Study on the Lymphatic Vascularisation of the Cranial Thoracic Mammary Gland (T1) in Bitch

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Abstract. The study high lightened the lymphatic irrigation of the cranial thoracic mammary gland (T1) at bitches, using as colorant substance the blue Evans. In this way, we have identified along the glandular lymphatic system, the flowing way of the lymph, as well as the lymph nodes stations afferent to the drainage direction, and also the following of possible lymph connections between the thoracic mammary glands homolateral, including the heterolateral ones

Key words: mammary gland, lymphatic vessels, lymph nodes, bitch, Evans blue.

INTRODUCTION

Although the first researches on the lymphatic system have a considerable number of years of study, the knowledge on the lymphatic system of the mammary gland at bitches didn’t register an appreciable progress. The fact is due to the difficulties found in the discovery and identification of some fragile vessels, with a colorless content and sinuous trajectory most often, situated along vessels much more developed, the blood vessels. The network of lymphatic vessels is spread in all the tissues and organs, except bones, cartilages, brain, and sclerotic. Starting from the premise that between lymphatic vessels and lymph nodes there are a lot of anastomosis, this study bases itself on the identification of the lymph vessels of the mammary gland at bitches.

The lymphatic irrigation of the mammary gland takes birth from the anastomosis of the two lymphatic networks: superficial and profound. The superficial lymphatic system collects the lymph from the subcutaneous interstitial spaces and the profound one from the glandular parenchyma through the perilobular conjunctive stroma.

Between these two territories (the superficial lymphatic system and the profound one), are present two types of lymphatic anastomosis. The first one can be observed at the mammary areola and it is given by the anastomosis of some lymphatic vessels, belonging to the profound system from the parenchyma, with the superficial areola vessels, with a centriped direction of lymph drainage., opposite to the venous circulation. The second one we noticed it at the periphery of the gland, between the superficial lymphatic plex, that is largely connected to the coetaneous and subcutaneous lymphatic vessels of the nearby regions, with a centrifuge direction. At the periphery of the gland, these lymphatic vessels are schematically grouped in a variable number of afferent ways, in each subject studied, that converge towards the regional lymph nodes.

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 trough
the lymphatic vessels. In spite of these being said, in the field studies there are few researches focused on these connections, most of them being focused on the lymph nodes study. Indeed, in neoplasia, the lymph node’s status is a prognostic factor and of great importance in establishing the therapeutic strategy. But, begging from the reality that one of the ways of metastatic dissemination is through the lymph system, on one hand, and on the other it is necessary to explain the atypical metastatic dissemination. All of these mechanisms must be framed in a perfect concept eligible and suitable for a therapeutic protocol.

MATERIAL AND METHOD

The research was made on a number of 11 bitches of common race, of different ages and weights that were brought by the owners to be euthanized from different reasons, but without presenting organic affections that might jeopardize their utilization in the research. Before the beginning of the experiment the subjects were sedated with Acepromazine 0,5mg/kg body mass and Ketamine 20mg/kg body mass.

The study method consisted in injecting in the cranialis thoracic mammary gland (T1), a colorant substance Evans blue, that is fixated with predilection in the lymphatic tissue. The solution’s concentration was 1%, and the quantity administrated was of 0,4 ml per thoracic gland. The administrations were done subcutaneously, as well as in the mammary gland’s parenchyma, in four points adjacent to it, cranial, medial, caudal, lateral, 0,1 ml in each injected point(Fig. 1).

The injecting was repeated for 5 consecutive days, at 24 hours interval, and the results reading and interpretation was made after 48 hours from the last administration. The total time of the protocol was of 7 days.

Fig 1 Appearance of the region of mammary thoracica cranialis after the injection.
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 subareola plex, and the profound is constitute by inter and perilobular vessels, anastomosis existing between them.

The lymphatic vessels of the thoracic cranialis mammary glands (T1), become afferences to the axilar lymphatic centre and thoracic ventral centre, a bigger part, or afferents to the caudalis profound cervical lymph nodes, or the superficial cervical lymph nodes in a smaller part.

Regarding the lymphatic vessels, these were observed better at the periphery of the mammary gland, and mostly in the cranial drainage way of it. This thing shows us that the lymphatic drainage of the cranialis thoracic mammary glands is predominant in a cranial sense, a fact that coincides with the studies made by others, and so, the first lymph node station is represented by the lymph nodes that make the axilar lymph centre. In this situation, at six subjects were present only the axilar lymph centre, and the accessory axilar lymph centre was missing. Better yet, this situation was found only on one side and on the other both of the lymph centers were present. In all situations, a better coloring is observed in the axilar lymph node, which when it appears unique, has bigger dimensions compared to the ones described in the field’s literature.

From the point of view of the shape of these lymph nodes, they have an aspect slightly oval, appearing as a homogeny compact mass, having a topographic disposition approximately constant. These being placed caudal from the distal area of the large round muscle ventral from the thoracic dorsalis aorta, at few centimeters form the dorsalis region of

Fig. 2 Appearance of the ln. axillare propri.
the ascending pectoral muscle.

Therefore, the afferent and the efferent lymphatic vessels of this lymph node have been obviously colored, thing that helps us follow easily the flowing sense of the lymph in the vessels of this lymph node, and even more the existence of surrounding lymph nodes must be accentuated because it explains the surprising metastasis from the profound tissues. (Fig. 2).

Next, following the direction of the lymph’s drainage through the lymphatic vessels efferent to the axilar lymph nodes, as well as taking into account the data from the studies done in this domain, these could arrive in the cranialis sterna lymph nodes. Referring to this lot, not to all the subjects taken into study, they were all presenting both of the lymph nodes cranialis sterna groups (right and left); in this respect nine individuals had only on one side the sterna cranialis lymph nodes.

The shape of the lymph nodules is slightly oval, with omogen compact mass, not having an invariable topographic disposition (being constantly present in the second intercostals space) placed a few centimeters lateral to the dorsal margin of the stern, above the transversal muscle of the thoraces, in the II intercostals space, on the trajectory of the internal thoraces vessels. (Fig. 3).

Starting from the observation that the axilar lymph nodes, as well as the sternal cranial ones were constantly colored, we can sustain with certitude that these lymph nodes can be considered as being responsible of the cranial lymphatic drainage of the cranial thoracic mammary gland (T1). From the intensity of the color point of perspective, we can see that the axilar and cranial sternal lymph nodes are the most intensive colored compared to the rest of the lymph nodes situated in the cranial drainage way, thing that would allow us to attribute the role of sentinel lymph nodes of this gland.

The using the term of sentinel lymph node to each organ is attributed also in the field’s study because the affections, especially the mammary gland’s tumoral ones have a high percentage in the total morbid entities existent at this specie. Even more, their exploration represents an obligatory request from a semiologic point of view and also from the diagnosis...
techniques point, especially the ecographic or radiological exam, combined according to the situation, with their biopsy.

The lymphatic system functions reside from the component element’s particularities, and especially, the transport ways for some vital or harmful substances through the lymphatic vessels and as barrier against the tumor and microbial invasion through the lymph nodes disposed along these paths. The hypothesis of the possible connections between the mammary glands starts from the signaling in this recent studies of an increasing incidence of the mammary neoplasma, approximately one of four non castrated bitches before the first heat period, develop mammary tumors in adulthood.

Following attentively the cranial lymphatic drainage way, we can notice that another lymph node group in which the efferent lymph vessels of the cranial thoracic mammary gland could arrive, is represented by the lymph nodes that constitute the superficial cervical lymph centre, which appear colored, especially the ventral lymph node package, and the dorsal one presenting only a weak impregnation with colorant, almost invisible from a macroscopical point of view. (Fig. 4).

Fig. 4 Appearance of the Inn. cervicales superficiales.

this colorant impregnation of the superficial colorant lymph nodes, especially the ventral lymph node package, oblige us to take into consideration these lymph nodes as being also responsible in a smaller part for the cranial lymphatic drainage of the cranial thoracic mammary gland. So, if we would make an hierarchy of the three described lymph centers, we can sustain with certainty that the first two (the axial lymph center and the ventral thoracic one) represented by the cranial sternal lymph nodes, would occupy a majority percent, reporting themselves to the number of afferent vessels which come from this gland. Even so, we cannot exclude the fact that a smaller number of lymph vessels arrive also in the superficial cervical lymph node, these being direct afferents coming from the cranial thoracic mammary gland, or from the other two lymph centers mentioned earlier.

Morphologically, the superficial cervical lymph nodes of the subjects from our lot, are pretty voluminous compared to the stature and specie. These appear under a package form, situated one above the other, in front of the supraspinos muscle between the notched neck
muscle and scalene on the one hand and trapeze muscle, omotransvers and brahiocephalic, on the other.

Next, the sternum efferents of the skull’s lymph nodes, can reach the deep cervical caudal lymph nodes or the cranial mediastinal ones, lymph nodes that often can be confused with each other, so in our batch, the lymphatic systems were not highlighted, not being colored, and further more, we encountered only one lymph node group.

We used this expression because according to the data in the field’s literature, they may be mistaken one for another.

Also, the lymph nodes opposite to the injection points and in this respect the axilar, cranial sternal and cervical superficial ones, were emphasized through dissection, but we found that they were not impregnated with dye.

If the cranial thoracic mammary glands is known as a gland whose lymphatic drainage is primarily cranial, we have pursued also the caudal drainage ways, in order to elucidate the existence possibilities of this effect, and surprise any possible features.

Thus, the lymphatic vessels that would drain the lymph from the cranial thoracic mammary glands to the superficial inguinal lymph nodes were not highlighted, although they were noticed in both sides.

Although the axilar lymph nodes and the cranial sternal ones, are part of the same primary lymphatic drainage of the cranial thoracic mammary gland, in the cancer’s pathology their topographical arrangement should be taken into account.

This statement must be made in the context of tumor cell’s dissemination in the mediastinal cavity and the appearance of lung metastasis or pleural. The spread of tumor cells is extremely easy through the lymphatic vessels coming from the neoplazic mammary gland, which bypass the axilar lymph node and become afferent to the cranial sternum lymph node.

In conclusion, both lymph nodes can be considered santinel lymph nodes of the cranial thoracic mammary gland.

Regarding the possibility of cutaneous metastasis from a breast tumor, that is achieved through the superficial lymphatic network. The deep lymphatic vessels of the profound lymphatic plexus in the proximity of a tumor, by the anastomosis at the areolar level with the superficial ones, may represent the cutaneous metastatic way of mammary gland’s neoplasm at the bitch.

The metastasis is a complex multistadial process, whose conduct is not random and in which the tumor cells leave the primary tumor through lymphatic vessels, setting new cancer outbreaks in remote and sometimes even in atypical locations.

CONCLUSIONS

• In the present study, we demonstrated that the cranial mammary glands (T1) has the majority of the lymphatic’s drainage towards axilar and ventral thoracic lymph centre and in minority towards the profound caudal cervical and cervical superficial lymph node, especially in the ventral lymph node package.

• The study points out the great morphological instability of the lymphatic system in the sense of the presence or absence of certain lymph nodes depending on the individual and the existence of certain associated lymphatic vessels that bypass the first superficial lymph nodes and get to be situated in a more depth location, explaining in this way the occurrence of distanced metastasis.

• The use for 5 consecutive days with a repeating every 24 hours, of a low concentration and quantity of colourant intravital Evans blue 1% and 0.4 ml per mammary glands
injected, with a standby time of 48 hours, allowed a good highlightening of the breast lymphatic vessels and also of the deep and at distance lymph node stations.

- As a general conclusion without implying a exhaustive approach to the theme, we believe that the information provided has a high degree of utility, accentuating the essential benchmarks that ensure the passing from morphology perspective to the pathology and therapeutics.

**BIBLIOGRAPHY**