Case report - Valves

Pseudo-aneurysm formation post apico-aortic conduit

George Dimitrakakis\textsuperscript{a}, Zeena Makhija\textsuperscript{a}, Heyman Luckraz\textsuperscript{b,∗}, Peter A. O’Keefe\textsuperscript{a}

\textsuperscript{a}Department of Cardiothoracic Surgery, University Hospital of Wales, Cardiff, UK
\textsuperscript{b}Heart and Lung Centre, New Cross Hospital, Wolverhampton, WV10 0QP, UK

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Abstract

Apico-aortic conduit (AAC) is an alternative to conventional aortic valve replacement (AVR) in selected high-risk patients. It involves the interposition of a vascular graft with a prosthetic valve from the left ventricular (LV) apex to the descending thoracic aorta. Its use is uncommon but increasing. We describe the complication of pseudo-aneurysm formation following an apico-aortic procedure and its subsequent management.

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1. Introduction

Over the last decade, cardiac surgeons have expanded their criteria for eligibility for cardiac surgery and thence more high-risk patients have benefited from intervention. The development of the apico-aortic conduit (AAC) in the paediatric congenital malformation setting, has been adapted to the adult population in whom aortic valve replacement (AVR) is deemed to carry excessive risk [1]. The procedure was popularised by Cooley [2] and is gaining popularity. Left ventricular (LV) pseudo-aneurysm is an uncommon, yet, potentially fatal postoperative complication. We report the successful surgical management of this challenging complication.

2. Case report

A 49-year-old male presented with a 2-year progressive dyspnoea (NYHA class III) due to significant aortic stenosis (peak gradient 75 mmHg, AWA 0.8 cm\textsuperscript{2}). He had undergone coronary artery bypass grafting (CABG) six years previously, via a median sternotomy, for diffuse coronary artery disease, and subsequent surgical repair of a juxta-ductal coarctation of the aorta through a left posterolateral thoracotomy three months after his CABG.

Preoperative assessment revealed patent bypass grafts, and severe diffuse native coronary arterial disease with no prospect for either PCI or CABG, as judged by multidisciplinary assessment, in order to improve myocardial blood supply.

Replacement of the aortic valve was indicated. However, concerns relating to potential damage to patent grafts, with inoperably poor native coronary targets, as well as challenges for myocardial protection by cardioplegia, were felt to preclude a successful outcome. He therefore underwent implantation of a valved AAC with an initially uneventful postoperative course. This procedure was carried out via a left lateral thoracotomy in the fifth intercostal space. Cardiopulmonary bypass (CPB) was instituted via femoral vessel cannulation. Interrupted 2/0 ethibond pledgeted horizontal mattress sutures were used to secure the conduit to the LV apex. Postoperative CT-scan with re-formatting confirmed good function of the conduit with no evidence of para-prosthetic leak.

Six weeks after the procedure, he was re-admitted with chest pain, NYHA grade IV dyspnoea and uncontrolled hypertension (systolic blood pressure 300 mmHg) having stopped his anti-hypertensive drug regimen arbitrarily two weeks prior to admission.

CT-scan revealed a massive left hemothorax, collapse of the left lung, a patent AAC with extensive dehiscence from the left ventricle and an associated pseudo-aneurysm (Fig. 1). His blood pressure was controlled by intravenous beta blockade and sodium nitroprusside. He underwent a redo AAC procedure.

CPB was instituted using femoral cannulation but arterial inflow was inadequate and was abandoned. Extensive fibrosis and inflammation in the posterior left pleural cavity mitigated against safe exposure and control of the descending thoracic aorta, therefore, the existing AAC was rapidly cannulated distal to the valve with a new arterial cannula. CBP was re-established with good perfusion pressure. Rapid ventricular pacing was instituted, the pseudo-aneurysm was incised, and near-complete dehiscence of the LV connector part of the conduit was confirmed. There was no evidence of infection.
The LV connector was removed from LV apex and a new 18 mm apical connector was parachuted into LV apex using Teflon-pledgeted 2/0 Ticron everting mattress sutures. Bioglue was used to reinforce the suture line and surrounding tissues. The distal end of the new apical connector was then anastomosed to the existing valved conduit with continuous 3/0 Prolene.

Postoperatively, the patient made a slow but steady recovery and was discharged home a month after the procedure. Blood pressure control was optimised prior to discharge: the importance of this was strongly re-inforced.

At 3 months follow-up, MRI imaging confirmed that the AAC had remained in situ and was conveying almost 60% of cardiac output (Fig. 2). He remains well with good blood pressure control over a year following his redo-surgery.

3. Discussion

The concept of AAC is based on the experimental work of Alexis Carrel in 1910 [3]. In 1955, Sarnoff was able to direct the entire cardiac output from the left ventricle to the thoracic aorta (in animals) using a Hufnagel valve in a Lucite tube, permanently occluding the ascending aorta [4]. In 1963, Templeton implanted Sarnoff’s prosthesis in five patients with one long-term survivor for over 10 years [5].

AAC is preferred in patients with porcelain ascending aorta/root, history of previous cardiac operations that precludes the safe performance of a redo-operation, multiple patent bypass grafts, prior sternal wound infection, patients with multiple comorbidities deemed to be at high risk for conventional AVR, previous failed annular augmentation procedure and patients with complex congenital LV outflow obstruction (where it can be used as an alternative to root enlargement procedures). Perceived advantages of AAC over conventional AVR in these circumstances include avoidance of conduction system injury, paravalvular leak and patient—prosthesis mismatch. Since cerebral blood supply continues through the native valve and ascending aorta, which is not manipulated during the procedure, this method is brain-protective in terms of stroke avoidance. The nature of the procedure itself, allows avoidance of manipulation of a porcelain/calcified ascending aorta. This further minimizes risk of plaque embolization, coronary artery encroachment, prosthetic valve migration and paravalvular leak.

Potential complications include bleeding [1], AAC dehiscence from LV apex [6], myocardial infarction, chest infections, pulmonary embolism, thrombus formation in the aorta [7], benign arrhythmias, sepsis and endocarditis. Late complications are related to prosthetic valve structure failure needing replacement of the part of valved graft.

In the case described above, the patient’s uncontrolled hypertension was considered to have resulted in tearing of the myocardium at the LV apex and subsequent pulling-through of the pledgeted sutures resulting in dehiscence of the connector from the left ventricle, marked blood loss and false aneurysm. The role of previous surgery through both the mediastinum and the left hemithorax in limiting blood loss prior to exsanguination can be speculated upon.

References