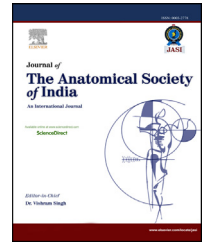


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Original Article

Estimation of gestational age from histogenesis of the thymus in human fetuses

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ABSTRACT

Introduction: Stages in development and maturation of various organs and tissues may help in fetal gestational age estimation. The present study was undertaken to study the maturation of fetal thymic tissue.

Methods: The study was conducted on 30 human fetuses of gestational age ranging from 9th to 38th weeks were used for the study. Gestational age estimation was done by the crown rump length followed by distribution of fetuses into five groups. Thymus was dissected out from each fetus followed by tissue processing. Sections of 4–5 μ m were cut and stained with Haematoxylin and Eosin stain. All slides were observed under the low and high powers of the light microscope.

Results: Lymphocytes first appeared in the thymus at the 9th week, trabeculae developed from the 9th week onwards, lobulation started to develop at the 9th week and continued till the 12th week, corticomedullary differentiation was apparent during the period of 9th–14th week, Hassall's corpuscles first appeared at the 15th week. Other developmental features continued to appear till the 38th week.

Discussion: The time of appearance of the various features in the developing thymus may help in rough estimation of the gestational age from minimal fetal thymic tissue remains especially during the early gestational weeks.

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1. Introduction

Estimation of the gestational age of a dead or aborted foetus is a specialized task in the medicine. Techniques for determining the gestational age of fetal or perinatal remains are

mainly aimed at calculating the time since conception and at determining if a specific disease could be the cause of fetal loss. The whole skeletal length, long bone length (femur length), foetal ultrasonography etc have been used routinely for age estimation. As several organs show major changes in developmental patterns throughout fetal development,

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maturation of fetal tissues and organs has also been proposed for gestational age estimation. Study of development of tissues for age estimation becomes even more important if only a few foetal remains are available. Depending on the general condition of fetal remains, there might be difficulties in age estimation.¹ Tissues from several organs like skin, lungs, thyroid gland, kidneys, adrenal glands, and central nervous system (each with unique but distinguishable stages of development) have been found to be useful for a more accurate assessment of gestational age when integrated with long bones measurements.²

The thymus is a lymphoepithelial organ and the key regulator of the immune system. It is responsible for cellular immunity of the body. Its location in the anterior mediastinum behind the shield of the sternum during most part of the fetal life not only saves the thymus from destruction even in grossly mutilated specimens, but also makes it an easily accessible organ which can be easily dissected out due to its superficial location. These features suggest that the thymus can serve as an important organ for forensic examination in the determination of fetal gestational age.

The size of the thymus is largest during embryonic life. It develops as two separate primordia one on each side of the midline. The thymus is divided into a number of macroscopic lobules, varying from 0.5 to 2 mm in diameter. The lobules are separated from one another by connective tissue and are divided into a darkly staining, peripheral (cortical) area and a lighter staining, inner (medullary) portion.³ Maturation of the fetal thymus and the time of appearance of various histological features may help in estimation of gestational age.

2. Materials and methods

The study was conducted in the Department of Anatomy, Himalayan Institute of Medical Sciences, HIHT University, Dehradun. 30 human fetuses of gestational age ranging from 9th to 38th weeks were obtained from the Department of Obstetrics and Gynaecology of the same institute after taking approval from the Institutional Ethics Committee and written informed consent from the concerned families. The fetuses were either products of pregnancy terminated under Medical Termination of Pregnancy Act of India, 1971 or were stillbirths. Only those fetuses which were apparently free from any gross anatomical or congenital abnormality were selected.

The fetuses were fixed in 10% neutral buffered formalin for two weeks. Age estimation for all fetuses was done from the Crown Rump Length (CRL) measured by Vernier Calipers from the vertex of the skull to the midpoint between the apices of buttocks and from the available history. The fetuses were categorized into the 5 groups arbitrarily as shown in Table 1.

The thymus was dissected out from each fetus and fixed in 5% neutral buffered formalin for histological study. Tissue processing was done. Sections of 3–4 μ thickness were cut followed by staining with Haematoxylin and Eosin stain. All slides were viewed under the low and high powers of the light microscope. All tissue remains were packed in yellow bags and disposed off as per the provisions for disposal of biomedical waste.

Table 1 – Distribution of fetuses in different groups according to gestational age.

Groups	Age (weeks)	Number of fetuses
Group I	9–11	5
Group II	12–14	5
Group III	15–17	6
Group IV	18–24	8
Group IV	25–38	6

3. Results

The histological findings in the various groups were as follows:

3.1. Group 1 (9th–11th week)

A thin capsule was visualized. Trabeculae were seen arising from the capsule and extending into the parenchyma. These trabeculae were having blood vessels lined by flattened endothelial cells. Mesenchymal cells were loosely arranged. The parenchyma started dividing into lobules but the cortex and medulla were not differentiated. Hassall's corpuscles were not visualized at this stage (Fig. 1). Two types of lymphocytes were visualized, few with small nucleus and plenty cytoplasm and others with large nucleus and less cytoplasm.

3.2. Group 2 (12th–14th week)

The capsule increased in thickness as compared to group 1. The trabeculae were well defined. The mesenchyma appeared to be denser. The lobulation of the parenchyma appeared to be completed. Each lobule had a recognizable cortex and medulla. Till the 14th week, no Hassall's corpuscle was seen. Lymphocytes were more numerous in number (Fig. 2).

3.3. Group 3 (15th–17th week)

The capsule became well defined. The trabeculae did not show any significant change. Mesenchyme became denser. The

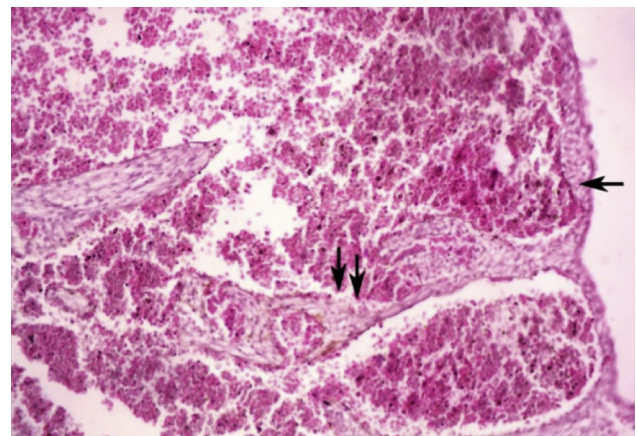


Fig. 1 – Photomicrograph of thymus of group I fetus showing capsule (arrow) and trabeculae (double arrow) (H&E X200).

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