Morphohistological Study of Thymus of an Adult Cadaver

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Research Article

Abstract: Thymus is a bilobed gland situated in superior and anterior mediastinum. Thymus normally undergoes involution after puberty and is replaced by fibrofatty tissue. **Objective:** To study morphohistology of human thymus gland of an adult cadaver. To compare our findings with previous related literature. **Materials and Methods:** Thymus was obtained from an adult male cadaver during routine dissection of thorax region. Histology was studied to see the age changes in persistent human adult thymus. **Conclusion:** In the present study the morphohistological features of an adult thymus are studied. The knowledge is important for clinicians and radiologists for the differential diagnosis of mediastinal mass, neck mass (ectopic thymic tissue) before doing any investigative procedure.

Key Words: thymus, involution of thymus, age changes in thymus, persistent thymus.

Introduction

The word thymus comes from the Latin derivation of the Greek word thymos, meaning "warty excrescence." Because thymos also means "soul" or "spirit," the thymus was misrepresented as the seat of the soul by ancient Greeks. Galen of Pergamum (130-200A.D.), who first noted that thymus was proportionally largest during infancy, referred to the thymus as the "organ of mystery"[1]. Thymus is one of the primary lymphoid organs in body, the other being the bone marrow [2]. Thymus plays crucial role in cellular immunity by generating circulating T lymphocytes. It is soft, bilobed organ and its two parts lie close together side by side, joined in midline by connective tissue that merges with capsule of each lobe. It is situated in superior and anterior mediastinum, behind sternum, just anterior to pericardium and great vessels and extends from pericardial sac caudally to root of the neck up to the inferior pole of thyroid gland cranially [3]. The thymus attains its greatest relative weight at the end of fetal life, but its absolute weight continues to increase reaching 30 to 40 gms at about the time of puberty. It then begins to undergo involution which progresses rapidly until in adult the organ is largely replaced by adipose cells and connective tissue [3]. It is an endocrine gland (ductless) and is most active during puberty. It produces hormones that enhance the strength of immune system. During neonatal and early postnatal life thymus is essential for normal development of lymphoid tissue. The appearance and size varies with age and physiological state. It is one of the earliest glands to start involution after 15 yrs of age (puberty) [4].Though the involution is said to start at puberty, it actually starts in early childhood [3]. It can either undergo atrophy or can persist abundantly than usual. It may be replaced by connective tissue and adipose tissue and form a discrete and well formed thymus as a gross organ even though histologically contain little thymic tissue[5]. Age associated changes seems to be reversible[4]. A reduction in thymic function results in greater susceptibility to tumours, rheumatic diseases, growth disorders, general geriatric conditions.

Materials and Methods

The present study was conducted in department of anatomy, B. J. Government Medical College, Pune, Maharashtra, India. The study was conducted on the thymus from 70 yr old male cadaver obtained during routine dissection of thorax. When thoracic cage was opened, the thymus was situated in superior and anterior mediastinum retrosternally in front of pericardium and roots of great vessels and was extending up to the lower pole of left lobe of thyroid gland in neck. The thymus was a bilobed gland[6].

The morphometric features of thymus were noted.

Weight of thymus gland – 35gms

Length –from upper pole to lower pole of the gland

Right lobe - 12 cm

Left lobe - 10 cm

Width of each lobe –

In superior mediastinum- 4cm

In anterior mediastinum- middle part - 5cm

lower part – 4.8 cm

The extension from left lobe of the thymus to lower pole of left lobe of thyroid gland was 3.5cm.

The blood supply was noted as a branch coming from internal thoracic artery.

The gland was kept in 10% formalin. 3-4 pieces of the gland tissue were obtained from different areas of the gland. After paraffin embedding, sections of 5 micron thickness were obtained. The sections were then stained with Haematoxylin & Eosin stains and examined under microscope under 100X and 400X magnification .

Observations and Result

The microscopic study shows –

1) 100X magnification - Shows most of the field is studded with adipose tissue and at places fibrous tissue is seen. Few blood vessels are observed in section. At places capsule is seen but it is thick due to fibrosis.
   Few lymphatic islands are observed at places but altogether distorted. Cortical and medullary region cannot be demarcated or histologically demonstrated. At places few portions of adipose and fibrous tissue are seen.
2) 400X magnification – Few Hassal's Corpuscles are seen . They are small in size and made up ofepitheliocyte like cells. It suggests degenerative aspect and shrinkage of Hassal's Corpuscles.

Discussion

Thymus develops from 3rd pharyngeal pouch during 6th wk of intrauterine life. Also gets very minor contribution from 4th pharyngeal pouch. It descends caudally forming thymopharyngeal duct. During 7th wk thymic primordia elongate and grow caudally and meet with opposite fellow thymic rudiment in front of aortic sac[4]. Initially both ventral and dorsal wing of this pouch communicate with primitive pharynx by superior pharyngobranchial duct. Eventually the duct disappears [7,8]. Descent of heart and caudal migration of aortic sac leads to caudal migration of thymic rudiments [7,8,9]. Many workers have studied involution in thymus. Thymus is an epithelial organ infiltrated with lymphocytes. It persist and functions even until old age. Though it is largely replaced by adipose cells, the lymphoid tissue that remains retains the function [3]. Regarding age related changes in weight, weight increases through increasing age group and then declines [10]. According to Raju Sugavasi *et al*, age related changes were - increased capsular thickness, separation between lobules not well demarcated and interlobular septae disappeared. The Hassal's Corpuscles were less in number, large in size and diameter. Parenchyma was arranged as small islands between replaced connective and adipose tissue [8]. According to M. Raica *et al* [11] involutionary changes include thymic tissue organized as islands and cords surrounded by adipose tissue. Lobular architecture was lost. Involution changes were seen even before puberty. 1st sign of involution – cortical lymphocyte depletion that leads to lymphocyte inversion with relative high density in medulla. Medulla was more intensely stained than cortex and was last to involve in the process of involution. Severe degenerative changes of Hassal's Corpuscles were seen. Lymphocyte depletion was associated with focal concentration of epithelial cells - either as anastomosing cords or form conglomerates. According to Flores *et al*, the thymic PVS- perivascular space increases with age in normal subjects and in myasthenia gravis patients. This increase in PVS volume is accompanied by accumulation of lymphocytes and adipose tissue within the PVS[12]. Normally perivascular infiltration with lymphocytes occurs in aging thymus. TES-thymic epithelial space decreases as PVS increases. According to Jayanti Singh and A.K.Singh *et al*, the organization of the parenchyma into cortex and medulla was preserved in spite of marked atrophy and cellular elements remained predominantly lymphoid. These lymphoid cells underwent changes. E-rosette forming cells progressively decreased and were replaced by an increasing proportion of cells devoid of 3 principal surface markers. The changes were independent of each other. 'Null cells' were undifferentiated. T lymphocytes seen were with no distinct surface markers [13]. According to Simpson *et al* [14] both the components of the lymphoid parenchyma of the thymus atrophy with age, the cortex at a slightly faster rate than the medulla. In both sexes, medullary atrophy was regular and linear. The sex difference in age involution of the cortex is linear in males and biphasic in females interrupted by a premenopausal rise at mean age 42 years. The difference is probably due to susceptibility of the cortex to hormonal influences. In the present study morphohistological features of persistent adult thymus are studied. The findings are similar to most of studies from the previous literature viz. Raju Sugavasi *et al*, M. Raica *et al*, Flores *et al*.

Conclusion

In the present study we have discussed the embryological and morphohistological features of a persistent adult thymus. This knowledge of anatomy and embryology is important for clinicians and radiologists to diagnose mediastinal mass and locate the ectopic thymic tissue in the pathway of descent of thymus.

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Figure 1: Shows Morphology of thymus 1. Right lobe of thymus 2. Left lobe of thymus 3. Extension from left lobe of thymus to left lobe of Thyroid, 4,5 – Branch from internal thoracic artery

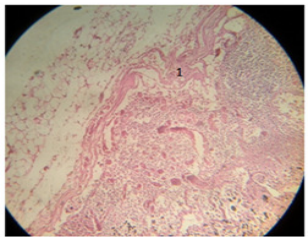

Figure 2: Histology of thymus under 100X magnification shows 1-Increased capsular thickness, No corticomedullary demarcation

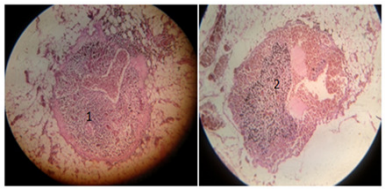

Figure 3: Histology of thymus under 100X magnification shows 1,2-Island of thymic parenchyma in the midst of adipose tissue

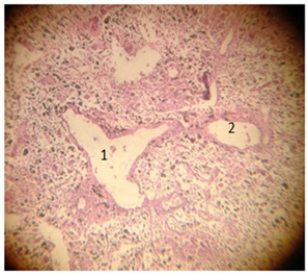

Figure 4: Histology of thymus under 100X magnification shows 1,2- Blood vessels with perivascular infiltration of lymphocytes

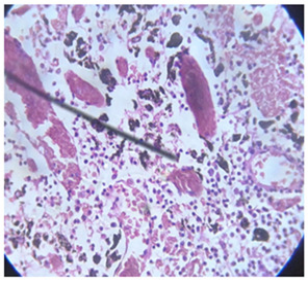

Figure 5: Histology of thymus under 400X magnification shows Hassal's Corpuscles