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ANGIOARCHITECTURE OF THE MAMMARY GLANDS IN RABBIT

(With 7 Figures)

By

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(Received at 23/8/1992)

البناء الوعائي للغدد الثدييه في الأرانب

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أجري هذا البحث على عشرين من اناث الأرانب لدراسة أصل وتوزيع الأوعية الدمويه الأساسيه التي تغذي الغدد الثدييه وكذلك الشكل الوعائي داخل نسيج هذه الغدد - كذلك فقد تم حقن هذه العينات بمحلول من الحبر الشيني والسيرم. وقد أوضحت الدراسه أن الغدد الثدييه في الأرانب تستمد مددها الدموي من ثلاث مصادر هي : الشريان الصدري الوحشي والشريان الشرسوفي القحفي والشريان الشرسوفي السطحي الذنبى وكذلك الأوعية بين الضلعيه الظهرية والأوعية القطنيه . كما تم تتبع هذه الأوعية داخل نسيج الغدد الثدييه حيث وجد أن هذه الشرايين تعطي تفرعات بين فصوص الغده الثدييه والتي تنقسم بدورها الى تفرعات أصغر بين فصيصات الغده الثدييه والتي تنتهي بدورها الى تفرعات داخل هذه الفصيصات تنتشر على شكل شعيرات دقيقه حول العينات الثدييه . كما أوضحت هذه الدراسه أن قناة حلمة الغده الثدييه تحاط بشبكه كثيفه من الأوعية الدمويه .

SUMMARY

Twenty does (female rabbit) were used in the present study. The animals were injected with 1:1 solution of indian ink and bovine serum. The present study revealed that the mammae of rabbit receive its blood via three main arteries, the lateral thoracic, cranial superficial epigastric and caudal superficial epigastric, in addition to the contribution of the dorsal intercostal and lumber

arteries. These arteries detach interlobar branches which successively divide into interlobular and further into intralobular branches which ramify between the glandular end pieces. They drain into the satellite veins. Moreover, the present study revealed that, the teat canal is encircled by a dense network of blood vessels.

INTRODUCTION

It is often said with truth that the quality of rabbit is made in the nest. The first three weeks of the rabbit's life when it should feed on milk from a doe are very important and well affect its future growth and ability to thrive. The milk of rabbit is the richest of all domestic animals (13-15% protein, 10-12% fat 2% sugars and 2-3% minerals) (SANDFORD, 1988). The role of blood vessels in such processes could not be denied. Many authors such as KONSOWA (1990); EL-SHERBINI (1978) and AHMED, *et al.* (1985) studied the skin of rabbit and its vasculature. About the vasculature of the mammae, inspite of its being a cutaneous gland the available literature are meagre. The aim of the present work is to spotlight on the main vasculature as well as the angio-architecture of the mammae in rabbit.

MATERIAL and METHODS

The present work was conducted on 20 does (female rabbit), five of them were nonlactating. The animals were injected with 1:1 solution of indian ink and bovine serum through the common carotid artery or by perfusion through the left ventricle and then immersed in 10% neutral buffer formalin. The blood vessels supplying the mammary glands were grossly described in ten animals. In the other specimens, the skin was incised along the mid-dorsal line reflected on both sides and removed with the mammae attached to it. The specimens were dehydrated in alcohol and cleared in methyl benzoate. Blocks were embedded in paraplast and sections (70 μ m thick) were cut.

The nomenclature used in this study was that adopted by N.A.V. (1983).

RESULTS

The mammary glands in rabbit are mostly represented by four pairs of mammae, one pair in the pectoral region, one in the thoracic, one in the abdominal and one in the inguinal region. These mammae were found completely distinguished from each other in one of the nonlactating animals (Fig. 1). In the other non lactating specimens the glandular tissue of each mammae is invisible. The main blood vessels supplying the mammae are the lateral thoracic, cranial superficial epigastric and caudal superficial epigastric arteries and its satellite veins, in addition to the intercostal and lumbar arteries.

A. Thoracica lateralis:

The lateral thoracic artery (Fig. 1,2/1) arises from the axillary medial to the tendon of insertion of the M.teres major and ventral to the proper axillary lymph node. It passes caudally on the dorsal border of the deep pectoral muscle and lateral to the M. serratus ventralis. It gains its subcutaneous course at the level of the 5th intercostal cartilage. It continues its caudal course until it anastomoses with the caudal superficial epigastric artery. In fact it is not easy to define the site of such anastomoses but most of the rami mammarii (Fig. 2/1') of the lateral thoracic artery go to the thoracic and abdominal mammae.

A. Epigastrica superficialis cranialis:

The cranial superficial epigastric artery (Fig. 1/2) is given off the cranial epigastric which is the direct continuation of the internal thoracic artery. It leaves the thoracic cavity caudal to the costal arch between it and the xiphoid cartilage. It perforates the transverse and external oblique abdominal muscles to gain its subcutaneous course, passes caudally and disappears in the glandular tissue of the abdominal mammae. During its course it detaches collateral branches (rami-mammarii) mostly to the thoracic mammae, within which it anastomoses with corresponding ones from the lateral thoracic artery. Shortly after its origin the cranial superficial epigastric artery gives off a distinct branch which passes cranially to supply the pectoral mammae.

A. Epigastrica superficialis caudalis:

The caudal superficial epigastric artery (Fig. 1/3 & 2/2) arises from the external pudendal artery at the subcutaneous ring of the inguinal canal. It passes cranially superficial to the rectus abdominal muscle to anastomose

with the lateral thoracic artery without definite site of anastomosis as mentioned above, it mostly supplies the inguinal mammae by rami mammarii (Fig. 2/2').

Aa. Intercostales dorsales and lumbales:

The dorsal intercostal, caudal to the fifth, and the lumbar arteries take part in vasculature of the mammae by very delicate rami mammarii (Fig. 2/3,4), mostly to the thoracic and abdominal mammae. Within these glands they anastomoses with the lateral thoracic and caudal superficial epigastric arteries.

All the aforementioned arteries are accompanied by the homonymous veins. The veins are often two in numbers but in their distribution resemble the accompanying arteries.

The main blood vessels supplying the mammary tissue namely lateral thoracic, caudal superficial epigastric and cranial superficial epigastric arteries (Fig. 3a/a) give off medial and lateral branches which pursue an interlobar course i.e. rami mammarii (Fig. 3 a/b). The latter arteries give several branches which penetrate the lobes and ramify inbetween the lobules to give interlobular branches (Fig. 3 a & b/c). These branches ramify intralobularly to nourish the various glandular end pieces (Fig. 3 a & b/d). Each glandular end-piece (acinus) is surrounded completely by fine capillaries (Fig. 4 & 5).

Each teat canal (9 in number) is encircled by a dense network of blood vessels (Fig. 6) which ramify freely into the longitudinal folds of these canal (Fig. 7).

DISCUSSION

The alternative arrangement of the mammary complexes which occurs in dogs and cats is rarely encountered in pig (SCHUMMER, et al. 1981). Such arrangement in pig is also found in rabbit as shown in the present work. SCHUMMER, et al. (1981) added that when the bitch is lying on her side each teat is readily accessible to the pups. The doe, however has no such alternation, so it often feeds its young in recumbent position.

In nonlactating bitch, the mammary tissue is so poorly developed that it is not normally visible (SCHUMMER, et al. 1981).

In rabbit, it is also invisible in nonlactating does but in one of the examined specimens the mammary tissue was clearly visible.

The lateral thoracic artery take a great part in supplying the mammary glands of rabbit. This artery is recorded to supply the mammae, also in pig and cat (SCHUMMER, et al. 1981).

The present study reported that the lateral thoracic artery in rabbit originates from the axillary artery. However, WHITEHOUSE and GROVE (1962), in the same animal mentioned that this artery arises from the subclavian artery and he called it the internal mammary artery. Moreover and exception of the other domestic animals, is the rabbit in which the lateral thoracic artery anastomoses with the caudal superficial epigastric.

The cranial superficial epigastric artery described in rabbit is found only in carnivores and ruminants (SCHUMMER, et al. 1981). Its origin, course and distribution are similar.

The present study revealed that the main blood vessels supplying the mammary gland give inter lobar branches which successively divide into interlobular branches, which lead to fine intralobular branches. These fine branches appeared as narrow meshed nets of capillaries surround the alveoli and their ducts (TRAUTMANN and FEIBIGER, 1960).

As revealed from the present investigation the teat canals were surrounded by network of blood vessels. These vessels share into the formation of the middle layer of the teat. A matter which was not recorded in carnivores (TRAUTMANN and FEIBIGER, 1960). These plentiful vascular supply of the teat may propably a thermoregulatory role to the milk in its way through these canals. In addition it might act as a mechanical control to regulate the flow of the milk through these canals.

In conclusion, a micro morphological investigation of these blood vessels may be recorded to reach the proper function of the vasodynamic of this organ.

ACKNOWLEDGEMENTS

Our great thanks to Prof. Dr. M.R. Fath El-Bab for his cooperation and continuous encouragement.

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LEGENDS

Fig. 1: Photographic picture showing the nonlactating mammary glands of rabbit in which the glandular tissue was visible, the mammae are separated and the sites of teats appeared dark.

(A) Site of the pectoral mammae.

(B) Site of the thoracic mammae.

(C) Site of the abdominal mammae.

(D) Site of the inguinal mammae.

1 - Lateral thoracic blood vessels.

2 - Cranial superficial epigastric blood vessels.

3 - Caudal superficial epigastric blood vessels.

4 - Intramammary space.

Fig. 2: Photographic picture of lactating mammary glands injected with serum indian ink and its sketch (2b).

1 - Lateral thoracic artery.

1' - Rami mammarii of lateral thoracic artery.

- 2 - Caudal superficial epigastric artery.
- 2¹ - Rami mammarii of caudal superficial epigastric A.
- 3 - Rami mammarii of dorsal intercostal arteries.
- 4 - Rami mammarii of lumbar arteries.
- 5 - Sulcus intermammaricus.

Note: The cranial superficial epigastric artery courses more superficially, so it did not appear into the photograph.

Fig. 3a & 3b: Free hand transverse section of the mammary gland, showing:

- a) Lateral thoracic blood vessel. b) Interlobar branch.
- c) Interlobular branch. d) Intralobular branch.

(3a x and 3b x : Stereo microscope).

Fig. 4: Thick vertical paraffin section of the mammary gland showing fine blood vessels surround each acinus (0). (x40).

Fig. 5: Thick vertical paraffin section of the mammary gland stained by light haematoxylin with inset showing fine blood vessels surround each acinus (0). (x63).

Fig. 6: Free hand section of teat of the rabbit showing the teat canals. (x25).

Fig. 7: Thick paraffin section of the teat stained by light haematoxylin.





