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Disciplines

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A Case of Pulmonic Stenosis with Single Coronary Artery in a Dog

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A 9-month-old female Bulldog (18.5 kg) was examined at Azabu University Veterinary Hospital because of progressive abdominal enlargement over a 4-month period. Physical examination revealed a considerable amount of ascites. Body weight decreased to 13.5 kilograms after the ascites was removed by paracentesis. A Grade IV crescendo-decrescendo systolic murmur was heard over the left heart base and recorded on a phonocardiogram. An electrocardiogram had wide P waves (0.06 seconds) and a right axis deviation consistent with right ventricular hypertrophy. Radiographically there appeared to be biventricular enlargement with particular prominence of the right side, loss of the cranial waist, and markedly enlarged vena cavae. The dog was treated with oral digoxin (0.025 mg/kg/day) divided BID. Cardiac catheterization one month later revealed infundibular and pulmonic valve stenosis and tricuspid valve insufficiency. Two months after initial examination open heart surgery was performed using cross-circulation cardiopulmonary bypass through a 50 kg Great Dane donor dog [17, 16]. During cardioplegic arrest, the right ventricular outflow tract was incised vertically and infundibular muscle was resected. Because significant obstruction was still present, the pulmonic valve ring was expanded with a synthetic patch graft *extending from the right ventricular infundibulum into the pulmonary trunk (Fig. 1). The procedures were completed during a 48-minute period of elective cardiac arrest, then the aortic clamp was removed and the heart was defibrillated by electrical countershock (100 V, 0.1 sec.). The right ventricle subsequently contracted but the left ventricle remained in asystole in spite of resuscitation efforts. The dog was considered dead 106

minutes after removing the aortic clamp.

On post mortem examination anomalous coronary arteries were found in addition to the usual pathology of pulmonic stenosis and secondary right heart hypertrophy and dilatation. There was a single right coronary artery which originated from the right aortic sinus. The left coronary artery originated from the right coronary artery approximately 5 mm from the aorta and passed anterior to the pulmonary conus then divided into normal left anterior descending and left circumflex arteries (Fig. 2). Retrospective evaluation of angiocardiograms indicated that an

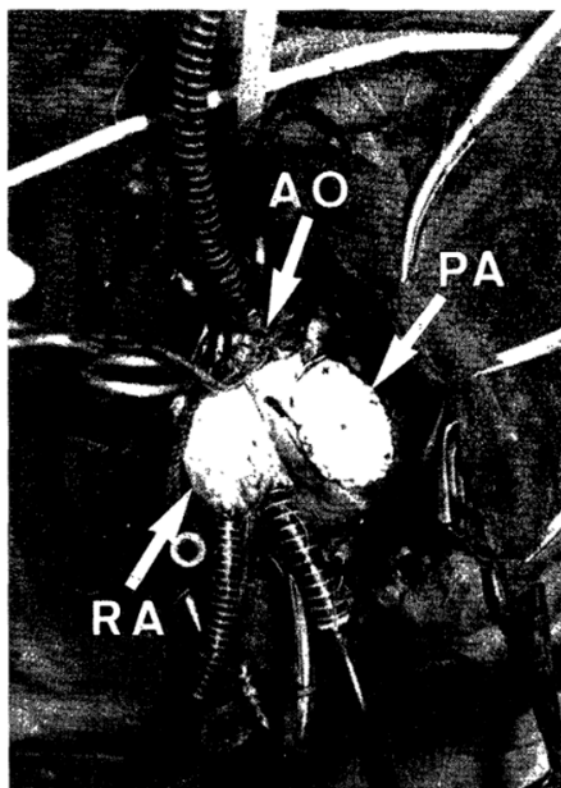
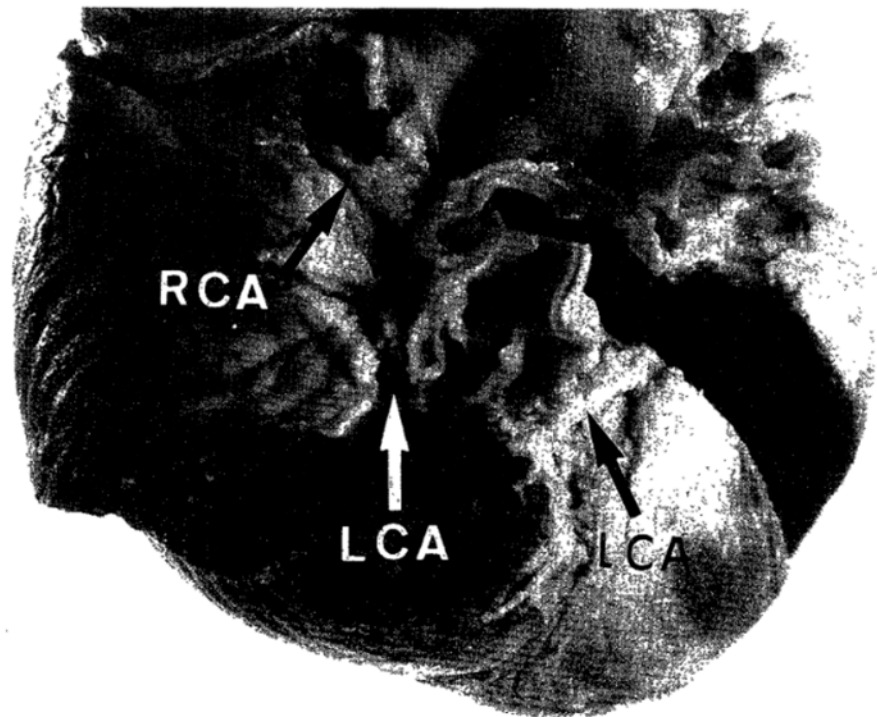
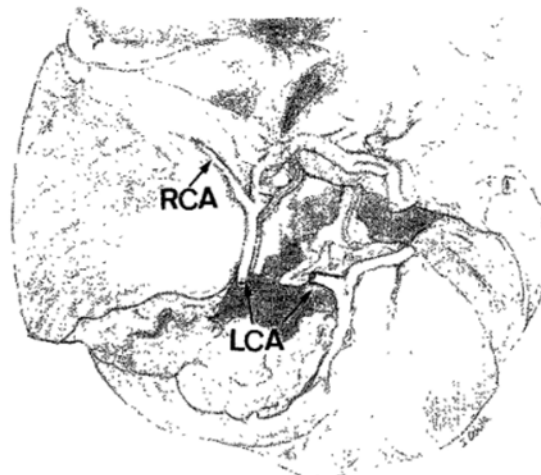


Fig. 1. Photograph at surgery of completed patch graft placement in the pulmonary artery (PA). Right atrial cannulas (RA) carried blood to the donor circulation dog and it was returned by the aortic annula (AO).

* GORTEX, W.L. GORE and Associates, Inc.



2-1



2-2

Fig. 2-1. Necropsy photograph and Figure 2-2 Schematic drawing of single coronary artery branches. The severed left coronary artery (LCA) passed over the pulmonary artery after originating from the right coronary artery (RCA).

abnormal coronary artery was visible but not recognized presurgically (Fig. 3).

This animal had both infundibular and pulmonic valve stenosis. Surgical approaches to correct the problem depend upon the types, location, and severity of obstruction and include open or closed procedures: 1) The closed bistoury valvulotomy technique for valvular or discrete subvalvular lesions; 2) Inflow occlusion pulmonary arteriotomy for valvular and some subvalvular

lesions; 3) Outflow tract enlargement using a patch graft (Breznock modification); and 4) An open heart surgery technique for severe obstructive lesions [2,3,7,8,12].

In this case we used an open heart approach and a modified cross circulation method for cardiopulmonary bypass. The method is reasonably safe and an economical substitute for a heart-lung machine for open heart accessibility in animals [16,17].



Fig. 3. Selective left ventricular angiogram showing origin of single coronary artery (SCA) from the right aortic sinus. The right coronary artery extends ventrally. The anomalous left main coronary artery is brightly opaque in end-on view before it curves caudally to become the left circumflex coronary artery.

The primary cause of death in this dog was severance of the unrecognized anomalous left main coronary artery. This occurred in the process of patch graft enlargement of the right ventricular outflow tract. The left main coronary artery in dogs supplies the entire left ventricle and interruption or occlusion of this vessel invariably causes massive myocardial infarction and death.

The anomalous coronary artery pattern in this dog is one of several types that have been reported in man [1,9,10,11,13,14]. Single coronary arteries may arise from the right or left aortic sinus. Subclassifications are made depending upon the branching pattern of the single coronary artery. Most investigators distinguish Type 1 single coronary artery as a single vessel that follows the course of only the normal right or left coronary and continues across the caudal aspect of the atrioventricular groove to supply the opposite ventricle [11,13,14]. Single coronary arteries that branch shortly after leaving the aorta are designated as Type 2. Further subdivision is made depending upon the location of the crossing vessel which may be determined angiog-

raphically [11]. Subclassifications of single right coronary artery are designated as R2A when the left main coronary artery passes anterior to the pulmonary conus as it did in the dog in this report. In Type R2B the left coronary artery passes between the pulmonary trunk and aorta. In Type R2P, the left coronary artery passes posterior to the aorta. Previously reported cases of single coronary artery in dogs have all been Type R2A [5,6,15].

In man, coronary artery malformations are detectable in approximately 0.5% of patients who have coronary arteriography [1,9]. If no other abnormalities are present, the single coronary artery is seldom of any clinical significance [11,13]. It occurs with greater frequency in patients with congenital heart anomalies such as transposition of the great vessels or Tetralogy of Fallot. Instances of surgical mortality have occurred in man when anomalous coronary arteries were transected in right ventriculotomy procedures similar to the present case.

Three other Bulldogs and a Boxer with pulmonic stenosis and single coronary artery have been recognized [4,5]. One of these was killed by

patch graft surgery because of anomalous coronary arteries identical to the present case. In two of other dogs the anomalous coronary artery was recognized in advance and alternative surgical procedures were used including an outflow conduit to bypass the anomalous coronary artery in one dog. A detailed review of these cases in addition to normal coronary embryology, angiocardiology, and pathogenesis of pulmonic stenosis in dogs with single coronary artery is being reported separately [4].

It is apparent that there is a breed predisposition for single coronary artery in Bulldogs with pulmonic stenosis and coronary angiography must be carried out preoperatively to plan surgical approaches for relief of the pulmonic stenosis at least in this breed.

The occurrence of identical combined anomalies in unrelated Bulldogs in different countries indicates a general breed predisposition rather than a gene pool concentration localized in the Eastern USA.

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要 約

イヌの単冠状動脈症を伴った肺動脈狭窄症の一症例（短報）：南 毅生・若尾義人・Buchanan James¹⁾・武藤 眞・渡辺俊文・鈴木立雄・高橋 貢（麻布大学獣医学部外科，¹⁾Department of Clinical Studies, School of Veterinary Medicine, University of Pennsylvania, Philadelphia, Pa）——交叉循環法を利用した開心術により、ブルドック種の肺動脈狭窄症に対して根治手術を実施した。右心室漏斗部の筋肉を切除し弁輪部を切断した後、弁輪部にパッチを装着することによって狭窄した肺動脈弁を拡大した。しかし、手術操作終了後、除細動を行ったが蘇生不可能であった。剖検によって、本症例は肺動脈狭窄以外に左冠状動脈が右冠状動脈より分枝する単冠状動脈症であったことから、心蘇生が不成功に終わった理由が明らかになった。

