Incidence of Aortitis in Surgical Specimens of the Ascending Aorta Clinical Implications at Follow-Up

Andrea De Martino, MD, Paolo Ballestracci, MD,* Lorenzo Faggioni, MD,† Stefano Pratali, MD,* Riccardo Morganti, ScD, PhD,‡ Angela Pucci, MD, PhD,§ and Uberto Bortolotti, MD**

The objectives of this study are to evaluate the incidence of aortitis on a surgical population, establish any relationship with systemic diseases, verify early and late surgical results and provide clinical and radiological follow-up to determine factors potentially predicting progression of the disease and influencing late outcome. From 2009 to 2017, 237 patients underwent elective operations on the ascending aorta. Segments of the excised tissues were routinely sent for histologic evaluation, providing adequate data in 178 (75%) for a clinical and pathologic correlation. Patients with aortitis (Group 1) ($n = 26$) were compared with 152 with atherosclerotic or degenerative disease (Group 2). Incidence of aortitis was 15%, being clinically isolated in 73%. In 24 patients (92%), a giant cell aortitis was found. Actuarial survival at 3 years is 88% in Group 1 and 98% in Group 2 and 74% and 98% at 5 years, respectively (P = 0.016). A control angio-computed tomography revealed an increased descending aorta diameter in 2 out of 14 late survivors. A positron emission tomography showed presence of arteritis in other vascular segments in 3 patients. Clinically isolated aortitis is extremely frequent in patients with inflammatory aortic disease. The diagnosis is often difficult and may be supported by routine pathologic evaluation of surgical explants and by multimodality imaging. The latter should be employed to allow adequate patient follow-up and to disclose potential recurrences in untreated aortic segments.

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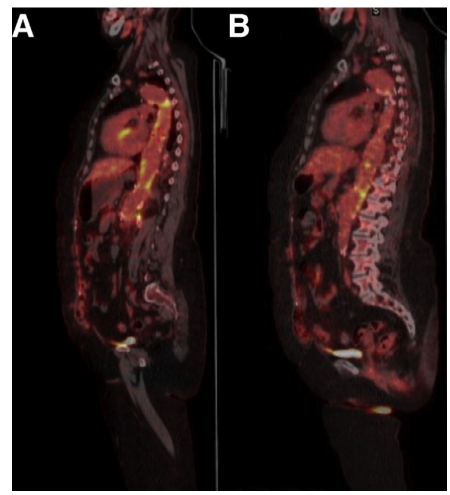
Keywords: aortitis, clinically isolated aortitis, inflammatory aortic disease



Postoperative PET showing reduction of inflammation after 8 months of steroid therapy.

Central Message

Inflammatory disease is associated with ascending aorta or root dilatation requiring surgical treatment. Such patients may present a higher late mortality and potential evolution of the aortic disease.

Perspective Statement

The importance of routine detailed analysis of aortic wall segments by histopathologic methods may help to establish the real incidence of aortitis. A multidisciplinary approach, including clinical, pathological, and multimodality imaging, should be used to better identify such patients and to provide adequate treatment and follow-up protocols.

INTRODUCTION

In patients with aneurysms of the ascending aorta, graft replacement of the dilated segment is still the procedure of choice after the first report by Cooley and De Bakey in 1956.[1] In those with aortic valve disease associated with ascending aorta or root dilation, combined replacement of the aortic valve and aorta, with the modified Bentall-de Bono procedure[2] or the use of valve-sparing techniques,[3,4] is indicated based on the type of valvular pathology. In most of such patients, the underlying disease, excluding atherosclerosis, is most frequently represented by degeneration of the medial

Abbreviations: CT, computed tomography; 2D, 2-dimensional; GC, giant cell; NYHA, New York Heart Association; PET, positron emission tomography; CIA, clinically isolated aortitis

*Section of Cardiac Surgery, University Hospital, Pisa, Italy
†Division of Radiology, University Hospital, Pisa, Italy
‡Section of Statistics, University Hospital, Pisa, Italy
§Division of Histopathology, University Hospital, Pisa, Italy

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Address reprint requests to U. Bortolotti, MD, Sezione Autonoma di Cardiochirurgia Universitaria, Università di Pisa, Via Paradisa, 2, 56124 Pisa, Italy. E-mail: uberto.bortolotti@med.unipi.it

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aortic layer in subjects with known or unknown connective tissue disorders.[5−8]

Inflammation of the aortic wall, identified as aortitis, may also be responsible for the onset of aneurysms and dissections, although its incidence is quite low, ranging from 2% to 15% in most surgical and pathologic reports.[9−12] Furthermore, a uniform classification of aortitis has never been available and only recently a Consensus statement has focused on the issue of inflammatory diseases of the aorta indicating criteria according to which ascending aorta specimens should be categorized.[13,14] We have analyzed samples obtained from patients undergoing a variety of procedures on the aortic valve and ascending aorta or root and the results are presented in this report. The main aims of the study were to assess in this surgical population the incidence of aortitis, to evaluate any relationship with systemic diseases, and to provide clinical and radiological follow-up to determine factors potentially predicting progression of the disease and influencing late outcome.

METHODS

Study Design

In patients having replacement of the ascending aorta, segments of the aortic wall were sent for histologic examination to disclose the ultrastructural nature of the underlying disease. This study was designed to evaluate patients with and without a histologic diagnosis of aortitis by comparing their clinical characteristics and the aortic diameters based on results of imaging studies. After a histologic diagnosis of aortitis, patients were referred for rheumatologic evaluation to assess presence and level of inflammatory markers such as C-reactive protein, erythrocyte sedimentation rate, and fibrinogen as previously suggested by others.[9−11] When appropriate, a positron emission tomography (PET) was planned to confirm inflammation and monitor response to treatment. Our institutional review board approved this retrospective study with patient consent waived.

Indication for Surgery

Preoperative assessment was based on transthoracic 2-dimensional (2D) echo and angio-computed tomography (CT) in all cases, whereas aortography was not routinely performed during coronary angiography. Indication for surgery was defined according to the aortic size in patients scheduled for isolated graft replacement of the ascending aorta and on clinical evaluation, aortic size and severity of aortic valve disease in those undergoing a combined procedure.

Histologic Analysis

For histology, at least 9 samples of each specimen were formalin-fixed, paraffin-embedded, and analyzed by using histochemical (Hematoxylin-eosin, Masson trichrome, Weigert and Alcian blue stains) and immunohistochemical methods for immunophenotyping of the inflammatory infiltrates. Aortic pathology was classified according to the diagnostic criteria of the Consensus Conference, including the evaluation of necrosis or scarring area extent.[13,14] In particular, aortitis was categorized as follows: (1) granulomatous/giant cell (GC) pattern, characterized by epithelioid macrophages with or without GCs (usually without well-formed granulomas) and by a lymphoplasmacytic component; (2) lymphoplasmacytic pattern without a granulomatous component; (3) mixed inflammatory pattern (different types of inflammatory cells without a granulomatous component); (4) suppurative pattern (neutrophilic abscesses with necrosis and cell debris).

Patient Follow-Up

All survivors were contacted and invited to refer to our center for clinical reevaluation. For those unable to come to our outpatient clinic, information was obtained from direct telephone interviews or through relatives or referring physicians. During the last follow-up visit, patient status was assessed, and major postoperative complications determined according to current guidelines.[15,16] In those undergoing valve repair or replacement, aortic valve or prosthesis function was evaluated using transthoracic 2D echo. In patients with a histologic diagnosis of aortitis, a rheumatologic evaluation was indicated to establish the most appropriate medical treatment and further more detailed studies such as PET and angio-CT. At control angio-CT, the aortic size was measured at the root (maximal dilation of the sinuses of Valsalva), ascending (at its maximal diameter), middle arch (between innominate artery and left carotid artery), and descending tract (at its maximal diameter). PET was directed to verify the diffusion of the disease and the effectiveness of the medical treatment.

Statistical Analysis

Categorical data were described by absolute and relative frequency, whereas continuous data by mean and standard deviation. To compare categorical variables, a z-test for 2 proportions was used; continuous variables were compared by t test (two-tailed). The study endpoint was late survival, defined as the time from aortic surgery to death. Survival curves were calculated using the Kaplan-Meier method, while the log-rank test was used to evaluate the differences between curves. Univariate survival analysis was performed by Cox regression using as main variables age, gender, hypertension, atrial fibrillation, New York Heart Association (NYHA) class, concomitant cardiac pathology, and aortitis. Hazard ratio (HR) (with its related confidence interval) and P value were calculated too. Differences were considered significant at $P < 0.05$. All analyses, descriptive and inferential, were performed using the SPSS v.24 technology.

RESULTS

From 2009 to 2017, 237 consecutive patients underwent elective replacement of the ascending aorta or arch, either isolated or combined with replacement or repair of the aortic valve.

Histopathologic Data

Although segments of the excised tissues were routinely sent for histologic evaluation, only in 178 (75%) of this series adequate clinical and pathologic data were available; therefore, 59 patients with incomplete data were excluded. In 26 (Group 1) out of 178 patients (15%), a histologic diagnosis of aortitis was reported (Fig. 1), whereas the remaining 152 (Group 2) showed degenerative ($n = 89$) or atherosclerotic ($n = 63$) disease. In Group 1, GC aortitis was found in 24 cases (92%) (pattern 1), and lymphoplasmacytic infiltrates in 2 (8%) (pattern 2). In both cases of the lymphoplasmacytic group, luetic aortitis was diagnosed based on serologic data. A preoperative diagnosis of GC temporal arteritis and polymyalgia rheumatica was present in 4 and 1 patients, respectively. The remaining 19 patients were considered to have a clinically isolated aortitis (CIA).

Patient Data

In the entire series, most patients were males (122; 69%); mean age was 66 ± 11 years (range, from 30 to 83 years). Preoperative diagnosis was isolated ascending aortic aneurysm in 55 patients (31%) and root and ascending aorta dilation with variable degree of aortic valve regurgitation or stenosis in 123 patients (69%). A bicuspid aortic valve was found in 47 patients (26%), while 5 had a diagnosis of Marfan's syndrome; other associated cardiovascular diseases were present in 26 patients (15%). Hypertension was present in 76%, diabetes in 12%, and atrial fibrillation in 7%. In 2% of cases, patients had previously undergone other cardiac surgical procedures. Table 1 shows patients' characteristics according to presence of aortitis: patients with aortitis were mainly females ($P = 0.015$) with fewer cases of bicuspid aortic valves. Table 2 shows the preoperative aortic sizes in the 2 groups measured at various aortic levels; in patients with aortitis, the ascending aorta was significantly more dilated (55.4 ± 10.7 mm vs 50.2 ± 6.7 mm, $P = 0.001$).

Surgical Data

The following surgical procedures were performed: isolated graft replacement of the ascending aorta in 103 patients (58%), with separate aortic valve replacement or repair in 68 of them, a valve-sparing procedure in 58 (32.5%), a modified Bentall-de Bono operation in 16 (9%), and an aortic root remodeling in 1 (0.5%). Details of the surgical techniques employed have been previously outlined.[17,18]

Early and Late Results

In the entire group there were 15 operative deaths (8%). In Group 1, 2 patients died of multiorgan failure, 1 of myocardial infarction, and 1 of sepsis; in Group 2, 4 patients died of multiorgan failure, 3 of respiratory failure, 2 of sepsis, and 2 of hemorrhage.

Median follow-up was 30.5 months (2−79 months), ending in December 2017. All operative survivors were reevaluated except 2 who were lost at follow-up, which is 92% complete. There were 5 late deaths (3 in Group 1 and 2 in Group 2).

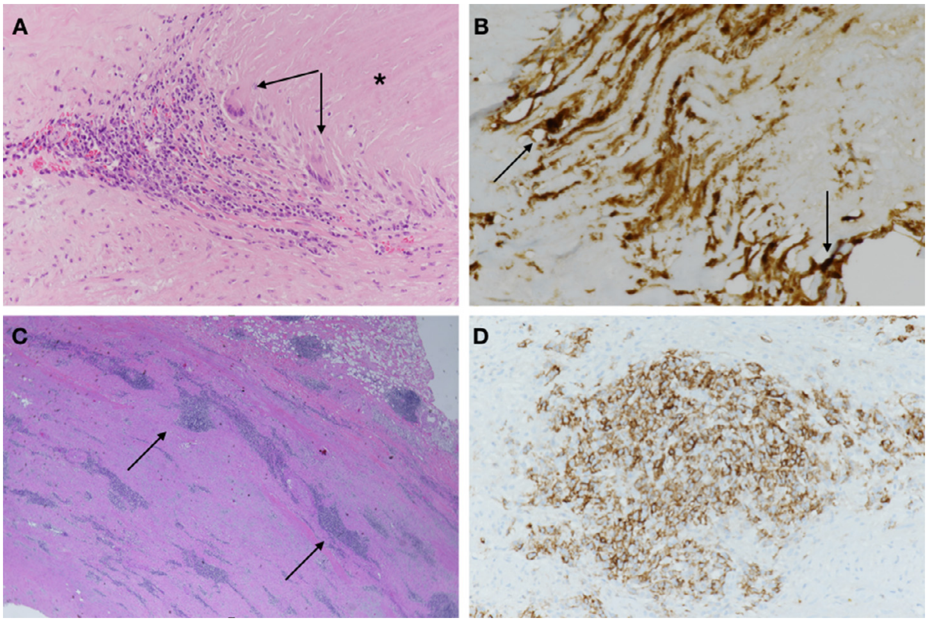

Figure 1. (A) Aortitis with giant cells (arrows) associated to lymphocytic and monocytic infiltrates, adjacent to areas of acellular necrosis (asterisk) of the media in the aorta of a 67-year-old woman with ascending aorta aneurysm. (B) In the same patient, giant cells are immunoreactive for monocyte-macrophage associated CD68 antigen as shown by immunoperoxidase reaction (arrows). (C, D) Diffuse infiltrates are present in a luetic aortitis of a 63-year-old man being mainly represented by CD138 positive plasma cells (arrows). (A, C) Hematoxylin-eosin staining, original magnification 20× and 2×. (B, D) Immunoperoxidase technique and hematoxylin counterstaining, original magnification 40× and 20×.

Table 1. Baseline Characteristics of Patients Undergoing Surgery on Thoracic Aorta

Patient Characteristics	Total *N* (%)	Group 1 (Aortitis)	Group 2 (No Aortitis)	*P* Value
Number of patients	178	26	152	
Female sex	56 (31)	14 (54)	42 (28)	0.015
Age at surgery (mean, years)	66 ± 11	69 ± 12	66 ± 11	ns
Hypertension	135 (76)	21 (81)	114 (75)	ns
Diabetes	21 (12)	1 (4)	20 (13)	ns
Atrial fibrillation	13 (7)	4 (15)	9 (6)	ns
NYHA class				
Mean	1.8 ± 0.8	1.6 ± 0.7	1.8 ± 0.9	ns
I	78 (44)	14 (54)	64 (42)	
II	61 (34)	9 (35)	52 (35)	
III	34 (19)	3 (11)	31 (20)	
IV	5 (3)	0	5 (3)	
Associated pathology				
Aortic stenosis	39 (22)	2 (8)	37 (24)	ns
Aortic regurgitation	87 (49)	13 (50)	74 (49)	ns
CAD	17 (10)	2 (8)	15 (10)	ns
Mitral stenosis/regurgitation	9 (5)	1 (4)	8 (5)	ns
Previous cardiac surgery	3 (2)	0	3 (2)	ns
Bicuspid aortic valve	47 (26)	1 (4)	46 (30)	0.010

CAD = coronary artery disease; ns = not significant; NYHA = New York Heart Association.

Table 2. Comparison of Mean Preoperative Aortic Diameters **(**mm**)** in the 2 Groups

	Total	Group1 (Aortitis)	Group 2 (No Aortitis)	*P* Value
Root	42.7 ± 7.1	40.3 ± 6.3	43.1 ± 7.2	ns
Ascending	50.9 ± 7.5	55.4 ± 10.7	50.2 ± 6.7	0.001
Middle arch	32.9 ± 6.4	34 ± 3.9	32.7 ± 4.5	ns
Descending	34.2 ± 6.2	33.7 ± 5.2	34.4 ± 6.1	ns

ns = not significant**.**

Causes of late death were cardiac failure in 1, neoplasm in 1, and cerebral hemorrhage in 1 in Group 1. In Group 2, 1 patient died of cerebral hemorrhage and 1 of cardiac failure. Univariate analysis showed that late mortality was influenced by presence of aortitis (P = 0.01, HR = 9.1), atrial fibrillation (P = 0.02; HR = 6.6), increasing degree of NYHA functional class (P = 0.01; HR = 2.9), and concomitant mitral valve disease (P = 0.01; HR = 8.0; Table 3). Actuarial survival at 3 years is 88% in Group 1 and 98% in Group 2 and 74% and 98% at 5 years, respectively (P = 0.016; Fig. 2).

Table 3. Univariate Analysis by Cox Regression of Factors Affecting Survival

Variable	HR (95% CI)	*P* Value
Female sex	3 (0.7–13.4)	ns
Age at surgery (mean, years)	1.1 (0.9–1.2)	ns
Hypertension	1.8 (0.2–15)	ns
Atrial fibrillation	6.6 (1.3–34.6)	0.025
NYHA class	2.9 (1.3–6.6)	0.012
Associated pathology		
Aortic stenosis	1.3 (0.2–6.5)	ns
Aortic regurgitation	1.8 (0.3–5.7)	ns
CAD	1.8 (0.2–12.3)	ns
Mitral stenosis/regurgitation	8 (1.6–61.4)	0.013
Bicuspid aortic valve	0.03 (0.1–45)	ns
Ejection fraction (%)	0.9 (0.9–1.1)	ns
Presence of aortitis	9.1 (1.5–54.9)	0.016

CAD = coronary artery disease**;** CI = confidence interval; HR = hazard ratio; ns= not significant; NYHA = New York Heart Association**.**

Imaging Studies Results

After an informed consent was obtained, out of 19 late survivors with aortitis, a control angio-CT scan was performed in 14 (74%) (from 13 to 60 months), while 3 refused such procedure and in 2 it was not performed for coexisting morbidities (Fig. 3). Comparison of the arch size and descending aorta at its maximal diameter did not show any significant variation at follow-up except for 2 patients: a 55-year-old woman with preoperative diagnosis of GC arteritis, in whom a dilatation of the thoracic aorta from 38 mm to of 55 mm after 11 months was observed and an 81-year-old woman with clinically isolated GC aortitis, who showed an increase in the descending aorta size of 12 mm at a 17 months interval (Table 4).

Based on the results of the rheumatologic evaluation and laboratory testing resulting positive for inflammatory syndrome, a PET was indicated in 6 patients. In 3 of them, it

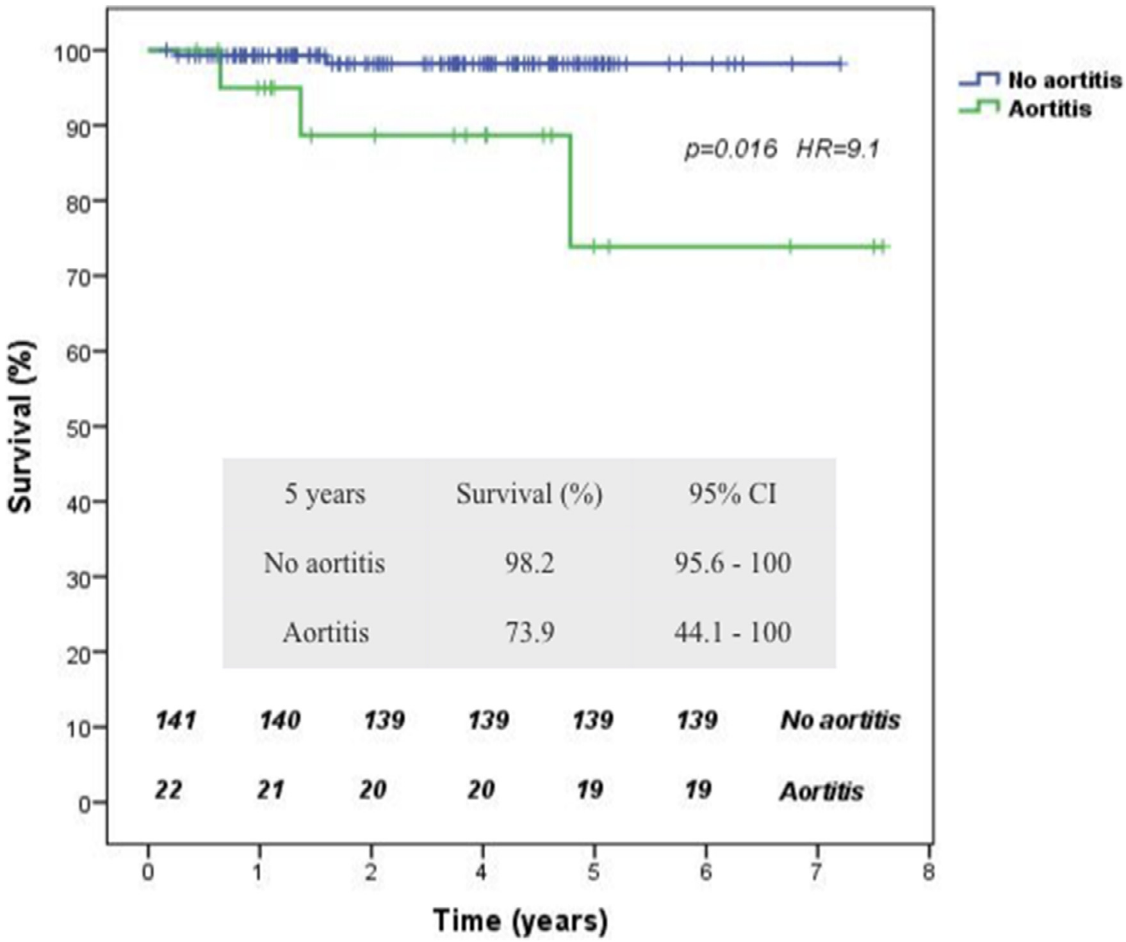

Figure 2. Actuarial survival in patients with and without aortitis. Numbers on the horizontal axis indicate patients at risk.

showed presence of inflammation in other vascular segments, while in 3 it was negative. Patients with persistent signs of inflammation were treated with high doses of steroids (prednisone 1 mg/kg/day orally to a maximum of 60 mg/day). In one of them, a repeat PET after 8 months showed a positive response to therapy (Fig. 4).

DISCUSSION

Incidence of Aortitis

The association between inflammatory diseases and thoracic or abdominal aortic aneurysms in surgical series has been recognized since 1972.[19,20] Until recently, however, the diagnosis of aortitis was predominantly made on postmortem observations.[12,21–23] In a report analyzing segments of thoracic and abdominal aorta in 20,591 necropsy studies performed between 1957 and 1971, aortitis was present in 15% of aneurysms, 8% of which were syphilitic, while 7% had the characteristics of inflammation that retrospectively was attributed to Horton disease or polymyalgia rheumatica.[12] Moreover, Pomerance et al in the late 70s, studying surgical specimens from patients undergoing various procedures on the thoracic aorta, reported 22% of aortitis, some of them being secondary to syphilitic infection.[20] Only in the early 90s, the importance of histologic patterns in surgically excised specimens to better define other causes of aortitis, such as Horton and Takayasu arteritis, started to be recognized.[24,25]

The incidence of aortitis in patients undergoing replacement of the thoracic aorta is infrequent, compared to degenerative and atherosclerotic disease, ranging from 2% to 15%.[9–12,24,25] Due to reduction or disappearance of specific infections, such as syphilis, CIA is currently diagnosed with increasing frequency. The study by Rojo-Leyva et al indicates that, excluding many diseases such as Horton arteritis, Takayasu disease, polymyalgia rheumatica, retroperitoneal fibrosis, and polyarteritis nodosa, CIA was diagnosed in 69% of their cases with inflammatory aortic disease.[10]

The results of our study confirm such observation. In fact, out of 178 aortic segments analyzed, a diagnosis of aortitis was made in 26 (15%) presenting as isolated disease in 19 (73%). Based on the recently revised classification,[13] 2 main patterns were observed: GC aortitis in 24 and lymphoplasmacytic aortitis in 2.

Figure 3. (A) Preoperative angio-computed tomography in an 81-year-old woman with dilatation of the ascending aorta and of the proximal tract of the descending aorta. Histology showed the presence of giant cell aortitis. (B) Postoperative control at 17 months following isolated replacement of the ascending aorta, with further dilatation of the thoracic aorta.

Clinical Presentation

Clinical diagnosis of aortitis may be difficult before histologic examination: indeed, out of 26 patients in this series, 19 were classified as isolated aortitis. Lee et al, reviewing various reports aiming to identify peculiar presentations in patients with GC aortitis, failed to find specific clinical features prior to histologic analysis.[26] Also in our experience, lacking peculiar symptoms and because common serologic markers of inflammation, such as erythrocyte sedimentation rate and C-reactive protein, were not uniformly elevated, the diagnosis of CIA was not recognized until the pathologic reports were available.

Analyzing retrospectively patients with aortitis, we found it more frequently in female sex and in patients with larger ascending aorta diameters compared to those with atherosclerotic or degenerative disease. While the prevalence of female sex has been previously recognized, differences in aortic diameters have not been so far underlined.[9,27,28] Thus, this may probably be considered an incidental finding which, however, should be worth of further confirmation by larger surgical series.

Surgical Treatment

Treatment of patients with aortitis may still be a surgical challenge. Recent evidences indicate that patients with this type of pathology tend to develop subsequent aneurysms or dissections in segments of aorta left untreated. In a case-control study with long-term follow-up on patients with GC aortitis without signs or symptoms of systemic vasculitis, Wang et al report a significant higher rate of aneurysmal evolution or dissections compared to the control group.[29] Indeed, other authors report that ascending aortic aneurismal disease due to GC aortitis is frequently associated with proximal and/or distal aortic involvement. In such patients, valve-sparing procedures are technically feasible, as performed also in our series with aortitis. However, the long-term durability of these procedures in this setting is still uncertain.[30]

Follow-Up

Although our follow-up is still limited, we have observed a better outcome for patients without aortitis with an actuarial

Table 4. Pre- and Postoperative Data in Patients With Aortitis

Sex/Age (y)	Systemic Disease	Types of Surgery	Pathology Diagnosis	Preop. Arch-DTA Diameter	Postop. Arch-DTA Diameter Surgery	Follow-Up
M/61	CIA	AA replacement	GC aortitis	44–41	44–41	Alive
M/38	CIA	Bentall	GC aortitis	34–28	34–29	Alive
F/65	CIA	AA replacement	GC aortitis	38–33	38–33	Alive
F/74	CIA	AA replacement	GC aortitis	31–36	NA	Operative death
M/63	Syphilis	Valve-sparing	LP aortitis	39–30	43–33	Alive
F/55	Horton arteritis	AA replacement	GC aortitis	31–38	41–55	Alive
F/78	Horton arteritis	Valve-sparing	GC aortitis	33–28	33–29	Alive
F/75	Polymyalgia rheumatica	AA replacement	GC aortitis	32–40	35–41	Alive
F/74	CIA	Valve-sparing	GC aortitis	35–41	NA	Late death
F/81	CIA	AA replacement	GC aortitis	35–36	38–48	Alive
M/46	CIA	Valve-sparing	GC aortitis	30–34	NA	Alive
F/67	Horton arteritis	AA replacement	GC aortitis	28–35	30–41	Alive
F/66	CIA	Bentall	GC aortitis	36–36	37–40	Alive
M/76	Horton arteritis	AA replacement	GC aortitis	30–50	NA	Late death
M/54	CIA	AA replacement	GC aortitis	30–38	NA	Alive
M/69	Syphilis	AA replacement	LP aortitis	28–28	NA	Alive
F/82	CIA	AA replacement	GC aortitis	34–32	NA	Operative death
F/78	CIA	AA replacement	GC aortitis	36–42	NA	Late death
M/80	CIA	AA replacement	GC aortitis	38–34	39–34	Alive
M/80	CIA	AA replacement	GC aortitis	39–40	NA	Operative death
F/69	CIA	AA replacement	GC aortitis	39–41	39–41	Alive
M/81	CIA	AA replacement	GC aortitis	30–25	NA	Alive
F/64	CIA	AA replacement	GC aortitis	38–28	40–33	Alive
M/79	CIA	AA replacement	GC aortitis	33–35	NA	Operative death
F/80	CIA	AA replacement	GC aortitis	32–36	NA	Alive
F/74	CIA	AVR + AA replacement	GC aortitis	32–33	35–34	Alive

AA = ascending aorta; AVR = aortic valve replacement; CIA = clinically isolated aortitis; DTA = descending thoracic aorta; GC = giant cell; LP = lymphoplasmacytic; NA = not available.

survival of 98% vs 74% at 5 years, aortitis being at univariate analysis a risk factor for late mortality. However, causes of late deaths were apparently not specifically related to aortitis itself; our finding could partly be related to chance and deserves further analysis. Svensson et al have observed a late survival at 8 years of 54.7% in patients with aortitis with an increasing number of reoperations with time.[9] However, comparison of late results in patients with and without aortitis undergoing ascending aorta procedures does not provide so far conclusive data from analysis of the current literature.[29,31]

In 14 (74%) of the survivors of Group 1, an angio-CT was performed in order to compare the size of the descending aorta before and after surgery. In only 3 of them, dilatation of the descending aorta was observed, being considered significant in 2. Furthermore, PET was obtained in 6 patients, revealing signs of inflammation in other vascular districts in 3; in 1 of them reduction of signs of inflammation following corticosteroid treatment was observed at repeat PET within 1 year from operation. These results indicate the need for a thorough evaluation by noninvasive methods of such patients to disclose potential evolution of the disease at follow-up.[32] In particular, as suggested by others, the use of PET appears essential also in the preoperative evaluation of these patients, being particularly helpful in defining the extension of the inflammatory process and allowing differential diagnosis with other pathologies.[33–35] This is also confirmed by others who found that in these patients, angio-CT frequently disclose aneurysms at other sites at the time of initial aortic surgery, supporting the use of this technique for the diagnosis and clinical monitoring of patients with isolated aortitis.[29]

Limits of the Study

One of the major limits of this preliminary study is its retrospective nature which will stimulate planning of a future larger prospective one. The latter should be based on a protocol which includes all patients with dilation of the ascending aorta to provide careful preoperative and postoperative evaluation also in noninflammatory patients. Moreover, the small sample of patients with aortitis did not allow a more complex statistical

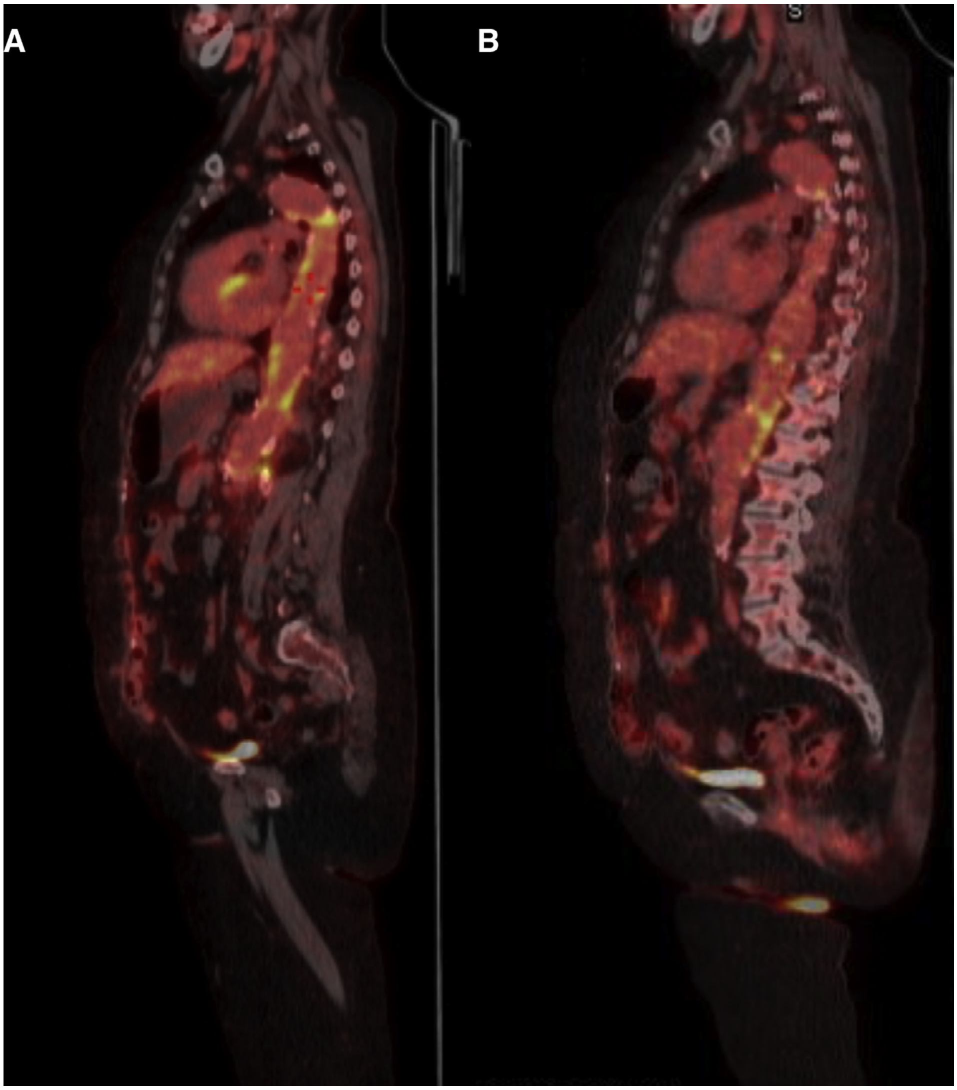

Figure 4. Sagittal views in a 75-year-old woman with giant cell aortitis undergoing replacement of the ascending aorta. (A) Postoperatively intense tracer uptake was localized mainly in the abdominal aorta. (B) After 8 months of corticosteroid therapy, partial reduction of inflammation is observed.

analysis. Angio-CT studies are planned as part of our follow-up protocol after surgical resection of the aorta but they are difficult to obtain due to absence of patient consent in most cases. For such reason, they were limited to cases of aortitis and therefore a comparison with patients with other etiologies is lacking. Moreover, in patients with aortitis, control angio-CT was mainly addressed to assess postoperative variation of aortic diameter. However, in the present report we have evaluated cases of aortitis according to a new classification and underlined the important role and prevalence of clinically isolated inflammatory aortic disease. These data may be helpful to better categorize this disease providing useful information for early and late management of such patients.

CONCLUSIONS

Our study has showed that the incidence of aortitis in patients undergoing ascending aortic surgery is infrequent, being in most cases clinically isolated and with the histologic features of GC arteritis. For this reason, accurate histologic evaluation of surgical samples appears extremely important for a correct diagnosis. In this setting, even complex valve-sparing procedures are feasible, but their long-term stability is still uncertain. Since aortitis may be associated with increased mortality and possible recurrence of dilatation of untreated aortic segments, careful preoperative assessment and postoperative evaluation with modern imaging techniques appears indicated.

SUPPLEMENTARY MATERIAL

The following is the supplementary data to this article:

Video 1. In this paper, we have reviewed a series of patients undergoing replacement of the ascending aorta to evaluate the frequency of aortitis. We underline the importance of a multidisciplinary approach, including clinical, pathological, and multimodality imaging, to better identify such patients and to provide adequate treatment and follow-up protocols.

APPENDIX

Table A1.

Table A1. Comparison of Baseline Characteristics of the Study Population and Patients Excluded

Patient Characteristics	Population	Excluded	*P* Value
Number of patients	178	59	
Female sex	56	17	0.703
Age at surgery (mean, years)	66 ± 11	67 ± 12	0.441
Hypertension	135	48	0.382
Diabetes	21	5	0.479
Atrial fibrillation	13	8	0.143
NYHA class (mean)	1.8 ± 0.8	2 ± 0.9	0.183
Associated pathology			
Aortic stenosis	39	20	0.066
Aortic regurgitation	87	24	0.274
CAD	17	9	0.224
Mitral stenosis/regurgitation	9	3	0.993
Previous cardiac surgery	3	3	0.150
Bicuspid aortic valve	47	12	0.350
Aortic diameter (mean, mm)			
Root	42.7 ± 7.1	42 ± 7.8	0.537
Ascending	50.9 ± 7.5	51.8 ± 9.5	0.472
Middle arch	32.9 ± 6.4	32.7 ± 5.2	0.828
Descending	34.2 ± 6.2	33.9 ± 4.9	0.736

CAD = coronary artery disease; NYHA = New York Heart Association.

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