Morphometric study of the isthmus of the thyroid gland in Bangladeshi cadaver

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ABSTRACT

Background: The position and size of isthmus of thyroid vary greatly in humans, and sometimes it is absent. The present study was designed to find out the difference in isthmus of the thyroid gland of Bangladeshi people in relation to age and sex.

Methods: The cross-sectional, descriptive study was performed in the Department of Anatomy, Dhaka Medical College, Dhaka, from January to December 2008, on 73 post mortem human thyroid gland collected from unclaimed dead bodies. Isthmus was found in 60 cases. The samples having the isthmus (n=60) were divided into three age-groups including group A (10-20 years), group B (21-50 years) & group C (>50 years) and the isthmus was cut off from the thyroid gland, then its length, breadth and thickness were measured and recorded.

Results: The isthmus of the thyroid gland was found in 82.2% cases. It extended from 2nd to 4th tracheal ring in 91.7% and from 2nd to 5th ring in 8.3% cases. No difference was found in length, breadth and thickness of the isthmus of the thyroid gland in between males and females. However, difference was found in breadth between group A & B ($p<0.05$) and A & C ($p<0.01$) and in thickness between group B & C ($p<0.05$).

Conclusion: The presence or absence, positional change and variation in gross dimension of the thyroid isthmus were evident in humans. The morphological difference was found with increasing age but not with sex.

Keywords: Isthmus of the thyroid; morphometry; thyroid gland

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Background:

The thyroid gland is an important endocrine gland in the human body, which is highly vascular, brownish-red in colour, situated anteriorly in the lower part of the neck extending from the level of the 5th cervical to the 1st thoracic vertebrae, consists of two symmetrical lobes connected by an isthmus.[1] The isthmus is a fibrous connective tissue which connects the lobes of the thyroid gland in the median plane.[2,3] Sometimes it is absent; its position and size greatly vary in humans.[3-5] As the isthmus is closely attached to the thyroid cartilage by the pretracheal fascia, the thyroid gland moves upwards on swallowing and thereby any thyroid swelling

is clinically distinguished from the other swellings of the neck.[6,7] Hence, the anatomical study of isthmus bears a great importance. We have only a few studies on human organs in our country especially in their anatomical variation in site, size or gross dimensions. Moreover, it has been observed by various researchers that the dimensions of different organs in Bangladeshi population have got variations from those of the western population.[8] Therefore, we proposed a cadaver study of the isthmus of the thyroid gland to observe the possible variation of its position and size in relation to age and sex, as well as compare with the data of previous studies.

Methods:

A cross-sectional, descriptive type of study was designed and done in the Department of Anatomy, Dhaka Medical College, Dhaka, from January to December 2008, based on collection of 73 human thyroid glands from the unclaimed dead bodies that were under examination in the Department of Forensic Medicine, Dhaka Medical College, Dhaka. All the samples were collected from medicolegal cases excluding hanging, poisoning, any cutting or crushing injury to the thyroid gland and known case of thyroid disease. Among them, isthmus was found in 60 cases.

Grouping of the samples:

The samples having the isthmus (n=60) were divided into three age-groups i.e. group A (10-20 years), group B (21-50 years) & group C (>50 years) (Table 1), according to Brown, Al-Moussa and Beck (1986).[9]

Table 1 : Grouping of the thyroid samples having the isthmus (n = 60)

Group	Age limit in years	Number of samples	
		Male	Female
A	10-20	08	05
B	21-50	24	10
C	>50	07	06

Procedure of morphological study:

The anterior aspect of the specimen consisting of pharynx, part of oesophagus, larynx, trachea, thyroid and parathyroid glands, major vessels of the neck was dissected. To see the position of the isthmus, two pin markings were given in the midline at the middle of the isthmus along its breadth, at both sides, before the removal of the thyroid gland, during dissection. The tracheal rings were identified and their numbers were recorded after removal of the gland. The thyroid gland was separated and taken on a tray. Its outer surface was dried with blotting paper and the right and left lobes of the thyroid gland were cut. The isthmus was taken off for measurement. The length and breadth were measured at its maximum position by putting a thread on the isthmus and then imposing it on a measuring tape (in mm). The thickness was measured by pricking a pin through it and then imposing it on a measuring tape (in mm). For each parameter three readings were taken and the average result was noted down.

Statistical processing of data:

The collected data were processed and statistical analyses were done by unpaired Student's 't' test and one-way ANOVA test. All the statistical analyses were done by using the SPSS 11.0 version.

Ethical clearance:

This research work was approved by the Ethical Review Committee of Dhaka Medical College, Dhaka.

Results:

In the present study, the isthmus of the thyroid gland was found in 82.2% cases. Among those, it was found extending from 2nd to 4th tracheal ring in 91.67% and from 2nd to 5th ring in 8.3% cases (Table 2).

Table 2 : Position of the isthmus (posteriorly relation to tracheal cartilage)

Group/Sex (n)	Position of the isthmus (in relation to tracheal cartilage)	
	2nd to 4th	2nd to 5th
A		
Male (8)	8 (100%)	0
Female (5)	5 (100%)	0
B		
Male (24)	22 (91.7)	2 (8.3%)
Female (10)	8 (80%)	2 (20%)
C		
Male (7)	6 (85.7%)	1 (14.3%)
Female (6)	6 (100%)	0
Total = 60	55 (91.7%)	5 (8.3%)

No difference was found in length, breadth and thickness of the isthmus of the thyroid gland in between male and female in any age group (Table 3). Statistically significant difference was found in breadth between group A & B and A & C and in thickness between group B & C (Table 4).

Table 3 : Length, breadth and thickness of isthmus in male and female in different age group

Group/ Sex (n)	Length (mm) Mean±SD	Breadth (mm) Mean±SD	Thickness (mm) Mean±SD
A			
Male (8)	11.00±1.31 (10.00-14.00)	5.63±1.30 (4.00-8.00)	3.13±0.64 (2.00-4.00)
Female (5)	12.20±3.42 (9.00-18.00)	6.80±1.92 (4.00-9.00)	3.20±0.45 (3.00-4.00)
P value	>0.10	>0.10	>0.50
B			
Male (24)	11.96±3.21 (8.00-20.00)	5.13±1.65 (3.00-8.00)	3.71±1.08 (3.00-7.00)
Female (10)	11.70±2.36 (10.00-18.00)	4.40±1.51 (3.00-8.00)	3.10±0.74 (2.00-4.00)
P value	>0.50	>0.10	>0.10
C			
Male (7)	11.00±0.82 (10.00-12.00)	4.29±0.76 (3.00-5.00)	3.00±0.00 (3.00-3.00)
Female (6)	11.67±1.63 (10.00-14.00)	4.17±1.17 (3.00-6.00)	2.67±0.52 (2.00-3.00)
P value	>0.10	>0.50	>0.10

Figures in parentheses indicate range. Comparison between sex done by unpaired Student's 't' test.

Table 4 : Length, breadth and thickness of isthmus in different age group

Group (n)	Length (mm) Mean±SD	Breadth (mm) Mean±SD	Thickness (mm) Mean±SD
A (13)	11.46±2.30 (9.00-18.00)	6.08±1.61 (4.00-9.00)	3.15±0.55 (2.00-4.00)
B (34)	11.88±2.65 (8.00-20.00)	4.91±1.62 (3.00-8.00)	3.53±1.02 (2.00-7.00)
C (13)	11.31±1.25 (10.00-14.00)	4.23±0.93 (3.00-6.00)	2.85±0.38 (2.00-3.00)
	P value	P value	P value
A vs B	>0.50	<0.05	>0.10
B vs C	>0.10	>0.10	<0.05
A vs C	>0.50	<0.01	>0.10

Figures in parentheses indicate range. Comparison between different age group by One-way ANOVA (PostHoc)

Discussion:

Marshall (1895),[4] Enayetullah (1996),[8] Begum (2004),[10] Pastor et al (2006)[11] and Sultana et al (2011)[12] observed the absence of the isthmus in 10%, 4%, 0%, 5-10% and 31.66% of cases respectively. In the present study, the isthmus of the thyroid gland was absent in 17.8% cases. The findings of the present study is higher than that of Marshall (1995)[4], Enayetullah (1996),[8] Begum (2004),[10] Pastor et al. (2006)[11] and much lower than that of Sultana et al (2011)[12].

The positional variation of the thyroid isthmus may be evident in a specified population and commonly among different races.[8] Enayetullah (1996)[8] observed that the isthmus was related to the 2nd to 4th tracheal ring in 72% of cases. Begum (2004)[10] found the extension of the isthmus from 2nd to 4th ring in 71.67% and from 2nd to 5th ring in 26.77% and from 1st to 6th ring in 1.56% cases. According to Berkovitz (2005)[1], the isthmus is usually placed anterior to the second and third tracheal cartilages. Sultana (2011)[12] found that the most common locations were 1st to 3rd and 2nd to 4th tracheal ring (18.3% in both cases). The present study reported that it extends from 2nd to 4th tracheal ring in 91.7% cases and from 2nd to 5th ring in 8.3% cases; that former finding is much higher than that of the previous studies, whereas the latter is much lower. This wide variability regarding position of the isthmus may be explained by failure of descent or excessive descent of thyroid gland during its embryonic course.[13]

Berkovitz (2005)[1] stated that the isthmus measures about 1.25 cm transversely as well as vertically. Begum (2004)[10] reported the mean lengths of the isthmus were 1.34±0.40 cm, 1.62±0.43 cm and 1.65±0.45 cm in A (0-20 years), B (21-50 years) and C (>50 years) respectively, whereas mean breadths were 1.46±0.46 cm, 1.55±0.47 cm and 1.41±0.40 cm respectively The mean breadth was found maximum in 21-50 years age group and lowest in >50 years age group. The mean thickness was found maximum in >50 years age group and lowest in 0-20 years age group. In thickness, those were 0.40±0.09 cm, 0.45±0.12 cm and 0.60±0.29 cm respectively. Sultana et al. (2011)[14] found the mean lengths of isthmus were 10.42±7.49 mm, 10.17±5.70 mm and 9.33±6.64 mm in Group A (up to 18 years), B (19 to 45 years) and C (>45 years) respectively. The mean values of breadth were 13.66±5.06 mm, 14±5.41 mm and 12.27±3.97 mm in Group A, B and C respectively and the mean thickness of the isthmus of thyroid glands were 4.91±1.78 mm, 4.72±2.68 mm and 4.45±1.36 mm in those age groups respectively. There was no significant difference in length, breadth and thickness among different age groups. Those data were also more or less supported by the present study. However, the

basic reason of presence or absence, positional change and variation in gross dimension of the thyroid isthmus is the disproportional developmental period and growth among different races of humans.[13]

Conclusion: The presence or absence, positional change and variation in gross dimension of the thyroid isthmus are evident in humans. The morphological difference may be found with increasing age. However, the present study reported no sexual variation in length, breadth or thickness of the isthmus of the thyroid gland. We would like to recommend further studies with larger samples and high technical backup both from goitre endemic and non-endemic zones.

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References:

1. Berkovitz BK. Neck. In: Standring S, Ellis H, Heally JC, et al. eds. Gray's Anatomy: The anatomical basis of clinical practice. 39th ed. Edinburgh: Elsevier Churchill Livingstone, 2005:560-4.
2. Snell RS. Clinical anatomy by regions. 8th ed. Baltimore: Lippincott Williams & Wilkins, 2008:817-21.
3. Sinnatamby CS. Last's Anatomy: regional and applied. 11th ed. Edinburgh: Elsevier Churchill Livingstone 2006:351-2.
4. Marshall CF. Variations in the form of the thyroid gland in man. J Anat Physiol 1895;29:234-9.
5. Tong ECK, Rubenfeld S. Scan measurement of normal and enlarged thyroid glands. Am J Roentgenol Radium Ther Nucl Med 1972;115:706-8.
6. Chatterjee CC. Human physiology. Vol.2. 10th ed. Calcutta: Medical Allied Agency, 1994: 65-9.
7. Swash M. Hutchison's clinical methods. 21st ed. Edinburgh: WB Saunders, 2002: 327.
8. Enayetullah M. Gross and histomorphological study of the thyroid and parathyroid glands in Bangladeshi people (M.Phil.Thesis). Dhaka: IPGMR, University of Dhaka; 1996.
9. Brown RA, Al-Moussa M, Beck JS. Histometry of normal thyroid in man. J Clin Pathol. 1986;39:475-82.
10. Begum M. Gross and histomorphological study of human postmortem thyroid gland in Bangladeshi people (M.Phil.Thesis). Dhaka: Sir Salimullah Medical College, University of Dhaka; 2004.
11. Pastor VJF, Gil VJA, De Paz Fernández FJ, et al. Agenesis of the thyroid isthmus. Eur J Anat 2006;10:83-4.
12. Sultana SZ, Khalil M, Khan MK, et al. Incidence of presence & variation in anatomical position of isthmus of thyroid gland in Bangladeshi cadaver. Bangladesh J Anat 2011;9:26-9.
13. Moore KL, Persaud TVN. The developing human: clinically oriented embryology. 6th ed. Philadelphia: WB Saunders, 1998: 222-32.
14. Sultana SZ, Khalil M, Khan MK, et al. Morphometry of isthmus of thyroid gland in Bangladeshi cadaver. Mymensingh Med J 2011; 20: 366-70.