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Original Research Article

A STUDY ON HISTOGENESIS OF THYMUS GLAND IN FETUSES

D. Sudhakar Babu *, M.Padmavathi, V.Sailaja.

Assistant Professor, Department of Anatomy, Osmania Medical College, Hyderabad, Telangana, India.

ABSTRACT

Aims and Objectives: To study the histology of Thymus gland which is one of the primary lymphoid organs present in the upper mediastinum, beneath the sternum & to evaluate the immunodeficiency of an individual and autoimmune diseases like Myasthenia gravis, Lupus erythematosis, Rheumatoid arthritis, as these are more likely to lead to thymus cancer.

Materials and Methods: The present study has been undertaken on thymus specimen of 100 fetuses of different age groups. The fetuses were obtained from the King George Hospital and Victoria Government hospital, Vishakapatnam.

Results: In the present study normal micro architecture of thymus has been studied at various fetal ages in chronological order.

Conclusion: Thymus is responsible for the provision of the T-lymphocytes to the whole body in newborns and children until puberty. For this reason it is important to know the histology of the gland at different ages.

KEY WORDS: Thymus, Histology, Lymphocytes.

Address for Correspondence: Dr. D. Sudhakar Babu, MD (Anatomy), Department of Anatomy, Assistant Professor, Osmania Medical College, Hyderabad, Telangana, India.
E-Mail: drsudhakarbabu123@gmail.com

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INTRODUCTION

The thymus is a primary lymphoid organ found within the superior mediastinum, behind the upper part of sternum [1,2]. It is a bi-lobed organ, the lobes being unequal in size. Thymus produces thymic hormones that support the growth and differentiation of T-cell progenitors. It produces unique environment in which the T-cell precursors (Thymocytes) undergo development, differentiation and clonal expansion. In addition to secreting thymic hormones, the adult thymus primes thymocytes before releasing them to the periphery [3].

It has two lobes divided into many lobules. The outer, darkly stained region is the cortex and this is highly cellular. The inner, lightly stained region is the medulla with less cellularity. It has outer connective tissue capsule and septa.

The epithelial network in the cortex is more finely branched than in the medulla and this network gives the name, reticular. The epithelial cells are connected to each other by desmosomes and the intermediate filament protein keratin is present in their cytoplasm. Hassall's corpuscles are made up of flat, non secreting epithelial cells arranged in concentric layers that are keratinized.

The T-cell progenitors proliferate in the outer

cortex. Unlike the other lymphatic organs, the thymus does not filter lymphatic fluid. Its primary function involves producing an array of histologically specialized cells vital to immune response.

MATERIALS AND METHODS

The present study has been undertaken on thymus specimen of 100 fetuses of different age groups. The fetuses were obtained from the King George Hospital and Victoria Government hospital, Vishakapatnam, Andhra Pradesh, India.

One specimen of thymus gland of the age of -15 years was taken from the department of forensic medicine. (The fetuses were weighed and their Crown - Rump lengths were measured. This was done to calculate the fetal age as per the description of Hamilton, Boyd and Mossman [4].

The thymus glands were removed and kept on jars containing 10% formalin. The glands were subsequently weighed.

Tissue processing for Histological Study: The tissue of thymus gland of 2mm thickness was taken and was kept under running tap water to thoroughly wash the formalin. Then tissue was passed through ascending grades of alcholols - 50%, 70%, 80%, 90%, and absolute alcohol as per the standard histological tissue processing.

Embedding: Embedding of tissue in paraffin was done by using Leuckhart embedding box consisting of two L - shaped pieces of brass resting on a glass plate. Later the blocks were allowed to cool at room temperature. Sectioning was done on Spencers rotary microtome at 6 microns thickness and mounted on slides smeared with egg - albumen - glycerol. The slides were allowed to dry at room temperature over night. Later they were stained with Haematoxylin and eosin.

Staining Procedure:

Haematoxylin and Eosin Method: Paraffin was removed by warming the slides with a burner and then treating them with xylol for 3-5 minutes. Xylol was removed by passing the slides through descending grades of alcohols 100%, 90%, 80%, 70% and 50%. They were then rinsed in water and stained with haematoxylin solution for 2-3 minutes. Slides were kept in running tap water till the sections became “blue’ and they were then counter stained with eosin solution for 30-40 seconds. They were then rinsed in water, dehydrated by passing through the ascending grades of alcohol, cleared with xylol, mounted with DPX [5].

Photomicrography: The photomicrographs of sections were taken at 40x, 100x and 400x magnifications using Labomed self illuminating binocular microscope and mercury digital camera. Later the camera was connected to a computer and copies of photographs were obtained.

One section of thymus of each age was selected and studied for the following features.

Capsule, Inter Lobular septa, Cortex and medulla demarcation, H.C diameter, Lobule diameter, Inter lobular connective tissue, Arrangement of cells.

OBSERVATIONS

Histogenesis and Cyto Architecture of Thymus: Well defined capsule was present at all ages (Figure 1). The cortex and medulla were well demarcated with the advancement of age. Lobules formed with the intervening interlobular septa, containing blood vessels, were seen at all ages (Figure 2). Epithelialization of medulla was observed from 34 weeks onwards. At the age of puberty interlobular connective tissue is seen with more adipose cells.

Table:1: Cytoarchitectural parameters of Thymus at different fetal age groups.

S.No.	Age in weeks	Avg. diameter of each lobule in µm.	Avg. diameter of H.C. in µm.	Avg. number of H.C. in lobule
1	18	0.4	29	2
2	22	0.4	29	2
3	24	0.5	30	3
4	25	0.6	34	5
5	26	0.6	38	5
6	27	1	39	6
7	28	1.3	38	7
8	29	1.2	40	8
9	30	1.4	43	8
10	31	1.3	48	8
11	32	1.5	45	7
12	33	1.7	54	8
13	34	1.6	61	8
14	35	1.8	72	8
15	Puberty	2	94	9

Fig. 1: Image showing well defined fibrous capsule (18 weeks) (H&E 40X).

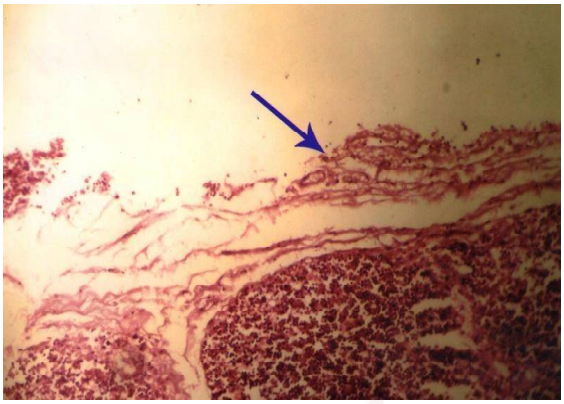
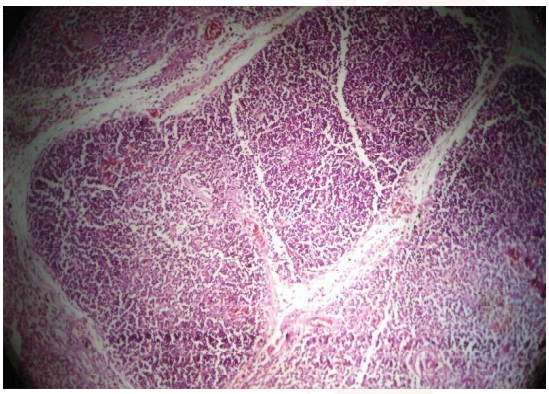


Fig. 2: Image showing well defined lobules with interlobular septa (22 weeks) (H&E 40X).



DISCUSSION

Histogenesis of thymus gland in general has been studied extensively by using various techniques starting with simple histological techniques with light microscope to recent immuno histochemical and computer analysis technique by the earlier workers, [6] to recent workers [7].

The differentiation of the thymic medulla and cortex occurs in embryos of about 40 mm C.R length. The former arises in the central part of the gland and in the deep portion of the lobules by hypertrophy of the cytoreticulum accompanied by degeneration or migration, of thymocytes. Later Hassall's corpuscles appear as differentiation of the cytoreticulum [4].

When sectioned, the thymus is seen to consist of an outer cortex of densely packed cells mainly of the T - lymphocyte lineage, the thymocytes, and an inner medulla rich in connective tissue but with fewer lymphoid cells. Both lobes have a loose fibrous connective tissue capsule, from which septa penetrate to the junction of cortex and medulla, to partially separate the irregular lobules each 0.5 to 2.0 µm in diameter.

Hassall's corpuscles are balls of flattened medullary epithelial cells from 30 to 100 µm in diameter. They start to form before birth and their number increases until puberty and then decreases [7] (Figure 3).

Their function is not clear, although in the past it has been suggested that they are graveyards for thymic cells [8] or regions where immunoglobulins are concentrated.

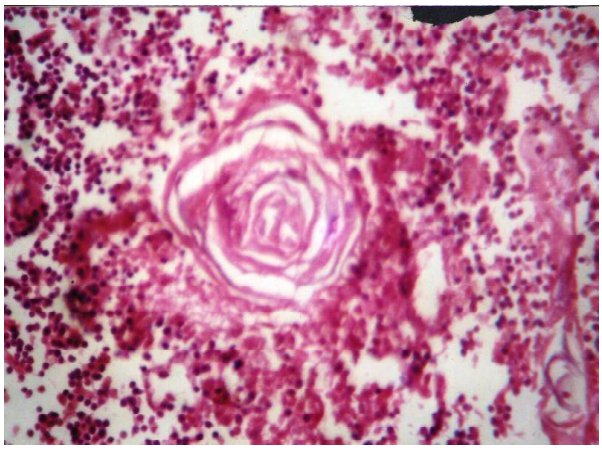
The present study demonstrated that, at 18 weeks - the section showing - the cortex and medulla are well demarcated. Capsule is well defined. The diameter of lobule is 0.4 µm and diameter of H.C is 29 µm the average number of H.C per lobule is 2 to 3.

At 34 weeks, the section showed well defined capsule and cortex and medulla are well defined. The average diameter of lobule is 1.6 µm and diameter of H.C is 61 µm and the average number of H.C per lobule is 7 to 8.

At pubertal age, the section showed well defined capsule, cortex and medulla were well demarcated. Interlobular connective tissue is more with some adipose tissue. The average diameter of lobule is 2 µm and average diameter of H.C is 94 µm and average no of H.C per lobule is 8 to 9.

The diameter of lobule is ranging from 0.4 to 2 µm and diameter of H.C ranging from 29 to 94 µm and there is gradual increase in thickness of interlobular connective tissue with some adipose cells observed at puberty.

Fig. 3: Image showing Hassall's corpuscle (32 weeks) (H&E 80X).



CONCLUSION

There is clear demarcation of capsule and inter lobular septa with the advancement of age of

fetuses. There is clear demarcation of lobules with the advancement of age of fetuses. Blood vessels in the interlobular septa became prominent with advancement of age of fetuses. Cortex and medulla are well demarcated at age of 18 weeks. Diameter of lobules is ranging from 0.4 to 2 µm. Number of H.C is lobule increased with advancement of age. Inter lobular connective tissue increased with advancement of age. The diameter of H.C is ranging from 29 to 94 µm. Demarcation of cortex and medulla is very clear with advancement of the age of fetuses.

ABBREVIATIONS

HC- Hassall's Corpuscle

CR- Crown-Rump

µm- Micro meter

Conflicts of Interests: **None**

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