Surgery for aortic root abscess: Prosthetic versus native valve endocarditis

Authors:

Amr Rouchdy: Assistant Professor of Cardiothoraic surgery, Cairo University .

Alaa Farouk: Assistant Professor of Cardiothoracic surgery, Cairo University.

Corresponding Author:

Alla Farouk

Adress: , Nasr city, Cairo

Tel: 0100/1822415

E-mail: alaafarouk777@hotmail.com

Abstract

Objective: Comparison of the surgical outcome for patients with aortic root abscess and valve prosthetic aortic valve endocarditis and native aortic valve endocarditis.

Methods: Between January 2009 and January 2014, 27 patients underwent surgery for aortic valve infective endocarditis and aortic root abscess in Cairo University Hospitals. 14 patients had prosthetic aortic valve endocarditis (group A) and 13 patients had native aortic valve endocarditis (group B). Surgery included debridement of necrotic tissues, reconstruction of the annulus with patches, repair of fistulae and valve replacement. Patients were followed for six months postoperatively.

Results: The mean age of patients was 42±9.27 years for group A and 41.9±10.05 years for patients in group B. The mean ejection fraction (%) was 50.4 ± 7.98 for group A and 55.4±7.7 for group B. Surgery was emergent in 4 patients (14.7%) and urgent in 13 patients (48.1%). The cross- clamp time was 208.4±17.95 in group A versus 191.1 ± 21.2 min in group B with a *P value of* 0.0158. Early mortality was 22.2% (6/27). Causes of mortality were low cardiac output (2), multi-organ failure (2), bleeding (1) and stroke (1). 14.8% of patients had late recurrence of endocarditis and died during the follow up.

Conclusion: Despite the considerable morbidity and mortality, surgery of aortic root abscesses is a live saving procedure mostly of urgent nature. Prosthetic aortic valve endocarditis is associated with increased risk of mortality and morbidity

Introduction

Infective endocarditis is a disastrous illness associated with high morbidity and mortality. Despite the advances in antimicrobial therapy, approximately one-third of patients with active endocarditis will require surgery to save the patient's life and eradicate the infection, and yet may yield a poor outcome [1-5]. Depending on how promptly the disease is diagnosed with the appropriate antibiotics started, on whether the infected valve is native or prosthetic, and on the virulence of the microorganism, the infection may extend into the valve annulus and surrounding tissues causing abscess and fistulae [6].

The incidence of infective endocarditis in patients with prosthetic valves is 0.3% to 1.2% per year, and such patients represent 1% to 5% of all patients with infective endocarditis [7], and periannular complications occur in approximately 9.8% to 40% of patients with aortic valve endocarditis, with a higher incidence in prosthetic valve endocarditis (PVE) compared with native valve endocarditis (NVE), and in Staphylococcal infections compared with other organisms [8].

Endocarditis affecting the aortic valve resulting in abscess formation is particularly challenging, and requires aggressive diagnostic and therapeutic approaches as it may result in severe complications such as heart block, destruction of the aorto-mitral continuity, fistulous communication to other cardiac chambers and extrinsic compression of coronary arteries [9,10,11,12].

Due to the diversity of aortic valve endocarditis complications, and the shortage of non-randomized prospective studies, we conducted this prospective study aiming to analyze the outcome of surgery for Egyptian patients who had aortic valve infective endocarditis combined with aortic root abscess, and to compare the outcome for PVE versus NVE

Patients and Methods

This study was conducted at Cairo University hospitals during a 5-years period between January 2009 and January 2014, 136 patients underwent surgery for aortic valve infective endocarditis at our department, of whom 27 patients (19.8%) had aortic root abscesses formation. These patients were the subject of this study. Preoperative patient characteristics were presented in table 1.

Fourteen patients (51.8%) had prosthetic aortic valve endocarditis (PVE) with vegetations and annular abscesses (group A). 13 patients (48.2%) had native aortic valve endocarditis (NVE) All patients had aortic valve dehiscence of various degrees. 4 patients of group A had a nearly complete valve dehiscence and needed emergency operations. Persistence of fever and sepsis as well as valve dehiscence was the indications for urgent surgery. Emergency surgery was indicated for patients with highly mobile vegetation or marked valve dehiscence (rocking valve).

Endocarditis was diagnosed according to the modified Duke criteria. Transthoracic echocardiography, clinical examination and blood cultures (table2) were the base of the diagnosis for all patients. . Abscess formation was defined as necrotic tissue in the aortic annulus or root, or as aortoventricular discontinuity. Sepsis was defined as fever, leucocytosis, positive blood culture, hemodynamic instability requiring vasopressors, or organ failure.

Data collections and statistical analysis

Data were collected prospectively. Patients were actively followed up for 6 months post-operatively by a heart team composed of cardiologists and cardiac surgeons. Continuous variables are expressed as the mean ± standard deviation. Categorical qualitative data were tabulated in 2^xn tables and analyzed by chi square or Fisher exact test. Continuous variables were analyzed by student *t* test. P value <0.05 was considered significant. Microsoft Excel was used for data collection and SPSS® v 10.0 was used for analytical statistics.

Operative details

All patients had a median sternotomy, then cardiopulmonary bypass was initiated via aorto-bicaval canulation. Myocardial protection was done by systemic hypothermia to 28°c, ice slush and cold blood home-brew cardiolplegia.

The surgical strategy in all patients was the radical debridement of all infected tissue, drainage, and exclusion of myocardial abscesses from the bloodstream and reconstruction of annular defects as needed with autologous pericardium or Dacron patches, followed by 6 weeks of antibiotics according to blood and tissue cultures. In 14 patients, the infected prosthetic aortic valve was removed first, before inspecting the annulus and the abscess for location and perforation. All tissues or prosthetic valves removed were sent for culture (aerobic, anaerobic and fungal).

The aortic valve was replaced by a mechanical valve in all patients. Irrigation of the sewing ring with gentamicin was done before securing the knots. Abscesses crossing the annulus and destroying the coronary ostia necessitated a Bentall procedure. Reconstruction of the aorto-mitral continuity was needed in three patients by a Dacron patch. Five patients had a perforation into the right atrium, left atrium and right ventricle.

Reconstruction of the aortic annulus was needed in 9 patients (33.3%) by autologous pericardium sutured by running 4/0 polypropylene to the surrounding fibrous tissue. Then Teflon pledgeted sutures passed through it to hold the new valve. In two cases in the PVE group, a Bentall procedure was done using a double velor Dacron® graft attached to the valve with 4/0 running polypropylene sutures. The coronary ostia were reimplanted using running 5/0 polypropylene sutures supported with native pericardial strips.

Results

Preoperative patient characteristics were presented in table 1. The percentage of emergency surgeries was 21.4% in PVE group versus 7.7% in the NVE group although it did not reach statistical significance. Most patients (76.9%) of the NVE group had a rheumatic affection of the aortic valve. Three patients in each group had a concomitant mitral valve disease. Organisms isolated at preoperative blood cultures of from intraoperative specimens were shown in table (2). Cross clamp time and bypass times were significantly longer in the PVE group. Patch reconstruction of the annulus was needed in 11 patients (78.6%) of group A and in 4 patients of group B (30.7%). Operative data were listed in table (3).

The overall early (30 days) mortality was 22.2%. Two patients had low cardiac output (LCO) syndrome postoperatively and needed maximal doses of inotropic support. One patient had persistence of sepsis and end organ damage. One patient died out of surgically uncontrolled bleeding. One patient did not regain consciousness after surgery; he had a preoperative embolic cerebral stroke. Postoperative mortality and morbidity were shown in Table (4). All survivals completed the course of 6 weeks of postoperative antibiotics in the hospital.

Follow up

Three patients had recurrence of endocarditis on the 3rd, 5th and 6 months respectively. All readmitted to the hospital and received antibiotics according to their blood cultures. One patient died shortly after due to septicemia (group B). One patient was reoperated upon for valve dehiscence (group A), but died due to failure to wean of bypass. (Table 4)

Table 1: Demographic and preoperative clinical characteristics

Characteristics(n=27)	Group A(n=14)	Group B(n=13)	*P* value
Age (years)	42 ± 9.27	41.9±10.05	NS
Females	8 (57.1%)	7(53.8%)	NS
LVEF (%)	50.4 ± 7.98	55.4±7.7	NS
Emergency	3(21.4%)	1(7.7%)	NS
Urgent	8(57.1%)	5(38.5%)	NS
Elective	3(21.4%)	7(53.8%)	NS
Positive blood culture at surgery	6 (42.8%)	4(30.7%)	NS
Heart failure	2 (14.2%)	1(7.7%)	NS
Renal insufficiency	4 (28.5%)	3(23.1%)	NS
Diabetes mellitus	2(14.2%)	2(15.4%)	NS
Cerebral embolism	2(14.2%)	1(7.7%)	NS
Renal/splenic embolism	1(7.14%)	2 (15.4%)	NS
Rheumatic aortic valve disease	-	10(76.9%)	
Calicific aortic valve	-	1(7.7%)	
Bicuspid aortic valve	-	2(15.4%)	
Concomitant mitral valve disease	3(21.4%)	3(23.1%)	NS
Concomitant mitral valve endocarditis	2(14.2%)	2(15.4%)	NS

Table 2: Organisms isolated at the time of initial blood cultures or from intraoperative specimens

Organism (n=27)	Group A(n=14)	Group B(n=13)	*P* value
Staphylococcus aureus	4 (28.57%)	2(15.4%)	NS
Staphylococcus epidermidis	2 (14.2%)	1(7.7%)	NS
Coagulase-negative staphylococci	1 (7.1%)	1(7.7%)	NS
Streptococci species	1 (7.1%)	2(15.4%)	NS
Enterococci	0	1 (3.7%)	NS
Escherichia coli	2 (2.4%)	1(7.7%)	NS
Proteus	1 (3.7%)	1(7.7%)	NS
Candida	2 (7.4%)	1(7.7%)	NS
Culture negative	1 (14.8%)	3(23.1%)	NS

Table 3: **Operative data**

n=27	Group A(n=14)	Group B (n=13)	*P* value
Abscess in			
Aortic valve annulus	4 (28.5%)	2(15.3%)	NS
LVOT	10 (71.4%)	9(69.2%)	NS
Central fibrous body	2 (14.2%)	2(15.3%)	NS
Aortic abscess diameter(cm)	1.85±0.82	1.84±0.65	NS
Mitral valve vegetations	2 (14.2%)	2(15.3%)	NS
Destruction of coronary ostia	2 (7.4%)	0(0%)	NS
Perforation into:	4(28.5%)	1(7.7%)	NS
Left atrium	1 (7.1%)	0(0%)	NS
Right atrium	2 (14.2%)	1(7.7%)	NS
Right ventricle	1 (7.1%)	0(0%)	NS
Procedure			
AVR	14 (100%)	13 (100%)	NS
Patch reconstruction	14 (100%)	11(84.6%)	NS
Direct suture closure of the defect	0(0%)	2 (15.3%)	NS
Patch reconstruction of the annulus	11(78.6%)	4(30.7%)	0.012
Bentall procedure	2 (14.2%)	0(0%)	NS
Concomitant surgery			
MV replacement	1(7.4%)	2(15.3%)	NS
MV reconstruction	2 (14.2%)	1(7.7%)	NS
TV surgery	1 (7.1%)	1(7.7%)	NS
CPB time (min)	208.4±17.95	191.1 ± 21.2	0.0158
Cross-clamp time (min)	162±20	144.3 ± 20.5	0.016

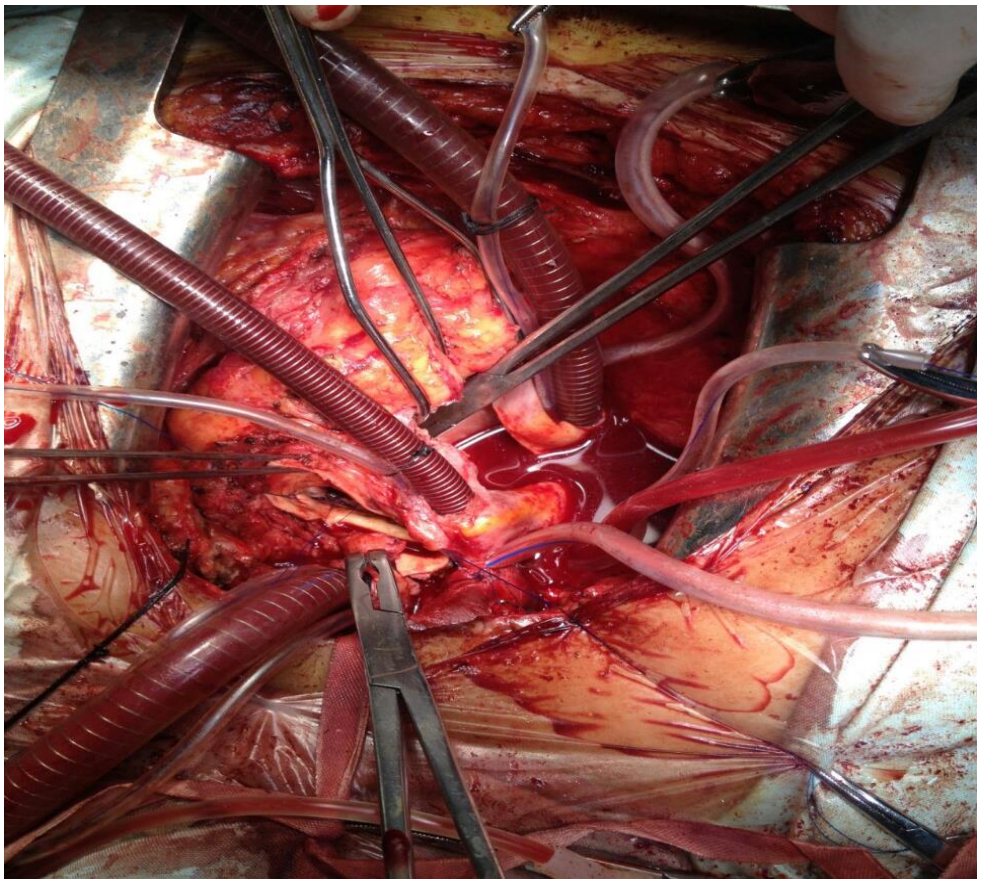
ARR, Aortic root reconstruction; *AVR*, aortic valve replacement; *CABG*, coronary artery bypass grafting; *CPB*, cardiopulmonary bypass; *LVOT*, left ventricular outflow tract; *MV*, mitral valve; *TV*, tricuspid valve, CPB= cardiopulmonary bypass, NS=not significant

Table 4: Postoperative data

	Group A(n=14)	Group B(n=13)	*P* value
Early mortality	4 (28.5%)	2(15.3%)	NS
Low cardiac output	5(35.7%)	3(23%)	NS
Persistence of Sepsis>2weeks	2(14.2%)	2(15.3%)	NS
Reoperation for bleeding	2(14.2%)	1(7.7%)	NS
Temporary pacing	6 (42.8%%)	4(30.7%)	NS
Pacemaker implantation (permanent)	2 (14.2%)	0(0%)	NS
Pneumonia	1 (7.1%)	0(0%)	NS
Delayed recovery of conscious	1 (7.1%)	1(7.7%)	NS
Renal impairment (creatinine>2.5mg/dl)	3 (21.4%)	2(15.3%)	NS
Temporary dialysis	2 (14.2%)	1(7.7%)	NS
ICU stay (days)*	5.7±4	4.7±3.1	0.047
Mechanical Ventilation (hours)*	22.3±15.4	18.4±14.1	NS
Recurrence of endocarditis	2 (14.2%)	1(7.7%)	NS
late mortality	1(7.1%)	1(7.7%)	NS

NS=non significant,* data expressed as mean±SD

Fig 1: Subaortic abscess opening to the right atrium. The gall bladder forceps is pointing to the fistula.



Discussion

Early, prompt surgical and medical approaches are the cornerstones for the management of aortic valve endocarditis with abscess formation[13]. Despite the high morbidity and mortality, long term follow up from Leipzig[5], Toronto[2], and Berlin[14], was satisfactory. David et al reported a 44% survival at 15 years[2], and Leontyev et al reported a 46% survival at 6 years[5].

Even with low virulent organisms as streptococci, delaying surgical treatment will result in extensive damage to heart valves and surrounding tissues[6]. More aggressive strains as staph aureus on valves of the left ventricle responds better to early surgery[4] despite the higher mortality compared to other strains[15].

In our series the early mortality (30 days) was 22.2%. The mortality was higher in the PVE group than the NVE group without statistical significance. This was matching with other studies. David et al reported a 12% early mortality and 23% late deaths[2]. Leontyev et al reported a 25% early mortality[5]. Nagvi et al reported a 31% of early mortality[16]. Lee et al reported a 13.8 % of early mortality in a PVE group of 20 patients versus a 6.9 % of mortality in a NVE group of 29 patients without statistical significance[17]. The wide variability of the results is related to the percentage of prosthetic aortic valve endocarditis (PVE), staphylococci infections, and associated lesions.

PVE doubles the risk of mortality[5.] In our series 51.8% of patients had an infected prosthetic valve in aortic position. The longer ischemic time needed and the virulence of the organisms associated, and related aggressive sepsis explained the increased mortality in such group. In our series the ischemic time was 208.4±17.95 min in PVE group versus 191.1 ± 21.2 min in NVE group with a *p* value of 0.0158. This was explained by the time needed to extract the prosthetic valve and reconstruct the annulus.

25.9% of our patients had a staphylococci infection. The later has been found to be a predictor of mortality[2]. In our series, we used mechanical valves only to replace the infected valves. David et al in a 15 years study found that recurrence of endocarditis is not related to the type of valve used[2]. Leyh et al in Hannover found that the excellent long term results are not related to the material used for aortic root replacement[18].

Proper eradication of all infected tissues is the key for long-term freedom from recurrence. However, due to the proximity to the conduction system, heart block became an inevitable price. In our series 7.4% of patients needed a permanent pacing for persistence of complete heart block more than 2 weeks.

Conclusion

Surgical management of infective endocarditis with aortic root abscess poses a high morbidity and mortality. PVE increases the risk but without statistical significance. Proper diagnosis and early management as well as radical excision of infected tissue are the key for a better long term outcome.

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