes it ideal for neck nerve reconstruction procedures [5, 6, 11, 21].

Variability in the course and location of the AC along the great vessels of the neck, as well as the

significant differences observed in the arrangement of its contributing roots and regional branching patterns, pose a great challenge to surgeons during surgical procedures of the neck [5, 11, 19]. Surgical procedures such as thyroplasty [7], arytenoids adduction [8], Teflon injection [2], and nerve-muscle pedicle implantation [17] have been reported to cause iatrogenic injuries to the AC. In order to avoid these injuries, it is important for surgeons to understand the course and morphological variations of the AC [5, 11, 19]. This study, therefore, aimed to determine the topographical and morphological anatomy of the AC.

MATERIAL AND METHODS

Thirty-eight cadavers were studied during routine dissection of the neck at the Department of Human Anatomy, University of Nairobi, Kenya. All the cadavers had been fixed in formalin and were without any grossly evident pathologies or surgical

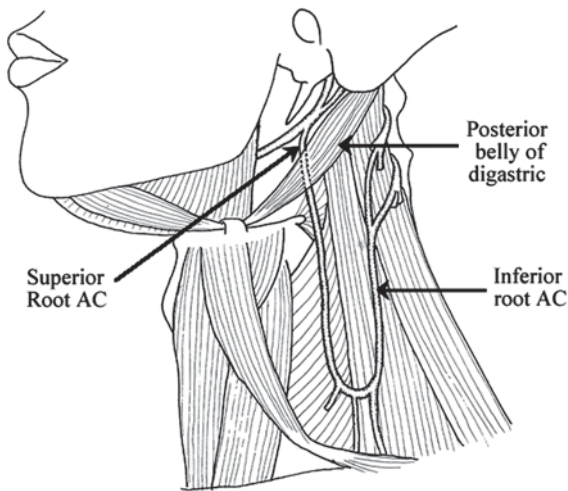


Figure 1. Superior root of the ansa cervicalis (AC) located above the posterior belly of the digastric muscle.

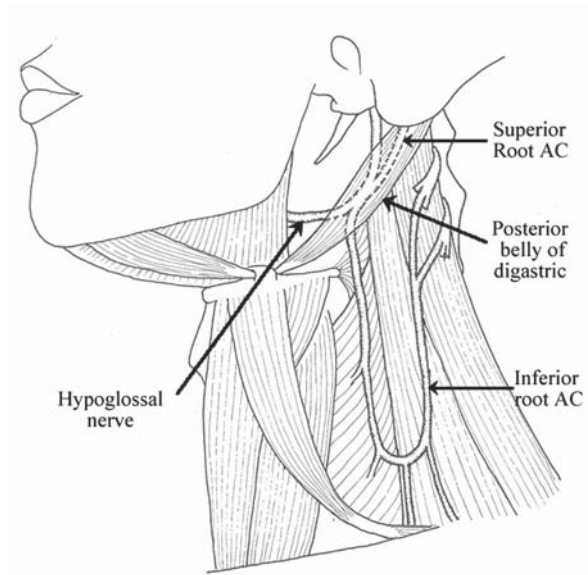


Figure 2. Superior root of the ansa cervicalis (AC) at the same level as the posterior belly of the digastric muscle.

procedures in the neck region. Both right and left sides were inspected for the presence or absence of superior and inferior roots of the AC. The origin of the superior root was recorded as being superior at the same level or inferior to the posterior belly of the digastric muscle. When the inferior root was present, its relation to the internal jugular vein was recorded as being medial or lateral to the vein. The number of branches arising from each of the roots was also noted. The location of the loop of the AC was also noted as being superior, at the same level, or inferior to the superior belly of the omohyoid muscle.

RESULTS

Superior root of the ansa cervicalis

The superior root of the ansa cervicalis (SRAC) was present in all cases on the right side, while one case had the SRAC missing on the left side. In all these cases it hitch-hiked on the hypoglossal nerve. Forty-two (56%) of the SRACs (22 right and 20 left) were located above the posterior belly of the digastric muscle, while 29 (38.7%) of the SRACs (14 right, 15 left) were located below this muscle (Figs. 1, 2). The remaining four SRACs (2 right and 2 left) were located at the same level as the posterior belly of the digastric muscle (Fig. 3). An average of two branches were seen arising from each of the SRACs.

Inferior root of the ansa cervicalis

The inferior root of the ansa cervicalis (IRAC) was present in 34 (89.5%) cases on the right side and 31 (81.6%) cases on the left side. Fifty three (81.5%)

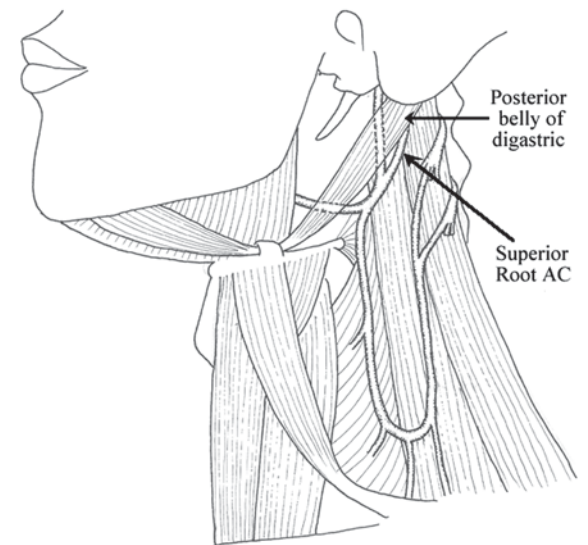


Figure 3. Superior root of the ansa cervicalis (AC) located below the posterior belly of the digastric muscle.

IRACs (28 right and 25 left) were positioned lateral to the internal jugular vein, while the remaining 12 (18.5%) IRACs (6 right and 6 left) were medial to this vein (Figs. 4, 5). None of the IRACs had a branch before joining the superior root to form the loop of the AC.

Loop of the ansa cervicalis

The loop was present in 34 (89.5%) cases on the right side and 31 (81.6%) cases on the left side.

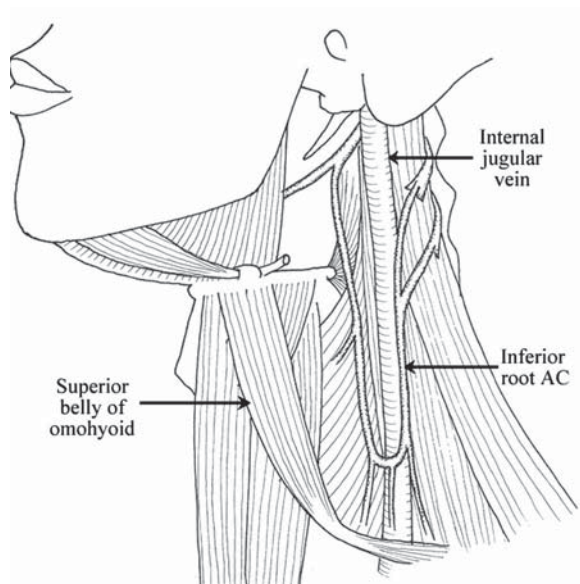


Figure 4. Inferior root of the ansa cervicalis (AC) positioned lateral to the internal jugular vein.

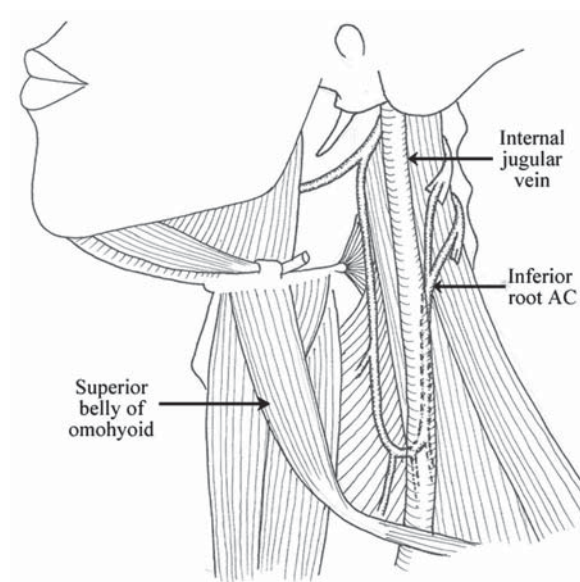


Figure 5. Inferior root of the ansa cervicalis (AC) positioned medial to the internal jugular vein.

Forty two (64.6%) of these loops (21 right and 21 left) occurred above the superior belly of the omohyoid muscle, while 16 (24.6%) loops (9 right, 7 left) were at the same level as the muscle. The remaining seven (4 right and 3 left) were inferior to this muscle. All these loops had an average of three branches supplying the infrahyoid muscles.

DISCUSSION

With the expanding use of the ansa cervicalis for reinnervation procedures and the fact that it is located in the vicinity of major nerves and vessels of the neck, knowledge of the topography and morphology of this loop is necessary in the modern era. Any variation in the course, contributing roots, or branching pattern of the ansa cervicalis potentially alters and perhaps complicates the course of any procedure involving this nerve [5, 6, 11, 21]. In the present study, the absence of the superior root of the AC was observed in one case on the left side. It is possible that the superior root in this case may have been totally absent or may have hitch-hiked on other nerves in the neck such as the vagus nerve. Reports by several authors that the superior root of the AC may arise from the vagus nerve are in agreement with this [1, 12, 20].

Topographical and morphological variations of the superior root of the AC have been reported in literature [5, 11]. In the current study more than half of the cases had this root above the posterior belly of the digastric muscle. Caliot and Dumont [4] observed the origin of this root above the digastric muscle in 75% of the cases studied, usually only several millimetres above, but frequently very high, even at the very exit of the hypoglossal nerve from the anterior condylar canal. In the remaining 25% of the cases, the origin was at the same level as the digastric muscle. A more recent study also reported the origin of the superior root of the AC above the digastric muscle in 92% of the cases [5].

In the present study, an average of two branches were seen arising from each of the superior roots. Usually the innervation to the superior belly of the omohyoid is derived from this root [22]. On rare occasions, other nerve branches have been noted to arise from this root. These branches may either join other nerves, such as the vagus [11] and phrenic nerve [18], or may directly supply muscles such as sternohyoid, sternothyroid, or sternocleidomastoid [10, 11].

The inferior roots of the AC in the current study were noted to be absent in 4 (10.5%) cases on the right side and in 7 (18.4%) cases on the left side. Absence of the inferior root has been reported with a frequency of up to 3% [4, 5]. Compared to the superior root, the inferior root displays more variations [3, 4, 11]. The observations in the current study therefore further add to the already known morphological variations of the inferior root of the ansa cervicalis. It is possible that the nerve fibres that form the inferior root may have joined the superior root

then hitch-hiked on the hypoglossal nerve, resulting in an absence of the inferior root.

The course of the inferior root has three patterns in relation to the internal jugular vein: medial, lateral, and mixed types [3, 4]. When the ansa is located deep in the internal jugular vein it is described as medial type, and when it lies superficial to the same vein it is known as lateral type. Sometimes the inferior root divides into branches that join the superior root independently [3]. Some of the branches may lie superficial to the internal jugular vein, with the rest passing deep into this vein, resulting in a mixed type. In our study, 81.5% of the inferior roots were of the lateral type while 19.5% were of the medial type. There are mixed results from the previous studies on the most frequent type, with some workers reporting a predominance of the lateral type [5, 4, 16] and others the medial type [3, 9].

The superior and inferior roots form a loop at the location of their anastomosis [5]. The position of the loop is dependent on the length of the inferior root [4]. In the present study the position of the loop was determined in relation to the superior belly of the omohyoid muscle, which is usually used as a landmark in locating it [11]. Our finding of more high loops concurs with the results of Loukas et al. [11], who found high loops in 70% of cases and short loops in the remaining 30%. The results of the current study, however, differ from the observations by Caliot and Dumont [4], who reported high loops in 17 (21%) out of 80 cases. In the same study, 51 (64%) cases had the loop occurring at the same level as the superior belly of the omohyoid muscle, and in 12 cases (15%) the loop was found inferior.

CONCLUSIONS

With the emerging utility of the AC in nerve reconstructive surgery, it is important for surgeons to be conversant with the morphology and topographic anatomy of these nerves. This study has reported variations that have never been described before, and also confirms some of the variations reported as case reports by previous authors.

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