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Histogenesis of thymus in human foetuses of different gestational ages - A Pilot Study

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Abstract: *Thymus is a primary lymphoid organ playing an important role in the development of immune system by generation of "T- cells". It is a bilobed and encapsulated organ consisting of two pyramidal lobes. Understanding age related changes in the macroscopic and microscopic appearance of the thymus is important in the evaluation of patients with diseases of thymus which are presented as a variety of immune system disorder and hence this study. The present work is the result of pilot study of 15 human foetal thymus obtained from the museum of department of Anatomy, GIMSR, Visakhapatnam. Age of the fetuses ranged from 19-40 weeks Visakhapatnam. The lobulation and cortico-medullary distinction was observed at 19 weeks gestation. Branching blood vessels at cotico-medullary junction and thicker capsule with wider inter lobular septae and Hassall's corpuscles were observed in thymic glands of 21st weeks old fetuses. Hassall's corpuscles which are peculiar nest like bodies with a central mass consisting of more granular cells made their appearance in 26thweek of gestation. Cortex with dense populated lymphocytes is observed. Medulla possessed Hassall's corpuscles of increasing maturity with few lymphocytes in 26thweek of gestation. Similar findings were observed in 30thweeks of gestation. The gland during 34thweek of gestation showed internal architecture of lobulation, septation and cortical demarcation with increased density of lymphocytes and medulla*

Keywords: *Thymus, Cortex, Medulla, Hassall's Corpuscles.*

I. Introduction

The name thymus comes from the Latin derivation of the Greek thymos, meaning "warty excrescence" due to its resemblance to the flowers of the thyme plant. The earliest known reference to the thymus is attributed to Rufus of Ephesus circa 100 A.D, a Greek anatomist renowned for his investigations of the heart and eye. Rufus attributed the discovery of the thymus to the Egyptians. Hassall AH and Vanarsdale H (1846) used recent improvements in compound microscope lens quality to study the thymus more thoroughly. Hassall's famous corpuscles were thus named. They also described differences between the thymus and other lymphoid tissues. Thymus is a primary lymphoid organ playing an important role in the development of immune system by generation of "T- cells". It is a bilobed and encapsulated organ consisting of two pyramidal lobes. It is located in the mediastinum behind the sternum and in front of the pericardium and great vessels of the heart in the adult. Embryologically, the thymus is derived from all 3 germinal layers and arises primarily from the third pharyngeal pouch.Thymus development commences early during fetal life, with the most critical period of growth thought to occur between 7 and 14 weeks of gestation. The thymic organogenesis begins at the third branchial pouch and the first lymphocytes appear in the thymus during ninth week of gestation[Jeppensen et al, 2009]. The paired epithelial primordia of thymus develop from the ventral part of 3rd pharyngeal pouch along with inferior parathyroid primordia in the region of superior neck in early fetal life. It progressively descends caudally with the descent of heart and aortic sac to reach final destination in the superior mediastinum.

II. Aim Of The Study

Understanding age related changes in the macroscopic and microscopic appearance of the thymus is important in the evaluation of patients with diseases of thymus which are presented as a variety of immune system disorder.

III. Materials And Methods

The present work is the result of pilot study of 15 human foetal thymus obtained from the museum of department of Anatomy, GIMSR, Visakhapatnam. Age of the fetuses ranged from 19-40 weeks Visakhapatnam. The age of foetus is judged by CR length.

The preserved fetuses in the jars of the museum were taken out, a window shaped incision was made in the region of superior mediastinum and thymus was observed and removed.

The human fetuses were categorized into groups.

- ✓ 1rd group – 19 to 25 weeks
- ✓ 2nd group - 26 to 32 weeks
- ✓ 3rd group – 33 to 40 weeks

The thymus was subjected to histological studies & observed under H&E stain..

IV. Observations

The lobulation and cortico-medullary distinction was observed at 19 wks gestation.

Each lobule had a peripheral dark zone called cortex and a light central zone called medulla.Medulla was recognized by its light stain containing WBC and epithelial cells (Fig.1). Branching blood vessels at cotico-medullary junction and thicker capsule with wider inter lobular septae and Hassall's corpuscles were observed in thymic glands of 21st weeks old fetuses (Fig.2).

Hassall's corpuscles which are peculiar nest like bodies with a central mass consisting of more granular cells made their appearance in 26thweek of gestation (Fig.3). Cortex with dense populated lymphocytes is observed. Medulla possessed Hassall's corpuscles of increasing maturity with few lymphocytes (Fig.4) in 26thweek of gestation. Similar findings were observed in 30thweeks of gestation (Fig.5).

The gland during 34thweek of gestation showed internal architecture of lobulation, septation and cortical demarcation with increased density of lymphocytes and medulla (Fig.6).

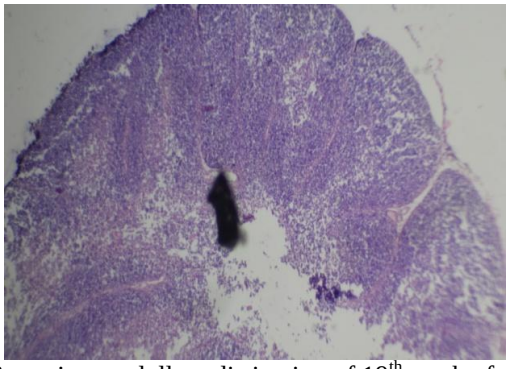

Fig.1- Lobulation & cortico-medullary distinction of 19th week of gestation (4X H&E)

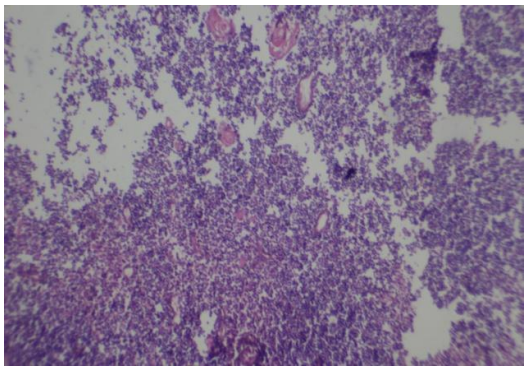

Fig.2 - Branching blood vessels at cotico-medullary junction of 21 week gestation(10X H&E)

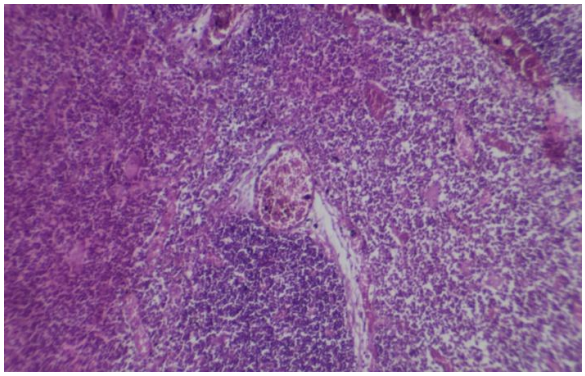

Fig.3 - Hassall's corpuscles with a central mass consisting of more granular cells made their appearance in 26th week of gestation (40X H&E)

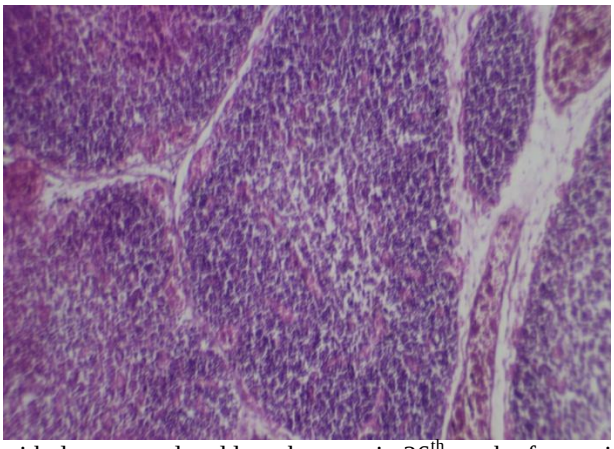

Fig.4 - Cortex with dense populated lymphocytes in 26th week of gestation.(10X H&E)

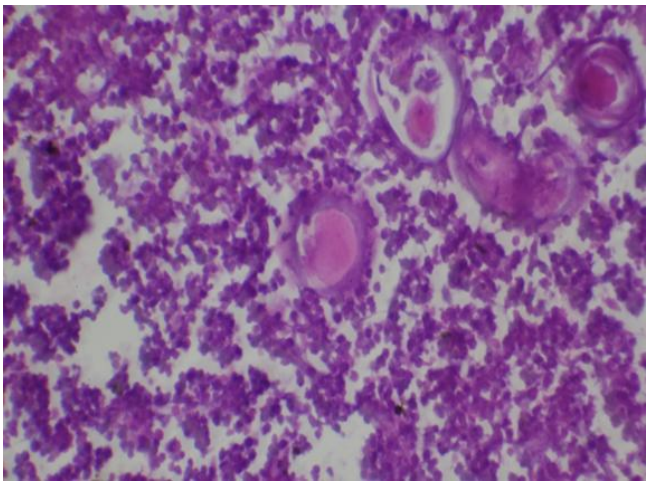

Fig.5 - Medulla possessed Hassall's corpuscles ofincreasing maturity with few lymphocytes in 30th weeks of gestation (40X H&E)

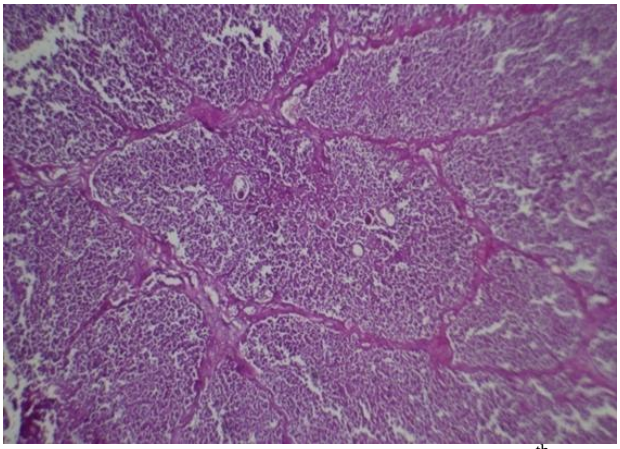

Fig.6- showing density of lymphocytes and septae of foetal thymus in 34th week of gestation (4X H&E)

V. Discussion

Thymus gland finds it's pathway of descent from 3rd branchial arch. During the 6th week of gestation, epithelial out pouching from the ventral aspect of 3rd pharyngeal pouch arch starts to develop and move caudally forming what is known as thymo pharyngeal duct. Inferior parathyroid also develops from 3rd pharyngeal pouch. There was a very minor and rudimentary portion of thymic tissue which develops from ventral aspect of 4th pouch.

Cortex-medulla differentiation and early stage of formation of Hassall's corpuscles were observed at 14 -16 weeks gestation and Varga etal (2011), reported cortico-medullary differentiation at 13th week. The study in

west Bengal region of India by Ajita etal (2006), who reported cortico-medullary differentiation at 9-11 weeks and Varga et al, (2011), reported noticeably wide interlobular septa at 14-16 weeks. In the present study, lobulation and cortico-medullary differentiation of the thymus was observed at 19th week of gestation. Good number of relatively large Hassall's corpuscles, branching blood vessels at cotico-medullary junction and thicker capsule with wider inter lobular septae were observed inthymic glands of 20-24 weeks old fetuses by Bodey, Siegel et al (2000). However, in the present study, these were observed at 21 week of gestation.

The first developing Hassall's corpuscle was reported at 13thweek by Varga et al. and 15th week by Ajita et al, (2006). They are seen as epithelial pearls of different sizes and shapes as reported by Saradha Kathiresan (2007). In the literature there are varying reports on the time of appearance of Hassall's corpuscle as early as 8thweek (Fawcett, 1994), 9th week (Gilhus et al, 1985), at 10thweek (Williams et al, 1995), at 11th week (Ghali et al, 1980), between 15th and 16th week (Lobach D F, and Haynes B F, 1987). Liberti et al, and Varga et al, reported these findings at 16-18 weeks. In the present study Hassall's corpuscles were observed at 19th week of gestation. Liberti et al, (1994) reported that the mean areas of the Hassall's Corpuscles increased with the foetal age, with the greatest observable difference between 20th to 23rdweeks. According to Valdes (1957), Shah et al, (2005), Hassall's Corpuscles increased in number and size during 17th to 24th week. Between 26th weeks to full term the hyalinization and keratinization of Hassall's corpuscles and "Starry sky appearance" at cortico-medullary junction. Similar findings were observed in the present study.

VI. Conclusion

This being a pilot study conclusion could not be derived at his level.

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