



## SONOGRAPHIC EVALUATION OF THYROID SIZE IN HEALTHY NEONATES IN INDIAN POPULATION.

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### ABSTRACT

**Introduction:** An accurate evaluation of thyroid size & volume, in neonates is important because the linear measurements of a developing thyroid gland do not correlate well with age, sex, or body composition variables. The main application of sonology of thyroid gland lies in its utility to assess position, size and volume of thyroid gland, diagnose thyroid gland abnormality, predict outcome and establish prognostic factors. Paucity of normative data of thyroid gland volume in Indian neonates leads us do this study. **Results:** RTV range in ml was 0.0780 to 0.430, the range of LTV in ml was 0.0710 to 1.350 while the range of total thyroid volume in ml was 0.1490 to 1.491. There was no statistically significant difference found in mean thyroid volumes between boys and girls, with a p value 0.0684. But there was a significant difference in p value less than 0.05 in left lobe thyroid volume of boys compared to girls with p value at 0.0122. **Conclusion:** Normative data of thyroid gland volume will definitely perform key role to establish early diagnosis of thyroid abnormalities.

### KEYWORDS :

#### INTRODUCTION:

Real-time sonographic (US) imaging is a valuable tool for diagnosing thyroid disorders.<sup>1</sup> An accurate evaluation of thyroid size & volume, in patients of all ages, is important for the correct diagnosis and monitoring of thyroid diseases. It is especially important in pediatrics because the linear measurements of a developing thyroid gland do not correlate well with age, sex, or body composition variables.<sup>2</sup>

The action of thyroid hormones during the antenatal and early postnatal period is most important which involves central nervous system (CNS) maturation and is also crucial for neurogenesis, dendritic and axonal growth, and neurotransmitter synthesis.<sup>3</sup> Untreated severe Congenital hypothyroidism (CH) thus leads to neurological and psych developmental defects, including intellectual disability, spasticity, and disturbances of gait and coordination.<sup>4</sup> So it is very important to diagnose thyroid abnormalities on time.<sup>5</sup>

Various methods are used to estimate thyroid size and volume. However sonographically measured thyroid volume is more accurate than thyroid size assessed with a physical examination. Imprecise calculation of thyroid size and volume may lead to false-positive or false-negative diagnoses of thyromegaly, which may result in unnecessary or delayed care.<sup>2</sup>

The most common preventable and treatable endocrine metabolic cause of intellectual disability (ID) or mental retardation in pediatric population is Congenital Hypothyroidism (CH).<sup>6</sup> The multicentric national study reveals a much higher incidence of CH all over India of 1 in 1172 live births, particularly in South India (1 in 727).<sup>7</sup> In this ultrasound may show no thyroid tissue in the neck because of either ectopia or agenesis. Alternatively, due to hypoplasia the gland may be small in volume, or enlarged because of dyshormonogenesis, which is seen in 20% of our neonatal population with congenital hypothyroidism. 1 In transient TSH elevation, associated with prematurity, acute illness, and congenital malformations,<sup>2</sup> the thyroid gland should be of normal size.<sup>8</sup>

Ultrasound of the thyroid gland is a safe, non-invasive screening method for quantitative assessment of thyroid

gland volume most suitable for mass screening in neonates and infants. Assessment of thyroid gland volume is one of the best indicator of its growth potential than other dimensions of gland.<sup>9</sup> The main application of sonology of thyroid gland lies in its utility to assess position, size and volume of thyroid gland, diagnose thyroid gland abnormality, predict outcome and establish prognostic factors. Sonologically detected abnormally enlarged thyroid glands, hypoplasia and absence of thyroid gland in normal neck position are being recognized increasingly.<sup>10</sup> Paucity of normative data of thyroid gland volume in Indian neonates leads us do this study.

#### AIMS & OBJECTIVES:

1. To establish normative ultrasound data for thyroid gland volume in Indian neonates.
2. To study the association of numerous factors like age, sex, weight, height, body mass index, body surface area and the size of the thyroid gland.

#### MATERIAL & METHODS

Present study was conducted at PDM Medical College Amravati, Maharashtra, India. Study period was one year with data collection. Study population included 50 healthy neonates. Study design was prospective and observational. After obtaining institutional ethical committee approval and informed written consents from parents of screened neonates study participants recruitment was decided based on TSH negative biochemical reports. Inclusion criteria was neonates should be healthy and free from associated diseases and anomalies. The exclusion criteria were preterm babies, low birth weight babies, refusal of consent, neonates with congenital anomalies, mothers and family members having thyroid disorders. 9–10 MHz pediatric probes used, while doing USG neonates given position with hyper extended neck in supine and posture measurement planes were transverse and antero-posterior. Width, length, breadth and depth of each lobe were measured and volume of each lobe was calculated by the following formula:

Volume in ml =  $L \times B \times D \times 0.479$ ,

in which Long axis diameter of each lobe (Length) = L, Short axis (Breadth) = B, Thickness of each lobe (Depth) = D. Each lobe volume was calculated as right and left and average was noted as Total Thyroid Volume (TTV). If each lobe is

considered as an ellipsoid, much of the contribution of the isthmus is already included. Hence, individually isthmus is not included in volume calculations.

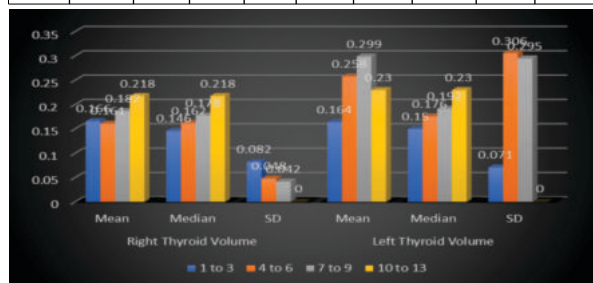
**Photograph 01: Sonographic measurement of thyroid gland volume (Transverse and longitudinal sections).**

**RESULTS**

In the present study we observed thyroid gland volume of 50 healthy neonates. All data was tabulated and statistical analysis was done by SPSS software. Mean, median and standard deviation were calculated. While in comparison between male and female thyroid volume unpaired t test was applied to find the significance level of association.

**Table No. 01: Age wise grouped thyroid gland volume (TV) in milliliters with mean, median and SD.**

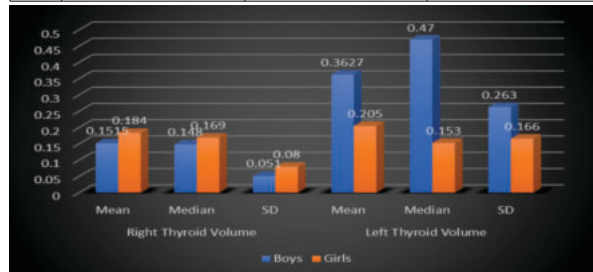
Age (Days)	Right Thyroid Volume (ml)			Left Thyroid Volume (ml)			Total Thyroid Volume (ml)		
	Mean	Median	SD	Mean	Median	SD	Mean	Median	SD
1 to 3	0.166	0.146	0.082	0.164	0.15	0.071	0.330	0.31	0.125
4 to 6	0.161	0.162	0.048	0.258	0.176	0.306	0.419	0.344	0.305
7 to 9	0.187	0.178	0.042	0.299	0.192	0.295	0.487	0.37	0.305
10 to 13	0.218	0.218	0	0.23	0.23	0	0.448	0.224	0.006



**Graph No. 01: Age wise grouped thyroid gland volume (TV) in milliliters with mean, median and SD.**

**Table No. 02: Gender wise grouped thyroid gland volume (TV) in milliliters with mean, median and SD.**

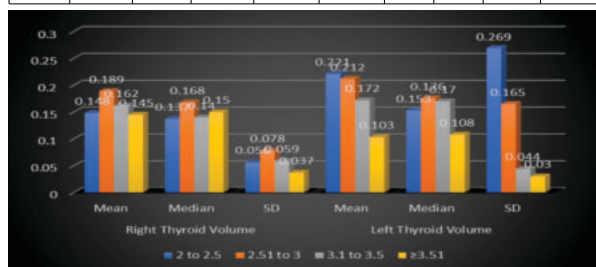
Gender	Right Thyroid Volume			Left Thyroid Volume (ml)			Mean Thyroid Volume (ml)		
	Mean	Median	SD	Mean	Median	SD	Mean	Median	SD
Boys	0.1515	0.148	0.051	0.3627	0.47	0.263	0.514	0.47	0.263
Girls	0.184	0.169	0.08	0.205	0.153	0.166	0.389	0.329	0.197
p value	0.0983			0.0122			0.0684		



**Graph No. 02: Gender wise grouped thyroid gland volume (TV) in milliliters with mean, median and SD.**

**Table No. 03: Weight wise grouped thyroid gland volume (TV) in milliliters with mean, median and SD.**

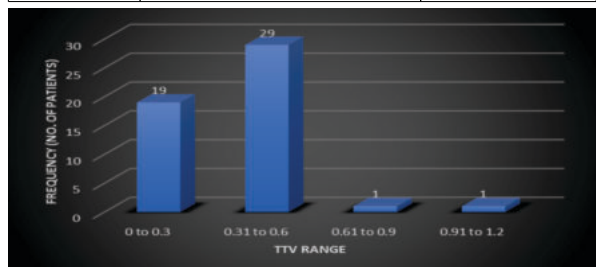
Weight	Right Thyroid Volume			Left Thyroid Volume			mean Thyroid Volume		
	Mean	Median	SD	Mean	Median	SD	Mean	Median	SD
2 to 2.5	0.148	0.137	0.056	0.221	0.153	0.269	0.370	0.320	0.278
2.51 to 3	0.189	0.168	0.078	0.212	0.176	0.165	0.401	0.37	0.189
3.1 to 3.5	0.162	0.14	0.059	0.172	0.17	0.044	0.335	0.287	0.100
≥3.5	0.145	0.15	0.037	0.103	0.108	0.03	0.249	0.258	0.067



**Graph No. 03: Weight wise grouped thyroid gland volume (TV) in milliliters with mean, median and SD.**

**Table No.04: Distribution of frequency (no. of patients) according to Total Thyroid Volume.**

TTV (ml)	Frequency (no. of patients)	Percentage (%)
0 to 0.3	19	38
0.31 to 0.6	29	58
0.61 to 0.9	1	2
0.91 to 1.2	1	2
Total	50	100



**Graph No. 04: Distribution of frequency (no. of patients) according to Total Thyroid Volume.**

**DISCUSSION**

Ultrasound imaging is a reliable method for estimation of thyroid size and volume in workup of neonates suspected to have CH. On distribution of thyroid volume, of neonates under study according to age groups we observed that for 1 to 3 days neonates had mean RTV 0.666 ml with SD 0.082 while mean LTV was 0.164 ml with SD 0.071. Neonates of 4 to 6 days age had mean RTV 0.161 ml with SD 0.048 while mean LTV was 0.258 ml with SD 0.306. 7 to 9 days old neonates had mean RTV 0.187 ml with SD 0.042 while mean LTV was 0.299 ml with SD 0.295. Neonates with age 10 to 13 days had mean RTV 0.218 ml while mean LTV was 0.23 ml.

Mean RTV for boys was 0.1515 ml with SD 0.051 and while LTV was 0.3627 ml and SD of 0.263. Mean RTV for girls was 0.184 ml with SD 0.08 and LTV was 0.205 ml and a SD of 0.166. No statistically significant difference was found in mean thyroid volumes between boys and girls, with a p value 0.0684. But there was a significant difference in p value less than 0.05 in left lobe thyroid volume of boys compared to girls with p value at 0.0122.

We distributed neonates under study according to weight groups. Neonates with weight 2 to 2.5 kg had mean RTV 0.148

ml with SD 0.056 while mean LTV was 0.221 ml with SD 0.269. 2.51 to 3 kg neonates had mean RTV 0.189 ml with SD 0.078 while mean LTV was 0.212 ml with SD 0.165. Neonates with weight 3.1 to 3.5 kg had mean RTV 0.162 ml with SD 0.059 while mean LTV was 0.172 ml with SD 0.044. Neonates with weight more than or equal to 3.51 kg had mean RTV 0.145 ml with SD 0.037 while mean LTV was 0.103 ml with SD 0.03.

In the similar study by Prabhu S et al<sup>6</sup>, Perry RJ et al<sup>8</sup>, Noor NA et al<sup>13</sup>, authors studied similar parameters. The thyroid volume in the euthyroid neonates observed in the present study were consistent with previous studies. Prabhu S et al<sup>6</sup> in their study also reached to the similar finding that there was significant difference in left lobe thyroid volume of boys compared to girls. Vade A et al in their study also reached to the similar findings. They measured thyroid volume cubic millimeter and in present study we measured in milliliter. Small difference in the total thyroid volume might be due to racial, geographical or difference in sample.

## CONCLUSION

Normative data of thyroid gland volume will definitely perform key role to establish early diagnosis of thyroid abnormalities. Early detection of thyroid gland abnormality will further improve clinical outcomes and when resources are limited, utility of ultrasound of thyroid gland among first line of investigations could be further cost-effective and define need for more investigations including scintigraphy.

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