

A Cadaveric Study on Morphometric Analysis of Adult Thyroid Glands in South Indian Population

Babu Rao Sake¹, G. GeethaVani², S. Lokanadham^{3*}

¹Associate Professor, Department of Anatomy, Santhiram Medical College and Hospital, Nandyal, Andhra Pradesh-518501, India

²Assistant Professor, Department of Physiology, Santhiram Medical College and Hospital, Nandyal, Andhra Pradesh-518501, India

³Assistant Professor, Department of Anatomy, Santhiram Medical College and Hospital, Nandyal, Andhra Pradesh-518501, India

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Abstract

Background: morphometric analysis of the thyroid gland alters with age, sex, race, and geographical location. The Ellipsoid method also has accuracy in evaluation of thyroid volume. **Aim:** to study the morphometric analysis of thyroid gland and its volume by ellipsoid method. **Materials and Methods:** 30 (Male-23; Female-7) cadavers with age range 55-60 years were utilized from the Department of Anatomy, Santhiram Medical College, Nandyal to study the morphometric parameters of adult thyroid glands. The morphometric parameters like length, width, thickness and weight of the glands were measured and recorded. The volume of the thyroid gland calculated by the ellipsoid method by using morphometric parameters. The formula for evaluation of thyroid volume by ellipsoid method ($\pi / 6 \times \text{Length} \times \text{Width} \times \text{Thickness}$) of the thyroid gland. **Results:** The weight of the thyroid glands was 14.02 ± 0.51 gms in males and 13.94 ± 0.55 gms in females. The average weight of the male thyroid glands was more compared to female thyroid glands in the present study. The length of the thyroid glands was 4.20 ± 0.19 cm in males and 3.95 ± 0.15 cm in females. The width of the thyroid glands was 6.2 ± 0.12 cm in males and 6.11 ± 0.14 cm in females. The thickness of the thyroid glands was 1.43 ± 0.07 cm in males and 1.40 ± 0.05 cm in females. The Thyroid volume was 17.95 ± 1.45 ml (CF: 0.479); 19.59 ± 1.53 ml (CF: 0.524) by ellipsoid method. Male thyroid volume was more compared to the female thyroid volume in the present study. **Conclusion:** The ellipsoid method of evaluation of thyroid volume to be further correlated with fluid displacement method in understanding morphometric analysis of the thyroid gland.

Keywords: Pyramidal lobe, thyroid gland, volume.

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INTRODUCTION

The thyroid gland is the largest endocrine gland in the body. It consists of two lobes connected by an isthmus. The gland is covered by a fibrous true capsule and false capsule. Sometimes a fibro muscular or fibrous band or Levator of the thyroid descends from the body of the hyoid bone to the isthmus or to the pyramidal lobe. Dysfunction and anatomic abnormalities of the thyroid are among the most common diseases of the endocrine glands [1]. By Ellipsoid method, the parameters like length, width, and thickness of lobes are measured and multiplied by a correction factor $\pi / 6$, or 0.524 for evaluation of thyroid volume [2, 3]. Volume measurement of autopsy thyroid glands subsequently immersed in water by using a modified correction factor of 0.479 resulted in a more accurate assessment of thyroid volume compared with the previously accepted correction factor of $\pi / 6$, or 0.524 [4, 5]. The present study was undertaken to evaluate the thyroid volume by the ellipsoid method in adult thyroid glands of south India.

MATERIALS AND METHODS

A total of 30 (Male-23; Female-7) cadavers with age range 55-60 years were utilized from the Department of Anatomy, Santhiram Medical College, Nandyal to study the morphometric parameters of adult thyroid glands. Thyroid glands were removed from the neck by dissection method (Figure-1). The presence of levator glandulae thyroideae, pyramidal lobe, and the shape of the thyroid glands were identified and recorded. The morphometric parameters like length, width, thickness and weight of the glands were measured and recorded (Figure-2). The length was measured as the average length of both the lobes, the width of the thyroid gland was measured transversely including isthmus and the thickness of the gland measured (Table-1). The volume of the thyroid gland calculated by the ellipsoid method by using morphometric parameters. The formula for evaluation of thyroid volume by the ellipsoid method ($\pi / 6 \times \text{Length} \times \text{Width} \times \text{Thickness}$) of the thyroid gland

(Figure-3) considered in the present study for evaluation of thyroid volume in adult human thyroid glands (Table-2).

RESULTS

The thyroid glands were located in the anterior lower neck in the present study. The shape of the thyroid glands was butterfly shaped in 20 specimens, broader right lobe in 2 specimens, 2 specimens with levator glandulae thyroidea and 6 specimens presented with pyramidal lobe extending from isthmus as well as from the right lateral lobe of the thyroid glands were noted in the present study (Figure-4). The weight of the

thyroid glands was 14.02 ± 0.51 gms in males and 13.94 ± 0.55 gms in females. The average weight of the male thyroid glands was more compared to female thyroid glands in the present study. The length of the thyroid glands was 4.20 ± 0.19 cm in males and 3.95 ± 0.15 cm in females. The width of the thyroid glands was 6.2 ± 0.12 cm in males and 6.11 ± 0.14 cm in females. The thickness of the thyroid glands was 1.43 ± 0.07 cm in males and 1.40 ± 0.05 cm in females. The Thyroid volume was 17.95 ± 1.45 ml (CF: 0.479); 19.59 ± 1.53 ml (CF: 0.524) by ellipsoid method. Male thyroid volume was more compared to the female thyroid volume in the present study.

Table-1: Morphometric parameters of adult thyroid glands

S.No	Sex	Thyroid Gland				Thyroid Volume (C.F-0.479)	Thyroid Volume (C.F-0.524)
		Weight (Gms)	Length (Cm)	Width (Cm)	Thickness(Cm)		
1	Male	14.0	4.0	6.2	1.6	19.95	20.79
2	Female	13.5	3.7	6.0	1.4	14.88	16.28
3	Male	14.0	4.1	6.2	1.4	17.04	18.64
4	Male	15.2	4.3	6.3	1.5	19.46	21.29
5	Female	14.0	3.9	6.0	1.4	15.69	17.16
6	Male	13.0	4.5	6.2	1.6	21.38	23.39
7	Male	13.5	4.1	6.0	1.4	16.49	18.04
8	Male	14.0	4.2	6.3	1.3	16.47	18.02
9	Male	13.0	4.1	6.2	1.4	17.04	18.64
10	Female	14.0	4.0	6.4	1.4	17.16	18.78
11	Male	14.0	4.0	6.0	1.5	17.24	18.86
12	Male	13.5	4.1	6.3	1.4	17.32	18.94
13	Male	14.5	4.1	6.2	1.4	17.04	18.64
14	Female	14.5	3.9	6.1	1.4	15.95	17.45
15	Male	14.4	4.2	6.1	1.5	18.40	20.13
16	Male	14.7	4.1	6.0	1.4	16.49	18.04
17	Female	14.6	4.0	6.0	1.3	14.94	16.34
18	Male	14.1	4.4	6.3	1.4	18.58	20.33
19	Male	13.9	4.2	6.1	1.4	17.18	18.79
20	Female	14.0	4.2	6.2	1.5	18.70	20.46
21	Male	14.0	4.6	6.2	1.4	19.12	20.93
22	Male	14.5	4.0	6.3	1.5	18.10	19.80
23	Female	13.0	3.9	6.1	1.4	15.95	17.45
24	Male	14.0	4.0	6.3	1.5	18.10	19.80
25	Male	14.0	4.3	6.1	1.4	17.58	19.24
26	Male	14.0	4.0	6.1	1.4	16.36	17.89
27	Male	13.7	4.0	6.1	1.4	16.36	17.89
28	Male	13.8	4.5	6.3	1.3	17.65	19.31
29	Male	14.0	4.3	6.4	1.4	18.45	20.18
30	Male	14.8	4.6	6.4	1.5	21.15	23.13
Mean		14.00	4.14	6.18	1.42	17.95	19.59
Standard Deviation		0.5165	0.2158	0.1297	0.0739	1.4501	1.5363

Table-1: Statistical Analysis

Thyroid Volume (Ellipsoid Method)	Male (n=23)	Female(n=7)
Correction Factor (0.479)	17.54 ± 1.59	16.18 ± 1.34
Correction Factor (0.524)	19.15 ± 1.70	17.70 ± 1.47



Fig-1: Position of thyroid gland in anterior lower neck
(TC: Thyroid cartilage; TG: Thyroid gland)



Fig-2: Measuring morphometric parameters like length, width and thickness of the thyroid gland

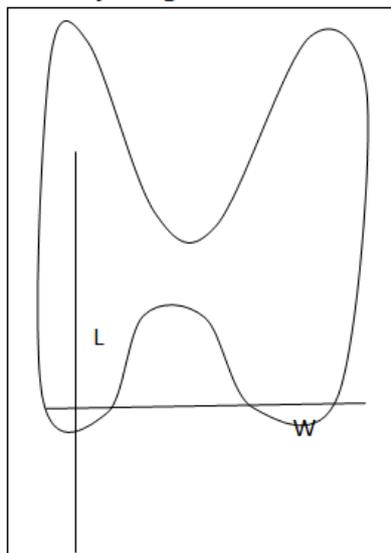


Fig-3: Ellipsoid method measurements of thyroid gland
(Length of the gland - L; W-Width of the gland; T-Thickness of the gland (Antero - posterior length))



Fig-4: Thyroid gland presenting with pyramidal lobe extending from the right lobe

DISCUSSION

The incidence of the pyramidal lobe (20%) in the present study indicating the lower incidence of pyramidal lobe compared with the previous literature [6, 7] and the pyramidal lobes arose from right lobe and from isthmus in the present study in contrast with previous literature [8]. The length, width and thickness of the thyroid glands in the present study were with lower values compared to the previous literature. The higher values in the previous literature may be due to racial difference and less number of thyroid glands utilized in the present study [9, 10]. The volume of the thyroid gland in 271 subjects aged 13-92 years by ultrasonic scanning technique and observed its relationship to body weight, age and sex [11]. The weight of the gland 40- 49 yrs were $21.81 \pm 2.48\text{gm}$, 50- 60yrs was $19.62 \pm 1.19\text{gm}$, 60- 70 yrs was $18.01 \pm 1.50\text{gm}$ [12]. The thyroid weight of the males was statistically significantly more than that of the females in 31-50 year old age group. In our study the weight of the thyroid gland and in males $14.02 \pm 0.51\text{gms}$ and in females $13.94 \pm 0.55\text{gms}$ indicating the higher age of the thyroid gland in cadavers both in males and females. Thyroid volume with the correction factor 0.479 and 0.524 showed more significant values in males when compared to females in our study indicating the role of sex in understanding the changes in thyroid volume. The volume of the thyroid gland rises in a linear fashion, stable in adults and decreased in relation to old age groups [13]. The thyroid volume in the present study suggesting mere values when compared with thyroid volume evaluated by fluid displacement method in the previous literature [14, 15]. The evaluation of thyroid volume by fluid displacement theory was already established, the current study was planned to evaluate the thyroid volume in adults by using the ellipsoid method.

CONCLUSION

The ellipsoid method of evaluation of thyroid volume to be further correlated with fluid displacement method in understanding morphometric analysis of the thyroid gland. The correlation between the ellipsoid and fluid displacement methods may give better knowledge to the surgeons in the understanding of morphometric analysis of the thyroid gland.

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Conflict of Interest: NIL

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