

A canine case of splenic hemangiosarcoma complicated with infectious splenic abscess

Tomohiro Oyamada¹, Rina Nabeta^{2,3}, Daigo Azakami^{4*}

¹Animal Medical Center, Faculty of Agriculture, Tokyo University of Agriculture and Technology, Tokyo, Japan; ²Laboratory of Veterinary Surgery, Tokyo University of Agriculture and Technology, Tokyo, Japan; ³Department of Veterinary Pathology, Western College of Veterinary Medicine, University of Saskatchewan, Saskatchewan, Canada; ⁴Laboratory of Veterinary Clinical Oncology, Cooperative Department of Veterinary Medicine, Faculty of Agriculture, Tokyo University of Agriculture and Technology, Tokyo, Japan.

Article Info

Article history:

Received: 03 March 2021

Accepted: 26 October 2021

Available online: 15 September 2022

Keywords:

Ascites

Dog

Splenectomy

Splenic abscess

Splenic hemangiosarcoma

Abstract

A 12-year-old spayed female Yorkshire Terrier presented with anorexia, and an intra-abdominal mass was examined at the Animal Medical Center, Tokyo University of Agriculture and Technology, Tokyo, Japan. Abdominal ultrasonography revealed that the mass originated from the spleen. Total splenectomy was performed the following day, where evidence of past rupture of the splenic mass and a small amount of purulent ascites were found. No gastrointestinal perforation or abscess formation in other tissues was noted during the surgery. Intra-operative cytological examination of the ascites revealed a large number of degenerated neutrophils and macrophages phagocytosing cocci. The splenic mass was histopathologically diagnosed as a splenic abscess, concurrent with a splenic hemangiosarcoma. Bacterial culture examination of the ascites identified *Staphylococcus schleiferi*. Although surgical management had been successful, the dog eventually developed clinical signs suggestive of intra-abdominal hemorrhage attributable to hemangiosarcoma approximately five months after surgery. This clinical report describes that splenic hemangiosarcoma might have created a milieu favorable for the development of splenic abscess.

© 2022 Urmia University. All rights reserved.

Introduction

Splenic abscesses in dogs are rare. The incidence rate of splenic abscesses has indicated less than 1.00% of the splenic pathology in dogs,^{1,2} and clinically, only a few cases of splenic abscesses have been reported.³⁻⁵ In humans, splenic abscess occurs in association with malignancies, immunodeficiencies, trauma, metastatic infections, and also diabetes.⁶⁻⁸

Some splenic abscesses have been reported to cause colon and pancreatic cancers.⁹ In contrast, the mechanisms of developing splenic abscess in dogs have never been fully understood. Furthermore, the case of splenic abscess accompanied by splenic hemangiosarcoma has never been noted in either humans or dogs.^{9,10} In this case report, a case of splenic hemangiosarcoma developed with splenic abscess was reported.

Case Description

A 12-year-old spayed female Yorkshire Terrier, weighing 3.80 kg, was referred to the Animal Medical Center, Tokyo University of Agriculture and Technology, Tokyo, Japan. This dog showed decreased appetite and abdominal distension, and an abdominal mass had been detected by the referral veterinarian 10 days before referral to the hospital. This patient had undergone sterilization 10 years prior to referral to the hospital.

Physical examination revealed pyrexia (39.50 °C) and dehydration (turgor test: 2.50 sec). Mucous membrane color was pale pink with a capillary refill time of approximately 1.00 sec. The dog was tachypneic (respiratory rate: 43 breaths per min; reference range [RR]: < 24 breaths per min). No cardiac murmurs were noted. The mandibular and superficial cervical lymph

*Correspondence:

Daigo Azakami, DVM, PhD

Laboratory of Veterinary Surgery, Tokyo University of Agriculture and Technology, Tokyo, Japan

E-mail: ft6225@go.tuat.ac.jp



This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International (CC BY-NC-SA 4.0) which allows users to read, copy, distribute and make derivative works for non-commercial purposes from the material, as long as the author of the original work is cited properly.

nodes were enlarged, and swelling of the upper abdomen was confirmed.

Complete blood cell counts revealed leukocytosis ($237 \times 10^2 \mu\text{L}^{-1}$; RR: $60.00 - 170 \times 10^2 \mu\text{L}^{-1}$), neutrophilia with left shift (neutrophils $17,775 \mu\text{L}^{-1}$ and bands $2,607 \mu\text{L}^{-1}$; RR: $3,000 - 11,500 \mu\text{L}^{-1}$ and $< 300 \mu\text{L}^{-1}$, respectively), anemia (32.30%; RR for hematocrit: 37.00% - 55.00%), and thrombocytopenia ($14.80 \times 10^4 \mu\text{L}^{-1}$; RR: $20.00 - 50.00 \times 10^4 \mu\text{L}^{-1}$). Serum biochemistry revealed increased blood urea nitrogen level (65.50 mg dL^{-1} ; RR: $9.20 - 29.00 \text{ mg dL}^{-1}$), slightly elevated alanine aminotransferase level (99.00 U L^{-1} ; RR: $17.00 - 78.00 \text{ U L}^{-1}$), high alkaline phosphatase level ($1,145 \text{ U L}^{-1}$; RR: $47.00 - 254 \text{ U L}^{-1}$), hypercholesterolemia (437 mg dL^{-1} ; RR: $111 - 312 \text{ mg dL}^{-1}$), and increased C-reactive protein (CRP; 17.00 mg dL^{-1} ; RR: $< 1.00 \text{ mg dL}^{-1}$) level. In blood coagulation analyses, fibrinogen and D-dimer levels were 537 mg dL^{-1} and $> 40.00 \text{ mg L}^{-1}$, respectively (RR: $150 - 350 \text{ mg dL}^{-1}$ and $< 1.00 \text{ mg L}^{-1}$, respectively).

Abdominal radiographs showed a circular structure in the middle abdomen (Fig. 1A). There were no metastatic lesions on chest radiographs. Abdominal ultrasonography using an 8.00 MHz high-frequency convex probe detected a mass approximately 7.00 cm in diameter originating from the spleen composing of hyper- and intermediate-echogenic parenchyma and hypoechogenic cysts (Fig. 1B). No other abdominal abnormalities, including retention of ascites, were observed. Chest ultrasonography revealed no remarkable abnormalities. At this time, since splenic hemangiosarcoma was suspected, fine needle aspiration of the splenic mass was not performed.

Exploratory laparotomy was performed the following day. As a pre-anesthetic protocol, subcutaneous atropine (0.05 mg kg^{-1} ; Tanabe, Osaka, Japan) and intravenous midazolam (0.20 mg kg^{-1} ; Maruishi Pharmaceutical, Osaka, Japan) were administered, followed by intravenous propofol (6.00 mg kg^{-1} , Fresenius Kabi, Tokyo, Japan) to induce anesthesia. Anesthesia was maintained using a mixture of isoflurane (Pfizer, Tokyo, Japan) and oxygen. Ventilation was maintained at a respiratory rate of 10 - 12 breaths per min and an airway pressure of 10.00 - 12.00 mm Hg. For pain control, intravenous fentanyl (Daiichi Sankyo, Tokyo, Japan) was continuously administered during and after surgery ($5.00 - 15.00 \mu\text{g kg}^{-1}$ per hr). After a midline abdominal incision, a splenic mass highly adherent to the omentum and a small amount of reddish to pink creamy purulent ascites in the upper abdomen were detected. Subsequently, a total splenectomy was performed. Blood vessels flowing into the spleen were cut using an ultrasonic coagulation incision system (SonoSurg, Olympus, Tokyo, Japan); whereas, larger diameter vessels were cut in the same way after ligation. No intra-abdominal abnormalities, such as gastrointestinal perforation or abscess formation causing purulent ascites in other organs, were noted during the surgery. Intra-

operative cytological examination of the ascites revealed septic suppurative and macrophagic inflammation with intra-cellular cocci (Fig. 2). Ascites were subjected to bacterial culture examination. Before closing the abdomen, intra-peritoneal irrigation was performed with sterile physiological saline. Subsequently, low-pressure continuous suction-type abdominal drainage (J-VAC®; Johnson and Johnson Inc., Tokyo, Japan) was placed. Recovery from anesthesia was successful with no complications.

Post-operative management was performed as follows: Ringer's acetate solution infusion (3.00 mL kg^{-1} per hr) and continuous intravenous (IV) antibiotic administration using meropenem (24.00 mg kg^{-1} , q24hr; Nipro, Osaka, Japan) for three days after surgery. Continuous IV administration of fentanyl was discontinued the day after surgery.

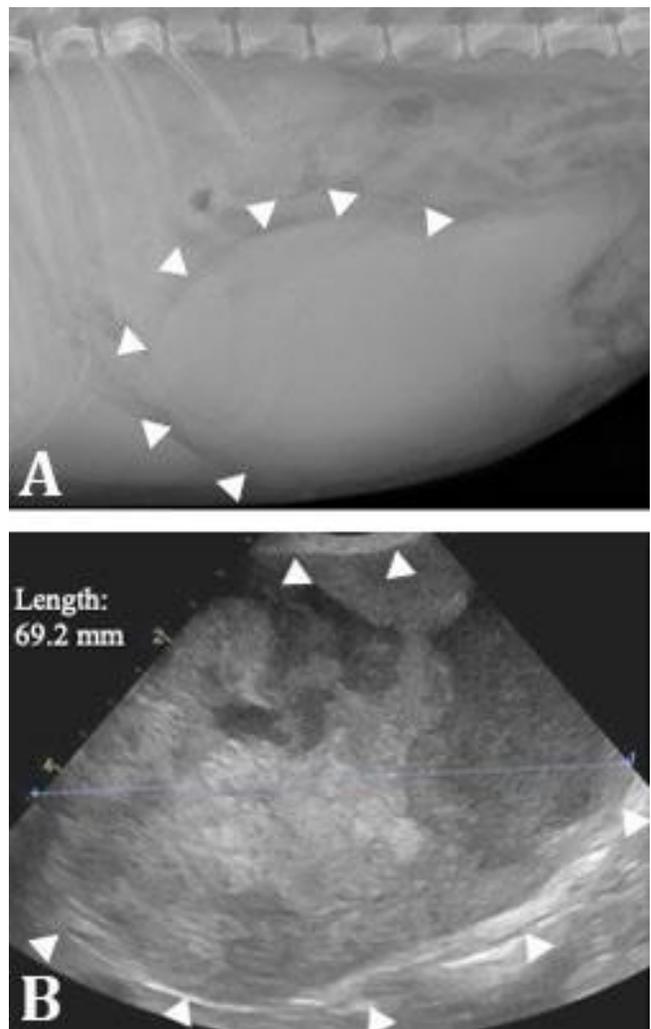


Fig. 1. Abdominal images of a 12-year-old Yorkshire Terrier. **A)** A circular soft tissue shadow is detected on upper abdominal radiography. **B)** Splenic mass is detected on abdominal ultrasonography using 8.00 MHz high-frequency convex probe, which is approximately 7.00 cm in diameter and shows mixed echogenicity. The boundaries of the mass in each image are indicated with arrowheads.

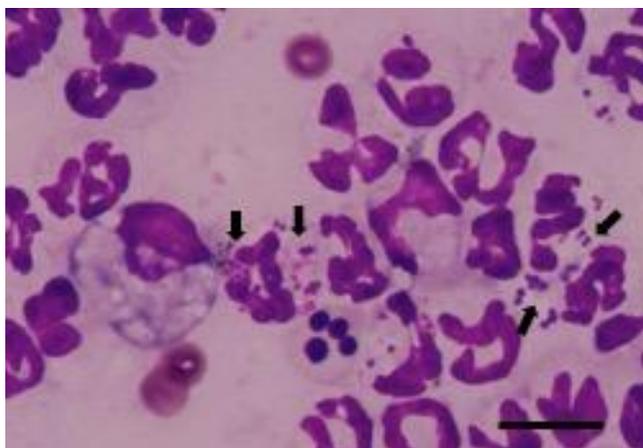


Fig. 2. A cell population is mainly composed of neutrophils and macrophages, and intra-cellular cocci (arrows) are detected by the intra-operative cytological examination of ascites (Wright and Giemsa stain; bar = 20.00 μ m).

The surgical wound was cleaned, and ascites was aspirated through abdominal drainage performed twice a day. The dog showed appetite on the second day after the operation, and healing of the surgical wound was smooth with no infection. The abdominal drainage was removed three days after the operation because of the significantly low volume of aspirated ascites. The dog was discharged from the hospital five days after the operation.

Bacterial culture examination of ascites identified *Staphylococcus schleiferi*. The splenic mass was histopathologically diagnosed as a hemangiosarcoma with an infectious splenic abscess. Hemangiosarcoma and suppurative inflammation lesions were not observed at the same site in the splenic tissue (Figs. 3A and 3B). Additionally, clusters of cocci were observed in the blood vessels distributed in the necrotic lesions (Fig. 3C).

At follow-up, a week and a month after discharge, the patient showed good physical condition, and no metastatic lesions were detected. Although the adjunctive chemotherapy was suggested for hemangiosarcoma, the owner did not select it. Due to the owner's request, medical management in the hospital was terminated one month after discharge.

According to a referral veterinarian, although the general condition of the patient had been well for a while, the dog showed clinical signs suggestive of intra-abdominal hemorrhage at approximately five months after discharge from the hospital. Since the owner refused further examination and treatment, the patient's current condition remains unclear.

Discussion

The dog reported in this paper presented with a hemangiosarcoma combined with an abscess in the spleen. This dog showed some hematological abnormalities suggestive of an inflammatory reaction and abnormal blood coagulation at the time of presentation to the hospital. It has been reported that canine hemangiosarcoma is associated with disseminated intra-vascular coagulation at a high rate.¹¹ Meanwhile, the left shift of neutrophils, CRP elevation, and abnormal blood coagulation parameters shown in the present dog were likely to be caused by potential rupture of the splenic abscess and splenic hemangiosarcoma.

In humans, it has been suggested that the splenic abscess formation requires splenic damage and presence of bacteremia.⁹ The torsion of splenic vascular pedicle has been suggested to cause splenic parenchymal congestion, hypoxia, and necrosis, leading to abscess formation in humans.¹² In this case, because there was no evidence of splenic vascular torsion, the definitive causes of splenic abscess formation have been unclear. However, one of the possible causes of splenic abscess formation in this case might be that the splenic hemangiosarcoma had caused splenic damage, including disruption of the vascularization in spleen, which may have allowed bacterial infection of the spleen. Although *S. schleiferi* was identified in the ascites of this case, it was unclear whether this patient had bacteremia because no blood culture examination was performed. No infectious lesions other than the spleen were observed during the surgery.

The prognosis for splenic abscess, a rare disease in dogs, is unclear. In the prognosis of human splenic abscess, significant delays in management may affect mortality,

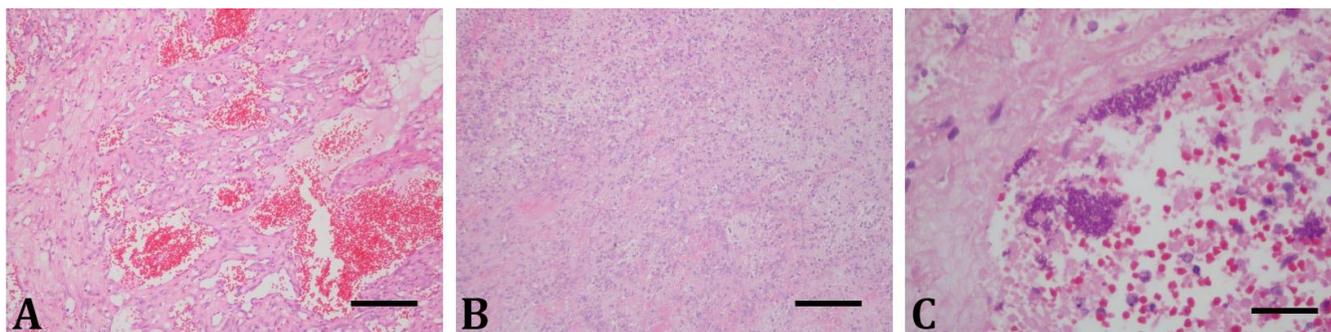


Fig. 3. Pathological images of a splenic mass. **A)** The lesion of hemangiosarcoma. **B)** The lesion of purulent inflammation. **C)** A cluster of cocci in the vessels of the necrotic lesion. Hematoxylin and Eosin stain; bars = 200, 200, 50 μ m (A, B and C, respectively).

which ranges from 0.00 to 24.50%, even if patients are properly managed.¹³ Meanwhile, two previously reported dogs with splenic abscess had obtained good prognosis by surgical management, including total splenectomy, abdominal lavage, and antibiotic therapy, despite severe peritonitis or pneumoperitoneum.^{4,5} In the present case, the splenic abscess itself was well controlled by splenectomy and intensive antibiotic therapy; therefore, the prognosis of splenic abscess in dogs depends largely on whether it ruptures, and even after rupture, early surgical intervention and thorough peri-operative management may improve the survival rate. The present patient had a good course for several months after discharge; however, she eventually developed clinical signs that were suspected to be intra-abdominal bleeding. Although the definitive cause could not be identified, intra-abdominal hemorrhage associated with hemangiosarcoma was considered most likely. After discharge, the dog did not receive adjuvant chemotherapy.

Splenic hemangiosarcoma is one of the most malignant clinical behaviors in dogs, with a median survival period of 1 - 3 months and 3 - 4 months with surgery alone and with the combination of surgery and chemotherapy, respectively.¹⁴ Therefore, the prognosis of this case largely depends on the malignant clinical behavior of hemangiosarcoma.

In conclusion, a rare case of splenic abscess with splenic hemangiosarcoma in a dog was presented. Although the causes of splenic abscess formation are not well understood in dogs, it is possible that splenic hemangiosarcoma is a pathological condition leading to splenic abscess formation in this dog.

Acknowledgments

The authors thank the medical staff involved in the management of this patient.

Conflict of interest

The authors declare no conflict of interest.

References

- Spangler WL, Culbertson MR. Prevalence, type, and importance of splenic diseases in dogs: 1,480 cases (1985–1989). *J Am Vet Med Assoc* 1992; 200(6): 829-834.
- Day MJ, Lucke VM, Pearson H. A review of pathological diagnoses made from 87 canine splenic biopsies. *J Small Anim Pract* 1995; 36(10): 426-433.
- Ginel PJ, Lucena R, Arola J, et al. Diffuse splenomegaly caused by splenic abscessation in a dog. *Vet Rec* 2001; 149(11): 327-329.
- Abdellatif A, Günther C, Peppler C, et al. A rare case of splenic abscess with septic peritonitis in a German shepherd dog. *BMC Vet Res* 2014; 10: 201. doi: 10.1186/s12917-014-0201-z.
- Rubanick JV, Breiteneicher AH, Thieman-Mankin K. Large-volume pneumoperitoneum and septic peritonitis secondary to splenic abscess rupture in a dog. *Can Vet J* 2020; 61(2): 138-141.
- Liverani E, Colecchia A, Mazzella G. Persistent fever and abdominal pain in a young woman with budd-chiari syndrome. *Gastroenterology* 2018; 154(3): 495-497.
- Divyashree S, Gupta N. Splenic abscess in immunocompetent patients managed primarily without splenectomy: a series of 7 cases. *Perm J* 2017; 21: 16-139. doi: 10.7812/TPP/16-139.
- Liu YH, Liu CP, Lee CM. Splenic abscesses at a tertiary medical center in Northern Taiwan. *J Microbiol Immunol Infect* 2014; 47(2): 104-108.
- Lotfollahzadeh S, Mathew G, Zemaitis MR. Splenic abscess. *StatPearls* (internet). Available at: <https://www.ncbi.nlm.nih.gov/books/NBK519546/>. Accessed: June 02, 2021.
- Awotar GK, Luo F, Zhao Z, et al. Splenic abscess owing to cancer at the splenic flexure: A case report and comprehensive review. *Medicine (Baltimore)* 2016; 95(38): e4941. doi: 10.1097/MD.0000000000004941.
- Maruyama H, Miura T, Sakai M, et al. The incidence of disseminated intravascular coagulation in dogs with malignant tumor. *J Vet Med Sci* 2004; 66(5): 573-575.
- Richter MC. Spleen. In: Tobias KM, Johnston SA (Eds). *Veterinary surgery: Small animal*. 2nd ed. Guelph, Canada: Elsevier Science & Saunders 2012; 1341-1352.
- Nieciecki M, Kozuch M, Czarniecki M, et al. How to diagnose splenic abscess? *Acta Gastroenterol Belg* 2019; 82(3): 421-426.
- Thamm DH. Hemangiosarcoma. In: Withrow SJ, Vail DM, Page RL (Eds). *Small animal clinical oncology*. 5th ed. Missouri, USA: Elsevier 2013; 679-688.