Surgical treatment of bilateral coronary-to-pulmonary artery fistulas

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Abstract

Bilateral coronary artery fistulas with the coronary artery stenosis are rare. In this case, we successfully performed closure of coronary artery fistulas with coronary artery bypass grafting. Furthermore, we were able to measure the flow in the coronary artery fistulas using transit-time flow measurement.

Keywords: Cardiovascular imaging • Coronary artery fistula • Multi-slice computed tomographic • Flow measurement

INTRODUCTION

A coronary artery fistula (CAF) is an abnormal communication between the coronary artery and the cardiac chamber, the great vessel or other vascular structures. The CAF is a rare anomaly, and its incidence is reportedly found in only 0.1% of cases identified by routine coronary angiography (CAG) [1]. Bilateral CAFs are even rarer, and account for 5% of all CAF cases [2]. We report a case of successful repair of bilateral coronary-to-pulmonary artery fistulas (CPAFs).

CASE REPORT

A 58-year old man was initially admitted to another hospital with chest discomfort. Bilateral CPAFs were diagnosed by multi-detector computed tomography (MDCT) imaging and CAG (Fig. 1A and B). Moreover, CAG showed stenosis of the left anterior descending (LAD) artery. He was then referred to our department for surgical treatment.

We operated via a median sternotomy. Initially, he underwent off-pump coronary artery bypass grafting (CABG) of the left internal thoracic artery on the LAD. A fistula originating from the right coronary artery (RCA) was identified on the surface of the right ventricle, but the exact origin of a fistula from the left coronary artery (LCA) was not clearly identified because fistulous vessels were considerably distributed (Fig. 2A). We measured the flow in the CPAFs using a transit-time flow metre (BF 2000; Medi-Stim AS, Oslo, Norway) (Fig. 2B), which indicated a mean flow of 113 ml/min from the LCA to the pulmonary artery and a mean flow of 54 ml/min from the RCA to the pulmonary artery, with a systolic dominant continuous waveform.

The RCA fistula was ligated at its origin with a 4-0 Prolene suture (Ethicon Inc., Somerville, NJ, USA) and vascular clip. The LCA fistula was ligated as close as possible to its origin with a vascular clip and 2-0 silk thread. The main pulmonary artery was opened under cardiopulmonary bypass support, and both orifices were closed with a 4-0 Prolene suture (Ethicon Inc.).

The patient’s postoperative course was uneventful and he was discharged on postoperative day 9. Postoperative MDCT imaging did not reveal any evidence of residual fistulas.

DISCUSSION

The CAF is an uncommon cardiac malformation, and bilateral CPAFs are extremely rare. The most common sites of origin are the RCA (50%), LCA (42%) and both the RCA and LCA (5%). The most common drainage sites are the right ventricle (41%), right atrium (26%) and pulmonary artery (17%) [2]. The CPAFs in the present case originated from both the RCA and LCA, and drained to the pulmonary artery.

Young patients tend to be asymptomatic, although symptoms may develop later in life due to a chronic left-to-right shunt, ischaemia from coronary steal or endocarditis. Surgical treatment is recommended in order to avoid long-term complications. Surgical treatments of bilateral CPAFs, some of which involved CABG similar to that used in the present case, have been reported [3].

Recently, transcatheter closure of CAFs has been reported as an acceptable alternative to surgery. However, surgical repair may be indicated in cases of CAFs with additional complex heart disease which requires surgery [4].

The transit-time flow measurement technique, which we used to measure the flow in the CPAFs in the present case, is most commonly used in the intraoperative graft assessment of CABG. To the best of our knowledge, there are no previous reports of transit time-flow measurement used in CPAFs in the literature.

In summary, we report a successfully treated case of bilateral CPAFs with estimation of flow in the CPAFs using transit-time flow measurement.
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The multidisciplinary approach is of paramount importance for all these patients. The type of treatment of most of the subgroups of coronary artery anomalies is not supported by evidence-based guidelines [4]. A careful assessment is needed to clarify who of those patients should be under close follow-up and who will be treated in the catheterization laboratory (use of vascular plugs, umbrella devices, covered stents or coils) or in the theatre (TOE, on/off CPB, plus/minus CABS).

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eComment. Surgical management of coronary-to-pulmonary artery fistulas

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Yamamoto and colleagues have described the successful surgical treatment of a patient with bilateral coronary-to-pulmonary artery fistulas [1]. We agree with their decision of opening the main pulmonary artery (PA) under CPB and closure of both orifices with a suture [1].

We reported this additional manoeuvre of opening the PA for the direct identification of the entrance points of all the fistulas into the PA plus the securing of its closure with a patch of autologous pericardium, sealed with Bioglue for the avoidance of recurrence and it seems to be a very helpful technique [2].

Biorck and Crafoord, on the 22nd of July 1946, in the Surgical Clinic I at Sabbatsberg Hospital in Stockholm, performed the first successful surgical ligation of a pulmonary-to-coronary artery fistula. The patient was a 15-year-old male who was referred due to exertional dyspnoea, fatigue and a ‘continuous’ murmur over the pulmonary area. The primary diagnosis after radiographic and phonocardiographic findings was of a case of patent ductus arteriosus Botalli [3].

For this reason the patient underwent left posterolateral thoracotomy by the method of Crafoord (according to the authors) with a removal of the fifth rib [3]. However, in the area of ductus arteriosus no thrill was palpable and further exploration revealed an arteriovenous aneurysm on the PA which was consistent with an arteriovenous communication between an aneurysm of an aberrant branch of the left coronary artery and the PA [3].

The authors applied and tightened a silk ligature for 3–4 minutes around the abnormal artery centrally to the aneurysm for observation of the reaction of the heart. No abnormalities in the cardiac function were noted and the silk ligature was tied. On direct auscultation with a sterile stethoscope the murmur had then decreased significantly. The authors applied another silk ligature distally now to the aneurysm and, thereafter, the continuous murmur disappeared. The pericardium and chest were closed with no drains and the patient had an uneventful recovery with significant improvement in his functional status (no dyspnoea on moderate exertion) when he was reviewed in November 1946 [3].

According to Angelini and colleagues, coronary artery anomalies (including coronary arteriovenous fistulas) appear quite frequently in the practice of cardiologists and cardiac surgeons. In addition, the coronary artery anomalies display a variety of anatomic variants, sizes, and clinical symptoms with different implications in all spectrums of ages [4].

It is very important to bear in mind that, according to the Sudden Death Committee of the American Heart Association, a 19% of deaths in athletes is related to coronary artery anomalies [5]. The multidisciplinary approach is of paramount importance for all these patients. The type of treatment of most of the subgroups of coronary artery anomalies is not supported by evidence-based guidelines [4].

A careful assessment is needed to clarify who of those patients should be under close follow-up and who will be treated in the catheterization laboratory (use of vascular plugs, umbrella devices, covered stents or coils) or in the theatre (TOE, on/off CPB, plus/minus CABS).