



LYMPHATIC DRAINAGE OF THE THORACIC AND PELVIC LIMBS OF THE RABBITS

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ABSTRACT

The present study is carried out on twenty healthy adult rabbits of different sexes up to 2.5 year of age and weighted from 2.5-3.5 kg. Ten rabbits are used for gross anatomical studies of the position and dimensions of lymph nodes. Other ten adult rabbits are used for the histological study. The rabbit thoracic limb has axillary lymphocenter which includes the proper and accessory axillary lymph nodes and the pelvic limb has the popliteal lymphocenter which comprises the superficial popliteal lymph node. The proper axillary lymph nodes are one to two nodes (one large and one small). They are situated in the axillary space. The accessory axillary lymph node is single node lies on each side subcutaneously in the axilla caudal to the shoulder joint. The superficial popliteal lymph node is single lymph node. It is located subcutaneously between M. biceps femoris and M. semitendinosus and dorsal to the lateral head of M. gastrocnemius. The structure of the lymph nodes is similar. They are surrounded by capsule that sends trabeculae that divides the nodes into several lobes. The subcapsular sinuses are very narrow and lack in some areas of the nodes. The cortex shows well-defined nodules (primary and secondary) which are located at the periphery of the node. The medulla is characterized by the presence of medullary cords with medullary sinuses. The cords consist of lymphocytes, macrophages, Reticular cells, plasma cells and occasional neutrophils

Key Words: Thoracic limb, pelvic limb, Rabbits

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1. INTRODUCTION

Rabbit has economic value as a source of meat and fur production and it is used as an ideal laboratory animal because of its high fertility, short generation span, small size and low cost so, it is used in the production of antibodies [1]. The rabbit is a good experimental clinico-anatomical model in the research of number of morphological anomalies and diseases in humans and animals [2].

The anatomy of the rabbit in general and specially its lymphatic system was inadequate and lacks the necessary details. So, the aim of the present study is to give detailed information on the anatomical features of the lymphatic system and histological structure of the lymph nodes of

the thoracic and pelvic limbs in the rabbit with the object to fill a gap in the field of comparative anatomy and as an aiding step for surgical and medicinal interferences.

2. MATERIALS AND METHODS

The present study was carried out on twenty healthy adult rabbits of different breeds and different sexes up to 2.5 year of age and weighted from 2.5-3.5 kg. Ten rabbits were used for gross anatomical studies of the position and dimensions of lymph nodes. Other ten adult rabbits were used for the histological study.

The ten specimens were used for the anatomical study were injected with 0.1-0.2

ml of diluted India ink that diluted with distilled water in ratio 1:1. The injection occurred by 25 gauge needle into skin of different body regions as skin of the dorsal aspect of manus and pes; also s/c injection at the different body regions. After that the rabbits were allowed to exercise for at least one hour then deep inhalation anaesthesia was carried out using chloroform until the desired anaesthetic effect was obtained. Then the rabbits were bled, then injected with 10% formalin solution, 4% phenol and 1% glycerol intraperitoneally. The rabbits were left for a weak for fixation, then dissected finely using Magnifying lens and stereomicroscope. A caliper was used for measuring of the different dimensions of lymph nodes. A digital camera was used for preparation of photographs.

Ten specimens for the histological study were taken immediately after slaughtering of the rabbits. They were fixed in 10% neutral buffered formalin, dehydrated in ascending grades of alcohol, cleared in xylene and embedded in paraffin wax. Sections of 5-7 um in thickness were obtained and stained with Harris's alum Haematoxyline for general histological observation. The staining methods were used as outlined by [3].

Several photographs were prepared. The nomenclature used in this study was adopted by the [4].

3. RESULTS

The rabbit thoracic limb had axillary lymphocenter and the pelvic limbs had the popliteal lymphocenter.

3.1. *Lymphocentrum axillare*:

The axillary lymphocenter was consisted of the proper and accessory axillary lymph nodes.

3.2. *Lymphonodi axillares proprii*:

The proper axillary lymph nodes (fig. 1 /1) were one to two lymph nodes (one large and one small) with an average of 1.45 in number. The large node measured 11 mm

in length and 6mm in width, while the small one measured 6 mm in length and 4mm in width. The average length of the proper axillary lymph node was 8.22mm and the average width was 5.2 mm (Table 1).

The nodes were situated in the axillary space that was bounded laterally by M. subclavius, M. teres major and M. latissimus dorsi, medially by wall of the chest and M. serratus ventralis and caudally by M. latissimus dorsi and cutaneous muscles. They related to the brachial vein and brachial plexus caudally, between superficial pectoral muscles laterally and teres major muscle and subscapular muscle medially.

The node was surrounded by somewhat thick capsule that send trabeculae that divided the nodes into several lobes. The capsule and trabeculae composed of dense white fibrous connective tissue & smooth muscles and showed infiltration by small number of lymphocytes and plasma cell. The subcapsular sinuses were very narrow and lacked in some areas of the nodes. The cortex showed well-defined nodules (primary and secondary) which were located at the periphery of the node. The medulla occupied a large part of the node and was characterized by the presence of medullary cords with medullary sinuses. The cords consisted of lymphocytes, macrophages, Reticular cells, plasma cells and occasional neutrophils (fig. 2 & 3).

3.3. *Lymphonodus axillaris accessorius*:

The accessory axillary lymph node (fig. 4/1) was single node located on each side subcutaneously in the axilla caudal to the shoulder joint. Each node measured 6-9 mm in length (with an average of 6.5 mm) and 3-6 mm in width (with an average of 3.7 mm) (Table 1). It was related medially to superficial pectoral muscle, cranially to shoulder joint, laterally to fascia covering the shoulder joint and omobrachial fascia, craniodorsally to deltoid muscle and caudodorsally to the M. latissimus dorsi.

The lymph node was surrounded by thick capsule that send trabeculae that divided the nodes into several lobes. The capsule and trabeculae composed of dense white fibrous connective tissue & smooth muscles and showed infiltration by small number of lymphocytes, plasma cell and macrophage. The sub capsular sinuses were very narrow and separated the capsule than cortex. The cortex occupied a large part of the node and showed well-defined secondary lymphatic nodules and the primary nodules were lacked in the cortex. The medulla was characterized by the presence of medullary cords with medullary sinuses. The cords consisted of lymphocytes, Reticular cells and plasma cells (fig. 5, 6& 7).

3.4. *Lymphocentrum popliteum*:

The popliteal lymphocenter included the superficial popliteal lymph node. While the deep popliteal lymph nodes were not recorded in the present study.

3.5. *Lymphonodus poplitei superficialis*:

The superficial popliteal lymph node (fig. 8/1) was single node and located bilaterally immediately under skin and fasciae between M. biceps femoris and M. semitendinosus and dorsal to the lateral head of M. gastrocnemius. Each node measured 8-14 mm in length (with an average of 9.05 mm) and 5-9mm in width (with an average of 6.3 mm) (Table 1). It was related medially to the lateral head of M. gastrocnemius, laterally to the M. biceps femoris and M. semitendinosus, skin and fascia, cranially to the ischiatic nerve and caudally to the popliteal vein.

They surrounded by somewhat thick capsule that send trabeculae that divided the nodes into several lobes. The capsule and trabeculae composed of dense white fibrous connective tissue & smooth muscles and showed infiltration by large number of lymphocytes, plasma cells & macrophage and small number of neutrophils. The sub capsular sinuses were very narrow and separated the capsule than the cortex. The cortex occupied a large part of the node and

showed well-defined secondary lymphatic nodules and the small number of the primary nodules. The medulla was characterized by the presence of well defined medullary cords with medullary sinuses. The cords consisted of lymphocytes, macrophages, reticular cells, plasma cells and neutrophils (fig. 9, 10& 11).

The micrometrical parameters (capsule thickness, trabeculae thickness, diameter of primary nodule and diameter of secondary nodule) of the lymph nodes of abdomen, pelvis and pelvic limb of rabbit were recorded & shown in Table 2.

4. DISCUSSION

Concerning the lymphocenters of the thoracic limb, the present study revealed that there was axillary lymphocenter in the thoracic limb. This was in agreement with [5, [6] and [7] in domestic animals.

With respect to the proper axillary lymph nodes, they were one to two lymph nodes in the current work confirm the findings of [8] in white rat. On other hand, [9] in laboratory rat and [10] in the Australian brushtail possum stated that there were four nodes.

The present work revealed that the average length was 8.2mm. A case which did not revealed in the rabbits in the available literature. While [11] in dog mentioned that the size of it was 2cm.

In agreement with [12], [13] in rabbits, [14] in the grey kangaroo and [10] Australian brushtail possum mentioned that the proper axillary lymph nodes were situated in the axillary space or axillary fossa.

The proper axillary lymph nodes were related to the brachial vein and teres major muscle in the present investigation. This was accepted by [5] & [6] in ox, [15] in sheep & goat, [14] in the grey kangaroo and [10] Australian brushtail possum. According to the histology of the proper axillary lymph node, the cortex showed well-defined nodules (primary and secondary), which were located at the

periphery of the node in the current work.

A fact did not record in the rabbits in the

Table 1. Showing the Number, Dimensions, standard deviation and standard error of lymph nodes of the thoracic and pelvic limbs of the Rabbit (N = number, L= length, W= width (in mm)).

Rabbit No.	Superficial popliteal			accessory axillary			proper axillary		
	N	L	W	N	L	W	N	L	W
1	5	8	1	4	9	1	6	11	2
2	5	8	1	3	7	1	5	9	1
3	7	10	1	3	6	1	5	8	2
4	6	9	1	3	6	1	4	8	2
5	5	8	1	4	8	1	6	9	1
6	7	9	1	3	7	1	5	7	1
7	7	8	-	3	5	1	5	6	1
8	9	14	1	4	7	1	5	8	1
9	6	8	1	4	5	1	5	8	2
10	6	8.5	1	4	7	1	5	8	1
11	5	8	1	4	9	1	6	-	2
12	5	8	1	3	7	1	5	-	1
13	7	10	1	3	6	1	5	11	2
14	6	9	1	3	6	1	6	9	2
15	5	8	1	3.5	7	1	6	8	1
16	7	9	1	4.5	8	1	5	8	1
17	7	8	-	3	5	1	5	9	1
18	9	14	1	4	7	1	5	7	1
19	6	8	1	4	6	1	5	6	2
20	6	8.5	1	4	7	1	5	8	2
Mean	6.3	9.05	1	3.55	6.75	1	5.2	8.22	1.45
Standard deviation	1.1	1.3	0	0.54	1.16	0	0.45	1.09	0.51
Standard Error	6.3±0.24	9.05±0.3	1±0	3.55±0.12	6.75±0.26	1±0	5.2±0.1	8.22±0.24	1.45±0.11

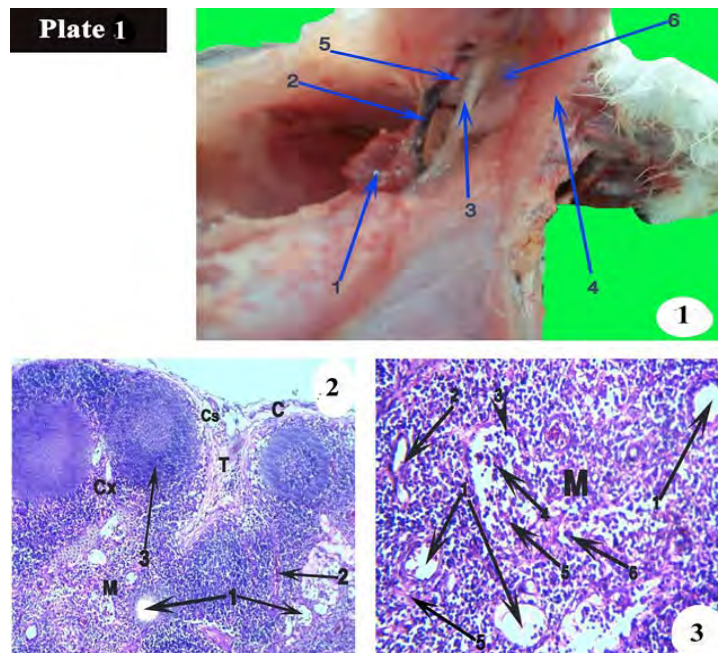


Plate (1): Fig. (1): photograph of fresh specimen showing position and relation of proper axillary lymph node: 1) Proper axillary lymph node. 2) Brachial vein. 3) Brachial plexus. 4) M. Pectoralis descendens superficialis. 5) Teres major muscle 6) M. Subscapularis. Fig. (2): Photomicrograph of rabbit proper axillary lymph node (H&E) X20 Showing: C= Capsule, Cx= Cortex, T= Trabeculae, M= Medulla, 1) Medullary sinus. 2) Medullary cord. 3) Secondary lymphatic nodule. Fig. (3): Photomicrograph of medulla proper axillary lymph node (H&E) X40 Showing: M= Medulla. 1) Medullary sinus. 2) Medullary cord. 3) Lymphocyte. 4) Plasma cell. 5) Macrophage. 6) Neutrophils

Lymphatic drainage of the thoracic and pelvic limbs of the rabbits

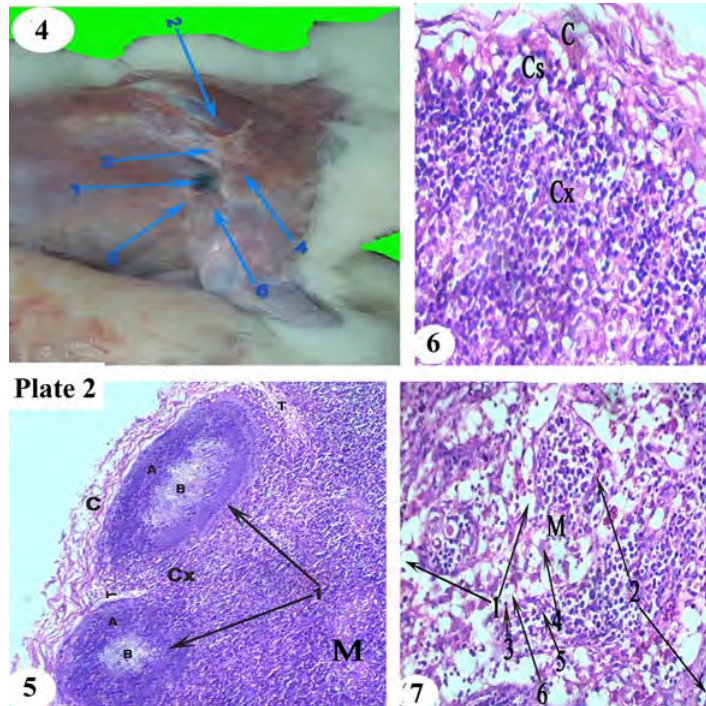


Plate (2):Fig. (4): photograph of fresh specimen showing position and relation of accessory axillary lymph node: 1) Accessory axillary lymph node, 2) M. Latissimus dorsi, 3) Omobranchial fascia, 4) M. Deltoidus. 5) M.Pectoralis superficialis descendens. 6) Long head of Triceps Brachii muscle.Fig. (5): Photomicrograph of rabbit accessory axillary lymph node (H&E) X20 Showing: C= Capsule, Cx= Cortex, T= Trabeculae, M= Medulla, 1) Secondary lymphatic nodule. A) Corona. B) Germinal center.Fig. (6): Photomicrograph of capsule and cortex of the accessory axillary lymph node (H&E) X40 Showing: C= Capsule, Cx= Cortex, Cs= Subcapsular sinus. Fig. (7): Photomicrograph of the medulla of the accessory axillary lymph node (H&E) X40 Showing: M= Medulla, 1) Medullary sinus, 2) Medullary cord, 3) Lymphocyte, 4) Plasma cell, 5) Macrophage, 6) Reticular fibers

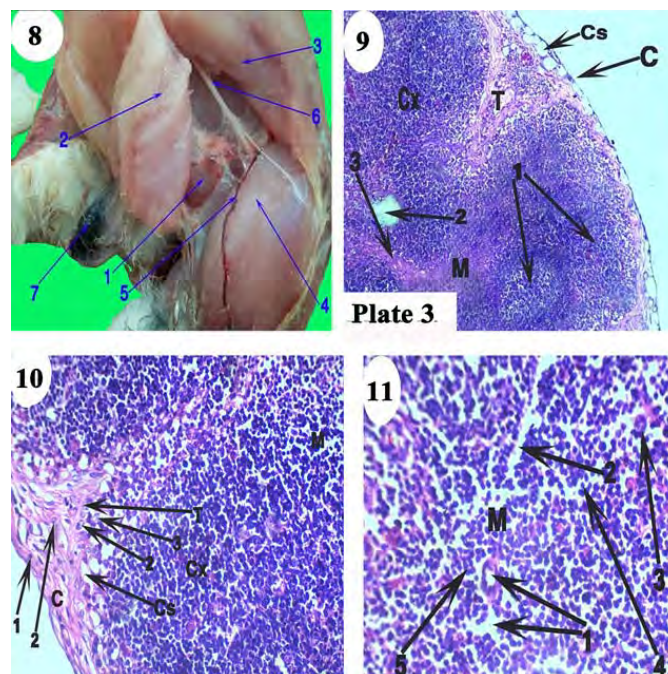


Plate (3):Fig. (8): photograph of fresh specimen showing position of popliteal lymph node: 1) Popliteal lymph node. 2) M. Semitendinosus. 3) M. Biceps femoris. 4) Lateral head of Gastrocnemius muscle.5) Popliteal vein. 6) Ischiatic nerve. 7) Site of injection of India ink. Fig. (9): Photomicrograph of rabbit popliteal lymph node (H&E) X10 Showing: C= Capsule, Cx= Cortex, T= Trabeculae, M= Medulla. 1) Secondary lymphatic sinus. 2) Medullary cord. Fig. (10): Photomicrograph of capsule of the popliteal lymph node (H&E) X40: C= Capsule, Cx= Cortex, T= Trabeculae, M= Medulla, 1) Lymphocyte, 2) Plasma cell, 3) Macrophage. Fig. (11): Photomicrograph of medulla popliteal lymph node (H&E) X40 Showing: M= Medulla, 1) Medullary sinus, 2) Medullary cord, 3) Macrophage, 4) Lymphocyte, 5) Neutrophils

Table 2. The means for the measurement of various micrometrical parameters of the lymphnodes of the Rabbit thoracic and pelvic limbs

Parameter side	Superficial Popliteal	Accessory axillary	Axillary
Capsule thickness (μ)	70	68	62
Trabeculae thickness (μ)	75	74	67
Diameter of secondary lymph nodule (μ)	376	452	402
Diameter of primary lymph nodule (μ)	299	-	388

According to the histology of the proper axillary lymph node, the cortex showed well-defined nodules (primary and secondary), which were located at the periphery of the node in the current work. A fact did not record in the rabbits in the available literature. However, [16] in Egyptian rat recorded that it occupied most of the nodes, and contain several nodules with prominent germinal centers.

The present work recorded that the capsule is slightly thick invaded by lymphocytes and in some places by plasma cells confirmed the findings of [16] in Egyptian rat.

Concerning the accessory axillary lymph node, [14] in the grey kangaroo stated that the superficial axillary lymph node was located superficially in the axilla confirm the finding in the present work.

The present work revealed that the accessory axillary lymph node was single lymph node. This was accepted by [17, 15 and 6] in sheep. On other hand, [6] in cat it was 3-5 lymph nodes.

The present study revealed that the accessory axillary lymph node was related to the superficial pectoral muscle. This was in agreement with that described by [14] in the grey kangaroo and [10] in the Australian brushtail possum.

Regarding the popliteal lymphocenter, in the current work, there was the superficial popliteal lymph node only in this lymphocenter. A case did not observe in the rabbits in the available literature. However, [5] and [6] in pig reported that there were

superficial popliteal and deep popliteal lymph nodes in such lymphocenter.

With respect to the superficial popliteal lymph node, the present study and [18] in rabbit observed that it was single node with 8-14 mm in length. However, [19] in the mouse revealed that it was single with approximately 2 mm long. While [5, 6, 11, 20, 21, 22 and 23] in dog showed that it was single node with up to 5cm length.

The present work revealed that the superficial popliteal lymph node was located in the popliteal fossa confirm the description of [12 and 24] in same animal and [9] in laboratory rat.

In the current work, the thickness of the popliteal lymph nodes was 70 μ m, thickness of trabeculae was 75 μ m, diameter of secondary lymphatic nodules was 376 μ m and diameter of primary lymphatic nodules was 299 μ m. A fact did not record in the rabbits in the available literature. However, [25] in goat mentioned that the capsule thickness of popliteal lymph node was 56 μ m, thickness of trabeculae was 75 μ m the diameter of secondary lymph nodule was 465 μ m and diameter of primary lymph nodule was 390 μ m.

Conclusion:

The rabbit thoracic limb had axillary lymphocenter and the pelvic limbs had the popliteal lymphocenter. The proper axillary and accessory axillary lymph nodes only detected in the axillary lymphocenter and the superficial popliteal lymph node in the popliteal lymphocenter.

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عدد 25 (1): 239-255 سبتمبر 2013

مجلة بنها للعلوم الطبية البيطرية



التصريف الليمفاوي للأطراف الصدري والحوضي في الأرناب

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الملخص العربي

تمت هذه الدراسة على عشرين من الأرناب البالغين الأصحاء من الجنسين والتي تزن حوالي 2.5- 3.5 كجم. حيث يستخدم عشرة أرناب للدراسات التشريحية للغدد الليمفاوية. وتم استخدام عشرة أرناب أخرى للدراسة النسيجية. اتضح من الدراسة أن الطرف الصدري للأرناب يحتوي على المركز الليمفاوي الإبطي والتي تحتوي على العقد الليمفاوية الإبطية والإبطية الملحقة، والطرف الحوضي لديه المركز الليمفاوي المأبضي والتي يضم العقدة الليمفاوية المأبضية السطحية. وقد لوحظ من خلال الدراسة أن العقد الليمفاوية الإبطية هي عقدة الى عقدتين (واحدة كبيرة وأخرى صغيرة). والتي تقع في المساحة الإبطية، العقدة الليمفاوية الإبطية الملحقة هي عقدة واحدة تقع تحت الجلد في الإبطن خلف مفصل الكتف بينما العقدة الليمفاوية المأبضية السطحية هي عقدة واحدة تقع تحت الجلد بين العضلة ذات الرأسين الفخذية العضلة الوترية فوق للرأس الوحشي للعضلة الساق. أوضحت الدراسة أن هيكل الغدد الليمفاوية مشابه. فهي محاطة بكبسولة التي ترسل حويصلات التي يقسم العقدة الليمفاوية الى عدة فصوص. وتتكون الكبسولة والحويصلات من ليفية بيضاء كثيفة من النسيج الضام والعضلات الملساء. الجيوب تحت المحفظة هي ضيقة للغاية وتفتقر في بعض المناطق من العقد. يظهر اللحاء عقيدات واضحة المعالم (الابتدائي والثانوي) والتي تقع في محيط العقدة. ويتميز النخاع بوجود الحبال النخاعية مع الجيوب النخاعية. تتكون الحبال من الخلايا الليمفاوية، الضامة، والخلايا الشبكية، خلايا البلازما والعدلات في بعض الأحيان.

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