

Measurement of the Breadth of the Thyroid Lamina in A Bangladeshi Population by Dissection Method

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Abstract

A cross-sectional, descriptive study was done to determine the breadth of the thyroid lamina and the differences in its values in respect of age and sex in Bangladeshi cadavers. A total 60 postmortem human larynges were collected between October 2008 and March 2009. Among those, 45 (male 23 and female 22) were collected from unknown dead bodies (aged between 9 and 60 years) under autopsy in the mortuary of Department of Forensic Medicine of Mymensingh Medical College, while the other 15 (male 6 and female 9) were collected from stillborn babies of viable age (28 to 40 weeks of gestation) in the Department of Obstetrics & Gynaecology of Mymensingh Medical College Hospital, Mymensingh, Bangladesh. The breadth of thyroid lamina was measured from laryngeal prominence to the posterior margins of lamina at its transverse plane using slide calipers and differences were observed in between age groups and sexes. The mean±SD breadth of thyroid lamina was found 12.40±1.30 mm in group A (from 28 to 40 weeks of gestation) ranging between 9 and 14 mm, while 26.19±3.69 mm in group B (from 9 to 16 years) ranging between 21 and 35 mm, and 30.76±4.17 mm in group C (from 17 to 60 years) with a range of 24 to 38 mm. The mean breadth of thyroid lamina was highest in age group C (30.76 mm) and was lowest in age group A (12.40 mm). The mean difference of breadth of thyroid lamina between group A & B, A & C and B & C were statistically significant (P=0.000). The breadth of thyroid lamina was found higher in male (32.70±3.96 mm) than that of female (28.00±2.69 mm) in Group C and the difference was statistically significant (p=0.001). Our study revealed that the breadth of thyroid lamina is greater in adult male than female and overall, the value increases with age.

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Introduction

Larynx or Voice box is well developed in humans.¹ The larynx lies below the hyoid bone in the anterior midline of the neck, extends from the upper border of the epiglottis to the lower border of the cricoid cartilage.¹⁻³ It projects ventrally between the great vessels of the neck and is covered anteriorly by skin, fascia, and the hyoid depressor muscles. Above, it opens into the laryngopharynx through the laryngeal inlet and forms its anterior wall while below, it continues into the trachea. It lies opposite the 3rd to 6th cervical vertebrae in adult males, although it is somewhat higher in adult females and the 1st to 4th cervical vertebrae in children. In infants between 6 and 12 months, the tip of the epiglottis (the highest part of the larynx) is a little above the junction of the dens and body of the axis vertebrae.³⁻⁵

Until puberty the male and female larynges are similar in size. After puberty, the male larynx enlarges considerably in comparison with that of

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the female. The growth of the larynx in adult female is slow, negligible and does not differ much from a child; hence the laryngeal tone of both females and children is high-pitched. The larynx is made up of skeletal framework of cartilages – the thyroid cartilage is the largest of the laryngeal cartilages. The thyroid cartilage acts as a shield to protect the larynx from the front and lies opposite the C₄ and C₅ vertebrae. It consists of two laminae. Each lamina is quadrilateral and consists of four borders – anterior, posterior, upper and lower and two surfaces – outer and inner.^{3,4}

The anterior border of each thyroid lamina meets in front and fuse with its partner along their inferior two thirds at a median angle of 90° in man and 120° in women, forming 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. The shallower angle in men is associated with the larger laryngeal prominence, the greater length of the vocal cords and the resultant deeper pitch of voice. The posterior surface of thyroid angle gives attachment to the following structures from above downwards: unpaired thyro-epiglottic ligament, a pair of vestibular ligaments, a pair of vocal ligaments and three intrinsic muscles medio-laterally on each side of the vocal ligaments – vocalis, thyro-arytenoid and thyroepiglottic muscles. Above, a V – shaped superior thyroid notch or incisures separates the lamina.^{3,4}

The posterior border of the lamina is free, thick, rounded and prolonged as slender horns above and below as superior and inferior cornua. It receives the conjoined insertion of stylopharyngeus, palato-pharyngeus and

salpingo-pharyngeus muscles.³⁻⁵ The superior cornu, which is long and narrow, curves upwards, backwards, and medially and ends in a conical apex connected to the tip of the greater cornu of the hyoid bone by the thyrohyoid ligament.^{3,4} The inferior cornu is short and thick and curves down and slightly anteromedially. On the medial surface of its lower end there is a small oval facet for the articulation with the side of the cricoid cartilage forming a synovial crico-thyroid joint. The recurrent laryngeal nerve enters the larynx behind the joint.^{3,4}

A knowledge of dimensions of cartilages of larynx is a must for clinical procedures like surgical operation, stenting, intubation, and endoscopy of the respiratory tract.⁶⁻⁸ However, there is a paucity of literature relating to measurements of the thyroid cartilage especially of thyroid lamina in different populations as well as in our country. Hence, the present study was designed with a view to contribute to data pool to establish a Bangladeshi standard metrics in the gross anatomy of larynx.

Methods

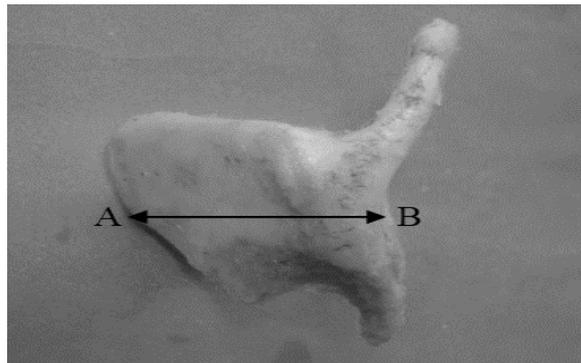
The present study was performed on 60 human larynges at the Department of Anatomy of Mymensingh Medical College, Mymensingh. Specimens containing larynx were collected from dead bodies autopsied at the autopsy laboratory of Department of Forensic Medicine and dead babies from Gynaecology and Obstetrics Department of Mymensingh Medical College, Mymensingh on different dates from October' 2008 to March' 2009 and all the collected specimens of cadavers were from medico-legal cases (unnatural death) and another group from stillborn infants. Only fresh specimens from

persons who died within the preceding 12 to 24 hours and stillborn infants just after expulsion were chosen. The age range of persons whose larynx were collected varies from 9 years to 60 years for groups after birth and 28 to 40 weeks for intrauterine group. The persons were belonged to either sex. From each cadaver the larynx and related neighboring structures were collected by "Block Dissection", during routine postmortem examination. Then the tissue block was washed gently with running tap water to remove the blood and blood clots as far as possible. Each specimen was duly tagged by a piece of waxed cloth, which bore an identifying number representing individual serial number. Then the specimen was fixed and preserved in 10% formol-saline solution. For convenience of differentiating the breadth of thyroid lamina in relation to age and sex, the collected specimens were divided into three groups: group A (28 to 40 weeks of gestation), group B (from 9 to 16 years) and group C (from 17 to 60 years) (Table-I). Careful dissection was done to isolate thyroid cartilages by removing associated muscles, ligaments, and mucous membrane. Measurement of the breadth of thyroid lamina was taken from laryngeal prominence to the posterior margins of lamina at its transverse plane⁶ by using slide calipers and was expressed as mm (Fig. 1).

Table-I: Age group of the study (n=60)

Age group	Male	Female
A (n=15) (From 28 to 40 weeks of gestation)	6	9
B (n=16) (From 9 to 16 years)	6	10
C (n=29) (From 17 to 60 years)	17	12

Fig. 1: Photograph of the thyroid cartilage (lateral view) taken from group C (17-60 years) showing the breadth of the thyroid lamina (AB)



All the data were compiled, sorted properly, and analyzed statistically using Statistical Package for Social Science (SPSS) version 11.0. One-way ANOVA test was performed to compare between the groups, while comparison between sexes was done by unpaired Student's 't' test. P value <0.05 was considered as significant. This study was approved by the Ethical Review Committee of Mymensingh Medical College, Mymensingh, Bangladesh.

Results

The mean±SD breadth of the thyroid lamina was found 12.40±1.30 mm in group A (28 to 40 weeks of gestation) ranging between 9 and 14 mm, while 26.19±3.69 mm in group B (up to 16 years) ranging between 21 and 35 mm, and 30.76±4.17 mm in group C (17 years and above) with a range of 24 to 38 mm. The mean breadth of thyroid lamina was highest in group C (30.76 mm) and was lowest in group A (12.40 mm). The mean differences of breadth of thyroid lamina between group A & B, B & C and A & C were statistically significant (P=0.000) (Table-I). The mean±SD breadth of the thyroid lamina were found 13.00±0.89 mm and 12.00±1.41 mm in male and female respectively in group A, while 27.66±5.04 mm and 25.30±2.49 mm respectively in group B.

Though the values were higher in male comparing with that of female in both group A and group B, the difference was not statistically significant ($P>0.05$). However, in group C the value was also found higher in males (32.70 ± 3.96 mm) than that in female (28.00 ± 2.69 mm) and that difference was statistically significant ($P=0.001$) (Table-II).

Table-II: Breadth of the thyroid lamina in different age groups

Age group	Mean \pm SD (in mm)	P value
A (n=15)	12.40 \pm 1.30 (9-14)	A vs. B $P=0.000^S$
B (n=16)	26.19 \pm 3.69 (21-35)	B vs. C $P=0.000^S$
C (n=29)	30.76 \pm 4.17 (24-38)	A vs. C $P=0.000^S$

Figures in the parentheses indicate range; S=significant. P value reached from One-way ANOVA test.

Table III: Comparison of mean breadth of the thyroid lamina between male and female of different age groups

Age group	Sex	Number	Mean \pm SD (in mm)	P value
A (n=15)	Male	6	13.00 \pm 0.89	0.150 ^{NS}
	Female	9	12.00 \pm 1.41	
B (n=16)	Male	6	27.66 \pm 5.04	0.226 ^{NS}
	Female	10	25.30 \pm 2.49	
C (n=29)	Male	17	32.70 \pm 3.96	0.001 ^S
	Female	12	28.00 \pm 2.69	

NS=not significant, S=significant. P value reached from unpaired Student's 't' test.

Discussion

In the present study, the mean \pm SD breadth of thyroid lamina was found 12.40 \pm 1.30 mm in group A (28 to 40 weeks of gestation), 26.19 \pm 3.69 mm in group B (9-16 years), and 30.76 \pm 4.17 mm in group C (17-60 years). Berkovitz stated that the infant thyroid cartilage is broader than in the adult.⁴ Ajmani studied 40

specimens of Nigerian cadavers, 28 males (from 17 to 50 years) and 12 females (from 20 to 50 years) and reported that the mean breadths of thyroid lamina were 34.89 \pm 4.08 mm in male and 32.17 \pm 4.27 mm in female.⁶ Sprinzi *et al.* did a study on 98 autopsy specimens (52 male and 46 female) at Cologne, Germany, and found the mean breadths 23.8 \pm 3.9 mm in male and 16.0 \pm 2.1 mm in female respectively.

Harjeet & Jit studied on a north-west Indian adult population and found the mean \pm SD breadth of thyroid lamina as 37.82 \pm 2.69 mm in male and 28.27 \pm 1.82 mm in female.⁹ Another study from India by Jain & Dhall did a C.T. scan based study on 60 living subjects (30 males and 30 females) from Haryana, India, and reported that the breadths of the thyroid lamina were found 35.52 \pm 5.9 mm and 36.8 \pm 4.8 in right and left side in males, while 29.5 \pm 6.9 mm and 30.0 \pm 6.5 in females respectively.¹⁰ In another study done in Punjab, India by Subramanyam *et al.* based on 300 cadaver dissection (238 males and 62 females) reported the breadths of the thyroid lamina as 36.50 \pm 7.56 mm and 36.48 \pm 7.49 in right and left side in males, while 32.44 \pm 8.18 mm and 32.52 \pm 8.21 mm in female respectively.¹¹ Kovac *et al.* found the mean values 39.17 \pm 4.00 mm and 30.04 \pm 4.00 mm in male and female respectively, as they carried out the study on 68 samples (39 male and 29 female) of adult thyroid cartilages in the eastern part of Croatia.¹² The findings of the present study are in congruence with the findings of above-mentioned studies regarding the difference between sexes. Moreover, we also observed that the breath of thyroid lamina increased with age.

Due to the irregular shape of the larynx, measured values of different parts of the larynx such as thyroid cartilage may vary from one study

to another.⁶⁻¹³ The fact that some of the absolute data differs quite heavily between these studies may be explained by different definitions of measuring points.⁷ Moreover, variations exist among different ethnic population in specific geographic area, which may be due to differences in stature and body built.^{7,9-11} The existence of sexual dimorphism may be used in determining the sex in unidentified remains, which has an immense importance in forensic practice.¹¹⁻¹³

This study was carried out in cadaveric specimens, which were preserved in formalin. We know that tissues tend to shrink in size due to fixation and preservation in formalin. Therefore, there might be somewhat difference or variation in the measurement as compared to measurements done in living subjects using CT/MRI scans.

Conclusion

Our study revealed that the breadth of thyroid lamina is greater in adult male than that of its female counterpart and overall, the value increases with age (from prenatal to postnatal and adulthood). The data obtained from this study may contribute to increase understanding in anatomy of laryngeal framework in our population. However, further studies with larger samples and advanced application of CT/MRI scans on different ethnicities in our country are recommended.

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