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CASE REPORT
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# Right Coronary Artery to Right Ventricular Outflow Tract Fistula in an Aged Dog - Imaging Diagnosis

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**ABSTRACT**

***Background*:** Coronary artery fistulas (CAFs) are uncommon congenital or acquired vascular anomalies that cause abnormal communication between the coronary artery and cardiac chamber or great vessels. If the drainage site is the cardiac chamber, the lesion is classified as a coronary-cameral fistula. Right coronary artery (RCA) to right ventricular outflow tract (RVOT) fistulas have not been clinically documented in dogs; however, other CAFs have been reported occasionally in small animal practice. This case report describes the echocardiography and computed tomography (CT) features of an RCA to RVOT fistula in an aged dog.

***Case*:** An 18-year-old, castrated male dog mixed-breed, weighing 3.6 kg, was presented for evaluation of a left intrathoracic wall mass with no overt clinical signs related to cardiopulmonary function. A grade 2/6 systolic murmur was auscultated, and systolic blood pressure was 150 mmHg. Echocardiography revealed an abnormal jet originating from the aortic root region and directed toward the RVOT with diastolic predominance and a peak velocity of 1.8 m/s. Mild pulmonary regurgitation with a peak velocity of 2.1 m/s was also detected, although no echocardiographic indices suggested secondary pulmonary hypertension. Based on the echocardiographic characteristics and anatomic location, a CAF was considered the most likely diagnosis, although alternative differentials could not be excluded based on echocardiography alone. Subsequent CT angiography demonstrated a small tubular communication between the proximal RCA and RVOT, without RCA dilation. These findings excluded alternative diagnoses, namely, supracristal ventricular septal defect, atypical patent ductus arteriosus, and aorto-right ventricular fistula or tunnel, thereby confirming a clinically silent RCA-to-RVOT fistula.

***Discussion*:** This report describes the 1st documented case of an RCA-to-RVOT fistula in a geriatric dog along with diagnostic imaging findings. The clinical relevance of CAFs depends primarily on the fistula size, associated hemodynamic changes, and the presence of related clinical signs. In this patient, the lesion was considered to have low clinical significance because it was small, demonstrated predominantly diastolic flow with relatively low velocity, and was not associated with any clinical signs. Long-term follow-up to rule out progressive changes in the fistulous tract and delayed onset of clinical signs was not available; however, based on the overall imaging findings and the patient's advanced age, clinically meaningful progression was considered unlikely. This case also highlights the complementary roles of echocardiography and CT angiography in diagnosing congenital cardiovascular malformations. Echocardiography enables detection of abnormal flow that is not expected in a normal heart, and provides functional information regarding hemodynamic relevance. Additionally, CT angiography using appropriate intravascular enhancement, optimized window settings, and multiplanar reformation provides three-dimensional anatomic information, allowing detailed definition of lesion morphology and its relationship to adjacent structures. When echocardiography identifies a predominantly diastolic jet coursing toward the RVOT, CAF should be included in the differential diagnoses. Combining echocardiography with CT is valuable for establishing a definitive diagnosis.

**Keywords:** computed tomography, coronary artery, diagnostic imaging, dog, echocardiography, fistula.

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## INTRODUCTION

Coronary artery anomalies are rare in dogs, accounting for approximately 0.8% of all congenital heart defects [22]. Coronary artery fistulas (CAFs) may be congenital or acquired, arising, for example, as complications of trauma, infection, or cardiac surgery, and are defined as abnormal communication between one or more coronary arteries and a cardiac chamber or great vessel, thereby bypassing the myocardial capillary bed [16,20]. According to the drainage site, fistulas draining into a cardiac chamber are referred to as coronary-cameral fistulas, whereas those draining into a great vessel, such as the vena cava, pulmonary artery, or coronary sinus, are termed coronary arterio-venous fistulas [4].

Multiple imaging modalities have been used to assess CAFs in humans, including invasive coronary angiography, coronary angiography with computed tomography (CT), and magnetic resonance imaging (MRI). Invasive coronary angiography has traditionally been regarded as the gold standard for diagnosis; however, it is invasive and may provide limited anatomical information [12]. Echocardiography can help assess the hemodynamic significance of a CAF, screen for concurrent congenital abnormalities, and visualize abnormal flow within a dilated coronary artery or drainage site; however, defining the precise origin and detailed anatomic course may be challenging with echocardiography alone [2].

Although a limited number of CAF cases have been reported in dogs [1,8,23,25,26], a right coronary artery (RCA)-to-right ventricular outflow tract (RVOT) fistula has not yet been described. This case report describes the imaging findings of an uncommon anomaly.

## CASE

An 18-year-old, castrated male dog mixed-breed, weighing 3.6 kg, was referred to the Kangwon National University Veterinary Teaching Hospital for evaluation of a left intrathoracic wall mass. Physical examination revealed a grade 2/6 systolic murmur, with systolic blood pressure of 150 mmHg. Thoracic radiographs demonstrated a vertebral heart score of 10.4v and a vertebral left atrial size of 2.0v; a left thoracic wall mass and pleural effusion were also identified.

Echocardiography (Canon Aplio i8001) was performed to investigate the cardiac murmur. Two-dimensional and color Doppler imaging demonstrated an abnormal turbulent flow that appeared to originate below the sinotubular junction at the level of the sinus of Valsalva and coursed immediately beneath the pulmonary annulus, entering the subpulmonic region of the RVOT (Figure 1A). Continuous-wave Doppler revealed that the flow was predominantly diastolic with a peak velocity of 1.8 m/s, corresponding to an estimated peak pressure gradient of 13 mmHg (Figure 1B). Mild pulmonary regurgitation was noted with a peak velocity of 2.1 m/s. However, the main pulmonary artery-to-aorta ratio was 0.94, RVOT acceleration time-to-ejection time ratio was 0.42, and right pulmonary artery distensibility index was 30%. There were no remarkable echocardiographic findings related to the right-sided cardiac chambers, and evidence of pulmonary hypertension was considered unlikely. Additional findings were consistent with myxomatous mitral valve disease without significant cardiac remodeling, and other congenital cardiac anomalies were excluded. Based on these echocardiographic findings, CAF was considered the leading differential diagnosis; however, an atypical patent ductus arteriosus (PDA) and aorto-right ventricular (Ao-RV) fistula or tunnel could not be completely excluded based on echocardiography alone.

To evaluate the left thoracic wall mass and characterize the vascular abnormality, CT angiography was performed using a 16-slice CT scanner (Alexion Advance[1]) with the following parameters: 120 kVp, 150 mA, 1 mm slice thickness. An intravenous catheter was placed in the right cephalic vein, and the dog was premedicated with butorphanol[2] [0.2 mg/kg - intravenous] and midazolam[3] [0.2 mg/kg - intravenous]. General anesthesia was induced with propofol[4] [5 mg/kg - intravenous], followed by endotracheal intubation. Anesthesia was maintained with isoflurane4 (2%) with oxygen. A triphasic scanning protocol was performed using iohexol, an iodinated non-ionic contrast medium[5] [Omnipaque - 300 mgI/mL] administered at 2.5 mL/kg, via a power injector[6] [MEDRAD® Salient Injection System] at 1.5 mL/s. Arterial (5 s), portal venous (30 s), and delay (90 s) phases were acquired.

CT angiography revealed a thin tubular vascular structure at the same anatomic location identified on echocardiography. This vessel was continuous with the RCA and terminated within the RVOT immediately beneath the pulmonary annulus (Figure 2). The proximal segment of the RCA was confirmed as the origin of the fistula, and no additional abnormal vessels or separate fistulous tracts were detected. No significant dilation of the RCA was observed. The fistulous vessel measured approximately 1.3 mm in diameter, which was less than the diameter of the noninvolved left coronary artery (1.7 mm), consistent with a small CAF. Collectively, these findings supported the diagnosis of an RCA- to-RVOT fistula.

Considering the imaging findings and the dog's geriatric age with no cardiopulmonary clinical signs, the fistula was considered to have low clinical significance; therefore, periodic monitoring with echocardiography was planned. The left thoracic wall mass was diagnosed as a fibrosarcoma, suspected to originate from the left 7th rib, based on CT and ultrasound-guided fine-needle aspiration, and palliative management was elected. The dog subsequently developed a hemothorax with secondary anemia requiring thoracentesis and intermittent blood transfusions; unfortunately, the dog died approximately 1 month after diagnosis.

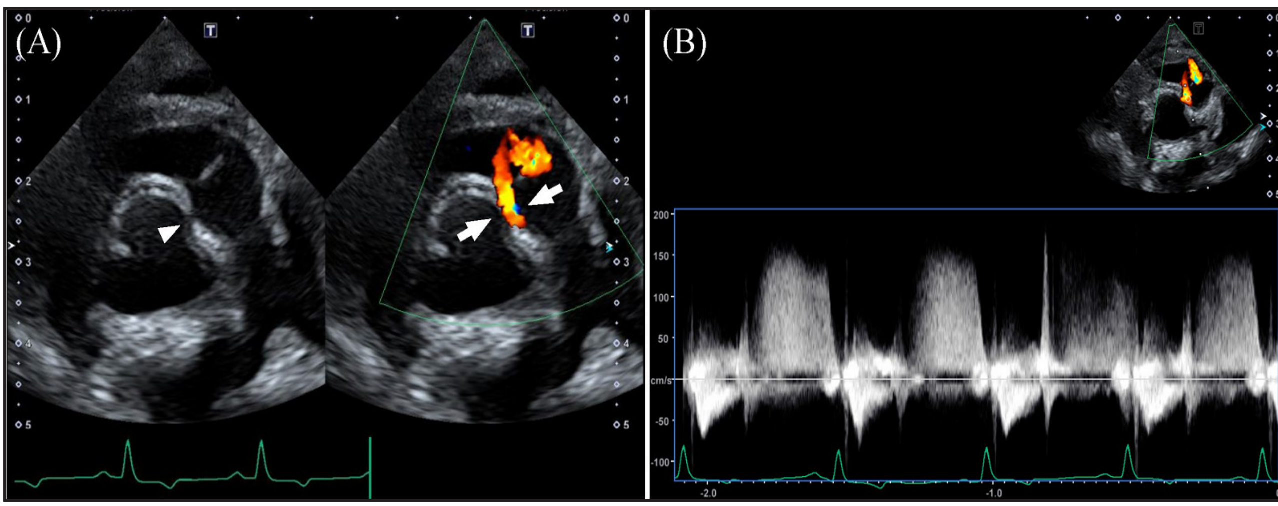


**Figure 1.** Echocardiographic images from the left cranial heart base view. A- A small focal defect of the aortic wall [arrowhead] is visible at the level of the sinus of Valsalva, presumed to be the right coronary cusp region. An abnormal turbulent flow (arrows) arises from the aortic root and drains into the right ventricular outflow tract (RVOT) immediately beneath the pulmonary annulus. B- Continuous-wave Doppler demonstrates that the previously identified turbulent jet is predominantly diastolic, with a peak velocity of 1.8 m/s; mild pulmonary regurgitation is concurrently visualized, with a peak velocity of 2.1 m/s.


**Figure 2.** Post-contrast computed tomographic angiography demonstrating a right coronary artery (RCA)-to-right ventricular outflow tract (RVOT) fistula (adjusted soft tissue window: WW 500, WL 150). (A) Transverse, (B) sagittal, (C) dorsal images show a thin tubular structure [arrows; approximately 1.3 mm in diameter] arising from the RCA and extending toward the RVOT beneath the pulmonary annulus [arrowheads], without evidence of RCA dilation.

## DISCUSSION

CAFs are defined as aberrant communications that allow coronary arterial blood to drain directly into a cardiac chamber or major vessel, bypassing the intramyocardial microvascular network and potentially altering myocardial perfusion and producing variable shunt physiology. In human medicine, approximately 80-90% of CAFs are considered congenital, although acquired fistulas have been described as complications of trauma, infection, or cardiac surgical intervention [24]. Congenital CAFs are commonly attributed to the persistence of primitive myocardial sinusoidal channels that normally remodel during cardiac morphogenesis. In a typical heart, these channels form the Thebesian vessels; incomplete regression, however, can leave a persistent communication between the coronary arterial system and a receiving chamber or vessel [20].

Although comparable epidemiological data and classification schemes are lacking in veterinary medicine, terminology and classification systems for CAFs in human medicine are often applied to help assess their clinical relevance and guide interventional or surgical approaches. Classification is commonly based on etiology and key morphological features, including the site of origin, drainage site, number of tracts, anatomic complexity, and presence of accompanying congenital cardiac abnormalities [15]. The RCA is the most commonly reported vessel of origin, followed by the left anterior descending artery and left circumflex artery [20]. Drainage most often occurs into low-pressure structures, particularly the right-sided cardiac chambers or pulmonary artery, followed by coronary sinus, left atrium, left ventricle, and superior vena cava [4,14]. Fistula size is described as small, medium, or large based on the fistula diameter being less than 1 time, 1 to 2 times, or greater than 2 times the diameter of the noninvolved coronary artery [29]. In addition, the Sakakibara classification from 1966, which categorizes CAFs according to whether their origin is in the proximal (type A) or distal (type B) segment of the coronary artery, has been used to inform the feasibility of an epicardial approach alone versus the potential need for an endocardial approach with cardiopulmonary bypass [12]. In addition, CAFs may develop in isolation or in combination with other congenital defects. The patient in this case had no history of past trauma, cardiovascular surgery, or infection. Based on the imaging findings, the diagnosis of an RCA-to-RVOT fistula could be made according to human CAF criteria as congenital, single, small size, coronary-cameral fistula, and Sakakibara classification type A.

Previous case reports in dogs have described CAFs draining into the pulmonary arterial circulation. One report described a left coronary artery-to-pulmonary artery fistula in a 10-week-old German Shepherd that produced a significant left-to-right shunt and was successfully treated using interventional procedures [23]. Other cases were diagnosed as coronary artery-to-pulmonary artery fistulas and coronary arteriovenous fistulas, including one incidentally detected in a 4-month-old dog [25], and another in a 3-year-old dog [1]. In contrast, coronary-cameral fistulas, especially RCA-to-RVOT fistulas, have not previously been clinically reported in dogs, and the present patient was notably geriatric, with no clinical symptoms. In humans, 75% of incidentally detected CAFs are asymptomatic and are considered to be clinically low-risk when the lesion is small, associated with trivial shunt volume, and without aneurysmal dilation or cardiopulmonary clinical symptoms [20,28].

In addition, the hemodynamic significance of a CAF depends on the fistula size, anatomic configuration including the site of origin and drainage, and resistance of the receiving chamber or vessel; therefore, careful assessment is essential for determining clinical relevance and management [12,20]. Drainage into the right heart may produce a left-to-right shunt and, if substantial, secondary pulmonary hypertension. In contrast, termination within the left heart can result in left-ventricular volume and/or pressure loading or mitral regurgitation-like volume overload; however, draining into the pulmonary artery may mimic the physiology of a PDA [15]. Another potential complication is coronary steal syndrome, in which flow through the low-resistance fistulous pathway reduces myocardial perfusion and may lead to ischemia and hypotension; in humans, suspicion is based on compatible clinical signs and supported by electrocardiographic (ECG) changes, increased cardiac troponin I, and reduced left ventricular systolic function on echocardiography [13]. In this patient, despite drainage into the right ventricle, which could theoretically contribute to left-to-right shunting, there was no echocardiographic evidence to support pulmonary hypertension; also, and the dog did not exhibit clinical signs suggestive of coronary steal syndrome. These observations were consistent with a lesion of low clinical severity.

In the present case, multimodal imaging enabled a definitive diagnosis of an RCA-RVOT fistula. Echocardiography allowed the formulation of a differential diagnosis list, including CAF, aortopulmonary window, atypical PDA, subarterial ventricular septal defect (VSD), and an Ao-RV fistula or tunnel, and helped narrow these possibilities. An aortopulmonary window represents a defect forming a window-like communication between the ascending aorta and the main pulmonary artery, rather than directly entering the RVOT [9]. PDA most commonly connects the descending aorta to the pulmonary artery and produces continuous shunt flow, whereas subarterial VSD generally results in predominantly systolic left-to-right shunting [6]. In contrast to these patterns, this patient showed a predominantly diastolic, relatively low-velocity flow profile, supporting CAF as the leading diagnosis, although an Ao-RV fistula or tunnel could not be fully excluded based on echocardiography alone.

CT angiography provided anatomical confirmation by directly visualizing the fistulous tract arising from the RCA and terminating in the RVOT, thereby allowing exclusion of an Ao-RV fistula or tunnel. Although an Ao-RV fistula could have been considered based on its location, it is most commonly associated with rupture of a sinus of Valsalva aneurysm [21], and no supportive imaging evidence of rupture, such as a windsock-like appearance [11], was present. An Ao-RV tunnel was also considered unlikely because it typically originates above the sinotubular junction and follows an extracardiac course [18,19], which was not compatible with the present findings.

In veterinary medicine, CT technology has evolved from 4-, 8-, and 16-slice systems to higher-specification scanners [5,10,27], and interest in ECG-gated CT angiography is growing because it can reduce cardiac motion artifacts and improve systolic or diastolic phase-specific assessment [3,17]. Although the low-slice-number CT angiography without ECG gating had some constraints, it still provided sufficient detail for a definitive diagnosis. While the absence of ECG gating may restrict the visualization of fast-moving structures such as the pulmonary valve leaflets [17], interpretation using an adjusted window (WW 500, WL 150) improved visualization of the pulmonary valve leaflets and enabled confident identification of the fistula's drainage site. Furthermore, multiplanar reformation clarified that the origin of the communication was the RCA in the aortic root region, supporting the definitive anatomic characterization. These findings are consistent with those of previous veterinary reports [7,10], suggesting that non–ECG-gated CT angiography remains a practical modality for evaluating coronary artery-related structural abnormalities when appropriate contrast enhancement and post-processing techniques are applied.

This case study had several limitations. First, the etiology could not be confirmed. However, in the absence of prior trauma, infection, or cardiac intervention and without evidence of other congenital anomalies, a congenital RCA-to-RVOT fistula was considered most likely. Second, long-term follow-up was not available after diagnosis. In human medicine, even small or asymptomatic CAFs may be complicated by infective endocarditis due to turbulent flow or by fistula thrombosis with subsequent myocardial infarction [20] and may become clinically relevant over time due to progressive enlargement of the fistulous tract and/or reduced cardiac reserve with aging, which can lead to delayed onset of clinical signs [13]. Although close clinical and echocardiographic monitoring is generally recommended, given the imaging-based classification, hemodynamic significance, and patient age, the clinical relevance of the fistula was considered low.

To our knowledge, this is the 1st report of an RCA-to-RVOT fistula in a geriatric dog. This case report adds to the veterinary literature by highlighting the value of combining echocardiography and CT angiography as complementary diagnostic modalities. Moreover, when echocardiography reveals a predominantly diastolic jet coursing from the aortic root region to the RVOT, an RCA-to-RVOT fistula should be included among the differential diagnoses. Integrating imaging findings and classification of anomalies with patient age and clinical status may assist clinicians in establishing appropriate follow-up and management strategies.

MANUFACTURERS

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## REFERENCES


1 **Agudelo C.F., Lukac B., Bockay A., Vargova V., Kackova G., Figurova M. & Hornak S. 2025.** Case report of an incidental left coronary artery to main pulmonary artery fistula in a dog. *BMC Veterinary Research*. 21(1): 503. DOI: 10.1186/s12917-025-04730-y.

2 **Al-Hijji M., El Sabbagh A., El Hajj S., AlKhouli M., El Sabawi B., Cabalka A., Miranda W.R., Holmes D.R. & Rihal C.S. 2021.** Coronary artery fistulas: Indications, techniques, outcomes, and complications of transcatheter fistula closure. *JACC: Cardiovascular Interventions*. 14(13): 1393-1406. DOI: 10.1016/j.jcin.2021.02.044.

3 **Auriemma E., Armienti F., Morabito S., Specchi S., Rondelli V., Domenech O., Guglielmini C., Lacava G., Zini E. & Khouri T. 2018.** Electrocardiogram-gated 16-multidetector computed tomographic angiography of the coronary arteries in dogs. *Veterinary Record*. 183(15): 473. DOI: 10.1136/vr.104711.

4 **Challoumas D., Pericleous A., Dimitrakaki I.A., Danelatos C. & Dimitrakakis G. 2014.** Coronary arteriovenous fistulae: A review. *International Journal of Angiology*. 23(1): 1-10. DOI: 10.1055/s-0033-1349162.

5 **Drees R., Frydrychowicz A., Reeder S.B., Pinkerton M.E. & Johnson R. 2011.** 64-multidetector computed tomographic angiography of the canine coronary arteries. *Veterinary Radiology & Ultrasound*. 52(5): 507-515. DOI: 10.1111/j.1740-8261.2011.01826.x.

6 **Graczyk S., Grzeczka A. & Paslawska U. 2025.** A comprehensive review of canine and feline ventricular septal defects-from pathogenesis to long-term follow-up. *Animals*. 15(6): 850. DOI: 10.3390/ani15060850.

7 **Gunther-Harrington C.T., Phillips K.L., Visser L.C., Fousse S.L. & Stern J.A. 2019.** Non-electrocardiographic-gated computed tomographic angiography can be used to diagnose coronary artery anomalies in Bulldogs with pulmonary valve stenosis. *Veterinary Radiology & Ultrasound*. 60(1): 38-46. DOI: 10.1111/vru.12689.

8 **Jacobs G.J., Calvert C.A., Hall D.G. & Kraus M. 1996.** Diagnosis of right coronary artery to right atrial fistula in a dog using two-dimensional echocardiography. *Journal of Small Animal Practice*. 37(8): 387-390. DOI: 10.1111/j.1748-5827.1996.tb02422.x.

9 **Jung S., Orvalho J. & Griffiths L.G. 2012.** Aortopulmonary window characterized with two- and three-dimensional echocardiogram in a dog. *Journal of Veterinary Cardiology*. 14(2): 371-375. DOI: 10.1016/j.jvc.2011.10.004.

10 **Kim J., Lee S., Hwang J. & Yoon J. 2023.** Clinical utility of a new protocol of cardiac computed tomography in dogs. *Veterinary Medicine and Science*. 9(2): 645-652. DOI: 10.1002/vms3.985.

11 **Kim J., Lee W.J., Lee Y., Choi H. & Kim D.H. 2025.** Perimembranous ventricular septal defect concurrent with an aorto-right ventricular fistula caused by a ruptured sinus of valsalva in three dogs. *Animals*. 15(7): 944. DOI: 10.3390/ani15070944.

12 **Kumar R., Kumar J., O'Connor C., Ullah I., Tyrell B., Pearson I., Matiullah S. & Bainey K. 2023.** Coronary artery fistula: A diagnostic dilemma. *Interventional Cardiology*. 18: e25. DOI: 10.15420/icr.2022.34.

13 **Lim E.C.N. & Lim C.E.D. 2025.** Coronary artery fistula presenting with coronary steal syndrome: The significance of clinical vigilance and second opinions. *Clinical Case Reports*. 13(9): e70874. DOI: 10.1002/ccr3.70874.

14 **Lim H.J., Hwang J.H., Kim J.H., Park S., Lee K.H. & Park S.H. 2021.** Fistula from right and left coronary arteries to pulmonary artery: Coronary ct angiography and coronary angiography findings. *Radiology Case Reports*. 16(7): 1790-1793. DOI: 10.1016/j.radcr.2021.04.014.

15 **Lu Y.H. 2024.** Coronary artery fistula_current status. *Journal of Taiwan Society of Cardiovascular Interventions*. 15: 19-26.

16 **Mangukia C.V. 2012.** Coronary artery fistula. *The Annals of Thoracic Surgery*. 93(6): 2084-2092. DOI: 10.1016/j.athoracsur.2012.01.114.

17 **Massarenti C., Croce M., Diana A., Tursi M., Zini E., Domenech O. & Auriemma E. 2025.** Ecg-gated cardiac multidetector ct evaluation of the normal pulmonary valve and right ventricular outflow tract in dogs. *Veterinary Radiology & Ultrasound*. 66(1): e70006. DOI: 10.1111/vru.70006.

18 **McKay R. 2007.** Aorto-ventricular tunnel. *Orphanet Journal of Rare Diseases*. 2: 41. DOI: 10.1186/1750-1172-2-41.

19 **McKay R., Anderson R.H. & Cook A.C. 2002.** The aorto-ventricular tunnels. *Cardiology in the Young*. 12(6): 563-580. DOI: 10.1017/s1047951102001038.

20 **Muhtaroglu M. 2025.** Treatment strategies for coronary artery fistulas: A contemporary review of anatomy, diagnosis, and management. *The Heart Surgery Forum*. 28(8): e668-e684. DOI: 10.59958/hsf.8799.

21 **Okino A.A., Andrade Pires M.A., Luvizotto J.M.O.L., Petinelli R.P., Fonseca J.L.I. & Khalil K.H. 2022.** Congenital aorto-right ventricular fistula in a 31 year old female. *Cirugía Cardiovascular*. 29(1): 40-42. DOI: 10.1016/j.circv.2021.10.006.

22 **Oliveira P., Domenech O., Silva J., Vannini S., Bussadori R. & Bussadori C. 2011.** Retrospective review of congenital heart disease in 976 dogs. *Journal of Veterinary Internal Medicine*. 25(3): 477-483. DOI: 10.1111/j.1939-1676.2011.0711.x.

23 **Pelosi A., Cote E. & Eyster G.E. 2011.** Congenital coronary-pulmonary arterial shunt in a German shepherd dog: Diagnosis and surgical correction. *Journal of Veterinary Cardiology*. 13(2): 153-158. DOI: 10.1016/j.jvc.2011.03.001.

24 **Rusali A.C., Lupu C.I., Manolache M.M., Rusali L.M., Bordei P. & Cojocaru L. 2025.** Coronary-to-pulmonary artery fistula in a patient with atypical chest pain: Case presentation and literature review. *Surgical and Radiologic Anatomy*. 47(1): 240. DOI: 10.1007/s00276-025-03724-7.

25 **Sato T.K., Takao T. & Fujioka T. 2015.** A case report of a dog with right coronary to pulmonary artery fistula [title_in_japanese]. *Advances in Animal Cardiology*. 48(2): 73-79. DOI: 10.11276/jsvc.48.73.

26 **Scansen B.A. 2017.** Coronary artery anomalies in animals. *Veterinary Sciences*. 4(2): 20. DOI: 10.3390/vetsci4020020.

27 **To A., Hostnik E.T., Rhinehart J.D. & Scansen B.A. 2019.** Electrocardiography-gated cardiac ct angiography can differentiate brachycephalic dogs with and without pulmonary valve stenosis and findings differ from transthoracic echocardiography. *Veterinary Radiology & Ultrasound*. 60(2): 145-158. DOI: 10.1111/vru.12701.

28 **Vaidya Y.P. & Green G.R. 2019.** Coronary artery fistula. *Journal of Cardiac Surgery*. 34(12): 1608-1616. DOI: 10.1111/jocs.14267.

29 **Yalçınkaya Öner D., Yarlıoğlueş M., Ergün E. & Murat S.N. 2025.** Diagnosis, management, and treatment of coronary artery fistulas: Three case reports and literature review. *Interventional Cardiology Perspectives*. 1(2): 75-81. DOI: 10.4274/intercardiopers.2025.2025-2-11.