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Research Article

Anatomo-Topographic and Radiological Study of the Sheep Lymph Node in Algeria

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Abstract

The Lymph Nodes (LN) of Ouled-djellal sheep in Algeria were the subject of this study in order to establish the anatomo-topographical and histo-cytological characteristics of these organs, thus highlighting the different morpho-functional areas of the parenchyma of these lymph nodes, (somatic and visceral). Thanks to the X-ray, we were able to highlight the circulation of the lymph in situ and see the different compartments of this organ. The standard hematoxylin and eosin staining allowed us to confirm the histological structure developed by radiography. The statistical study of different histological functional areas was carried out by the Point S system created by the laws of mathematics. The sheep lymph node represents a unique autonomous form, corresponds to the lymph node typical of other mammals with sign of a certain fusional orientation, the linear and topographic characteristics generally correspond to parameters similar to the lymph node of cattle. Enveloped by a layer of capsule (CP) which integrates inside the parenchyma forming the trabecula (TR), the nature of the relationship with the extra-lymphatic vessels, the lymph nodes of sheep belong to classic type nodes, in which the afferent lymphatic vessels drain directly into the marginal and efferent sinuses which are located in the area of the sub- grids of the subunits, come from the sinus of the hilum and connected to several large lymphatic vessels which are located next to the largest arteries and veins. The follicles have a very clear structure, each segment presents a unit of deep cortex (DCU), of follicles in the cortical and paracortical zone, which is the external part of the DCU and the Medullary Cord (MC), with cells specific for each zone. Moving towards the reticular nucleus. The base of each Lymphoid Follicle (LF) in the lymph node parenchyma shows the unity of the DCU. The main quantitative morphological features of the structural organization of the lymph nodes in sheep. Among the individual cell areas, the maximum relative lymphoid parenchymal area is typical of DCU and MC, and the minimum of lymph nodes.

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INTRODUCTION

In mammals, the lymphatic system is made up of organized lymphoid structures, the LN, linked together by a network of lymph vessels that drain lymph from peripheral tissues to the main veins (Hall, 1992). The orderly circulation of lymphocytes between these different lymphoid compartments ensures a coordinated expression of the immune functions of this system, and in particular promotes the initial contact between lymphocytes and antigens, and the dissemination of the cells produced in response to this interaction throughout the organism [1]. The immune system is thus able to respond to external stimuli occurring anywhere in the body. Although current knowledge in immunology is largely based on studies carried out in mice and humans, numerous experiments carried out on large domestic species such as sheep have largely contributed to the study of l ontogeny and the anatomy of the immune system, the functioning of the LN, as well as the induction and regulation of the immune response in mammals [2].

Our research consists in making a topographic, morphological, and in particular histological, and cytological study, of the functional areas of the LN of the sheep breed Ouled-djellal. The aim of which is to highlight the immunological status of the sheep of the Ouled-djellal breed, as well as to make a comparison with the improved breeds (genetically) and of sheep existing in the world.

MATERIALS AND METHODS

The study was based on sheep LN (Ouled-djellal breed) from the Annaba region of Algeria, obtained from several adult sheep, aged two years on average, weighing between 42 and 55 kg, of different clinically healthy places.

The animal not treated preventively, is subjected to an ante-mortem examination, after slaughter, the taking of the LN (pre-scapular, retro-pharyngeal, mesenteric and hepatic), was carried out after evisceration and anatomical dissection of the animal. During the sampling, the anatomo-topography characteristics of each LN were determined. The photos of the LN were taken with an OLYMPUS OM D E M5 camera. The absolute organ weights adjusted using "Tehniprot-WTW" weights, up to 0.002 mg. Likewise; the relative mass of the LN to the mass of the animal's

body was calculated. The measurements (length, width) of each LN were determined using a centimeter ruler with a division value of 1 mm. The removed LN is immersed in a 10.0% formalin solution for fixation for 24-48 hours. Additional fixation was performed at room temperature in a 10.0% formalin solution for 10 to 14 days. The detection of the LN by selective radiology in sheep was done in a radiology and radio diagnostic clinic. For radiography, the products used for this technique are: a mixture of radio-selective (iodine), its role is internal clouding of the LN, ethylene greens (tetraethyl-4,4-diaminotriphenylmethane oxalate) , its role is the dilation of the blood and lymphatic vessels to promote easy penetration of products, gelatin is to solidify the routes after injection and cooling of the limb. In a beaker, 500 ml of distilled water are put, an amount of 10 ml of ethylene greens, then an amount of 200 g of gelatin is added and the whole is placed on a hot plate at 40 °C. in order to dissolve the gelatin. The hind limb of the animal was stripped of its fleece and cleaned with lukewarm water, injections of the product prepared in the intersecting spaces were carried out, and then an injection of 5 ml of radio selector was carried out after [3].

After about thirty minutes, a dissection was made, we recovered the LN of the pre crural region and put in cassette, with the help of the radiologist, we were able to take pictures of these organs by the passage of cassettes by a selective x-ray at high magnification, the images obtained are analyzed and commented on.

The organ segments were washed with running water and then dehydration was carried out with ethyl alcohol in an increasing concentration; the LN fragments were poured into paraffin. Finally, staining with hematoxylin and eosin, May-Grunwald Giemsa according to conventional methods was performed, to obtain a view of the compartments, which allowed us to study the morphometry and cytology of the LN. For the localization of the functional zones of the LN (cortical plateau, para-cortical zone, DCU, LF, MC) in the parenchyma of the organs, an impregnation technique was used on sections frozen with nitrate of silver by serial passage in silver nitrate and potassium permanganate tanks with decreasing concentration, which provides a clear visualization of the corresponding parts of the architectonic structure characteristic of the reticular fibers of this organ. The histological and cytological characteristics were determined using an ocular microscope and a stereo MBS-10 microscope.

RESULTS

The weight of the animal is mentioned in with the appreciation of the age. After the animal was slaughtered, we started by looking for somatic LN. First, we located the retro pharyngeal LN (Photo N ° 03) which is a LN ensuring the circulation of the crossroads of the ganglion chain of the head, located in depth, behind the pharynx, on the internal face of the rising bronchus of the hyoid bone. Triangular flattened with pinkish coloring. The pre-scapular LN (Photo N ° 04) which is located in the fatty mass, at the junction of the neck and the shoulder, in front of the point of the shoulder, so an incision was made perpendicular to the omo-transversarius muscle, oval in shape, with a slightly grayish pink coloration Figure 1.

On the other hand, we visualized the visceral LN, after evisceration, we located the mesenteric LN which is at the level of a large, elongated LN chain located in the mesentery a few centimeters from the jejunum. It has an elongated, greyish red color. In addition, we detected the hepatic LN which is located below the hilum in the fatty mass of the insertion of the lesser omentum, cuboid in shape with a reddish coloration in its middle and gray at the bottom of its structure. After the section of the LN of the sheep, we could visualize a thin layer of connective tissue surrounding the lymphatic parenchyma, spans of trabecular tissue infiltrate inside and form para-cortical zones, sinuses, at the end towards the medullary area, so the CP contains diverticula leaving the blood and lymphatic vessels inside the LN, the efferent pathway has not been elucidated.

The study of the mass of the LN carried out with a precision balance. For the somatic LN, it has been found that the maximum absolute mass is obtained in the retro pharyngeal LN is 7.5 ± 0.009 g (Table 1).

Concerning the visceral LN, the minimum absolute mass in the hepatic LN which is 1.71 ± 0.011 g (Figure 2).

In the study of the morphometry of the LN of sheep (Table 2), it was observed that the maximum length among the somatic LN was attributed to the retro pharyngeal LN equal to 2.96 ± 0.06 cm. For somatic LN; the maximum width was reserved for the retro pharyngeal LN which is equal to 1.76 ± 0.057 cm.

For visceral LN, the minimum length obtained in the mesenteric LN is 2.06 ± 0.059 cm (Figure 3).

Concerning the visceral LN, the maximum width is found at the level of the mesenteric LN which is equal to 2.54 ± 0.057 cm, while the minimum value of width is reserved for the hepatic LN which is 1.34 ± 0.057 cm (Figure 4).

The dynamic of the lymph study of the LN of sheep, according to the pictures obtained, we were able to visualize the passage of the lymph through the efferent lymphatic vessels, penetrating towards the central zone of the LN, a retrograde mass of the clouding product towards the peripheral zones which this diversified directly in the center of the hilum (afferent) (Figure 5).

In our histological results of the LN of the sheep, we established the structural characteristics of the Prescapular, Retropharyngeal, Hepatic, Mesenteric LN of the sheep. After preparing histological sections and staining with hematoxylin

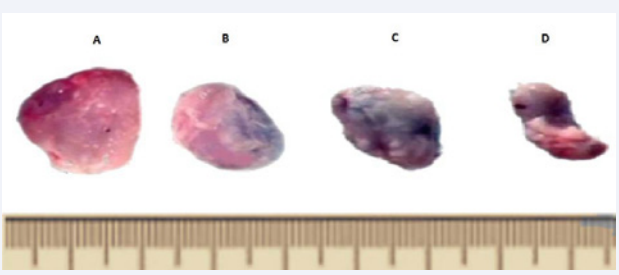

Figure 1 Demonstrative photo of certain somatic LN: 1. Pre scapular LN, 2. Retro pharyngeal LN, 3. Hepatic LN, 2. mesenteric LN.

Table 1: Dynamics of the absolute and relative mass, the length and the width of LN of the sheep (M ± m), n = 3, %.

LN	Absolut mass, g		Relative mass, g	
	max-min	M±m	max-min	M±m
Prescapular	6,65±0,05	6,69-6,53	0,0173±0,000738	0,021-0,013
Retropharyngeal	7,5±0,009	7,53-7,43	0,0047±0,000274	0,006-0,003
Mesenteric	2,88±0,005	2,89-2,87	0,003±0,0001323	0,004-0,003
Hepatic	1,71±0,011	1,72-1,68	0,0681±0,003183	0,076-0,045

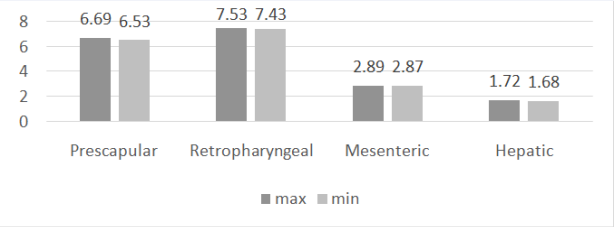

Figure 2 Mass diagram of certain somatic LN in sheep (g).

Table 2: Dynamics of the length and the width of the LN of the sheep (M ± m), n = 3, %.

LN	Length, cm		Width, cm	
	Max-min	M±m	Max-min	M±m
Prescapular	2,44±0,103	2,8-2,3	1,5±0,05	1 ,6-1,4
Retropharyngeal	2,96±0,06	2,8-3,1	1,76±0,057	1,6-1,9
Mesenteric	2,06±0,059	2,7-2,4	2,54±0,057	2,7-2,4
Hepatic	2,56±0,057	2,7-2,4	1,34±0,057	1,5-1,2

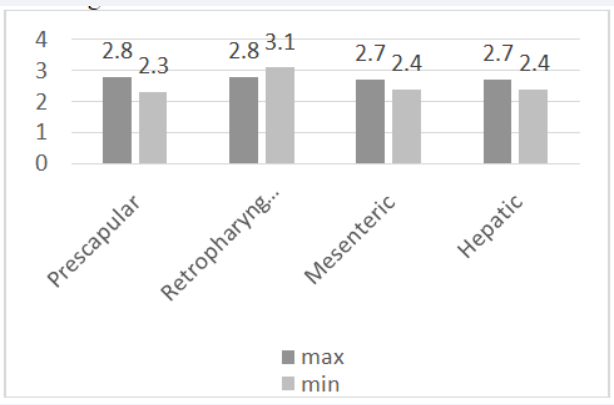

Figure 3 Morphometric parameters (length) of LN of the sheep (cm).

and eosin, it has been possible to elucidate that the LN on the outside is covered with a CP of connective tissue, from which the thin partitions - TR - leave the parenchyma of the knot. In the parenchyma we noted the presence of clusters of spherical lymphoid tissues (follicles) in the cortical region, in the deeper part of the LN, MC was founded in the central area (medullary zone). The presence of numerous marginal type sinuses located directly under the CP and limiting the cortical substance of the ganglion; also cortical sinuses have been observed in the intermediate zone which surround the LF, on the other hand, sinuses have been detected in the medullary zone, located in the spaces of the substance of the medullary mesh (Figure 6).

In the quantitative study of the components of the parenchyma of the LN of the sheep according to our statistics, it was found that each somatic, visceral LN is composed of stroma which is itself divided into CP and TR, the parenchyma which comprises (inactive follicles, active follicles, para cortical area and MC), and sinuses (Table 3).

The histological statistical results of the somatic LN, the stroma which is composed of CP, its maximum value is found at the level of the retro pharyngeal LN which is equal to 15.15 ± 0.75% and a minimum value of 12.41 ± 0.74%, in the retro pharyngeal LN. The percentage of the paracortical zone of the lymphatic parenchyma takes its maximum value in the pre-

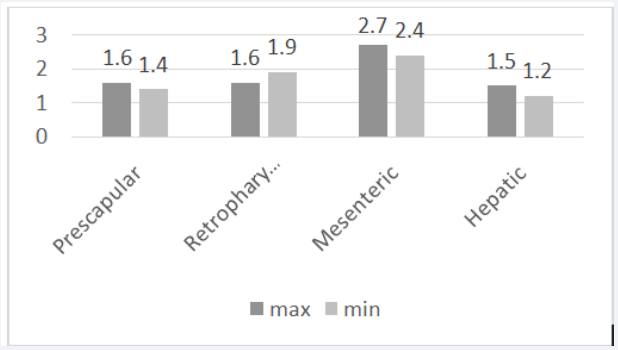

Figure 4 Morphometric parameters (width) of LN of the sheep (cm).

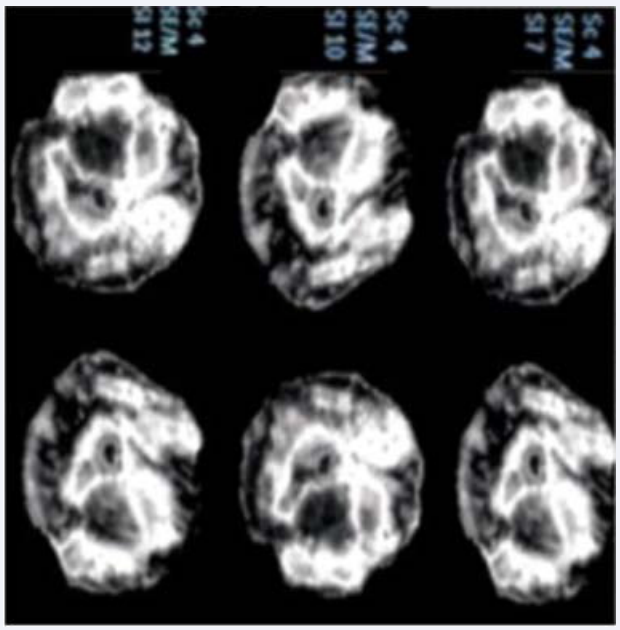

Figure 5 Results of conventional lymphographic of the Mesenteric LN after impregnation with radio selector (rad 1400 w-cross section 0.2 mm).

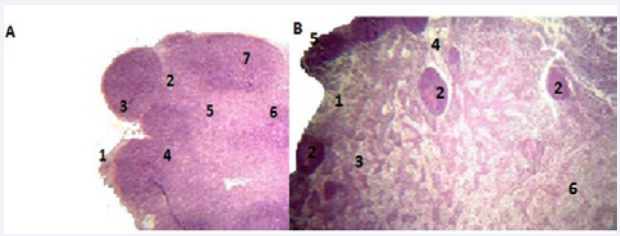

Figure 6 A: histological section of the retro pharyngeal LN, hematoxylin eosin X40 staining (1. CP, 2. TR, 3. Sub CPzone, 4. Cortical zone, 5. MC, 6. Deep medullary zone, 7. LF). B: histological section of the mesenteric LN, hematoxylin eosin X 25 staining (1. cortical zone ,2. LF; 3. Paracortical zone, 4.TR, 5. CP, 6. MC).

Table 3: Summary table of the tissue composition of certain LN of the sheep %.

LN	Stroma	Parenchyma	Sinus
Prescapular	27,1	41,57	31,33
Retropharyngeal	27,56	41,31	34,17
Mesenteric	42,66	45,81	11,79
Hepatic	39,06	52,64	7,72

scapular LN which is 19.34 ± 0.78%, as well as the minimum value is 14.47 ± 0.43%, and found at level of the retro pharyngeal LN, the inactive follicles, the maximum value is obtained at the level of the retro pharyngeal LN is equal to 3.53 ± 0.37%, while the minimum value is assigned to the pre-scapular LN which is 1.23 ± 0.55%, as well as a minimum value is obtained at the level of the pre-scapular LN which is 2.23 ± 0.54%. In our results too, we found that the percentage of MC reaches its maximum value at the level of the retro pharyngeal LN which is 19.56 ± 0.89%, for the sinuses, we found that the maximum value of the sinuses is reserved for the retro pharyngeal LN which is equal to 34.17 ± 0.68%. On the other hand, the minimum value of the sinuses is obtained in the pre-scapular LN which is equal to 31.33 ± 0.42% (Figure 7).

The statistical results of the histological study of the visceral LN, showed us that the maximum value of the CP is obtained in the mesenteric LN which is equal to 25.53 ± 0.53%. For the TR, the maximum TR value is obtained in the hepatic LN which is 18.23 ± 0.23%. The percentage of the Para cortical zone of the lymphatic parenchyma takes a minimum value is obtained at the level of the hepatic LN is equal to 17.25 ± 0.25%.

The inactive follicles are presented by a maximum value at the level of the mesenteric ganglion which is equal to 3.47 ± 0.36%, while the minimum value is obtained in the hepatic LN which is 0.54 ± 0.44%. Let's talk about the active follicles, the minimum value is assigned to the mesenteric LN which is 3.48 ± 0.66%. The rate of the MC for the visceral LN takes its maximum value at the level of the mesenteric LN which equals 25.64 ± 0.63%, while the minimum value is reserved for the hepatic LN which equals 22, 43 ± 0.65%. The sinuses had a minimum sinus value is obtained in the pre-mesenteric LN which is 7.72 ± 0.46%.

The impregnation of the sections prepared with silver nitrate, allowed us to detect the reticular structure (the architectonic structure) of the hepatic LN of the sheep breed Ouled-djellal, with lymphoid formations limiting the TR areas, marginal and deep sinuses well also visualized, the crown of the follicles of increased volume receive the furrows of the reticular tissue in conical form, the medullary zone is jostled behind under the effect of the para cortical zone (Figure 8).

DISCUSSION

The sheep of the Ouled-djellal breed from Algeria region is a ruminant recognized for its resistance to various pathologies and to the extreme conditions of climate biodiversity. Few data in the literature mentioning the anatomical characteristics of the LN in this breed, which according to our research, are organs of the lymphatic system and the immune system. The macroscopic characteristics of the LN of sheep determined to a large extent, the patterns of their morphology and the function of structure at tissue levels.

The results of our studies indicate that the LN of this breed are generally arranged in accordance with the general principles of structural and functional organization of these organs in mammals, however the LN of sheep have a number of morphological characteristics which may be due the adaptation of animal species to extreme living conditions that require maximum efficiency of the body's life support systems [4].

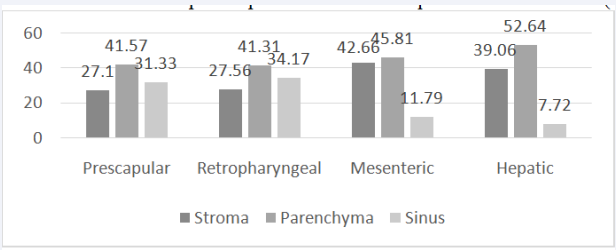

Figure 7 Graph of the tissue composition of the parenchyma of certain somatic LN.

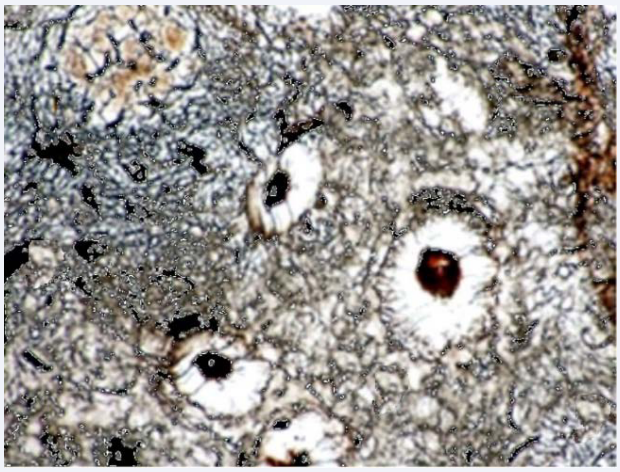

Figure 8 Histological preparation of the hepatic LN. Impregnated with silver nitrate, × 400. 1- center of DCU, 1 - peripheral of DCU, 2 - TR, 3 - sinus, 4 - LF, 5 - plateau cortical, 6 - MC.

The data we have obtained are in agreement with the results of studies [5], which indicate that the topography of the LN of sheep basically corresponds to that of mammals, also according to research carried out on the LN of sheep in regions of eastern countries, many authors [6], mention that the lymphatic system of sheep is generally close to the lymphatic system of cattle, in particular the topography of the LN of cattle, buffalo and camel is very similar. LN in sheep is considerably less than in cattle (in sheep on average 130). The anatomo-topographic situation of the LN of sheep of the Ouled-djellal breed is similar to that of bovid according to [1].

Some differences in the LN in sheep by comparing the location of these with those of the dromedary, which are very dense fatty tissue and connective tissue, that in sheep are in conspicuous. According to our findings, it has been deduced that the topography of the LN in sheep has some peculiarities, the shape is diverse, but especially bean-shaped. Generally gray, pale pink in color, sometimes with a reddish tint, which agrees with the authors' data [7].

According to research by the authors [8], the color of the LN in young and healthy sheep is most often gray or yellowish gray, in older animals it is yellowish in color. In pigs, the somatic LN often have a reddish color due to the characteristics of the arrangement of blood vessels, the color of the LN of internal organs (lung, liver, intestine) is often colored due to their content in various hemosiderin pigments, lipofuscin melanin, during digestion, the LN in the intestine becomes juicy, swollen, whitish [9].

Regarding the shape of the LN in sheep, comes in different forms like other mammals, they are triangular flattened in the retro pharyngeal LN, in the pre-scapular LN, it is oval, for visceral LN, the elongated form in the mesenteric LN has been noted, these characteristics have also been mentioned in mammals, flattened, triangular, elongated and can be formed from a conglomerate. In cattle, they are more often rounded or oval, in pigs, in the form of conglomerates, oval and round [10], in humans, the LN has mainly an oval or spherical shape [7]. While in horses, the authors describe that the size of the LN vary according to the age of these animals, thus, in ponies, the submaxillary LN can reach bean values, while in adult horse, they have a pea shape and are barely palpable separately [11].

Like other LN, that of sheep, it also has a convex side, to which a certain number of lymphatic vessels are suitable, which supply the lymph to the LN, and a concave side, called the hilum, the sheath of vessels (blood, lymphatics and nerves) penetrate the LN by the so-called efferent route, while the incoming flow of lymph is through the afferent routes, which corresponds to research by [12].

In the quantitative study, we found the mass of the retro pharyngeal LN equal to 7.5 g, on the other hand the minimum absolute mass is for the hepatic LN1.71 g. In the context of the weight of the LN of sheep, little or no research concerning this specialization in the literature.

The morphometric study of the LN of sheep has also been mentioned in other research, it has been observed that the length of the mesenteric LN presented the minimum length is 2.06 cm and a width of 2.54. The maximum length is reserved for the retro pharyngeal LN which is equal to 2.96, with a width of 1.76 cm. In summary, in the hepatic LN, according to other authors mention that these measurements are variable and depend on the type and age of the animal. The length of the LN varies on average from 2 mm to 10-20 cm, but there are exceptions, in cattle, the length of the mesentery LN reaches 8 to 12 cm [13], also in the same animal, the length of the LN varies from 2 to 29 cm and its cross section reaches 2 to 3 cm.

The structural study with medical imaging with injection of contrast agent revealed to us that the LN is formed of an appropriate thin layer, blades of connective tissue penetrating the organ forming cavities, dividing the LN into compartments very clear in the picture [14]. Dark zones which correspond to the medullary zones immersed by TR, in the center a slight slit of circular shape, of well-defined outline which corresponds to the opening of the hilar canal, similar research carried out for the same purpose, carried out on animals such as rabbits [1] and cattle also by other researchers [15], have well described the techniques and methods of using the conventional radiology to demonstrate the exact structure in vivo of the LN and this for the purpose of diagnosing diseases which affect the immune system such as lymphomas. A technique that helps highlight the in-situ circulation of the lymph, using contrast products based on iodine [16].

Lymphographic of the LN of the ovine Ouled-djellal breed has shown us the diversification of the spans of the tTR areas to the intern of the LN which also has elucidated the different areas (cortical and medullary), because Para cortical area was not well visualized, the center of lymphatic evacuation was clearly visible, surrounded by thick layers apparently are the lymphatic and blood vessels. Similar studies have been done on other laboratory animals [17], but the difficulty in obtaining similar results has not yet been elucidated, probably due to the lack of contrast media and handling at radiology centers.

In the study of the three-dimensional architecture of the sheep's LN, the radiographs of the lymph show that the segments of the parenchyma are made up of separate structurally functional units (compartments), each of which is located in a certain sequence of zones. functional. The geometric shape of most compartments of the LN is approximated by a spherical shape which has the shape of an asymmetric ellipse with an extension in the cortical region. At the base of each compartment of cortex is the area of para-cortex (DCU), covered with a cortical plate with impregnations of LF of spherical shape, it was established the presence of large clusters of cortex deep clear, with different contours, without clear boundaries, in which are located LF at different levels of structural organization. It has also been noted that the skeleton of the connective tissue of the artiodactyls of the LN (sheep, goats, cattle) is characterized by an important development of the CP-TR system [18].

The images obtained by lymphographic of the LN of the sheep, we revealed that the cortical area in the form of a layer of rather uniform thickness underlying the entire peripheral cortex. However, this concept has not been supported by actual observations. Instead, previous researchers observed related structures whose appearance varied widely between nodular-type components and poorly defined components. Clearly, current

knowledge of cortical histology is inadequate and confused. Therefore, we have undertaken a three-dimensional study of the region in different LN. The present work, on the topography of the region, has revealed that the cortex of the LN is formed from one to several basic "units". Each unit is a semi-rounded structure, varying from hemispherical to semi-ovoid in shape and contains part of the peripheral cortex. Work has also shown that two or more units can merge to form a "complex". The data indicated that the number, size and shape of the units and / or complexes of a LN differ to some extent depending on its anatomical location. These differences probably reflect corresponding variations in the nature and extent of antigenic stimulation at different sites in the body. Also, a number of segments have been found in the somatic LN, including the hepatic LN. Thus, the structurally functional organization of the parenchyma of the LN of sheep corresponds to the general principle's characteristic of a class of mammals in general, the main of which is the discrete nature of the structure of the lymphoid tissue, with an identical histological architecture of the corresponding subunits. The dynamics of the nature of the mass distribution of contrast in the units of the LN of the sheep shows a lymphatic basin, represented by the edge and the portal sinus, the first of which is directly linked to the afferent lymphatic vessels and the other to the vessel's efferent lymphatics.

Finally, the study demonstrated the need for a three-dimensional examination of a LN to obtain adequate information on its overall architecture and, in particular, on its topography of the cortex. The results of the cuts impregnated with silver nitrate, showed us that the base of each LN is a unit of the spherical shape of the DCU, with central and peripheral zones clearly defined, the sinus enters the cortical plateau or the so-called superficial cortex with obvious borders. The follicles, thus, detected on the entire periphery of the DCU, on the boundary with an edge of the peritrabecular sinuses and other deep sinuses surrounding other follicles. In addition to the unity of the DCU and follicles, each includes complex, relatively underdeveloped MC with medullary sinuses, which are usually located in the follicular centers and directed to the hilum of the parenchymal sinus arranged in a single row, all the LN without exception, the MCgo up along the lobules bordering the upper part. Consequently, it is of specific histo-architectonic form like other mammals in general, provided by a combination of lymphoid nodule, dense diffuse lymphoid tissue and MC, these results coincide with research by [19].

The histological sections stained with hematoxylin and eosin, we have to elucidate that the LN on the outside are covered with a CP of connective tissue, from which the thin partitions infiltrate inside which we name TR, leave the parenchyma of the LN. In the parenchyma we noted the presence of clusters of spherical lymphoid tissues (follicles) in the cortical region, in the deepest part of the LN was detected MC in the central area (medullar area), the presence of many sinuses of the marginal type located directly under the CP and limiting the cortical substance of the ganglion; also we observed cortical sinuses in the intermediate zone which surround the LF, on the other hand we detected sinuses in the medullary zone, located in the spaces of the substance of the MC, these are the same results found by other authors for other mammalian LN, after [20], who mention that the LN is enveloped by a CP which lines the contents of the LN, made of dense connective tissue accompanied by some elastic laminae and rare smooth muscle fibers. Its convex face is pierced allowing the passage of the afferent lymphatic vessels which is not in the pig which has a reverse structure, it thickens in an area called the hilum to form a connective-adipose tissue layer (efferent lymphatic vessels and pedicle vascular).

In the histological study of the components of the parenchyma of the LN of the sheep, it has been found that each somatic and visceral LN is composed of stroma which is itself divided into CP and TR, the parenchyma which comprises (inactive follicles, active follicles, para cortical area and MC), and sinuses, as also mentioned by the authors [21]. In their research, also the LN is divided into compartments called lymphatic nodules (or lobules) each consisting of a cortical region of combined follicular B cells, a para cortical region of T cells, and a basal part of the nodule in the medulla.

Our results indicate that the sheep's LN form a single unit, partially surrounded by connective tissue and fatty layer that come in different forms, widely found throughout the animal's body. They are linked by lymphatic vessels as part of the circulatory system. The CP of the LN is composed of dense and irregular connective tissue, and from its internal surface are emitted a number of membranous processes or TR. They pass inward, radiating toward the center of the LN, for about a third or a quarter of the space between the circumference and the center of the LN. Other research indicates that in some animals, they are sufficiently well marked to divide the peripheral or cortical part of the LN into a number of compartments (nodules), but in humans this arrangement is not obvious. The largest TR which spring from the CP is divided into thinner bands, and these intertwine to form a mesh in the central or medullary part of the node [22].

The sinuses include, the sub CP sinus, is a channel in the LN, the somatic LN in the sub CP sinus than the visceral LN, the number of sinuses of which is much higher in the medullary area and this probably due to localization LN that are close to some center rich in antigens, especially the mesenteric LN. On the other hand, those which are somatic, the **CP** barrier is thick which favors the decrease in traction to the antigens which increase the number of sinuses in this zone, which theoretically and which is suitable with the researches of (Haller. A 1983), in both cases (somatic or visceral) this allows the lymph to flow smoothly through them, from where the lymph pours into the efferent lymphatic vessels out of the hilum node on the concave side. These vessels are smaller and do not allow passage of macrophages so they remain confined to function in the LN.

These sinuses take the form of dead ends in the inter follicular cortex, then cross the unit of the peripheral cortex and flow into the medullary sinuses. They have been called unitary sinuses, cortical sinuses and peripheral sinuses [23], and also described as lymphatic labyrinths [24]. When the para cortical sinuses are filled with lymphocytes, they are histologically seen as irregular, densely basophilic islets and tightly packed lymphocyte ribbons surrounded by the thin pale line of the sinus-lobule membrane. At the cortico-medullary junction, the paracortical sinuses discharge their lymphocytes into the medullary sinuses [25]. According to Bélisle et Sainte-Marie [26], lymphocytes emigrate

from the lobule and enter the sinus system by penetrating narrow sinuses less than 100 microns wide, then circulate between the para cortical cords, this exploitation required too much material and equipment so we were unable to realize the latter.

Our research has found that the sheep's LN contains lymphoid tissue, which coincides with the results of [27]. As well as the subcapsular follicles are very clear in the somatic, retro pharyngeal and pre-scapular LN. The outer shell of the CP is constructed from sheep LN of connective tissue fibers and forms a kind of network of elastic cells.

Authors have noted that in all sheep LN, their CPCP are impregnated with fine elastic fibers, as well as collagen fibers with well-defined spare folds. In the deep layers of the CP there are thicker elastic fibers. In collagen and TR elastic fibers, simply form a network with loops of different shapes and sizes and long oriented along the longitudinal axis of TR. It should be noted that the fibers of connective tissue are closely related to and combined with myocytes in the structural-functional syncytium. Thus, the afferent lymphatic vessels of the LN pierce the CP at an acute angle to its surface, extend a certain distance in the thickness of the CP, and only after that are opened in the marginal sinus. Such a course of lymphatic vessels, in our opinion, prevents reflux of the lymph, even in the case of an overflow or its sinuses at the time of the CP of the systole LN. At the confluence of the lymphatic vessel's afferent to the LN CP, collagen and elastic fibers, as well as the first fan-shaped myocytes pass all the CP layers without visible limits (Spadling et al, 1989).

The cortex of the sheep's LN has been observed under the CP and the subcapsular sinus, it has an external superficial part and a deeper part known as the para cortex, the sub CP sinus flows towards the TR sinuses, then the lymph flows into the medullary sinuses, the external cortex consists mainly of B cells arranged in follicles, which becomes active when attacked with an antigen, and the deeper para cortex mainly consists of T cells with reticulocytes , and the reticular network has become dense, this research corresponds to data from [28].

Also, under the microscope it was observed that the medullary zone of the somatic and visceral LN, contains large blood vessels, sinuses and MC, data also correspond to the results of the authors [29]. The medullary sinuses separate the MC, the lymph flows into the medullary sinuses from the cortical sinuses and into the efferent lymphatic vessel.

On the other hand, in the retro pharyngeal LN, the follicles reveal discrete structures of DCU with different contours, without clear boundaries, which may be due to the intensity of the antigenic pressure. The degree of development of structurally functional units depends on their locations and the intensity of the dynamics of the lymph in various areas of the LN. The follicles in the sheep LN are characterized by a tiered arrangement, with a predominance in the region of the cortical sinus. The relative area of the stromal connective tissue of the LN is approximately 6.7-17.1% in sheep, 15.9-21.6% in cattle [30], which almost coincides with our research results. The LF have a different level of localization, both at the poles and on the lateral surfaces of the units of the DCU and the deep layers of parenchyma, para cortex on all sides, which gives the characteristic mosaic pattern of parenchyma segment. The LF of the visceral LN, are formed not only on the basis of the cortical plateau, but also in the reticular frame of the medullary area. The in-depth study of somatic LN in sheep has been established is mentioned about 12 LF, most of which are active and the visceral LN around 8 non-active LF. The quantitative results of the percentage composition of the different LN of the sheep, we have the stroma which is composed of CP, its maximum value is at the level of the visceral mesenteric LN is 25.53 ± 0.53%. In contrast, the somatic LN, the pre-scapular node has a value of 14.45 ± 0.53%, while the retro pharyngeal node has a value of 15.15 ± 0.75%. For visceral LN, the hepatic node has been found to have a CP value of 24.43 ± 0.22%. The TR has a maximum value in the hepatic LN of 18.23 ± 0.23%. At the level of the somatic LN, it was found that the TR value for the retro pharyngeal LNis 12.41 ± 0.74%, while that of the pre-scapular LN, it has been found that the value of the paracortical zone of the pre-scapular LN is 19.34 ± 0.78%. On the other hand, the visceral LN, we found the value of the hepatic node is 17.25 ± 0.25%, and 18.56 ± 0.64% for the mesenteric LN, these results coincide with the data from [31]. Inactive follicles, the maximum value is obtained at the level of the retro pharyngeal ganglion is equal to 3.53 ± 0.37%. On the other hand, the minimum value is observed on the hepatic ganglion 0.54 ± 0.44%. So, for the somatic LN, it has been found that the value of the inactive follicles of the pre-scapular node is 1.23 ± 0.55%. The visceral LN have a value of 3.47 ± 0.36% for the mesenteric node, then in other research by [32], mentioning that the follicles are formed by a chin less thick which is not in our case study, probably that the exaggerated effect of anti-parasitic has made a change in this volume.

The results of [33], correspond with our results also, the active follicles are presented by a percentage of 2.23 ± 0.54% is observed in the pre-scapular LN. Among the somatic LN, the retro pharyngeal LN has a value of 3.75 ± 0.71%. For visceral LN, the value of the active follicles of the hepatic LN has been found to be 5.59 ± 0.51%, while the value of 3.48 ± 0.66% for the mesenteric LN [34]. Also, in our results, it was found that the percentage of the MC reaches its maximum value at the level of the mesenteric LN was therefore equal to 25.64 ± 0.63%, which is also mentioned in the results of [35]. For the pre-scapular LNs, the value of the MC has been found to be 18.77 ± 0.62%. While the value of 19.56 ± 0.89% is reserved for the retro pharyngeal LN, it has been noted for the visceral LN, it has been found that the value of the hepatic LN is 22.43 ± 0, 65%. Concerning the sinuses, it was found that the maximum value of the sinuses is reserved for the retro pharyngeal LN which is equal to 34.17 ± 0.68%. While the minimum value is obtained at the level of the mesenteric LN is equal to 7.72 ± 0.46%. For somatic LN, the pre-scapular LN has a sinus value of 31.33 ± 0.42%. On the other hand, in the visceral LN, the hepatic LN has a sinus value of 11.79 ± 0.53%. In summary, these results are in agreement with data from other authors Snoeijs et al, 2007.

CONCLUSION

The characteristics of the structural and functional organization of the parenchyma of the LN of the sheep of the mature Ouled-djellal breed, in terms of concept identical to the structure of the lymphoid tissue of the organs from data from other mammals.

The LN of sheep of the Ouled-djellal breed represents a unique autonomous form, corresponding to the LN typical of other mammals with a sign of a certain fusional orientation. As well, the segments of the LN are made up of structural and functional units (compartments), the number of which indicates an essentially "single compartment" structure of the segment. The spatial organization of the predominant majority of the functional areas of the LN compartments is approximate to spherical with an expansion near the marginal sinus.

The linear and topographic characteristics of the LN of sheep of the Ouled-djellal breed generally correspond to similar parameters of these organs in cattle, but on the macroscopic structure occupy an intermediate position between the LN of domestic horses and pigs.

The nature of the relationship with the extra ganglionic lymphatic vessels, sheep LN belong to nodes of the classical type, in which the afferent lymphatic vessels drain directly into the marginal and efferent sinuses which are located in the area of the sub grid sets - units, come from the sinus of the hilum and connected to several large lymphatic vessels which are located next to the largest arteries and veins.

The follicles of the LN have a very clear structural organization, each segment presents a DCU, lymphatic nodules which is the external part of the units of DCU and MC) with specific cells for each zone of while moving towards the reticular nucleus. The base of each LF in the sheep's LN parenchyma shows the DCU. The main quantitative morphological features of the structural organization of the LN of the sheep at the tissue level are important connective framework of development in the different LN groups and the intra-site sinus system, so that the relative area is less than lymphoid parenchyma in the somatic LN and in the visceral LN.

The results of in-depth analyzes of the characteristics of the dynamics, of the external and internal macrostructure and the regularities of the structural and functional organization of the follicles in the LN of sheep of the Ouled-djellal breed; the nature of the macrostructure of the LN which have a distinct type, formed by following a total fusion - The sequential architecture of the parenchyma includes centers of lymphoid tissue, surrounded by lymphatic sinuses. For the first time we note that the follicular parenchyma of the LN of sheep of the Ouled-djellal breed has a relevant characteristic of lymphoid tissue like other mammals.

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