

STRUCTURAL AND FUNCTIONAL CHARACTERISTICS OF THE PARENCHYMA OF THE LYMPH NODES DROMEDARY (*Camelus dromedarius*)

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ABSTRACT: The study of somatic and visceral lymph nodes of mature dromedary (*Camelus dromedarius*) has shown a structure of conglomerates, which are they made up of same subunits, the detailed histological study shows a wide parenchyma and lymphatic sinuses divided into distinct structural and functional areas (compartments). It was found that somatic lymph node (LN) has an unequal development of the main components of the tissue (stroma of connective tissue, lymphatic sinuses, lymphoid parenchyma) the relative area of each of them is about 30 to 35%. The richest areas in cells in the lymph nodes of the dromedary are the depth cortex units in the somatic lymph nodes and the medullary cords in visceral lymph nodes. The content in the two groups of follicles of the lymph nodes of the adult dromedary does not exceed 6%.

Keywords: Lymph Nodes, Dromedary, Structural And Functional Areas, Lymphoid Parenchyma, Deep Cortex Units, Histoarchitectonics Relative Area, Medullary Cords, Lymphoid Follicles

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INTRODUCTION

In productive mammals, where the mature born animal species, have one of the mechanisms of the most perfect adaptation to environmental factors, particularly the functional morphology immunogens better than in humans and laboratory animals (Abdel-Magied, 2001, Cynthia, 2006 and Gavrilin, 2014). The dromedary (*Camelus dromedarius*) is one of the mammals that adapts to unfavorable conditions. The adaptation of the species in the extreme desert environment contributed to the development of a number of structural and functional characteristics in the immune defense system of the organism (Guy Sainte-Marie, 2010; Kayouli 1995 and Mosallam, 1979).

This work is devoted to the study of individual characteristics cytoarchitectonics structural and functional areas of the parenchyma of the lymph node (LN) (somatic and visceral) of the dromedary. At the same time, one of the main contradictions is the statement on the particular structure of the LN, where there is no clearly marked zoning of the lymphatic parenchyma, which is typical for all other mammalian species (Zine Filali, 2004). For a possible explanation, we made extensive studies on the LN of the dromedary at different levels of structural and functional organization of this body.

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MATERIALS AND METHODS

The selection of material produced at slaughter of healthy animals at slaughter (meat processing plant) city Ouargla, Algeria. The experimental part of the work performed in the laboratory of histology, immunocytochemistry and morpho-pathology research center for Biosafety and environmental control resources agro industrial complex at the Department of anatomy and pathological anatomy of farm animals - Dnipropetrovsk State Agrarian and Economic University, Ukraine.

We selected somatic (parotid submandibular, superficial cervical, the axillary, the popliteal) and visceral (medial retropharyngeal, caudal mediastinal, hepatic, jejunum, medial iliac) LN from dromedary mature, age 3-5 years (*Camelus dromedarius*) LN. Every single part of the LN was dissected in the sagittal plane, through the hilum and selected small pieces, taking into account their histological architecture. Fixation was performed in 10% neutral formalin aqueous solution. Fixed part of the material used to manufacture thin paraffin sections (5

microns). Subtle paraffin sections were stained with hematoxylin and eosin to determine the general histo-architectonics domains to the LN (Santambrogio 2013), Wiegert hematoxylin and PICRO-fuchsine (Van Gieson) to study the structural features of the connective tissue – stroma (Goralska, 2005).

The relative area of tissue components LN determined by the method of "accurate calculation" using the ocular GG test systems Avtandilov (Avtandilov, 1990) using light microscopes Olympus CH-20, Leica DM1000. Morphometric data processing was performed using the Leica QwinV.3. Histological sections were photographed with a digital camera Leica DFC 295 and stored in the image format designs on the electronic media.

RESULTS AND DISCUSSION

Previous studies have shown that the LN dromedary have a certain number of features at the macro and microscopic structural organization. Dromedary LN were distinguished that have a lobed structure and represent a conglomerate, partly merged in units (macro-units) with no evidence of a specific spatial organization (Sapin 1978).

It was noted that the intra-site system lymphatic sinuses is much larger than in the LN of other species that are represented by a uniform set of large lymphatic spaces limiting lymphatic parenchyma islands. Despite this, the islands of the parenchyma of the LN are under lobular form (compartment), while in other mammalian species consist of a set of structural-functional zones (DCU, primary and secondary follicles, cords medullary), with a specific binding with a reticular structure and cytoarchitectonics. However, the main feature of the nodal organization of the dromedary is a mosaic arrangement of lobes or compartment, which is not typical for other types of animals in parts which are generally arranged in a single row.

During the analysis of histological preparations LN dromedary it has been found that they are constituted by the parenchyma, stroma and lymphatic sinuses. Outdoor units are covered with a capsule of dense fibrous connective tissue, and the space between the units (lobules) is filled with loose connective tissue with numerous blood and lymph vessels. The capsule of this great branch, extends far into the depth of the parenchyma, and can sometimes reach the thickening of the hilum. As in the capsule, and that there are clusters of trabecular smooth myocytes. In somatic LN, stroma was developed fairly evenly; with respect to the surface they present almost 30%. The minimum number of stromal components between somatic LN present in the popliteal and parotid LN (relative area is respectively 27.78% and 27.36%), and the maximum in the superficial cervical LN (relative area - 33.04%) (Figure 1).

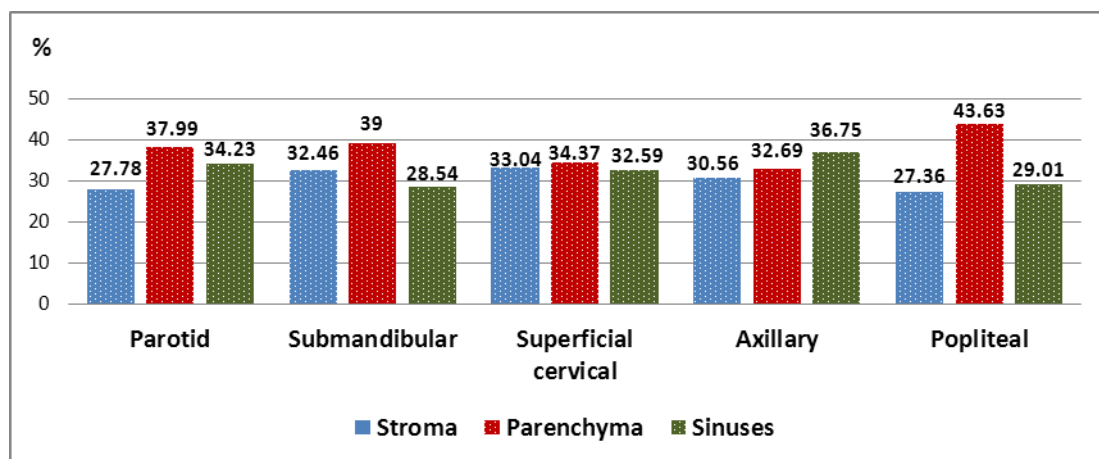


Figure 1. The relative area of the stroma, parenchyma and sinus some somatic LN dromedary, %.

In terms of visceral LN, the stroma is weakly developed. It was noted in all the visceral LN studied its relative area is less than 30%, except for the internal iliac LN. Thus, somatic and visceral LN, stroma contains the capsule. The relative area of the cap is maximal in the superficial cervical LN ($21.13 \pm 0.75\%$), the jejunum LN ($21.03 \pm 0.92\%$) and minimum in the caudal mediastinal LN (9.8 ± 0.34). We also noted that the trabeculae somatic LN is more efficient, their relative area is about 12% in almost all somatic LN, except the popliteal LN. The values at visceral LN, the relative area of the trabecular area is more than 11%, in particular median iliac LN and the relative area of the trabecular area of all other visceral LN does not exceed 10%, then they are relatively thin and much stronger.

A main feature of the LN the dromedary is the significant development of the lymph sinuses. In somatic LN, they are much more developed than in the visceral LN. The total relative area of the sinus in somatic LN varies between 28.54% (mandibular LN) - 36.75% (axillary LN), while in the visceral LN, it does not exceed 22.02% (medial retropharyngeal LN) (Figure 1, 2). In somatic LN, lymphatic sinuses are considerably developed and

systematically sub capsular sinus, the medullary cords and medullary sinuses. These laws have been identified. It was noted that in the visceral LN, the sub-capsular sinus of the capsule is present below each subunit, draining lymph in the afferent lymphatic vessels.

Sub capsular sinus is more developed in somatic LN; it covers an area of $10.55 \pm 0.26\%$ (submandibular ILN) to $13.75 \pm 1.35\%$ (axillary LN). Visceral LN for the sub capsular sinus, there was a relative surface area of $2.63 \pm 1.56\%$ (jejunum LN), $8.22 \pm 0.38\%$ (median retropharyngeal LN), except of mediastinal LN possesses a relative surface that is high ($14.69 \pm 2.57\%$). The intermediate cortical sinuses are better developed in somatic LN, where their relative surface is $6.53 \pm 1.14\%$ (submandibular LN) - $12.56 \pm 1.35\%$ (axillary LN). The relative area is maximal for intermediate sinus visceral LN; there was $9.17 \pm 1.99\%$ for the hepatic LN.

As part of the organization of the entity parenchymal LN dromedary, namely a mosaic arrangement of a multi-layer compartments within the same subunit, the medullary sinuses are not only in the medullary area near the thickening of the hilum, but also in the depth of parenchyma in contact with the cortical plate and the underlying compartment. This medullary sinus is much better expressed in the somatic LN than in the visceral LN (Figure 2).

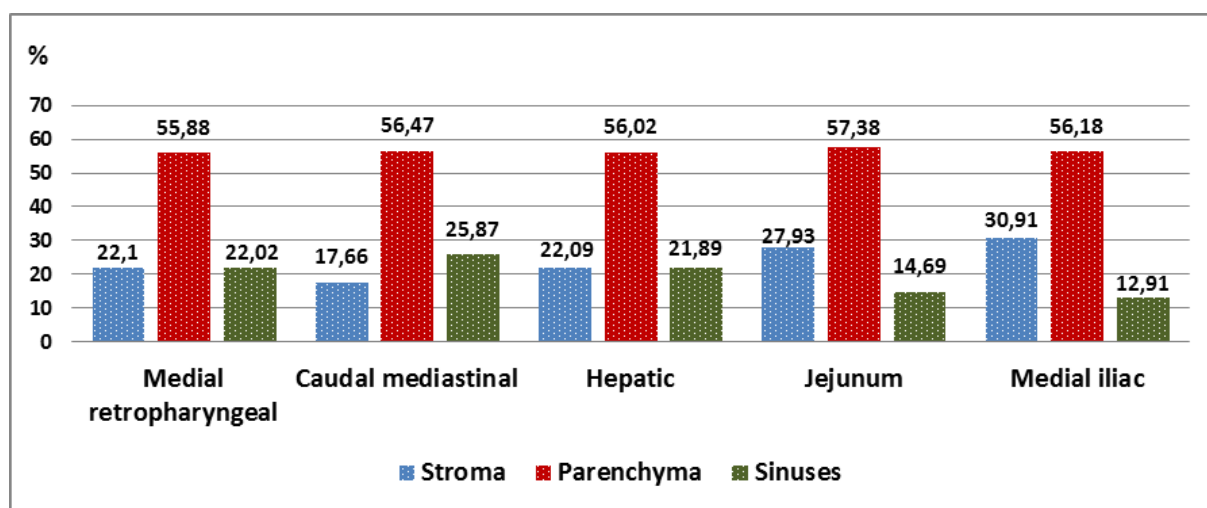


Figure 2. The relative area of the stroma, parenchyma and sinus some visceral LN dromedary, %.

Thus, in somatic LN; it was noted that the relative area of the medullary sinuses is minimal and almost identical to the axillary and popliteal LN (respectively $10.44 \pm 1.40\%$ and $10.43 \pm 1.49\%$), this surface is maximum - in the superficial cervical LN ($14.28 \pm 1.04\%$). This result is much lower in visceral LN. Therefore the relative area of medullary sinus is maximum does not exceed 8% in the medial retropharyngeal, hepatic and jejunum LN, it is minimal is only $2.7 \pm 0.61\%$ in the iliac LN. The main components of the lymphoid tissue of the LN dromedary are the parenchyma. Its relative area of less than 50% in somatic LN, while in all the visceral LN, it exceeds this proportion.

It was noted that the minimum relative area of somatic lymphoid parenchyma is in the axillary LN (32.69%), while the maximum is in the popliteal LN (43.63%); this number is reduced in the visceral LN, 55% (median retropharyngeal LN) and not more than 57% (jejunum LN). As in all mammals, the parenchyma of the LN in dromedary is divided into separate compartments, including structural domains and complex areas with the specific structure of reticular nucleus and Cytoarchitectonics. Among the functional areas of the LN parenchyma units the dromedary is the most developed are the units of the DCU and medullary cords. In the parotid, submandibular and popliteal LN, there was a very functional development noticed at the DCU (Figures 1, 2), whereas in the visceral LN, it is visible only in the medial retropharyngeal LN.

The prevalence of the relative area of the medullary cords in other functional areas of the parenchyma somatic LN found in the axillary LN, superficial cervical, as in the visceral LN investigated except the medial retropharyngeal LN. In somatic LN, The relative area of the DCU is minimal, as it was found in the superficial cervical LN ($8.63 \pm 1.83\%$), it is maximal in the parotid LN ($22.56 \pm 0.77\%$). The relative surface is maximal for this functional area is in the medial retropharyngeal LN ($27.66 \pm 0.47\%$); the minimum is $19.63 \pm 1.06\%$ in the jejunum LN. The center of each DCU, reticular fibers are shaped polygonal cell, forming a network in the form of large loop.

T lymphocytes are predominant in this domain, which has been shown by the immunocytochemical study. On the periphery of the DCU of the cortical plate, there exist primary and secondary lymphoid follicles. Similarly, both of which are located on the DCU, transmitted to the sub capsular sinus, and intermediate sides adjacent sinuses and even the underside surface in contact with the medullary sinuses. The relative area of lymphoid follicular area does not exceed 6%, in both somatic and visceral LN.

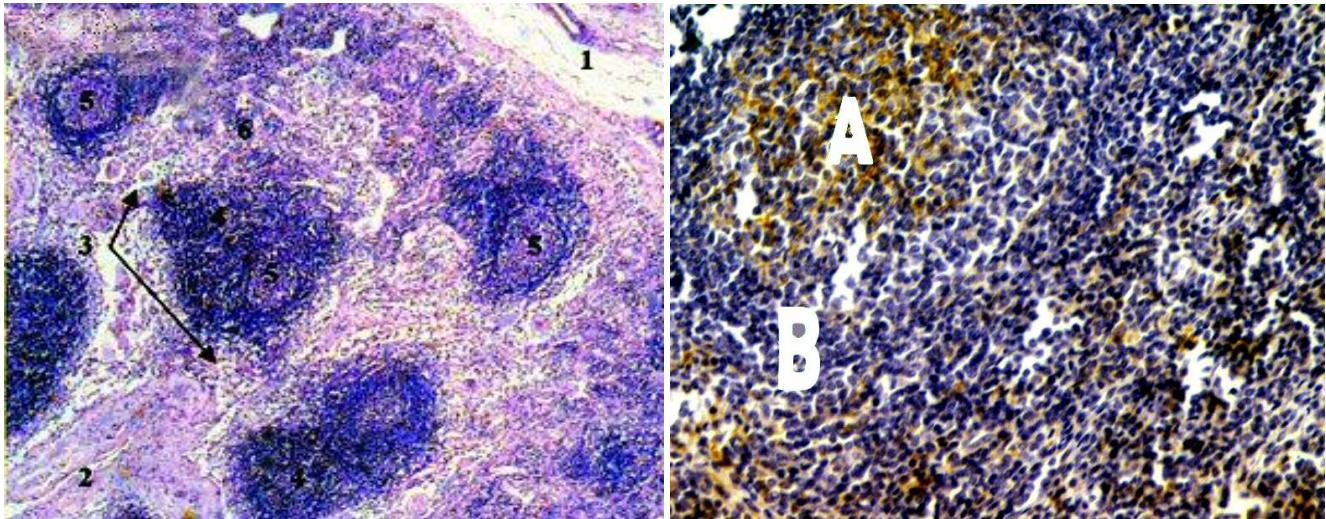


Figure 1 (Left): lymph node: 1 - capsule, 2 - trabeculae, 3 - System intermediate sinuses, 4 - DCU, 5 - lymphoid follicles, 6 - medullary cords
Figure 2 (Right): A germinal center - B mantle zone.

It is also noteworthy that in most of the LN, the total area occupied by the lymphoid follicles (primary lymphoid follicles: without germinal center and secondary follicles: with a germinal center). In somatic LN, it was noted that the relative area occupied by the primary follicles was 3.64% in the superficial cervical LN and 0.34% in the axillary LN. The secondary follicles were observed that also are highly developed in the axillary and popliteal LN, and is relatively smaller and the same in parotid, submandibular and superficial cervical LN.

In the visceral LN, primary follicles are negligible and do not exceed 1.5 to 1.7%, while the secondary follicles, their related fields does not fall below 2.56%. The maximum number of secondary follicles in the visceral LN was detected in the internal iliac LN (4.55%) and jejunum LN (4.03%). Lymphoid follicles are reticular argyrophile shape and variety is distinct, consisting of large mesh, undergoing degeneration of secondary follicles and they take the form of fiber fragments, separated and released and slightly sinuous. On the narrowed side of DCU, there has been the deposition of the medullary cords, where the relative area varies between 13.5% and 20.6% for somatic LN and of 22.7 to 32.7% for the visceral LN. In one compartment the medullary cords is developed unevenly. Therefore, the lobules are located under the capsule; the medullary cords are often minor and may even be absent.

The medullary cords are well developed and they lead directly into the compartments near the thickening of the hilum. The reticular architecture in the medullary cords is typical and has felt-like appearance.

CONCLUSION

LN of the dromedary are partially in the form of conglomerates (units) fused to a specific histoarchitectonics form which consists of a stack of layers and a mosaic arrangement of the structural units (lobules) of parenchyma in the area of the capsule to the thickening of the hilum. The main morphological characteristics of the LN dromedary, at the structural organization of tissues are: an important development of the lymphatic sinuses, which is characteristic of all the units, in particular expressed in somatic LN. Therefore, the total relative area is less for the lymphoid parenchyma in somatic LN was 40% and 50% for the visceral LN. Among the functional zones of LN in the parenchyma units dromedary are the medullary cortex, very advanced in depth, the relative area of the medullary cortex in both groups of LN does not exceed 6%. The architecture of reticular skeleton is a characteristic of each functional area lobular units with a maximum density of the arrangement of fibers in the medullary cords and a minimum in the follicles.

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