

Development of the Human Lymph Nodes- A Histological Study

AKSH DUBEY, SUNDER LAL JETHANI, NAMITA MEHROTRA, DEEPA SINGH

ABSTRACT

Background: A lymph node is a large accumulation of lymphatic tissue organized as a definite lymphatic organ. Such nodes are located along the course of lymphatic vessels.

Objectives: The aim of present study was to study the developmental histology of lymph nodes in human fetuses of different gestational ages.

Methods: Fetuses were divided into five groups according to different gestational ages. Axillary lymph nodes were procured, fixed, processed and stained with Heamatoxylin and Eosin.

Results: Lymphatic sacs and lymphatic vessels developed around blood vessels. The lymphatic vessels interlaced with each other. Later on lymphocytic infiltration occurred and lymph nodes formed. Later, increase in size and number of lymphocytes converted these nodes into mature lymph nodes.

Interpretation and conclusion: The human lymph nodes developed from infiltration of lymphatic sacs and lymphatic vessels by lymphocytes. The subcapsular sinus appeared during the gestational period from week 15 to 17 and corticomedullary differentiation took place from week 25 to 38.

Key Words: Fetus, Lymph node, Lymphatic sac, Lymph vessels, Lymphocytes

INTRODUCTION

The immune system comprises of Lymphatics structures and cells that are distributed throughout the body; their principal function is to protect the body from invasion and damage by microorganisms and foreign substances. The main anatomical structures that participate in the immune response are the lymphoid organs like lymph nodes [1]. A lymph node is a large accumulation of lymphatic tissue organized as a definite lymphatic organ. Such nodes are located along the course of lymphatic vessels. Lymph nodes are scattered in large numbers, usually in groups. They are flat, well defined bodies varying from 1mm to 25mm in diameter. Their form is rounded or kidney-shaped, and their surface is somewhat rough. Usually there is a slight indentation, the hilus, on one side of the node where blood vessels enter and leave the organ. Lymphatic vessels enter the node at many places over its convex surface but leave it only at the hilus. The lymph node is covered by a capsule of dense collagen fibres. Trabeculae of dense collagenous connective tissue arise from the capsule and penetrate the organ. Some loosely meshed areas occur under the capsule and along the trabeculae, where they are called subcapsular and trabecular sinuses respectively [2]. Developmentally, lymph sacs exist till the end of embryonic period. During early foetal period these sacs are transformed into groups of lymph nodes. Mesenchymal cells invade lymph sacs and form capsule and connective tissue framework of lymph node primordia. Later on lymphoblasts from thymus invade lymph nodes [3,4]. The aim of the present study was to study the developmental histology of lymph nodes in human fetuses of different gestational ages.

MATERIALS AND METHODS

Thirty human fetuses of different age groups ranging from gestational weeks 9 to 38 were studied after prior permission from the In-

stitutional Ethical Committee (IEC). The fetuses were procured from the Himalayan Institute Hospital Jolly Grant Dehradun, (Uttarakhand) after obtaining necessary permission from the Medical Superintendent and consent of the concerned families. They were either stillbirths or terminated under the Medical Termination of Pregnancy Act of India, 1971. Only those fetuses which were free from any gross anatomical abnormality were selected.

The fetuses were fixed in 10% formalin for 2 weeks. The ages were calculated from the crown-rump length taken with the help of a measurement board and also from the available history. They were divided into 5 groups [Table/Fig-1].

OBSERVATIONS

The histological Examination of the slides revealed following findings in different groups:

Group 1 (week 9 to 11):

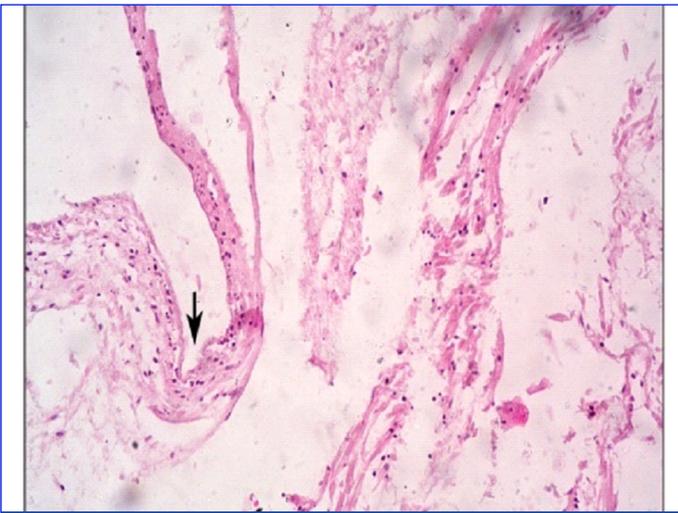
Appearance of a broad, thin walled space /lymph sac produced by connective tissue invagination. This invagination was lined by an endothelium. The non specific connective tissue contained many cells [Table/Fig-2].

Group 2 (week 12 to 14):

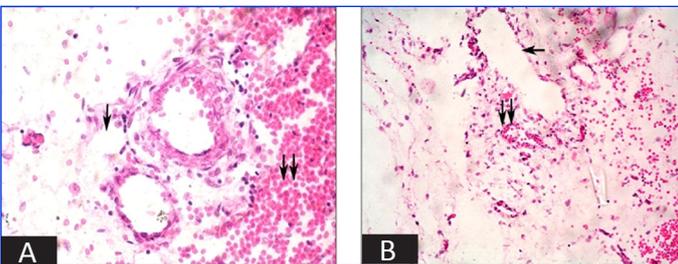
Formation of an early lymph node started. An early node was pri-

Crown rump length (mm)	Age (weeks)	Groups	No. of fetuses
50-53	9 to 11	1	5
65-80	12 to 14	2	5
95-116	15 to 17	3	6
129-205	18 to 24	4	8
241-452	25 to 38	5	6

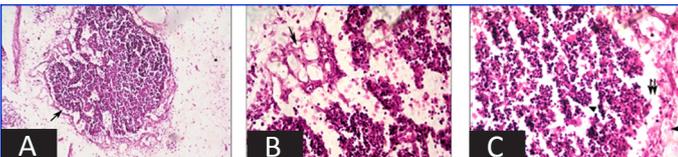
[Table/Fig-1]: Distribution of study fetuses in 5 Groups



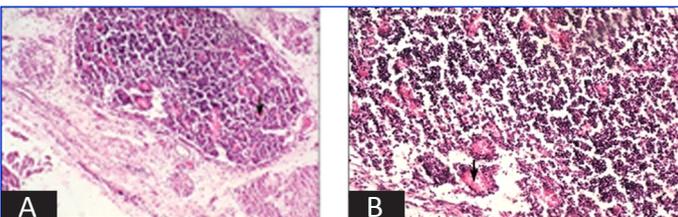
[Table/Fig-2]: Photomicrograph of Lymph node of Group 1 fetus showing connective tissue invagination (arrow). (H & E X200)



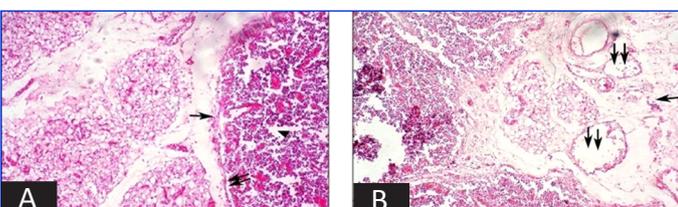
[Table/Fig-3]: Photomicrographs of developing lymph nodes of Group 2 fetuses showing various features (H&E X200)



[Table/Fig-4]: Photomicrographs of developing early lymph node of Group 3 fetuses showing various features (H&E X200).



[Table/Fig-5]: Photomicrographs of developing late lymph node of Group 4 fetuses showing increased cellular density with interspersed capillaries and blood vessels (arrow) (H&E X200).



[Table/Fig-6]: Photomicrographs of developing lymph node of Group 5 fetuses showing various (H&E X200)

marily a cellular reticulum interspersed with free cells and blood vessels. It lacked a capsule but an indentation of a hilum was present. Further, lymphatic sacs anastomosed with each other and formed a network of interlacing channels the lymphatic plexus. The lumina and walls of the developing vessels and lymphatic plexus contributed to the formation of nodes [Table/Fig-3(a),3(b)].

Group 3 (week 15 to 17):

Subcapsular sinus started appearing. This is the space between early node and the wall of the lymph sac or channel. Hilus became clearly visible with different lymph vessels emerging from it. Small lymphocytes started appearing in the early lymph node. Cellular density also increased in early nodes [Table/Fig-4(a), 4(b)].

Group 4 (week 18 to 24):

Transformation of early fetal lymph node into late fetal lymph node Was noticed due to an increase in the cellular density and volume. Capsule was visible which was formed by condensation of the surrounding connective tissue. Afferent lymphatic vessels pierced the capsule at several points [Table/Fig-5(a),5(b)].

Group 5 (week 25 to 38):

Capsule became well marked as condensation of connective tissue. The hilus appeared as a stalk of connective tissue. The efferent lymphatic vessels appeared to be emerging from the hilus. Cellular density increased further. Corticomedullary differentiation started appearing. Trabeculae containing blood vessels started penetrating the parenchyma. The parenchyma contained primary lymphocytes, blood vessels and other cells. Multiple venules were observed at the hilus [Table/Fig-6(a),6(b)].

DISCUSSION

In the present study we found that the lymph nodes developed from lymphatic sacs. Sabin FR et al., also reported that mammalian lymph nodes develop in regions occupied by lymph sacs [5]. Petrenko VM found that lymph nodes form a functional anastomosis between lymph vessels and blood vessels. As these sacs were found to develop near blood vessel related regions, the lymphatic system has a close proximity with the vascular system in the adult human body [6].

In the present study, we found that the lymph sacs anastomosed with each other and formed a network of interlacing channels during weeks 12 to 14 of gestation. This appeared to form a lymphatic plexus. Weiss L and Bailey RP reported in their study that during the initial development of human lymph nodes, the lymph sac was transformed into a system of anastomosing channels called a lymph plexus [7, 8].

Subcapsular sinus appeared in the present study during weeks 15 to 17. This was formed by the space between the 2 walls of the anastomosing channels, one in which the developing node was present and other opposite to this. This explains why afferent lymphatic channels enter through the capsular side into lymph nodes. Bailey RP and Leon W had similar observations in their study [8].

In the present study, early nodes were observed at weeks 15 to 17 of gestation. Petrenko VM also observed the same feature in his study. Bailey RP and Leon W showed that early fetal lymph nodes were found in human fetuses at 11-16 weeks. The growth of the lymph nodes varied depending upon the deposition of lymphocytes at the sites [6,8].

A gradual transformation of the lymph node from early to late stage was found in the present study. Late fetal lymph nodes were found to be present at weeks 18 to 24, while in the study done by Bailey RP and Leon W late fetal lymph nodes were found in fetuses measuring more than 14 weeks.

Cortico medullary differentiation in the present study could be distinguished at weeks 25 to 38.

In the present study, during the gestational period from weeks 25 to 38, multiple venules were observed in the region of the hilum. Weiss L and Bailey RP showed that there was a relationship between the development of the parenchyma of fetal nodes and the appearance and activity of postcapillary venules at the hilum. This also suggested that lymphocytes in the developing nodes migrated through these venules from the vascular system [7,8].

CONCLUSION

Lymph nodes develop in lymph sacs which appear at the week 9. Early lymph nodes start developing at weeks 15 to 17 and late lymph nodes at weeks 18 to 24. Corticomedullary differentiation occurs at the weeks 25 to 38, multiple venules or efferent lymphatics are found around the hilum at weeks 25 to 38 .

The present study differs from earlier studies in the sense that it deals with the development of lymph nodes starting from early to late stage. Earlier studies have dealt with development of either early or late lymph nodes.

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