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Case Report

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# A case report of patent ductus arteriosus in a Brazilian longhair female kitten

## Abstract

Among the congenital cardiac alterations observed in small pets, the persistence of the right aortic arch has been described as a rare anomaly in cats. The ductus arteriosus corresponds to a normal fetal vascular structure derived from the distal portion of the sixth left aortic arch that connects the pulmonary artery to the dorsal aorta. During fetal life, this structure has the function of transporting oxygenated blood from the maternal placenta to the aorta, bypassing the collapsed lungs of the fetus. At birth, the increase of $O_2$ partial pressure dissolved in arterial blood ($PaO_2$) and the decline in prostaglandin concentration cause the closure of the ductus arteriosus in the first hours of life, giving rise to the ligamentum arteriosus. If this process does not occur, the ductus arteriosus will remain patent. In this case report, a 4-month-old longhair female kitten was treated, and, during auscultation, a heart murmur was found. After performing a Doppler echocardiogram and color flow mapping, the presence of continuous turbulent flow in the pulmonary artery was demonstrated, characteristic of patent ductus arteriosus persistence. The animal was sent for surgery, and in the post-surgical Doppler echocardiogram, correction of patent ductus arteriosus was verified, demonstrating the absence of continuous turbulent flow in the pulmonary artery.

**Keywords:** cat disease, congenital heart disease, heart disease, persistent right aortic arch, diagnostic imaging

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Paolo Ruggero Errante
Professor of the Veterinary Medicine Course, New University of July (UNINOVE), Campus Memorial, Avenida Dr. Adolpho Pinto, 109, Barra Funda, São Paulo, SP, Brasil

**Correspondence:** Professor of the Veterinary Medicine Course, New University of July (UNINOVE), Campus Memorial, Avenida Dr. Adolpho Pinto, 109, Barra Funda, São Paulo, SP, Brasil, Email errante.paol@uni9.pro.br

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## Introduction

The ductus arteriosus is a normal fetal vascular structure, derived from the distal portion of the sixth left aortic arch that connects the pulmonary artery to the dorsal aorta and has the function of transporting oxygenated blood from the maternal placenta to the aorta, bypassing the collapsed lungs of the fetus, transforming it into if, after birth, in the ligamentum arteriosus.[1]

After birth, with the interruption of the flow of blood from the placenta to the fetus, oxygenation becomes a function designated by the respiratory system. As a result, there is an increase in oxygen tension, inhibiting the release of local prostaglandins that lead to smooth muscle contraction and anatomical occlusion of the ductus arteriosus, which occurs in the first ten days of life.[2]

If this does not occur, the process is called persistence of ductus arteriosus, ductus arteriosus patent, or persistent ductus arteriosus.[3]

In the persistence of ductus arteriosus, blood flow from the aorta to the pulmonary artery occurs due because the difference in vascular resistance between pulmonary and systemic circulation.

This leads to increased myocardial contractility and heart rate, which can cause left congestive heart failure, which can progress to pulmonary edema, atrial fibrillation, moderate pulmonary hypertension secondary to left congestive heart failure and mitral regurgitation secondary to left ventricular dilation.[4–6]

## Case report

Clinical care was provided in September 2023 to a female kitten, mixed breed, long-haired, 4 months old, due to the owner's complaint that the cat had clinical signs of mild dyspnea and cachexia. On physical examination, a low body score and mild respiratory difficulty were observed. The heart rate was within the reference values for the age and species (125 bpm), and auscultation of the heart sounds revealed the presence of a heart murmur. The owner was unable to provide information about the history of the other cats in the brooding or their parents.

Blood was collected to evaluate the blood count, kidney and liver profile, the results of which were within normal limits for the species. A Doppler echocardiogram was performed with a diagnosis of persistence of right aortic arch with flow from left to right and slight repercussion in the left ventricle (Figure 1A, Figure 1D), no alterations in aortic valve (Figure 1B), but Doppler study and color flow mapping indicate continuous turbulent flow in the pulmonary artery (Figure 1C).

Because this diagnosis, surgery was performed to ligate the duct followed by section of the ligament. Antibiotic therapy was followed with the use of ceftriaxone (25 mg/kg twice a day, 7 days), meloxicam (0.1 mg/kg once a day, 3 days) and tramadol hydrochloride (1 mg/kg, three times a day, 3 days). The post-surgical Doppler echocardiogram showed correction of patent ductus arteriosus, demonstrating the absence of continuous turbulent flow in the pulmonary artery (Figure 1E).

## Discussion

Anomalies in the vascular rings are considered rare in the feline species, with the persistence of the right aortic arch being a congenital vascular irregularity diagnosed in the first months of animal's life. The animal described in the case report was four months old and showed mild respiratory difficulty and low body score, aspects in line with the literature.[3]

Cardiac and pulmonary auscultation, for the most part, is within normal parameters in affected cats, a fact not described in this case report. Laboratory changes do not establish a direct correlation with the vascular malformation in question, as was observed in this case report.[3]

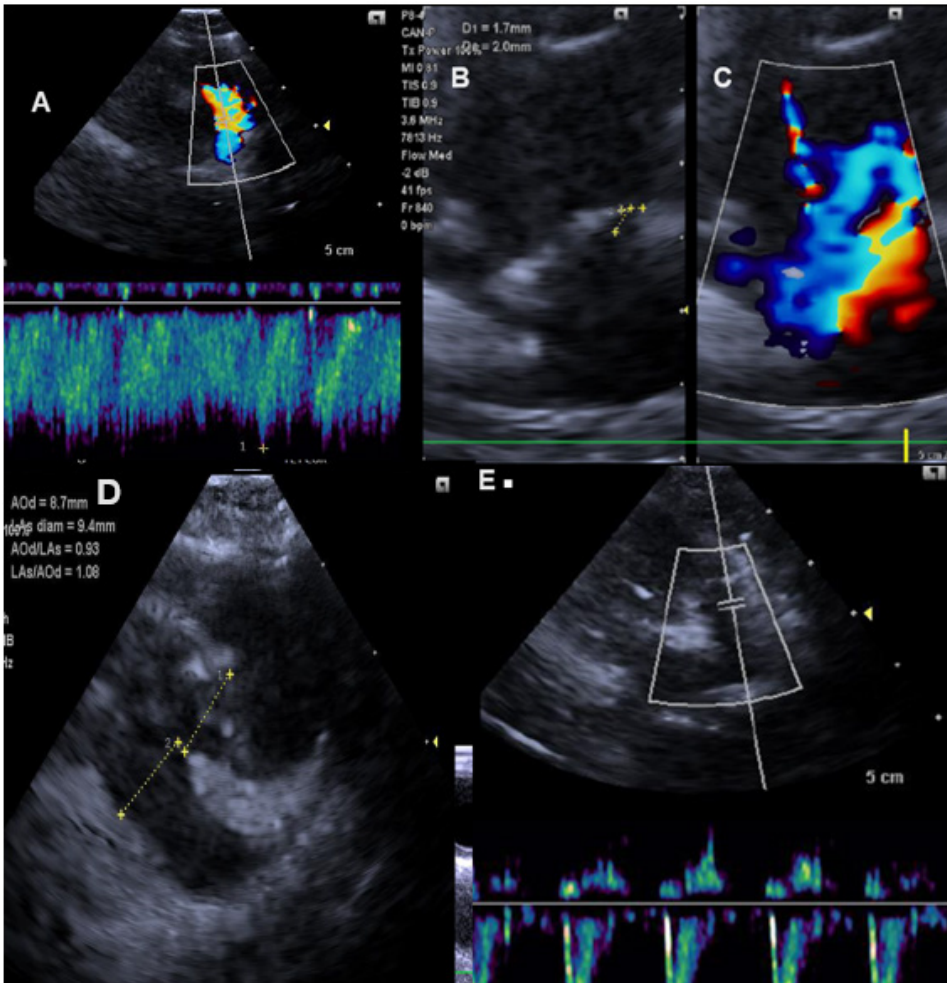


**Figure 1** Doppler echocardiogram.

A. Persistent ductus arteriosus with flow from left to right and slight repercussion in the left ventricle.

B. Aortic valve with normal appearance and movement of its valves.

C. Pulmonary valve with normal appearance and movement of the valves. The Doppler study and color flow mapping indicate continuous turbulent flow in the pulmonary artery, characterizing the persistence of patent ductus arteriosus.

D. Presence of a patent ductus arteriosus, measuring 0.17 cm at its opening into the pulmonary artery and 0.2 cm in length from the ductal ampulla.

E. Post-surgical examination for correction of patent ductus arteriosus demonstrating the absence of continuous turbulent flow in the pulmonary artery with reduction in left atrial and ventricular diameters.

In the persistence of the ductus arteriosus, the passage of blood flow from the aorta to pulmonary artery occurs due to the difference in vascular resistance between pulmonary and systemic circulation. With increased myocardial contractility and compensatory heart rate, left-sided congestive heart failure will occur, which can cause pulmonary edema, atrial fibrillation, moderate pulmonary hypertension secondary to left congestive heart failure and mitral regurgitation secondary to left ventricular dilation.

Animals with a small ductus arteriosus present a continuous focal and fixed murmur, audible only at the left base of the heart, as observed in our case report; while in cases of a wide ductus arteriosus, the murmur is audible in almost any distension of the chest.[7]

In symptomatic cases of persistent ductus, clinical signs vary depending by the size of the deviation and the amount of vascular blood volume, such as a continuous murmur heard at the left base of the heart, overlapping with normal sounds, and dyspnea in cases of pulmonary edema, fact not reported by the owner or observed during the clinical evaluation.[8]

The diagnosis of patent ductus arteriosus can be initiated at the time of cardiac auscultation, as described in this study. A complete assessment of the thoracic region in young animals is recommended at the time of the first vaccination, as if heart murmurs are identified, a specific assessment is necessary.[7]

The Doppler echocardiogram makes it possible to visualize eccentric hypertrophy of the left ventricle, with volume overload at the end of diastole, left atrial enlargement, enlargement of the ascending and descending aorta, in addition to measuring the extension of the duct, observed in M mode and in two-dimensional mode in the persistence of the classical patent ductus arteriosus. Two-dimensional Doppler echocardiography allows identifying the turbulent aortic ejection flow and the direction of continuous high flow in the aortic ductus arteriosus to the pulmonary artery.[3,9]

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In this case report, the Doppler study and color flow mapping indicate continuous turbulent flow in the pulmonary artery, characterizing the persistence of patent ductus arteriosus.[10,11]

Treatment consists of surgical correction, an efficient and safe procedure in up to 95% of cases. Among the complications associated with surgical correction of the patent ductus arteriosus, rupture of the ductus arteriosus may occur during dissection, infection, pneumothorax, cardiac arrhythmia, cardiac arrest, heart failure, thrombosis, pulmonary hypertension, and recanalization in cases of recurrence.[12,13]

## Conclusion

The patent ductus arteriosus in cats is an uncommon cardiac report, when present, is diagnosed in the first months of the animal's life. Early diagnosis is essential to preventing the natural progression of disease to congestive heart failure. The surgical treatment continues to be the main therapeutic option that improves the quality of life and increase the survival of affected animals.

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## Conflicts of interest

Author declares there is no conflict of interest in publishing the article.

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