Experimed 2023; 13(3): 170-173

ORIGINAL ARTICLE

DOI: 10.26650/experimed.1297722

Age and Regional Features of Quantitative Indicators of Lymphoid Nodules of the Human Intrahepatic Bile Ducts

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Cite this article as: Aliyeva N, Shadlinskaya S. Age and regional features of quantitative ındicators of lymphoid nodules of the human intrahepatic bile ducts. Experimed. Experimed 2023; 13(3): 170-173.

ABSTRACT

Objective: This study aimed to elucidate the age and regional characteristics of the quantitative indicators of lymphoid nodules the intrahepatic bile ducts in humans.

Materials and Methods: In our study, the lymphoid structures of the intrahepatic bile duct walls taken from the corpses of 48 people, including newborns, early childhood, puberty, adolescence, adulthood and, elderly were examined. Lymphoid formations were stained using Hellman's method, a macro microscopic method. The digital data obtained during the study were subjected to statistical processing. At the same time, the general recommendations for medical and biological research were observed.

Results: A macro microscopic study of lymphoid formations in the human intrahepatic bile ducts showed that lymphoid formations in the walls of these organs were represented by lymphoid nodules and diffuse lymphoid tissue. Lymphoid formations were determined in the neonatal period and throughout subsequent life. Lymphoid nodules on total preparations were detected as dark (mostly dark blue) structures located against a lighter background of the surrounding organ wall. The peripheral contours of the lymphoid nodules were clearly defined, and the germinal centers were constantly absent. The number of lymphoid nodules was maximal in the lobular ducts and minimal in the common bile duct. This indicator was increased from the neonatal period to early childhood and then gradually decreased.

Conclusion: The results of this study have revealed that lymphoid nodules of the intrahepatic bile ducts acquire maximum development in early childhood. Further, the morphometric parameters of the lymphoid structures gradually decrease, and involutive transformations were noted.

Keywords: Intrahepatic bile ducts, lymphoid nodules, diffuse lymphoid tissue, regional characteristics

INTRODUCTION

In modern times, chronic liver diseases, including cirrhosis, annually cause the deaths of more than 1 million people (1, 2). Every tenth inhabitant of the globe suffers from diseases of the liver and biliary tract, which indicates the importance of early and adequate diagnosis (3, 4). Therefore, the liver remains the focus of attention not only for surgeons and therapists but also for morphologists (5, 6).

There are many studies in the literature about lymphoid formations being the source of many diseases (7-11). The study aimed to elucidate the age and regional characteristics of the quantitative indicators of lymphoid nodules of the human intrahepatic bile ducts.

MATERIALS AND METHODS

The material of the study consisted of the lymphoid structures of the intrahepatic bile duct walls obtained from the corpses of 48 people who died at different ages, from the neonatal period to old age, as newborns, early childhood, puberty, adolescence, adulthood, and elderly.

In our study, when creating the groups, it was taken into account that the people were healthy throughout their lives

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Submitted: 17.05.2023 **Revision Requested:** 29.07.2023 **Last Revision Received:** 28.08.2023 **Accepted:** 28.09.2023 **Published Online:** 01.12.2023

and that they lost their lives due to various injuries, asphyxia, and acute poisoning. Cases with concomitant diseases of the immune system, and large glands of the body (liver, pancreas) were excluded from the general sample group.

The study used a macro microscopic method for the study of total preparations. After the removal of the liver, the bile ducts were separated from the surrounding tissues. The isolated preparations were washed with a light stream of running water. The lymphoid formations thus obtained on total preparations were stained according to the method of Hellman T. (12). Total preparations were initially placed for 2-3 days in a 3% solution of acetic acid (until the walls of these organs became transparent), then washed in running water. Harris hematoxylin was used to stain lymphoid nodules. Staining was carried out within 36–48 hours.

Statistical Analyses

The digital data obtained during the study were carried out for statistical evaluations using the programs of the Statistical Packages MS Excel 2016 and SPSS 22 (13, 14).

For a preliminary assessment of the difference between the variation series, the parametric criterion Student-t test was used. Further, to compare and determine the reliability of quantitative differences in groups and subgroups, a non-parametric rank, Mann-Whitney U test was used. The mean values of the obtained samples, standard errors, minimum (min), and maximum (max) values of the series were calculated. $p<0.05$ was accepted as the significance limit.

RESULTS

A macro microscopic study of lymphoid formations in the human intrahepatic bile ducts showed that lymphoid formations in the walls of these organs were represented by lymphoid nodules and diffuse lymphoid tissue. Lymphoid formations were determined in the neonatal period and throughout subsequent life.

Lymphoid nodules on total preparations were detected as dark (mostly dark blue) structures located against a lighter background of the surrounding organ wall. The peripheral contours of the lymphoid nodules were clearly defined, but the germinal centers were constantly absent (Figure 1).

On total preparations, we counted the number of lymphoid nodules in the walls of these organs (Table 1).

The number of lymphoid nodules in the wall of the common hepatic duct compared with newborn children in early childhood was increased by 1.72 times ($p<0.001$), and was then gradually decreased. In comparison with early childhood, this indicator decreased in puberty by 1.39 times ($p<0.01$), in people in the 1st period of adulthood by 1.76 times ($p<0.001$), and in senile age by 2.93 times ($p<0.001$).

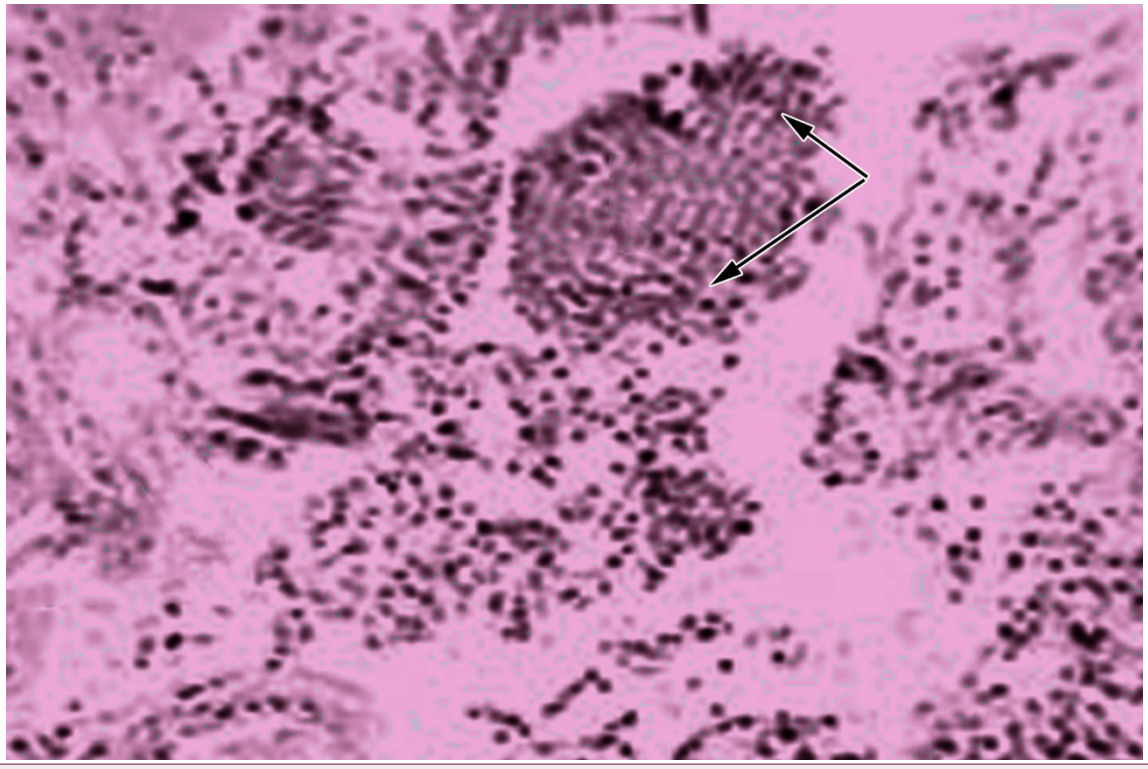

Figure 1. Lymphoid nodule in the wall of the common hepatic duct (indicated by arrows). Cross section. Hematoxylin-eosin staining. Magnification 96X

Table 1. The number of lymphoid nodules per area of 1 cm^2 walls of the intrahepatic bile ducts of humans of different periods.

		Number of lymphoid nodules, bile ducts		
Life Periods	**n**	**Common bile duct [a]**	**Interlobar ducts [a]**	**Lobular ducts[a]**
Newborns	6	35.2 ± 1.1 (28-40)	30.0 ± 1.2 (24-38)	20.4 ± 1.5 (16-32)
Early childhood	5	85.6 ± 4.4 (50-98)[1, 2]	64.2 ± 3.6 (33-72)[1, 2]	35.2 ± 3.5 (26-64)[2, 3]
Puberty	8	63.4 ± 4.7 (44-80)	45.2 ± 3.9 (30-60)	25.3 ± 4.2 (20-52)
Adolescence	8	60.0 ± 4.7 (40-76)	40.0 ± 3.3 (29-54)	22.8 ± 3.7 (18-46)
Adulthood	10	54.2 ± 3.2 (32-64)	32.2 ± 2.4 (26-50)	20.0 ± 3.0 (12-42)
Elderly	11	30.2 ± 4.1 (15-56)	24.5 ± 2.9 (13-42)	16.2 ± 3.0 (10-40)

[1]: p<0.01, versus Puberty

[2]: p<0.001, versus Newborns, Adulthood, and Elderly

[3]: p<0.01, versus Adolescence

[a]: Values are shown as mean ± standard errors (min-max).

n: Number of observations

The number of lymphoid nodules in the wall of the interlobar ducts, compared with neonates in early childhood, increased by 2.14 times (p<0.001), reaching maximum numbers during postnatal ontogenesis. In comparison with early childhood, this indicator was decreased in puberty by 1.42 times (p<0.01), in the first period of adulthood by 1.99 times (p<0.001), and in senile age by 3.21 times (p<0.001).

The number of lymphoid nodules in the wall of the lobular ducts were maximal in early childhood, when the value of this indicator was 2.43 times (p<0.001) higher than in newborns. Compared with this indicator in the period of early childhood, the value decreased in adolescents by 1.35 times (p<0.01), in the first period of adulthood by 1.58 times (p<0.001), and in senile age by 3.03 times (p<0.001).

Thus, the number of lymphoid wall nodules from the lobular ducts to the common bile duct was found to be increased. This indicator has been increasing from the neonatal period to early childhood and was then gradually decreasing during postnatal ontogenesis.

DISCUSSION

According to our data, lymphoid formations in the intrahepatic bile ducts of a human are constantly determined in the walls of these organs, being detected in the neonatal period and throughout subsequent life. In this regard, our results were supported by Yunusov R. who believes that lymphoid structures (lymph follicles in the author's terminology) were present only occasionally (15).

Analysis of morphometric studies showed that lymphoid formations of the intrahepatic bile ducts acquired the maximum development in early childhood, which is typical for many other immune organs (1, 7, 8, 15).

According to Shadlinskaya S. (11) the number and size of lymphoid formations of the vaginal vestibule was individually variable. The level of variability (amplitude of the variation series of indicators) was mainly increased during postnatal ontogenesis. The amplitude of the variational series of dimensional indicators of the lymphoid structures in newborns and early childhood was more than that of women of adulthood periods, elderly and senile ages (11).

Further, as these indicators gradually decrease, involutive transformations are noted. The involution of the lymphoid tissue is manifested by a decrease in the number of lymphoid nodules, which progressively increases with age.

According to Huseynov B. (9), maximal development in lymphoid formations of the trachea and main bronchi were acquired in early childhood. Further, the morphometric parameters of the lymphoid structures were gradually decreased, and involutive transformations were noted. The involution of lymphoid tissue is manifested by a decrease in the number and size of lymphoid nodules, a decrease in the density of the arrangement of cells of the lymphoid series in their composition and in diffuse lymphoid tissue, which progressively increases towards the elderly and senile ages (9).

Ethics Committee Approval: Approval was received from the Ethics Committee of Azerbaijan Medical University (dated 05.07.2023 and numbered 28).

Informed Consent: Consent was obtained from the relatives of 48 people.

Peer-review: Externally peer-reviewed.

Authors' Contributions: Conception/ design of Study- N.A., S.S.; Data acquisition: N.A.; Data Analysis/Interpretation: S.S.; Drafting Manuscript: N.A.; Critical Revision of Manuscript: S.S.; Final Approval and Accountability: N.A., S.S.

Conflict of Interest: All authors declare that they have no conflicts of interest.

Financial Disclosure: The authors declare that this study has received no financial support.

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