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CASE REPORT

Peripheral arteriovenous malformation in a dog

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Abstract

Arteriovenous malformation (AVM) is a circulatory alteration that can be described as an abnormal communication between an artery and vein. AVM is a snarled tangle of arteries and veins. They are connected to each other, with no capillaries between. That interferes with the blood circulation in an organ. An AVM leads to localized swelling, ischemia, and ulceration and possible compression of nervous tissue which contributes to pain. To date, in veterinary medicine, case reports of an AVM are rarely described. An 11 year old, mixed breed, spayed-female dog was presented with a swelling of left hindlimb. Physical examination revealed left hind limb edema but the gait appeared normal and without pain when palpated. A strong pulse of the saphenous vein was detected. Blood profiles and blood chemistry were within normal limits. Based on radiographs, soft tissue swelling was seen without radiographic evidence of skeleton abnormalities. Ultrasonography revealed that the femoral artery and femoral vein were enlarged. Computed tomography (CT) angiography revealed the vascular engorgement beginning from left external iliac artery and vein down to femoral artery and vein. The saphenous artery and the lateral saphenous vein were tortuous and engorged. Fluoroscopic angiography revealed a massive arteriovenous malformation and a venous varix was detected. Without surgical treatment, 3 months later, the dog started to develop pain and lameness. Consultation with human medical colleagues agreed that vascular correction was determined not to be possible. Limb amputation was performed to improve quality of life.

Keywords: canine, CT scan, ultrasound, selective angiography

รายงานสัตว์ป่วย

รายงานการพบ Arteriovenous malformation ในสุนัข

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บทคัดย่อ

รูปผิดปกติของหลอดเลือดแดงและดำ (Arteriovenous malformation; AVM) คือการเปลี่ยนแปลงการไหลเวียนโลหิตที่ผิดปกติระหว่างหลอดเลือดแดงและหลอดเลือดดำ ทำให้เกิดกระจุกหรือปมของหลอดเลือดที่เชื่อมต่อกันโดยไม่มีหลอดเลือดฝอยกั้นกลางทำให้เกิดการรบกวนการไหลเวียนโลหิตไปยังอวัยวะ AVM ทำให้เกิดการบวมน้ำ ขาดเลือด แผลที่ผิวหนังและอาจเกิดแรงกดไปที่เนื้อเยื่อเส้นประสาททำให้เกิดอาการเจ็บได้ ปัจจุบันนี้ในทางสัตวแพทย์รายงานสัตว์ป่วยเกี่ยวกับ AVM นั้นมีน้อยมาก สุนัขพันธุ์ผสมเพศเมียอายุ 11 ปีมาด้วยอาการขาบวมการตรวจร่างกายเบื้องต้นพบว่าขาหลังซ้ายบวมไม่พบอาการเจ็บปวดสามารถเดินได้อย่างปกติและที่ตำแหน่งหลอดเลือดดำ saphenous สามารถตรวจพบชีพจรผลการตรวจทางโลหิตวิทยาและเคมีคลินิกไม่พบความผิดปรกติ การตรวจภาพทางรังสีพบว่าเนื้อเยื่ออ่อนรอบๆขามีการบวมแต่ไม่พบความผิดปกติของกระดูก ผลการอัลตร้าซาวน์พบ femoral artery และ femoral vein ขยายขนาด ผลจากการตรวจด้วย CT scan ด้วยเทคนิคการฉีดสารทึบรังสีเข้าหลอดเลือดพบการขยายขนาดของหลอดเลือดตั้งแต่ external iliac artery และ vein ลงไปถึง femoral artery และ femoral veinในส่วนของหลอดเลือด saphenous artery และ lateral saphenous vein มีการขยายขนาดและบิดเบี้ยว ผลการตรวจด้วย Fluoroscope พบวิการหลอดเลือดและพบ venous varix ขนาดใหญ่ที่ปลายขา หลังการวินิจฉัยสุนัขไม่ได้รับการผ่าตัดแก้ไข 3 เดือนต่อมาขาของสุนัขมีอาการบวมมากขึ้นและเริ่มแสดงอาการเจ็บปวด จากการปรึกษากับแพทย์ทางศัลยกรรมได้ผลว่า ไม่สามารถผ่าตัดแก้ไขหลอดเลือดที่ผิดปกติได้ จึงทำการรักษาด้วยการตัดขาเพื่อบรรเทาความเจ็บปวด

คำสำคัญ: รูปผิดปกติของหลอดเลือดแดงและดำ, ซีทีสแกน, อัลตร้าซาวน์, การฉีดสารสี

Introduction

Arteriovenous malformation (AVM) is a circulatory change and can be described as abnormal communication between a high-pressure, high-resistance arterial system and low-pressure, low-resistance, high-capacity venous system (Ozcanet al., 2013) or can be explained by a basic hemodynamic principle: "Blood, like flowing water, has an inherent and natural tendency to follow the path of least resistance" (Gloviczkiet al., 2012). The vascular system includes arteries, veins, and capillaries. For instance, arteries carry blood away from the heart to other organs; veins carry blood back to the heart. Capillaries connect the arteries and veins. AVM is a snarled tangle of arteries and veins. They are connected to each other, with no capillaries. That interferes with the blood circulation in an organ. Resulting in perfusion diminishes can cause localized swelling, ischemia, and ulceration and possibly compression of nervous tissue contribute to pain (Eason et al., 2017; Saunders et al., 2009).

Arteriovenous malformation disease in veterinary medicine is rarely reported. In Thailand, this could be the first case report. Diagnostic imaging modalities such as fluoroscopy, CT scan and MRI are useful to confirm this abnormality. The treatment technique is very different due to lack of experience and advanced instrumentation is needed.

Case report

Cookie, an 11 year old, mixed breed spayed female dog presented at Veterinary Teaching Hospital (VTH), Khon Kaen University (KKU), with the left hind limb swelling, the owner noticed in the morning. Physical exam revealed normal gait and normal vital sign. Severe swelling of the entire left hind limb was seen (Figure 1). A strong pulse and engorged saphenous vein can be noticed by palpation. Differential diagnostic included deep vein phlebitis, disseminated intravascular coagulation (DIC), arteriovenous fistula (AVF), arteriovenous malformation (AVM) and infection. Blood profiles and blood chemistry were within normal limits and blood parasites were not found.

Diagnostic Imaging techniques

On the radiographs, soft tissue of the left hind limb was swollen. There were no radiographic abnormalities of the skeleton. Ultrasonography revealed that the artery and femoral vein were enlarged (Figure 2). The velocity of femoral vein was up to 40 cm/sec which was higher than normal value range which is less than 30cm/sec (unpublished data). There was suspicion of a fistula connecting artery and vein from the ultrasonographic findings, therefore AVF was highly suspected.

Figure 1. Severely swollen of left hind limb.

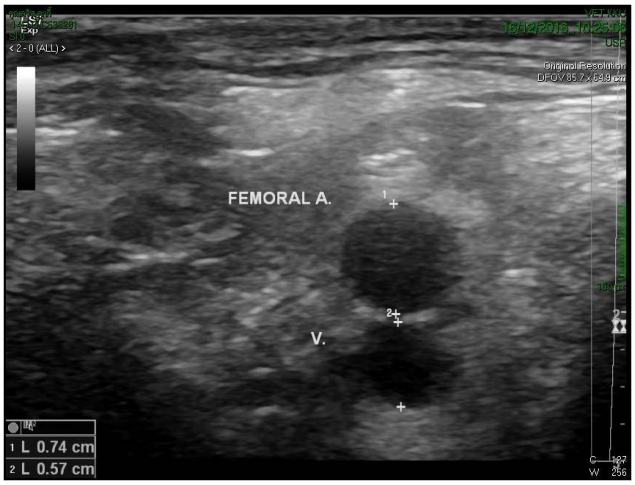

Figure 2. The artery and femoral vein were enlarged.

CT angiography(Siemens, Somatom emotion 16) was performed under anesthesia and Iohexol, dose of 600 mg/kg was injected by automatic infusion pump at rate of 2 ml/sec. CT angiography revealed the vascular engorgement started from left external iliac artery and vein down to femoral artery and vein. The saphenous artery was tortuous and engorged as was the lateral saphenous vein. A large venous varix was presented at the cranial aspect of the distal tibia and proximal aspect of the metatarsus was seen (Figure 3).

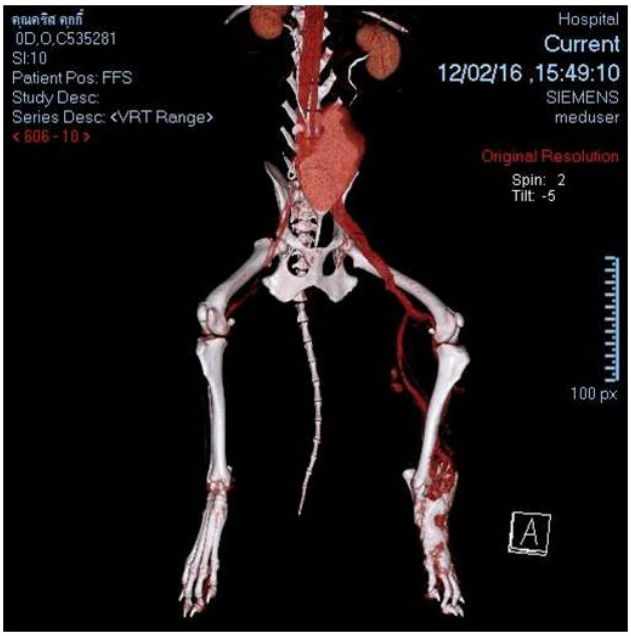

Figure 3. CT angiography revealed large torturous saphenous artery and vein with enlarged popliteal lymph node. Large venous varix at cranial aspect of metatarsus and distal tibia was also noticed.

The sizes of the left hind limb blood vessels were larger than the right limb. (Figure 4). Left hind limb edema was noticed and inguinal lymph node and popliteal lymph node were enlarged. To differentiate between AVF and AVM, selective fluoroscopic angiography was performed to determine the real-time vascular blood flow. 10 ml of Iohexol was injected through femoral artery. The contrast study revealed that the contrast was appeared into the venous varix and immediately return to the saphenous artery at cranial of distal tibia and no fistula track between artery and vein was detected (Figure 5).

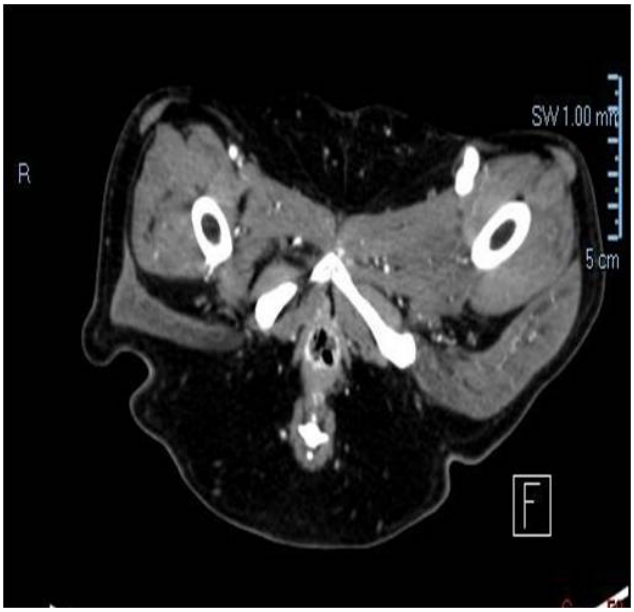

Figure 4. Premature contrast enchanted at left femoral vein and also engorged of both femoral vein and artery.

Figure 5. Selective fluoroscopy angiography showed AVM formation at crania of tibia. The selective fluoroscopy angiography confirmed the diagnosis of the AVM at crania of left tibia and ruled out AVFs at the proximal femoral artery and vein.

Follow-up

Without surgerical treatment, the dog was discharged a few days later. Three months later, the dog came

back again with clinical signs of lameness and pain over the left hind limb. Amputation of the left hind limb was done as a palliative treatment and to reduce the pain. Three months after surgery, the dog developed kidney failure and die.

Discussion

To date, in veterinary medicine, case reports about AVM are rarely described (Leach et al., 2010). The abnormal vascular communication that occurs with an AVM allows blood to flow through the path of least resistance from the high-pressure arteries to the low-pressure veins resulting in increased venous pressure and decreased distal perfusion. The resulting increase in pressure and volume causes compensatory hypertrophy and dilation of the veins depending on the relative size of the fistula. Blood flow to the arteries distal to the fistula may be compromised and as perfusion diminishes, localized swelling, ischemia, and ulceration and possibly compression of nervous tissue contribute to pain. AVM can be congenital or acquired. In acquired cases, traumatic injury can lead to vascular damage and develop into AVM, years after the injury (Gloviczkiet al., 2012). In an uncommon case, this could cause congestive heart failure due to high flow of AVM (Eason et al., 2017; Madani et al., 2015; Saunders et al., 2009).

Advance imaging diagnostics tools such as a CT scan and especially magnetic resonance imaging (MRI) can provide information regarding the anatomy and location of the fistula. Angiographic findings classic for AVM include enlarged, tortuous arteries and premature filling of the veins (Eason et al., 2017; Madani et al., 2015; Saunders et al., 2009).

Treatment can be divided into 2 ways, non-surgical and surgical treatment. Non-surgical: Elastic compression, in the form of elastic stocking or garment to wrap around the extremity, to compress the distended superficial veins but not curative and also give more protection from trauma to the vascularized lesions. Embolization by using percutaneous catheterization is important procedure to treat AVM. The procedure is complicated and need a well-trained radiologist in selective and selective catherization to perform (Gloviczkiet al., 2012). The materials used for embolization are stainless steel coils (Leach et al., 2010) and glue-like material, n-butyl cyanoacrylate (Eason et al., 2017). The main idea of embolization is to stop abnormal shunting at the precapillary or capillary level. An embolization at main arterial trunk is critical as allowing the AVM to open new distal collateral vessels.Complication of percutaneous embolization are inappropriate embolization, incomplete occlusion and AVM from new collateral branches (Gloviczkiet al., 2012; Eason et al., 2017).

In human medicine, only 1 in 8 cases require surgical removal of AVM due to sudden progression, involvement of adjacent important structures, limb ischemia, disabling pain, or rarely congestive heart failure, it should be most carefully planned. Percutaneous embolization may perform preoperative to reduce blood loss and increase successful rate (Gloviczkiet al., 2012; Ozcanet al., 2013).

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