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Original Article

A STUDY OF FORAMINA THYROIDEUM

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ABSTRACT

Background: A foramen in the lamina of thyroid cartilage is an occasional opening existing in one or both thyroid laminae which may or may not contain a neurovascular component. Foramen was first described by Segond in 1847.

Materials and methods: Larynx specimens were collected from Department of Forensic Medicine Mysore Medical College. 62 Larynx specimens were collected, 31 male and 31 female, and fixed in 10% formalin solution for 2-3 weeks. Careful dissection was done to separate thyroid cartilage and following observations were made. Location of foramen, regarding the side of lamina and its relation to oblique line was noted. Size, shape and measurements were noted.

Results: Foramina were observed in the laminae of 9 thyroid cartilages in females and 6 in male specimens. 1 male specimen showed bilateral foramina thyroideum. Among 16 Foramina Thyroideum (FT), 13 were on right lamina and 3 on left lamina. Shape of FT was round in 9 specimens and oval in 7 specimens. 10 FT were located in front of oblique line, 5 were behind and 1 was on the line. Size of FT range from 1mm - 5.67mm, close to upper boarder in 13 specimens and 3 were in the middle.1 specimen showed presence of superior laryngeal vessels in FT.

Conclusions: Incidence of FT in the present study was 25.8%.To conclude presence of FT being a rare variation clinicians need to be aware of the possible contents such as external and internal laryngeal nerve communication and presence of superior laryngeal vessels before undertaking surgical procedures.

KEY WORDS: Thyroid cartilage, foramen thyroideum (FT), internal laryngeal vessels, Internal laryngeal nerve.

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INTRODUCTION

Foramina Thyroideum (FT) has been described as an occasional opening existing in one or both plates of the thyroid cartilage, which may or may not contain a neurovascular component. Although first described in 1847 by Segond it remains a contentious issue as some consider its existence routine structural variation rather than anomaly [1]. Previous investigations have yielded either unilateral or bilateral occurrence of FT that extend a wide range with reports of more than one foramina on the same thyroid lamina also having been recorded. The literatures are available where the foramina functions as unique conduit for branch of superior laryngeal nerve as well as vessels [1].

FT is commonly found near the upper lateral angle, a little below the superior tubercle of the

thyroid cartilage which transmits superior laryngeal artery and rarely some fibres of external laryngeal branch of superior laryngeal nerve. The foramina represents cleft between 4th and 5th pharyngeal bars [2].

Occasionally there may be a foramina in the lamina of thyroid cartilage situated near the upper part of the posterior boarder, an abnormal branch of superior laryngeal artery passes through it [3].

Roberto et al [4] have reported presence of branch of superior laryngeal artery passing through the foramina on right side and continue as internal branch supplying the supraglotic region of larynx, a rare variation of superior laryngeal artery has been reported.

MATERIALS AND METHODS

Larynx specimens were collected from Department of Forensic Medicine Mysore Medical College and Research Institute Mysore during the period from Sept 14 –Jan 15. Total 62 specimens, 31 male and 31 female, were collected. Specimens were preserved in 10% Formalin solution for a period of 2 weeks. Dissection was carried out and thyroid cartilages were separated and cleaned. Laminae of thyroid cartilages were observed for presence of any foramina and contents in it. Details such as shape, location in relation to oblique line and distance from upper boarder were noted. Vertical and horizontal measurements of the foramina were taken by using digital calipers

RESULTS

Among the 62 specimens Foramina Thyroideum (FT) were observed in 15 especimens, and bilateral in 1 male specimen giving the incidence 25.8%. And total 16 FT were studied.

Morphology: FT were round in 13 specimens, among these 7 were in female and 6 in male specimens. FT were oval in 7 and among these 2 were in female and 5 were in male specimens.

Size: Range of measurements varies from 1 mm to 5.67 mm. FT more than 3 mm were in 3 male, and 2 female specimens. Mean horizontal diameters were 2.29 mm on right side and 2.73 mm on left side. Mean vertical diameter was 3.34 mm on right side and 3.9 mm on left side.

Location: Presence of FT in relation to oblique line and distance from upper boarder. The FT was found in front of oblique line in 10 specimens, 6 in female and 4 in male specimens. FT was behind the oblique line in 5, and 2 in female and 3 in male specimens. FT was on the line in 1 female specimen.

Side of lamina: FT was on right lamina in 13 specimens, includes 7 in female and 6 in male specimens and 3 were on left lamina, 2 in female and 1 in male specimen.

Table 1: Measurements of thyroid foramina in mm.

Mm	Horizontal		Vetrical	
	Right	Left	Right	Left
Mean	2.29	2.73	3.34	3.9
Minimum	1	1.73	1	2.79
Maximum	3.58	3.72	5.67	5.01

Fig. 1: Oval foramina seen on right lamina of thyroid cartilage behind the oblique line in a male specimen.

Fig. 2: Showing FT behind the oblique line in the middle of right lamina of thyroid cartilage in a female specimen.

Fig. 3: Foramina Thyroideum in both laminae of thyroid cartilage in a male specimen.

Fig. 4: 9 Female thyroid cartilage specimens with thyroid foramina.

Fig. 5: 6 male thyroid cartilage specimens with thyroid foramina.

Table 2: Showing the incidence of FT in various studies [1].

Authors	Population	Sample size	No. of FT	Incidence %
He et al. (1999)	French	50	1	2
Ortug et al. (2005)	Turkish	50	6	12
Ramsaroop et al.	Africa	80	6	7.5
Guerrier et al.	French	94	24	26
Lang et al.	German	22	6	43.27
Present study	Indian	62	15	25.8

Table 3: Showing relation with oblique line.

Authors	Anterior	posterior	On the line
Ramsaroop et al.	8	2	2
Present study	10	5	1

Table 4: Showing comparison of sex distribution with other studies [1].

Authors	male	Female	Unknown
Zemlin et al.	8	13	1
Ortug et al.	6	0	0
Ramsaroop et al.	9	3	0
Present	7	9	0

Table 5: Showing range of measurements of FT [1].

Author	Range
Gruber et al.	0.5 -9.0
Afifi et al.	2.5
Long et al.	2.5 – 4.0
Zemlin et al.	0.45 – 6.5 (F), 0.5 – 6.0 (M)
Ramsaroop et al.	2.2 – 4.5
Present	1 – 5.67

DISCUSSION

Incidence of FT in the present study was 25.80%.The observations were compared with studies reported in literature. A study reported by Ramsaroop et al [1] done in South African population in 80 thyroid specimens. FT were seen in 6 specimens, 5 were bilateral and 1 unilateral (total 12 FT, incidence 7.5%). There were double FT on the same side in 1 of the specimens. In the present study among 15 specimens with FT one had bilateral foramina. And there was no specimen with double FT on the same side. Sex difference was not significant in both the studies.

Regarding the shape of FT, Ramsaroop et al [1] observed round shape in 6 specimens and oval in 6 specimens. In the present study shape of FT was round in 9 and oval in 7 specimens. Regarding the size range was 1 mm to 5.67 mm in present study and 2.2 to 4.3 mm in study reported by Ramsaroop et al [1] and all 12 specimens showed external laryngeal nerve and internal laryngeal nerve communication, but in the present study 1 specimen showed superior laryngeal vessels in FT.

Developmentally two theories have been proposed to explain the foramen thyroideum [1].

1) Incomplete union of the cartilaginous elements of the 4 th & 6 th pharyngeal arches, that give rise to thyroid lamina.

2) Neurovascular theory which postulates that the presence of a vessel or a nerve in the lamina of thyroid cartilage during the embryonic period resulting in failure of chondrification and thus formation of foramina in lamina of thyroid cartilage.

Failure of coalescence of 4^{th} and 6^{th} branchial arches and presence of abnormal nervous and mesenchymal growth appear to be two

processes that are intimately connected with one another and that failure on either end could lead to abnormal growth in either side.

CONCLUSION

Thyroid cartilage is one of the important unpaired cartilages of larynx. Presence of foramina in the lamina is a rare variation, if containing neurovascular bundle, is important for surgeries associated in the region. Awareness of its presence is of paramount importance in order to preserve the structures that traverse it and also to comprehensively treat laryngeal cancer. Iatrogenic injury to the internal laryngeal nerve, terminal portion of recurrent laryngeal nerve is one of the most crucial concerns during thyroid surgery.

Conflicts of Interests: **None**

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