Study of the Lymphatic Mammary Connections in Bitch

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Abstract. In this study we tried to evidence the type of lymphatic vascularisation in the mammary gland at bitches, as well as the capture of some possible lymphatic connections between the border homo-lateral mammary glands, including the hetero-lateral ones. All of these things imply a good knowledge of the mammary lymphatic irrigation, the lymphatic’s drainage way and the possibility of communication between the mammary glands through the lymphatic vessels, although, in this field of study there are few data on these kind of connections.

Key words: mammary glands, lymphatic vessels, connections, lymph nodes, mammary tumors.

INTRODUCTION

Although the first knowledge on the lymphatic circulation have a considerable age of study being mentioned beginning from the XVIIth century, the study on the lymphatic system of the mammary glands at the canine specie do not register a considerable progress. This fact is due to the difficulties found in the discovery and identification of some fragile vessels, with a colorless content and often sinuous trajectory, situated along other more developed vessels and more obvious also: the veins and arteries (1, 5, 6, 11, 15).

The network of lymphatic vessels is spread in all the tissues and organs, except the bones, cartilages, brain, and sclerotic. Beginning from the fact that between the lymphatic vessels on one side and the lymph nodes on the other, there are a lot of anastomosis, our study is focused on highlighting the lymphatic connections in the mammary gland at bitches (3, 8, 12, 13, 17, 19).

A number of authors point to the independence if these two mammary gland chains, saying there is no communication between these symmetrical mammary glands (11, 12, 15, 16), and others affirm that there are lymphatic connections between all the glands of each row (13, 17, 18, 19).

The majority of the researches are based on the study of lymph nodes that drain a certain area, supported by the importance attributed to the first lymph nodes that drain the subjected territory – the alarm lymph nodes (4, 10, 14) indeed, in neoplasia, the lymph nodes status is a prognostic factor and plays an important role in establishing the therapy strategy. But, beginning from the reality that one of the ways to determine metastatic dissemination is through the lymphatic system, on one side, and on the other it’s necessary to explain the atypical metastatic dissemination, all of which must be integrated into a perfectly eligible and retable therapeutic protocol (2, 7, 18, 19).
We consider that of the same importance are also the aspects of the elementary lymphatic vessel circulatory aspects, analyze through morphological researches: the vital colorants, the stratigraphic and regional dissection method, the observation and none of the less the topography and anatomic position. (17, 18, 19, 20).

Because the number of mammary neoplasma at bitches is increasing, it’s necessary to get a better inside on the lymphatic circulation in the mammary gland, on the way of lymphatic drainage and the communication possibilities between the mammary gland through the lymphatic vessels. In spite of these being said, in the field studies there are few researches that focused on these connections.

MATERIAL AND METHOD

The biological material of this study was represented by a lot of 8 bitches, common race, of different ages and weights, which were brought by the owners in order to be euthanized for different reasons, but without presenting other organic affections which could have made their use in this experiment not possible.

The method of work consisted in injecting the blue colorant substance Evans. This is a blue, dark, very soluble, easy penetrable solution, with a tropism for the lymphatic tissue and a very good biological insertion being able to be injected intra vital, without inducing toxic phenomenon. The dilution was done in physiologic ser, and then added xilina 1%, to diminish the painful effects of the injection. We mention that the injections were done in conditions of perfect asepsis, because it’s a known fact that any injury caused to an anatomic region has repercussions on the lymph nodes, these being the first ones to react, an improper situation to a morphological research.

![Fig. 1 Mammary glands T2, A1 and A2 injected.](image)

The Evans blue solution had a concentration of 0.5%, and the injected quantity was of 0.2 ml, subcutaneous, and also in the studied mammary gland’s parenchyma, in two adjacent points to each gland (cranial and caudal), 0.1 ml on injected point. The election points were represented by: the mammary caudal thoracic gland (T2), the cranial abdominal (A1) and the caudal abdominal (A2) from the right side.
The technique was done under neuroleptanalgesia with Acepromazine 0,5mg/kg.corp and Ketamine 20mg/kg body weight. The protocol was repeated for 24 hours, 5 consecutive days following the same administration scheme, while the subjects were under constant supervision.

The reading and interpretation of the results was done at 48 hours from the last injection. The using of a lower concentration and quantity of Evan blue colorant is due to our experiences prior to this one in which the using of higher concentration and quantity has taken to the visualization of the lymph nodes exclusively making the lymphatic vessels hard to identify. Also, the waiting time until euthanasia was imposed in order to obtain a corresponding diffusion in the mammary lymphatic network.

RESULTS AND DISCUSSIONS

The mammary gland’s lymphatic, are born from the two main streams – coetaneous superficial and profound perilobular. The superficial network is represented by the coetaneous and subcutaneous lymphatic that are drained in the areola and subareolar plexus, and the profound is constitute by inter and perilobular vessels, between them existing anastomosis.

The lymphatic capillary have their origin in the interstitial space, in the “sack bottom” or “finger glove”, having a resembling structure to the blood vessels, presenting a high permeability, especially towards the protein macromolecules, reported to the blood vessels.

Fig. 2 Reticular appearance of A1.

The lymphatic vessels of the mammary gland, become afferent to the axilar lymphatic center in great part, or to cranial sterna lymph nodes, or to caudal profound cervical lymph nodes, or superficial cervical lymph nodes. In a caudal way, the lymphatic drainage is done through the superficial inguinal lymph nodes (retromammary), or the iliofemural lymph nodes, or through the lymph nodes that belong to iliosacral or lumbar lymph centers, situated on the abdominal cavity’s ceiling, near the aorta, at the origin point of the lumbar arteries or in the quadrifurcation terminal angle of the aorta.

The functions of the lymphatic system reside in the particularities of its components: transport way for some vital or bad substances, through the lymph vessels and barrier against the microbial and tumor invasion represented by the lymph nodes disposed along these ways.
We consider that these are sufficient reasons in choosing a research subject concentrated on the connections between the mammary glands in which they find a high applicability.

The hypothesis of the possible connections between the mammary glands starts from the recent studies were it’s reported a higher incidence in time of the mammary neoplasm, approximately one of four non castrated bitches before the first period of heat, develop mammary tumors in the adulthood.

The choosing of mammary glands T2, A1 and A2, is due primarily to their central position in the mammary chain, relatively equally distanced from the first lymph nodes stations (cranial and caudal) and also the visual access in optimal conditions of the followed aspects.

The results of our research make us affirm that there are two types of lymphatic connections of the mammary gland:

- Connections between both of the mammary gland’s rows.
- Connections between the adjacent mammary glands.

We take into consideration the fact that there might be a connection, when one or more lymphatic vessels are connected at the lymphatic plex of two mammary glands.

The lymphatic connections between the mammary gland represent in fact, the connections that are established between elements of the same structure (lymphatic vessels), and are based on a chaining and mutual conditioning of the functional phenomenon, of high importance in explaining the metastasis through lymphatic ways. The metastasis is a complex multi staged process, its progress not being accidental and in which the tumor cells leave the primary tumor through the lymph vessels, establishing new neoplasm focuses at distance and sometimes with atypical localizations.

An explanation to tumor’s extend appearance at more than one mammary gland, or a hole mammary chain, could be the existence of these lymphatic connections between the mammary glands through which the dissemination and invasion is very easily done.
The impregnation with vital colorant of the lymphatic vessels, microscopically visible, allows us to make appreciations on the type and lymphatic vascular way of each gland. In this respect, at the mammary areola we can see the reticular aspect of the lymphatic vessels, most of which are part of the mammary lymph parenchyma having a centripetal direction of flow towards the superficial plexus, and from which it heads for the gland’s periphery with a plexiform disposal of the lymphatic network.

A part of these vessels are grouped schematically in a variable number of afferent ways, with a higher caliber that converge towards the regional lymph nodes. But there is, a thin lymphatic system resulted from the anastomosis of some lymphatic vessels that come from the adjacent mammary glands T2 and A1 of plexiform aspect at the majority of individuals taken into study (6 from 8 cases). Between the cranial abdominal mammary gland (A1) and the caudal abdominal one (A2), the connection is of reticular type. It results from the vessel’s anastomosis of plexiform type with centripetal direction of the two glands.

At all the individuals taken into study, the drainage way in the injecting of the three mammary glands was double, both cranial and caudal.. We affirm this because they were impregnated with colorant even at a low concentration of the Evans blue substance, mainly the lymph nodes that belong to the axial lymph centre, in the cranial way, and in the caudal sense the superficial inguinal lymph nodes.

This fact imposes the remark that the drainage of the caudal thoracic mammary gland (T2), might be done also by the superficial inguinal lymph nodes, and the one of the caudal abdominal mammary gland (A2), by the axial lymph node. Although these are mentioned, from a microscopically point of view we can not affirm that there are direct vessels of the mammary glands T2 and A2 towards the mentioned lymph nodes.

These connections are of complex diversity through the different aspect of the lymphatic trajectory, by their diverse character: rectilinear, sinuous, uninterrupted or monoliform, and present a topographic variability extremely high in all the subjects taken into study.

The appreciation of the connections under the aspect of the multitude or their paucity is very hard to do, each individual studied presenting variations framed in the physiological limits, on this matter being found plexiform connections as well as reticular ones.

Another mentionable aspect, found in our study, is the one regarding the lymph nodes connections, specifically, between the heterolateral superficial inguinal lymph nodes, aspect seen by impregnating with Evans blue solution some lymphatic vessels, that connect these symmetric lymph nodes.

We do not consider these as being afferent, because the injection of the mammary gland was done on one side, respectively the right side. Taking into consideration these facts, obtained through morphology, a believable interpretation of the functional is created that is based on the clinical analysis and the framing in some domain, physiologic or pathologic.

CONCLUSIONS

- Using a low concentration and quantity of the Evans blue colorant (0,5% and 0,2 ml on each mammary gland injected) allowed a very nice evidence of the lymphatic mammary vessels and also the first lymph nodes stations.
- Adopting a repetitive protocol of injection (at 24h), respecting at the same time the period of waiting, has led us of noticing the lymphatic system of the mammary gland.
• It has been underlined the existence of some connection between the thoracic caudal mammary gland (T2), the abdominal cranial (A1) and the caudal abdominal caudal (A2).

• The connections seen are of plexiform type, from 6 to 8 subjects between the caudal thoracic mammary gland and the cranial abdominal and of reticular type between the two abdominal mammary glands (A1 and A2).

• Lymphatic connections were evidenced between the inguinal superficial heterolateral lymph nodes

• As a general conclusion and without any other approach of the subject, we consider that the information given has a high rank of utility, and we accentuate the essential mark that assures the stepping to morphopathology perspective into the pathology and therapeutic one.

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