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Developmental Anomalies In The Foetal Thyroid Gland

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ABSTRACT

Introduction: Thyroid gland abnormalities are one in 2000 - 4000 new borns[1]. Key developmental anomalies encompass the persistence of the pyramidal lobe, thyroglossal cyst, agenesis, and ectopic thyroid [7].

Materials and methods: A total of 30 fetuses, aged between 12 and 40 weeks, were dissected. Out of 30 foetuses, 17 were females and 13 were male foetuses. Presence of pyramidal lobe, its length and extent were measured. The shape of thyroid gland, presence of levator glandulae thyroideae, abnormalities of isthmus and agenesis of thyroid gland were all assessed.

Results: The presence of a pyramidal lobe was observed in 10 out of 30 fetuses, representing 33%. 4 out of 30 were arising from isthmus (13%). Among 12 male foetuses, 2 (6.6%) foetuses showed the presence of pyramidal lobe. Among 18 female foetuses, 8 (26.6%) showed the pyramidal lobe. 3 out of 30 (10%) showed agenesis of thyroid gland, 2 out of 30 (6.6%) revealed levator glandulae thyroideae and 2 out of 30 (6.6%) revealed accessory thyroid tissue. Most of the thyroid glands were butterfly shaped. 3 out of 30 (10%) were horseshoe shape, 3 out of 30 (10%) were W shaped (gland with separate lobes), 2 out of 30 (6.6%) had broader right lobe and 1 out of 30 (3.3%) had broader left lobe.

Conclusion: Interventionists and surgeons must have a solid understanding of embryology, surgical anatomy, and thyroid gland variations to prevent complications and ensure safe, effective thyroidectomies. [6].

Keywords: *pyramidal lobe, thyroid gland, foetus, isthmus, levator glandulae thyroideae.*

1. INTRODUCTION

The thyroid gland originates as a midline structure from the pharynx. It forms as a median thickening of endoderm in the pharyngeal floor, between the first and second pharyngeal pouches, and dorsal to the aortic sac. A median diverticulum appears early in the fifth week at the foramen caecum, located in the groove just behind the median tongue bud. It continues caudally as the thyroglossal duct, running ventral to the hyoid bone's primordium. After the tip of duct bifurcates, the tissue mass divides into the isthmus and lateral lobes of the thyroid gland. The epithelial tissue derived from the endoderm is surrounded by mesenchyme from the vagal neural crest. This mesenchyme forms the connective tissue capsule and interlobular septa, as well as the perifollicular mesenchyme, which provides the gland with its neurovascular and lymphatic supply.[5]. It regulates the basal metabolic rate, supports somatic growth, influences mental development, manages calcium metabolism, affects circadian rhythm [12], and promotes brain growth and development during fetal life. Thyroid gland abnormalities are observed in roughly one out of every 2,000 to 4,000 newborns[1]. Major developmental anomalies of the thyroid gland include persistent pyramidal lobe, thyroglossal cysts, thyroid agenesis, aberrant thyroid tissue, accessory nodules, and ectopic thyroid tissue[7]. The presence of thyroid tissue in the tracheal lumen is a rare cause of upper respiratory obstruction[8]. Interestingly, the presence of a pyramidal lobe is often overlooked in pre-operative imaging [14]. Thus, developmental differences impact the thoroughness of surgical treatment and the recurrence rates of both benign and malignant thyroid conditions. Surgeons must consistently recognize anatomical anomalies to guarantee complete resection of all thyroid gland components, ultimately leading to better surgical outcomes[13] and also to prevent iatrogenic injuries[15].

Understanding the incidence of developmental anomalies is crucial for surgeons, radiologists, and interventionists, as these variations are often overlooked and require careful consideration. [1].

Materials and methods

After getting approval of Ethical Committee, 30 foetuses of gestational age 12- 40 weeks were collected from the Department of Obstetrics and Gynaecology and dissection of foetuses was conducted in the Department of Anatomy for 3 Years duration. Out of 30 foetuses, 17 were females and 13 were male foetuses. All the foetuses were preserved in glass specimen jars having 10% formalin. The dissection of 30 foetuses of gestational age 12 – 40 weeks was carried out according to Cunningham's manual under good ventilation and bright light. The presence of pyramidal lobe if is attached to the isthmus, right lobe, left lobe or both lobes of thyroid gland, if it is made up of fibrous tissue or smooth muscles or both were noted. The normal shape of thyroid gland and other shapes were noted. Presence of abnormalities of isthmus and agenesis of thyroid gland were all noted.

Results:

In the present study, 30 foetuses were dissected and data were collected. The fetuses were categorized according to their gestational age into three groups: 12 to 20 weeks, 21 to 30 weeks, and 31 to 40 weeks. Out of 30 foetuses of gestational age 12 - 40 weeks, 12 were males and 18 were females. Most of the thyroid glands were butterfly shaped (Table 3 and Figure 3). 3 out of 30 (10%) were horseshoe shape, 3 out of 30 (10%) were W (Figure 2) shaped (gland with separate lobes), 2 out of 30 (6.6%) had broader right lobe and 1 out of 30 (3.3%) had broader left lobe. 10 out of 30 (33%) foetuses showed the presence of pyramidal lobe (Table 1 & Figure 1) in 12 – 40 weeks gestational age (Table 1). Most of them, 4 out of 30 (13%) were arising from isthmus (Figure 1). Among 12 male foetuses, 2 (6.6%) foetuses showed the presence of pyramidal lobe. Among 18 female foetuses, 8 (26.6%) showed the pyramidal lobe, therefore showing female preponderance. 3 out of 30 (10%) exhibited agenesis of isthmus of thyroid gland (Table 2 & Figure 5), 2 out of 30 (6.6%) displayed the presence of levator glandulae thyroideae (Table 2 & Figure 4).

Table 1: Showing the presence of pyramidal lobe.

Gestational age (In Weeks)	Sex	No. of Foetuses	Foetuses With Pyramidal Lobe	Site of Origin			
				Left	Right	Both lobes	Midline (isthmus)
12 - 20	Male	04	0	-	-	-	-
	Female	02	0	-	-	-	-
21 - 30	Male	07	02	-	01	01	-
	Female	08	04	01	-	-	03
31 - 40	Male	01	0	-	-	-	-
	Female	08	04	01	-	02	01
Total	Male	12	02	0	01	01	0
	Female	18	08	02	0	02	04
Grand total		30	10	02	01	03	04

Table 2: Showing the Agenesis of isthmus, Levator glandulae thyroideae and Accessory thyroid lobe according to gestational age in weeks.

Gestational age (In Weeks)	**Sex**	**No. of Foetuses**	**Different shapes encountered**				
			Butterfly shape	**Horseshoe shape**	**W shape**	**Broader right lobe**	**Broader left lobe**
12 - 20	Male	04	04	-	-	-	-
	Female	02	02	-	-	-	-

21 - 30	Male	07	05	01	01	-	01
	Female	08	08	-	-	02	-
31 - 40	Male	01	-	01	-	-	-
	Female	08	05	01	02	-	-
Total		**30**	**24**	**03**	**03**	**02**	**01**

Table 3: Showing different shapes of thyroid gland.

Gestational age (In Weeks)	**Sex**	**No. of foetuses**	**Agenesis of isthmus**	**Presence of Levator glandulae thyroideae**	**Presence of Accessory thyroid lobe**
12 - 20	Male	04	01	-	-
	Female	02	-	-	-
21 - 30	Male	07	01	-	-
	Female	08	-	02	01
31 - 40	Male	01	-	-	-
	Female	08	01	-	01
Total		**30**	**03**	**02**	**02**

2. DISCUSSION

The pyramidal lobe is a remnant of the inferior end of thyroglossal duct, extending variably from the isthmus. It usually attaches to the left side of the isthmus but can connect to either lateral lobe. The isthmus may be incomplete, and there can be separate fragments of thyroid tissue. Present in about 50% of individuals, the pyramidal lobe is more commonly associated with the left side of the isthmus[4]. According to Cicekcibasi in 2006, the incidence of pyramidal lobe in foetus was 18.3% with male preponderance in turkey. According to Lokanadham in 2012, the incidence of pyramidal lobe in foetus was 6.6% with male preponderance in South India. According to Ozguner in 2011, the incidence of pyramidal lobe in foetus was 29.5% with female preponderance and most commonly originating from isthmus in turkey. As reported by Anupriya in 2016, the incidence of the pyramidal lobe in fetuses from South India was 30%. Kishan Reddy reported in 2016 that the incidence of the pyramidal lobe in South Indian fetuses was 55%. In 2016, Navodita found that the incidence of the pyramidal lobe in North Indian fetuses was 19.23%, with a predominance in males and typically originating from the left lateral lobe. According to Arun in 2017, the incidence of pyramidal lobe in foetus was 16% with male preponderance in North India. The current study found a 33% incidence of the pyramidal lobe in North Indian fetuses, with a female predominance and most commonly originating from the isthmus, slightly higher than in other studies. (Figures 1 & 2).

The pyramidal lobe develops from the distal thyroglossal duct and connects to the hyoid bone through fibrous tissue and/or the levator muscle of the thyroid gland[8]. Variations in the musculature around the thyroid gland may lead to iatrogenic injuries during neck and thyroid surgical procedures. Presence of pyramidal lobe and levator glandulae thyroideae which originating from pyramidal lobe are common, but origin of levator glandulae thyroideae from isthmus is rare[15]. According to Anupriya in 2016, the incidence of levator glandulae thyroideae in foetus was 15 % in South India. According to Navodita in 2016, the incidence of levator glandulae thyroideae in foetus was 19.23 % in North India. According to Arun in 2017, the incidence of levator glandulae thyroideae in foetus was 16% with male preponderance in North India. In the present study, the incidence of levator glandulae thyroideae in foetus was 6.6% with female preponderance in North India and most commonly arising from the isthmus which is rare (Figure 4).

Thyroid gland is H shaped[12]. The gland has right and left lobes joined by the isthmus[3], and these lobes are roughly conical in shape[5]. The thyroid gland achieves its definitive shape by 7 weeks. [8]. Anupriya reported in 2016 that the thyroid gland was "horse-shoe shaped" in all fetuses except for one, which had an "irregular shape" due to the absence of the isthmus (2.5%). Lokanadham reported in 2012 that 40% of cases showed a broader right lobe, while 26.7% exhibited a broader left

lobe. In the present study in 2019, most of the thyroid glands were H shaped. 3 out of 30 (10%) were horseshoe shape (the lateral lobes were almost or in line with isthmus), 3 out of 30 (10%) were W shaped (gland with separate lobes, joined together by an elevated projection in centre and isthmus was absent in the lower end), 2 out of 30 (6.6%) had broader right lobe and 1 out of 30 (3.3%) had broader left lobe (Figures 2 & 3).

Congenital hypothyroidism, caused by defective development of the thyroid gland, is common, while the absence of the gland or one of its lobes is a rare anomaly; in cases of thyroid hemiagenesis (unilateral failure of formation), the left lobe is more frequently absent[8]. According to Anupriya in 2016, the incidence of agenesis of isthmus in foetus was 2.5%. The current study observed an incidence of 10% for isthmus agenesis in fetuses (Figure 5).

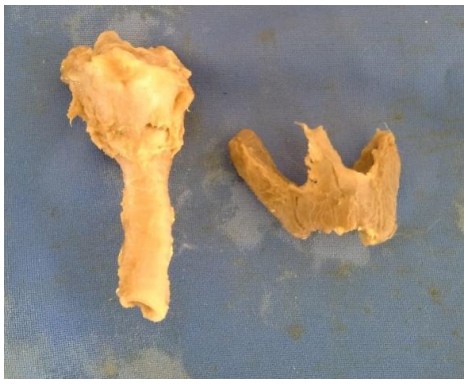

Figure 1: Showing pyramidal lobe arising from isthmus.

Figure 2: Showing pyramidal lobe arising from both lobes and W shape of the gland.

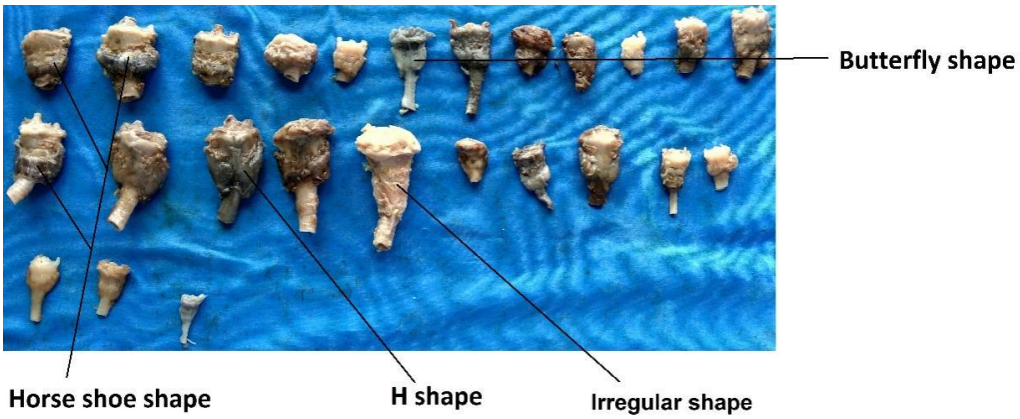

Figure 3: Showing different shapes of the thyroid gland

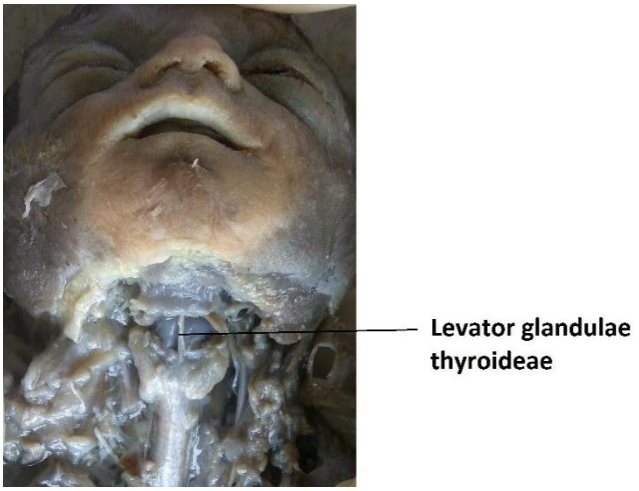

Figure 4: Showing presence of levator glandulae thyroideae.

Figure 5: Showing absence of isthmus of thyroid gland.

3. CONCLUSION

Highlighting the various anatomical variations of the thyroid gland is essential for establishing a foundation for safe and effective surgical procedures[15]. During total thyroidectomies, the anterior cervical region must be meticulously examined to ensure that no residual thyroid tissue is left behind[11]. Our study aims to explore the developmental variations of the thyroid gland to optimize patient care and ensure more successful surgical procedures.

REFERENCES

[1] Anupriya A, Kalpana R. Morphological and histological features of human fetal thyroid gland. Int J Sci Stud. 2016; 3 (10): 136-140.

[2] Arun S, Mahesh KS, rupinder S. Morphological and morphometric study of foetal thyroid gland at different gestational ages. Paripex Indian journal of research. 2017; 6 (7): 28-30.

[3] Chaurasia BD (2015), Human anatomy head and neck. 6th edition. CBS publishers and distributors, New Delhi: p 145.

[4] Cicekcibasi, AE; Salbacak, A; Seker, M; Ziylan, T; Buyukmumcu, M. Development variations and clinical importance of the fetal thyroid. A morphometric study. Saudi medical journal. 2006: 28 (4): 524-8.

[5] Gray H. Standring S (2016) Gray's anatomy: the anatomical basis of clinical practice, 41st edition. Elsevier Churchill Livingstone. Edinburgh, p 470.

[6] Kishan R, panchakshari M. A study of anatomical and morphological variations of thyroid gland. Sch. J. App. Med. Sci., 2016; 4(9E): 3510-3513.

[7] Lokanadham S, Devi SV. Gestational age related developmental anatomy and histogenesis of human fetal thyroid gland. World J Med Sci 2011; 6: 173.

[8] Moore KL, Persaud TV. The Developing Human- Clinically oriented embryology. 8th ed. USA: Saunders Elsevier; 2008. p. 252.

[9] Navodita C, Niranjan R, Singh AK, Sinha DN, Pant MK. Pyramidal lobe and levator glandulae thyroideae in human fetal thyroid gland. J. Anat. 2016 Jun; 24 (1): 31-7.

[10] Ozguner G., Sulak O. Size and location of thyroid gland in the fetal period. Surg Radiol Anat. 2014; 36 (4): 359-367.

[11] Ranade, Anu V., et al. "Anatomical variations of the thyroid gland: possible surgical implications." Singapore medical journal 49.10 (2008): 831.

[12] Kratzsch J, Pulzer F. Thyroid gland development and defects. Best Pract Res Clin Endocrinol Metab 2008;22:57-75.

[13] Kaklamanos I, Zarokosta M, Flessas I, Zoulamoglou M, Katsoulas T, Birbas K, Troupis T, Mariolis-Sapsakos T. Surgical anatomy of double pyramidal lobe on total thyroidectomy: a rare case report. Journal of Surgical Case Reports. 2017 Mar;2017(3):rjx035.

[14] Biello A, Kinberg EC, Wirtz ED. Thyroidectomy.

[15] Chaudhary P, Singh Z, Khullar M, Arora K. Levator glandulae thyroideae, a fibromusculoglandular band with absence of pyramidal lobe and its innervation: a case report. Journal of Clinical and Diagnostic Research: JCDR. 2013 Jul;7(7):1421.