Lymphatic Metastasis in a Case of Feline Peritoneal Mesothelioma

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ABSTRACT. Histopathological study based on the anatomy of the lymphatic system was carried out to clarify the metastatic routes in a case of feline peritoneal mesothelioma. Two routes, via sternal lymphatic drainage and the intestinal lymph trunk, were involved in the metastasis from the peritoneal to the thoracic cavity. The case seems to be a good example of a spontaneous tumor which proves the importance of lymphatics in the initial stage of tumor metastasis.—**KEY WORDS:** lymphatic metastasis, mesothelioma.

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It is generally agreed that lymphatics play an important role in the early stage of metastasis of experimental tumors [2–4, 8–10]. In spontaneous cases, however, it is not easy to clarify the manner and route of metastasis, i.e. whether metastasis occurs by way of blood and/or lymphatic vessels.

We had the opportunity to necropsy a cat suffering from peritoneal mesothelioma which showed an initial stage of lymphatic metastasis from the peritoneal cavity to the lungs.

This note describes the distribution of neoplastic lesions in the whole body and traces the metastatic routes from the viewpoint of the anatomy of the lymphatic system.

Clinical and pathological findings of the

present case were already reported in the previous paper [1]. The animal was a 6-year-old male Siamese, which was diagnosed as an epitheloid type of malignant mesothelioma, based on the WHO's standard.

As shown in Table 1, neoplastic lesions were mainly located in the peritoneal cavity, but a few were also observed in the thoracic cavity. Histopathological findings of neoplastic lesions in lymphatics and lymph nodes appeared remarkable and were as follows.

1) Digestive tract: In lymphatics, prominent dilatation and neoplastic cell embolism were common findings, which were not observed in blood vessels (Fig. 1). Proliferation of neoplastic cells anchored to the valves was obvious in some lymphatics (Figs. 2 and

Table 1. Distribution of neoplastic lesions

Cranial mesenteric lymph nodes	+	Omentum	+
Left colic lymph nodes	–	Mesentery	+
Pancreaticoduodenal lymph nodes	–	Parietal peritoneum	+
Right colic lymph nodes	–	Diaphragma	+
Lumbar aortic lymph nodes	–	Digestive tract	+
Medial iliac lymph nodes	–	Liver	–
Hypogastric lymph nodes	–	Spleen	+ a)
Sternal lymph nodes	+	Pancreas	+ a)
Cranial mediastinal lymph nodes	+	Bladder	+
Tracheobronchial lymph nodes	–	Lungs	+

a) Peritoneal surface.

Fig. 1. Multiple neoplastic cell emboli (arrows) in dilated lymphatics of the small intestinal mucosa. H-E stain. $\times 130$.

Fig. 2. Beaded appearance of lymphatics with neoplastic cell proliferation (arrow). H-E stain. $\times 45$.

Fig. 3. High magnification of Fig. 2. Neoplastic cell proliferation anchored to the valve. H-E stain. $\times 230$.

Fig. 4. Prominent dilatation of lymphatics in the mesentery in comparison with the diameter of blood vessels. H-E stain. $\times 38$. A: Artery, V: Vein, L: Lymphatic.

3). These lesions were most evident in the small intestine.

2) Mesentery and omentum: Enlargement of lymphatic diameter was striking, becoming greater than that of blood vessels (Fig. 4). Fibrous thickening and narrowing of lymphatics followed neoplastic cell embolism and proliferation (Fig. 5). Perivascular infiltration and accumulation of lymphocytes were often observed.

3) Lymph nodes: Although the degree of metastatic lesions was different from node to node, mesenteric nodes were most severely affected. Neoplastic cells occupied not only the cortex and the marginal and medullary sinuses, but also the afferent lymphatics

Fig. 5. Neoplastic cell proliferation and emboli in mesenteric lymphatics. H-E stain. $\times 120$.

Fig. 6. Neoplastic cell masses metastasized to medullary sinus of the cranial mesenteric lymph node. H-E stain. $\times 300$.

Fig. 7. The cortex of the cranial mediastinal lymph node was almost replaced by neoplastic cell masses. Arrow indicates an embolus in the afferent lymphatic. H-E stain. $\times 14$.

Fig. 8. High magnification of metastasized neoplastic masses in the marginal sinus and the cortex in Fig. 7. H-E stain. $\times 250$.

(Figs. 6, 7 and 8).

4) Diaphragm: In addition to the growth of the tumor masses on the peritoneal surface, invasion and embolism of neoplastic cells in lymphatics were frequently observed (Figs. 9

and 10).

From the distribution of neoplastic lesions described above and the absence of lesion in the liver, the route of lymphatic metastasis was strongly suggested in the present case.

Fig. 9. Tumor growth on the peritoneal surface of the diaphragm and emboli in lymphatics (arrows). H-E stain. $\times 40$.

Fig. 10. High magnification of Fig. 9. Lymphatics packed with neoplastic cells. H-E stain. $\times 190$.

Modified drawing of Fig. 7 from [7]

Schema. Possible routes of lymphatic metastasis

★: Neoplastic lesion	① Lymphatic drainage (sternal course)
ME: Cranial mesenteric lymph nodes	② Lymphatic drainage (lumbar course)
S: Sternal lymph nodes	③ Intestinal lymph trunk
M: Cranial mediastinal lymph nodes	
T: Tracheobronchial lymph nodes	
L: Lumbar aortic lymph nodes	

Fig. 11. Proliferation of neoplastic cells in the pulmonary artery and alveoli. H-E stain. $\times 175$.

In the feline lymphatic system, two courses of lymphatic drainage from the peritoneal cavity to the thoracic have been recorded [5, 6, 7]. As shown in the schema, the first course was lymphatic drainage which originated from almost all parts of the diaphragm, with exception of the dorsal area, and ran along to the internal thoracic artery and vein attained to the cranial mediastinal lymph nodes (sternal course). The second originated from the dorsal area of the diaphragm and drained to the lumbar aortic lymph nodes (lumbar course). In the case described here, neoplastic lesions were observed in lymphatics of the diaphragm and the cranial mediastinal lymph nodes, but no lesions were present in the lumbar aortic lymph nodes. Another possible route was via the intestinal lymph trunk caused by the invasion of neoplastic cells into lymphatics of digestive tract. Therefore, it is reasonable to consider that two routes were involved in the metastasis of the present case, one was by way of sternal lymphatic drainage and the other was via the intestinal lymph trunk. Thus, neoplastic cells attained to the cranial mediastinal lymph nodes could have been transported to the heart via the subclavian vein. Although a few of small metastatic lesions were demonstrated in vascular

areas of the lungs (Fig. 11), but not in the tracheobronchial lymph nodes. In addition to these findings, absence of direct lymphatic communications between the lungs and the cranial mediastinal lymph nodes in cats [6] exclude the possibility of lymphatic metastasis from the lungs to the lymph nodes. This will support the hypothesis that metastasis had just commenced by way of pulmonary circulation. Therefore, dissemination of neoplastic cells throughout the whole body via heart had not started when the cat was subjected to necropsy.

To our knowledge, this is the first report of feline peritoneal mesothelioma which can clearly reveal the lymphatic metastasis. This case seems to be a good example of a spontaneous tumor which proves the important role of lymphatics in the initial stage of tumor metastasis.

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要 約

猫腹膜中皮腫1例のリンパ管転移(短報): 鈴木義孝・杉村 誠・阿閉泰郎・秋山 潔¹⁾(岐阜大学農学部家畜解剖学教室, ¹⁾愛知医科大学付属動物実験施設)——猫の腹膜中皮腫例の転移経路をリンパ系解剖学の立場から検討した。腹腔および骨盤腔に主座した腫瘍は、次の2経路、すなわち、腸リンパ本幹ならびに胸骨リンパ節への排導リンパ管を介して胸腔転移が成立したことが組織学的に確認された。本例は腫瘍転移の初期に果たすリンパ管の重要性が実証された貴重な1例と考えられた。