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HISTOLOGIC FEATURES OF THE DOG'S MAMMARY GLANDS BLOOD SUPPLY

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ABSTRACT

The purpose of this study was to establish and characterize the kinds and types of blood vessels microcirculation from parenchyma of the dog's mammary glands.

The incoming blood vessels in mammary complexes and their branches in inter- and perilobular connective tissue septs, as so the following smaller blood vessels in glandular parenchyma were investigated. These vessels presented on histological slides from bitches' mammary gland in diestrous cycle were obtained and prepared by conventional histological method and was observed. The samples were fixed in solution 10 % neutral formaldehyde, then cut by microtome at 7 μm and stained with Hematoxylin and Eosin.

Myotypical arteries and arterioles in specific position as rosette were established in mammary teats and postarteriolar capillaries as so venules and small myotypical veins in inter- and perilobular connective tissue septs were observed. Capillaries decrease their number in correlation of glandular parenchyma involution.

The established blood vessels morphologic features in bitches' mammary glands are important for glandular functional characteristic in norm and as so frequently happened pathological conditions, especially in mastitis and neoplasms.

Key words: dog, microcirculation, blood vessels, mammary gland, histology.

Introduction

Mammary gland (MG) is the study subject by many authors, both because of important economic significance of its secretion and therefore frequently observed pathological changes associated with functional impairment. In this regard, the basic morphology knowledge of the lymph and blood vessels is necessary, and also in connection of the metabolic processes provided, especially on microcirculatory level.

Diagnosis and treatment against mammary gland diseases are serious problem in clinical pathology. There are events, e.g., where after a false pregnancy accompanied with lactation, it may pass without treatment. But the problem is serious in connection with cases of mastitis and mammary oncologic disorders.

Neoplasms of the dog's MG are common in this species and have higher percentage for further development in comparison with other domestic mammals. Dogs 25–35 % of all tumors, and 24 % cats, and mainly get ill adult animals (8–11 years).The tumors grow slowly, about two-thirds of them are localized mostly in the last or penultimate mammary complex (MC). In comparative aspect, tumors are more common in the dog, while in the cat they are more malignant (85 %). Average about 50 % of mammary tumors in dogs are clinically malignant neoplasias in which metastasize through blood and lymph way.

Object and purpose of the research is blood circulation to the MG in the dog, because the bloodstream and lymphatic drainage have contemporary relevance for both anatomical structure and for surgical interventions and manipulations for treatment in disease processes.

Materials and Methods

For the purpose of the study was used fresh tissue material from a female dog euthanized in private veterinary clinic for reasons other than the tasks of our research. The animal was in later dioestrus or anoestrus, showing different stages of MG involution significantly advanced in breast MC, while caudal MC were still larger size, which is characteristic for delayed involution. The material was taken from different MC from sections with incoming blood vessels and other parenchyma of the MG. Samples with cuboidal form and dimensions of the walls of about 1 cm, were preserved in 10% buffered formalin and subsequently treated conventionally to their inclusion in paraffin blocks. Sections were made with a microtome in a thickness of 7 μm, and stained with hematoxylin and eosin, and subsequently prepared permanent histological slides.

The slots were observed with a light microscope Olympus CH 21FS1 (China), and morphometry was performed by eyepiece-micrometer. Foto documentation was processed by camera Olympus C-5050Z (Japan).

Results and Discussion

The investigated dog according to the criteria of Chandra, S. A. et al. (2010) was determined in cycle of stage IV from latest diestrus or anoestrus, which was conformed by histological findings and macroscopic state of the mammary glands. In this condition we decided to trace the blood circulation but we could not find enough details about microvascularisation of the dog's mammary gland in the literature.

Svilikova (according to Kovatchev, (1976)), experimentally studied the microvascular bad of canine mammary gland in comparative aspect that was seen in women. She observed dendritic branches of the large gland vessels into interlobular septes connective tissue and she founded that terminal outside branches cover densily every lobule. Some vessels, mostly blood capillaries, enter the lobule like a loop which cover the glandular alveoli. It was stated that there is a correlation between vascularization, age and functional state of the gland expressed by strong development of vasculare meshwork in actively lactating MG, which fact has been conformed also in a sheep [1].

Vascularization of the excreting system of the mammary gland is poorly researched, especially in the wall of the lactiferous ducts and channels. For them, there is not much information as well as for productive animals and for the woman. The blood circulation to the mammary gland's fascia is slightly investigated but it is important morphological and functional part of the gland.

Furstenberg, Riederer and Rubeli according to Kovachev, G. (1976) found in the cow papilla wall a specific vasculary-musculare layer which is richer with blood vessels, mainly longitudinal veins, and they have identified this vascular area as corpus cavernosum.

In our previous studies by contrast radiography was found that dog's papilla shows several mainly longitudinal myotypic arteries and arterioles.

Kovatchev (1976), wrote that Kaeppeli, describing the microscopic structure of the papilla in sheep indicated that in the middle layer of it's wall between the lining mucosa of the milk cystern and skin at longitudinal direction several large blood vessels has passed. The veins are more numerous than the arteries and are equipped with valves. Such a picture described by other authors [2], we have confirmed in several sections of teats in the dog. In a papilla, counting about 8–12 transversely cuted arterial vessels which are ring-like placed around the terminal lactiferous ducts. The vessels are located at the position between the skin and the excretory system of the gland. Valves of the

veins in the dog in this area were not observed (Fig. 1). Into dog mammary complexes several channels systems usually from 6 to 12 were observed in our sections.

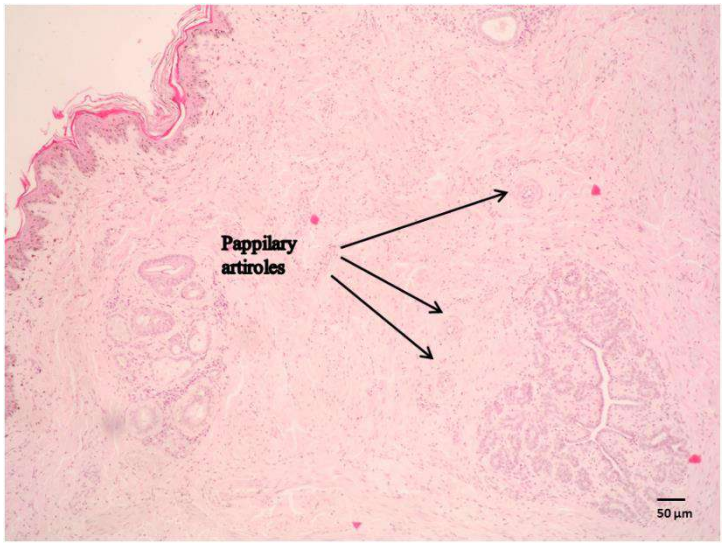

Figure 1: Transversal (cros) section of some pappillar arterioles. H&E. X40.

According to literature information (4) and our macro- and microscopic observations the involution of the gland is occured first in cranial MC and at least on the lenth of the abdominal and iliac MC. In glandular lobes, there are single alveoles with eosinophilic excretion in it (Fig. 2).

Figure 2: A milk alveola from inguinal mammary gland with an eosinophilic secret in the lumen. H&E. X400.

On histological slides of thoracic MC was observed highly developed arteriolo-venular and capillary circulation, and lymphocapillary meshwork around slightly developed parenchyma, against which prevails well-developed ductal system. On most preparations especially the thoracic

MC prevails connective tissue that replaces lobes of glandular parenchyma. This illustrates the morphological process of involution of the MG, which is in the advanced stage of abdominal and iliac MC.

It was counted that one lob of the gland is average 11–28 cross cut capillaries (average of random lobs or ductal systems of different sections and parts of the gland). This gives a partial quantification of blood flow to the mammary gland.

A. thoracica lateralis can be defined as arteria myotypica, in which media is occured in trace single elastic fibers among smooth muscle cells. There is not observed valves in the corresponding vein.

Rr. perforantes and rr. mammarii of a. thoracica interna are covered by a capsule or rather sleeve of connective tissue together with satellite venous vessels and nerve fibers. In the media of these vessels it was noticed hardly a single elastic fibers. In our view (Fig. 3) these are transition forms from mixtotypical (rr. perforantes) to the typical muscle type arteries (rr. mammarii). Some of the relevant medium veins have valves.

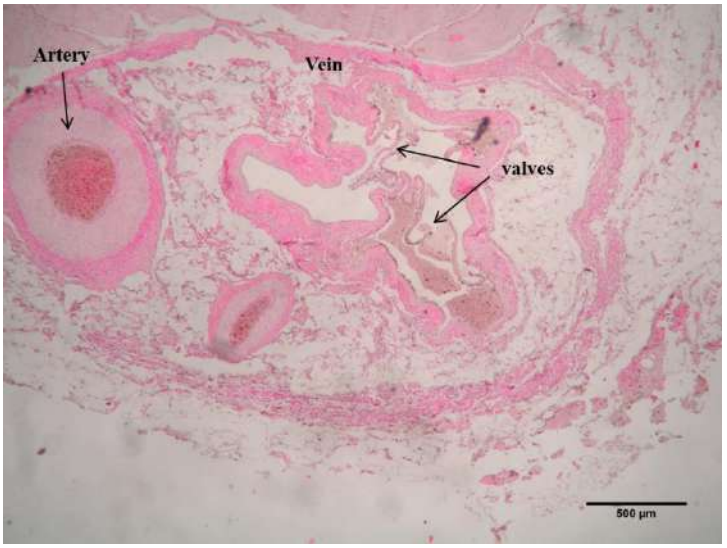

Figure 3: Rr. perforantes near to second thoracic mammary gland surrounded with connective tissue capsule. A vein with a valves is visible on the right of the artery. H&E. X40.

A cut which consists skin of the gland, parenchyma and underlying muscle in the second thoracic MC was observed relatively large muscle type artery and medium-sized vein (with a few smooth muscle layers). These vessels were derived probably from direct branch of a. thoracica lateralis for the glandular complex. The location of these vessels from the lateral side of the gland gives us reason to believe that there are not a branches from a. thoracica interna, which as perforating must first pass through the muscles (Fig. 4).

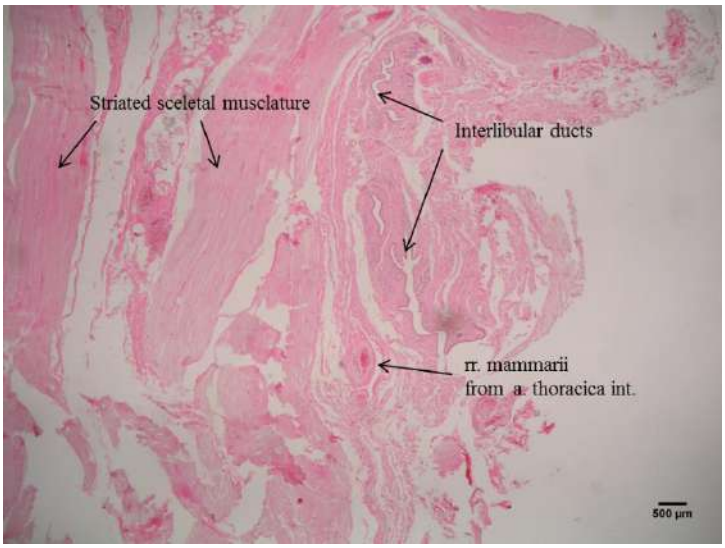

Figure 4: Slice from dog's thoracic mammary gland. On the right are interlobular lactiferous ducts, on the left are bundles from thoracic musculature. H&E. X40.

A. pudenda externa is more of some mixed type arteries. It owns as many elastic fibers so many smooth muscle fibers. The internal elastic membrane is clearly visible on the border with tunica intima, after which follows a broad middle layer of smooth muscle cells and elastic fibers. It is notable that the elastic fibers are concentreted peripherally from the smooth muscle layer, followed by the middle layer passes in a thin layer adventitia in which the capillaries were observed by the composition of the vasa vasorum. Several outgoing from gland parenchyma postcapillary venules were observed (Fig. 5).

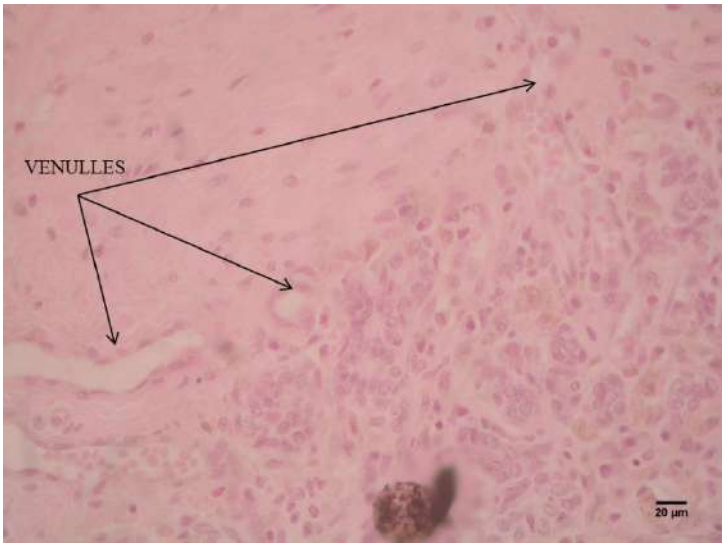

Figure 5: Outgoing postcapillary venulles from a mammary lobule of inguinal dog's mammary gland. H&E. X400.

Conclusions

1. The Incoming arteries to mammary complexes are the type arteria myotipica, or arteria mixtotypica. The arteries in perylobular connective tissue are arteries of muscular type or arterioles. In arteries there are relatively more elastic fibers, beacause of its proximity to the heart.
2. Thoracic mammary complexes undergo faster involution of the parenchyma compared with abdominal and inguinal.
3. In lower parts of the mammary gland and its papilla is mostly seen longitudinal blood vessels as arterial prevail over venous.
4. In glandular lobs was seen well-developed blood and lymphatic vessels system, which on average quantify 11-28 transversely cut capillares.

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