

Original Article

Morphometric characteristic of thyroid cartilage in Gujarat region: A cadaveric study

Shital Patel¹, Rashmi Bhardwaj¹, Priyanka Parmar¹, Vasant H Vaniya¹

¹Department of Anatomy, Government Medical College, Vadodara, Gujarat, India

DOI: 10.5455/jrmds.20164215

ABSTRACT

Background: The larynx is the organ for production of voice & a sphincteric device used in respiration. Larynx from inside outward has a framework of mucosa surrounded by fibroelastic membrane which in turn surrounded by cartilages & muscles. Thyroid cartilage is largest among all the laryngeal cartilage.

Aims: To find out dimension of various parameters of thyroid cartilage, variation, differences among all the data & to compare data between males & females.

Material & Methods: Forty five samples of adult thyroid cartilage (24 males & 21 females) of known sex were taken from embalmed cadavers. Morphometric measurement was taken using a digital vernier caliper & goniometer to see normal variation, sex differences and bilateral asymmetry. Observations were analysed after calculating mean & SD.

Results: Parameters measured in thyroid cartilage were show significant difference in males & females. All the parameters of thyroid cartilage except thyroid angle were higher in males than females. Bilateral asymmetry in the size of thyroid lamina was seen in majority of specimens. However, in 3 cases (6.67 %) thyroid prominence was not in median plane, deviated towards left side. In one case asymmetry was also associated with asymmetry in direction of superior cornu.

Conclusion: The detailed study of thyroid cartilage in the form of morphometric parameters of thyroid cartilage is useful for Anatomist, Plastic surgeons, ENT surgeons and Radiologist to perform advanced surgical & endoscopic procedure & surgeries, planning of laryngeal framework & facial feminization surgery & to analysis of CT-MRI scans of larynx.

Key words: Morphometry, Thyroid cartilage, Larynx, Thyroid lamina, Asymmetry

INTRODUCTION

The thyroid cartilage is the largest of the laryngeal cartilages. It consists of two quadrilateral laminae with anterior borders that fuse along their inferior two-thirds at a median angle to form the subcutaneous laryngeal prominence -Adam's apple. This projection is most distinct at its upper end, and is well marked in men but scarcely visible in women. Above, the laminae are separated by a V-shaped superior thyroid notch or incisure. Posteriorly, the laminae diverge, and their posterior borders are prolonged as slender horns, the superior and inferior cornua. The superior cornu, which is long and narrow, curves upwards, backwards and medially, and ends in a conical apex while the inferior cornu is short and thick, and curves down and slightly anteromedially. Knowledge of laryngeal cartilage anatomy is being utilized for diagnosis of various congenital &

acquired laryngeal disorders using laryngoscopy, myography & imaging techniques. So the particular attention & sound knowledge of morphometry of thyroid cartilage will be helpful in performing laryngeal framework surgery, laryngeal electromyography, injury & repair of cartilage surgeries. Hence present study was undertaken with the aim, to find out dimension of thyroid cartilage in the form of height of thyroid lamina, width of thyroid lamina, length of posterior border, length of superior and inferior cornua of both laminae and distance between tips of superior cornua, distance between roots of superior cornua, distance between tips of inferior cornua, distance between roots of inferior cornua, angle between two lamina of thyroid cartilage, to find out variation & difference among all the data, to compare data between male & female[1].

METHODS AND MATERIAL

Sample size & study area: Forty five specimens of thyroid cartilage out of which twenty four male and twenty one female were dissected from embalmed cadavers in the Anatomy Department, Medical College, Baroda, Gujarat during routine dissection from February 2015 to December 2015.

Methodology: Thyroid cartilage samples used in this research were of known sex. Soft tissues were removed from the thyroid cartilage samples with routine dissection instruments and the preparations were kept in 10% formalin. Morphometric measurements were then taken using the methodology determined in the previously conducted similar research [2]. The measurements were taken directly on preparations using a digital vernier caliper. Thyroid angle was determined with goniometer. In order to precisely describe the morphology of the thyroid cartilage, bilateral parameters separately for the left and the right side were measured (**Figure-1**).

the thyroid cartilage laminae was measured on both sides for obtaining the height of the thyroid lamina.

BE - The width of thyroid lamina.(Distance between the bottom of the superior thyroid notch to the posterior border at root of superior cornu of the thyroid cartilage was measured on both sides.)

AD - The posterior border length of the thyroid cartilage. (The distance between the tips of the superior and inferior cornua.)

AB - The length of the superior cornu.

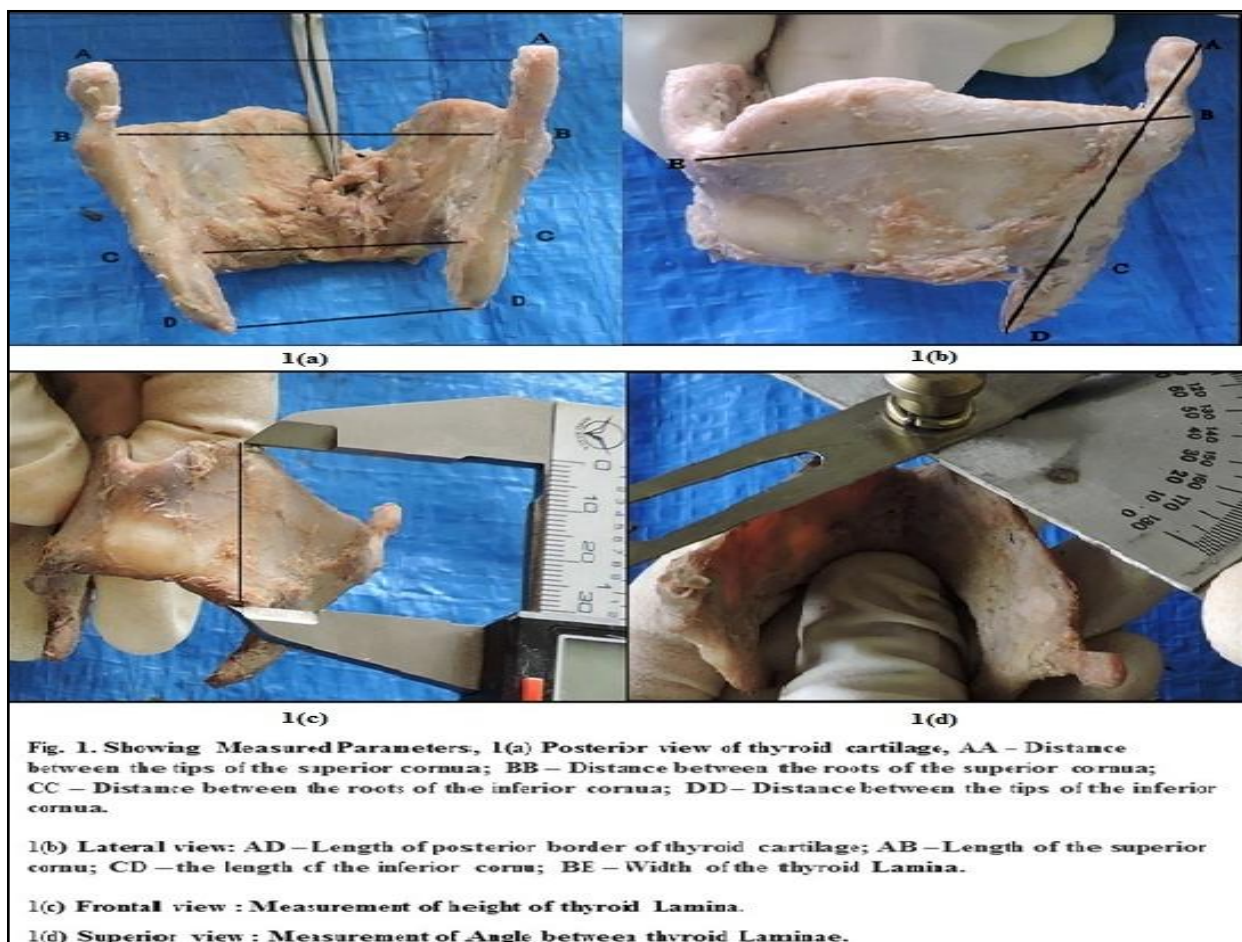
CD - The length of the inferior cornu.

AA - The distance between the tips of the superior cornua.

BB - The distance between the roots of the superior cornua.

CC - The distance between the roots of the inferior cornua.

DD - The distance between the tips of the inferior cornua.



Thyroid Angle-Angle between two thyroid lamina was measured with goniometer.

Height of lamina-Distance between the highest point on the upper border and the lower border of

Statistical analysis

All these measurements were statistically analysed

by calculating Mean and Standard Deviation (SD) with the help of Microsoft Excel.

Ethical clearance

Ethical clearance has been taken from the institutional ethical committee.

RESULT

In the present study total no of 45 thyroid cartilages were studied, out of which 24 thyroid cartilages were of male and 21 thyroid cartilages were of female. Following tables shows the results made during the study.

Table 1: Parameter of thyroid cartilage in male and female

No	Parameter	Male				Female			
		Max	Min	Mean	SD	Max	Min	Mean	SD
1	Height of right lamina (mm)	36.8 2	19.8 4	31.52	3.6 1	34.2 4	19.7 8	23.96	3.6 2
2	Height of left lamina (mm)	36.1 8	19.2 6	30.93	3.8 4	34.8 3	19.1	24.12	3.8 1
3	Width of right lamina (BE) (mm)	46.0 3	24.3 1	40.26	4.6 1	40.9 6	23.3 2	30.94	5.0 4
4	Width of left lamina (BE) (mm)	45.9 7	23.5 2	39.89	4.6 6	39.7 8	23.1 4	30.96	4.9 0
5	Length of right posterior border (AD) (mm)	52.3 8	32.9 3	44.27	6.1 6	43.0 4	30.4	35.11	3.0 7
6	Length of left posterior border (AD) (mm)	53.4 8	34.7 5	44.86	5.9 0	44.1	32.7	36.10	2.4 8
7	Length of right superior cornu (AB) (mm)	21.7 8	10.3 4	16.71	2.3 5	16.9 0	9.35	12.32	1.7 2
8	Length of left superior cornu (AB) (mm)	22.5 9	12.6 5	16.84	2.4 1	16.5 7	9.40	11.99	1.7 5
9	Length of right inferior cornu (CD)(mm)	14.0 0	7.90	10.43	2.1 1	10.0 9	6.35	7.98	1.2 6
10	Length of left inferior cornu (CD) (mm)	14.5 8	7.80	10.86	2.0 7	11.5 3	6.20	7.94	1.3 9
11	Distance between tips of superior cornua (AA) (mm)	48.4 9	30.7 8	39.42	5.4 2	46.7 8	32.2 6	39.06	3.6 6
12	Distance between roots of superior cornua (BB) (mm)	50.2 5	32.7 0	42.39	4.7 6	50.2 3	32.3 6	39.08	4.5 4
13	Distance between roots of inferior cornua (CC) (mm)	43.9 7	22.9 6	34.84	4.6 0	36.2 4	22.4 0	29.78	3.8 0
14	Distance between tips of inferior cornua (DD) (mm)	41.5 7	22.4 4	33.47	4.9 1	34.8 1	18.3 6	28.20	4.3 3
15	Angle between thyroid laminae(°)	99.0 0	70.0 0	86.13	7.6 9	120	89	100.2 4	7.6 2

Table 2: Distribution of the thyroid cartilage according to divergence and convergence of the superior and inferior cornua

	Male		Female		All samples	
	Divergent (% , n = 24)	Convergent (% , n = 24)	Divergent (% , n = 21)	Convergent (% , n = 21)	Divergent (% , n = 45)	Convergent (% , n =45)
Superior cornu	05 (20.83%)	19(79.16%)	08 (38.09%)	13 (61.90%)	13(28.88%)	32 (71.11%)
Inferior cornu	03 (12.5%)	21 (87.5%)	02 (9.52%)	19 (90.47%)	05(11.11%)	40 (88.88%)

Table 1 shows Means, Standard Deviation Maximum and Minimum of various measurements of thyroid cartilages in both sexes. The obtained results showed that there was statistically significant difference between all analysed parameters in male and female samples. All parameters of thyroid cartilage were higher in males than in females except for the thyroid angle, which was greater in female.

Bilateral asymmetry in the size of thyroid lamina and cornu was seen in majority of specimens. However, in 3 cases (6.67%) thyroid prominence was not in median plane, deviated towards left side. In one case asymmetry was also associated with asymmetry in direction of superior cornu.

Superior and inferior cornua in some thyroid cartilages converge, which means that the distance between the cornu tips is lesser than the distance at the root, and in some cartilages diverge.

It is evident that superior cornua diverge more frequently than inferior cornua and also that superior cornua diverge more frequently in women, and inferior cornua in men.

DISCUSSION

Table-2 shows the distribution of the thyroid cartilages according to divergence and convergence of the superior and inferior cornua for male and female samples and in total.

Various authors have conducted a study on morphometric characteristic of thyroid cartilage from time to time. Among them more comprehensive study on the thyroid cartilage were done by Rawal JD et al in 2014 [3], Tanja Kovac et al in 2010 [4], Monica Jain et al in 2008 [5], Ajmani et al in 1990[6]. Present study was compared with above studies and various parameters were compared.

Table 3: Comparison of thyroid cartilage morphometry in present study with other studies

Sr No	Parameter	Sex	Present Study	Rawal JD et al[3]	Tanjakovac et al[4]	Monica Jain et al[5]	Ajmani et al[6]
1	Height of lamina (mm)	M	31.22±3.73	26.58±2.86	Not observed	27.5±2.96	37.92±4.42
		F	24.04±3.71	24.20±3.89	Not observed	22.70±3.71	35.25±3.1
2	Width of lamina (BE) (mm)	M	40.07 ±4.64	36.95±3.6	39.32	36.80±4.84	34.89±4.08
		F	30.95±4.97	31.85±3.69	29.78	30±6.50	32.17±4.27
3	Length of posterior border (AD)(mm)	M	44.56±6.03	Not observed	45.35	38.80±6.97	44.82±6.45
		F	35.60±2.77	Not observed	37.37	34±6.34	37.25±7.47
4	Length of superior cornu(AB)(mm)	M	16.78± 2.38	Not observed	18.22	19.10±4.49	20.70±2.99
		F	12.16±1.74	Not observed	15.32	13.10±3.95	20.92±3.01
5	Length of inferior cornu (CD)(mm)	M	10.65±2.09	Not observed	13.99	8.04±1.60	18.35±3.11
		F	7.96±1.32	Not observed	11.97	7.20±2.29	17.35±2.67
6	Distance between tips of superior cornua (AA)(mm)	M	39.42±5.42	Not observed	40.19	Not observed	Not observed
		F	39.06±3.66	Not observed	36.91	Not observed	Not observed
7	Distance between roots of superior cornua (BB)(mm)	M	42.39±4.76	Not observed	45.75	Not observed	47.45±5.19
		F	39.08±4.54	Not observed	39.19	Not observed	39.50±5.80
8	Distance between roots of inferior cornua (CC)(mm)	M	34.84±4.6	Not observed	39.82	Not observed	Not observed
		F	29.78±3.8	Not observed	33.25	Not observed	Not observed
9	Distance between tips of inferior cornua (DD)(mm)	M	33.47±4.91	Not observed	35.85	Not observed	38.25±8.4
		F	28.20±4.33	Not observed	29.62	Not observed	31.20 ± 7.5
10	Angle between thyroid laminae(°)	M	86.13±7.69	74.40±8.21	78.83	85.25±9.54	89.92 ±13.67
		F	100.24±7.62	92.35±6.63	94.19	97.85±10.35	106.38±28.36

The differences in the parameters between male and female thyroid cartilages are conspicuous and mostly highly significant in males except angle between laminae, which is greater in females than males. These results are somewhat similar to those Rawal JD et al [3], Monica Jain et al [5], Tanja Kovac et al [4], Ajmani et al [6]. Ajmani et al [6] in his study reported average height of lamina 37.92±4.42 in males and 35.25±3.1 in female, while in present study it is 31.22±3.73 in males and 24.04±3.71 in female. In female there is little difference found in both studies. In present study length of inferior cornu is 10.65±2.09 in males and 7.96±1.32 in female. Ajmani et al [6]reported 18.35±3.11 in males and 17.35±2.67 in females. These do not correlate with present study. Other

parameters like width of lamina, length of posterior border, length of superior border, distance between tips of superior cornu, distance between tips of inferior cornu, distance between roots of inferior cornua are similar like those of others studies.

Superior cornu divert more frequently in women than men in our study, same result obtained in study of Tanja K et al [4].

CONCLUSION

As thyroid cartilage is largest among all laryngeal cartilages, its detailed study in the form of morphometric parameters of thyroid cartilage is useful for Anatomist, Plastic surgeons, ENT

surgeons and Radiologist to perform advanced surgical procedures, endoscopic procedure & surgeries, planning of laryngeal framework surgery, facial feminization surgery & to analysis of CT-MRI scans of larynx.

REFERENCES

1. StandringS (Ed). Gray's Anatomy; The Anatomical Basis of Clinical Practice. 40th ed. New York; Churchill Livingstone; 2008.
2. Eckel HE, Sittel C, Zorowka P, Jerke A. Dimensions of the Laryngeal Framework in Adults. Surg Radiol Anat 1994;16(1):31-6.
3. Rawal JD, Kariya VB, Doshi BD, Jadav HR. Morphometric Study of Thyroid Cartilage in Indian Cadavers. NJIRM 2014;5(3):46-50.
4. Tanja K, Branka P, Ksenija M, Vjekoslav W, Marko K, Vasilije Net at al. Morphometric characteristics of

Thyroid Cartilage in People of Eastern Croatia; Coll. Anthropol 2010;34(3):1069-73.

5. Monica Jain, Usha Dhall. Morphometry of the thyroid and cricoid cartilages in adults. J Anat Soc India 2008;57(2):119-23.
6. Ajmani ML. A metrical study of the laryngeal skeleton in adult Nigerian; J Anat 1990;171:187-91.

Corresponding Author:

Dr. Shital Patel,
A-13, Darshanam Villa – 2,
Near Sapphire Global School,
Parivar Char Rasta,
Waghodiya Road, Vadodara - 390025
Email: bishushital@gmail.com

Date of Submission: 26/04/2016
Date of Acceptance: 06/06/2016
