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CASE REPORT

Palliative balloon dilation of pulmonic stenosis in a dog with tetralogy of Fallot



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Abstract A 6-month-old Beagle with tetralogy of Fallot underwent balloon valvuloplasty of the pulmonary valve. Balloon valvuloplasty was successful and resulted in palliation of clinical signs and an improved quality of life for approximately 9 months. After 9 months, the dog became symptomatic and a modified Blalock–Taussig shunt procedure was successfully performed. Based on this report, balloon valvuloplasty in dogs with tetralogy of Fallot appears to be a feasible technique that may result in improvement of clinical signs. In addition, it may allow for the delay of the more invasive surgical palliation and provide time for weight gain and development of the pulmonary vascular bed for greater ease of surgical shunt creation.

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A 6-month-old female spayed Beagle presented to Colorado State University Veterinary Teaching Hospital (CSU VTH) cardiology service for evaluation of previously diagnosed tetralogy of Fallot (TOF). The dog was owned by a rescue organization and had been diagnosed with TOF at 1 month of age at another institution. The dog was referred to the CSU

VTH to discuss surgical palliation. The rescue organization reported that the dog would tire easily and become cyanotic with even mild excitement or exertion. These clinical signs improved briefly after the initiation of atenolol (approximately 1 mg/kg PO q 12 h for 2 months before evaluation at CSU), yet ultimately were progressive in frequency and severity. On presentation to the CSU VTH, a grade IV/VI left basilar systolic crescendo-decrescendo

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Abbreviations

BT	Blalock–Taussig
BVP	balloon valvuloplasty
CSU	Colorado State University Veterinary
VTH	Teaching Hospital
mBT	modified Blalock–Taussig
PCV	packed cell volume
PS	pulmonic stenosis
RV	right ventricle
TOF	tetralogy of Fallot
VSD	ventricular septal defect

murmur was noted. Femoral pulses were mildly reduced in strength and were synchronous with heart beats. The dog became cyanotic with excitement in the examination room and during initial diagnostics. The remainder of the physical examination was within normal limits. Packed cell volume (PCV) was 63% and total solids were 6.2 g/dL. A limited biochemical profile (blood urea nitrogen, creatinine, and electrolytes) was within normal limits. There was a sinus rhythm with a right axis deviation on the electrocardiogram. Echocardiographic findings included severe concentric hypertrophy of the right ventricle (RV), flattening of the interventricular septum during systole, and paradoxical septal motion. The main pulmonary artery diameter was 9.1 mm, approximately 50% of the aortic diameter. The pulmonary valve leaflets appeared subjectively thickened with systolic doming and decreased excursion. The peak instantaneous pressure gradient across the valve derived from the modified Bernoulli equation was 130.4 mmHg. There was trace pulmonary valve regurgitation and no evidence of subvalvular stenosis. The right atrium and ventricle were mildly dilated based on subjective assessment. The left ventricular dimensions measured on M-mode were decreased compared with normal reference ranges [1]. There was a perimembranous ventricular septal defect (VSD) with a maximum diameter of 7.9 mm. Color Doppler flow across the VSD was primarily right to left during systole with a short period of time during early systole when flow was left to right. An intravenous bubble study showed primarily right-to-left shunting across the VSD during systole. The aorta was malpositioned and over-riding the interventricular septum. Based on these echocardiographic findings, a diagnosis of TOF was confirmed.

Balloon valvuloplasty (BVP) of the pulmonary valve or creation of a systemic to pulmonary arterial shunt was recommended. The goals of BVP

included palliation of TOF-associated clinical signs as well as theoretically improving pulmonary artery perfusion to promote growth of the pulmonary vascular bed. The rescue group was told the dog would likely need a second procedure in the future to create a surgical shunt if clinical signs were to return and would likely be a better candidate for a surgical shunt with more robust pulmonary artery vasculature.

The dog was anesthetized for BVP. Right jugular vein access was obtained via a 1.5 cm vascular cut-down and modified Seldinger technique to place a 7 Fr introducer.^c

A 4 Fr balloon wedge pressure catheter^d was introduced into the vein and advanced with fluoroscopic guidance into the RV. The pressure was 115/11 (50) mmHg. Attempts to advance across the pulmonary valve were unsuccessful. The balloon wedge catheter was removed and a 4 Fr Berman angiographic catheter^e was advanced into the RV where an angiogram was obtained using 1 ml/kg iohexol^f delivered over 1 second. The angiogram showed simultaneous opacification of the aorta, pulmonary artery, and left ventricle (Fig. 1), moderate RV hypertrophy, and thickening of the pulmonary valve leaflets. The maximum angiographic measurement of the pulmonary valve annulus was 8.8 mm and the aortic annulus was 18.1 mm. After removal of the catheter, a 5 Fr 100 cm catheter^g with hydrophilic coating with an angled tip was inserted and advanced into the right atrium. A 0.035" 180 cm guide wire with hydrophilic coating^h was advanced through catheter into the RV, across the pulmonary valve and into a branch pulmonary artery. The catheter was advanced over the wire and the wire then exchanged for a 0.035" J-tipped Teflon-coated 260 cm wire.ⁱ The catheter was exchanged over the wire for a 9 mm × 30 mm balloon dilation catheter^j with rated burst pressure of 13 atm. The balloon was centered across the stenosis, inflated, and a discrete waist observed during inflation disappeared when rated burst pressure was reached. A second inflation was performed, and a slight waist was noted. This catheter was exchanged over the wire for a

^c Boston Scientific, Marlborough, MA, USA.

^d Arrow Balloon Wedge Pressure Catheter, International Inc, Reading, PA, USA.

^e Berman angiographic catheter, International Inc, Reading, PA, USA.

^f Omnipaque 350, GE Healthcare, Buckinghamshire, UK.

^g Glide catheter, Terumo Corporation, Shibuya, JPN.

^h Glide wire, Terumo Corporation, Shibuya, JPN.

ⁱ TSF exchange wire, Cook Medical, Bloomington, IN, USA.

^j FoxCross, Abbot Laboratories, Chicago, IL, USA.

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