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Hypertrophic osteopathy associated with aortic thrombosis in a dog

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Abstract

Background: Aortic thrombosis (ATh) is an uncommon problem in dogs. Although the pathogenesis of hypertrophic osteopathy (HO) is unknown, it is thought this can be due to blood flow disorder. In this case, removal of aortic thromboembolism (ATE) resulted in periosteal proliferation. **Case description:** A 4.8-kg, 3-year-old, intact female Maltese was referred with a bite wound showing pneumomediastinum, pneumothorax, and subcutaneous emphysema. After adequate treatment, the dog had recovered well and was discharged. **Findings/treatment and outcome:** Acute non-painful paraparesis suddenly developed 5 days after discharge. An abdominal ultrasound showed ATE at the level of 1 cm proximal to the external iliac arterial bifurcation. Based on clinical sign, physical exam, neurologic exam, and ultrasonography, ATh was diagnosed. Arterial thrombectomy was performed to remove the thrombus. Twenty-four days after surgery, the dog had pain and soft tissue swelling of both stifles due to HO. After rehabilitation, the dog finally started to ambulate, and the dorsal pedal arteries pulse was normal. Hypertrophic osteopathy also resolved completely. **Conclusion:** This report suggests the relationship between HO and ATh, for the first time in veterinary medicine.

Key words: Hypertrophic osteopathy, Periosteum proliferation, Thrombectomy, Thrombosis

Introduction

Aortic thrombosis (ATh) is an uncommon problem in dogs (Lake-Bakaar *et al.*, 2012). Aortic thrombosis is associated with various conditions, such as bacterial endocarditis, hyperadrenocorticism, immune-mediated disorders and pancreatitis (Boswood *et al.*, 2000). No effective drugs are identified for aortic thromboembolism (ATE), but anticoagulant and antiplatelet drugs have been tried. Other treatments include thrombolytic therapy and surgical thrombectomy (Lake-Bakaar *et al.*, 2012; Winter *et al.*, 2012). Recently, a significant difference has been reported in survival time between acute and chronic ATh (Williams *et al.*, 2017).

Hypertrophic osteopathy (HO) is characterized by periosteal reactions, often associated with pulmonary tumors, pneumonia, pulmonary granuloma and other neoplasia (Hesslink and van den Tweel, 1990; Randall *et al.*, 2015). In addition, urinary bladder sarcoma and hepatic adenocarcinoma have been reported in extra-thoracic diseases (Headley *et al.*, 2005; de Melo Ocarino *et al.*, 2006). It presents clinically with bilateral symmetrical swelling and pain of the distal portion of all the affected limbs (Headley *et al.*, 2005; Cetinkaya *et al.*, 2011). Response to surgical resection of the primary thoracic lesion and bilateral cervical vagotomy has been reported (Yap *et al.*, 2017). The bone abnormalities may

recover over several months. Although the pathogenesis of HO is unknown, enhanced blood flow to the distal extremities is thought to be the cause of HO (Cetinkaya *et al.*, 2011). To the authors' knowledge, this is the first report of the occurrence of HO secondary to ATh in a dog.

Case description

A 4.8-kg, 3-year-old, intact female Maltese was referred with a bite wound and showed moderate pneumomediastinum, pneumothorax, and severe subcutaneous emphysema (Figs. 1A-B). Prophylactic cefazolin (22 mg/kg, IV, Cefamezine, Donga-st, Seoul, Korea, BID) was administered, and a 16-Fr chest tube was inserted. The pneumomediastinum and pneumothorax improved after fluid therapy and oxygen supplementation. Radiological examination showed neither respiratory tracts rupture nor esophagus lesion. After three days, the patient had recovered well and was discharged. Five days after discharge, the dog suddenly developed acute non-painful paraparesis. Femoral pulses and cold pelvic limbs were noticed on physical examination. The forelimb blood pressure was 145/120 mm Hg with a mean arterial pressure (MAP) of 128 mm Hg, whereas the hind limb blood pressure was 106/85 mm Hg with a MAP of 67 mm Hg. Neurological examination showed decreased to absent postural

reaction in pelvic limbs, decreased perineal reflex, anal sphincter tone, and absent patellar reflexes. Abdominal and spinal radiography were normal. However, an abdominal ultrasound showed ATE at the level of 1 cm proximal to the external iliac arterial bifurcation (Fig. 2A). Aortic thrombosis was diagnosed, and arterial thrombectomy was performed to remove the thrombus. The dog was fasted 12 h and anesthetized for the surgery. Midazolam (0.2 mg/kg, IV, Midazolam, Bukwang Pharm, Seoul, Korea) and propofol (6 mg/kg, IV, Provive, Myungmoon Pharm, Seoul, Korea) was administered as premedication and induction agent, respectively; followed by sevoflurane (Hana Pharm Co., Ltd., South Korea) through an endotracheal tube. A skin incision was made in the ventral aspect of the abdomen, and celiotomy was performed. The abdominal aorta was identified and traced caudally to locate the thrombus. No

pulse was observed below the level of the iliac arterial bifurcation. To occlude the caudal part of the aorta and both external iliac arteries, the Rumel tourniquet with 3-0 black silk was used. A full-thickness incision was made 1 cm proximal to the thrombus. The incision line was continued distally by using iris scissors. A thrombus (about 2-cm long) was identified and removed by a nerve hook and the DeBakey atraumatic forceps (Fig. 2B). The defect was copiously lavaged by sterile saline and sutured in simple continuous pattern by using 6-0 PDS (polydioxanone). Prior to complete closure, the occlusion was released to prevent air thromboembolism. The abdomen was lavaged with sterile saline, and the subcutaneous layer and skin were closed in a routine fashion. Anticoagulant therapy was initiated simultaneously. Cefazolin (22 mg/kg, IV, Cefamezine, Donga-st, Seoul, Korea, BID), tramadol (3 mg/kg, IV,

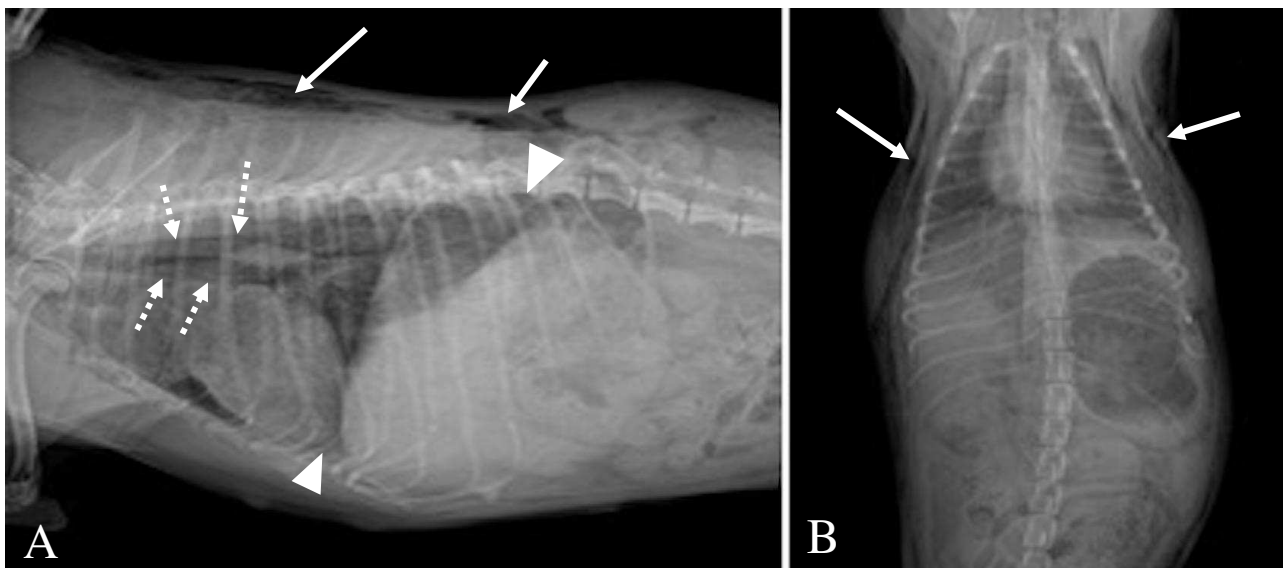


Fig. 1: Radiological images of a dog with a bite wound on day 1. Severe emphysema (white arrows), moderate pneumomediastinum (white dotted arrows), and mild pneumothorax (white arrowheads) were found. (A) Lateral view, and (B) Ventrodorsal view

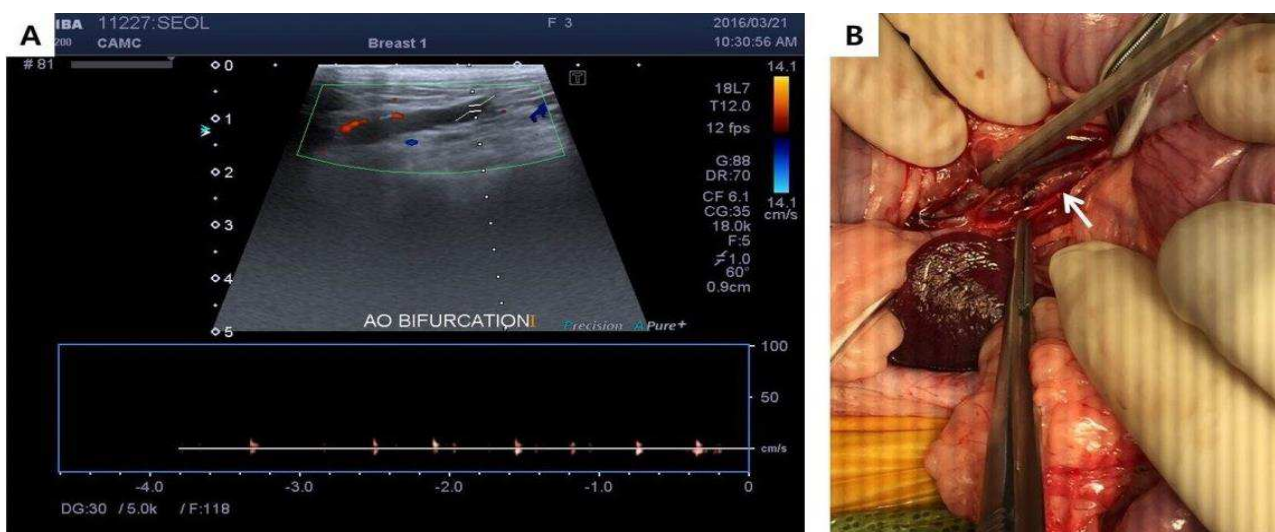


Fig. 2: Location images of aortic thromboembolism. (A) Abdominal ultrasound image showing evidence of aortic thromboembolism (ATE) at the level of iliac arterial bifurcation, and (B) Intraoperative photograph of arterial thrombectomy. The 2-cm-long thrombus (white arrow) was removed using a nerve hook and the DeBakey atraumatic forceps

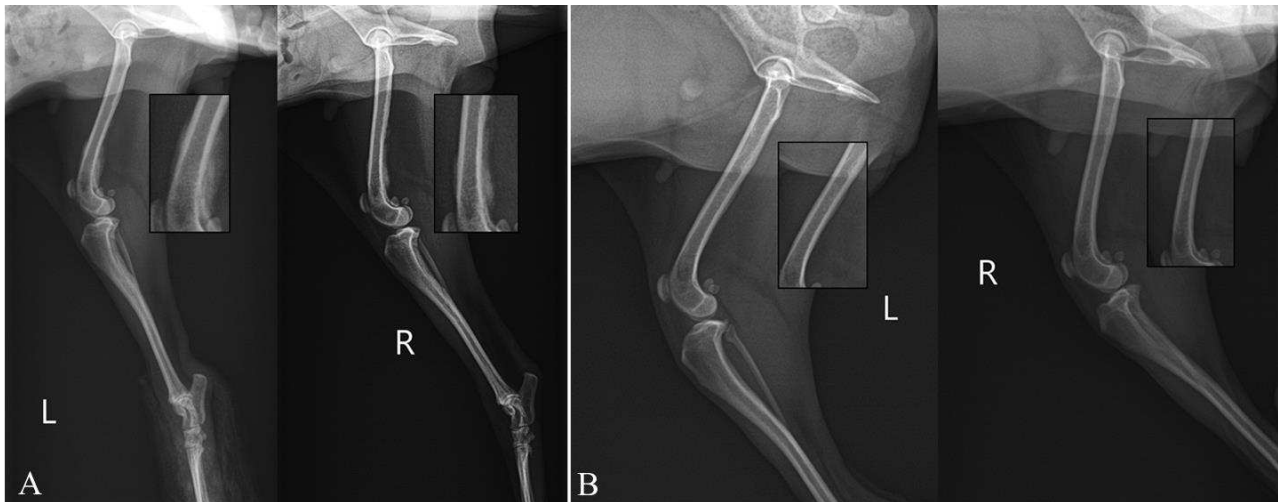


Fig. 3: Lateral radiographs of femurs on postoperative day 24 (A), and 55 (B). The treatment directed at the ATE resolved the hypertrophic osteopathy (HO) as well. L: Left, and R: Right

Toranzin, Shinpoong Pharm, Seoul, South Korea, BID), clindamycin (11 mg/kg, IV, Fullgram, Samjin Pharm, Seoul, South Korea, BID), and heparin (20 IU/kg/h, Heparin injection Choongwae, Choonwae Pharm, Seoul, South Korea, CRI) were administered 3 days after surgery. Long-term anticoagulant treatment with oral clopidogrel (2 mg/kg, SID, Clivix, Jinyang Pharm, Seoul, South Korea) was administered. Twenty-four days after surgery, the dog was reported to have pain and soft tissue swelling of both stifles. A radiologic examination found HO (Fig. 3A), but no remarkable finding like neoplasia or infection. Water treadmill rehabilitation was performed three times a week, and regular pelvic limbs massage was performed. On postoperative day 55, the dog finally started to ambulate, and the dorsal pedal arteries pulse was normal with a pressure of 135/90 mm Hg (systolic/diastolic) on both limbs. Neurological examination and abdominal ultrasonography revealed no abnormalities with normal aortic bifurcation area. Hypertrophic osteopathy also resolved completely (Fig. 3B). At 3 months postoperatively, the patient could walk and run normally.

Results

Aortic thrombosis is associated with various conditions and in this case, ATh was caused by bite wound. With the clinical signs, physical examination, neurologic examination and ultrasound, ATh was diagnosed at the level of 1 cm proximal to the external iliac arterial bifurcation. The thrombus was removed by operation but, HO was found on 24 days post operation. Nonetheless, 55 days post operation, the patient was able to ambulate and normal femoral pulse returned to normal. At 3 months post operation, the patient could walk and run.

Discussion

This report is about the rare case of HO associated

with the treatment of ATh developed in a dog with a bite wound. Hypertrophic osteopathy commonly results from neoplasia or chronic inflammation within the thoracic cavity and from tumors of the liver or urinary bladder within the abdominal cavity (Headley *et al.*, 2005; Cetinkaya *et al.*, 2011). Periosteal new bone formation on the outside of the diaphyses of cortical bones affected distal part of all limbs with lameness and nonedematous soft tissue swelling (Martínez *et al.*, 1996; Headley *et al.*, 2005). Lameness was not observed due to paraparesis, but the radiological examination showed osteogenesis at the distal parts of both femurs without any alterations within the thoracic cavity. The most important theory explaining HO is the development of the bone lesions related to an increased blood flow to the limbs. The differential diagnosis of this includes primary bone neoplasia, osteitis, bacterial or fungal osteomyelitis, and HO (Yanai *et al.*, 2015). In this case, other factors like hyperadrenocorticism, immune-mediated disorders were ruled out based on the results of complete blood count (CBC), biochemical tests and radiologic examination. The patient might have been in a hypercoagulable state and had endothelial damage due to the inflammation and the bite wound. The efficacy of the anticoagulants, platelet antagonists, and thrombolytic drugs and the standard protocol for ATE in veterinary medicine are limited (Boswood *et al.*, 2000). Few studies have reported on the surgical removal of ATh in dogs (Lake-Bakaar *et al.*, 2012; Winter *et al.*, 2012). In this patient, a stronger pulse palpated immediately after the removal of the thrombus from the aorta. Twenty-four days after the surgery, HO was observed on bilateral femoral radiographs. Surgical removal of the thrombus was thought to cause the blood flow change around the femur. Hypertrophic osteopathy pathogenicity is unclear, but the nervous reflex theory and humoral theory are well accepted in veterinary medicine. In this theory, an autonomic neurovascular reflex changes the peripheral blood supply and induces local hypoxia in the periosteum causing new bone formation. The humoral theory explains the HO in relation to thoracic lesions.

The thoracic lesion promotes the flow of blood to the limbs by inducing hypoxia, inducing excess vasoactive substances production, and formation of arteriovenous shunts (de Melo Ocarino *et al.*, 2006). In this case, sudden increase in the peripheral blood flow after the removal of ATH caused a local passive congestion and periosteal proliferation. With time, the blood became well oxygenated, and the hind limbs were able to recover normally.

In summary, this case demonstrates that HO results from the removal of an ATH in a dog. Aortic thrombosis in dog has rarely been reported, and the acquired form of HO without a thoracic lesion is also rare. In addition, a similar case has not been previously reported in any veterinary and human medicine literature.

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