Bang Med J Khulna 2023; 56; 14-18

ORIGINAL ARTICLE

Postmortem morphometry of the thyroid gland in Bangladeshi people

IB Razzaque[1], R Begum[2], R Mustafa[3], M Benzir[4]

Abstract

Background: *Estimation of the size of the thyroid gland is clinically important in the evaluation and management of thyroid disorders, particularly in cases, where medical treatment is not sufficient to manage thyroid disorders, specially in malignancy and when there are compressive symptoms. The understanding of the anatomical relations, functional states and blood supply of the thyroid gland is of paramount importance to thyroid surgeons.*

Objectives: *The present study aimed to determine the morphometric values of the thyroid gland in different age groups and both sexes in Bangladeshi people.*

Methodology: *This cross sectional descriptive study was conducted in department of Anatomy, Rajshahi Medical College from December, 2017 to December, 2018. The study was performed on 60 cadaveric thyroid gland, collected from unclaimed dead bodies in department of Forensic Medicine and Toxicology. The samples were categorized in three groups according to age. Morphometry of the thyroid glands was done to measure length, breadth and thickness of both lobes and isthmus. Weight and volume of the whole gland were also measured.*

Results: *The mean length, breadth and thickness of the right and left lobe of the thyroid gland were 3.39 ± + 0.55 cm and 3.31 ± 0.51 cm, 2.48 ± 0.53 cm and 2.41 ± 0.52 cm, 1.61 ± 0.27 cm and 1.56 ± 0.31 cm respectively. The isthmus was absent in 10 out of 60 cadavers (16.7%). Pyramidal lobe was found in 23 cadavers (38.3%), arising most commonly from left side of the isthmus. The mean weight and volume were 18.16 ± 2.73 gm and 14.37 ± 2.52 ml respectively. The length of lobes, weight and volume of the gland were found higher in males than females.*

Conclusion: *The morphological parameters of the thyroid gland, also its weight and volume, vary significantly with the ages and sexes of the individuals.*

Key words: *Thyroid gland, isthmus, pyramidal lobe.*

Introduction

The thyroid gland is the earliest endocrine gland to appear in mammalian development. It begins to form approximately 24 days after fertilization.[1] The word 'thyroid' derived from the Greek word 'thyrose that means shield and 'edos' that means 'form'. Thus thyroid gland is an organ that forms a shield around the laryngeal cartilage.[2]

The thyroid gland is brownish-red in colour, highly vascular and placed anteriorly in the lower neck, at the level of 5th cervical to 1st thoracic vertebrae. It has right and left lobes connected by a narrow median isthmus. Occasionally the isthmus is absent. The whole thyroid gland is ensheathed by pretracheal layer of deep cervical fascia.[3] The size and weight of thyroid gland vary with age, sex, physiologic state, race and geographical location. Its weight was found slightly heavier in females, specially during menstruation and pregnancy.[4]

The relative prevalence of the different thyroid disorders was dominated by iodine deficiency disorders. At the beginning of the twenty first century hypothyroidism, Grave's disease, postpartum thyroiditis and thyroid malignancies are common thyroid disorders in Bangladesh. It is believed that around 10% of the Bangladeshi people suffer from clinically evident thyroid disorders.[5]

1. Iftekhar Bin Razzaque M.Phil. Lecturer, Dept. of Anatomy, Khulna Medical College (ifti7119@gmail.com)
2. Rezia Begum M.Phil. Assistant Professor, Dept. of Anatomy, Kushtia Medical College (Formerly in MPhil course, Raj MC)
3. Rashed Mustafa M.Phil. Associate Professor, Dept. of Anatomy, KYA Medical College (Formerly in MPhil course, Raj MC)
4. Maskura Benzir M.Phil. Assistant Professor, Dept. of Anatomy, TMSS Medical College, Bogura (Formerly in MPhil course, Raj MC)

This postmortem study was proposed to observe the morphometric variations of the thyroid gland in relation to age and sex in Bangladeshi cadavers which would give a guideline to the clinicians to evaluate various thyroid disorders and also to the surgeons during thyroid surgery.

Materials and methods

This was a cross sectional descriptive study. It was carried out in department of Anatomy, Rajshahi Medical College from December, 2017 to December, 2018. A total of 60 cadaveric thyroid glands were studied, collected from unclaimed dead bodies in department of Forensic Medicine and Toxicology, Rajshahi Medical College. Ethical clearance was taken prior to the study from the ethical review committee. Samples were collected within 24 hours of death before appearance of any sign of putrefaction. Unusual enlargement (e.g. goitre, carcinoma) and gross anomaly in architecture of the thyroid gland or any injury in the neck region (e.g. cut throat or hanging) were considered as ineligible cases for the study.

The neck region was dissected to expose the thyroid gland by fine dissection method. During midline dissection of the neck, infrahyoid groups of muscles were displaced laterally. Sternothyroids and sternohyoids were cut near their lower ends and reflected upwards, thereby exposing pretracheal layer of deep fascia and fat. The collected samples were washed thoroughly with tap water to remove blood clots. Each sample was tagged with a token bearing identification number, age and sex of the individual. Then the specimens were preserved in 10% formalin solution. The samples were classified into three groups according to age. Group A: 20 years & below, Group B: 21 to 50 years. Group C: Above 50 years.

Measurement of length, breadth and thickness of each lobe:

The length of each lobe was measured in its long axis from base to apex. The maximum thickness was measured antero-posteriorly at its thickest point. The breadth was measured transversely from its posterior aspect. The measurement was done with a slide calipers.

Measurement of length, breadth and thickness of the isthmus:

The length of the isthmus was measured transversely at its superior limit, middle part and inferior limit with a measuring tape. The mean value was recorded. The breadth of the isthmus was measured at its two end and middle part with a measuring tape. The mean value was recorded. The thickness of the isthmus was measured antero-posteriorly at its two end and middle part with a slide caliper, The mean value was recorded.

Measurement of the weight of the whole thyroid gland:

Excess water from the specimen was soaked with a blotting paper and then the gland was measured on an analytical balance in gram.

Measurement of the volume of the whole thyroid gland:

The volume was measured by fluid displacement method. A measuring glass jar filled abrim with water was taken and the thyroid gland was gently placed in the water to allow complete immersion. The amount of water which brimmed over was collected in a measuring glass cylinder. Then the volume of water was measured representing the volume of the thyroid gland.

After completion of data collection, they were checked, verified and edited for consistency and validity. Data were analyzed with the help of SPSS software.

Results

The present study was carried out on 60 cadaveric thyroid glands of different age groups. 66.7% sample was male and 33.3% was female. Mean age was 36.7+12.2 years in male, 40.3±10 years in female and 37.8+11.6 years in total sample (Table I).

Table I

Distribution of sample according to age and sex

Age groups (years)	Frequency				Total	
	Male		Female			
	n	%	n	%	n	%
A (<20)	8	13.3	2	3.3	10	16.7
B (21-50)	28	46.7	15	25	43	71.7
C (>50)	4	6.7	3	5	7	11.7
Total	40	66.7	20	33.3	60	100
Mean±SD (years)	36.68±12.23		40.26±10.05		37.82±11.6	

The mean length (±SD) of right and left lobes of the thyroid gland was 3.4±0.5 cm and 3.3±0.5 cm respectively. The mean breadth (±SD) of right and left lobes of the thyroid gland was 2.5±0.5 cm, and 2.4±0.5 cm respectively. The mean thickness (±SD) of right and left lobes of the thyroid gland were 1.6±0.6 cm and 1.6±0.3 cm respectively. The differences in mean length between age groups were statistically significant, $p<0.025$ (Table II)

Table II

Morphometry of the right and left lobes of the thyroid gland in different age groups

Age Groups (years)	No. (n)	Mean thickness+SD(cm)		Mean length+SD(cm)		Mean breadth+SD(cm)	
		Right	Left	Right	Left	Right	Left
<20	10	2.97+0.49	2.91+0.56	2.27+0.35	2.14±0.40	1.60±0.29	1.59±0.29
21-50	43	3.49±0.54	3.41±0.47	2.52+0.53	2.47+0.52	1.60±0.25	1.56±0.30
>50	7	3.25±0.41	3.16+0.39	2.42+0.63	2.37±0.55	1.62±0.31	1.50±0.40
Total	60	3.39+0.54	3.30+0.50	2.47+0.52	2.41+0.52	1.61±0.26	1.56+0.30

Measuring the isthmus, the mean length (±SD) was 1.42+0.30 cm, the mean breadth (±SD) was 1.12±0.17 cm and the mean thickness (±SD) was 0.93±0.12 cm (Table III).

Table III

Morphometric values of the isthmus of thyroid gland

Age groups (years)	Number (n)	Length of isthmus Mean±SD(cm)	Breadth of isthmus Mean±SD(cm)	Thickness of isthmus Mean±SD(cm)
<20	6	1.20+0.00	1.04+0.04	0.86±0.07
21-50	38	1.47±0.30	1.14+0.19	0.94±0.13
>50	6	1.29+0.30	1.03+0.06	0.89+0.08
Total	50	1.42+0.30	1.12+0.17	0.93+0.12

The mean weight+SD of the thyroid gland was 18.15+2.72 gm. The mean volume SD of the whole thyroid gland was 14.36+2.52 ml. Differences of different age groups in mean weight and mean volume were statistically significant, p<0.01 (Table IV).

Table IV

Weight and volume of the thyroid gland in different age groups

Age groups (years)	Number (n)	Mean weight+SD (gm)	Mean volume+SD (ml)
<20	10	15.05±1.83	11.56±1.52
21-50	43	18.55±2.12	14.74±2.21
>50	7	17.63+4.26	13.62±3.10
Total	60	18.15+2.72	14.36±2.52

All the morphometric values are found higher in males than that of females in all age groups with an exception in group C where the length of both lobes are found higher in females. The mean weight and mean volume of the gland was found higher in males than that of females. However, the difference of mean volume of the gland between two sexes was statistically significant only in group B, p<0.022 (Table V).

Table V

Morphometry of the thyroid gland in both sex

Age groups (years)	sex of the individual	Number (n)	Mean length+SD (cm) Right lobe	Left lobe	Mean weight+SD	Mean Volume+SD
<20	male	8	3.02+0.50	2.95+0.58	15.12+1.95	11.66+1.59
	Female	2	2.63±0.00	2.58±0.00	14.53+0.00	10.80+0.00
21-50	male	28	3.64±0.50	3.51+0.44	18.99+2.25	15.28+2.26
	Female	15	3.21+0.51	3.20±0.47	17.71+1.58	13.69+1.73
>50	male	4	3.24+0.53	3.10±0.52	20.77+5.50	16.57+4.06
	Female	3	3.27±0.30	3.24+0.17	18.10+1.73	14.36+0.05

The pyramidal lobe was present in 23 cadavers and absent in 37 cadavers. The isthmus was present in 50 cadavers and absent in 10 cadavers (Table VI).

Table VI

Frequency of pyramidal lobe and isthmus of the thyroid gland

Traits	Pyramidal lobe Frequency	%	Isthmus Frequency	%
Present	23	38.3	50	83.3
Absent	37	61.7	10	16.7
Total	60	100.0	60	100.0

Discussion

The present study was carried out on 60 human cadaveric thyroid glands of different ages of both sexes (40 males and 20 females). From previous studies, it was found that, the morphological dimensions of the thyroid gland increase with age during childhood and adolescence, remains stable in young adult and later declines in older subjects.6 In another study, the weight of the thyroid gland was found to increase from early childhood and puberty upto 50 years and then declines.7 With this idea, the samples of the present study were grouped into group A (0-20 years), group B (21-50 years) and group C (>50 years).

In the present study, the mean length of right and left lobes of the thyroid gland was 3.39 ± 0.54 cm and 3.31 ± 0.51 cm in total sample. The differences in the mean length between groups were statistically significant ($p < 0.02$ and $p < 0.01$ for the right and left lobe respectively). This result was nearly similar to that of Malik P, where the mean length of the right and left lobes was 3.67 ± 0.70 cm and 3.51 ± 0.54 cm respectively.6 The mean length of right and left lobes estimated in the present study was lesser than that of Diana SM, (right and left lobe were 4.05 ± 0.70 cm and 3.79 ± 0.60 cm respectively), Joshi SD, (right and left lobe were 4.32 cm and 4.22 cm respectively) and

Prakash et al. 2012 (right and left lobe were 4.43 cm and 4.21 cm respectively).[3,8,9] Those studies were conducted in India and showed significant difference with the present study ($p < 0.05$). It indicates the variations in thyroid morphometry due to racial and geographical variations.

The mean length of right and left lobes was found relatively higher in male cadavers in group A and group B, while in group C the result was opposite. However, the difference in the mean length was found significant in group B only ($p < 0.01$ and $p < 0.04$ for right and left lobe respectively). This result coincided with that of Patil S, and Poddar R, where the mean length of the thyroid lobes was found higher in males than females, but the differences between mean values were significant in comparison to the present study.[10,11]

In this study, the mean breadth of right and left lobes of the thyroid gland were 2.48 ± 0.53 cm and 2.41 ± 0.52 cm respectively in total sample. This result was nearly similar to that of Patil S, et al. where the mean breadth was 2.63 ± 0.31 cm in males and 2.60 ± 0.28 cm in females.[10]

The present study revealed that, the mean thickness of right and left lobes of the thyroid gland was 1.61 ± 0.27 cm and 1.56±0.31 cm respectively in entire sample. The mean thickness estimated in the present study was higher than that of Malik P, where the mean thickness of the right and left lobes was 1.67±4.69 cm and 1.56±0.45 cm respectively.[6] In the present study, isthmus was absent in 10 out of 60 cadaveric specimens (16.7%) The present study showed nearly similar result as Joshi SD, which showed that, the isthmus was absent in 15 cases (16.66%).[8]

The present study revealed presence of pyramidal lobe in 23 out of 60 cadaveric specimens (38.3%). In a study, conducted by Rajkanwar and Kurse on 80 cadaveric thyroid glands showed nearly similar value of presence of pyramidal lobe (38.75%).12 However, Poddar R, found pyramidal lobe in 22% cases only. The mean weight of the thyroid gland in the present study was 18.15±2.72 gm. Estimated value was nearly similar to the study done by Nurunnabi ASM, that showed the mean weight as 16.84 ±1.14 gm.13 The mean weight of the thyroid gland was higher in males than females in all age groups. The mean volume of the thyroid gland measured in this study was 14.36±2.52 ml. Estimated value was relatively higher than the values estimated by Diana SM, and Banna FAMH.3,14 The mean volume was higher in males than females, but it was not statistically significant.

There were limitations in the study as the sample size was small, only 60 cadavers. If it was in larger scale, the results were more accurate. Quantity of sample was not equal in each age group. There was unavailability of unclaimed dead body.

Conclusion

The morphological parameters of the thyroid gland i.e. length, breadth and thickness of the lobes and isthmus, also its weight and volume increase significantly upto 5 decade of life and then decline to some extent. Weight and volume of the thyroid gland were significantly higher in the people aged 21-50 years. The morphometric values were higher in male cadavers than that of female.

References

1. Dhingra PL, Dhingra S. Diseases of ear, nose and throat and head neck surgery, 6th ed Bangalore: Elsevier; 2011. pp. 335-36
2. Moore KL, Persaud TVN. The developing human clinically oriented embryology, 7th ed Philadelphia: Saunders; 2009. pp. 230-33
3. Diana SM, Subramanian RK, Kumar SS, Morphometric features of thyroid gland: A detailed cadaveric study. International Journal of Applied Research 2016; 2: 856-59
4. Standring S, Anand N, Birch R, Collins P, Crossman AR, Gleeson M (eds). Gray's Antomy: Anatomical basis of clinical practice, 41st ed. Edinburgh: Churchill Livingstone, 2016. pp. 470-71
5. Ansari MAJ, Thyroid disorders in bangladesh- past, present and future. J Dhaka Med Coll 2014; 23: 151-52
6. Malik P, Srivastava SK, Dhattarwal SK, Verma U, Singhora R, Yadav S, Morphometry of the thyroid gland in different age groups in north Indian population: A cadaveric study, IJPSR 2017; 8: 2545-50
7. Nurunnabi ASM, Alim A, Sabiha M, Begum M, Monira K, Shamim A, Weight of the human thyroid gland- A postmortem study. Bangladesh Journal of Medical science 2010; 9: 44-48
8. Joshi SD, Joshi SS, Daimi SR, Athavale SA, The thyroid gland and its variations: a cadaveric study, Folia Morphol 2010; 69: 47-50
9. Prakash, Rajini T, Ramachandran A, Savalgi GB, Venkata SP, Mokhasi V. Variations in the anatomy of the thyroid gland: clinical implications of a cadaver study, International J. of Healthcare and Biomedical Research 2012; 87: 45-49
10. Patil S, Anupama D, Nindoni MV, Gouda S, A cross-sectional morphometric study of thyroid glands in cadavers, International Journal of Anatomy, Radiology and Surgery 2017; 6: 07-11

11. Poddar R, Bhattacharya A, Ghosal AK, Biswas S. Morphometric study of human thyroid gland with emphasis on pyramidal lobe- A cadaver based study on eastern Indian population, Indian Journal of Basic and Applied Medical Research 2017; 6: 92-100
12. Rajkanwar AJ. Kurse G, Morphological variations of the thyroid gland among people of upper Assam region of northest India A cadaveric study, Journal of Clinical and Diagnostic Research 2016; 10: 01-03
13. Nurunnabi ASM, Alim A, Sabiha M, Begum M, Monira K Shamim A. Weight of the human thyroid gland- A postmortem study, Bangladesh Journal of Medical science 2010.944-48
14. Banna FAMH, Sultana Z, Khalil M, Sultana SZ, Bakar SMA, Quddus A. et al. Weight and volume of whole thyroid gland in Bangladeshi people: A postmortem study Bangladesh Anat 2010; 8: 72-75.