Comparative Study of Human Lymph Nodes

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Author’s contribution

The sole author designed, analyzed, interpreted and prepared the manuscript.

Article Information

DOI: 10.9734/JPRI/2021/v33i42A32382

Received 25 May 2021
Accepted 01 August 2021
Published 25 August 2021

ABSTRACT

All the lymph nodes observed were typically bean shaped irrespective of their age or sex. The cervical lymph nodes were the largest of all the four groups in size. The mean maximum short axis axial diameter was 7.19mm (Range 5.67mm - 8.12mm). The mesenteric lymph nodes were the smallest of all the four groups in size. The mean maximum short axis axial diameter was 3.89mm (Range 2.7mm - 6.1mm). The lymph nodes showed well defined deep cortical regions often containing large lymphoblasts and prominent endothelial cells in small blood vessels. The thickness of the deep cortex was however reduced when compared to its foetal counterpart. The mean thickness of the deep cortical region was 423 microns. To reconfirm the age related involution of the paracortical region, the mesenteric lymph nodes were observed. In sharp distinction, axillary lymph nodes showed fewer germinal centres which were relatively smaller in size. Mean actual diameter of the germinal centre was 77 microns also had had fewer and smaller germinal centres.

Keywords: Foetal; lymphnodes; axillary lymph nodes.

1. INTRODUCTION

The lymphatic system constitutes the major part of the peripheral lymphoid tissues. Lymph nodes are anatomically and functionally composed of three distinct areas: the cortex, paracortex and medulla [1-3]. The cortex is a B-cell dependent area containing primary and secondary follicles.
Primary follicles are spherical aggregates of small lymphocytes. Secondary follicles are the site of antigen exposure, and of B lymphocytes recruitment and rearrangement; they are formed by a "pale" germinal centre encircled by a dark, thick border of small B- lymphocytes. The paracortex surrounds the follicles and is interposed between the cortex and the medulla; it is a T-cell dependent area, formed by small lymphocytes. The medulla has sinuses from where the lymph is conveyed towards efferent lymphatic ducts and is a B dependent area; the medulla contains macrophages, plasma cells and lymphocytes. Structural changes in lymph node morphology directly reflect local immune reactivity of an individual [4-8].

Hence, it is of practical importance that the age, site and structural changes are be taken into account in the diagnostic evaluation of lymph node sections. Systemic studies of lymph node morphology in relation to both age and lymph node location in normal human subjects would provide the necessary background for meaningful functional interpretation of tissue sections. Since such information is of immense importance, this study was undertaken to provide an insight into the 'normal' histology of 4 representative human lymph node regions (Cervical, Axillary, Inguinal and Mesenteric) and in 3 different age groups of the axillary region and to establish the age dependent histoarchitectural changes in the lymph nodes in three different age groups

2. METHODOLOGY

Collection of specimen: A total of 35 axillary lymph nodes from 35 different subjects were taken for the study ranging from 18 and 70 years of age and a total of 48 lymph nodes belonging to different regions (cervical, axillary, inguinal & mesenteric) from 48 different subjects, ranging mostly from 18 - 35 years were obtained from the Department of Pathology, Sree Balaji Medical College, Chrompet, Chennai and from the cadavers, Department of Anatomy, Sree Balaji Medical College, Chrompet, Chennai.

In the cadavers, lymph nodes were procured from the following regions. Cervical lymph nodes were procured from the submandibular region, the Mesenteric lymph nodes lying between the layers of the mesentery close to the wall of the small intestine and among the terminal twigs of the superior mesenteric artery were removed. The deep inguinal lymph nodes located medial to the femoral vein and under the cribriform fascia were obtained. The axillary lymph nodes were removed from the carefully after removal of the axillary pad of fat. Fourteen lymph nodes reported to show Reactive hyperplasia was gathered from the department of pathology, Sree Balaji Medical College, Chrompet.

Age distribution:

Chart 1. The samples of the human axillary lymph nodes utilised in the present study was categorized into the following three groups

<table>
<thead>
<tr>
<th>Group</th>
<th>Age</th>
<th>No. of samples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group I</td>
<td>37-42 weeks</td>
<td>8</td>
</tr>
<tr>
<td>Group II</td>
<td>18-35 years</td>
<td>15</td>
</tr>
<tr>
<td>Group III</td>
<td>60-70 years</td>
<td>12</td>
</tr>
</tbody>
</table>

From the study samples the ratio of the maximal diameter of the lymph nodes along the short axis (S) to the maximum diameter of the lymph along the long axis (L), i.e., S:L ratio was calculated using vernier caliper. Furthermore, the tissues obtained were processed to determine the capsule thickness, thickness of the deep cortical area and diameter of the germinal centers were measured using ocular and stage micrometer and tabulated.

3. RESULTS

Measurements of the short axial diameter (SAAD) and long axis axial diameter (LAAD) of axillary lymph nodes of different age groups are depicted in Fig. 1.

All the lymph nodes observed were typically bean shaped irrespective of their age or sex. The short axis to long axis ratio of group I, II and III was 0.46, 0.45 and 0.46 respectively (<0.5).

A young adult Lymph node(27 yrs) of the Mesenteric region showing deep cortex/paracortex (DC) which was reduced in thickness when compared to the old adult Lymph node of the Mesenteric region. (H&E stain). An old adult Lymph node(65 yrs.) of the Mesenteric region showing markedly increased paracortical/deep cortical thickness.
Fig. 1. Human axillary lymph nodes of different age groups

(i) 37 weeks

(ii) 33 years

(iii) 27 years

(iv) 65 years

Fig. 2. Histological examination of axillary lymph nodes of different age groups: Greatly expanded Paracortical regions (regions of diffuse lymphoid tissue) with many post capillary venules and Aggregations of lymphocytes around post capillary venules at 37 weeks and at 33 years. Human lymph node of a young adult (33 yrs.) of axillary region showing well defined deep cortical (DC) regions whose thickness was increased when compared to the old but reduced when compared to its foetal counterpart.
of existing literature concerning intranodal fatty infiltration. When compared to the young adults due to lymph nodes in the old were larger in size. From this study it is very evident that the size of the lymph nodes seldom showed variations with age too. The lymph nodes were typically bean shaped. The short axis/long axis ratio was less than 0.5 in lymph nodes of both the sexes and in lymph nodes of all the 3 age groups. Similar findings were also reported by Ying M, Ahuja A, Brook F., 2002. None of the foetal lymphocytic follicles showed evidence of a prominent germinal centre which is similar to previous studies done [8-10]. The present study confirms this documentation and also adds on that the germinal centers were not only more numerous but also larger in size with the Mean actual diameter being 77 microns. In Group III (old), an overall reduction in the number and size of the lymphocytic follicles with germinal centers was noted. The mean actual diameter of the germinal center was reduced to 36 microns. Studies on young and aging mice by perkins EH and makinodan T, 1971 have demonstrated decreased B responsiveness to antigens with age. Moreover, repeated stimulation with the same antigen leads to dissolution of germinal centers. In addition to that, it is reasonable to assume that fewer and fewer new antigens are encountered with advancing age. The germinal centres of young adults were not only more numerous but also larger in size when compared to the old. This study focuses on the confusion in existing literature concerning the presence of smooth muscle in the capsule and trabeculae. The foetal lymph nodes displayed greatly expanded deep cortical regions which showed rich vascularity and numerous post capillary venules. Aggregations of lymphocytes were particularly found around post capillary venules. Small primary follicles were discernible in the outer cortex and evidence of corticomедullary differentiation was encountered. None of the foetal lymphocytic follicles showed evidence of a prominent germinal centre. The germinal centres of young adults were not only more numerous but also larger in size when compared to the old. Hence, large or numerous germinal centres in lymph nodes of elderly persons, most likely signal that a humoral response of unusual dimension is ongoing and warrants special attention. An age related involution of the paracortical region was witnessed in the axillary lymph nodes but not in the mesenteric lymph nodes. Thus, the involutional process regarding T cell mass is not the same in all lymph nodes but rather shows substantial regional differences.

### 4. DISCUSSION

From this study it is very evident that the lymph nodes in the old were larger in size when compared to the young adults due to intranodal fatty infiltration. There were hardly any variations in both, the size and shape of the lymph node between the two sexes. The shape of the lymph nodes seldom showed variations with age too. The lymph nodes were typically bean shaped. The short axis/long axis ratio was less than 0.5 in lymph nodes of both the sexes and in lymph nodes of all the 3 age groups. Similar findings were also reported by Ying M, Ahuja A, Brook F., 2002. None of the foetal lymphocytic follicles showed evidence of a prominent germinal centre, which is similar to previous studies done [8-10]. The present study confirms this documentation and also adds on that the germinal centers were not only more numerous but also larger in size with the Mean actual diameter being 77 microns. In Group III (old), an overall reduction in the number and size of the lymphocytic follicles with germinal centers was noted. The mean actual diameter of the germinal center was reduced to 36 microns. Studies on young and aging mice by perkins EH and makinodan T, 1971 have demonstrated decreased B responsiveness to antigens with age. Moreover, repeated stimulation with the same antigen leads to dissolution of germinal centers. In addition to that, it is reasonable to assume that fewer and fewer new antigens are encountered with advancing age. The germinal centres of young adults were not only more numerous but also larger in size when compared to the old. This study focuses on the confusion in existing literature concerning the presence of smooth muscle in the capsule and trabeculae. The foetal lymph nodes displayed greatly expanded deep cortical regions which showed rich vascularity and numerous post capillary venules. Aggregations of lymphocytes were particularly found around post capillary venules. Small primary follicles were discernible in the outer cortex and evidence of corticomедullary differentiation was encountered. None of the foetal lymphocytic follicles showed evidence of a prominent germinal centre. The germinal centres of young adults were not only more numerous but also larger in size when compared to the old. Hence, large or numerous germinal centres in lymph nodes of elderly persons, most likely signal that a humoral response of unusual dimension is ongoing and warrants special attention. An age-related involution of the paracortical region was witnessed in the axillary lymph nodes but not in the mesenteric lymph nodes. Thus, the involutional process regarding T cell mass is not the same in all lymph nodes but rather shows substantial regional differences.

### 5. CONCLUSION

Hence, large or numerous germinal centres in lymph nodes of elderly persons, most likely signal that a humoral response of unusual dimension is ongoing and warrants special attention. Experimental evidence indicates that lymph nodes in humans undergo alterations and degenerations during ageing.

### CONSENT

As per international standard or university standard, patient’s written consent has been collected and preserved by the author(s).

### ETHICAL APPROVAL

The study was approved by the Institutional Ethics Committee.

### COMPETING INTERESTS

Author has declared that no competing interests exist.

### REFERENCES


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