

ANATOMICAL VARIATIONS OF SENSORY NERVE BRANCHES OF THE CERVICAL PLEXUS

Nunes Drisana R², Santos Catharine NOB², Nogueira Matheus S², Bueno Nazareth F², Reis Francisco P², Almeida Junior Erasmo², Oliveira Juciele VR¹.

*¹Department of Biomorphology, Human Anatomy for Medicine, Federal University of Bahia (UFBA), Salvador, Brazil.

² Department of Health, Human Anatomy for Medicine of Tiradentes University (UNIT), Sergipe, Brazil.

ABSTRACT

Introduction: The cervical plexus is formed by the union of the anterior branches of the cervical nerves from C1 to C4. These nerves originates sensory fibers and motor that will innervate the skin, muscles, glands and regions of the head and neck.

Objective: In literature, it has been a frequent description of findings of anatomical variations of peripheral nerves of the cervical plexus. A study of descriptive type anatomical design was carried out by observing the formation of the cervical plexus of its peripheral nerve branches, and search of possible anatomic variations of these nerve branches.

Methods: This study was conducted with Bilateral dissections were performed in 32 stillborns, formalin- fixed, all males with a mean age of 26.5 weeks (SD = 2.121). The fetuses were meticulously dissected and the formation of cervical plexus and its branches were observed. **Results and Discussion:** Among the 32 fetuses dissected, it found a variation of the CTN and an anastomosis between CTN and SCN and an anatomical variation was found in the form of anastomosis between the roots C1 to C4, forming a common trunk from which emerge some other nerve branches.

Conclusion: The most frequent anatomical identifications were confirmed, some variations already described and verification of new variations of the sensory branches in the cervical plexus. The identification of the sensory branches of the cervical plexus, and anatomical variants may help in clinical, therapeutic, surgical and diagnostics.

KEY WORDS: cervical plexus; sensory branches; anatomical variations.

Corresponding Author: Oliveira, Juciele VR, Department of Biomorphology, Federal University of Bahia (UFBA). Av. Reitor Miguel Calmon, s/n, Vale do Canela, CEP 40160-100, Salvador, Brazil. Tel.: 557132838888; **E-Mail:** juciele.valeria@ufba.br or jucielevaleria@yahoo.com.br

Access this Article online	Journal Information
Quick Response code  DOI: 10.16965/ijar.2019.337	International Journal of Anatomy and Research ICV for 2016 90.30 ISSN (E) 2321-4287 ISSN (P) 2321-8967 https://www.ijmhr.org/ijar.htm DOI-Prefix: https://dx.doi.org/10.16965/ijar 
	Article Information
	Received: 25 Oct 2019 Peer Review: 26 Oct 2019 Revised: None
	Accepted: 11 Nov 2019 Published (O): 05 Dec 2019 Published (P): 05 Dec 2019

INTRODUCTION

The sensory branches of the cervical plexus consist of anastomosis between the anterior primary branches of the spinal nerves, which emerge laterally from the intervertebral foramen

located between the nerve roots of C1 to C4 [1-4]. They are derived from nerves in the alar plate of the spinal embryonic segments C1 to C4 and the pattern of anastomosis between the divisions of the cervical plexus often occurs in

the C2 roots and C3 [5,6].

Prior to the formation of nerves, these roots emerge from the respective intervertebral foramen and form branches motor, sensitive, shallow, deep and communicating. The sensory nerves have anastomotic branches and give rise to four branches of sensory nerves: minor occipital nerve (OMN), major auricular nerve (AGN), transverse cervical nerve (CTN) and supraclavicular nerve (SCN). These branches innervate the occipito-mastoid, auricular and parotid regions as well as provides the sensory innervation of the skin of the anterior neck, shoulder and upper chest, formed by the anterior cutaneous nerves of the neck, C2 and C3 roots. The supraclavicular branches, roots C3 and C4, and the root C1 participates only in the sensory innervation of intracranial structures, such as the dura mater [5,6].

Among the sensory nerves of the cervical plexus, the AGN is the largest, coming predominantly from a common trunk with the OMN, from the third cervical ventral branch [7].

In this way the identification of anatomical variations of the sensory branches of the cervical plexus can help in the clinical-surgical procedures, painful symptoms and in the diagnosis of the path of the branches of this nervous plexus [8,9].

METHODS

The study design was of descriptive exploratory nature. They were dissected cervical plexus of 32 fetuses with an average age of 26.5 weeks (SD = 2,121), all of the anatomy laboratory at the University Tiradentes - Sergipe, Brazil and acquired in accordance with Law No. ... that deals with the use of cadavers unclaimed, for studies and research. The plexus were documented through high resolution photographs.

RESULTS AND DISCUSSION

The present study found anatomical variations of the sensory branches of the cervical plexus, whose description has not been usual in the literature. Among the 32 fetuses dissected it was found by a variation TCN branch (Figure 1) and an anastomosis between TCN and SCN [10-12](Figure 2). An anatomical variation was found in the form of an anastomosis between

the roots of C1 to C4, forming a single common trunk from which emerged some other nerve branches (Figures 3 and 4). These C1 to C4 cervical roots after their emergence through the intervertebral foramina were limited dorsally by the anterior, middle and posterior scalene muscles and were superficially limited by the sternocleidomastodeus muscle. This study confirmed the variations in the anatomical pattern of AMN, with a description of its division into three branches.

In a general picture, the variations of the sensitive cervical plexus branches among the studied fetuses had the following distribution. 23 cases (72%) corresponded to a pattern more usually described in the literature; 5 cases (15.6%) were of anatomical variations of TNC branches; 3 cases (9.4%) of anastomosis between the CTN and nerves of the CNS; and 1 case (3.10%) corresponded to the anatomical variations of the anastomosis of the cervical roots from C1 to C4, (Figure 5).

Fig. 1: Ramifications of 1-Cervical Transverse Nerve (CTN); A: Ascending branch; B: Ascending Branch Previous; C: Previous Branch and 2- Auricular Magnificent Nerve (AMN).



Fig. 2: 1- Identification Occipital Minor Nerve (OMN); 2- Auricular Magnificent Nerve (AMN) and anastomosis between the 3- Cervical Transverse Nerve (CTN) and the 4- Supraclavicular Nerve (SCN).



Fig. 3: Posterior view of anastomotic trunk of cervical roots C1 to C4 and the formation of nerve 1 Occipital Nerve Minor (OMN); 2- Auricular Magnificent Nerve (AMN); 3- Cervical Transverse Nerve (CTN) and the 4- Supraclavicular Nerve (SCN). Figure 3: Rear view of anastomotic trunk of cervical roots C1 to C4 and the formation of nerve 1 Occipital Nerve Minor (OMN); 2- Auricular Magnificent Nerve (AMN); 3- Cervical Transverse Nerve (CTN) and the 4- Supraclavicular Nerve (SCN).



Fig. 4: Front view of Trunk anastomotic cervical roots and formation of nerve 1 Occipital Nerve Minor (OMN); 2- Auricular Magnificent Nerve (AMN); 3- Cervical Transverse Nerve (CTN) and the 4- Supraclavicular Nerve (SCN).

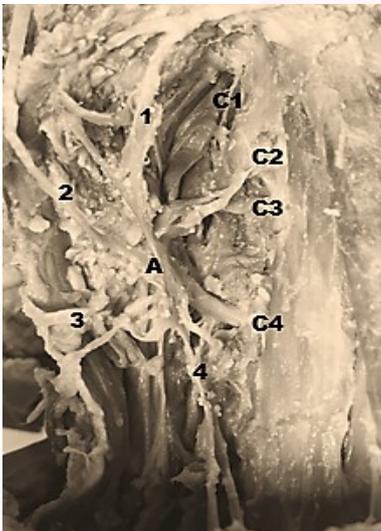
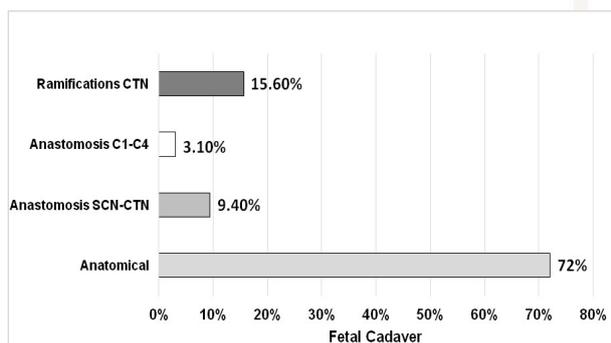


Fig. 5: Percentage distribution of anatomical identification of the sensory branches of the cervical plexus.



The present study confirms the anatomical variations of the nervous pathway, according to the authors [13] studying the anatomical pattern of AMN, described their division into three branches: superficial, deep and posterior. Besides, the CTN emerges from the intervertebral foramen at the level of the cervical spinal C2 and C3, and provides skin sensitivity in the anterolateral region of the neck. It is also originates in the cervical plexus and through the sternocleidomastoid postero-lateral. In the front of the muscle around the middle portion of the muscle, usually passing deep to the external jugular vein. Then, this nerve divided into upper and lower branches. In this way, the innervated the skin of the middle of the neck [14].

Verified in this work, the distribution of CTN and AMN, there is description that the angle of the jaw innervated by the auricular branch of the superficial cervical plexus (SCP) and cervical cutaneous nerve plexus convey sensitivity to the skin of the anterolateral neck region [15]. Regarding the communications established between nerves of the cervical plexus and cranial nerves, the study by Colbert et al [16] sought to clarify whether there is a relationship between the widths of the AMN of the trunk and the main trunk of the facial nerve in order to prevent such injuries parotidectomy nerve fibers. Despite this description, we did not find these communications.

The CTN commonly encountered during resection procedures in the cervical area, anastomosis to the facial nerve and often sacrificed. Although his communication with the cervical branch of the facial nerve well documented, not all reports describing their commitment to the marginal mandibular branch and communication between the transverse cervical nerve and the marginal mandibular branch of the facial nerve reported in research, referenced by the study Reuther et al [14]. However, in this study we found anastomosis between CTN and SCN, not yet described by the authors.

Yang, Kim and Hu [13] revealed that AMN communicates with multiple cranial nerves as follows: the nerve branch auricular sends one (or more) small branch to the parenchyma of the parotid and thereafter connects with facial nerve

(FN), with auricular branch of the vagus nerve (VN) and posterior auricular branch of the FN. In the present study did not verify the nerve communications described by the authors above, but found other different, an anastomosis between the roots of C1 to C4, not yet described in any scientific work.

As for the painful clinical picture in the cervical region, it has been widely described in the literature. Mostly the sensitive aspect hampered by radiculopathy reported with impaired sensation [17,18].

CONCLUSION

The most frequent anatomical identifications were confirmed, some variations already described and verification of new variations of the sensory branches in the cervical plexus, which can aid in clinical, therapeutic, surgical and diagnostics in the path of the ramifications of this nerve plexus.

ABBREVIATIONS

AMN - Auricular magnificent nerve
 CTN - Cervical transverse nerve
 FN - Facial nerve
 OMN - Occipital minor Nerve
 SCP - Superficial cervical plexus
 SCN - Supraclavicular nerve
 VN - Vagus nerve

ACKNOWLEDGEMENTS

We thank the board of health and the coordination of the anatomy laboratory of the Tiradentes University, which made the cadavers available and allowed this scientific work.

Conflicts of Interests: None

REFERENCES

- [1]. Soo KC, Hamlyn PJ, Pegington J, Westbury G. Anatomy of the accessory nerve and its cervical contributions in the neck. *Head Neck Surg.* 1986 Nov-Dec;9(2):111-5.
- [2]. Ariëns GA, van Mechelen W, Bongers PM, Bouter LM, van der Wal G. Physical risk factors for neck pain. *Scand J Work Environ Health.* 2000 Feb;26(1):7-19.
- [3]. Johnson GM. The sensory and sympathetic nerve supply within the cervical spine: review of recent observations. *Man Ther.* 2004 May;9(2):71-6.
- [4]. Bater MC, Dufty J, Brennan PA. High division of the accessory nerve: a rare anatomical variation as a possible pitfall during neck dissection surgery. *J Craniomaxillofac Surg.* 2005 Oct;33(5):340-1.
- [5]. Khaki AA, Shokouhi G, Shoja MM, et al. Ansa cervicalis as a variant of spinal accessory nerve plexus: a case report. *Clin Anat.* 2006 Sep;19(6):540-3.
- [6]. Pu YM, Tang EY, Yang XD. Trapezius muscle innervation from the spinal accessory nerve and branches of the cervical plexus. *Int J Oral Maxillofac Surg.* 2008 Jun;37(6):567-72.
- [7]. Pillay P, Partab P, Lazarus L, Satyapal KS. The Great Auricular Nerve in Fetuses. *Int. J. Morphol.* 2012 Mar; 30(1): 40-44.
- [8]. Nathe T, Tseng S, Yoo B. The Anatomy of the Supraclavicular Nerve During Surgical Approach to the Clavicular Shaft. *Clin Orthop Relat Res.* 2011 Mar;469(3):890-4.
- [9]. Siefferman J, Khelemsky Y. Occipital Neuralgia after Hair Transplantation and Its Treatment. *Case Rep Neurol Med.* 2015: 428-413.
- [10]. Havet E, Duparc F, Tobenas-Dujardin AC, Muller JM, Fréger P. Morphometric study of the shoulder and subclavicular innervation by the intermediate and lateral branches of supraclavicular nerves. *Surg Radiol Anat.* 2007 Dec;29(8):605-10.
- [11]. Rao TR, Shetty P, Rao S. A rare case of looping of supraclavicular nerve branches around external jugular vein and transverse cervical artery. *International Journal of Anatomical Variations.* 2009. 2: 48-50.
- [12]. Tubbs RS, Salter EG, Oakes WJ. Anomaly of the Supraclavicular Nerve: Case Report and Review of the Literature. *Clin Anat.* 2006 Oct;19(7):599-601.
- [13]. Yang HM, Kim HJ, Hu KS. Anatomic and histological study of great auricular nerve and its clinical implication. *J Plast Reconstr Aesthet Surg.* 2015 Feb;68(2):230-6
- [14]. Reuther WJ, Blythe JN, Anand R, Brennan PA. Communication of the transverse cervical nerve with the marginal mandibular nerve: a previously unreported anatomical variant. *Br J Oral Maxillofac Surg.* 2014 Jul;52(6):577-8.
- [15]. Ella B, Langbour N, Caix P, Midy D, Deliac P, Burbaud P. Transverse cervical and great auricular nerve distribution in the mandibular area: a study in human cadavers. *Clin Anat.* 2015 Jan;28(1):109-17.
- [16]. Colbert S, Parry DA, Hale B, Davies J, Brennan PA. Does the great auricular nerve predict the size of the main trunk of the facial nerve: A clinical and cadaveric study. *Br J Oral Maxillofac Surg.* 2014 Mar;52(3):230-5.
- [17]. Rainville J, Laxer E, Keel J, Pena E, Kim D, Milam RA, Carkner E. Exploration of sensory impairments associated with C6 and C7 radiculopathies. *Spine J.* 2016 Jan 1;16(1):49-54.
- [18]. Umapathi T, Sheng Jie Christen L, Yuki N. Similar to other forms of axonal Guillain-Barré syndrome, sensory nerves show reversible conduction failure in Fisher syndrome. *Clin Neurophysiol.* 2014 Jan;125(1):212-3.

How to cite this article: Nunes Drisana R, Santos Catharine NOB, Nogueira Matheus S, Bueno Nazareth F, Reis Francisco P, Almeida Junior Erasmo, Oliveira Juciele VR. ANATOMICAL VARIATIONS OF SENSORY NERVE BRANCHES OF THE CERVICAL PLEXUS. *Int J Anat Res* 2019; 7(4.3):7183-7186. DOI: 10.16965/ijar.2019.337