A Case of Vascular Anomaly in Swine: Infrahepatic Caudal/Inferior Vena Cava Interruption with Azygos/Hemiazygos Continuation

Won Kyu Park, Kil Ho Cho

Department of Radiology,
College of Medicine, Yeungnam University, Daegu, Korea

Abstract

Absence of caudal/inferior vena cava (CVC/IVC) with azygos/hemiazygos continuation is an uncommon vascular anomaly. To the best of the investigators knowledge, this is the first report of absence of CVC/IVC with azygos/hemiazygos continuation in the swine in the world. In this case, absence of CVC/IVC was confirmed by venography and necropsy. The recognition of this congenital venous anomaly (CVC/IVC interruption with azygos/hemiazygos continuation) is important for interventional radiologist and cardiologist.

Key Words: Caudal vena cava, Inferior vena cava, azygos/hemiazygos vein, congenital anomaly

Introduction

Swine are commonly used as a model to study congenital cardiovascular defects that occur in humans and these models have been both spontaneous and experimentally induced. Ventricular septal defect, patent ductus arteriosus, and atrial septal defect (ASD) are examples of experimentally induced models. In necropsy surveys of commercial breeds of farm pigs, ASD was detected in 31/1906 pigs for an incidence of 1.6%.[9] Swine have been used as a model to produce a functional ASD by using a transeptal stationary angioplasty balloon technique.[10]

Caudal vena cava (CVC) in animals is the equivalent of inferior vena cava (IVC) in humans and normally, CVC/IVC provides the main channel of drainage for the hind limbs, abdominal muscles, and abdominal organs.
through the portal and hepatic veins. The main tributaries of the CVC/IVC are common iliac, lumbar, deep circumflex iliac, right testicular or right ovarian, renal phrenicoabdominal, hepatic, and phrenic veins.\textsuperscript{2,3}

The vascular anomaly presented in this case report was an incidental finding on a pig that was evaluated for experimental percutaneous closure of patent foramen ovale using a percutaneous femoral vein approach. To the best of the investigators knowledge, this is the first report of absence of CVC/IVC with azygos/hemiazygos continuation in the swine.

Case Report

The study protocol was approved by the Oregon Health & Science University’s (OHSU) Animal Care and Use Committee (IACUC). The animal facilities are accredited by the American Association for the Accreditation of Laboratory Animal Care (AAALAC) international and meet all federal (AWA and PHS) guidelines for animal care. The animal room was maintained at an average temperature of 68° F and a relative humidity of 30~70%. A female domestic swine (Sus scrofa domestica), 28 kg of body weight and approximately 10~12 weeks of age, was evaluated for experimental transcatheter implantation of a closure device for foramen ovale, using the percutaneous femoral vein approach. The swine was acclimated for at least 48 h before the terminal procedure.

Preanesthesia treatment included 0.01 mg/kg of atropine sulfate (American Regent Laboratories, Shirley, NY) and 1 g dose of Cephaparin (Ancef; Abbot Laboratories, Chicago, IL) intramuscularly. Anesthesia was induced with Telazol (tiletamine HCl and zolazepam HCl; Fort Dodge Animal Health, Fort Dodge, IA) 3~6 mg/kg, IM, and an endotracheal tube was placed. Maintenance of anesthesia was done with 2~3% isoflurane (Isothesium, Burns Veterinary Supply, Rockville Center, NY). During anesthesia, oxygen, carbon dioxide, EKG, respiration and heart rate were

![Image of venogram](image_url)

**Fig. 1.** Ventrodorsal subtraction venogram of the chest in a swine after simultaneous contrast injection into the right jugular vein and right femoral veins. Injection into the right femoral vein demonstrates the large hemiazygos trunks (HAV) draining into the coronary sinus (CS), which then communicates directly with the right atrium (RA). Injection into the right jugular vein shows normal right cranial/superior vena cava (RCSVC) draining into right atrium.