

An anatomical cadaveric study of variations in the formation and pattern of the Ansa cervicalis

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Abstract

Background: The ansa cervicalis, a loop of nerves arising from the cervical plexus, plays a crucial role in innervating the infrahyoid muscles. Although typically formed by fibres from the C1–C3 spinal nerves, numerous studies have reported variations in its formation, particularly in the contribution to its superior and inferior roots. The present study aimed to examine the anatomical variations in the formation of the ansa cervicalis, with special emphasis on the roots and their contributing spinal nerve fibres. **Materials and Methods:** The study was conducted on cadaveric specimens to observe the origin, formation, and variations of the ansa cervicalis. Particular attention was given to the contributions of cervical spinal nerves and any anomalous connections. **Results:** The majority of specimens demonstrated the classical formation of the ansa cervicalis from C1–C3 spinal nerve fibres. The inferior root was predominantly formed by contributions from C2 and C3. However, variations were noted, including a case where the inferior root arose solely from the C2 ventral ramus. Additionally, a rare variation was observed in which fibres from the vagus nerve contributed to the formation of the ansa cervicalis, specifically to the inferior root. **Conclusion:** The study confirms that while the typical pattern of ansa cervicalis formation is most common, significant anatomical variations exist. The identification of rare anomalies, such as vagal contribution, emphasizes the importance of detailed anatomical knowledge for clinicians and surgeons performing procedures in the cervical region.

Keywords: Ansa cervicalis, variations, inferior root, vagus nerve, neck surgeries.

Introduction

The ansa cervicalis is a loop of nerves formed from the ventral rami of C1, C2 and C3 cervical spinal nerves. The advanced medical science uses the ansa cervicalis to reinnervate the paralysed muscles of the larynx. The surgical procedures for the treatment of dysphonia secondary to unilateral paralysis of the vocal cord will be corrected by using ansa cervicalis nerve to the recurrent laryngeal nerve by a process called nerve to nerve anastomosis. This procedure helps to maintain uniformity in vocal cord mass and tension [1]. It is formed by a superior root and an inferior root, and both form a thin loop in the neck [2]. The superior root carried the fibres of C1 cervical spinal root fibres along with hypoglossal nerve as descending hypoglossi [3]. The inferior root is derived from the C2 & C3 fibres as the descending cervicalis passes laterally and then anterior to the internal jugular vein, finally joining the superior root in front of the common carotid artery [3]. The nerve distribution of the ansa cervicalis innervates the infrahyoid muscles. These muscles act on the larynx by supporting the laryngeal cartilages during phonation [4]. The ansa cervicalis has become a prime choice for laryngeal reinnervation because of its proximity to the recurrent laryngeal nerve. The knowledge of the anatomical course, location and formation of ansa cervicalis becomes essential during the skull base surgeries, thyroplasty, arytenoid adduction, Teflon injections, and carotid endarterectomy to avoid iatrogenic injuries to the ansa

cervicalis [5]. Hence, the present study will be taken up to observe the formation, course and location of ansa cervicalis in the cadavers of the south Indian population.

Materials and Methods

The present study was conducted on 30 formalin-fixed South Indian cadavers of both sexes, aged between 40 and 60 years, at Pondicherry Institute of Medical Sciences, Pondicherry. The dissections were carried out during routine anatomical teaching sessions for first-year MBBS students. The anterior triangles of the neck were bilaterally dissected in all cadavers to identify and trace the ansa cervicalis. The nerve roots contributing to the formation of the ansa cervicalis were carefully exposed and followed to determine their origin and course. Branches arising from the ansa cervicalis were meticulously traced up to their termination in the infrahyoid muscles. Particular attention was given to identifying any variations in the formation, location, and course of the ansa cervicalis. All observed anomalies were documented, and photographic records were obtained to support the findings.

Results

The Fibres from C1 cervical spinal root form two loops before coming as descending hypoglossi in the specimen no.8. The C1 fibres came along with the hypoglossal nerve and directly come with the C1 root and join with the superior root of ansa cervicalis.

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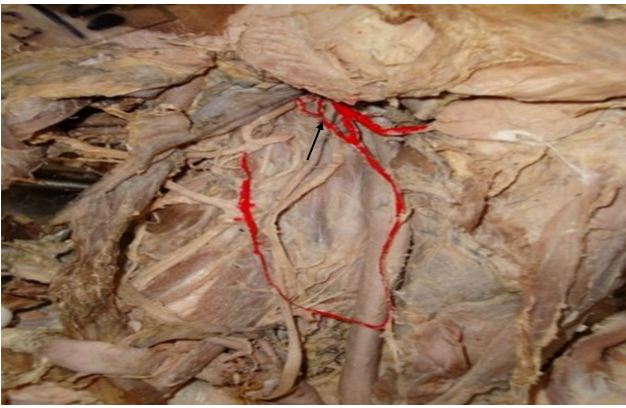


Fig 1: The Double loops formed by C1 fibres before descend as descending hypoglossi.



Fig 2: The Vagal fibres coming along with C2 fibres of Descending Cervicalis.



Fig 3: The C3 fibres are absent. The C2 fibres came as trunk and divide in to two branches and forms two loops at different levels.

Out of all specimens in specimen 13, the Vagal communication of fibres with C2 fibres was observed (fig 1). In the specimen no.20, the C3 contribution for ansa cervicalis was absent (fig 3). The C2 fibres came as a single trunk, and later it divides into two branches and joins with the superior root of C1 fibres at different levels and forms a double loop of ansa cervicalis.

Discussion

Previous studies by Khaki et al., [5] D'Souza AS, [6] and Ganapathy et al. [7] have reported that the most frequent contribution to the ansa cervicalis arises from the C1–C3 spinal nerve fibres. In contrast, Banneheka et al. [8] observed that the ansa cervicalis may also be formed by

fibres extending from C1 to C4 spinal segments, indicating a broader range of contribution. The findings of the present study are consistent with the majority of earlier reports, as most cases demonstrated formation of the ansa cervicalis from C1–C3 cervical spinal nerves.

Various cadaveric studies have demonstrated significant variability in the formation of the inferior root. Povirae and Chernikov [9] reported the classical formation by the ventral rami of C2 and C3 in 74% of cases. However, variations were also noted, with contributions from C3 alone in 5% of cases, from C2, C3, and C4 in 14%, from C2 alone in 4%, and from C1, C2, and C3 in 2% of cases. Similarly, Caliot and Dumont [10] observed that the inferior root was formed by C3 in 80% of cases and by C2 in 36% of cases, indicating overlapping contributions. In another study, Loukas et al. [11] found that the inferior root originated from C2 and C3 in 38% of cases, from C3 alone in 40%, from C2 in 12%, and from a combination of C2, C3, and C4 in 10% of cases. The present study also demonstrated that the inferior root was predominantly formed by contributions from C2 and C3. However, in one specimen, the inferior root was found to arise solely from the C2 ventral ramus, indicating a less common variation. These findings collectively highlight the anatomical variability in the formation of the inferior root, which is of considerable importance in clinical and surgical contexts.

Occasionally, the superior root may be derived from the vagus nerve either partly or entirely, but the fibres can be tracked back to their true origin from the cervical plexus. Jelev L, [12], Suma H Y et al [13] were also reported as having an ansa cervicalis with vagal relation. Manjunath KY [14] reported that the superior root of ansa cervicalis arose from the trunk of the vagus nerve. D'Souza AS and Biswabina Ray mentioned in their study that in the two cadavers, the superior root of ansa cervicalis was emerging from vagus at the upper border of the thyroid cartilage. The present study observed a variation with a root coming from the vagus nerve and contributed to the inferior root of ansacervicalis. It was a very rare anomaly.

Conclusion

The present study reaffirms that the ansa cervicalis is most commonly formed by contributions from the C1–C3 cervical spinal nerves. The inferior root contributed by the C2 root alone was a less common variation. Importantly, this study identified a rare variation in which fibres from the vagus nerve contributed to the formation of the ansa cervicalis, specifically to the inferior root. Although such anomalies are uncommon, their presence highlights the complexity of cervical plexus anatomy and the potential for atypical neural pathways. Overall, these variations hold significant clinical relevance, particularly in surgical procedures involving the neck, such as nerve grafting, laryngeal reinnervation, and thyroid surgeries. A thorough understanding of these anatomical differences is essential to avoid inadvertent nerve injury and to improve surgical outcomes.

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