Proposal for bail-out procedures - Aortic and aneurysmal

Modification of the Cabrol as a bailout procedure in complicated bicuspid valve aortopathy

Antonios Kourliouros\textsuperscript{a,}*; Julia Grapsa\textsuperscript{b}; Petros Nihoyannopoulos\textsuperscript{b}; Thanos Athanasiou\textsuperscript{b}

\textsuperscript{a}Department of Cardiothoracic Surgery, St George’s Hospital, Blackshaw Road, London SW17 0QT, UK
\textsuperscript{b}Departments of Cardiovascular Sciences and Cardiothoracic Surgery, Imperial College NHS Trust, Hammersmith Hospital, London, UK

Received 15 September 2010; received in revised form 28 October 2010; accepted 2 November 2010

Abstract

The Cabrol technique is reserved where the conventional ‘button’ or Bentall techniques fail to maintain a tension-free anastomosis between the coronary arteries and aortic conduit. However, the side-to-side anastomosis of the interposition graft that connects the coronary ostia with the aorta in the Cabrol, may lead to kinking or tension, and subsequent occlusion. We present a case of successful Cabrol modification in a patient with bicuspid aortopathy where the graft to the right coronary artery was anastomosed directly onto the valved conduit and the graft to the left main stem onto the previous right aortocoronary graft in a T-fashion.

Keywords: Cabrol; Modification; Bicuspid aortopathy

1. Introduction

The original Cabrol technique comprises of ascending aortic replacement with a composite graft and direct reimplantation of coronary arteries into an interposition graft, which is anastomosed side-to-side to the aortic graft [1]. It was initially proposed as an efficacious modality for treatment of dissections and ascending aortic aneurysms. Long-term results were found to be inferior to the established Bentall techniques [2, 3]. However, in cases where tension on the ostial anastomoses is anticipated (large dissections/aneurysms, reoperations and in the presence of heavily calcified aorta), the Cabrol remains an invaluable modality for tension-free reimplantation of the coronary arteries [4]. Recent series utilising computational flow dynamics have demonstrated cases of failure of the Cabrol graft. It appears that non-laminar flow into the right limb of the Cabrol graft, kinking of the interposition graft at the level of the side-to-side anastomosis and angulation of the left limb near the left coronary ostium are factors predisposing to graft occlusion [4, 5]. We present a successful modification of the Cabrol technique and highlight its usefulness as a bailout procedure in the presence of bicuspid aortopathy.

2. Case report

A 57-year-old male presented with mixed aortic valve disease. Transthoracic echocardiography demonstrated severe aortic stenosis (peak gradient: 80 mmHg, estimated aortic valve area: 0.8 cm\textsuperscript{2}), mild aortic regurgitation, poststenotic dilatation of the ascending aorta (40 mm) and good biventricular function. The patient consented for aortic valve replacement and the possibility of concomitant root replacement.

Femoral artery cannulation and two-staged cannula of the right atrium for cardiopulmonary bypass were used. Intraoperatively, a bicuspid aortic valve and asymmetric coronary ostia were found. The left ostium was close to the annular plane and the right ostium in proximity to the commissure. The patient underwent aortic valve replacement with a mechanical valve (Carbomedics 23 mm, Austin, TX, USA). Aortotomy closure was reinforced with teflon felt strips due to the thin aortic wall and attempted external plication of the ascending aorta to reduce its size. Following aortic clamp release it was not possible to achieve satisfactory haemostatic control of the aortotomy and the decision was made to cross-clamp the aorta, re-arrest the heart and revisit the aortotomy. An aortic tear was identified in the medial part of the aortotomy, extending posteriorly very close to the left coronary ostium. In view of its position and the friability of the aortic wall, we opted to replace the aortic root. The initial prosthesis was removed, and the aortic root and ascending aorta were replaced with a 23-mm Valsalva conduit. After the proximal anastomosis of aortoavalvar conduit was complete, both coronary ostia were maximally mobilised including a cuff of the native aortic wall to form coronary ‘buttons’. However, due to the small distance of the left coronary ostium from the annular level, and in order to avoid aortocoronary anastomosis under tension, the following modification of the Cabrol operation was undertaken (Fig. 1a): a 8-mm

*Corresponding author. Tel.: +44 208 725 2652; fax: +44 208 725 5173.
E-mail address: akou@doctors.org.uk (A. Kourliouros).
© 2011 Published by European Association for Cardio-Thoracic Surgery.
Gore-Tex conduit was utilised (12 cm long) which was sutured initially to the left main stem ‘button’ that was already reinforced with a Teflon felt ring (anastomosis 1). Subsequently, the other end of the Gore-Tex conduit was sutured to the felt-reinforced right coronary ostium in a similar fashion (anastomosis 2). The distal aortic anastomosis of the Valsalva prosthesis was completed. Blood cardioplegia was injected through the Cabrol conduit to test the integrity of the coronary ‘button’ – graft anastomosis. The Gore-Tex conduit was then divided 3 cm away from the right coronary anastomosis and attached in an end-to-side T-fashion on the anterior part of the Valsalva conduit. Finally, the remaining graft originating from the left main stem was routed onto the posterior part of the aortic root and brought anteriorly, forming a smooth curve. It was then anastomosed in a T-fashion end-to-side on the previous Gore-Tex graft, which directly connected the valved conduit to the right coronary artery (anastomosis 3) (Fig. 1b). An intra-aortic balloon was inserted to support the heart, which was removed on the second postoperative day. Recovery was otherwise unremarkable and the patient was discharged from hospital eight days later.

Follow-up with investigations took place at eight weeks postoperatively. A 2-D echocardiogram was performed followed by 3-D and speckle tracking (Echopac GE Vivid 7, GE Healthcare, Horten, Norway) showed satisfactory global and regional function. Myocardial perfusion study with dipyridamole-exercise test confirmed normal coronary flow across all coronary arteries. A cardiac magnetic resonance scan was performed with balanced steady-state free precession sequence for image acquisition. The ascending aorta and the coronary arteries were reconstructed in three-dimensions and normal flow was demonstrated (Fig. 2). Clinical follow-up at eight months postoperatively is unremarkable.

3. Discussion

The Cabrol technique was initially proposed as a safer and more practical alternative to the Bentall procedure for the management of aortic disease, however, it never became a first-line treatment modality due to higher rates of early and long-term morbidity [3]. Although there have been no randomised trials to examine outcomes between different approaches, and quite often, these outcomes of the Cabrol technique may reflect patient selection with more complex pathology, the Cabrol maintains its important role as a bailout procedure. In our report, the presence of bleeding from the medial aspect of the aortotomy line, friable aortic wall and unfavourable anatomy with low origin of the left coronary ostium necessitated this procedure. Although the distinct morpho-pathological characteristics of bicuspid aortopathy are known [6], the application of the Cabrol procedure for the acute management of this entity has not been reported. In order to maintain optimal alignment of the interposition graft connecting the two coronary ostia we devised a modification of the Cabrol procedure as described above. We anticipate that the commonly reported problems with graft occlusion due to kinking or tension from the placement of the side-to-side anastomosis on the high lateral aspect of the aortic graft could be avoided. Imaging studies confirmed good functional and anatomical results and we advocate the early utilisation of these modalities during follow-up. This approach may provide a tangible alternative to the conventional Cabrol procedure, especially when the anatomy is not favourable for smooth single graft placement between the coronary ostia and the aorta.

References


