Influence of aortitis on late outcomes after repair of ascending aortic aneurysms

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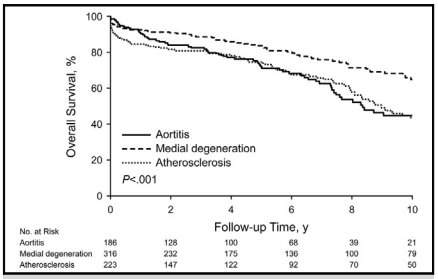
ABSTRACT

Objective: To determine outcomes of repair of ascending aortic aneurysms in patients with histopathologic diagnoses of aortitis.

Methods: We reviewed histopathologic findings and outcomes of elective repair of ascending aortic aneurysms between January 1, 1955, and December 31, 2012. Noninfectious aortitis was identified in 186 patients, and we compared outcomes for these patients with outcomes for others operated on at the same time with diagnoses of medial degeneration (n = 317) or atherosclerosis (n = 232).

Results: Early mortality (<30 days postoperatively) for patients with aortitis was 2%, and overall 10-year survival was 45%, compared with 66% for patients with medial degeneration, and 45% for patients with atherosclerosis ($P < .001$ vs medial degeneration). In addition to histopathologic diagnosis, overall mortality was influenced by older age at operation (hazard ratio [HR]: 1.060; 95% confidence interval [CI], 1.046-1.077; $P < .001$), chronic obstructive pulmonary disease (HR: 1.560; 95% CI: 1.136-2.136; $P = .006$); concomitant coronary artery bypass grafting (HR: 1.980; 95% CI: 1.520-2.600; $P < .001$); and use of circulatory arrest (HR: 1.500; 95% CI: 1.148-1.960; $P = .003$). Risk of aortic reoperation at 10 years was 21% for aortitis patients, compared with 11% for those with medial degeneration, and 19% for patients with atherosclerosis ($P = .028$).

Conclusions: Patients with repaired ascending aneurysms secondary to noninfectious aortitis have low early mortality, but late risks of death and aortic reoperation are increased, compared with these outcomes for patients with aneurysms that result from medial degeneration. (J Thorac Cardiovasc Surg 2015;150:589-94)



Overall survival differed significantly between groups.

Central Message

Patients with aneurysms and aortitis have greater risk for reoperation (21%) than do those with medial degeneration (11%) or atherosclerosis (19%).

Perspective

This study describes outcomes of patients who were found to have aortitis at the time of excision of ascending aortic aneurysms. Compared with patients who have medial degeneration or atherosclerosis, patients with aortitis have an increased risk of aortic reoperation. Precise pathologic diagnosis of ascending aortic aneurysms may be helpful in stratifying prognosis and treatment.

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ACD

Inflammation of the aortic wall is an important cause of aortic aneurysms, and noninfectious aortitis is being identified with increasing frequency in patients undergoing elective replacement of the ascending aorta.[1] Of the patients who are found to have aortitis, 96% have no associated systemic illness.[2] In surgical series, the prevalence of noninfectious aortitis among patients with aortic aneurysms ranges from 4.4% to 8.4%, yet few data are available to guide surgical and postoperative management.[1,2]

Previous studies of surgical treatment of patients with aortic aneurysms secondary to aortitis have focused on the extent of aortic involvement and surgical methods, including the need for aortic valve replacement.[3] However, no large studies have been done of late outcomes of ascending aneurysm repair in patients who have aortitis, compared with patients who have medial degeneration or atherosclerosis. The purpose of this study was to determine whether the outcome of repair of ascending aortic aneurysms, in patients who have noninfectious aortitis, differs from the outcome of operation in patients with aneurysms caused by atherosclerosis or medial degeneration.

METHODS

Cohort Selection

After obtaining approval from the Mayo Clinic Institutional Review Board, we reviewed all patients aged >18 years who underwent surgical replacement of the ascending aorta between January 1, 1955, and December 31, 2012, at Mayo Clinic in Rochester, Minn. Patients were

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Read at the American Association for Thoracic Surgery Aortic Symposium, New York, New York, April 24-25, 2014.

Received for publication Dec 30, 2014; revisions received June 5, 2015; accepted for publication June 16, 2015; available ahead of print July 15, 2015.

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0022-5223/$36.00

http://dx.doi.org/10.1016/j.jtcvs.2015.06.027

Abbreviations and Acronyms
CI = confidence interval
HR = hazard ratio

excluded if they did not give permission for research or did not have available pathology reports. Patients were additionally excluded if they had aneurysms secondary to aortic dissection, heritable connective tissue disease (eg, Marfan syndrome or Ehlers-Danlos syndrome), infectious aortitis, or congenital heart disease, including bicuspid aortic valve. Patients with Takayasu arteritis were excluded because they are generally younger and have characteristic clinical presentations and associated obstructive aortic disease (Figure 1).

Preoperative and postoperative clinical data were obtained from the patients' electronic health records and a cardiovascular surgical database. Additional follow-up data were obtained from patient and physician correspondence, and from questionnaires sent to patients 1, 3, 5, 10, 15, and 20 years after their operation.

Histopathologic Evaluation

Patients who met study criteria were divided into 3 groups, according to the cause of their ascending aortic aneurysm as assessed via a histologic examination of the surgical specimen, conducted by a cardiovascular pathologist. The resected ascending aortic wall was fixed in 10% neutral buffered formalin, embedded in paraffin, cut at a thickness of 4 μm, and stained with hematoxylin-eosin and Verhoeff-van Gieson. Typically, 6 to 8 transmural sections were evaluated per patient.

Presence of aortitis was defined as medial inflammation, with associated medial damage. The character of the inflammatory infiltrate was noted as well—specifically, whether giant cells were present. Presence of medial degeneration was defined as fragmentation of elastic lamella, with associated mucopolysaccharide deposition. Presence of atherosclerosis was defined as intimal collections of foamy histiocytes and cholesterol, with or without associated inflammation and associated subjacent secondary medial change. The presence of any aortitis prompted classification as such. Those without aortitis were dichotomized into diagnosis categories of medial degeneration or atherosclerosis, depending on which process was most evident.

Statistical Analysis

Categoric data were summarized as frequency and percentage of samples; continuous data were summarized as mean ± SD. Categoric data for the groups were compared, using χ^2 analysis or the Fisher exact test; continuous data were compared using standard ANOVA or Kruskal-Wallis ANOVA, as appropriate. The Kaplan-Meier product-limit method was used to draw survival curves and calculate 5-year and 10-year survival, and estimates for freedom from reoperation.

Cox regression models were used to find the univariate and multivariate predictors of overall mortality and time to aortic operation. The multivariate models included variables that were significant on univariate analysis ($P < .05$), with model selection using the stepwise method (backward and forward methods resulted in the same model). All statistical tests were 2-sided.

RESULTS

Between 1955 and 2012, a total of 3177 patients underwent ascending aorta replacement. Of these patients, 735 met criteria for the study and were divided into 3 groups according to aortic pathology (Figure 2). Inflammatory, noninfectious aortitis was identified in 186 patients; medial degeneration was present in 317 patients; and atherosclerosis was the pathologic finding in 232 patients.

Demographics

Among patients with noninfectious, inflammatory aortitis, the mean age was 71 ± 11 years, and 35% of the patients (66 of 186) were men. These demographic data differed ($P < .001$) from data for patients who had medial degeneration (mean age: 64 ± 14 years; 69% men [219 of 317], $P < .001$) and for patients with atherosclerosis (mean age: 66 ± 11 years; 61% men [141 of 232], $P < .001$). Other vascular conditions, such as occlusive peripheral vascular disease ($P < .001$), coronary artery disease ($P = .003$), and stroke ($P = .010$), were significantly less prevalent in patients with medial degeneration, compared with patients who had noninfectious aortitis or atherosclerosis (Table 1). Among the 186 patients with noninfectious aortitis, giant cells were identified in 138 patients (74%), and lymphoplasmacytic infiltrates without giant cells were observed in 48 patients (26%).

Among patients who had preoperative echocardiography (n = 348), the mean diameter of the midascending aorta was 57.3 mm in the group with noninfectious aortitis, 51.5 mm in the medial degeneration group ($P < .001$), and 52.7 mm in the atherosclerosis group ($P < .001$). Moderate-to-severe aortic valve regurgitation was diagnosed preoperatively in 56% (103 of 183) of patients with aortitis, 63% (190 of 300) of patients with medial degeneration, and 47% (92 of 195) of patients with atherosclerosis ($P < .001$ for all 3 groups; $P < .010$ for comparison of the medial degeneration group with the atherosclerosis group).

Aortic Valve

Concomitant aortic valve procedures were performed in 58% (107 of 186) of patients with noninfectious aortitis, 77% (243 of 317) of patients with medial degeneration ($P < .001$), and 59% (137 of 232) of patients with atherosclerosis ($P < .753$). Among patients who underwent concomitant aortic valve operations, aortic valve–sparing procedures were used relatively more often in patients with noninfectious aortitis (40%; 42 of 106) than in patients

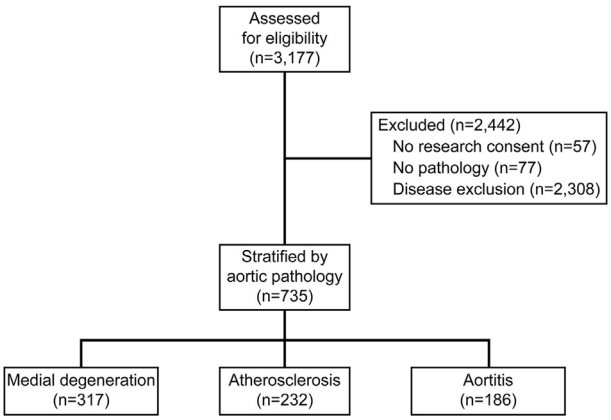

FIGURE 1. Patient selection and stratification.