Introduction

Lymph samples are analysed in pharmacologic [2, 20] and immunologic [3, 14] studies; pathologic changes [7, 10] occur in the lymphatic vessels and lymph nodes in infectious diseases, and the cancerous lymphoid cells join the venous system via the lymphatic vessels [11]. Therefore, the exact anatomical knowledge of the lymphatic system is necessary for both collection of lymph samples and proper diagnosis of pathologic disorders related to lymphatic system. However, few studies were found on the lymphatic system of cats, regarding the Cisterna chyli.

Conformation of Cisterna chyli in cats (Felis catus)

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SUMMARY

The aim of this study is to determine the location and conformation of Cisterna chyli in cats. Eight adult, healthy cats, of both sexes and of different ages, were used. Abdominal cavity was opened with a median incision under general anaesthesia. Then, Indian ink was injected into the lymph nodes of the abdominal cavity, and into the popliteal lymph nodes. After exsanguination by the conventional methods, the animals were fixed with 10% formalin. Then, the Cisterna chyli was investigated by dissection.

The Cisterna chyli is an oval sac, approximately 2.5 cm in length, was located dorsal to the abdominal aorta, at the level of L 2 to L 4. It receives caudally the lumbar trunks in all cats; and ventrally: the visceral trunk in five cats; the intestinal and celiac trunks in two cats; the jejunal, colic and celiac trunks independently in one cat. The lymphatic trunks seem to be jointed because of having valves.

Considering the normal anatomical position, it was concluded that Cisterna chyli is more practical to establish permanent cannulation than other lymphatic ducts or trunks for collection of lymph samples.

KEY-WORDS: anatomy · cat · Cisterna chyli · Visceral trunk.

RÉSUMÉ

Conformation de la Citerne du chyle chez le Chat (Felis catus). Par E. EKEN, S. TIPIRDAMAZ, M. GEZICI, K. BESOLUK et V. OZDEMIR.

Cette étude se propose de déterminer la position topographique et le mode de formation de la Citerne du chyle, chez le Chat, dans un but d’application aux prélèvements d’échantillons de lymphe. Huit chats, au total, ont été utilisés, tous sains et adultes, de différents âges, des mâles et des femelles. Sous anesthésie générale, la cavité abdominale a été ouverte, par incision médiane ventrale ; de l’encre de Chine a été injectée dans les nœuds lymphatiques abdominaux viscéraux et poplité. Après saignée mortelle, selon les techniques habituelles, les tissus ont été fixés dans une solution de formol à 10 % et la Citerne du chyle a été disséquée.

L’organe, en forme de sac ovale, de 2,5 cm de long approximative- ment, est situé contre la face dorsale de l’aorte abdominale, sous les corps vertébraux L2 à L4. Caudalement, la Citerne du chyle reçoit constamment les troncs lombaires ; ventralement au contraire, la disposition est variable selon le type de confluence des trois troncs lymphatiques : coeliaque, jejuna- l et colique ; constitution d’un tronc viscéral dans 5 cas, d’un tronc intestinal et coeliaque dans 2 cas, les trois troncs étant restés indépendants jusqu’à la Citerne du chyle dans un cas. L’aspect moniliforme et flexueux de ces troncs puissant valvulés, évoque des réseaux lymphatiques primitifs de l’embryon, nous semble explicatif de l’étendue des variations consta- tiées.

Pour la mise en place de canules permanentes, en vue de prélèvements d’échantillons de lymphe, la Citerne du chyle elle-même nous semble indi- quée, plutôt que les troncs lymphatiques afférents, sujets à de trop amples variations.

MOTS-CLÉS :  anatomie · chat · Citerne du chyle · Tronc viscéral.

ARTICLE ORIGINAL

Revue Méd. Vét., 2001, 152, 6, 463-468
The Cisterna chyli is located on the dorsal aspect of the abdominal aorta at the level of L 2 [4] or L 1 to L 4 [1] in cats. It lies at the level of L 1 to L 3 [18] or L 1 to L 4 [5] and is generally crossed by the lumbar arteries in dogs [17]. Some researchers have reported that the Cisterna chyli constantly has dorsal and ventral parts [12, 15, 16]. The sac shaped dorsal cistern, lies on the abdominal aorta at the level of T 13 to L 4 [15, 16], and receives mostly the lumbar trunks [12, 15], more rarely two lumbar trunks and the intestinal trunk [15]. The ventral cistern, frequently plexiform [15, 16], more rarely sac shaped [12], lies between the caudal vena cava and the ventral aspect of the aorta [15, 16], and is constituted either by a dilatation of the visceral trunk [12] or by both the lumbar trunks and two intestinal trunks [15, 16]. Others have reported that the Cisterna chyli is constituted either by the reunion of the visceral and lumbar trunks [5, 17, 18, 19] or by the intestinal and lumbar trunks [6, 8], and is approximately 3 cm in length [17, 18]. The visceral trunk is constituted by the reunion of the intestinal celiac trunks [12, 17, 18]. The intestinal trunk is formed by the confluence of the efferent lymphatic vessels of the colic and jejunal lymph nodes, and the celiac trunk by those of the splenic and hepatic lymph nodes [17, 18]. Only one [15] or two [15, 17, 18] lumbar trunks are formed by the efferent lymphatic vessels of the medial iliac lymph nodes.

**Materials and methods**

Recorded data of a total of 8 adult cats used in this study are arranged in Table I. All cats were obtained from Konya Municipality Animal Care & Shelter Centre. They were judged to be clinically healthy based on physical examination, abdominal ultrasonography and laboratory evaluation (serum chemistry, complete blood cell count). All procedures were approved by the Ethic Board of Veterinary Faculty, the University of Selcuk. Animals were anaesthetised with 0.15 ml/kg xylazin HCl (Rompun® - BAYER) and 0.1 ml/kg ketamin HCl (Ketanez® - ALKE), IM. Under anaesthesia, approximately 0.5 cc Indian ink was injected into each hepatic, cecal, colic, jejunal and medial iliac lymph nodes following the opening of the abdominal cavity with a median incision, and also into the popliteal lymph nodes following the dissection of the popliteal region in order to make the Cisterna chyli and its afferent lymphatic trunks more visible macroscopically. Thirty minutes later, they were killed by exsanguination from the right common carotid artery without regaining consciousness, and fixed with 10 % formalin. Then, the location of the Cisterna chyli and its conformation were revealed by fine dissection, and the observations were recorded and photographed.

**Results**

The Cisterna chyli of cats was determined to be situated dorsal to the abdominal aorta at the level of L2 to L4 and of the renal veins (Fig. 2/a). It was observed that the Cisterna chyli was close to the psoas major and psoas minor muscles dorsally and to the greater splanchnic nerves, left adrenal gland, caudodorsal extremities of the pleural sacs and lumbar aortic lymph nodes laterally. In its cranial third, the Cisterna chyli was attached by connective tissue to muscle fibres of the right crus and to the tendon of the left crus of the diaphragm. The Cisterna chyli could be seen when the retroperitoneal sublumbar fat was completely removed. It was an oval shaped sac, about 2.5 cm in length, which received caudally the lumbar trunks in all cats, and ventrally, the visceral trunk in five and the intestinal trunk in two cats, the jejunal, colic and celiac trunks independently in one cat. The efferent lymphatic vessels from the adrenal glands and kidneys joined directly the cistern, caudoventral to it.

Two and three lumbar trunks originated from the medial iliac lymph nodes at the level of L 7 in three and five cats, respectively. After coursing cranially via dorsal and ventral situation to the abdominal aorta, they were seen to terminate caudally to the Cisterna chyli at the level of L 4 and immediately caudal to the left renal artery (Fig. 2/c). During their courses, the lumbar trunks contracted variable connections with each other around the aorta and numerous valves were observed. The lumbar trunks were also found to anastomose with the visceral and intestinal trunks near the Cisterna chyli and ventral to the abdominal aorta.

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TR : Turkish Angora Red Tabby
SB : Short-haired cat Bi-colour ;
SS : Short-haired Silver spotted.

Table I. — Materials.
A. Visceral Trunk = Intestinal Trunk + Celiac Trunk (Cats N° : 1, 2, 3, 4) ; B. Visceral Trunk = Colic Trunk + Celiacjejuneral Trunk (Cats N° : 5) ; C. No Visceral Trunk = Intestinal trunk and celiac trunk join the Cisterna chyli directly (Cats N° : 6, 7) ; D. No Visceral nor Intestinal Trunk = the celiac, jejunal and colic trunks are independent, and join the Cisterna chyli directly. (Cats N° : 8).

a : celiac trunk ; b : jejunal trunk ; c : colic trunk ; d : intestinal trunk ; e : celiacjejuneral trunk ; f : visceral trunk ; g : Cisterna chyli ; h : lumbar trunk ; i : diaphragm ; k : abdominal aorta ; l : celiac artery ; m : cranial mesenteric artery.

**FIGURE 1.** — Schematic representations of the observed afferent types.

At intestinal level (Cats N° : 5). See explanations in text.

a : *Cisterna chyli* ; b : thoracic duct ; c : lumbar trunk ; d : visceral trunk ; e : celiacjejuneral trunk ; f : celiac trunk ; g : jejunal trunk ; h : colic trunk ; i : medial iliac lymph node ; k : jejunal lymph nodes ; l : first lumbar vertebra ; m : right kidney ; n : thoracic aorta ; o : left renal artery (sectioned) ; p : abdominal aorta ; r : cranial mesenteric artery ; s : diaphragm ; t : stomach ; u : liver ; v : spleen ; y : jejunum ; z : transverse colon ; z' : descending colon.

**FIGURE 2.** — Conformation and location of *Cisterna chyli* and afferent trunks in cats, left view - retroperitoneal sublumbar fat and left kidney are removed ; visceral organs are drawn ventrally.
PUBLICITÉ
The visceral trunk was formed principally by the confluence of the intestinal and celiac trunks. The intestinal trunk received both the colic and jejunal trunks constituted by the efferent lymphatic vessels of the colic and jejunal lymph nodes, respectively. The celiac trunk was seen to be formed by the union of the efferent lymphatic vessels of the celiac lymph nodes.

In four cats (Fig. 1/A), the jejunal and colic trunks were detected to course craniodorsally parallel to the cranial mesenteric artery and to join the intestinal trunk dorsal to the greater curvature of the stomach. After coursing about 1 cm dorsally, the intestinal trunk joined the celiac trunk caudal to the celiac artery forming the visceral trunk. Dorsally the visceral trunk ran caudal to cranial mesenteric artery and terminated in the mid-ventral third of the Cisterna chyli. In one cat (Figs. 1/B, 2), the colic and jejunal trunks, situated dorsal and ventral to the cranial mesenteric artery, respectively, coursed parallel to each other up to dorsal to the visceral surface of the spleen. At this level, the jejunal trunk and celiac trunks joined the visceral trunk forming a common trunk named the celiaocejunal trunk, but the colic trunk joined independently. The visceral trunk ran dorsally in a bow-like/arched direction, with a cranial convexity, and terminated cranioventrally to the Cisterna chyli.

In two cats (Fig. 1/C), the jejunal and colic trunks coursed dorsally around the cranial mesenteric artery, and formed the intestinal trunk by joining together immediately after crossing ventral to the abdominal aorta. The intestinal trunk terminated cranioventrally to the Cisterna chyli after coursing approximately 0.5 cm dorsally. The celiac trunk ran caudodorsally on the right side of the celiac artery, and drained cranioventrally to the Cisterna chyli.

In one cat (Fig 1/D), the jejunal and colic trunks dorsally ran on the right and left sides respectively of cranial mesenteric artery up to its origin. At this level, the colic trunk was directed caudodorsally and opened into the caudal third of the Cisterna chyli, but the jejunal trunk was inclined craniodorsally and drained in the mid-ventral third of the Cisterna chyli. The celiac trunk coursed caudodorsally after crossing the celiac artery from the right, and then joined the cranial third of the Cisterna chyli just after passing ventral to the abdominal aorta.

In all cats, the above mentioned lymphatic trunks seemed to be beads-like-arranged due to having valves; these valves permit a one-way lymph flow in plexiform routs.

Discussion and conclusions

In all cats, the Cisterna chyli was determined to be located at the level of L2 to L4, which is inconsistent with the findings of others [1, 4, 17, 18]. Although it was reported that the Cisterna chyli was divided into dorsal and ventral parts [12, 15, 16], the occurrence of a prominent Cisterna chyli has not been reported in cats [10]. In our study, the Cisterna chyli was seen as a dilated sac, as reported earlier [1, 5, 6, 17]. Although it was constituted by the visceral and lumbar trunks in five [5, 17, 18, 19] or by the intestinal and lumbar trunks in two cats [6, 8], the Cisterna chyli was formed by the confluence of the jejunal, colic, celiac and lumbar trunks independently in one cat thus showing a quite large variability. The efferent vessels of lumbar aortic lymph nodes drain into the thoracic duct [9, 15] or into the lumbar trunks [18]. In the present study, however, at the time, these efferent vessels were detected to open into both the Cisterna chyli and medial iliac lymph nodes. Although NICKEL et al. (17) reported that the Cisterna chyli was frequently pierced by the lumbar arteries in dogs, a similar finding was not recorded in our study on cats.

In conclusion, it was found that the Cisterna chyli of cats is probably more practical to establish permanent cannulation than other lymphatic ducts or trunks for the collection of lymph samples and that its afferents are variable. We hope that this study will shed light on future studies on the lymphatic system in the cat, and that it contributes to the present anatomical knowledge concerning the Cisterna chyli in this species.

Acknowledgements

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References

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Conformation of Cisterna chyli in cats (Felis catus). This system is necessary for both collection of lymph samples and proper diagnosis of pathologic disorders related to the lymphatic system. However, few studies have focused on this topic.

A study was carried out to identify the various bacterial species in the oral cavity of cats in two human hospitals in Sokoto, Nigeria. The buccal cavities of 26 cats Felis catus were examined. The study identified a variety of bacterial species, including Rictularia cahirensis, Strongyloides spp., Toxascaris leonine, Toxocara cati, and Toxascaris leonine. Ingestion of T. cati and T. leonina worms was reported in a study of stray cats Felis catus in Iraq.

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Adipose Gene Expression in the Cat (Felis catus). PLoS ONE 8(11). FIGURE 2: Conformation and location of Cisterna chyli and afferent trunks in cats, left view - retroperitoneal sublumbar fat and left kidney are removed; visceral organs are drawn ventrally. Revue Méd. Vét., 2001, 152, 6, 463-468. Discussion and conclusions: In all cats, the Cisterna chyli was determined to be located at the level of L2 to L4, which is inconsistent with the findings of others [1, 4, 17, 18]. Although it was reported that the Cisterna chyli was divided into dorsal and ventral parts [12, 15, 16], the occurrence of a prominent Cisterna chyli has not been reported in cats [10]. In our study, the Cisterna chyli was seen as a dilated sac, as reported earlier [1, 5, 6, 17]. Although it was constituted by the visceral and lumbar trunks Revue Méd. Vét., 2001, 152, 6, 463-468. 467. The Cisterna chyli of cats was determined to be situated dorsal to the abdominal aorta at the level of L2 to L4 and of the renal veins. FIGURE 2. FIGURE 2: Conformation and location of Cisterna chyli and afferent trunks in cats, left view - retroperitoneal sublumbar fat and left kidney are removed; visceral organs are drawn ventrally. 466 eken (e.) and collaborators.