Techniques

Mechanical Prosthetic Valve Sparing for Aortic Root Abscess

Complicated by Infective Endocarditis

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Aortic root abscess complicated by infective endocarditis of a mechanical prosthetic valve is associated with morbidity and death. We retrospectively report our experience with a valve-sparing technique for managing this condition.

From October 2014 through November 2017, 41 patients at our center underwent surgery for aortic root abscess complicated by infective endocarditis of a mechanical prosthetic valve. Twenty (48.7%) met prespecified criteria for use of our valve-sparing technique after careful assessment of the mechanical valve and surrounding tissues. Our technique involved draining the abscess, aggressively débriding all infected and necrotic tissues, and then repairing the resulting defect by suturing a Gelweave patch to the healthy aortic wall and to the cuff of the valve.

We successfully preserved the mechanical aortic valve in all 20 patients. Two (10%) died early (≤30 d postoperatively) of low cardiac output syndrome with progressive heart failure, superadded septicemia, and multisystem organ failure. At 1-year follow-up, the 18 surviving patients (90%) were symptom free and had a well-functioning mechanical aortic valve with no paravalvular leak.

We conclude that, in certain patients, our technique for managing aortic root abscess and sparing the mechanical aortic valve is a safe and less time-consuming approach with relatively low mortality and encouraging midterm follow-up outcomes. ***(Tex Heart Inst J 2020;47(4):280-3)***

Key words: *Abscess/complications/diagnosis/surgery; aortic valve/surgery; debridement; endocarditis, bacterial/complications; heart valve prosthesis/adverse effects; prosthesis-related infections/surgery; reoperation*

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Aortic root abscess is a severe and challenging complication of infective endocarditis (IE) associated with a high risk of surgical morbidity and death.[1] The incidence of endocarditis in patients with a prosthetic valve ranges from 0.3% to 1.2%.[2] In a large multicenter study of patients with aortic valve IE, periannular abscess was relatively frequent overall (22%) and even more frequent in prosthetic valves (40%) than in native valves (19%).[1,3] Depending on the virulence of the microorganism, infection can be localized or extend into surrounding tissues.[1,4] Extensive aortic root abscess can present as a fistula or a rupture into one of the cardiac chambers, as a pseudoaneurysm, or as a life-threatening cardiac arrhythmia.

Aggressive surgical repair is frequently needed when antibiotics alone cannot stop infectious progression.[5] Coagulase-negative staphylococcal infections in particular are more aggressive and complicated than other microorganism infections.

Early surgical intervention is the optimal treatment for an echocardiographically diagnosed aortic root abscess. Conventional surgery includes aggressive débridement of the aortic root and all necrotic tissues, patch reconstruction of the débrided area, and aortic valve replacement with a prosthesis.[1] For large defects after débridement, the root may be replaced with a composite graft.[1] Delaying diagnosis or surgery may result in further destruction, ending in left ventricular–aortic discontinuity, especially in patients with an infected prosthetic valve.[6]

We retrospectively report our updated experience with a technique for managing aortic root abscess and preserving the mechanical prosthetic valve in certain patients.

Patients and Methods

From October 2014 through November 2017, 41 patients at our center underwent surgery for aortic root abscess complicated by IE of a mechanical prosthetic aortic valve. All patients were evaluated pre- and intraoperatively to determine their eligibility to

undergo the valve-sparing technique (Table I). Twenty-one patients did not meet those criteria and underwent abscess drainage, débridement, and valve replacement surgery. Twenty patients were eligible for the mechanical valve-sparing technique. The protocol for this retrospective study was approved by the local ethics committee.

Clinical diagnosis of IE was based on suspicious history and clinical examination according to modified Duke criteria. The presence of aortic root abscess was confirmed by means of transesophageal echocardiography. In-hospital laboratory tests included white blood cell counts, inflammatory marker assays, and blood cultures. Table II summarizes the demographic and clinical characteristics of the 20 patients, all of whom had a St. Jude bileaflet mechanical aortic valve.

Surgical Technique

Median sternotomy and cannulation of the ascending aorta were performed in standard fashion. Next, 19 patients underwent 2-staged right atrial venous cannulation. The remaining patient underwent bicaval cannulation because concomitant mitral valve replacement was needed. Cardiopulmonary bypass was started, and hypothermia was maintained at 32 °C. Myocardial protection was achieved with antegrade blood cardioplegia. After aortotomy, the mechanical valve was carefully examined to confirm that no vegetations were present and that the leaflets moved freely. Finally, we ensured that any paravalvular leakage involved no more than one third of the circumference of the valve cuff.

The valve-sparing technique began with draining the abscess, aggressively débriding infected and necrotic tissue, and repairing the resulting defect with a Gelweave patch (Vascutek), as described in a previous report.[7] The patch suture, performed in continuous running fashion, was started at the healthy aortic wall and continued to the cuff of the mechanical prosthetic valve (Fig. 1), with care taken to avoid injuring the affected coronary ostium.

Postoperatively, patients underwent 6 weeks of antibiotic treatment based on their blood culture findings and sensitivity.

TABLE I. Criteria for Using the Mechanical Prosthetic Valve-Sparing Technique

No rocking movement of valve, confirmed by preoperative TEE
Free movement of valve leaflets
No vegetations attached to valve leaflets or healthy part of valve cuff
Paravalvular leak involving no more than one third of the valve circumference
No defect in healthy part of prosthetic valve cuff, confirmed by gentle probing
No deep extension of abscess into endocardium or heart chambers, confirmed by TEE
No heart block, indicating no deep extension of abscess
Improved white blood cell counts and inflammatory markers, indicating good response to IV antibiotics

IV = intravenous; TEE = transesophageal echocardiography

Results

Annular aortic root abscesses were found in all 20 patients who underwent valve-sparing surgery. The mean interval between valve implantation surgery and reoperation was 7.35 ± 4.09 years (range, 1.5–20 yr).

The valve-sparing technique was successful in all the patients. Combined procedures included mitral valve replacement in one patient and coronary artery bypass grafting (CABG) in another. The valve-sparing procedure was elective in 11 patients (55%) and urgent

TABLE II. Demographic and Clinical Characteristics of the 20 Patients Who Underwent Valve-Sparing Surgery

Variable	Value
Age (yr)	36.25 ± 8.43 (18–56)
Sex	
Male	16 (80)
Female	4 (20)
Infectious organism	
Streptococcus viridans	9 (45)
Staphylococcus aureus	4 (20)
Enterococci	3 (15)
None (culture-negative)	4 (20)
Hypertension	4 (20)
Diabetes	6 (30)
Dyslipidemia	4 (20)
NYHA class	
I	0
II	2 (10)
III	16 (80)
IV	2 (10)
Renal impairment	1 (5)
Atrial fibrillation	6 (30)
Ventricular arrhythmia	0
Heart block	0
LVEF (%)	54.4 ± 12.37 (37–70)
Time since primary surgery for valve implantation (yr)	7.35 ± 4.09 (1.5–20)

AF = atrial fibrillation; LVEF = left ventricular ejection fraction; NYHA = New York Heart Association

Data are presented as mean ± SD and range or as number and percentage.

in 9 (45%) because of increasing dyspnea, New York Heart Association class II to IV function, and the need for diuretics. Surgical details are provided in Table III.

Low cardiac output syndrome necessitating inotropic support developed in 3 patients (15%). New temporary atrioventricular heart block necessitated implantation of a temporary pacemaker in 2 patients (10%), both of whom recovered completely. One patient had postoperative renal impairment but did not need dialysis. One patient had delayed neurologic recovery due to brain edema. Two patients (10%) died early (≤30 d postoperatively) of low cardiac output syndrome with progressive heart failure, superadded septicemia, and multisystem organ failure. Postoperative results are summarized in Table IV.

At 1-year follow-up, 18 patients (90%) were symptom free and had a well-functioning prosthetic aortic valve without paravalvular leak. Two patients had experienced recurrent IE. One of them was treated with antibiotics alone. The other underwent aortic root replacement with a composite graft 8 months after the valve-sparing procedure.

In the 4 patients who died or had a recurrent infection during the postoperative and follow-up periods, the infectious organisms were *Staphylococcus aureus* (n=3) and enterococci (n=1). The latter infection occurred in one of the patients who died early.

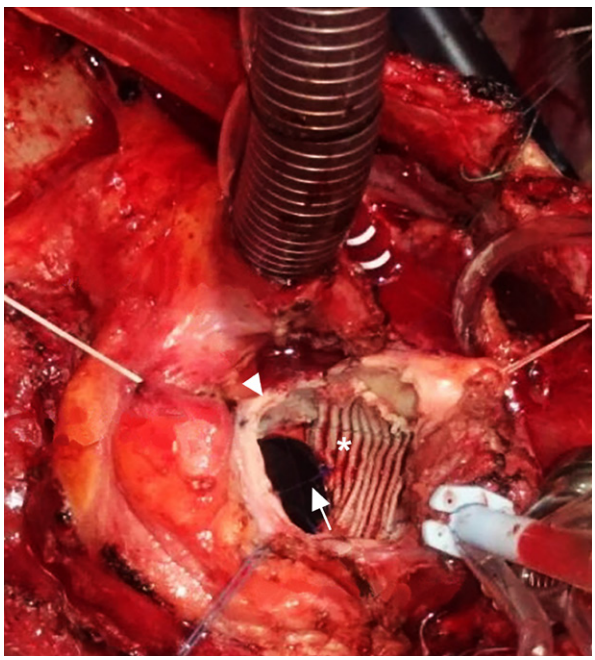

Fig. 1 *Intraoperative photograph shows a Gelweave patch (asterisk) that has been sutured to the healthy aortic wall and to the cuff of the spared bileaflet mechanical prosthetic valve (arrow). Also shown is the opening of the right coronary artery (arrowhead).*

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Discussion

Aortic root abscess in patients with an infected mechanical prosthetic aortic valve has long been a surgical challenge. In an autopsy study from 1976, Arnett and colleagues[8] reported frequent aortic root abscesses, with or without prosthetic valve dehiscence and extension of infection to adjacent structures. The natural history and expected clinical outcome of progressive heart failure and septicemia in such patients mandates urgent surgery.

Different surgical approaches have been used to manage aortic root abscess complicated by IE of a prosthetic aortic valve. Reitz and associates[9] successfully treated 3 patients by translocating the prosthetic aortic valve, closing the right and left coronary ostia, and then performing CABG with saphenous vein grafts. The groups of Frantz[10] and VanHooser[11] reported replacing the aortic root with a composite prosthetic valve–Dacron tube conduit. Glazier and colleagues[12] successfully treated 21 patients by means of homograft aortic root replacement. Symbas and associates[13] replaced an infected aortic valve and closed the abscess cavity with a synthetic patch. Yet, despite the good results, these techniques were surgically challenging, necessitating lengthy aortic cross-clamp and operative times, which can affect outcomes in such critically ill patients.[9-13]

Our valve-sparing technique was performed within relatively short cross-clamp (mean, 67 min) and total bypass (mean, 103 min) times (Table III). In comparison, Nottin and colleagues[14] reported a mean aortic cross-clamp time of 138 min and a mean total bypass time of

TABLE III. Surgical Details for the 20 Patients

Variable	Value
Urgency	
Urgent	9 (45)
Elective	11 (55)
Site of aortic root abscess	
Below RCC	7 (35)
Between right and left coronary ostia	9 (45)
Related to NCC	4 (20)
Concomitant procedures	
Mitral valve replacement	1 (5)
CABG	1 (5)
Cross-clamp time (min)	66.5 ± 23.9
Bypass time (min)	102.7 ± 31.3
Ventilation time (hr)	27.8 ± 18.5
ICU stay (hr)	65.2 ± 24.3

CABG = coronary artery bypass grafting; ICU = intensive care unit; NCC = noncoronary cusp; RCC = right coronary cusp

Data are presented as number and percentage or as mean ± SD.

TABLE IV. Postoperative Results in the 20 Patients

Variable	No. (%)
Low cardiac output	3 (15)
New temporary heart block	2 (10)
Renal impairment	1 (5)
Delayed neurologic recovery	1 (5)
In-hospital death*	2 (10)

*Both in-hospital deaths occurred within 30 days postoperatively.

236 min for their technique, which involved aortic valve translocation and distal CABG.

The 1-year mortality rate of 10% in our cohort of 20 patients was low, given their increased surgical risk, critical condition, and need for reoperation. In a study of 168 patients over a 13-year period, Elgalad and associates[15] found that outcomes were not affected by surgical complexity or valve substitute. In contrast, Masur and Johnson[16] reported that only one of 14 patients with prosthetic endocarditis survived after medical therapy and surgical prosthetic valve replacement after débridement. Ivert and colleagues[17] reported an overall mortality rate of 36% in a study of 33 patients diagnosed with prosthetic valve endocarditis and treated surgically; of note, 44% of the survivors needed reoperation. In a prospective observational study of patients with IE, Hill and associates[18] found that age, staphylococcal infection, and contraindication to surgery predicted 6-month mortality. In our study, the 1-year recurrence rate of endocarditis after surgical débridement and repair was 10% (2 of 20 patients). We considered it satisfactorily low for our relatively simple and less time-consuming valve-sparing technique.

Although our study included only a small number of patients who were followed for only one year, its results show that our mechanical valve-sparing technique for treating aortic root abscess complicated by IE is safe and less time-consuming than conventional débridement and valve replacement. Studies in larger populations are warranted.

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