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Normal reference ranges of thyroid volume in North Indian subjects using ultrasound

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Abstract
Aims and Objectives: This study is aimed to establish normal reference range of thyroid gland volume in North Indian subjects using ultrasound.
Materials and Methods: A total of 100 healthy subjects, 76 (76%) females and 24 (24%) males, were prospectively studied from oct - dec 2019.Samsung H60 with 7-12 MHz linear probe was used in the study. Thyroid volume was estimated using ellipsoid formula with correction factor of 0.524.
Results: The overall mean volume ± SD volume of the thyroid gland for both lobes in all the patients studied was 5.95 ± 3.23 ml. The mean volume for both lobes in males and females were 7.82 ± 4.76 ml and 5.36 ± 2.31 ml respectively. The mean volume of right and left lobes of thyroid gland in both males and females were 3.28 ± 1.79 ml and 2.66 ± 1.53 ml respectively.
Discussion: Diagnosis of goiter/thyromegaly is based on volume measurement. Volume measurement of the thyroid gland is easy to obtain by ultrasound. This study has shown that the right thyroid lobe volume is greater than the left with significant statistical difference.
Conclusion: This study provides normative reference values of thyroid volume which can be used in diagnosis and follow-up of patients with thyroid diseases.

Keywords: aimed, patients, thyroid, ultrasound

Introduction

The thyroid gland is among the most commonly imaged glands using ultrasound due to the limitation of clinical examination [1]. Computed tomography (CT) and magnetic resonance imaging (MRI) provide structural information of the thyroid gland just like ultrasound but are relatively more expensive. Goiter is a common clinical condition and is defined as enlarged thyroid with increased thyroid volume (TV). The diagnosis is usually made by inspection and palpation. But the sensitivity and specificity of diagnosis of goiter by these methods are poor as it is very subjective and is influenced by the circumstances of examination, the experience of the examining person and the neck anatomy of the person examined. Estimation of thyroid volume using ultrasound (US) scan is more precise than clinical examination in identifying enlarged thyroid glands. Goiter by ultrasound is defined as glands with volume more than 97th centile of normal population. Hence most epidemiological studies utilize this method for the assessment of goiter prevalence and iodine status. Sonography has improved with the development of high frequency transducers, which allow a more detailed study of the thyroid gland [7]. As the volume of the thyroid gland depends on many factors, such as race, age, gender, body built, iodine status etc., the normal reference volume may be different for different population and the normal cut offs for goiter may be different. Thyroid data among adults are scanty from India as most of the field studies were conducted in school children. To our knowledge there are few data on the normal volume of thyroid among adult population in India and there are no previous local study for comparison to the best of our knowledge. This study is aimed to establish a local reference of thyroid volume in North Indian normal subjects using ultrasound.

Aims and Objectives

This study is aimed to establish normal reference range of thyroid gland volume in North Indian subjects using ultrasound.

Materials and Methods

A total of 100 healthy subjects, 76 (76%) females and 24 (24%) males, were prospectively studied from Oct - Dec 2019. Samsung H60 with 7-12 MHz linear probe was used in the study. Thyroid volume was estimated using ellipsoid formula with correction factor of 0.524. The data was collected and analyzed using SPSS for windows version 17
Exclusion Criteria: Subjects with anterior neck swelling or clinical evidence of thyroid disease were excluded. Furthermore, pregnant women, women who have delivered within the last 12 months, were excluded from the study because this may affect the thyroid size.

Results

The 100 subjects studied consist of 76 (76%) females and 24 (24%) males. The mean age of the subjects was 37.34 years with a range of 18–60 years. The overall mean volume of the thyroid gland for both lobes in all the patients studied was 5.95 ± *3.22 ml* (Table 1). The mean volume for both lobes in females and males was 5.*35* ± 2.3 mL and 7.81 ± *4.75*mL, respectively. The mean volume of the right and left lobes of the thyroid gland in all the patients studied were

3.28 ± *1.78* mL and 2.66 ± *1.52* mL, respectively (Fig 1).

Table 1: Volume of the thyroid gland

Gender	Thyroid volume	Right lobe volume	Left lobe volume
Female			
Mean	5.35	2.94	2.41
N	76	76	76
Std. deviation	2.31	1.26	1.14
Male			
Mean	7.81	4.36	3.45
N	24	24	24
Std. deviation	4.75	2.63	2.21
Total			
Mean	5.95	3.28	2.66
N	100	100	100
Std. deviation	3.22	1.78	1.52

The right thyroid lobe volume was greater than the left. The mean thyroid volume of the right lobe among the females studied was 2.94 ± *1.26*mL, and the left was 2.41 ± *1.14* mL (Table 1). The values were greater for the right than the left lobe. In males, the right and the left lobes of the thyroid gland volumes were 4.36 ± *2.63* mL and 3.45 ± *2.21* mL, respectively (Table 1). The values were greater for the right than the left lobe and more than that of the females.

Table 2: Comparison of thyroid volume studies

Author	Gender	Age range (years)	Number of subjects	Thyroid volume (mL) ± SD	Country
Current Study	24 M 76 F	18-60	100	5.95 ± 3.22	North India
Menon V U et al.	530 F	51.6 ± 11.8	530	8.80 ± 3.1	South India
Ahidjo et al. [24]	71 M 72 F	23-69	143	8.55 ± 1.82	Nigeria
Chanoine et al. [25]		17–20	256	11.6 ± 4.4	Belgium
Adibi et al. [26]	123 M 77 F	37.27 ± 11.80	200	9.53 ± 3.68	Iran
Ivanac et al. [23]		20–38	51	10.68 ± 2.83	Croatia

Discussion

In recent decades, the WHO has changed the diagnostic criteria for goiter. The diagnosis of goiter used to be based on palpation, but now it is based on volume measurement using sonography. Volume measurement of the thyroid gland is especially easy to obtain because the gland has a different echogenicity compared with adjacent soft tissues [11]. Due to its conical morphology, a thyroid lobe is assumed to resemble an ellipsoid, and its volume is approximated using height × width × depth × a correction factor. Other methods such as the 3D sonography and the automated transverse surface area method have been proposed to evaluate thyroid volume [13, 14]. Thyroid lobes, however, show variations in shape as is evident in anatomic and imaging studies [15, 16]. The thyroid size was found to increase during pregnancy and decreases up to 12 months postpartum period [17, 18]. The overall mean thyroid gland volume combined for both lobes and sexes obtained from this study was 5.95 cm^3. There were very few previous local studies for comparison to the best of our knowledge. But in Africa, Anele [3] studied the thyroid gland volume among Nigerians. This value showed the thyroid dimensions to be slightly lower than the Western values [5, 20]. This study has shown that the right thyroid lobe volume (3.28 mL) was greater than the left (2.66 mL) with significant statistical difference between the right and the left lobe volumes in both sexes. This finding is in agreement with previous studies done among the Caucasians and the Chinese [5, 20, 21]. The total mean values for the females (5.35 mL) and the males (7.81 mL) have shown the thyroid gland to be greater in males compared to females. Anele [3] found no significant difference in the thyroid volume between males and females. This finding differs from our study and most of the previous studies [5, 20, 22].

Conclusion

In conclusion, the thyroid volume obtained in this study was in the lower range of the values reported in previous studies (Table 2). The volume of the right lobe of the gland was greater than the left in both sexes. The mean thyroid volume in the males is greater than that in the females. A local reference of thyroid volume was established, and further studies are required to establish national references of thyroid volume in India.

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