



Contents lists available at BioMedSciDirect Publications

International Journal of Biological & Medical Research

Journal homepage: www.biomedscidirect.com



Original Article

Morphological features of human thymus glands from foetal to old age

*Dr.Krishna Murthy JV, ^aV.Subhadra Devi

Assistant Professor, Department of Anatomy, Sri Muthukumaran Medical College Hospital and Research Institute, Chikarapuram, Chennai-69,
Professor and Head, Department of Anatomy, S.V Medical College, Tirupati-517501, Andhra Pradesh, India

ARTICLE INFO

Keywords:

Primary lymphoid organ
Cervical extensions
Primordia

ABSTRACT

ABSTRACT Thymus is a primary lymphoid organ and plays an important role in strengthening the immune system. A total of 53 thymus glands of human cadavers of both sexes, normal and abnormal individuals and pre and post natal age group were observed for morphological features. The gland was located in superior mediastinum or in both superior and anterior mediastinum. Eleven different types of cervical extensions of thymus were observed. The prenatal and prepubertal glands were pyramidal in shape while post pubertal were flat. The prenatal thymuses were pink grey to brown in color and postnatal varied from white grey to yellow. Most of the glands had two lobes while a few were with three or four. The growth of thymus was maximum at pubertal age. A regression in thymus was observed at the age of 20 years that was exaggerated at 55 years of age.

© Copyright 2010 BioMedSciDirect Publications IJBMR -ISSN: 0976:6685. All rights reserved.

1. Introduction

Thymus is a ductless gland and therefore belongs to the endocrine system and it produces hormones that enhance the strength of immune system. During neonatal and early postnatal life thymus is essential for the normal development of lymphoid tissue. As an endocrine gland it is most active during puberty. A reduction in thymus function results in greater susceptibility to tumors, rheumatic disease, growth disorders and general geriatric conditions [1]. The appearance and size of thymus varies with age and physiological state. It is one of the earliest glands to start involution after 15 years of age. Age associated involution seems to be reversible and increases the possibility of therapeutic strategies aimed at improving thymus function in the elderly.

Thymus consists 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. The primordia of thymus develop in the region of superior neck in early fetal life and reach final destination in the mediastinum by progressive descent. During the descent, thymic tissue may be occasionally implanted along the cervical pathway and appear as ectopic thymus. There are limited reports on variations in thymic anatomy and there were no

studies on morphological parameters of wide age range of prenatal to old age. Therefore the present study was carried out on a sample of thymus glands collected from pre and postnatal cadavers of different age groups.

2. Materials and methods

A total of 53 thymuses were observed in the dead fetuses and adult cadavers by careful dissection of front of neck and superior mediastinum. 43 dead fetuses of both the sexes were collected from the Government Maternity Hospital and 10 adult thymus glands were collected at autopsy with the consent of the next of kin from the Forensic Medicine department and from the embalmed cadavers used for routine student dissection at the Department of Anatomy. During collection of the specimen special search was made for the extension of thymic lobes cranially up to angle of the mandible. Any accessory thymus gland tissue or ectopic gland, if present, was also separated. Observations on the thymus gland regarding number of lobes, presence of ectopic tissue, accessory lobes and extension of thymus were recorded. All variations were photographed.

Thymus specimens were categorized into prenatal and postnatal groups depending on their age. The prenatal thymuses were categorized into less than 16 weeks of gestational age and above 16 weeks to full term. The postnatal thymuses were divided into two groups as those belonging to pre pubertal i.e., less than 16years and post pubertal (>16 years) ages.

* Corresponding Author : Dr. V.Subhadra Devi

Professor and Head
Department of Anatomy
S.V Medical College
Tirupati-517501
Andhra Pradesh, India
E.mail: sdvelichety@hotmail.com

3.Results

A total of 53 thymus glands were collected from cadavers of prenatal (14 weeks to full term) and postnatal (5 to 55 yrs) age groups. The distribution of these specimens in different age groups, sexes, normal and abnormal categories is shown in tables 1-3.

There were 15 abnormal cases in the pre-natal group and 2 in the postnatal group (Table 1). Among fifteen abnormal prenatal cases in 10 cases there is bad obstetric history and in the remaining 5 cases the fetuses presented external abnormalities.

Table 1: Prenatal and Postnatal Specimens of Thymus

	Male		Female		Total
	Normal	Abnormal	Normal	Abnormal	
Prenatal	15	5	13	10	43
Postnatal	4	1	4	1	10
Total	19	6	17	11	53

Table 2: Prenatal Thymus Specimens (Age wise & Sex wise Distribution)

Gestational Age in Weeks	Male			Female			Grand Total
	Normal	Abnormal	Total	Normal	Abnormal	Total	
0-16 wks>	2	-	2	1	-	1	3
16 wks	13	5	18	12	10	22	40
Total	15	5	20	13	10	23	43

Table 3: Postnatal Thymus Specimens (Age wise & Sex wise)

Age in Years	Male			Female			Grand Total
	Normal	Abnormal	Total	Normal	Abnormal	Total	
0-16 yrs>	1	-	1	3	-	3	4
16 yrs	3	1	4	1	1	2	6
Total	4	1	5	4	1	5	10

Table 4. Morphological Features of Normal Thymus Gland

Category	Age	No	Shape	No. of lobes	Color of the gland
Male					
Prenatal	0-16 wks	2	Pyramidal	2	Pink grey to brown
Postnatal	> 16 wks	13	Pyramidal	2-4	Pink grey to brown
	0-16 yrs	1	Pyramidal	2	White grey to yellow
	>16 years	3	Flat	2	White grey to yellow
Female					
Prenatal	0-16wks	1	Pyramidal	2	Pink grey to brown
	> 16wks	12	Flat to	2-3	White grey to yellow
	0-16 yrs	3	Pyramidal	2-4	White grey to yellow
	>16 yrs	1	Flat	2	

Table,5 Distribution of Anatomical Variations of Thymus Glands

Variations	Number of cases
Accessory Thymus (Fig.1)	7
Thymus above Thyroid (Fig.2)	3
Accessory lobes (Fig.3)	14
Feathery margins (Fig.4)	1
Thymus behind innominate vein (Fig.5)	1
Fibrous band connection to thyroid (Fig.6)	10
Thymus extension upto Diaphragm (Fig.7)	5
Cervical Extensions of Thymus (Fig.1,3,6)	40

3.Results

Table. 6. Various types of cervical extensions

Cervical extension of Thymus	Number of Cases
1. Up to suprasternal notch	8
2. Above suprasternal notch	4
3. Up to middle of the neck	2
4. The Lower pole of thyroid gland	7
5. Isthmus of Thyroid gland	5
6. Up to right lobe of thyroid gland	9
7. Up to left lobe of thyroid gland	1
8. Left lobe of Thymus above thyroid	1
9. Right lobe of thymus up to thyroid and left lobe above thyroid gland	1
10. Thymus up to the isthmus of thyroid in midline and left lobe up to left thyroid cartilage	1
11. Thymus extending above left thyroid cartilage	1
Total	40

Those with external abnormalities included two cases of anencephaly, one case of OEIS complex (Omphalocele, Exstrophy of cloaca, Imperforate anus, skeletal abnormalities), one case of meningocoel, and a macerated fetus with ascitis. Among the post-natal specimens, one was a case of death due to gas burns and the other was a suspected case of cerebral malaria or hepatic encephalopathy leading to cardio respiratory failure. Death in the remaining cases was due to traffic accidents. All the pre-natal and two of the postnatal thymus glands were pyramidal in shape (table 4). Both of the pyramidal thymus glands were observed in less than 16 years age group. Remaining 8 postnatal specimens were flat. The colour of the thymuses were pink grey to brown in pre-natal period and white grey to yellow in post-natal period. Thirty nine of the thymuses presented two lobes, seven had three lobes and the remaining seven exhibited four lobes. Eight different types of gross anatomical variations were observed in the present study (table.5).

Among 43 prenatal 21 male and 18 female specimens showed cervical extension. The cervical extensions ranged from suprasternal notch to the level above the thyroid cartilage. In postnatal specimens, thymus was found extending up to suprasternal notch only in two female cadavers. Eleven different types of cervical extension observed in the present study are summarized (table.6).

In the 43 prenatal and all the postnatal specimens thymus was located in the superior mediastinum or in the superior and anterior mediastinum. In 5 of these prenatal specimens right lobe of the thymus extended upto diaphragm. In one of these 5 specimens left lobe was anterior to the right lobe. In this specimen left lobe was located in the superior mediastinum and did not extend either to the anterior mediastinum or diaphragm. In this specimen although the thymus appeared as a single lobe, on careful examination after separating the capsule, a small left lobe was found in front of the right lobe, which extend deep to the left lobe. When the left lobe was carefully retracted the right lobe was found to extend behind the left innominate vein, which partially covered the right lobe.

4.Discussion

Published literature on thymus is on clinical and immunological aspects [2-5] and on ultrasonographic and radiological studies [6]. There is no reported literature on morphological parameters of a wide range as was done in the

present study on local population. Those that were reported in literature were not based on large sample study. In the present study all the prenatal and pre-pubertal thymus glands were pyramidal in shape as was reported earlier [7]. Similarly all the post-pubertal specimens showed flat thymus glands an observation that corresponded to earlier observations [8].

In the literature there is no clear cut description to distinguish cases of ectopic thymus and mediastinal thymus with cervical extensions though it was mentioned cervical ectopic thymus as a common embryological anomaly that is diagnosed incidentally at autopsy [5].

Abnormal position of thymic tissue was reported in 34 out of 3236 paediatric necropsies and 10 surgical cases [9]. In the study of Patricia and Cirilo(9) in 19 cases the thymus was situated near the thyroid gland and in lower neck in 6 cases and higher neck in 9 cases. In our study 40 cases of cervical extensions were observed and among them 22 were at or near thyroid gland, 14 were in lower neck and 4 were in higher neck regions. Only 90 cases of ectopic, aberrant or accessory thymus gland have been reported in the literature [4]. In the present study seven cases of accessory thymus were observed. Accessory thymus body along the line of embryonic descent will be found in 25% of population though it is not clinically significant [10].

The percentage incidence of number of lobes observed in the thymus glands varied from 74% for two lobes in (39/53), 13% for three lobes in (7/53) and 13% for 4 lobes (7/53). In an earlier report [2] 45% incidence of cases with more than 2 lobes were reported where as in the present study it is 26% only. Eight different types of gross anatomical variations were observed in the present study. Seven of the specimens (13%) showed accessory thymic tissue. It is difficult to comment on the frequency of accessory thymic tissue observed in the present study because in the published literature accessory thymic tissue was often described as aberrant, ectopic, undescended, persistent or accessory thymus (4). In the present study while three (5.66%) of the thymuses were located above the thyroid only one such case was reported earlier [2].

The most common anatomical variation observed in the present study was the presence of cervical extension of the thymus gland (50%). This particular variation was reported to be the most common by earlier workers though the exact percentage was not mentioned.

5. Conclusion

Several morphological variations in the gross anatomy of the thymus gland were recorded in this study on a wide age range starting from 14 weeks of gestation to 65years age. This type of observations were not reported in literature. This bears a definite significance to clinicians and radiologists to look at extra mediastinal sites for the location of thymus before diagnosing thymicagenesis.

6. References

- [1] Micans P. The Thymus gland, immune health and aging. International anti aging systems bulletin (online), 2004.
- [2] Jaretzki III A, Betha M, Wolff M et al. A rational approach to total thymectomy in the treatment of myasthenia gravis. *Ann Thoracic Surgery*.1977;24(2):120 – 130 (Med line).
- [3] Prashant KA, Gaurav B, Dharmendra Singh, Sangram Singh. Case Reports – Aberrant cervical thymus in children. *Bombay Hospital Journal*, 2003; 45 (03) (online).
- [4] Shukla VK, Jha A, Shankar BG. Cervical thymic cyst – case report. *MJAFI* 2004;60(1): 204 – 205.
- [5] Amit K Chowhan, Vijay SB, Kinnera, Mutheeswaraiyah, Yootla and M Kumaraswamy Reddy. Cervical ectopic thymus masquerading as metastatic thyroid papillary carcinoma. *Malaysian J Pathol* 2010; 32(1) :
- [6] Farbod Nasserri and Farzin Eftekhari. Clinical and Radiologic Review of the Normal and Abnormal Thymus: Pearls and Pitfalls. *radiographics.rsna.org*. 2010; 413-428.
- [7] Shah P. Mediastinum: Thymus. In: Gray's Text-book of Anatomy- The anatomical basis of clinical practice.39th ed., 2005, p980- 984. Elsevier Churchill Livingstone.
- [8] Romanes G.J. Cunningham's Text-book of Anatomy, 12th ed., 1981, pp.598 – 602, Oxford Univ.Press.
- [9] Patricia M. Bale and Cirilo Sotel-Avila. Maldescent of thymus:34 necropsy and 10 surgical cases including 7 thymuses medial to the mandible. *Fetal and Pediatric pathology*.1993; 13(2): 181-190.
- [10] Sushmita Bhatnagar, Rohit Pradhan, Pankaj Shastri, Pradeep Shenoy. Accessory thymus in posterior mediastinum. *J Indian Assoc Pediatr Surg / Oct-2008 / Vol 13 (4) 140-141.*