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PRE NATAL DEVELOPMENT OF HUMAN THYROID GLAND

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ABSTRACT

The present study has been taken as the part of the project to review the histogenesis of thyroid gland in human fetuses of Indian origin. So far the material available in the literature is not from India. Fetuses of gestational age ranged from 11 weeks to 40 weeks have been obtained from local hospitals. All the fetuses have been subjected to the protocol of dissection, processing & staining procedures already in existence. The H&E stained slides were studied under light microscopy.

Keywords: endodermal cells, follicle, colloid

INTRODUCTION

Thyroid though an organ of very ancient history but does not exhibit evolutionary change, as its histology & endocrine action are similar through out the series of vertebrates. Much of the knowledge regarding thyroid function in the foetus & neonate is derived from rats & sheep so far as the animal species are excellent models of human thyroid gland development & differ mainly in timing of events. The incidence of congenital anomalies like ectopic thyroid tissue, thyroid dysgenesis had been reported throughout the world with a frequency of 1 in 3500. Since the available material is mostly confined to species mentioned, an attempt is made to study the histogenesis of thyroid gland in human foetuses.

MATERIALS AND METHODS

50 Still born foetuses ranging from 11wks to full term constitute the material for present study. Foetuses were dissected & thyroid glands were removed & fixed in 10% formalin. The thyroid glands were subjected to routine histological preparation. The H&E stained slides were studied under light microscopy.

Table 1: Showing the number of fetuses in each group

Age	No.of fetuses
A –Group (11-14 weeks)	32
B- Group (15-24 weeks)	11
C – Group (25-40 weeks)	07

Observations:

11 Weeks:

A solid mass of endodermal cells arranged in cords &strands was observed.

(Fig: 1a &1b)

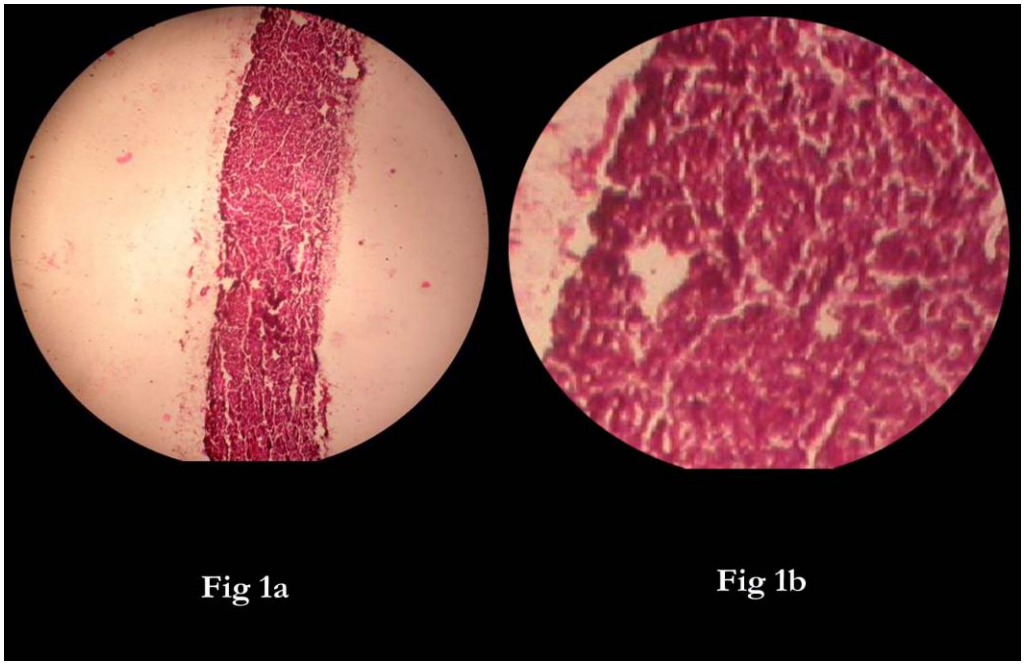


Fig 1a: Showing mass of endodermal cells in microscopic structure of thyroid before differentiation, 11wks G.A, H&E, 10X10.

Fig 1b: Showing mass of endodermal cells in M.S of thyroid, 11wks G.A, H& E, 40x10

12 Weeks:

A complete but thin fibrous capsule surrounded the gland with few septae, leading to the initiation of lobular formation of gland was noted. Aggregation of endodermal cells into follicles of different shapes was the characteristic feature.

Follicles were negative for colloid. (Fig.:-2a & 2b)

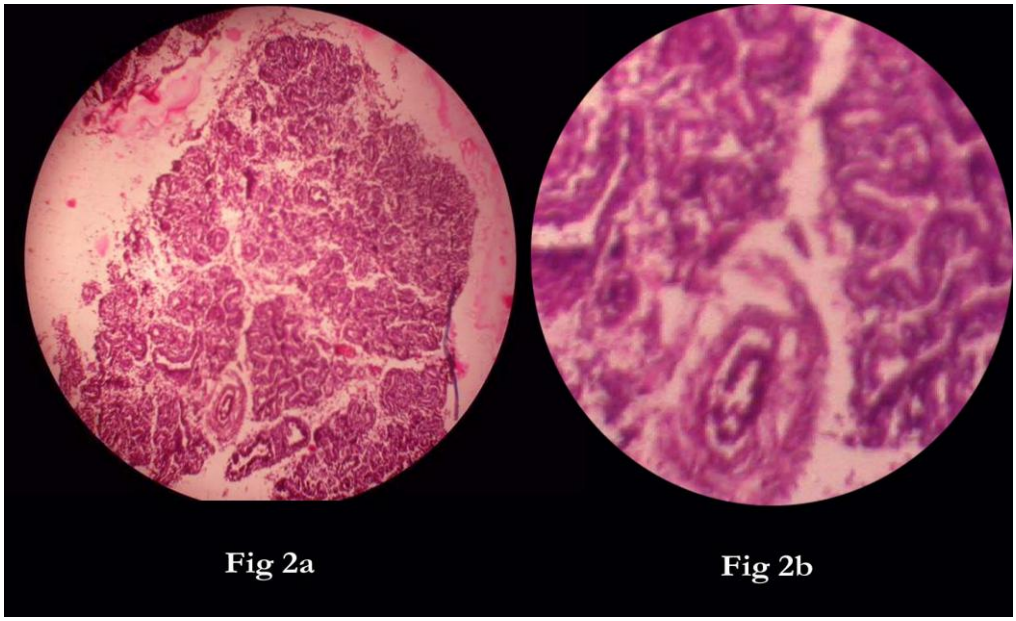


Fig 2a: Showing follicles of various shapes in M.S of thyroid, 12wks G.A, H&E, 10X10.
Fig 2b: Showing follicles of various shapes in M.S of thyroid, 12wks G.A, H&E, 40X10.

13Weeks:

Endodermal cells lined up the periphery of follicles. Cellular outlines were clear. Interfollicular aggregation of cells was yet to be differentiated and process of vascularisation was visualized. (Fig: 3a&3b)

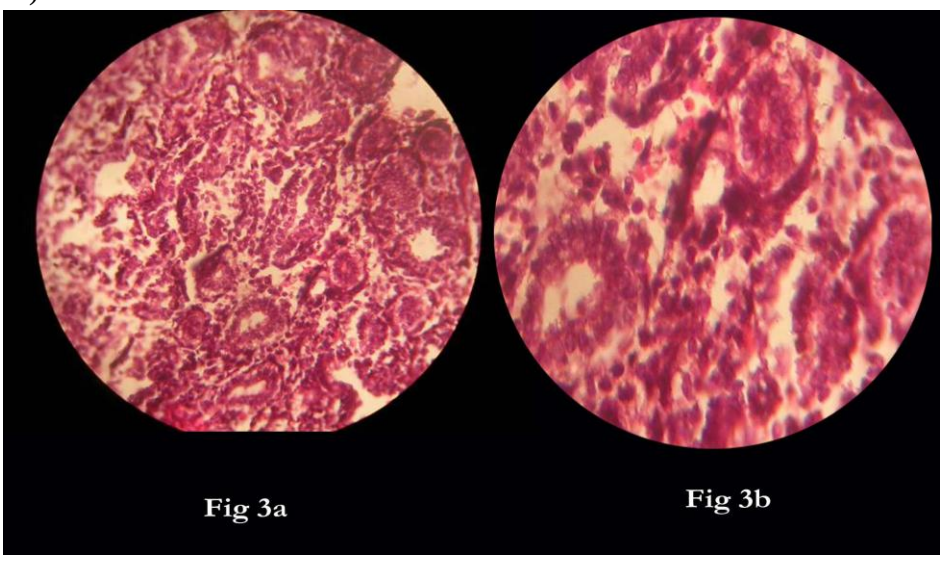


Fig 3a: Showing M.S of thyroid, 13wks G.A, H&E, 10X10.
Fig 3b: Showing M.S of thyroid, 13wks G.A, H&E, 40X10.

20Weeks:

Cell outline was sharper and cuboidal with rounded & blue nuclei.

Follicular lumina were clear and empty without any traces of colloid.

(Fig: 4a&4b)

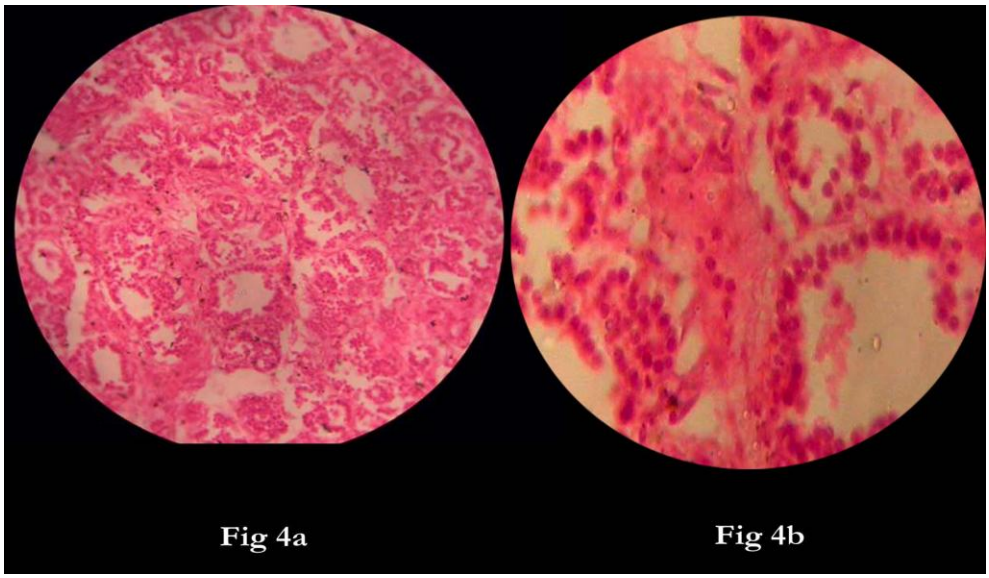


Fig 4a: Showing M.S of thyroid, 20wks G.A, H&E, 10X10.
Fig 4b: Showing M.S of thyroid, 20wks G.A, H&E, 40X10.

25Weeks:

Lobular pattern of gland was the prominent feature. Well developed follicles were lined by active cuboidal follicular cells. Eosin stained colloid occupies follicular lumina.
(Fig: 5a&5b)

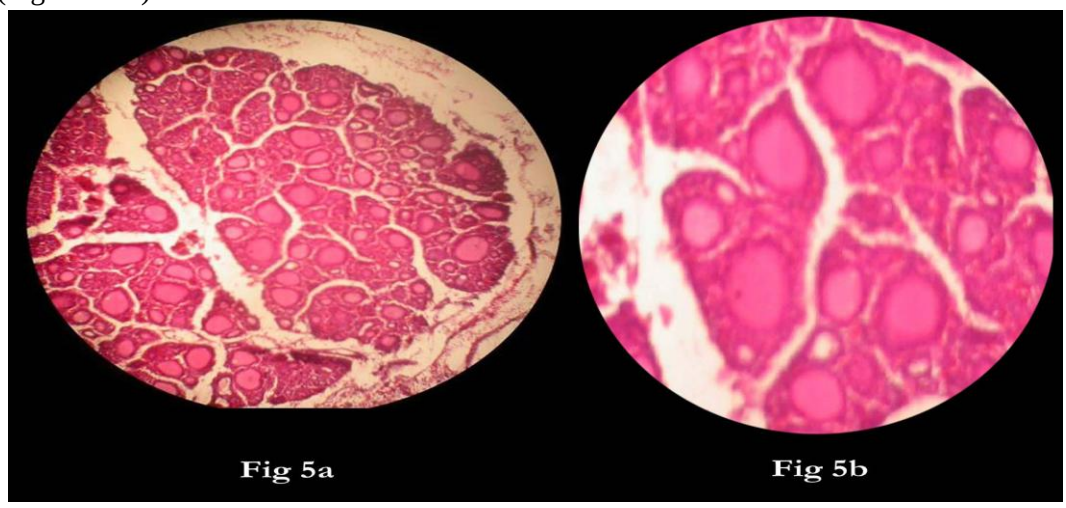


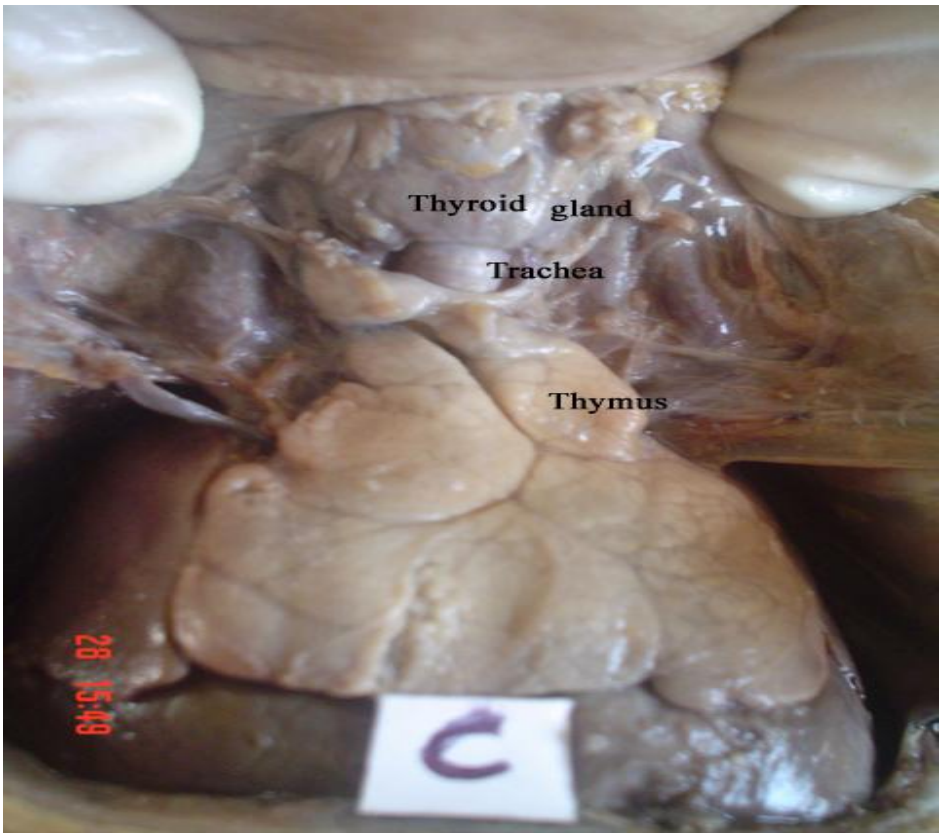
Fig 5a: Showing M.S of thyroid, 20wks G.A, H&E, 10X10.
Fig 5b: Showing M.S of thyroid, 20wks G.A, H&E, 40X10.

26 weeks to 40 weeks:

Gradual increase in the amount of colloid with gradual decrease in the size of the follicles was appreciated in most of the follicles.

Embryology:

Thyroid gland is the first of the body's endocrine glands to develop on approximately 24th day of gestation[1]. Thyroid gland is brownish-red and highly vascular, placed anteriorly in the lower part of the neck (Fig: 6) ensheathed by pre-tracheal layer of deep cervical fascia. Even though thyroid starts its development early, it does not develop synchronously throughout[2].



Thyroid gland appears as an epithelial proliferation in the floor of pharynx between tuberculum impar and copula, then descends infront of gut as a bilobed diverticulum, during this migration thyroid remains as a thyroglossal duct, later disappears. If thyroglossal duct does not atrophy, it manifests as thyroglossal duct cyst, 50% of these cysts generally lie in midline at or just below the level of hyoid bone[3]. By 7th week it reaches its final position infront of trachea by descending downwards infront of hyoid and laryngeal cartilages. Initially thyroid is a down growth of hollow diverticulum having lining of endodermal cells. The cells multiply rapidly and form a solid mass and arranged as cords and strands. The cells mature and develop intracellular canaliculi and contain a thin granular substance. At a later stage the granular substance is coalesced at the center of follicle as a colloid.

DISCUSSION

Hegedus et al [4](1983) have demonstrated the relation ship between thyroid gland volume, as estimated by ultrasound and body weight, age and sex in normal subjects. More recently Ueda[5] (1990) has

correlated thyroid gland volume in children of 8 months to 15 years with height, weight, body surface and age. No significant difference in thyroid was observed between males and females over this age group.

Based on epithelium/ colloid ratio, intra uterine development of thyroid gland may be divided into 3 distinct stages[6]

10-18 weeks: massive folliculogenesis and gradual accumulation of colloid occurs.

19-29th week: Unchanged values of epithelium/ colloid ratio and the size of follicles.

From 29th week: Gradual increase in epithelium/ colloid ratio and a decrease in the size of follicles.

In the present study folliculogenesis has been observed in 1st stage i.e., between 10-18 weeks, without any traces of colloid. By 25th week of gestation colloid was observed in follicular lumina and between 26-40 weeks, there was an increase in the amount of colloid and maturation of follicles has been noted. During 5th month eventhough the pituitary gland is well developed and releases TSH hormone, this is not required for the gross morphological development of thyroid since the development is normal in anencephalic monsters[7]. However TSH is required for the growth of follicles as evidenced by loss of colloid in decapitated foetus [8]. As per the hypothesis of Chapman, E M[9] (1948), Hodges et al [10](1955), the thyroid gland is able to concentrate iodine at 4th month. How ever in the present study the colloid formation in the follicles has been noted by 25th week. Most probably the delay in formation of colloid in fetuses under study may be due to delayed release of TSH from anterior pituitary.

Congenital hypothyroidism is the most common neonatal metabolic disorder and results in severe neurodevelopmental impairment and infertility if untreated. Congenital hypothyroidism is usually sporadic but up to 2% of thyroid dysgenesis is familial, and congenital hypothyroidism caused by organification defects is often recessively inherited[11]. The present study may provide useful information for the prenatal diagnosis and in-utero treatment of thyroid dysfunctions.

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Figure legend:

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Fig 6: Showing thyroid gland in front of neck in 25wksG.A foetus

Abbreviations:

1. G.A: Gestational age.
2. M.S: Microscopic structure.
3. H&E: Haematoxylin and eosin stain.