Original Article

Aortic Root Replacement for Ascending Aortic Disease: A 10 Year Review

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Background: **Bentall's procedure and its modifications have been used for over 40 years for the treatment of ascending aortic disease. This study reviewed 10 years of experience with Aortic Root Replacement (ARR) in a major cardiac surgical centre.**

Methods: **Eighty-nine patients underwent ARR between 1999 and 2009. The records were scrutinised by retrospective chart review.**

Results: **The mean age was 54 years. Seventy-nine percent of patients were male and 21% female. The indications for the procedure were Aortic Root Aneurysm (ARA) (65%), type A dissection (28%), infective endocarditis (4.4%) and prosthetic valve regurgitation (2.2%).**

Fifty-seven percent of these were performed electively and 43% as an emergency. A bicuspid aortic valve was present in 37%.

Arch surgery was required in 15.7%, bypass grafting in 12.3% and mitral valve surgery in 5.6%. The descending aorta was involved in 16.8%.

Operative mortality was 3.3% and in-hospital mortality 12.3%. Mean follow-up was 67.05 months (range 2–143). No patients required re-operation.

Conclusions: **The factors associated with increased in-hospital mortality were pre-operative haemodynamic instability, concommitant coronary artery disease and acute renal failure.**

The presence of a bicuspid valve may be associated with lower rates of complications, but no difference in mortality.

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Keywords. Bentall; Aortic aneurysm; Aortic Root Replacement; Dissection; Bicuspid

Introduction

First performed in 1968 by Bentall and DeBono in Hammersmith Hospital [1], London, modifications of Bentall's original procedure have become established as the primary operative techniques for replacement of the ascending aorta and root. They described replacing the aortic valve and used a Dacron conduit to replace the aortic root and ascending aorta. The aortic aneurysm sac was then closed around the graft and a fistula from the perigraft space to the right atrium created using saphenous vein. In recent years the technique has been modified such that the sac is resected, and the coronary buttons are anastomosed directly to the dacron graft. In addition, the development of ready made valve-graft conduits, changes to graft design and the development of topical haemostatic agents which have increased the ease of conduit implantation have resulted in this operation becoming widely used and the term Aortic Root Replacement (ARR) has replaced the eponymous term Bentall's procedure.

For over 40 years ARR has been successfully employed to treat the two commonest pathologies of the ascending aorta requiring operative repair – Type A Aortic Dissection and ARA.

This study examines a decade's experience with ARR in a major cardiac surgical centre. A total of 89 patients have been included in this study and this comprises the largest published series of valved conduit procedures produced in Australasia to date.

Methods

A review of the published literature was undertaken via online searches of the major clinical databases: Medline,

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Abbreviations: ARR, Aortic Root Replacement; ICU, Intensive Care Unit; DHCA, Deep Hypothermic Circulatory Arrest; ACP, Antegrade Cerebral Perfusion; CVA, Cerebrovascular Accident; SIRS, Systemic Inflammatory Response Syndrome; AF, Atrial Fibrillation; ARF, Acute Renal Failure; PPM, Permanent Pacemaker; LRTI, Lower Respiratory Tract Infection; CABGS, Coronary Artery Bypass Graft Surgery; IE, Infective Endocarditis.

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Table 1. *Pre-operative Patient Characteristics.*

Characteristic	*N* = 89
Age (mean)	54 years
Male:female	70 (79%):19 (21%)
Hypertension	49 (55%)
Hypercholesterolaemia	23 (25.8%)
Smoking	28 (31.8%)
Bicuspid/unicuspid aortic valve	33 (37%)
Marfan's	4 (4.4%)
Ehlers-Danlos	1 (1.1%)
Coarctation of aorta	2 (2.2%)
Family history	2 (2.2%)
Emergency:elective	38 (43%):51 (57%)
Haemodynamic instability	13 (16.8%)
Tamponade	6 (6.7%)

Table 2. *Indications for Operation.*

Indication	*N* = 89
Aortic Root Aneurysm	58 (65%)
Type A Dissection	25 (28%)
Infective Endocarditis	4 (4.4%)
Prosthetic Valve Regurgitation	2 (2.2%)

Pubmed, Embase, Cochrane database, Google Scholar. The search years included ranged from 1970 to 2010. Bibliographies, from included papers, were assessed for suitable references, in an attempt to avoid missing potentially useful material.

Between the years 1999 and 2009, 89 patients underwent ARR at Royal Perth Hospital. These patients' records were scrutinised by retrospective chart review. Long-term follow-up was conducted by telephone interview with the patient themselves, if contactable, and with their current general practitioner or cardiologist. All data was collected and entered into a database.

All relevant pre- and intra-operative variables were recorded and analysed for their impact on operative morbidity and mortality, see Tables 1–3.

All relevant post-operative variables were recorded and analysed for their impact on in-hospital and late mortality, see Tables 4 and 5.

Table 4. *Operative Mortality.*

Operative mortality	11 (12.3%)
On-table mortality	3 (3.3%)
Failure to wean	2 (2.2%)
Uncontrollable haemorrhage	1 (1.1%)
Low cardiac output syndrome	3 (3.3%)
Sepsis	3 (3.3%)
Cerebrovascular accident	1 (1.1%)
SIRS	1 (1.1%)

Table 5. *Post-operative Complications.*

Atrial fibrillation	30 (33.7%)
Return for bleeding/tamponade	13 (14.6%)
ARF	13 (14.6%)
LRTI	9 (10.1%)
PPM insertion	8 (8.9%)
Tracheostomy	8 (8.9%)
cerebrovascular accident	7 (7.8%)
Deep sternal wound infection	0

Table 3. *Operative Characteristics.*

	Total Population *N* = 89	Aneurysm Subgroup *N* = 58	Dissection Subgroup *N* = 25
Venous cannulation			
Right atrial	79 (88.7%)	52 (89.6%)	23 (92%)
Femoral	6 (6.7%)	2 (3.4%)	2 (8%)
Bicaval	4 (4.6%)	4 (6.8%)	0
Arterial cannulation			
Aortic	44 (49.4%)	39 (67.2%)	2 (8%)
Femoral	36 (40.5%)	14 (24.2%)	19 (76%)
Axillary	9 (10.1%)	5 (8.6%)	4 (16%)
DHCA	49 (55%)	27 (46%)	20 (80%)
DHCA times (mean)	27 min	25 min	29 min
Cerebral perfusion	6 (6.7%)	3 (5.1%)	3 (12%)
Arch/hemiarch replacement	14 (15.7%)	5 (8.6%)	8 (32%)
CABG	11 (12.3%)	8 (13.8%)	3 (12%)
Mitral surgery	5 (5.6%)	4 (6.8%)	0