

## Gestational Age Related Developmental Anatomy and Histogenesis of Human Fetal Thyroid Glands

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**Abstract:** Thyroid glands of 25 aborted fetuses (11 males, 14 females) of 6-40 weeks gestational ages were observed for age related developmental anatomy and histogenesis. The thyroid glands obtained by neck dissection were preserved in 10% formalin and subjected to routine histological processing, sectioning and staining procedure. The histological study of thyroid glands revealed that, there was a delay in the pre colloid formation to follicular growth stage. Disorders of thyroid gland development and function are relatively common affecting approximately one newborn infant in 2000-4000. The present study helps that delay in the pre colloid stage to follicular growth stage of thyroid gland leads to thyroid hyperplasia.

**Key words:** Thyroglossal duct • Solid nest cells • Follicles • Colloid

### INTRODUCTION

The thyroid gland is the first endocrine gland to develop in the embryo around 3<sup>rd</sup> week of intrauterine life and is the largest endocrine gland in the body [1, 2]. It is the only endocrine gland that depends on the external environment for raw materials for the synthesis of its hormones. The thyroid hormones are necessary for regulating the basal metabolic rate, somatic growth, psychic growth, calcium metabolism and circadian rhythm. Dysfunction and anatomical abnormalities of the thyroid are among the most common diseases of the endocrine glands affecting approximately one in 2000-4000 newborn infants [3].

### MATERIALS AND METHODS

A Total of 25 formalin preserved dead embryos and fetuses (normal - 22, abnormal-3) are with relevant obstetric records available in dept of anatomy, S.V.M.C, Tirupati were utilized for this study. The fetuses are of both the sexes and of 6-40 weeks of gestational age. External features of the fetuses and visible anomalies if any were recorded. The larger fetuses were preserved by injecting 10% formalin solution into the pleural, peritoneal and cranial cavities and their extremities were preserved by multiple injection technique described by [4]. The

smaller fetuses were preserved in 10% formalin solution. We dissected over the neck and identified the bi-lobed thyroid gland specimens. All the specimens were categorized in to four groups based on gestational age. The specimens were preserved in 10% formalin. The thyroid glands were subjected to routine processing by dehydration in graded alcohols, clearing in xylol and were embedded in paraffin [5]. Sections of 5microns thickness were cut and stained with Haematoxylin &Eosin and mounted in Canada balsam.

### RESULTS

In the present study a total of 25 aborted embryos and fetuses of different gestational ages, of both sexes and normal and abnormal were observed (Table 1) for development and histogenesis of thyroid gland during prenatal period. The pre natal specimens are categorized in to 4 gestational age groups of 0-12 weeks, 12-24 weeks, 24-36 weeks and more than 36 weeks. One representative sample of thyroid tissue from each gestational age group was processed for routine histological examination and stained with Haematoxylin and Eosin for observing histogenesis at different gestational ages. We observed the histogenesis of the thyroid like precolloid stage, colloid stage, follicular growth stage along with development of the capsule etc.

Table 1: Prenatal thyroids-Distribution of specimens

Gestational age (Weeks)	Male	Female	Total
0 -12	2	1	3
12 -24	4	3	7
24 -36	2	3	5
>36	3	7	10
	11	14	25.

### DISCUSSION

In the present study at 8-10 weeks gestational age (15 mm CRL) thyroglossal duct was observed (Fig. 1). In the literature appearance of thyroglossal duct was reported in embryo of less than 10 weeks gestational age in the floor of the pharynx [6, 7].

The fetal thyroid attains maturity in terms of relative weight and appearance of colloid at 7-10 weeks gestational age when the embryo is 65-80mm CRL [8, 9].

There is a delay of 2 weeks in the appearance of thyroglossal duct in the present study when compared to that reported in the literature. The thyroid completes its descent in the seventh gestational week, coming to rest in its final location immediately anterior to the trachea. In the present study in the embryo of 10-12 weeks network of solid cords of cells (Figure 2) were observed [19].

At 16-18 weeks follicles in early stage of differentiation were observed. Endodermal cell clusters (small group of cells) in some areas (Fig. 3.A) follicles with a lumen (Fig. 3.B) in other areas were observed. Probably the network of solid cords of cells that were seen at less than 12 weeks gestational age will reorganize into small groups of cells by 16 to 18 weeks gestational age. The endoderm breaks in to plates and forms cells grouped around a follicular lumen at 10-12 weeks [10-13]. There is a delay of 4 weeks in the appearance of clusters of endodermal cells in the present study when compared to

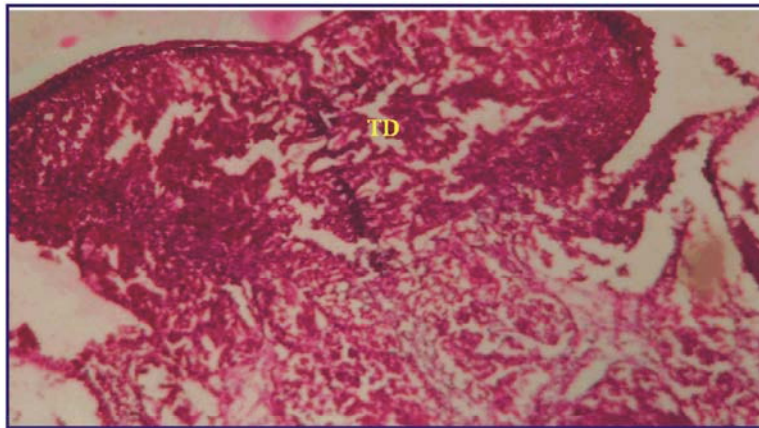


Fig. 1: Histological section of thyroid gland showing the Thyroglossal duct at 8-10 weeks - magnification 10x10X. (TD: thyroglossal duct)

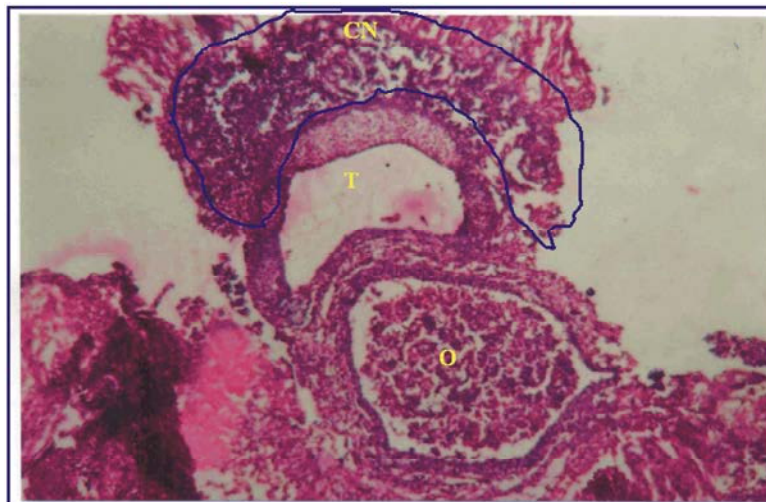


Fig. 2: 10-12 weeks - Histological section showing the thyroid gland at 10-12weeks magnification 10x10X (CN: Solid cell nests; T: Trachea; O: Oesophagus)

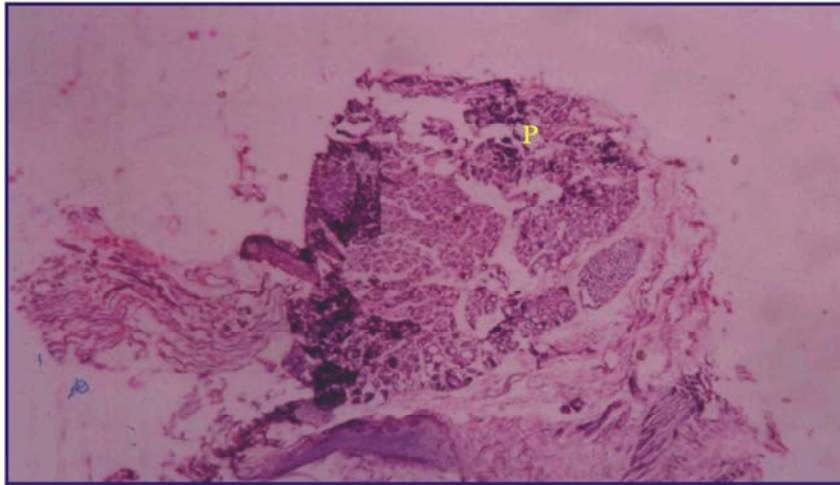


Fig. 3A: 16-18 Thyroid gland microscopic structure at 16-18weeks magnification 4 x10X showing primary follicles (*P: Primary follicles*)

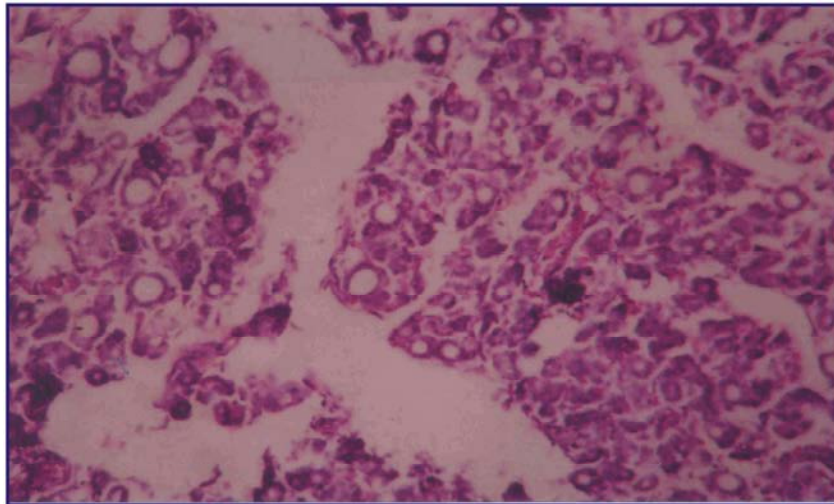


Fig. 4B: Thyroid gland microscopic structure showing primary follicles at 16-18 weeks magnification 20x10X

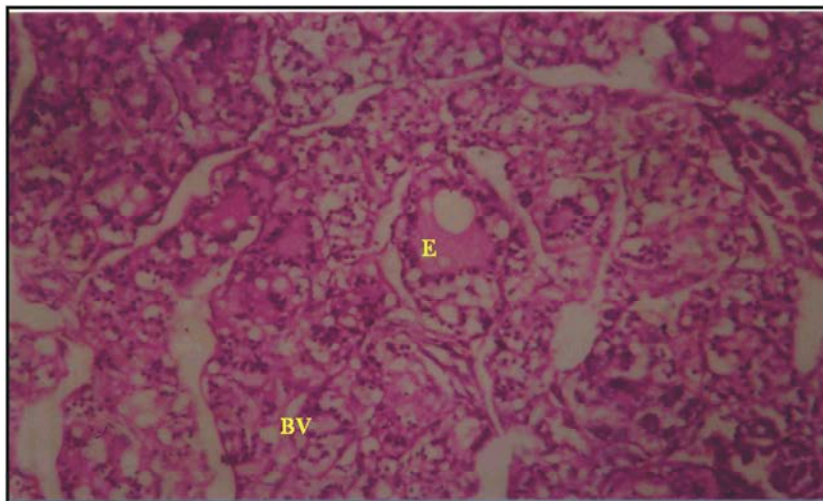


Fig. 5: Thyroid gland histological section showing connective tissue, follicular lining epithelium, colloid filled follicles and blood vessels at 22-23 weeks magnification 20x10X (*E: Epithelium; BV: Blood vessels*)

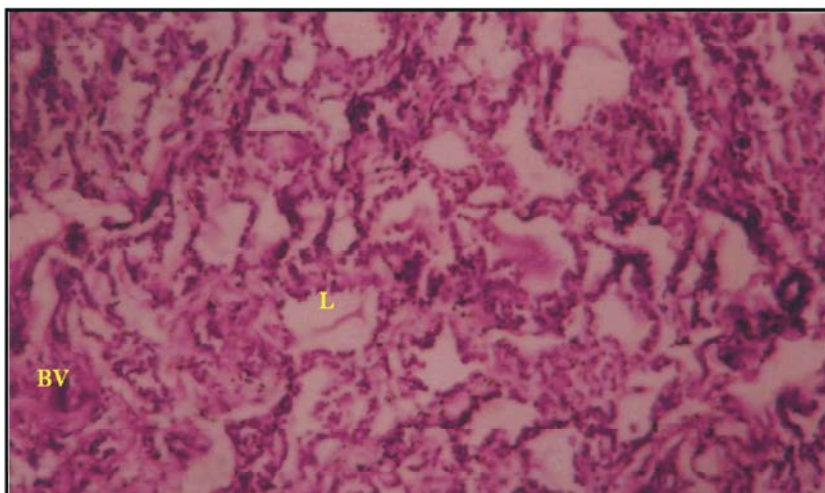


Fig. 6: Thyroid gland microscopic structure showing enlarged lumen, follicles lined with epithelium and blood vessels at 36 weeks magnification 20x10X (L:Lumen; BV: Blood vessels)

those reported in the literature. Delay in the pre colloid stage of thyroid gland leads to hyperplasia [14]. Clearly visible primary follicles and synthesis of thyroid hormones are present at 16 -18 weeks [15]. The findings in the present study are not in agreement with those reported by Torand - Allerand (1978) as colloid was not observed in the follicles at this stage.

In the present study at 22 weeks of gestational age fetal thyroid showed enlarged follicles with a lining epithelium showing prominent nuclei. Some of the follicles showed the colloid in the lumen (Fig. 4). There is development of hypothalamic - pituitary - thyroid axis and increased production of thyroid hormones at mid gestation [16]. In the present study there is delay in this phase.

At 36 weeks gestational age the thyroid gland showed maturation of thyroid follicles. Enlarged follicles with some of them filled with colloid were observed (Fig. 5). Vascularity also increased. The cuboidal epithelium lining the follicles were observed at 36 weeks (Fig. 5). Full maturation of thyroid follicles occurs at 36- 40 weeks [17]. The findings in the present study are in agreement with those reported by Rosalind Brown *et al.*, (2005). Sexual differences were noted in the appearance of follicles, connective tissue, nerve fibers in the thyroid gland that were earlier in the male fetuses [18].

### CONCLUSION

In the present study there is a delay in the pre colloid stage to follicular growth stage. This delay in the pre colloid stage may be related to follicular growth stage of

thyroid leads and hyperplasia [20]. This study gives knowledge to the clinicians about the histo-pathological changed and state of the disorder.

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