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ORIGINAL RESEARCH

Morphological assessment of perforated CTG (Cervicothoracic Ganglion) in cadavers of India

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ABSTRACT

Background: CTG (Cervicothoracic ganglion) has a high surgical significance in the diagnosis and management of chronic regional pain syndromes, vascular occlusive disorders, refractory angina, and herpes zoster. CTG can be perforated with the VA (vertebral artery) which can lead to complications encountered in the ganglionic block. **Aim:** The present study was aimed at morphological assessment of perforated CTG (cervicothoracic ganglion) in cadavers of India. **Methods:** The present study assessed 50 cadavers that were embalmed in formalin comprising 14 female and 36 male cadavers. Among 50 cadavers, 4 specimens from the right side were excluded owing to damage and adhesion to the ganglion. A total of 96 specimens including 50 left and 46 right were included and assessed for perforated CTG. **Results:** CTG was seen in 87.5% of the specimens, whereas, inferior cervical ganglion was seen in 12.5% of the specimens. Perforated CTG was seen in 9.52% (n=8) specimens exclusively on the left side where the vertebral artery pierced at its middle or superior pole. The perforated CTG was exclusively seen on the left side, and in all 8 specimens, the vertebral artery was the branch from the subclavian artery. **Conclusion:** The present study concludes that analysing the morphology of perforated CTG in cadavers from India depicts the occurrence of CTG. It is vital to consider the associated risk of injury to the vertebral artery while giving a CTG block. Also, it is vital to understand the variations that could help aesthetics, surgeons, and neurosurgeons in the prevention of complications during the diagnostic and therapeutic ganglionic blocks.

Keywords: CTG, cervicothoracic ganglion, Inferior cervical ganglion, stellate ganglion, sympathetic chain, vertebral artery

INTRODUCTION

The CTG or cervicothoracic ganglion which is also known as stellate ganglion is a part of the cervical sympathetic trunk which provides the sympathetic innervation to the upper limbs, neck, and head. The cervicothoracic ganglion is present anteriorly to the neck of the first rib and the transverse process of the seventh cervical vertebra.[1]

The upper part of the cervicothoracic ganglion is usually located in the triangle which is formed from the three arteries namely subclavian arteries, vertebral arteries, and common carotid arteries. Blockade of cervicothoracic ganglion is usually needed for the diagnostic as well as for therapeutic purposes in subjects having phantom limb pain, refractory chest pain, herpes zoster, and chronic regional pain syndromes.[2]

Block of a cervicothoracic ganglion is also highly efficacious in the management of chronic nerve pain, post-mastectomy pain syndrome, and the treatment of facial pain. The cervicothoracic ganglion varies concerning its morphology and might be seen in various forms as perforated, dumbbell-shaped, inverted L-shaped, and fusiform shape.[3]

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In cases with the perforated pattern of cervicothoracic ganglion, the VA (vertebral artery) perforates the ganglion. Hence, during the ganglionic block, the artery has a high vulnerability to injury. In the previous and existing literature, perforated cervicothoracic ganglion is reported rarely and existing literature data is scarce for anatomical studies focusing on cervicothoracic ganglion and its perforation concerning the Indian context.[4] Hence, the present study was aimed at morphological assessment of perforated CTG (cervicothoracic ganglion) in cadavers of India.

MATERIALS AND METHODS

The present observational descriptive study was aimed at morphological assessment of perforated CTG (cervicothoracic ganglion) in cadavers of India.The study subjects were from the Department of Human Anatomy of the Institute.

Thestudy included 50 cadavers of Indian origin that were fixed in the formalin and were of 14 females and 36 male subjects that were used for teaching undergraduate students in the Department of Human Anatomy within the defined study period. Among 100 specimens from 2 sides, 4 samples were excluded owing to the damage and adhesion to the CTG. Hence, the final specimens in the study were 96 comprising 46 right-side and 50 left-side specimens that were dissected and assessed in the study.

Cunningham's Manual of Practical Anatomy was used for the dissection of the neck in the cadavers.[5] Following the removal of the clavicle, a deep dissection was performed for the exposure of the cervical sympathetic chain. This was followed by the identification of the CTG and the following morphology was assessed. The vertebral artery was then dissected to its origin from the subclavian artery and the relationship between CTG and vertebral artery was noted.

The presence of perforation of the CTG by the vertebral artery was seen and identified. Vernier Caliper having a sensitivity of 0.1 mm was used for assessing the morphometry of CTG including the perforated cervicothoracic ganglion. The parameters assessed were distance from the midline to the ganglion, and length, thickness, and width of the cervicothoracic ganglion.

The data gathered were analyzedstatistically using SPSS (Statistical Package for the Social Sciences) software version 24.0 (IBM Corp., Armonk. NY, USA) for assessment of descriptive measures, Student t-test, ANOVA (analysis of variance), and Chi-square test. The results were expressed as mean and standard deviation and frequency and percentages. The p-value of <0.05 was considered.

RESULTS

The present observational descriptive study was aimed at morphological assessment of perforated CTG (cervicothoracic ganglion) in cadavers of India.The present study assessed 50 cadavers that were embalmed in formalin comprising 14 female and 36 male cadavers that were used for teaching undergraduate students in the Department of Human Anatomy of the Institute. Among 50 cadavers, 4 specimens from the right side were excluded owing to damage and adhesion to the ganglion. A total of 96 specimens including 50 left and 46 right.

The study results showed that CTG was seen in 87.5% (n=84) subjects and inferior cervical ganglion was seen in 12.5% (n=12) study specimens. Among the specimens that had CTG, the perforated CTG was seen in 9.52% (n=8) of study subjects. However, study results also showed that in all the cases where CTG was perforated, it was seen on the left side only. In all the specimens, the vertebral artery showed its origination as a branch from the subclavian artery.

It was seen that in 2 cases, the vertebral artery pierced the CTG from the medial side and in 4 cases, it was pierced from the lateral side of the ganglion. In all these cases, the CTG was pierced at the superior pole only. In the other four cases, the vertebral artery pierced the middle of the CTG from the anterior aspect. After piercing the CTG, the vertebra artery coursed posteriorly to the ganglion and proceeded towards the transverse foramen at the level of C6 in all the assessed cadaveric samples.

The study results also showed that for the comparative assessment of various parameters in perforated CTG and CTG in study subjects, the distance of CTG from midline was 19.29±2.61 in CTG which was higher compared to perforated CTG where it was 18.9±4.53. The mean thickness of CTG was 2.93±0.96 in CTG and was higher in perforated CTG with 3.59±0.8mm. For width, it was 6.82±1.9 and 6.45±1.39 in CTG and perforated CTG which was higher in CTG. The mean length was 18.57±6.89mm in CTG which was lesser compared to perforated CTG where it was 23.22±1.66mm (Table 1).

Table 1: Comparison of various parameters in perforated CTG and CTG in study subjects

Parameter (mm)	CTG	Perforated CTG
Distance of CTG from the midline	19.29±2.61	18.9±4.53
Thickness	2.93±0.96	3.59±0.8
Width	6.82±1.9	6.45±1.39
Length	18.57±6.89	23.22±1.66

DISCUSSION

The present study assessed 50 cadavers that were embalmed in formalin comprising 14 female and 36 male cadavers that were used for teaching undergraduate students in the Department of Human Anatomy of the Institute. Among 50 cadavers, 4 specimens from the right side were excluded owing to damage and adhesion to the ganglion. A total of 96 specimens including 50 left and 46 right. These data were comparable to the studies of Iwanaga J et al[6] in

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20121 and NarouzeS et al[7] in 2014 where the study design used by the authors in their studies was similar to the study design in the present study.

It was seen that CTG was seen in 87.5% (n=84) subjects and inferior cervical ganglion was seen in 12.5% (n=12) study specimens. Among the specimens that had CTG, the perforated CTG was seen in 9.52% (n=8) of study subjects. However, study results also showed that in all the cases where CTG was perforated, it was seen on the left side only. In all the specimens, the vertebral artery showed its origination as a branch from the subclavian artery. These results were consistent with the findings of Goel V et al[8] in 2019 and Higa K et al[9] in 2006 where results were comparable to the present study in their respective studies.

The study results showed that in 2 cases, the vertebral artery pierced the CTG from the medial side and in 4 cases, it was pierced from the lateral side of the ganglion. In all these cases, the CTG was pierced at the superior pole only. In the other four cases, the vertebral artery pierced the middle of the CTG from the anterior aspect. After piercing the CTG, the vertebra artery coursed posteriorly to the ganglion and proceeded towards the transverse foramen at the level of C6 in all the assessed cadaveric samples. These findings were in agreement with the results ofChaturvedi A et al[10] in 2010 and Rastogi S et al[11] in 2010 where vertebral artery piercing reported by the authors was comparable to the results of the present study.

It was also seen that for the comparative assessment of various parameters in perforated CTG and CTG in study subjects, the distance of CTG from midline was 19.29±2.61 in CTG which was higher compared to perforated CTG where it was 18.9±4.53. The mean thickness of CTG was 2.93±0.96 in CTG and was higher in perforated CTG with 3.59±0.8mm. For width, it was 6.82±1.9 and 6.45±1.39 in CTG and perforated CTG which was higher in CTG. The mean length was 18.57±6.89mm in CTG which was lesser compared to perforated CTG where it was 23.22±1.66mm. These results were in line with the findings of Sharma V et al[12] in 2018 and Tardieu GG et al[13] in 2017 where various parameters concerning length, width, thickness, and distance of CTG from midline comparable to the present study were also reported by the authors in their respective studies.

CONCLUSIONS

The present study, within its limitations, concludes thatanalyzing the morphology of perforated CTG in cadavers from India depicts the occurrence of CTG. It is vital to consider the associated risk of injury to the vertebral artery while giving a CTG block. Also, it is vital to understand the variations that could help anesthetics, surgeons, and neurosurgeons in the prevention of complications during the diagnostic and therapeutic ganglionic blocks.

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