Reoperation of the proximal aorta: impact of presternotomy extracorporeal circulation on clinical outcomes

Tomonobu Abe, MD · Akihiko Usui, MD
Masaharu Yoshikawa, MD · Hideki Oshima, MD
Toshiaki Akita, MD · Yuichi Ueda, MD

Abstract

Purpose. Adverse events can occur during a sternotomy for reoperation of the proximal aorta. Presternotomy extracorporeal circulation is often employed to avoid catastrophic events. The purpose of this study was to investigate the impact of presternotomy extracorporeal circulation on clinical outcomes of redo proximal aortic surgery.

Methods. Between January 1990 and December 2005 a total of 21 aneurysms or dissections of the proximal aorta were repaired via a repeat sternotomy. Extracorporeal circulation was established before the sternotomy in 9 (49%) patients and after the sternotomy in 12 (51%) patients.

Results. There were no statistically significant differences in the age, sex, emergency surgery, chronic obstructive pulmonary disease, and renal function between the groups. Femoral cannulation was used more often in the presternotomy extracorporeal circulation group (8/9, 89% vs. 1/12, 8.3%; \( P = 0.000 \)). The difference in the pump time did not reach a statistically significant level. The 30-day and in-hospital mortality rates were 11% (1/9) and 11% (1/9) in the presternotomy extracorporeal circulation group and 0% (0/12) and 17% (2/12) in the poststernotomy extracorporeal circulation group. There were no statistically significant differences in stroke, respiratory failure, myocardial infarction, or renal failure. There was a trend toward a longer hospital stay in the presternotomy extracorporeal circulation group (85.8 vs. 48.1 days; \( P = 0.06 \)).

Conclusion. Presternotomy extracorporeal circulation was not associated with any major adverse outcomes such as death, stroke, or renal failure.

Key words Reoperation · Extracorporeal circulation · Aorta

Introduction

Patients who undergo major cardiovascular surgery may later develop aneurysmal disease in the proximal aorta (i.e., aortic root, ascending aorta, transverse arch) thus requiring surgery via a redo sternotomy. The proximal aorta is the only structure that has systemic blood pressure among cardiac chambers and great vessels, which are at risk of developing reentry injury. An injury of the aorta is closely associated with poor clinical outcomes in redo surgery. Dobell and Jain reported a mortality rate of 47% among 30 patients with aortic sternal reentry injury with catastrophic hemorrhage. Although several authors have advocated the use of extracorporeal circulation (ECC) before a sternotomy for redo cardiac surgery, there are only a few studies that have directly
analyzed its effects on clinical outcomes. No article has previously specifically focused on redo proximal aortic surgery. The aim of this study was to compare the early results of redo proximal aortic surgery based on applying ECC before versus after a redo sternotomy.

Subjects and methods

Patients

From January 1990 to April 2005, a total of 21 operations for the proximal aorta were performed via a redo median sternotomy. ECC was initiated before the redo sternotomy in 9 patients (group A) and after the redo sternotomy in 12 patients (group B). In two cases in group A, the patients were cooled to achieve circulatory arrest before the sternotomy.

Preoperative planning and surgical technique

The criteria for presternotomy ECC were the preoperative judgment and the surgeon’s preference. All surgeons involved in this series used presternotomy ECC when they thought that the redo sternotomy without circulatory support was unsafe based on preoperative computed tomography (CT) images. All patients underwent preoperative CT scans as one of the preoperative evaluations. Surgeons thought that the most important finding to identify potentially hazardous cases is attachment of the aortic wall to the sternum. When there was no space between the aortic aneurysmal wall and the sternum in the CT images, a redo sternotomy was considered dangerous. Some examples of CT images are shown in Fig. 1.

A median sternotomy was used in all patients. In group A, one of the femoral arteries and/or the right axillary artery and one of the femoral veins were cannulated before the sternotomy. In two patients, circulatory arrest was achieved by cooling the patient to 20°C before the sternotomy. All of the median sternotomies were done using an oscillating saw. In the poststernotomy group, the vessel selection for the arterial cannulation depended on the presence or absence of aortic dissection and atheromatous disease. Circulatory arrest was used during replacement of the aortic arch or in cases in which aortic clamping was judged to be impossible or unsafe. Retrograde or antegrade cerebral perfusion was often used as an adjunctive method, based on the surgeon’s preference. The aneurysmal or calcified aorta was replaced by a Dacron graft. In selected cases of a false aneurysm, if the native aortic tissue was good and the

Fig. 1 Preoperative computed tomography images. A Patient in group A. B Another patient in group A. This patient was cooled down to circulatory arrest before sternotomy. C Patient in group B