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Original Article

Concomitant Bentall operation plus aortic arch replacement surgery

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Abstract

Background: The Bentall operation is recommended for thoracic aortic dissection or aneurysm involving the aortic root. However, if the lesion extends to the aortic arch, concomitant Bentall operation plus aortic arch replacement (CoBAAR) surgery is required. CoBAAR is challenging because of its complex cardiopulmonary procedure, prolonged cardiopulmonary bypass time, and demanding operative techniques. Therefore, surgical mortality and morbidity rates for CoBAAR are very high. However, the Bentall operation performed as a single procedure may lead to reoperation if the residual aneurysm progresses. Therefore, CoBAAR as a one-stage surgery can lower the need for reoperation and possible further complications.

Methods: Nine patients received CoBAAR during January 2005 to May 2010. Six patients were diagnosed with Sanford type A aortic dissection and three with nondissecting ascending aortic and arch aneurysm. Four patients received a Bentall operation plus hemiarch replacement. The others received a Bentall operation plus total arch replacement along with elephant trunk because of extensive lesions.

Results: The in-hospital mortality was 11.1% (1 patient with total arch replacement). Morbidity included stroke (2 patients), spinal cord injury (1 patient), mechanical ventilation for more than 72 hours (5 patients), and temporary renal dialysis (3 patients). Eight patients survived.

Conclusion: CoBAAR is a demanding operative technique requiring complex cardiopulmonary bypass. However, surgeons can perform this procedure on extensive ascending aortic dissection or aneurysm patients, achieving satisfactory results.

Keywords: aneurysm; aorta; arch; Bentall; dissection

1. Introduction

Surgeons recommend the concomitant Bentall operation plus aortic arch replacement (CoBAAR) surgery in some conditions. However, this procedure is complicated, requiring demanding operative techniques, complex cardiopulmonary bypass, brain perfusion, and detailed surgical planning. The characteristics of a disease, pathology, comorbidity, and surgeon's experience are all factors which determine if ascending aorta repair includes the aortic arch. This is individualized, and the decision-making can be difficult, especially in cases of urgent arch setting and combined aortic root ascending aorta reconstruction. If surgeons only perform ascending aortic replacement, there is an increased likelihood of subsequent aortic arch aneurysm rupture and need for reoperation.[1,2] Although some patients require Bentall operation plus total arch replacement, surgeons rarely perform this procedure because of its complexity. There are few previous studies, usually case reports, which describe the use of this type of surgery.[3,4] The present study, therefore, aimed to evaluate the safety and outcomes of CoBAAR performed in the authors' institution.

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2. Methods

2.1. Patient selection

From January 2005 to May 2010, 117 patients with type A aortic dissection received surgery. Six (5.1%) of these patients underwent CoBAAR surgery. Four patients presented with acute dissection and the other two with chronic dissection. Three patients received CoBAAR for nondissecting ascending aortic aneurysm plus arch aneurysm. During the evaluation period, the total number of CoBAAR surgeries was nine (Table 1). One patent classified as having nondissecting ascending aortic aneurysm, in fact, had concomitant type B aortic dissection with aortic root ectasia and dilatation with severe aortic regurgitation. Most patients' aortic valve regurgitation was severe. Only one had aortic regurgitation of moderate severity. The mean age of the patients was 51 years (range, 26–73 years), and seven (77.8%) were men. Five patients had hypertension, one patient had received a diagnosis of Marfan syndrome, and one patient had previously undergone heart surgery. Surgeons recorded eight patients' cardiac functions using preoperative transthoracic echocardiogram or transesophageal echocardiogram under anesthesia, except for one patient who presented with congestive heart failure [New York Heart Association (NYHA) Fc IV] before the operation. Four patients presented with type A aortic dissection plus other concomitant critical problems (Tables 1 and 2).

Four patients with acute type A aortic dissection received emergent operation, and the others underwent complete examination before the elective surgery. In five of the six type A aortic dissection patients, the level of dissection extended to the descending aorta and common iliac artery. The other patient's dissection extended to the distal arch and proximal descending aorta.

In the acute type A aortic dissection and emergent operation group, transesophageal echocardiogram in the operation room assessed cardiac function and severity of aortic regurgitation.

Table 1
Characteristics of aortic aneurysm that underwent CoBAAR.

Disease characteristics (n = 9)	n (%)
Acute dissection	4 (44.4)
Dissection	7 (77.7)
Stanford type A	6 (66.7)
Stanford type B (with ascending aortic aneurysm)	1 (11.1)
Aortic valve regurgitation	
Severe	8 (88.9)
Moderate	1 (11.1)
Concomitant comorbidity	4 (44.4)[a]

CoBAAR = concomitant Bentall operation plus aortic arch replacement; NYHA = New York Heart Association.

[a] Four patients were associated with concomitant comorbidity. The first patient had brain infarction with change in consciousness, pulmonary edema, and respiratory failure; the second had left lower limb critical ischemia; the third had congestive heart failure, NYHA Fc IV; the fourth had sudden change in consciousness.

Table 2
Characteristics of patients.

Patient characteristics (n = 9)	n (%)
Age (y)	46 ± 5.8 (26–73)
Male gender	7 (77.8)
Hypertension	5 (55.6)
Marfan syndrome	2 (22.2)
Old CVA	2 (22.2)
Previous open heart surgery	1 (11.1)
CHF NYHA Fc III/IV	1 (11.1)
COPD	0
CAD	0
Chronic renal disease	0

CAD = coronary artery disease; CHF = congestive heart failure; COPD = chronic obstructive pulmonary disease; CVA = cerebrovascular accident; NYHA = New York Heart Association.

According to the aneurysm's characteristics, such as its extensive range, severity of intimal tear, and the fragility of the aortic wall, aortic arch replacement was of two types: total arch replacement and hemiarch replacement. Five patients received total arch replacement. Both the dissecting and nondissecting ascending aortic aneurysm patients had undergone these two procedures.

2.2. Operative techniques

All operative procedures involved the use of sternotomy, antegrade cerebral perfusion with circulation arrest, and hypothermia of approximately 17–20°C. Arterial cannulation was via the right axillary artery, with the exception of one cannula inserted into the left femoral artery because of the dissection of the axillary artery. Venous cannulation was via the right atrium in six patients, and three patients received cannulation via the right femoral vein (Fig. 1). Coronary perfusions with cardioplegia were antegrade in seven patients and both antegrade and retrograde in two patients.

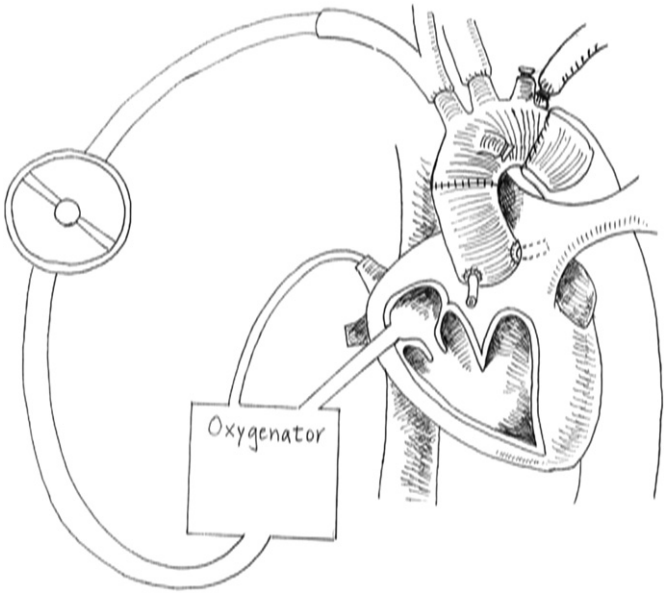

Fig. 1. The cardiopulmonary bypass for concomitant Bentall operation plus aortic arch replacement (CoBAAR).