

In vitro measurement volume of the neonate thyroid gland

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Abstract

Measurement and replacement fluid methods to estimate the thyroid gland volume. Because there is wide-ranging of variation in the volume of the thyroid gland in healthy individuals of different geographical location, ages, gender, and races. **Objectives:** To estimate normal neonate thyroid gland volume it can throw light to help clinicians deal better with the gland during neonatal age besides providing native standard data. **Period:** From Sept 13, 2018, to Mar 22, 2019. **Material & Methods:** Total of 48 subjects were included, 24 male and 24 female. The neonate thyroid gland collected and inspected grossly and taken all measurements, then use these measurements for finding volume thyroid gland. Also, the volume is taken by using replacement fluid. **Results:** The mean aggregate thyroid gland volume of measures method for male subjects study was $250.53 \pm 4.37 \text{ mm}^3$, while a female was $246.31 \pm 3.42 \text{ mm}^3$. The mean volume thyroid gland of replacement fluid method for male subjects study was $295.71 \pm 4.41 \text{ mm}^3$, while the female was 291.43 ± 4.04 . The mean thyroid volume of the male is expressively larger than female in both methods but statically non-significant variation. The difference between both ways statistically highly significant ($p < 0.01$). **Conclusion:** according to results that achieved by two methods, we should use another correction factor, higher than 0.749, until getting the nearest value to replacement fluid. Working out different ages to establish average data.

Keyword: thyroid gland, the volume of the neonate thyroid gland

Introduction

The thyroid gland is one of the ductless glands, red-brownish, and highly vascular gland. It's the biggest endocrine gland in the human body consists of two lateral lobes, one on each side, attached by a narrow thin isthmus to form H shape structure.⁽¹⁾ Moreover, these two lateral lobes there is the pyramid in shape which direction upward from the isthmus of the thyroid gland. The gland placed anteriorly in the lower part of the neck just below laryngeal prominence "Adam apple."⁽²⁾ Weight of the thyroid gland increases postnatal life from approximately 2–4 gm at birth to about 15–20 gm in adulthood.⁽³⁾ The mean length, thickness, and width of the right lobe is 5.26, 2.39, and 2.97 while the mean length, width, and depth left portion is 5.21, 2.90, and 2.33 cm, respectively.⁽⁴⁾

The lobes of the thyroid approximately conical in shape have a broad lower segment. Each lateral portion has convex surface anteriorly and concave surface posteriorly.⁽⁵⁾ The inferior end of the thyroid is one of the most common places of risk regarding

recurrent laryngeal nerve damage and no injuries to the external branch of the superior laryngeal nerve related to a superior pole. Thyroid particularly labile gland that varies significantly in structure and size.⁽⁶⁾

The thyroid gland has an abundant blood supply delivered by two pairs of main arteries. It obtains 5% of the cardiac output, which is high in percentage to its weight and size. It usually is supplied by inferior and superior thyroid arteries and is drained by inferior, middle, and superior thyroid veins. Also, the arteries anastomose profusely with one another over the surface of the gland stuck between the fibrous capsule and the loose facial sheath.⁽⁷⁾ Thyroid ima artery not usually present, understanding of the anatomy of the thyroid ima artery is essential for neck surgeons.⁽⁸⁾ The veins of thyroid gland form a plexus which lies beneath the proper capsule if the thyroid gland and drained by superior thyroid vein, middle thyroid vein, inferior thyroid vein.⁽⁹⁾ The lymphatics drain mainly to deep cervical nodes, uncommon enters prelaryngeal, pre- and paratracheal nodes and a rare drain directly into the thoracic duct.

The gland gets its innervation from the superior, middle and inferior cervical sympathetic ganglia. They are vasomotor in function. Parasympathetic fibers are derivative from the X cranial nerve and influence the gland via divisions of the laryngeal nerves⁽¹⁰⁾

A postmortem study, the size and volume of thyroid gland differ considerably with gender, age, geographical situation, and physiologic state. It is greater and fuller in women than in men. It hypertrophies during pregnancy and menstruation.⁽¹¹⁾ The maximum volume was 70ml. The minimum amount was 5ml. the volume of the thyroid gland in 50 years 13.33 ± 5.97 .⁽¹²⁾ Thyroid volume increased with stage of development during childhood and adolescence, remained accurately constant in younger adults and dropped more slowly in older people.⁽¹³⁾

Material Method

Volume Measurement (A) Grossly volume of neonate thyroid gland measured by using the replacement fluid technique.⁽¹⁴⁾ by taken two identical measuring cylinders (1000 mm^3). After residence the organ into the empty cylinder, water is gradually added to it from another bottle that contain 500 mm^3 of water until reached to 500 mm^3 . The residual percentage of water in the container representing the amount of thyroid gland fluid moved, measured in milliliters. (B) Gross measurements length, width and thickness for lobes of the thyroid gland done by using a digital vernier calliper, millimetre (mm) was used as a unit of measurements. The volume of each lobe calculated by the World Health Organization recommended formula: measurement of the maximum superoinferior, horizontal and ventrodorsal dimensions of both lobes; multiplying these values (mm) with each other and then 0.479 to obtain the volume (mm^3) of each lobe. Immediate results of the two lobes provided volume of the thyroid gland. The isthmus dimensions Wasn't included in the formula.⁽¹⁵⁾

Result

The thyroid gland is located anteriorly in the lower part of the neck, in the muscular triangle. Related to the lamina of the thyroid cartilage, the thyroid gland lies lateral to lower third of lamina of the thyroid cartilage.

Concerning to cricoid cartilage, the gland present inferior and lateral to cricoid cartilage from an anterior and lateral view, respectively. Simultaneous anterior to superior tracheal rings. Thyroid gland appear as completely developed U shape, reddish in color due to perfused blood sources, without agenesis of any part.

The thyroid gland consists of two lobes; these lobes lie on a parasagittal plane, both lateral lobes of the neonate thyroid gland have been found to be somewhat symmetrical pyramidal in shape, have a broad base with a direct connection to the isthmus from the lower medial side, and are slightly tapering superiorly. The medial surface looks like concave, and laterals surfaces appear convex. According to the lower third of thyroid cartilage and cricoid cartilage levels, the superior boundary of lateral lobes of the thyroid gland was observed reach to the lower third lamina of the thyroid cartilage. The inferior border of the right and left portions, related to tracheal rings was determined reached to the fourth tracheal rings. The mean of the neonate thyroid gland weight was 1.43 ± 0.2 , 1.39 ± 0.19 gram for male and female, respectively. The mean dimensions of length, width, and depth for right and left lobes in each gender see table(1). The statistical analysis revealed that the male larger than female. Still, there is non-significant variation among lobes of same gender or even between two sex in all criteria of measurements. The mean total thyroid gland volume of measures method for male subjects study was $250.53 \pm 4.37 \text{ mm}^3$, while a female was $246.31 \pm 3.42 \text{ mm}^3$.

The mean neonate thyroid gland volume that obtained by replacement fluid method for male subjects study was $295.71 \pm 4.41 \text{ mm}^3$, while the female was 291.43 ± 4.04 . The mean thyroid volume of the male is larger than female in both methods. Still, the statistical analysis of these values revealed non-significant variation among the volume of the thyroid gland between male and female if using same methods for both sex. While if we make a comparison between neonate thyroid volume in the measurements method with the volume in replacement fluid, for both genders, there is a highly significant variation ($p < 0.01$) between two processes.

Table (1) Show anatomical measurements of other studies and current work.

Authors		Lobes	Length mm	Width mm	Thickness mm
Anupriya		Both lobes	12.1	4.5	2.9
Cicekciba		Right	12.99	6.64	3.11
		left	12.19	5.87	3.11
Kishor P		Right	12.02	6.35	4.71
		Left	12.05	6.38	4.73
Current study	Male	Right	12.21 ±0.06	5.48 ±0.04	3.82 ±0.05
		Left	12.16 ±0.04	5.61 ±0.06	3.89 ±0.03
	Female	Right	12.11 ±0.05	5.40 ±0.04	3.82 ±0.06
		Left	12.10 ±0.05	5.58 ±0.04	3.87 ±0.03

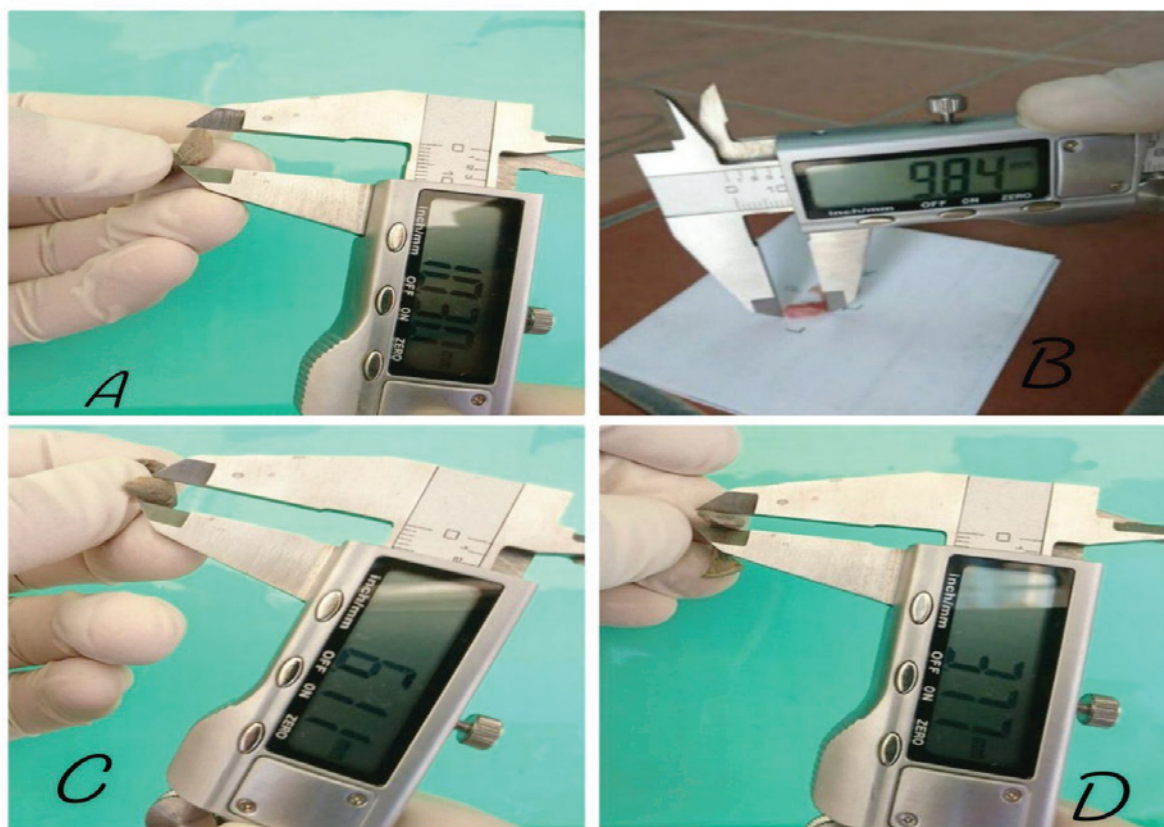


Figure (1) shows measurements A & B length of right & left lobes, C width of the right lobe, D thickness of right portion, for the neonate thyroid gland.

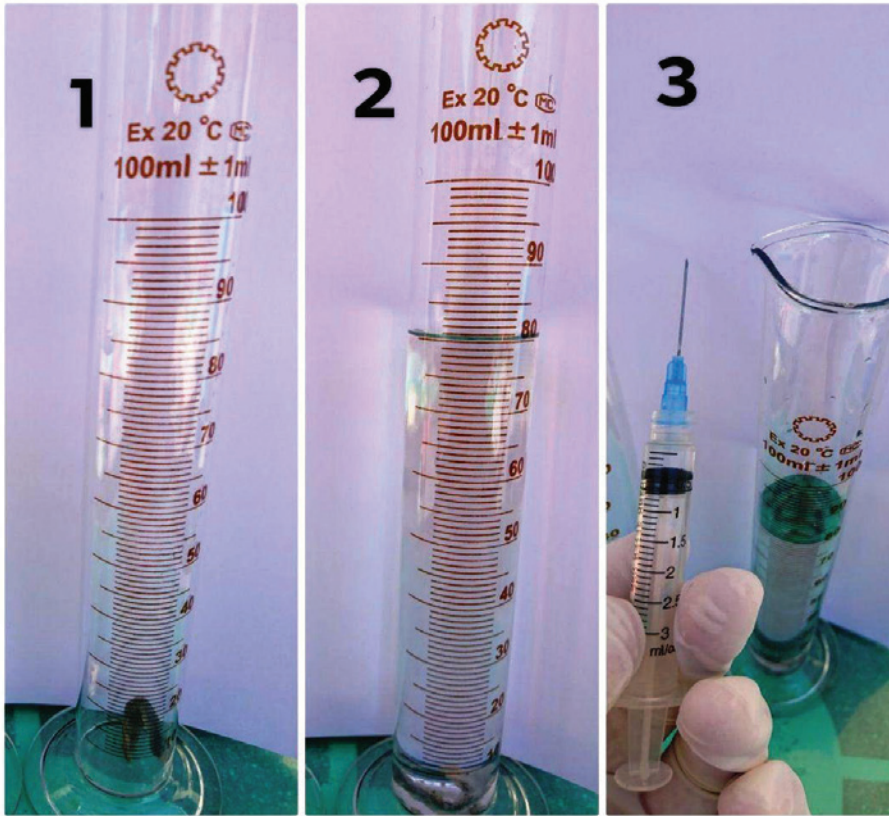


Figure (2) show replacement fluid, 1 empty cylinder tube in the bottom thyroid gland, 2 cylinder tube contain water and gland, 3 amount of replacement fluid in the syringe

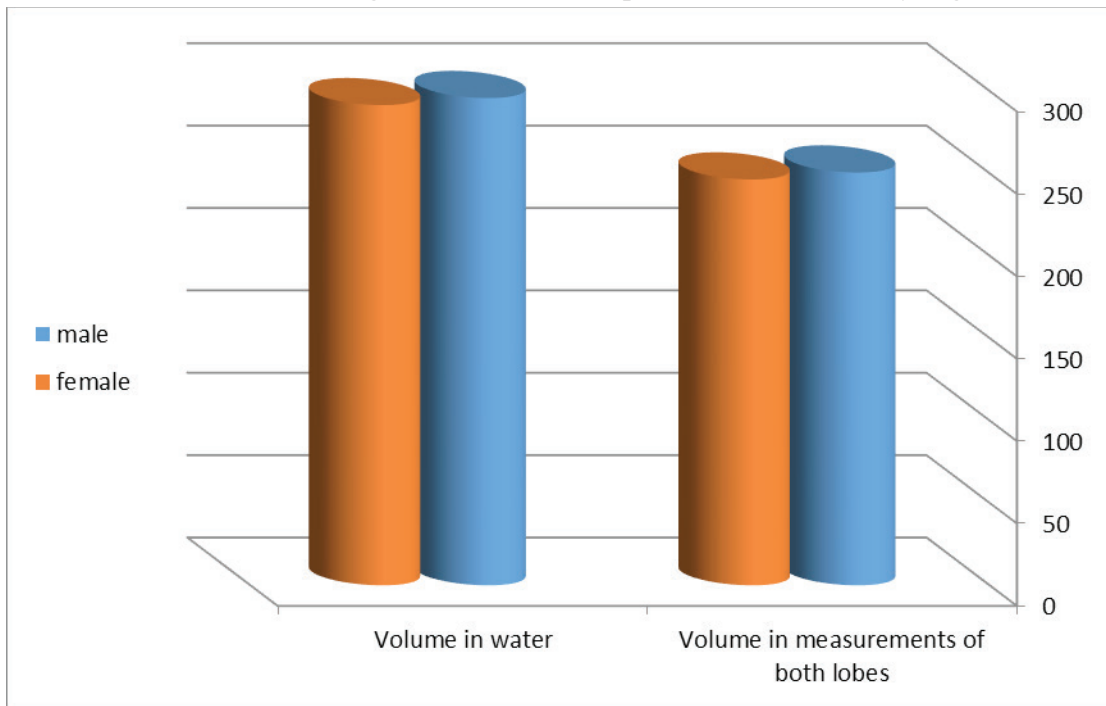


Figure (3) show volume for male and female in both methods

Discussion

The values and observations obtained in this study expose interest points, so these have been considered worthy because this is first training evaluating the volume of the neonate thyroid gland in normal subjects of the Iraqi population to provides local data of thyroid gland volume. The volume of the thyroid gland should be done as a screening test to avoid this abnormalities. Because the thyroid gland is essential for healthy growth and thyroid dysfunction causes mental and physical retardation and dwarfism.⁽¹⁶⁾ The size of the thyroid differ inversely in response to alterations in iodine ingestion, both undersupplied or excessive iodine intakes may increase gland volume.⁽¹⁷⁾ Since there is no native study yet informed for assessment in our country so well be take the nearest reviews to verify the validity of our work.

The thyroid gland lies at the anterior lower part of neck-deep to the sternothyroid and sternohyoid muscles, this agrees with Muktyaz H et al.⁽¹⁸⁾ Morphology of thyroid gland specimens involved in this study appear as U shape which conforms with Archana.⁽¹⁹⁾ In the existing work all measurement noticed during neonatal life included the means of length, breadth, and depth of lateral lobes have minor difference was noted compared to the study of other authors Kishor⁽²⁰⁾ Cicekcibasi⁽²¹⁾, and Anupriya.⁽²²⁾ (table 1) The present study showed both lobes linked together by an isthmus, definitely not significant variation was observed among dimensions of the right and left lobes, but their sizes increased with age advanced, that agree with Lokanadham.⁽²³⁾ Agenesis is any thyroid gland lobes not discovered in the current research that is in line with Dixit.⁽²⁴⁾ The weight rises in infancy and childhood. During early years weight increases at a rate of 0.054 grams per month.⁽²⁵⁾ In the current work, the weight of thyroid gland was 1.43 ± 0.2 , 1.39 ± 0.19 gram for male and female, respectively. These values correspond with Griffin⁽²⁶⁾ and Ratnakar⁽²⁷⁾ studies they found the weight 1 to 1.5 gm at term and 1.25 gm, respectively. But not accepted with Srivastava⁽²⁸⁾ he found the weight of neonate thyroid gland 0.46 gm.

The volume increases in a line fashion with advancing age, because of increasing size and amount of follicles this agree with Brown⁽¹⁴⁾, Roberts⁽²⁹⁾ studies they construct that the thyroid volume greater than before during babyhood and teenaged, remained

stable in young adults and dropped in older subjects. The alteration in volume from neonatal age to different living period is due to concern of the changes in sizes of the gland acini, for this reason, the volume is not constant which agree with Nurunnabi.⁽³⁰⁾ The study explains that there are no sex differences in thyroid volumes, also in agreement Musleh⁽³¹⁾. But the variation present between methods selected. To fixed above by comparing the present study that finds neonate thyroid volume in male and female was 250.53 ± 4.37 mm³, 246.31 ± 3.42 mm³ respectively. Neonate thyroid gland volume that obtained by replacement fluid method for male was 295.71 ± 4.41 mm³, while the female was 291.43 ± 4.04 mm³. For this purpose, the correction factors for neonate thyroid gland volumes should appear not far away, higher or lower, displacement fluid. A healthy relationship should be established between the capacity of the thyroid gland calculated in vivo and in vitro as indication by Shabana.⁽³²⁾

Ethical Clearance: The Research Ethical Committee at scientific research by ethical approval of both environmental and health and higher education and scientific research ministries in Iraq.

Conflict of Interest: The authors declare that they have no conflict of interest.

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