A case of acute heart failure due to giant aortic pseudoaneurysm with fistulization to the right ventricle after a modified Bentall operation

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Simultaneous en bloc replacement of the ascending aorta and aortic valve by a composite valve graft, as first described by Bentall and De Bono in 1968 and with later modifications, has become the standard surgical technique in the treatment of aneurysms of the aortic root associated with severe aortic valve dysfunction. Despite the good surgical results overall, it is still associated with considerable perioperative mortality and with dire complications in the long run. We report a case of a giant aortic pseudoaneurysm compressing the right heart chambers and communicating with the right ventricle, presenting as rapidly progressing heart failure a few months after a Bentall operation.

KEYWORDS
Aortic pseudoaneurysm; Bentall operation; Acute heart failure

A 49-year-old obese male patient with annuloaortic ectasia associated with a bicuspid and severely regurgitant aortic valve underwent a modified Bentall operation with insertion of a 25 mm St Jude composite valve graft (CVG) and re-implantation of the coronary arteries using the ‘button technique’ in our institution. He had an uneventful recovery and was discharged on warfarin and a beta-blocker.

Five months later, he was re-admitted with acutely decompensated heart failure that had progressed over the week before. He complained of dyspnoea, orthopnoea, abdominal swelling, and low urinary output and presented with respiratory distress, lung congestion, distended neck veins, and peripheral oedema. Cardiac auscultation revealed a grade 2/6 systolic ejection murmur over the left sternal border and aortic area. The International normalized ratio on admission was 1.97. The chest X-ray showed enlargement of the mediastinum and cardiac silhouette with a prominent right border. Cardiac auscultation revealed a grade 2/6 systolic ejection murmur over the left sternal border and aortic area. The International normalized ratio on admission was 1.97. The chest X-ray showed enlargement of the mediastinum and cardiac silhouette with a prominent right border. The 12-lead electrocardiogram showed sinus rhythm and non-specific repolarization abnormalities in the inferior and left pre-cordial leads. The transthoracic echocardiogram showed normal-sized heart chambers with preserved left ventricular systolic function, a normal functioning bileaflet aortic prosthetic valve, and the presence of a large vascular structure anterior to the aortic graft and extending inferiorly, compressing the free wall of the right ventricle (Figure 1A–C and Supplementary data online, Videoclip S1). A communication between the graft and mass could not be identified, but the presence of a continuous but predominantly diastolic flow from the structure to the right ventricular chamber at its apex was noted (Figure 2A and B and Supplementary data online, Videoclip S2). Adding up to these data, the use of echocontrast agent injected in a peripheral vein suggested the presence of a left-to-right shunt by showing sequential opacification of the right heart chambers, left heart chambers, and vascular structure (Figure 3A–C). In order to establish the origin of the mass, a cardiac catheterization was performed. It confirmed the presence of a large para-aortic vascular structure extending anteriorly and inferiorly adjacent to (and compressing) the right ventricle. The structure was shown to communicate with the tubular graft by an opening at the level of the implantation of the right coronary button (Figure 4A and B). A communication between the mass and the right ventricle was not visible in the study, but there was an estimated pulmonary-to-systemic flow ratio of 1.6 (using the Fick method), suggesting the presence of a left-to-right shunt. Diagnosis of a large pseudoaneurysm originating from the suture line of the implantation of the right coronary artery in the tubular aortic graft compressing and communicating with the right ventricle was established as the cause of the clinical presentation and the patient was transferred to the Cardiothoracic Surgery Department for urgent surgical
treatment. A femoro-femoral cardiopulmonary bypass was instituted and the patient cooled down to about 23°C of oesophageal temperature. As soon as the sternum was opened, the pseudoaneurysm lying right behind it immediately ruptured. Oxygenated blood coming from the right coronary button’s anastomosis could be seen; a tear in the suture line was identified and carefully sewn. The orifice in the right ventricular free wall was closed with a Teflon patch. Pathology from the resected tissue showed fibro-sclerotic material with fibrinoid deposition and foci of haemorrhage, with no signs of infection. The patient had an uneventful recovery and was discharged after 13 days.

Discussion

After earlier attempts at separate repair of the aortic valve and ascending aorta with a high incidence of bleeding complications at the suture lines, the use of en bloc replacement of both structures by a CVG, as described by Bentall and De Bono nearly 40 years ago, became the procedure of choice in the treatment of disease of the aortic valve, aortic root, and ascending aorta. Later modifications of the procedure, including re-implantation of the coronary arteries on the graft using the ‘button technique’ and better strategies of myocardial and cerebral protection have improved outcomes.

Recently published series of patients submitted to the modified Bentall operation have shown favourable results, with 30-day mortality rates ranging from 0.7 to 6.9% and
5-year actuarial survival rates of 77.7 to 95%. However, major complications in the medium and long term may occur, including (i) progression of disease in the native aorta with recurrent aneurysm, dissection, and rupture; (ii) prosthetic valve infection and dysfunction; and (iii) complications involving the prosthetic conduit.6

Figure 3  (A–C) Apical four-chamber view echocardiogram after intravenous injection of echocontrast agent showing sequential opacification of right ventricle (A), left ventricle (B), and vascular mass (C), which appear to communicate with the right ventricular chamber at its apex (*).

Figure 4  (A and B) Left anterior oblique view of angiogram of the aortic graft. (A) Leak of contrast can be seen from the graft lumen at the implantation of the right coronary button (white arrow). Flow to the right coronary artery was not compromised (black arrow). (B) A pig-tail catheter was inserted in the pseudoaneurysm and contrast agent was injected, showing its large multilobed contour extending both upward and anteroinferiorly from its origin.

Pseudoaneurysms originating from dehiscence of suture lines are one of the most feared and lethal complications of the operation. They usually evolve insidiously and unnoticed or with non-specific findings, as an early or late complication, until they cause serious life threatening conditions, namely compression of the cardiac chambers and nearby structures, major thromboembolic events or rupture (either free rupture or fistulization into various structures). The incidence of pseudoaneurysms after CVG implantation as reported in the literature varies from 0 to 39%, reflecting different practices in follow-up surveillance.
and selection bias. Risk factors associated with its occurrence include suture line tension, infection, excessive anticoagulation, and underlying disease (with worse results reported in cases of Marfan syndrome and after correction of aortic dissection). Pseudoaneurysms complicating CVGs may originate in three different sites: (i) proximal anastomosis at the aortic annulus; (ii) distal anastomosis between graft and native aorta; and (iii) implantation site of the coronary arteries. Several imaging modalities have been reported to be useful in their diagnosis, including aortography, transthoracic (TTE) and transoesophageal echocardiography (TEE), computed tomography, and magnetic resonance imaging and they often complement each other. TEE with Doppler has become the modality of choice in this context, due to its ready availability and higher accuracy than TTE in identifying the presence of pseudoaneurysms and their sites of origin, by showing an area of flow extending a variable distance beyond the aortic lumen into an echo-free space surrounding the aortic graft, often partially filled by echodense masses corresponding to extravascular thrombus.

Our case of a giant aortic pseudoaneurysm complicating a previous Bentall procedure had the unusual finding of fistulization to the right ventricle, which has not, to our knowledge, been previously reported in the literature. We were unable to either establish the cause of the giant structure or identify flow from the aortic lumen into it by conventional Doppler TTE and TEE was not readily available, but fistulization into the right ventricle was observed and the use of contrast was helpful in suggesting the diagnosis. Cardiac catheterization with aortography was also important in showing the origin of the pseudoaneurysm from the right coronary button and confirming the already suspected left-to-right shunt. It illustrates the complementary role of the available imaging techniques in the accurate assessment and follow-up of these patients.

Supplementary data
Supplementary data are available at European Journal of Echocardiography online.

References