The Lymph Vessels of the Thoracic Limb of Swine

L. I. Saar
Iowa State University

R. Getty
Iowa State University

Follow this and additional works at: https://lib.dr.iastate.edu/iowastate_veterinarian
Part of the Veterinary Anatomy Commons

Recommended Citation
Available at: https://lib.dr.iastate.edu/iowastate_veterinarian/vol26/iss3/4

This Article is brought to you for free and open access by the Journals at Iowa State University Digital Repository. It has been accepted for inclusion in Iowa State University Veterinarian by an authorized editor of Iowa State University Digital Repository. For more information, please contact digirep@iastate.edu.
I. INTRODUCTION

This article is the continuation of previously published papers (10, 11, 12, 13) regarding the lymph nodes of swine and their afferent and efferent lymph vessels (drainage areas). The details of the "materials and methods" have been described and discussed previously (11, 12).

II. GENERAL OBSERVATIONS

The lymphocenters associated with the lymph drainage of the thoracic limb are the superficial cervical (Lnn. cervicales superficiales ventrales, dorsales and medii) and the axillary lymphocenter. The latter lymphocenter is represented in swine by the costo-axillary (Lnn. axillares primae costae) lymph nodes only.

The ventral superficial cervical lymph nodes (Figs. 1, 2, 3, and 4: 5, 5') form a row on the ventro-lateral side of the cleido-occipitalis and the lateral side of the cleidomastoideus muscles along the posterior border of the parotid gland. The dorsal superficial cervical ("prescapular," Sisson, 1953) lymph nodes are situated cranio-dorsal to the shoulder joint, anterior to the prescapular portion (pars ascendens) of the deep pectoral muscle, located on the serratus ventralis muscle (Figs. 1 and 2: 7).

* From Iowa State University, Ames, Iowa, where Dr. Saar is Research Associate and Dr. Getty is Professor and Head, Department of Veterinary Anatomy, College of Veterinary Medicine.

Supported in part by Project No. 82, Veterinary Medical Research Institute, Iowa State University.

Appreciation is extended to Miss J. Mathewson, Medical Illustrator, and Mr. Daniel J. Hillmann for art work and photography.
The medial superficial cervical lymph nodes (11) can be described as two inconsistently found lymph node groups of which the first group is located along the course of the ascending cervical vein as far as the termination of this vein into the external jugular vein. The second group is situated dorsal to the course of the external jugular vein (11).

The axillares primae costae (costo-axillary) lymph nodes (11) are located anterior to the first rib, lateral to the thymus, and ventral to the axillary veins.

The lymph vessels of the thoracic limb may be classified as the superficial and the deep lymph vessels. The superficial lymph vessels (networks) are confined to the subcutis and the fasciae. The deep lymph vessels are closely associated with the intermuscular connective tissue sheets and with the route of the blood vessels.

The terms “superficial” and “deep” lymph vessels are used for the descriptive purpose only because of difficulties to distinguish clearly the extent of the latter networks. In fact, frequently some of the deep lymph vessels may join the superficial lymph vessel networks and vice versa. Furthermore, it was observed that in the areas to be described, the superficial and the deep lymph vessels originated from the same injection sites. Thus, the division of the lymph vessels as “superficial” or “deep” is an empirical one and the use is to be justified in a broad sense only.

III. LYMPH VESSELS OF THE THORACIC LIMB

A) The lateral superficial lymph vessels.

The direction of the lymph flow from the cutis and the subcutis on the lateral aspect of the thoracic limb is shown in Figure 1. The lymph vessels which originate from subcutaneous injection sites in regions of the scapula and the triceps brachii muscle follow anteriorly a more or less horizontal course to the dorsal and ventral superficial cervical lymph nodes. There is a confluence anteriorly, along the ventral border of the brachiocephalic muscle, of the superficial lymph vessels of the anterior two-thirds of the lateral aspect of the limb (Fig. 1). They pass medial to the cutaneous colli muscle and terminate into the ventral superficial cervical lymph nodes (Figs. 3 and 4). The superficial lymph vessels of the posterior third of the lateral side of the thoracic limb (from the region distal to the olecranon up to the os carpi accessorium) pass posteriorly around the caudal border of the limb to join the superficial lymph vessel network on the medial side.

B) The medial superficial lymph vessels.

The superficial lymph vessels on the medial side of the thoracic limb pass along the fatty subcutaneous tissue in an anterior-dorsal direction to the superficial cervical lymphocenter (Figs. 2, 3, and 4). Coincidently, this pattern of the direction of the lymph flow corresponds in general with the distribution of the subcutaneous branches of the V. cephalica humeri. In general, however, the lymph vessels on the medial side of the limb form a loose network of lymph vessel plexuses. Yet, it can be observed that somewhat larger lymph vessels follow the route of the V. cephalica accessoria proximalis and distalis and the V. cephalica antebrachii to join the course of the V. cephalica humeri. There is a confluence of the subcutaneous lymph vessels coming from the lateral and medial side of the thoracic limb. This newly formed lymph vessel plexus crosses over the V. cephalica humeri to pass antero-dorsally along the ventral border of the brachiocephalicus muscle to terminate into the ventral superficial cervical lymph nodes (Figs. 1,2,3,4). The latter lymph nodes receive superficial lymph vessels also from the ventral and lateral portions of the thorax, including the first two mammary glands.

C) The lymph vessels distal to the carpus.

1) The superficial lymph vessels
   a) Volar aspect

The superficial lymph vessels from subcutaneous injection sites on the
volar aspect of the metacarpo-phalangeal joints (between metacarpus 2 and 5) course dorsally to the antebraehio-carpal joint along the caudomedial side of metacarpus 3. From here the lymph vessels may go in two directions. First, some of the lymph vessels pass from the volar to the medial aspect of the limb to follow the communicating branch found between the V. cephalica antebraehii and the V. cephalica accessoria distalis. They continue antero-dorsally with the latter vein to the V. cephalica humeri. Secondly, the lymph vessels may turn from the volar aspect of the antebrachio-carpal joint to the medial side of the limb and pass cranio-dorsally to the V. cephalica humeri. The lymph vessels cross over the V. cephalica humeri to follow cranio-dorsally the medial aspect of the cutaneus colli muscle to the Lnn. cervicales superficiales ventrales.

b) Medial aspect

The superficial lymph vessels from subcutaneous injection sites between the metacarpo-phalangeal joints 2 and 3 follow mainly the course of the V. metacarpica dorsalis medialis. They pass dorsally with the V. cephalica accessoria distalis and join the lymph vessels coming from the volar aspect of the digits 3 and 4 as previously described under (a).

c) Dorsal aspect

The superficial lymph vessels of the subcutis from the dorsal aspect of the digits 3 and 4 follow mainly the course of the V. metacarpica dorsalis lateralis and medialis to continue with the V. cephalica accessoria proximalis to the V. cephalica humeri. From here the lymph vessels take a course similarly described under (a). However, some of the latter lymph vessels may turn at the metacarpo-phalangeal joint from the dorsal to the medial aspect of the metacarpus 3 and join the superficial lymph vessel networks on the medial side of the limb.

d) Lateral aspect

The superficial lymph vessels from the subcutis (between the distal proximity of the metacarpus 4 and 5) pass caudo-dorsally to the volar side of the os carpi accessorii. From here the lymph vessels turn to the medial side of the limb and join the superficial lymph vessels passing craniodorsally to follow the V. cephalica humeri.

2) The deep lymph vessels

In regions distal to the carpus it is difficult to distinguish clearly the deep or superficial lymph vessel networks. On the volar aspect of the digits the deep lymph vessels which arise from the superficial structures (skin, subcutis, bulbs of the digits) and also from the muscles, tendons and the interphalangeal joint capsules in that region, follow mainly along the deep metacarpal vessels to the deep volar arch (Arcus volaris profundus) on the volar aspect of the carpal joint. The deep lymph vessels may pass along the A. mediano-radialis (A. radialis, Sisson, 1953), the A. mediana, the A. collateralis ulnaris, or the A. interossea communis to the A. brachialis and continue to the axillary vessels. These deep lymph vessels pass to the axillares primae costae lymph nodes. However, in the region of the medial epicondylus of the humerus some of the lymph vessel anastomose with the superficial lymph vessel networks in that region and pass along the V. cephalica humeri to the ventral superficial cervical lymph nodes.

D) The lymph vessels of the carpal, cubital and the shoulder joint

1) The carpal joint

The superficial lymph vessels of the carpal joint emerge from the dorsolateral and dorso-medial surface. They join the superficial lymph vessels along the course of the V. cephalica accessoria proximalis and distalis to the V. cephalica humeri. The deep lymph vessels of the carpal joint arise from the volar side. These lymph vessels follow the course of the A. mediano-radialis and the A. mediana. In the region of the V. mediana cubiti the deep vessels may anastomose with the superficial lymph vessel networks and pass to the ventral superficial cervical lymph nodes; or they may pass along the axillary vessels and terminate into the axillares primae costae lymph nodes.
Figure 1—The arrows indicate the directions of the lymph flow. Muscles.—A. Masseter; B. Brachiocephalicus; C. Trapezius; D. Omotransversarius; E. Deep pectoral (pars acendens); H. Sternohyoideus. Veins.—a. External maxillary; b. Internal maxillary; c. External jugular; d. Internal jugular; e. Cephalic humeral; f. Axillary; g. Ascending cervical. Lymph Nodes.—1. Mandibular; 2. Parotid; 3. Accessory mandibular; 4. Lateral retropharyngical; 5, 5'. Ventral superficial cervical; 7. Dorsal superficial cervical; 10. Axillares primae costae (costo-axillary). Other structures.—G. Mandibular gland; th. d. Thoracic duct.
Figure 2—The arrows indicate the direction of the lymph flow. All ribs except the 1st have been removed. Muscles.—B. Brachiocephalicus; D. Omotransversarius; E. Deep pectoral (pars ascendens); E'. Superficial pectoral (pars descendens); E", Superficial pectoral (pars transversus); L. Supraspinatus; O. Subscapularis; P. Teres major; Q. Latissimus dorsi; R. Cutaneus trunci; S. Deep pectoral (pars humeralis). Veins.—c. External jugular; d. Internal jugular; c. Cephalic humeral; f. Distal axillary; f'. Proximal axillary; g. Ascending cervical; j. Thoracodorsal; k. Deep Lymph vessels along brachial veins; m. External thoracic. Lymph Nodes.—5'. Ventral superficial cervical; 7. Dorsal superficial cervical; 8. Medial superficial cervical; 10. Axillares primae costae (costo-axillary); 11. Sternal.
2) The cubital joint

The lymph vessels of the cubital joint emerge mainly from the lateral and the medial aspect. Those of the lateral side follow the course of the A. collateralis radialis (distal branch of the A. circumflexa humeri caudalis) to the A. axillaris; or they may go to the A. brachialis along the small branches of the latter artery which supply the cubital joint. The lymph vessels of the medial aspect of the joint follow the course of the A. collateralis ulnaris to the A. brachialis where they continue along the axillary vessels anteriorly and terminate into the axillares primae costae lymph nodes.

3) The shoulder joint

The lymph vessels of the shoulder joint arise mainly from the lateral and the medial aspect. On the lateral side the lymph vessels follow the ramus proximalis of the A. circumflexa humeri caudalis to the truncus subscapularis (1) and join here the lymph vessels coming from the medial side of the shoulder joint along the ramus ascendens of the A. circumflexa humeri cranialis. These lymph vessels course with the axillary vessels dorso-cranially and terminate into the axillares primae costae lymph nodes.

E) The lymph vessels of the muscles

In this investigation the lymph vessels of the muscles of live (anesthetized) swine were determined by injecting "Evans Blue" (T-1824) intramuscularly into predetermined areas. In order to avoid "contamination" of regions not intended to be injected with the dye, a clean needle was placed first into the muscle followed by the injection of 0.2-0.5 cc. of the dye (12). With the needle in place, another 0.2-0.5 cc. of distilled water was injected and then the needle removed quickly. The areas unintentionally "contaminated" by this technique were considered as "another" injection site.

The lymph vessels from these interscapular injection sites followed mainly the route of the blood vessels to the axillary artery and veins and terminated into the axillares primae costae lymph nodes. The latter lymph nodes received afferents from the following muscles: infraspinatus, supraspinatus (lymph vessels from the cranial border of this muscle went to the dorsal superficial cervical lymph nodes); deltoideus; teres minor; subscapularis; brachialis; tensor fasciae latae antebrachii; triceps brachii; extensor carpi radialis (from the anterior-medial aspect of the muscle, some lymph vessels joined the superficial lymph vessel networks and went to the ventral superficial cervical lymph nodes); extensor digitalis communis (lymph vessels of the lateral aspect of the muscle anastomosed with the superficial lymph vessels on the lateral side and passed anterio-dorsally to the ventral superficial cervical lymph nodes); extensor digiti IV and V (lymph vessels from the lateral side of these muscles occasionally joined the superficial lymph vessel networks); abductor pollicis longus (some lymph vessels from the distal portion of the muscle turned anteriodorsally and anastomosed with the superficial lymph vessels); extensor carpi ulnaris (lymph vessels of the proximal portion (lateral aspect) anastomosed with the superficial lymph vessels which passed around the caudal border of the limb to the medial side; flexor carpi ulnaris; flexor carpi radialis (a few lymph vessels from the medial aspect (proximal portion) of these last two muscles joined the superficial lymph vessel networks and passed to the ventral superficial cervical lymph nodes); flexor digitorum profundus. Furthermore, the axillares primae costae lymph nodes received lymph vessels from all the structures distal to the carpus, as described previously. From these areas the lymph vessels also went to the ventral superficial cervical lymph nodes.

IV. Discussion and Summary

The direction of the lymph flow of the thoracic limb from subcutaneous, intra-articular and intramuscular injection sites with "Evans Blue" (T-1824) on living (anesthetized) swine are in basic agreement with the results achieved on the nonliving animals by other investigators.

The lymph vessels of the thoracic limb enter the superficial cervical and the axillary lymphocenters.
Figures 3 and 4. The arrows indicate the direction of the lymph flow. Muscles.—B. Brachiocephalicus; E. Superficial pectoral (pars descendens); E”. Superficial pectoral (pars transversus); F, F’. Cutaneus colli; H. Sternohyoideus. Other Structures.—G. Mandibular gland; J. Parotid gland; M. The dotted line indicates the outline of the mandible. Lymph Nodes.—1. Mandibular; 3. Accessory mandibular; 5’. Ventral superficial cervical.
The superficial cervical lymphocenter in swine includes the ventral, dorsal and medial superficial cervical lymph nodes. They receive afferents from the cutis and the subcutis of the lateral and medial aspect of the entire thoracic limb. Lymph vessels are received also from the carpal, metacarpo-phalangeal and interphalangeal joint capsules and from all deeper structures (tendons, muscles, connective tissue) distal to the carpus. Furthermore, the superficial cervical lymphocenter receives afferents from the anterio-medial aspect of the extensor carpi radialis, the lateral surface of the extensor digitalis communis and the extensor digitalis lateralis (extensor digitii IV and V), the distal portion of the abductor pollicis longus, the lateral aspect of the proximal portion of the extensor carpi ulnaris, and finally, also from the medial aspect (proximal portion) of the flexor carpi ulnaris and flexor carpi radialis.

The axillary lymphocenter is represented in swine by the axillares primae costae lymph nodes only. They are situated anterior to the first rib, ventral to the axillary vessels. These lymph nodes receive afferents from all the deep structures (muscles, tendons, joint capsules and connective tissue sheets) of the thoracic limb. Furthermore, afferents originated also from the cutis and subcutis distal to the carpus, including the bulbs of the claws.

The efferent lymph vessels of the axillares primae costae lymph nodes terminate into the brachiocephalicus vein by forming numerous variations with the thoracic duct (left side), or with the efferents of the dorsal and medial superficial cervical lymph nodes. The efferent lymph vessels of the ventral superficial cervical lymph nodes go to the dorsal and the medial superficial cervical lymph nodes. The inter-relationship of the lymph vessel connections in the head, neck and shoulder region has been described previously (12). According to these findings the lymph vessels from the carpal, metacarpo-phalangeal or the interphalangeal joints may follow the principle routes as enumerated below:

1. Axillares primae costae lnn.→brachiocephalic vein.
2. Ventral superficial cervical lnn.→medial superficial cervical lnn. (ventral group)→brachiocephalic vein; or from the medial superficial cervical lnn.→the axillares primae costae lnn.→brachiocephalic vein.
3. Ventral superficial cervical lnn.→dorsal superficial cervical lnn.→medial superficial cervical lnn. (dorsal group)→brachiocephalic vein, or to the axillares primae costae lnn.→brachiocephalic lnn.

REFERENCES

Iowa State University Veterinarian