Reoperative surgery on the thoracic aorta

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Objective: The objective of our study was to report our hospital and long-term results after reinterventions on the thoracic aorta.

Methods: Between 1986 and 2011, 224 reoperations on the proximal thoracic aorta after previous aortic surgery were performed in our institution. The number of reinterventions quadrupled during the course of the study period. Mean patient age was 58.1 years, and 174 patients (77.7%) were male. An urgent/emergency operation was performed in 39 patients (17.4%). Indications for surgery included degenerative and chronic postdissection aneurysm ($n = 166$), false aneurysm ($n = 31$), active prosthetic infection ($n = 16$), acute dissection ($n = 10$), and other ($n = 1$). Surgical procedures involved the aortic root in 40.6% of patients, the ascending aorta in 9.4%, the aortic arch in 24.6%, and the entire proximal thoracic aorta in 25.4%.

Results: Hospital mortality was 12.1%. On multivariate analysis, cardiopulmonary bypass time (odds ratio, 1.1023/minute; $P < .001$), and urgent/emergency status (odds ratio, 5.6; $P < .001$) emerged as independent predictors of hospital mortality. The follow-up was 98.7% complete. Estimated 1-, 5-, and 10-year survival rates were 84.4%, 72.5%, and 48.5%, respectively. Eighteen reinterventions were performed during follow-up—16 because of the progression of aortic disease at the proximal aorta ($n = 2$) and downstream aorta ($n = 14$). Freedom from reoperation at 1, 5, and 10 years was 95.6%, 90.2%, and 81.5%, respectively.

Conclusions: Reoperative aortic surgery was associated with satisfactory short- and long-term results, especially if carried out on an elective basis. The extent of the aortic replacement did not impact survival and was associated with a reduced need for reintervention. The progressive nature of aortic disease and the favorable results of elective primary aortic interventions suggest favoring aggressive aortic resections at initial surgery. (J Thorac Cardiovasc Surg 2013;S145:78-84)

It has been estimated that the need for reoperative aortic surgery will continuously increase and will eventually account for 10% of all procedures on the ascending aorta.¹ In the literature, hospital mortality ranges from 8% to 15%, which highlights the complexity of referred patients and contemplated procedures in this setting.²⁻⁵ We report our experience with 224 consecutive patients undergoing reoperation on the thoracic aorta.

METHODS

Medical records and available aortic data sets were reviewed to identify patients who underwent reoperation on the thoracic aorta (after previous aortic surgery) in our institution between January 1986 and September 2011. Patients who had previously undergone nonaortic surgery (eg, coronary artery bypass grafting or mitral valve replacement) and those who

required a reoperation only on the aortic valve were excluded from the study. Thus, pre-, intra-, and postoperative variables were analyzed in 224 patients whose mean age was 58.1 ± 13.3 years.

The distribution of the aortic reoperations throughout the study period is shown in Figure 1. An urgent/emergency reoperation was performed in 17.4% of patients, and 8.9% of patients had already undergone at least 1 previous aortic redo procedure using a mid sternotomy. The mean time elapsed from the last operation was 9.5 ± 8.4 years. Patient demographics and previous aortic procedures are reported in Tables 1 and 2. The indication for surgery was a degenerative aneurysm in 101 patients (45.1%), a chronic postdissection aneurysm in 65 patients (29.0%), an acute type A aortic dissection in 10 patients (4.5%), a false aneurysm in 31 patients (13.8%), endocarditis in 16 patients (7.1%), and iatrogenic aortic supra-valvular stenosis in 1 patient (0.4%).

Surgical Techniques

A median sternotomy was used in 223 patients, and a median sternotomy with a left anterior thoracotomy (to obtain better exposure of the proximal descending thoracic aorta) was used in 1 patient. For cardiopulmonary bypass (CPB), a central arterial cannulation site (ascending aorta, aortic arch, right axillary, innominate or carotid arteries) allowing antegrade blood flow through the thoracoabdominal aorta was used in 119 patients (53.2%), the femoral artery was cannulated in 104 patients (46.4%), and right axillary + femoral artery cannulation was performed in the 1 remaining patient (0.4%). Venous drainage was obtained by means of right atrium, bicaval, or femoral cannulation, as indicated. The right superior pulmonary vein, the pulmonary artery trunk, or the left ventricular apex (with a left anterior minithoracotomy) was cannulated for left ventricular drainage. Myocardial protection was obtained by means of antegrade ($n = 207$, 92.4%), retrograde ($n = 13$, 5.8%), or retrograde + antegrade ($n = 2$, 0.9%) intermittent infusion of cold crystalloid cardioplegia.

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Abbreviations and Acronyms

ASCP	= antegrade selective cerebral perfusion
CI	= confidence interval
CPB	= cardiopulmonary bypass
OR	= odds ratio

On preoperative imaging tests, 26 patients presented with a sternum-to-aorta distance of < 1 cm. Of these patients, 18 were placed on CPB before chest reopening, and 8 required deep hypothermic circulatory arrest. In 3 of the latter patients, brain perfusion was continued by cannulating the right axillary artery and by isolating and clamping the innominate artery (proximal to the origin of the right carotid artery) at the jugular notch before re sternotomy. In all patients requiring various degrees of aortic arch replacement, or in those undergoing chest reopening under circulatory arrest, brain protection was achieved by means of antegrade selective cerebral perfusion (ASCP). Our ASCP technique has been described previously. Briefly, it involves bilateral brain perfusion, moderate hypothermia (26°C), and a flow rate of 10 to 15 mm Hg adjusted to maintaining a perfusion pressure between 40 and 70 mm Hg.⁶ The CPB data are reported in Table 3.

Various aortic procedures were performed according to the underlying pathology. Reoperative surgery involved 91 procedures (40.6%) on the aortic root, 21 procedures (9.4%) on the ascending aorta, and 55 procedures (24.6%) on the aortic arch. Concomitant procedures on the root, ascending aorta, and arch were performed in another 57 patients (25.4%), and associated cardiac procedures in 29 patients (12.9%; Table 4). Root replacement was performed using a composite graft according to modified Bentall or Cabrol techniques.^{7,8} For complete arch replacement, the arch vessels were reimplanted using the en bloc or separated graft technique.⁹ In patients with a diseased descending thoracic aorta, conventional and frozen elephant trunk¹⁰ techniques were frequently associated.

Careful debridement with resection of all the infected tissue was performed in patients with active endocarditis; the left ventricular outflow tract was reconstructed with a pericardial patch as indicated, and mechanical or biologic grafts were used to replace the diseased aorta (homograft, *n* = 9; Toronto root, *n* = 1; shell-high conduit, *n* = 4, mechanical composite graft, *n* = 2).

Statistical Analysis

Continuous variables are expressed as the mean $\pm$ 1 SD and were analyzed by using the unpaired, 2-tailed *t* test. Categorical variables are presented as percentages and were analyzed with the χ^2 test or the Fisher exact test when appropriate. A two-tailed *P* value < .05 was considered statistically significant. All the pre- or intraoperative variables that achieved a *P* value < .05 in the univariate analysis were examined using multivariate analysis by stepwise logistic regression to evaluate independent risk factors for hospital mortality.

The patients were monitored in the outpatient clinic with computed tomography and magnetic resonance imaging, and by means of telephone calls. Survival curves (taking into account perioperative deaths) and freedom from aortic reoperation (in the surviving patients) were estimated at 1, 3, 5, and 10 years using the Kaplan-Meier method. Independent predictors of 10-year survival were determined using Cox proportional hazards analysis. Statistical analysis was performed using SPSS 18.0 (IBM SPSS, Chicago, Ill).

RESULTS

Hospital Results

Overall, hospital mortality was 12.1% (*n* = 27): 7.6% (14/185) in elective patients and 33.3% (13/39) in urgent/

emergency patients (*P* < .001). Causes of death were cardiac (*n* = 6), neurologic (*n* = 3), multiorgan failure (*n* = 15), sepsis (*n* = 2), and intestinal ischemia (*n* = 1). Hospital mortality varied according to the underlying pathology—4% in patients with degenerative aneurysms, 13.8% in patients with chronic dissections, 16.1% in patients with false aneurysms, 31.2% in patients with endocarditis, and 40.0% in patients with acute dissection (*P* = .001).

On multivariate analysis, urgency/emergency (odds ratio [OR], 5.6; *P* < .001; 95% CI, 2.021-15.747) and CPB time (OR, 1.023; *P* < .001; 95% CI, 1.012-1.036) were identified as independent predictors of hospital mortality.

The main postoperative complications included stroke (*n* = 7, 3.1%), coma (*n* = 4, 1.8%), ventilatory support > 72 hours (*n* = 28, 12.5%), temporary (*n* = 12, 5.4%) and permanent (*n* = 2, 0.9%) dialysis, and bleeding requiring rethoracotomy (*n* = 26, 11.6%). The mean intensive care unit stay ($\pm$ standard error) was 6.1 $\pm$ 0.7 days (Table 5).

Follow-up

Follow-up was 98.7% complete at a mean of 55.5 $\pm$ 52.2 months (range, 0.13-221.7 months). Forty-nine patients died during follow-up, and causes of death were cardiac related in 7 patients, aortic rupture in 7, stroke/coma in 2, endocarditis in 2, gut ischemia in 1, sepsis in 1, and noncardiac/aortic related in 29 patients (vehicular crash, *n* = 1; neoplasm, *n* = 6; pneumonia, *n* = 1; unknown, *n* = 21). Kaplan-Meier estimates of survival at 1, 3, 5, and 10 years were 84.4 $\pm$ 2.5%, 79.0 $\pm$ 2.9%, 72.5 $\pm$ 3.4%, and 48.5 $\pm$ 5.2%, respectively (Figure 2). On Cox regression, age (OR, 1.074; *P* < .001; 95% CI, 1.039-1.109) and chronic obstructive pulmonary disease (OR, 2.6; *P* = .015; 95% CI, 1.208-5.607) emerged as independent predictors of reduced long-term survival for patients surviving their most recent reoperation.

Eighteen patients underwent subsequent aortic procedures during follow-up. Of these, 3 patients underwent different degrees of open arch replacement (hemiarch replacement, *n* = 1; total arch replacement, *n* = 2) as a result of infective false aneurysm formation, aneurysmal progression of the aortic disease, and penetrating aortic ulcer, whereas 15 patients underwent secondary endovascular repairs using conventional (*n* = 7) or frozen (*n* = 7) trunks as proximal landing zones because of the progressive dilatation of a chronically dissected descending thoracic aorta (*n* = 14) and a distal type 2 frozen elephant trunk endoleak (*n* = 1). Two patients died after secondary endovascular procedures: one from abdominal aortic rupture and the other from an aorto esophageal fistula. Freedom from aortic redo at 1, 3, 5, and 10 years was 95.6 $\pm$ 1.5%, 94.2 $\pm$ 1.8%, 90.2 $\pm$ 2.6%, and 81.5 $\pm$ 5.2%, respectively (Figure 3). Multivariate analysis failed to identify any independent predictors of reintervention at follow up.

FIGURE 1. Distribution of aortic reoperations throughout the study period.

DISCUSSION

Although percutaneous aortic procedures have become available to treat pseudo-aneurysms in high-risk patients with favorable anatomic characteristics,¹¹ the number of reoperations on the thoracic aorta is increasing rapidly as a result of the increased incidence of aortic diseases in an aging population, the increased use of biologic aortic valves and root substitutes, and the increased use of techniques for valve-sparing aortic root reconstruction. Our experience strongly confirms such a trend, because the number of aortic reinterventions has quadrupled from the early 1990s to date (Figure 1).

Aneurysmal and dissecting progression of aortic disease and mechanical (noninfective pseudo-aneurysm, prosthetic valve dysfunction/degeneration) or infective aortic complications represent the main indications for reoperative aortic surgery. Schepens and colleagues¹² have reported that

FIGURE 2. Kaplan-Meier estimate of 10-year survival.

TABLE 1. Patient demographics (n = 224)

Variable	Frequency	%
Male	174	77.7
Age	58.1 ± 13.3	
NYHA class III-IV (n = 219)	58	26.5
Hypertension	131	58.5
Diabetes	11	4.9
Obesity	10	4.5
Smoking	74	33.0
COPD	21	9.4
Renal insufficiency	12	5.4
Peripheral vasculopathy	9	4.0
Cerebral vasculopathy	4	1.8
CAD	23	10.3
Marfan	13	5.8
Urgent/emergency status	39	17.4
Redo > 2	20	8.9
Years from last operation	9.5 ± 8.4	

NYHA, New York Heart Association; COPD, chronic obstructive pulmonary disease; CAD, coronary artery disease.

aneurysm formation and acute dissection accounted for approximately 50% of all indications for aortic reoperation in a series of 124 patients. In our study population, the role of the progression of aortic disease seems even more

TABLE 2. Previous aortic procedures (n = 224)

Variable	Frequency	%
Aortic valve replacement	93	41.5
Aortic valve + ascending aorta replacement	9	4.0
Aortic valve replacement + ascending aorta reduction	7	3.1
Aortic valve repair + ascending aorta replacement	7	3.1
Aortic valve repair + ascending aorta reduction	1	0.4
Aortic valve repair + hemiarch replacement	1	0.4
Aortic valve repair + ascending aorta replacement + aortic arch stent	1	0.4
Aortic valve commissurotomy	1	0.4
Bentall	37	16.5
David	2	0.9
Ascending aorta replacement	48	21.4
Ascending aorta reduction	2	0.9
Hemiarch replacement	4	1.8
Ascending + hemiarch replacement	2	0.9
Ascending + arch replacement	2	0.9
Ascending aorta replacement + aortic arch stent	1	0.4
Ascending + arch replacement + elephant trunk	1	0.4
Ascending + arch replacement + frozen elephant trunk	1	0.4
Bentall + hemiarch replacement	2	0.9
David + arch replacement + elephant trunk	1	0.4
David + hemiarch replacement	1	0.4
Associated procedures		
CABG	12	5.3
Mitral valve repair	8	3.6
Mitral valve replacement	1	0.4
Atrial septal defect closure	1	0.4

CABG, Coronary artery bypass grafting.

TABLE 3. Operative data

Variable	Frequency	%
Cannulation site		
Central	120	53.6
Remote	104	46.4
Cardioplegia		
Antegrade	207	92.4
Retrograde	13	5.8
Antegrade + retrograde	2	0.9
CPB time	202.5 ± 75.2	
Clamp time	140.2 ± 52.4	
Antegrade selective cerebral perfusion	112	50.0
ASCP time	77.2 ± 42.4	
Sternotomy on CPB	18	8.0
Sternotomy on HCA	8	3.6

CPB, Cardiopulmonary bypass; ASCP, antegrade selective cerebral perfusion; HCA, hypothermic circulatory arrest.

predominant, representing 80% of the indications for surgery. Considering that failure to resect all diseased aortic tissue at initial surgery increases the probability of subsequent surgery, and the excellent current outcomes after elective root/ascending aorta replacement, these observations reasonably support a more aggressive management of aortic disease at the first operation, especially in low-risk younger patients with or without connective tissue disorders. A further clinical implication is that close and continual surveillance with imaging techniques is mandatory in patients undergoing aortic valve replacement or procedures on the proximal thoracic aorta.

In the literature, hospital mortality after aortic reoperations ranges from 8% to 15%.²⁻⁵ For the most part, underlying disease, type of previous procedure, and appropriate surgical techniques influence patient outcome. In reoperative aortic surgery, probably more than in other aortic/cardiac procedures, a valid strategy increases the chances of a successful operation. Technically, the main concerns include chest reentry, CPB institution, myocardial/brain protection, and the specific technique of aortic repair, the latter depending on the underlying pathology. Reading the report of the previous surgical intervention is of primary importance and can reduce the proportion of unforeseeable events that are always a possibility. Preoperative imaging and, in particular, an angiographic computed tomographic scan, is mandatory in every patient to perform a safe resternotomy; this will assess the relationship existing between the aorta, the aneurysm or conduit, and the undersurface of the sternum (Figure 4). If sternal reopening is judged safe, our resternotomy techniques involve removal of the sternal wires, an oscillating saw, patient arterial pressure < 100 mm Hg, opening of the pleural spaces, and tubing for prompt CPB institution ready on the operative table. Conversely, under high-risk conditions—such as those of patients with aneurysms in close contact with the sternum or with an aorta-

TABLE 4. Surgical procedures (n = 224)

Variable	Frequency	%
Root surgery	91	40.6
Bentall	67	29.9
Cabrol	1	0.4
Noncoronary sinus + ascending aorta replacement	1	0.4
Aortic valve prosthesis-sparing operation	15	6.7
Aortic valve + ascending aorta replacement	6	2.7
Aortic valve replacement + pseudo-aneurysm direct closure	1	0.4
Ascending aorta surgery	21	9.4
Ascending aorta replacement	19	8.5
Pseudo-aneurysm direct closure	1	0.4
Other	1	0.4
Arch surgery	55	24.6
Hemiarch replacement	11	4.9
Total arch replacement	13	5.8
Total arch replacement + frozen elephant trunk	20	8.9
Total arch replacement + elephant trunk	10	4.5
Total arch replacement + descending aorta replacement	1	0.4
Root + ascending aorta + arch surgery	57	25.4
Bentall + hemiarch replacement	13	5.8
Bentall + ascending and arch replacement	19	8.5
Bentall + ascending and arch replacement + frozen elephant trunk	6	2.7
Bentall + ascending and arch replacement + elephant trunk	5	2.2
Aortic valve prosthesis-sparing operation + hemiarch replacement	4	1.8
Aortic valve + ascending aorta + arch replacement + frozen elephant trunk	6	2.7
Aortic valve + ascending aorta + arch replacement	3	1.3
Aortic valve + hemiarch replacement	1	0.4
Associated procedures		
CABG	18	8.0
CABG + mitral valve plasty	1	0.4
Mitral valve replacement	6	2.7
Tricuspid valve plasty	3	1.3
Ventricular septal defect closure	1	0.4

CABG, Coronary artery bypass grafting.

to-sternum distance of < 10 mm—sternal reopening can be performed more safely using a short period of CPB or under deep hypothermic circulatory arrest. With this strategy, difficult resternotomy does not emerge as an independent predictor of mortality in this, or in the previous¹³ series from our institution. Recently, in patients with pseudo-aneurysms in contact with the sternum, we have avoided deep hypothermia and circulatory arrest by cannulating the axillary artery for CPB inflow, and—by isolating and clamping the innominate artery at the jugular notch proximal to the origin of the carotid artery—we have been able to institute brain perfusion before resternotomy. Another similarly effective option would be to cannulate the right (±left) carotid artery to institute antegrade brain perfusion before chest reopening.¹⁴

TABLE 5. Hospital outcomes

Variable	Frequency	%
Hospital mortality	27	12.1
Ventilatory support > 72 h	28	12.5
Acute myocardial infarction	10	4.5
Renal complications	24	10.7
Temporary dialysis	12	5.4
Permanent dialysis	2	0.9
Neurologic complications	16	7.1
Coma	4	1.8
Stroke	7	3.1
Paraplegia	5	2.2
Bleeding	26	11.6
ICU stay, mean days $\pm$ SE	6.1 $\pm$ 0.7	

ICU, Intensive care unit; SE, standard error.

Vessel selection for arterial cannulation depends on the presence of aortic dissection, atheromatous disease, the extent of the aortic replacement, and the degree of safety at chest reentry. In general, when surgery is limited to the root/ascending aorta and a low-risk re sternotomy is anticipated, CPB arterial inflow can be obtained by cannulating the distal ascending aorta or the aortic arch. In patients who require some extent of aortic arch replacement, the right axillary artery or the innominate artery represent our favorite sites for arterial cannulation, mainly because they facilitate antegrade cerebral perfusion. In our institution, the femoral artery is cannulated in patients who require CPB before re sternotomy when other central sites are unavailable for cannulation. However, it should be noted that, in a recent series of aortic reoperations, we could not show any benefit in terms of survival or reduction of stroke in patients undergoing central arterial cannulation compared with those having cannulation of the femoral artery.¹³

To guarantee the safety of the procedure, great attention also has to be paid to myocardial protection. In patients with

moderate to severe aortic regurgitation, avoiding (or delaying) ventricular fibrillation—and consequently left ventricle distension—will reduce the risk of myocardial dysfunction at the end of the operation. In patients in whom the ascending aorta (or graft) cannot be controlled and clamped rapidly, transapical venting of the left ventricle through a small left thoracotomy should be considered. After clamping (or under circulatory arrest), routes for cardioplegia infusion may vary according to patient characteristics. Antegrade cardioplegia infusion through the ascending aorta should be avoided in patients with aortic valve/prosthesis insufficiency and in the presence of proximal leaks from dehiscent suture lines. Selective cannulation of the coronary ostia should be carried out with care if detachment, dissection, or infection of the ostia have been documented previously. Retrograde or percutaneous infusion of cardioplegia¹⁵ through the coronary sinus may represent a valid alternative. If difficulties in delivering cardioplegia are anticipated with all routes, a lower core temperature will provide some extra time for myocardial protection to address the complex situation more effectively. In our experience, we were able to protect the heart with antegrade infusion of cardioplegia in approximately 90% of cases, with a postoperative incidence of myocardial infarction of 4.5%, which we consider satisfactory.

Approximately 50% of our aortic reoperations involved some degree of arch replacement. Undoubtedly, brain protection plays an important role in this setting, and ASCP, by avoiding deep hypothermia and providing a safe period of brain protection (up to at least 90 minutes),⁶ has represented our method of choice since 1996. In this series, the mean ASCP time was 77 minutes and our stroke/coma rate was 4.9%. We strongly believe our results would have been far worse if we had used different methods of brain protection.

In the context of a repeat Bentall procedure, the reattachment of the coronary ostia is of paramount importance because torsion and kinking resulting from inadequate mobilization are more likely than in primary interventions. The modified button Bentall technique remains the one we always aim for, even though difficult mobilization of the coronary arteries and large aneurysms may hinder a safe and tension-free conduit-to-coronary anastomosis. In this setting, compared with a straight tube graft, the Valsalva composite graft, which mimics aortic sinuses, may help in performing a tension-free coronary artery reattachment by reducing the distance between the coronary ostia and the graft itself. However, in some cases, the Cabrol technique has a pivotal role, often as a bailout procedure, given that long-term outcomes may be disappointing as a result of the high rate of Cabrol graft thrombosis and occlusion.^{16,17}

In patients who underwent aortic valve replacement during prior interventions and who require a root replacement, a prosthesis-sparing operation may facilitate surgery and

FIGURE 3. Kaplan Meier estimate of 10-year freedom from reoperation.

FIGURE 4. Preoperative angiographic computed tomographic scan showing a likely safe chest reentry with an aorta-to-sternum distance > 10 mm (A), a high-risk re sternotomy resulting from aortic pseudo-aneurysm sternal erosion (B), and a patent left internal thoracic artery graft in contact with the undersurface of the sternum (C).

may likely reduce the risk of pseudo-aneurysm formation.¹⁸ This procedure foresees the replacement of the aortic root with a graft sutured directly to the well-functioning valve prosthesis. So far, 14 such procedures have been performed in our institution without mortality (and major complications), confirming preliminary favorable outcomes from other centers.¹⁹

In the current series, overall hospital mortality was 12.1%: 7.6% in the elective patients and 33.3% in the urgent/emergency patients. Undoubtedly, the underlying pathology greatly influenced hospital outcomes, as demonstrated by higher mortality rates in patients with active endocarditis and acute dissection, and with urgent/emergency status, which was as the most relevant predictor for hospital mortality using multivariate analysis (OR, 5.6). Once more, CPB time was confirmed to be the strongest intraoperative predictor of mortality (bearing in mind that extent of aortic replacement was not), and likely acted as a surrogate for complex aortic procedures, such as those required for redo root or arch operations in patients with acute dissection and active endocarditis. It remains true that aortic reoperation for active endocarditis, at least in our hands, still represents a serious concern and, with the lack of randomized studies comparing outcomes after medical or surgical management, selecting the most effective (or least harmful) therapy continues to be difficult in this setting.

Nevertheless, we believe that our results are satisfactory after considering that approximately 50% of our patients underwent some degree of arch replacement (mostly total) and approximately 25% had complete replacement of the proximal thoracic aorta from the aortic valve to the isthmus. Despite this, confirming previous data,¹³ the extent of aortic replacement was not a predictor of mortality, indicating (albeit with some exceptions) that aggressive aortic

resections should always be performed. Our long-term data continue to support this concept. Fourteen of 18 reoperations at follow-up were endovascular, and were indicated for treating chronic postdissection aneurysms of the downstream aorta, which could not have been addressed during the earlier intervention through a sternotomy; 2 of 3 open surgical reoperations were necessary because of progression of the disease at the proximal aorta (aneurysm formation and penetrating ulcer).

CONCLUSIONS

Aortic reoperative surgery is being performed increasingly and represents a formidable challenge for the cardiovascular surgeon. Appropriate surgical strategies, techniques, and methods for organ protection are crucial in obtaining favorable postoperative outcomes.

In our experience with 224 thoracic aorta reoperations, short- and long-term results were excellent in patients with aneurysms, and disappointing in those who presented with acute dissection and active endocarditis. Urgent/emergency surgery and prolonged duration of CPB emerged as strong predictors of reduced hospital survival; extensive aortic replacement did not increase hospital mortality and resulted in a reduced need for reintervention in the proximal aorta. The well-known progressive nature of aortic disease and the favorable results of elective primary aortic interventions would suggest that diseased aortic tissue should be resected aggressively during the initial surgery.

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