

ANGIOARCHITECTURE OF BLOOD VESSELS IN MAMMARY GLAND IN A DOG

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ABSTRACT

The purpose of this study is to examine the microcirculation section of the mammary glands in a dog. An euthanized dog's cadaver was used with pre-cannulated a. subclavia and a. iliaca externa, through which an ink-gelatin solution is introduced. The samples were prepared by specific histological method. In the enlightened specimens are visualized the specific structure of arterial and venous sections of the circulatory system of the mammary glands, as well as the specific shaped capillary nets and arteriole-venular anastomoses. This method not only establishes the specific morphology of vascular formations, but also the possibility of proving regenerative, inflammatory and degenerative processes.

Key words: angiarchitectonics, capillary net, mammary gland, dog.

Introduction

The mammary gland is a modified apocrine sweat gland found only in mammals. It consists of a network of ducts surrounded by a fibrovascular and adipocyte-rich stroma. The development of this gland is unique, as the last stages of development occur in the adult female only during pregnancy.

The mammary gland is a unique organ with very specific features. It is the subject of many studies (3, 4) because, first it is an organ in which neoplastic processes occur very often in the dog and second it has the specific vascular system organization.

Materials and methods

A cadaver of an euthanized dog of the breed of rotvailer was used. In pre-cannulated a. subclavia dextra et sinistra and a. pudenda externa dextra et sinistra, a warmed to 37 °C ink-gelatin solution prepared by the method of Vankov, 1968 (5) was introduced. The samples were fixed in 10% neutral formalin. From these, suitable cuts are prepared by cutting into a cryostat. The resulting slides were dehydrated in ascending alcohol series and enlightened in methylsalicylate by the method of Spalteholz, 1914 (8). The slides were observed with an "Olympus CX 21FS1" light microscope and the morphometry was performed by an ocular micrometer and the data were photographed with a camera "Olympus C-5050Z" (Japan).

Results and discussion

The results of our study demonstrate that architecture of blood vessels in mammary gland is quite typical and unique. This organ is a combination of exocrine gland and integument, which is set in its embryological origin. In the parenchyma of mammary gland, in the milk alveoli a dense and highly interconnected vessels networks assure its intensive function, especially in time of lactation. Because of superficial topography of the gland, specific thermoregulatory mechanisms and features are necessary to exist.

Through the period of lactation, vascular network is well developed in the parenchyma of the mammary gland (2), in our investigation an old female dog was used. In involution only the channel elements survive. The channel system is surrounded by interstitial connective tissue (stroma) and fat tissue has replaced the parenchyma. Obviously the blood vessels are concentrated into this stromal part.

Ink-gelatin injection technique is a suitable method for studying architecture of blood vessels of organs, both because of its penetration and durability.

We confirm that the penetration side of incoming arterioles and outflows venules is quite variable in the glandular lobule (Fig. 1a). Here capillary blood vessels tightly embrace the milk alveoli, as Kovachev G. (1) wrote especially in lactating sheep's mammary gland. Anastomosis between these capillary loops are numerous (Fig. 1a, 1h).

Vertical position of the main vessels in the area of the papilla is confirmed as seen in our previous studies by radiography (6). The suggestion of existence of ring-like anastomosis in the proximal part of papillary ducts and lactiferous sinus is proved (Fig. 1b).

The statement of Kovachev G. (1), that in the walls of excretory part (lactiferous ducts, interlobular ducts, papillary duct) of mammary gland in sheep exists two layered vascular network we confirm for dog's mammary gland (Fig. 1d, 1e).

In interlobular septes and in the superficial glandular derma, a number of arteriole venular anastomoses are observed (Fig. 1h). These anastomoses are important for regulation of the blood flow what depends from the current functional state of the mammary gland.

We found that in the top of the milk papilla a dense vascular network – Glomus-like anastomosis is evolved. Similar structures was described by G. I. Georgiev in dogs footpads (1). Our interpretation is that these structures have thermoregulatory function (Fig. 1c).

The skin of the gland displays the typical for integumental blood vessels arrangement, which because of its thinness as some authors described (7), shows a higher vascular density (Fig. 1f, 1g).

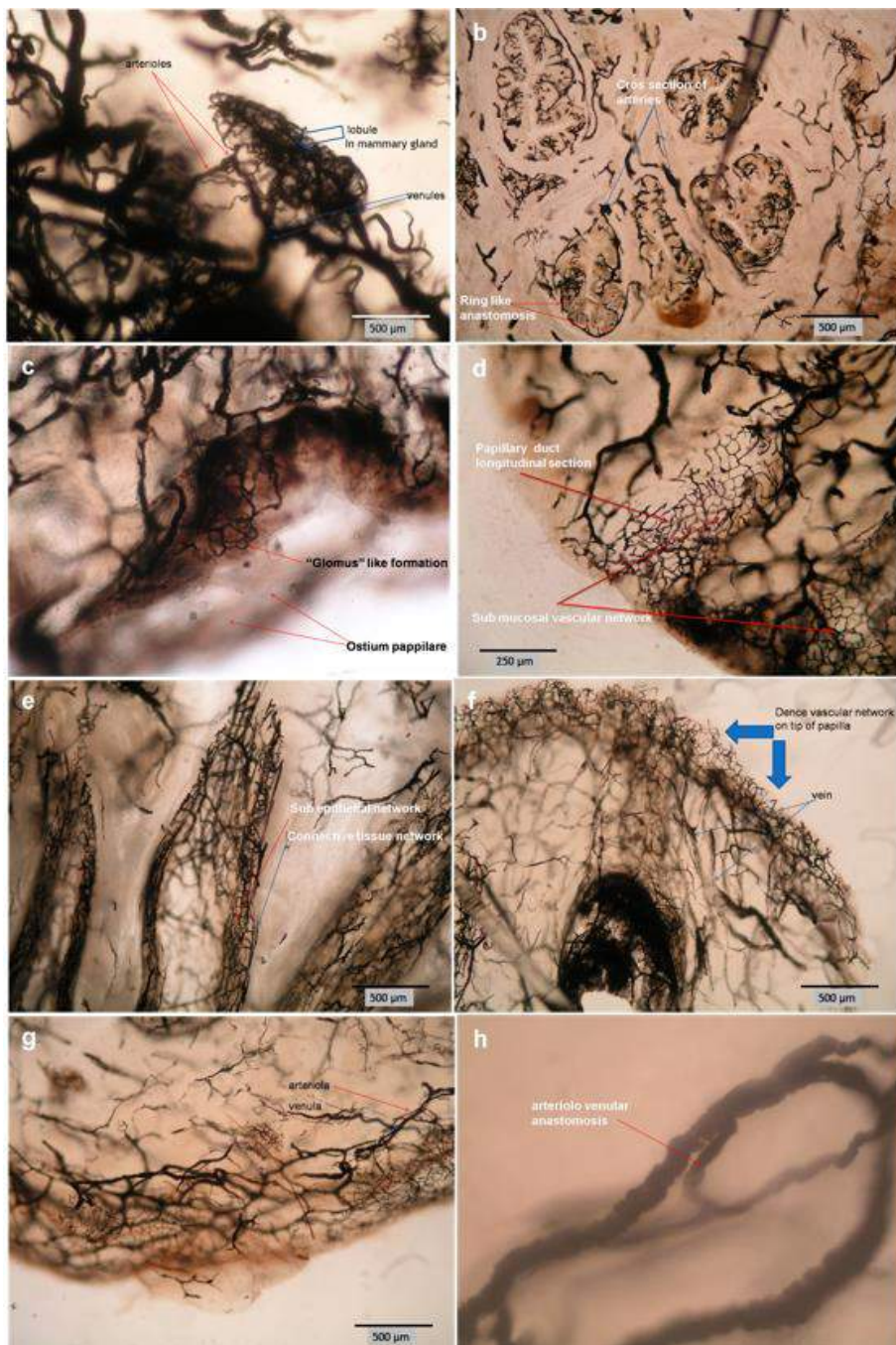


Figure 1: a: Area with a mammary lobule, showing afferent and efferent blood vessels. b: Transversal section through the basal(proximal) part of papilla mammaria. Cross section of vertical vessels and ring-like anastomosis are presented. c: "Glomus" like anastomosis on the edge of papillary ostium. d: View from the tip of papilla mammaria, a layer of submucosal vascular network is shown. e: Area with papillary ducts where double layered vascular system is presented. f: Dense vascular network in the skin, on the tip of papilla is shown (blue arrows). g: Area from the mammary gland where the architecture of skin vessels is presented. h: Arteriolo-venular anastomosis in the stroma of the mammary gland.

Conclusion

On the base of our results we made the following consequences:

1. In the milk lobule, the penetration side of incoming arterioles and outflows venules is quite variable.
2. The lobules are deeply embraced with a dense capillaries loops and postcapillaries venules. Vascular network into the lobule is highly interconnected.
3. The preliminary observed vertical position of the main vessels in the area of the glandular papilla is confirmed.
4. On the top of the milk papilla is evolved a dense arteriole venular network. Glomus-like anastomosis with thermoregulatory function are observed.
5. In the proximal part of papillary ducts and lactiferous sinus because of arteriole venular anastomoses a ring like formation is presented.
6. In interlobular septes and in the skin derma, a number of arteriole venular anastomoses are observed.
7. Within the walls of the larger excretory ducts of mammary gland a two layered capillary network in tissues of submucosal and in propria level are presented.

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