



Occurrence of Thyroid Foramina - A Clinico - Anatomical Correlation

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Introduction: The larynx is a sphincteric device and an organ of phonation. One of its cartilages is thyroid cartilage which houses the thyroid foramina. The foramen thyroideum (FT) is commonly circular and may contain nerves, vessels, neurovascular bundles, and connective tissue. Among these structures, the most important are the internal branch of the superior laryngeal nerve (SLN) and the superior laryngeal arteries and veins. It is useful for Radiologists, Head and Neck surgeons. Reconstructive surgeries and ENT surgeons to plan and perform advanced surgical procedures of the larynx.

Aim: Analyze the Incidence and Distribution of Thyroid Foramina and perform its anatomico-clinical & surgical correlation

Material and Method: 15 Cadaveric thyroid cartilages were taken from Department of Anatomy, Government Medical College & Rajindra Hospital, Patiala. Thyroid cartilages were cleaned & dried. Incidence and pattern of distribution of thyroid foramina was studied.

Result: Single foramen thyroideum towards the superior border was present in 60% of the specimens. Out of which in 44.4% of specimens it was present in the right lamina, in 33.3% of specimens in the left lamina and in 22.2% of specimens it was bilateral. A total of 11 foramina with [Right:Left :: 6:5] was observed and Position of foramen thyroideum with the Oblique line in the right lamina was anterior in 16.7% of specimens, posterior in 33.3% specimens and at oblique line in 50% of specimens while in left lamina it was anterior in 20% specimens, posterior in 60% and at oblique line in 20% of specimens.

Keywords: Foramen Thyroideum, Thyroid Cartilage, Larynx, Internal Laryngeal Nerve, Superior Laryngeal Nerve (SLN)

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Introduction

The larynx is a sphincteric device and an organ of phonation. The larynx is essentially a cartilaginous tube that connects inferiorly to the respiratory system and superiorly to the vocal tract and oral cavity. The laryngeal skeleton consists of three unpaired and three paired cartilages. One of its unpaired cartilages, is thyroid cartilage which houses the thyroid foramina.

The foramen thyroideum (FT) first described by Segond in 1847 is located in the posterior superior position of the thyroid lamina, below the superior thyroid tubercle. Basic human anatomy texts and medical dictionaries fail to illustrate it (1-3). Previous studies have indicated a wide range in incidence of FT between 2% to 55% (4-7). This foramen is commonly circular and may contain nerves, vessels and connective tissue. Among these structures, the most important are the internal branch of the superior laryngeal nerve (SLN) and the superior laryngeal arteries and veins.(5) Knowledge of incidence and location of this foramina may help Radiologists, Head and Neck surgeons and ENT surgeons to plan and perform advanced surgical procedures of the larynx.

Aim

To study the Incidence and Distribution of Thyroid Formina and carry out its anatomico-clinical & surgical correlation.

Material and Method

During routine cadaveric dissection of head & neck, 15 thyroid cartilages of either sex were harvested. The cartilages were cleaned with the help of dissecting instruments like scalpel and BP knife. After cleaning, presence and pattern of distribution of thyroid foramen was observed and noted.

Result

Out of the 15 specimens studied, a thyroid foramen (FT) was observed in a total of 9 (60.0%) specimens. Among these, 7 (46.67%) specimens presented with unilateral foramen, while 2 (13.33%) specimens presented with bilateral foramina.

Of the 7 specimens with unilateral thyroid foramen, 4 (26.67%) were right-sided and 3 (20%) were left-sided.

Regarding their topographic relationship to the oblique line (OL) in right side, 1 (6.67%) was located anterior to the OL, 2 (13.33%) were posterior to the OL, and 1 (6.67%) was situated directly at the OL. In contrast, all 3 (20%) left-sided unilateral foramina were consistently located posterior to the OL.

Bilateral thyroid foramina were observed in 2 (13.33%) specimens (representing 4 total foramina across the right and left laminae). In the first specimen, the left-sided foramen was located anterior to the OL, whereas the right-sided foramen was situated directly at the OL. In the second specimen, both the right- and left-sided foramina were located directly at the OL.



Figure 1: lateral view of thyroid cartilage showing Foramen Thyroideum

Discussion

Embryologically two hypotheses have been proposed to explain the origin of the FT.

The first is the branchial origin. FT is considered to be an incomplete union of the cartilaginous elements of the fourth and sixth pharyngeal arches from which the thyroid lamina is derived.

The second is neurovascular theory; it is associated with a chondrification defect of thyroid lamina caused by presence of vessel and/or nerves (5-7).

Ortug et al reported 6 specimens with distinctly identifiable foramina out of 50 specimens. Where 1 specimen had bilateral FT, 5 specimens had unilateral with [Right:Left :: 3:2], and 1 specimen, in left, had double foramen.(5)

Rusu et al observed that out of 50 specimens in 68% of specimens superior laryngeal artery (SLA) originated from the superior thyroid artery.

From the 68% SLA originating from the superior thyroid artery, in Five sides, two left and three right, an ASLA was found entering the larynx through the foramen thyroideum. From the total specimens dissected, the ASLA represented only 5% and it was never bilateral.(8)

Ramsaroop et al found that 6 out of the 80 (7.5%) specimens examined had distinctly identifiable foramina. Out of which 5 cases (4 male, 1 female) displayed bilateral foramina (6.3%), with 1 case (1 female) of a unilateral foramen (1.3%).

One of the larynx that had bilateral foramina, presented with two foramina on the same (right) thyroid lamina, separated by only a thin band of cartilage. No statistically significant differences between sexes or sides were noted.

They also reported locations of the foramina in relation to the oblique line of the thyroid lamina. 8 of the foramina were situated anterior to the oblique line, 2 were located posterior to the oblique line, and 2 were located on the oblique line.

The single case of double foramina on the right thyroid lamina was observed posterior to the oblique line, facing Posteriorly.(7)

Raikos and Paraskevasin reviewed the previous studies and found that the incidence of foramen thyroideum differs greatly between studied populations. The incidence rate of foramen thyroideum amongst the European population, according to a study conducted in France on 94 cadavers, was only 2%. While in neighboring countries such as Germany it was 55% (Wal dever, 1927) and in Spain it was found 31.1% (Sanudo et al., 1999). The frequency in South Africans was 7.5% (Ramsaroop et al., 2010) whilst in adult Indians ranged from 10 to 16% (Harjeet et al., 2012; Joshi et al., 2011; Jain et al., 2012).(6)

Yalcin et al observed 6 specimens with foramen thyroideum out of 57 specimens. . It was bilateral in 3 (5.3%) specimens, suggesting that it was observed in 9 out of 113 (7.9%) sides.

The foramen thyroideum was located at the oblique line in 33.3%, or posterior in 66.7% below the superior tubercle in all nine sides.(9)

Galvao et al reported 2 specimens out of 100 with foramen thyroideum present on them corresponding to an incidence of 2%. Regarding its location, 1 was unilaterally (right side) in the posterior-superior portion, and other was on both sides symmetrically.

The thyroid foramen interrupted the oblique line in both cases and was located near the superior tubercle of the thyroid cartilage of the larynx.(1)

Conclusion

Association between foramen thyroideum and oblique line is useful for the surgeons in locating the superior laryngeal nerves & vessels during surgery.

Therefore, the frequent occurrence of foramen thyroideum in the north Indians is going to be extremely useful for radiologists, head and neck surgeons, and reconstructive and ENT surgeons in this region when performing any type of surgical procedure.

LIMITATIONS

The present study though it provides valuable morphological insight but it has a limitation of statistical power due to relatively small sample size.

ETHICAL CONSIDERATIONS

The study was conducted in accordance with the ethical standards of the Declaration of Helsinki and was approved by Institutional Ethics Committee. Written informed consent was obtained from all participants prior to enrollment.

CONFLICTS OF INTEREST

The authors declare that they have no conflict of interest.

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Table 1: Comparison of Incidence & Pattern of Thyroid Foramina with Previous Studies

Author	Population Group	Sample Size	Incidence (%)	Unilateral Incidence (%)	Bilateral Incidence (%)	Total Foramina	Anterior to Oblique Line	Posterior to Oblique Line	At the Oblique Line
Ortug et al.[5] (2005)	Turkish	50	12	Right 6%, Left 4%	2 %	Not Addressed	Not Addressed	Not Addressed	Not Addressed
Liu et al.[3] (2007)	China	20	30%	20%	10%				

Rusu et al.[8] (2007)	Romania	50	10%	0%	10%				
Miklaszewska et al[4](2010)	Poland	39	76.9%	66.7%	10.2%				
Ramsaroop et al.[7](2010)	South African	80	7.5	1.25% (two foramina on single lamina)	6.25%	12	8	2	2
Jain et al.[2] (2012)	India	60	17%	10%	7%				
Yalcin et al.[9] (2018)	Turkish	57	10.52	5.26%	5.26%	9		6	3
Galvao et al. [1](2022)	Brazil	100	2	1%	1%	3			3
Present study(2026)	North Indian	15	60	Right 26.67%, Left 20%	13.33%	11	Right 1, Left 1	Right 2, Left 3	Right, 3Left 1

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