

Reoperative aortic root and transverse arch procedures: A comparison with contemporaneous primary operations

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Supplemental material is available online.

Objectives: Long-term survival and risk factors affecting outcome after reoperative root/ascending aorta and transverse arch procedures have not been clearly described.

Methods: Two hundred patients (138 male patients; age, 60 ± 15 years) underwent reoperative root/ascending aorta ($n = 100$) or transverse arch ($n = 100$) procedures at our institution from January 1998 to December 2004 and were compared with 480 consecutive contemporaneous patients with primary procedures (323 male patients; age, 62 ± 16 years; 335 proximal aorta and 145 transverse arch procedures).

Results: Reoperative proximal aorta procedures had a higher hospital mortality (7%) than primary root/ascending aorta procedures (3%), but there was a less dramatic difference in operative mortality after primary and reoperative arch procedures (9% vs 10%). Separate multivariable analyses of root/ascending aorta procedures and arch procedures revealed chronic obstructive pulmonary disease and age to be significant risk factors for death after either procedure. In addition, an ejection fraction of less than 30% posed a significant risk for proximal aortic surgery, and diabetes and nonelective operations predicted poorer outcome after arch operations. For survivors of root/ascending aorta operations, there was no significant difference in long-term outcome between reoperations and primary procedures, with both restoring longevity to expected levels for an age- and sex-matched normal population. Patients undergoing arch operations, however, continued to have a poorer long-term outlook than their normal peers.

Conclusions: In this series, reoperations in the transverse arch carry the same risk as primary arch procedures, but a higher operative mortality is seen with reoperative than with primary root/ascending aorta procedures. The long-term outlook is better for patients undergoing root/ascending operations than for patients undergoing aortic arch operations, with no difference in the longevity of patients undergoing primary procedures versus reoperations.

Operations on the aortic root/ascending aorta and aortic arch are not uncommon in patients who have had, often many years earlier, other types of cardiac or aortic operations.¹⁻⁸ This study was undertaken to assess the risk factors associated with these reoperations and to determine their long-term outcomes.

Preliminary analysis of the patients who had reoperative surgery involving the proximal aorta showed significant differences in reoperative profile from patients

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Abbreviations and Acronyms

COPD	= chronic obstructive pulmonary disease
HCA	= hypothermic circulatory arrest
SCP	= selective cerebral perfusion
SMR	= standardized mortality ratio

whose reoperations involved the aortic arch. It was therefore decided that the patients who had aortic root/ascending aorta reoperations should be analyzed separately from those whose reoperations involved the aortic arch.

To analyze not only the immediate results of the reoperations but also their long-term sequelae, we reviewed our results in patients who had undergone either aortic root/ascending aorta or aortic arch surgery as a primary operation during the same interval as the patients undergoing reoperations. This allowed us more accurately to determine long-term survival after aortic root/ascending aorta and aortic arch surgery, to assess risk factors for adverse outcomes for each operative group, and to try to determine whether reoperation has a significant effect on long-term outcome.

Because patients undergoing aortic operations are usually somewhat elderly and have significant comorbidities, we have elected to place the emphasis on outcome compared with an age- and sex-matched general population. Thus in addition to describing operative mortality and complications according to standard surgical definitions, we also describe survival at 1 year and after 1 year compared with that of an age- and sex-matched New York State population.

Materials and Methods

A review of the institutional database disclosed 680 patients who underwent aortic root or transverse arch replacement from January 1998 to December 2004. A previous cardiac or aortic operation had been performed in 200 patients; 480 patients underwent primary procedures within this period. The institutional review board approved this research, and additional patient consent was not required.

Patient Demographics

Patients undergoing reoperations. Two hundred patients (146 male patients; age, 60.2 ± 15.1 years) underwent aortic reoperations at our institution (January 1998–December 2004) after 1 or more previous cardioaortic procedures. Table 1 summarizes the clinical characteristics of the patients undergoing reoperations. Most of the patients undergoing reoperations had undergone 1 previous operation, but 29 had 2 previous procedures, 9 had 3 previous procedures, and 1 each had 4, 5, and 6 previous heart procedures. Patients with multiple previous operations often had congenital heart defects that involved heart valves or the transverse arch. Because our institution is a referral center for aneurysm surgery, the patients reported herein might not reflect the prevalence of different kinds of aortic pathology in the community at large.

The principal indication for reoperative surgery was chronic aortic dissection in 69 patients, degenerative aneurysm in 54 and atherosclerotic aneurysm in 30 patients, aortic valve dysfunction in 37 patients, endocarditis in 12 patients, and acute dissection in 4 patients. In patients undergoing primary procedures, in contrast, there were fewer patients with chronic dissection (7.5% vs 35%), infection (2% vs 6%), and false aneurysms (0% vs 6%).

Primary procedures. Four hundred eighty patients who had undergone aortic procedures as primary operations during the same interval as the reoperations (January 1998–December 2004) were also reviewed: 335 patients who had primary aortic root/ascending aorta procedures and 145 who had transverse arch procedures. Three hundred twenty-three were male, and the mean age was 62.4 ± 15.9 years. The patients who had primary procedures were well matched with those who had reoperations with regard to a history of hypertension, coronary artery disease, chronic obstructive pulmonary disease (COPD), and diabetes, sex, urgency of operation, and ejection fraction, but differed in having a significantly higher incidence of aortic dilatation and a higher mean age than the patients undergoing reoperations.

Previous procedures in patients undergoing reoperations. In accordance with our hypothesis that patients with root/ascending aorta and arch aneurysms differ, it should be noted, as detailed in Table 1 and Figure 1, that previous aortic valve surgery had been carried out in 50% of patients undergoing reoperative root procedures, whereas previous surgical intervention on the aorta had

TABLE 1. Clinical profile of patients undergoing reoperative root/ascending aorta (n = 100) and arch (n = 100) procedures

Demographics	Roots	Arches
No. of patients	100	100
Mean age, y (\pm SD)	58.8 (\pm 15.6)	61.7 (\pm 14.6)
Age >60 y	54	55
Male sex	79	67
Number of previous operations (median [range])	1 (1–6)	1 (1–5)
Aortic valve replacement/repair	50	14
CABG with or without valve (other than aortic)	16	13
Aortic root replacement \pm arch	23	58
Other	11	15
Timing of operation		
Elective	80	83
Urgent	9	10
Emergency	11	7
Risk factors		
Left ventricular EF \leq 30%	6	4
History of hypertension	43	62
Coronary artery disease	25	25
Smoking	13	21
Diabetes	3	2
COPD	3	5

Values are presented as percentages or mean numbers as shown. SD, Standard deviation; EF, ejection fraction; COPD, chronic obstructive pulmonary disease.

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