

# Replacement of the Aortic Root with a Composite Valve-Graft Conduit: Risk Factor Analysis in 246 Consecutive Patients



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## Background

Composite valve-graft (CVG) replacement of the aortic root is a well-studied and recognised treatment for various aortic root conditions, including valvular disease with associated aortopathy. There have been few previous studies of the procedure in large numbers in an Australian setting.

## Method

From January 2006 to June 2013, 246 successive patients underwent CVG root replacements at our institution. Mean age was 56.8 years, 85.4% were male, and 87 had evidence of bicuspid aortic valve. Indications for operation included ascending aortic aneurysm in 222 patients, annuloaortic ectasia in 67 patients, and aortic dissection in 38 patients.

## Results

The overall unit 30-day mortality was 5.7%, including: elective 30-day mortality of 2.2%, and emergent 30-day mortality of 17.2%. Statistically significant multivariate predictors of 30-day mortality were: acute aortic dissection (OR = 20.07), peripheral vascular disease (OR = 11.17), new ventricular tachycardia (OR = 30.17), re-operation for bleeding (OR = 14.42), concomitant mitral stenosis (OR = 68.30), and cerebrovascular accident (OR = 144.85).

## Conclusions

Low postoperative mortality in our series matches closely with results from similar sized international studies, demonstrating that this procedure can be performed with low risk in centres with sufficient experience in the operative procedure.

## Keywords

Aortic root replacement • Composite valve graft • Bentall procedure • Bicuspid aortic valve • Aortic valve replacement

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## Introduction

Replacement of the aortic root with a composite valve-graft (CVG) conduit is a well-described method for operative management of aortopathies with a disease component proximal to the sinotubular junction, and an aortic valve that cannot be spared. It is also indicated in Marfan patients with normal sinuses due to the frequent need for reoperation [1]. It involves valve implantation with either a biological or mechanical prosthesis, reimplantation of the coronary ostia, and anastomosis of the conduit to the aorta. The length of ascending aorta replacement depends on the extent of the pathology, and can involve hemiarch replacement or be combined with total arch replacement.

To date the published results of aortic root replacement in an Australian setting have been limited; only one study with 89 patients investigated the results of CVG replacement specifically [2]. Thus we present here the largest Australian series of 246 consecutive CVG root replacements over a seven-year period, focussing on 30-day clinical outcomes and examining predictors of early mortality and morbidity.

## Methods

### Patients

Between January 2006 and June 2013, 246 consecutive patients underwent CVG replacement of the aortic root and varying lengths of ascending aorta in our institution (The Royal Prince Alfred Hospital, Sydney, Australia). Patients who had valve sparing aortic root reconstruction were excluded from this study. Approval for a retrospective study of these patients was granted by the Sydney Local Health District Ethics Review Committee. Preoperative patient characteristics are presented in Table 1. The mean age of the patients was  $56.8 \pm 14.3$  years and 210 (85.4%) were male. Sixty-six (26.9%) patients were NYHA functional class III or IV. The most common documented valvular pathology was bicuspid aortic valve, which was present in 87 (35.4%) patients (either true bicuspid or pseudo-bicuspid). There was no significant difference in age between the bicuspid group and the rest of the operative population ( $55.0 \pm 13.15$  vs.  $57.8 \pm 14.92$  years,  $p = 0.135$ , respectively).

The most common documented pathology was ascending aorta aneurysm involving the aortic root, which occurred in 222 (90.2%) patients. Annuloaortic ectasia, defined as dilation of the sinuses of Valsalva causing aortic regurgitation and cephalad displacement of the coronary ostia, occurred in 67 (27.2%) patients. Thirty-eight (15.4%) patients had either acute or chronic aortic dissection: all but one of which were Stanford Type A, 24 (63.2% of dissection patients) were acute, and 14 (36.8% of dissection patients) were chronic. Twenty-two (8.9%) patients had previous operations of the ascending aorta, aortic valve, or both: 18 (81.8% of reoperation patients) of which were for sinuses of Valsalva aneurysm, and four (18.2% of reoperation patients) were for valve failure without new dilatation.

**Table 1** Patient characteristics.

Characteristic	n (%)
Total number of patients	246
Clinical characteristics	
Sex (male)	210 (85.4)
Age (years)	
Mean $\pm$ SD	$56.8 \pm 14.3$
Range	21–82
> 65 years	81 (32.9)
NYHA Class	
I	95 (38.6)
II	70 (28.5)
III	44 (17.9)
IV	12 (4.9)
Marfan syndrome	11 (4.5)
Bicuspid aortic valve	87 (35.4)
Aortic stenosis	94 (38.2)
Aortic incompetence	193 (78.5)
Infective endocarditis	13 (5.3)
Indications for primary operations	
Aortic aneurysm	222 (90.2)
Annuloaortic ectasia	67 (27.2)
Dissection	38 (15.4)
Acute	24 (63.2)
Chronic	14 (36.8)
Indications for reoperations	
Valsalva sinus aneurysm after AVR	18 (7.3)
Valve failure without new dilatation	4 (1.6)

NYHA = New York Heart Association; AVR = aortic valve replacement.

## Operative technique

All procedures were conducted via a standard median sternotomy. Cardiopulmonary bypass (CPB) was established via cannulation of the ascending aorta, aortic arch, axillary or femoral artery (depending on the extent of the aneurysm, the presence of dissection, and surgical preference) and the right atrium or via a long femoral vein cannula. Cold blood cardioplegic solution was used for myocardial protection. We have previously described our technique for CVG replacement of the ascending aorta and aortic root using an interlocking Teflon pledgetted technique [3]. However, the majority of patients in this series underwent xenograft replacement of the aortic root using the Medtronic Freestyle graft. The aortic root annular sutureline is performed with a continuous 3/0 Prolene. The graft is then extended with an appropriately sized Dacron graft to complete the ascending aorta/hemiarch replacement. Selective antegrade cerebral perfusion (SACP) was used in the majority of patients later in the series to perform the distal arch or hemiarch replacements, either via direct cannulation of the innominate and

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