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MORPHOTOPOGRAPHIC ASPECTS OF CERTAIN PELVIC LIMB LYMPH NODES IN FERRETS

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Abstract

Data regarding the pelvic limb lymph centres in ferrets is quite scarce in the literature, so the aim of this paper is to present the morphotopographic relationship between the lymph nodes and the muscles of the pelvic limb, given their adjacent position. The muscles of the pelvic limb are well developed. The medium gluteus is very powerful, though it lacks its lumbar portion, and it clings to the accessory gluteus muscle. The long digital extensor muscle is covered by the cranial tibial muscle. The fat in the inguinal region forms an adipose pedicle that embeds superficial inguinal lymph nodes. The superficial inguinal lymph nodes are represented by two structures located along the epigastric caudal artery. In literature, inguinal lymph nodes are described as inconstant, but we were able to identify them in all three examined bodies. The popliteal lymph centre is represented by a single lymph node with a globular appearance lying in the popliteal fossa. In the ferret, the lymph nodes have considerable dimensions.

Key words*: ferret, pelvic limb, lymph centers.*

INTRODUCTION

The ferret (*Mustela putorius*) is used for its fur, for research purposes, as a pet, as well a game animal (Hrițcu et al., 2000).

This carnivorous mammal belongs to the *Mustelidae* Family, *Mammalia* Class, Carnivora Order, *Mustela* Genus, *putorius* species.

It is generally assumed that the domesticated ferret is an albino breed derived from the wild polecat *(Putorius foetidus)*, but it differs from the latter principally in the yellowish-white colour of its fur and the pink-red colour of its eyes.

This is commonly known as the "English" ferret.

During the past 12 - 13 years, the ferret has become increasingly important as a laboratory animal, particularly for virus research. Since it was first shown by Dunkin and Laidlaw to be susceptible to canine distemper, it has been used to great advantage in the study of several other virus infections (Dunkin et al., 1926).

Ferrets are also subject to abcesses, which occur in the neck region and often involve the salivary glands.

A variety of organisms have been isolated from these, the most common being *Staphylococcus aureus*. Some researches presumed that it originates from the feed.

Several species of internal parasites may find the ferret a suitable host.

As parasitic infections in this animal are rather uncommon, and even rare, space and time will not be given to their description (Mőnning, 1934).

Scabies sometimes appears on the tail and over the back.

Studying the lymph centers of this species is important, in order to guide practicing veterinarians, laboratory researchers as well as those who wish to specialise in the pathology of this species (Paștea, 1979; Predoi, 1999).

The comparative newness of the species as a laboratory animal, and its limited use in this respect, explain, perhaps, why there exists a paucity of data with regard to its anatomy, physiology, endocrinology, and nutritive requirements.

It is hoped that this report will stimulate further investigations along there lines (Coțofan et al., 2003; Paștea, 1978; Predoi et al., 2001).

These animals are used in long-line cable transport by NASA in the Propulsion Laboratory, but also for testing in research laboratories for pharmaceutical products in medical investigations

MATERIALS AND METHODS

Three adult corpses from animals with no anatomo-pathological changes and without any sign of any disease were used.
Used materials:

- sanitary alcohol
- 2 ml sterile syringes
- ink substance 40%
- curved scissors
- scalpel

The method for identifying the lymphatic structures was the injection of a coloured substance - China ink dye 40%.
The dye was filtered through filter paper.
The filtrate was diluted 1/1 with physiological saline solution.
The areas of choice for injecting the colouring substance were in the plantar regions. The colorant dose used for injection was 0.3 ml.
Stratigraphic and regional dissections were performed up to the limit of visibility, while for more detailed investigations and photographs SMZ-Nikon stereomicroscope was used.
After removing the skin, the muscles, arteries and veins were dissected, revealing the lymph centres and the lymphatic vessels, preserving their relations with the adjacent formations.
The homologation of the formations was made according to Nomina Anatomica Veterinaria 2017.

RESULTS AND DISCUSSIONS

Due to the close relationship between lymph centers and musles, a brief presentation of the pelvic limb muscles which form the elongated muscle mass of the hips and thigh region in ferret is considered necessary.
The superficial gluteus muscle is small, inserts on the sacrum and consists of a single muscular tummy. Medium gluteus muscle is very well developed. It does not have a lumbar portion, is attached to the accessory gluteus muscle, and their separation can only be done at the tendons level. The accessory gluteus muscle originates on the ventral edge of the iliac palate and is inserted onto the trochanteric crest. The deep gluteus muscle has a triangular pyramid shape.
The deep muscles of the basin include the outer obturator muscle that is well developed.
The femoral quadriceps muscle is well developed and merges with the large round muscle that is joined to the articular capsule.
The cranial abductor muscle of the shank is placed between the superficial gluteus muscle and the femoral biceps muscle.
The femoral biceps muscle consists of a cranial portion, that originates from the ischial tuberosity, and a caudal portion that is longer than the previous one and originates from the sacrotuberous ligament, the ischial tuberosity and the base of the tail (Fig. 1).

Fig. 1. Pelvic limb muscles (original):
1 - External oblique muscle of the abdomen; 2, 2' -Femoral biceps muscle; 3 - Fascia lata tensor muscle;
4- Medium gluteus muscle; 5 - Semitendinosus muscle; 6 - Long fibular muscle; 7 - Gastrocnemian lateral muscle

Semitendinosum muscle is inserted on the medial face of the tibia. It originates on the coccygian fascia, the sacro-tuberous ligament and the ischial tuberosity.
The semimembranous muscle consists of a cranial well developed portion having the insertion on the femur and a smaller caudal portion with insertion on the medial condyle of the tibia.
The gracilis muscle is small.
The sartorius muscle participates in the formation of the cranial form of the thigh due to its massive muscular development. Its origin is on both the ventro-caudal and the ventro-cranial iliac spine, medial to the insertion of the tensor muscle of the fascia lata. A portion of its fibers merge with the gracilis muscle and inserts onto the tibia, and another small portion of the fibers stop on the patella.
The pectineus muscle is inserted halfway to the caudal face of the femur and has a fusiform shape
The short adductor muscle is specifically outlined, while the long adductor and large adductor muscles form a common muscle mass.
The tibialis cranial muscle is highly developed, has a superficial position and its distal tendon is inserted onto the metatarses I and II and on the small cuneiform.
The long digital extensor muscle is almost entirely covered by the tibialis cranial muscle.
The long extensor muscle of the thumb is thin. It is inserted at the metatarso-phalangienne joint level and is distributed to fingers I and II
The short fibular muscle has a thin tendon which inserts onto the fifth metatarsal bone.
The long fibular muscle almost completely covers the origin of the short fibular muscle, and its tendon crosses the plantar face of the tarsus and inserts onto the proximal end of the first metatarsal bone.
The lateral extensor muscle of the foot is assigned to the phalange V. The triceps surae muscle consists of a well developed soleus muscle and of the gastrocnemius muscles that show very prominent bellies.
The superficial flexor muscle of the foot is well developed, and its tendon splits into four branches that are assigned to the fingers II-V.
The popliteus muscle is a powerful, but small muscle.
Since lymph centers are located along the arterial paths, it is necessary to point out some elements specific to the vascular structures of the pelvic limb in ferrets (Fig. 2).
The lymph nodes of the ferret are characterized by their considerable dimensions in relation to the animal`s size. Their topography is particular because they drain the lymph from a large area. During the dissection, the lymph nodes and lymphatic vessels from the femoral trigon and popliteal space were identified.

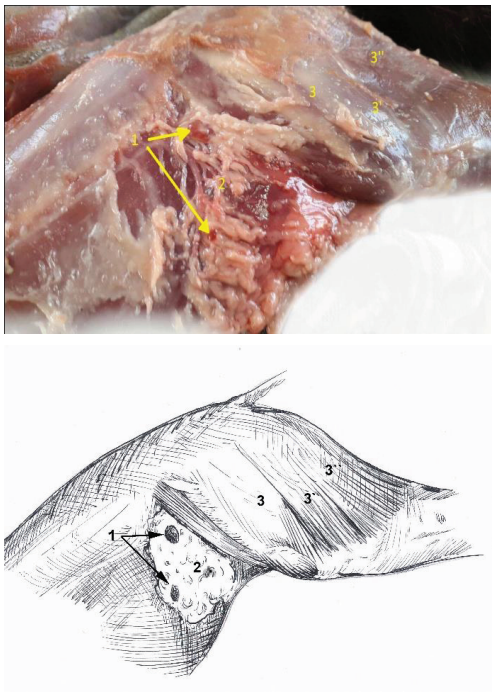

Fig. 2. Subiliac lymph nodes and superficial ingvinal lymph node (original):
1 - subiliac lymph nodes, 2 - superficial ingvinal lymph node, 3 – biceps muscle, 3’ - biceps muscle, cranial portion, 3’’ - biceps muscle, caudal portion

In all investigated corpses the inguinal superficial lymph nodes and the internal iliac lymph nodes were shown. The popliteal lymph node has also been identified.
The superficial inguinal lymph centre appears situated on the epigastric caudal artery in all three corpses investigated, being represented by a single 2 mm lymph node. The afferent

lymphatic vessels come from the ventro-caudal abdominal region, from the mammary region, the medial face of the thigh, vulva, foreskin, penis and anus. The efferent lymphatic vessels are tributary to the medial iliac lymph nodes (Fig. 3).

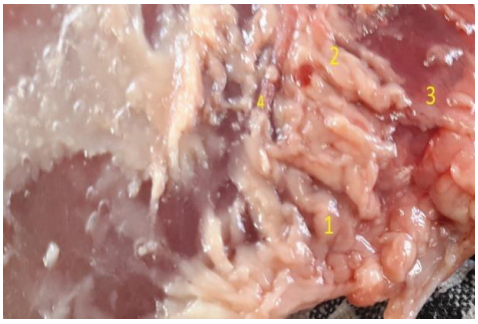

Fig. 3. Subiliac lymph node (original):
1 - inguino abdominal fat pedicle; 2 - subiliac lymph node; 3 - tensor fasciae latae muscle; 4 - circumflex iliac profound artery, vein

In the inguinal region there is a large amount of adipose tissue that surrounds the superficial inguinal lymph nodes. The adipose tissue forms the inguino-abdominal adipose pedicle.
The external iliac artery emits as a collateral the deep iliac circumflex artery. The pudendoepigastric trunk detaches at a sharp angle and directs itself, dorsally of the femoral ring, to the caudal edge of the deep inguinal ring, where it ends through the caudal epigastric artery and the external pudendal artery. The caudal epigastric artery follows, along the floor of the abdominal cavity, the medial border of the deep inguinal ring, and then, along the lateral edge of the right abdominal muscle, anastomoses with the cranial epigastric artery.
The subiliac lymphnodes, although described as inconstant in the literature, were identified in all dissected corpses (Fig. 3). These lymph nodes have a globular aspect, approximately 3.5 mm in size, and are located on the deep iliac circumflex artery. The associated afferent lymphatic vessels come from the lumbar and gluteal region, the lateral face of the thigh and calf. Efferent lymphatic vessels are tributary to the medium iliac lymph nodes.
The popliteal lymph center is represented by a lymph node disposed in the conjunctival space bounded by the femoral biceps and the semitendinosus muscle on the tract of the caudal femoral artery (Fig. 4).

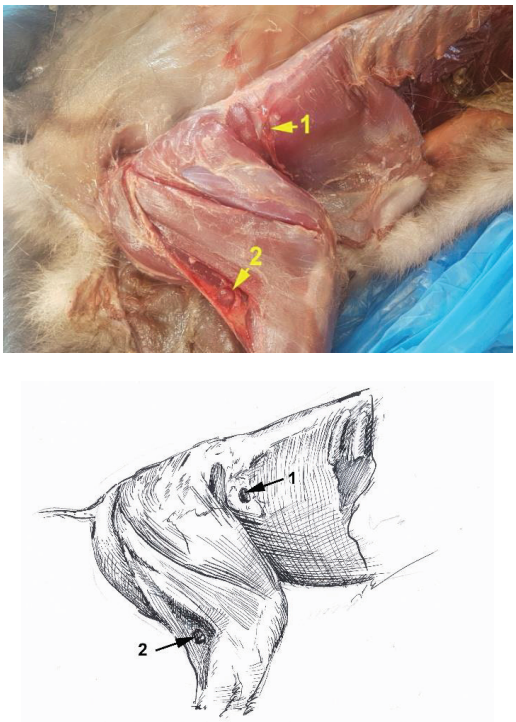

Fig. 4. The popliteal lymph center (original):
1 - popliteal lymph nodes; 2 - subiliac lymph nodes

The femoral artery is the direct continuation of the external iliac artery in the femoral region; it passes through the space between the femoral ring and the large adductor ring, from where it continues with the popliteal artery. In the femoral triangle, the femoral artery is covered by the deep inguinal lymph center and covers, in turn, the femoral vein. In its path, it emits the following collaterals: lateral femoral circumflex artery, saphenous artery, descending genicular artery and caudal femoral artery.
The lateral circumflex femoral artery originates under the femoral ring at a sharp angle. It heads cranially between the sartorius muscle and the psoas major muscle, and then between the vastus medialis muscle and the right femoral muscle, contributing to their irrigation.
The saphenous artery detaches itself in the distal segment of the femoral triangle, leaving it, along the inner face of the gracilis muscle, accompanied by the saphenous vein and nerve (n, a, v); on the medial face of the shank, it

divides into a cranial and a caudal branch. The caudal branch is more developed and joins the caudal root of the saphenous till above the tarsus, where it anastomoses with the caudal tibial artery. After the completion of this anastomosis it ends in the post-tarsal sheath through the plantar arteries (lateral and medial).

Here, the plantar arteries cross the lateral edges of the deep flexor tendon. These are satellites to the plantar nerves, till below tarsus, where the deep branches of these arteries anostomose between them, generating the "deep plantar arch", together with the perforating tarsal artery. The very fine superficial branches of the plantar arteries continue with the common plantar digital arteries II and III respectively, which are located medial and lateral to the tendons of the flexors, down to the distal end of the metatarsus, where they anastomose with the proper plantar digital arteries. From the deep plantar arch, the plantar metatarsal arteries II and III come off distally, which are more developed than the common digital arteries. All these mentioned branches anastomose distally in a collector trunk to the distal perforating branch of the dorsal metatarsal artery.

The descending genicular artery heads ventro-cranial, between the sartorius and the gracilis muscles, to the medial face of the knee joint, where it spreads arboriformly.

The caudal femoral artery is the last collateral femoral artery. It detaches at the level of the large adductor muscle ring and is located between the femoral biceps muscle and the semitendinous muscle (popliteal space), where it ends through ascending and descending branches. The ascending branch irrigates the propulsor muscles, in which it anastomoses with the medial femoral circumflex artery. The descending branch contributes to the irrigation of popliteal lymph nodes and gastrocnemius muscles. A long branch accompanies the tibial nerve and anastomoses, proximal to the calcaneus, to the saphenous artery.

This lymph node has a globular appearance and a size of about 2.5 mm. The afferent lymphatic vessels come from the thigh region, the leg, and the autopodium regions. The efferent vessels are tributaries of the sacral lymph nodes and sometimes to the medium iliac lymph nodes.

CONCLUSIONS

The medius gluteus muscle was found to be very well developed, but we noticed the absence of its lumbar portion and the merging with the accessory gluteus muscle

The long digital extensor muscle in ferret is almost completely covered by the cranial tibial muscle.

Unlike other carnivores, in ferrets, the lymph nodes have considerable dimensions as compared to the animal size.

The lymph nodes topography is particular because they are able to drain lymph from a large area.

The adipose tissue from the inguinal region is very abundant; it forms the fatty pedicle which surrounds the superficial inguinal lymph nodes.

The superficial inguinal lymph nodes were observed to be located on the epigastric caudal artery.

Although the literature describes the subiliac lymph nodes as being inconstant, we have found them in all corpses.

The popliteal lymph node is represented in the ferret by a single structure with a globular appearance located in the popliteal conjunctive space.

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