Interventional Radiology Management of Vascular Malformations

Portosystemic Shunts and Vascular Fistulae/ Malformations

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KEYWORDS

• Portosystemic shunt • Intrahepatic portosystemic shunt • Vascular malformation
• Arteriovenous malformation • Embolization

KEY POINTS

- Vascular malformations are uncommon in companion animals, although those affecting the liver occur with relative frequency.
- Diagnostic imaging is essential for thorough assessment of vascular malformations and to assist with treatment planning.
- Minimally invasive, image-guided techniques hold tremendous potential for the treatment of vascular malformations and early results are promising.

INTRODUCTION

Vascular malformations are abnormalities of the vascular system that are often classified based on their endothelial characteristics, such as arterial, venous, arteriovenous, capillary, lymphatic, and combined vascular malformations.[1] In companion animals, abnormal vascular connections involving the liver occur most readily, but these malformations can be diagnosed in any location. Portosystemic shunts (PSS) are the most common malformation described in veterinary patients, and much literature has focused on this topic. However, arteriovenous fistulae (AVF) and arteriovenous malformations (AVM) have also been reported multiple times. Although surgical treatment of PSS, AVF, and AVM can be pursued in many situations, other techniques are emerging as acceptable treatment options for these diseases. Interventional radiology (IR) techniques hold advantages over other treatment modalities because the

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abnormal vascular connections can be mapped and more specifically targeted, and patients can be treated in a less invasive fashion. The outcomes associated with IR treatments such as embolization are encouraging, although extensive evaluation is still needed.

ANATOMIC CONSIDERATIONS

Portosystemic shunts can be congenital or acquired secondary to chronic portal hypertension. Congenital PSS most commonly involve 1 (and rarely 2 or more) intrahepatic or extrahepatic vessels that act to provide direct communication between the portal venous circulation and systemic venous circulation (caudal vena cava or azygos vein), allowing portal blood to bypass the liver. Extrahepatic PSS connect the portal vein, left gastric vein, splenic vein, cranial or caudal mesenteric vein, or gastroduodenal vein to the caudal vena cava or azygos vein. Intrahepatic PSS connect portal vein branches to the systemic circulation via the hepatic veins or abdominal vena cava.[2] Left-sided intrahepatic PSS (often consistent with patent ductus venosus) arise from the left portal vein branch, course through the left liver lobes or papillary process of the caudate lobe, and drain into a venous ampulla at its confluence with the left phrenic vein and left hepatic vein (cranial to the liver) before draining into the caudal vena cava at the level of the diaphragm.[3] Central intrahepatic PSS course through the right medial or quadrate lobes, and right-sided intrahepatic PSS course through the right lateral lobe or caudate process of the caudate lobe before draining into the vena cava.[2]

In comparison to congenital PSS, acquired PSS vessels are typically multiple, tortuous, and extrahepatic. Commonly, these vessels link a portal tributary to a renal vein or the caudal vena cava in the region of the kidneys.[4,5] However, shunt vessels connecting the portal system to gonadal, internal thoracic, or other systemic venous vessels can also occur.

AVF and AVM occur rarely in veterinary patients and are typically congenital diseases associated with communications between multiple high-pressure arterial and low-pressure venous vessels within the liver.[6,7] The term “malformation” is now preferred over “fistula” to describe this condition in most situations because the majority of affected animals have multiple abnormal communications rather than a single communication. These malformations are most commonly present in the right or central divisional hepatic lobes. Typically a single lobe is affected, but 20% of dogs with hepatic AVM have 2 affected lobes.[6] They generally appear as large, tortuous vessels along the surface of the affected lobes, and multiple acquired extrahepatic PSS vessels may also be present secondary to portal hypertension. Although hepatic AVM are classically macroscopic in nature, microscopic hepatic AVM may be suspected in cases of young dogs with identical clinical signs, including portal hypertension and/or ascites, and histopathologic findings of hepatic AVM in which a macroscopic hepatic AVM is not identified.[8] Nonhepatic vascular malformations have been rarely described in companion animals with locations including the spinal cord,[9] gastrointestinal tract,[10] orbit,[11] ear,[12] and limbs.[13–17]

PHYSIOLOGY

The majority (66%–75%) of congenital single PSS are extrahepatic in dogs and cats.[18,19] Most extrahepatic PSS occur in small breed dogs, and most intrahepatic PSS occur in large breed dogs.[18] Epidemiologic factors including breed, sex, and country of origin have been reported to have significant association with the anatomic location of intrahepatic PSS in dogs.[20]