Reoperative aortic root replacement: Outcome in a contemporary series

Jiro Esaki, MD, PhD,[a] Bradley G. Leshnower, MD,[b] Jose N. Binongo, PhD,[c] Yi Lasanajak, MPH,[c] LaRonica McPherson, RN,[b] Vinod H. Thourani, MD,[b] and Edward P. Chen, MD[b]

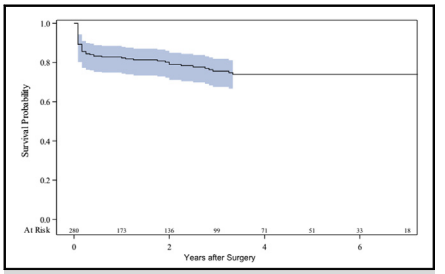
ABSTRACT

Objectives: Reoperative aortic root replacement is a challenging procedure associated with significant mortality and morbidity. The purpose of this study was to investigate the outcomes of reoperative aortic root replacement when performed in a number of complex clinical settings and to identify risk factors for operative mortality and long-term survival.

Methods: From 2006 to 2015, 280 consecutive patients at an academic center underwent reoperative aortic root replacement after a variety of previous aortic or cardiac operations. Logistic regression and extended Cox proportional hazards regression analyses were used to determine risk factors for operative mortality and long-term survival, respectively.

Results: The mean age of patients was 52.5 ± 14.1 years. Prior operations included proximal aortic replacement in 113 patients, valve surgery in 162 patients, and coronary artery bypass grafting in 46 patients. Concomitant procedures included arch replacement in 135 patients, coronary artery bypass grafting in 68 patients, and mitral valve repair/replacement in 18 patients. Operative mortality was 14.3%. Five-year survival was 74.0%. Univariable analysis did not find previous root replacement, prior proximal aortic surgery, and concomitant arch replacement to be risk factors for operative mortality. In the multivariable analysis, chronic lung disease, prior myocardial infarction, and concomitant mitral valve surgery were risk factors for operative mortality. Age, peripheral artery disease, emergency, and concomitant mitral valve surgery were risk factors for mortality in the late phase.

Conclusions: Reoperative aortic root replacement represents complex procedures carrying significant morbidity and mortality. Chronic lung disease, prior myocardial infarction, and concomitant mitral valve surgery were risk factors for operative mortality. Age, peripheral artery disease, emergency, and concomitant mitral valve surgery were risk factors for long-term mortality. (J Thorac Cardiovasc Surg 2017;154:800-8)



Long-term survival.

Central Message

Reoperative root replacement after previous cardiac or aortic surgery remains a significant surgical challenge.

Perspective

Reoperative root replacement is associated with significant morbidity and mortality. Chronic lung disease, prior myocardial infarction, and concomitant mitral valve surgery were risk factors for operative mortality. Age, peripheral artery disease, emergency, and concomitant mitral valve surgery were risk factors for long-term mortality.

See Editorial Commentary page 809.

Surgical therapy for the treatment of aortic root pathology has undergone significant improvement over the last 20 years. Recent advances in operative technique and

Scanning this QR code will take you to a supplemental video, tables, and figures. To view the AATS 2016 Webcast, see the URL next to the webcast thumbnail.

From the [a]Department of Cardiovascular Surgery, Otsu Red Cross Hospital, Otsu, Japan; [b]Division of Cardiothoracic Surgery, Department of Surgery, Emory University School of Medicine; and [c]Department of Biostatistics & Bioinformatics, Rollins School of Public Health, Emory University, Atlanta, Ga.

Read at the 96th Annual Meeting of The American Association for Thoracic Surgery, Baltimore, Maryland, May 14-18, 2016.

Received for publication Nov 23, 2016; revisions received April 1, 2017; accepted for publication April 26, 2017; available ahead of print June 30, 2017.

Address for reprints: Edward P. Chen, MD, Division of Cardiothoracic Surgery, Emory University School of Medicine, 5665 Peachtree Dunwoody Rd, Suite 200, Atlanta, GA 30342 (E-mail: edward.p.chen@emory.edu).

0022-5223/$36.00

http://dx.doi.org/10.1016/j.jtcvs.2017.04.084

Abbreviations and Acronyms

AVR = aortic valve replacement
CABG = coronary artery bypass grafting
CAD = coronary artery disease
CI = confidence interval
HR = hazard ratio
OR = odds ratio

improvements in myocardial protection and postoperative management have significantly decreased the surgical risk for aortic root replacement with reports of operative mortality ranging from 1% to 5% when performed in the setting of primary cardiac procedures.[1-5] As the patient population ages, a larger number of patients are requiring redo cardiac operations and reoperations on the aortic root are performed with increasing frequency.[6]

Although there is extensive evidence regarding the safety of the modified Bentall operation when performed as a first-time procedure, the potential clinical challenges associated with performing this operation in the setting of reoperative surgery are significant. In addition, there is limited information regarding the clinical outcomes of this operation after previous cardiac surgery and in particular after a previous aortic root replacement or other proximal aortic procedures. The purpose of this study was to investigate the outcomes of reoperative root replacement when performed in a number of complex settings and identify risk factors for operative mortality and long-term survival in a contemporary series.

MATERIALS AND METHODS

Patients

This study was conducted with approval of the Institutional Review Board at Emory University in compliance with the Health Insurance Portability and Accountability Act regulations and the Declaration of Helsinki. The Institutional Review Board waived the need for individual patient consent. A review of the Emory Aortic Surgery database identified 867 aortic root replacement procedures that were performed within Emory Healthcare–affiliated hospitals from January 2006 to June 2015. Of those cases, 280 consecutive patients who had undergone an aortic root replacement after previous cardiac or proximal aortic operations were included in this study without exclusion criteria.

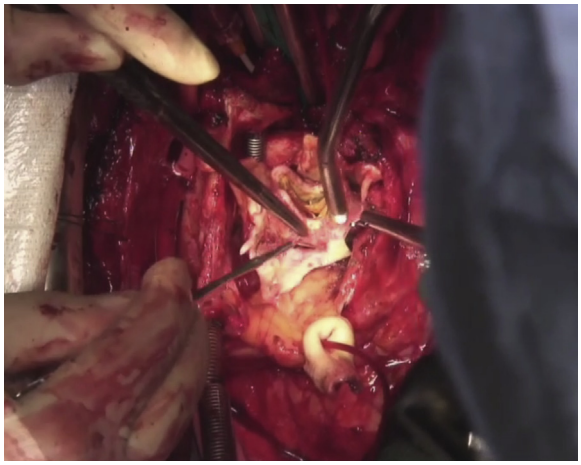
To clarify risk factors for operative mortality, the association between relevant preoperative variables and operative mortality was assessed. Also, to know the impact of a specific type of prior intervention on operative and long-term mortality, patients were further divided and 3 more analyses were performed according to their previous surgery. The 3 additional analyses compared patients with a history of aortic root replacement with patients who did not have this history, patients having prior aortic valve replacement (AVR) with patients without prior AVR, and patients with a history of coronary artery bypass grafting (CABG) with those without prior CABG. These analyses are included in Tables E1-E3 and Figures E1-E3 The separate analyses were done because the patient heterogeneity had several different previous operations or a history of multiple different operations. For example, if a patient had a history of aortic root replacement and CABG, the patient was included in both the previous root replacement group and the previous CABG group.

Operative Technique

All procedures were performed via redo sternotomy. Methods of arterial and venous cannulation varied according to the perceived risk of cardiac or aortic injury during sternal reentry. Chest computed tomography imaging was vital toward making this determination, and in patients who were thought to have a low risk of cardiac or aortic injury during reentry, central cannulation via the ascending aorta and right atrium was performed after adequate exposure of the heart. Patients who were thought to be at high risk for injury to aorta or heart during sternal reentry had right axillary artery or femoral artery cannulation performed before sternotomy. If the patient had an aortic arch aneurysm, the right axillary artery was usually cannulated and aortic arch reconstruction was performed using hypothermic circulatory arrest with unilateral selective antegrade cerebral perfusion as previously described.[7] However, retrograde cerebral perfusion or deep hypothermic circulatory arrest alone also was used if the patient had a history of right axillary artery cannulation or if a pseudoaneurysm was positioned in front of the arch and arch vessels prevented easy access.

The specific root procedure performed depended on the patient's characteristics, the aortic valve anatomy, and the surgeon's preference. If the patient was young and the aortic valve cusps did not have significant degeneration, the David V reimplantation method was often used as previously described.[8] For patients undergoing root replacement using a composite valve conduit, with a mechanical or bioprosthetic valve-conduit, the modified Bentall technique[9] was performed (Video 1). For elderly patients, a bioprosthetic valve-conduit was used. If the patient opted not to take anticoagulation to reduce the risk of bleeding and avoid lifestyle adjustments associated with anticoagulation, a bioprosthesis was used even if the patient was young. For patients with root abscess, root replacement with homograft was performed. For patients who previously underwent mechanical AVR, the valve was inspected, and if valve function was intact, an aortic root graft was sewn to the sewing ring of the previously implanted valve using pledgeted 2-0 braided polyester sutures.

In the majority of cases, the coronary arteries were primarily reimplanted as buttons; however, in patients in whom the coronary ostia were friable because of infection or in patients in whom the coronary arteries could not reach the new graft because of geometry or length issues, a Cabrol extension was used using a vein graft and occasionally a Dacron graft, depending on the surgeon's preference.[10] The Cabrol technique was defined as an anastomosis between coronary ostia and new graft and was included as one of the techniques in CABG, being categorized as CABG for non–coronary artery disease (CAD) reason in this study. Cardioplegia



VIDEO 1. Reoperative root replacement after previous AVR. Video available at: http://www.jtcvsonline.org/article/S0022-5223(17)31153-4/addons.