

Editorial Manager(tm) for General Thoracic and Cardiovascular Surgery
Manuscript Draft

Manuscript Number:

Title: Treatment of Prosthetic Valve Endocarditis Complicated with Destruction of the Aortic Annulus

Article Type: Original Article

Keywords: prosthetic valve endocarditis; aortic annular abscess; patch plasty

Corresponding Author: Kenji Minakata, M.D., Ph.D

Corresponding Author's Institution: Kyoto University Graduate School of Medicine

First Author: Yuki Okamoto, M.D.

Order of Authors: Yuki Okamoto, M.D.;Kenji Minakata, M.D., Ph.D;Tomoyuki Yunoki, M.D.;Masatake Katsu, M.D., Ph.D.;Shin-ichiro Chino, M.D.;Masahiko Matsumoto, M.D., Ph.D.

Abstract: Objective: It has been reported that surgical treatment for prosthetic valve endocarditis complicated with destruction of the aortic annulus is associated with high mortality and morbidity. We use a relatively simple procedure consisting of a patch plasty of the abscess cavity, in addition to complete removal of the infected tissue of the abscess cavity followed by a standard aortic valve replacement.

Methods: Between October 2003 and April 2009, 8 patients (7 males; mean age, 68.6 ± 9.8 years) with prosthetic valve endocarditis complicated with destruction of the aortic annulus were surgically treated at Tominaga hospital. All patients were in New York Heart Association functional class III or IV. All patients had active endocarditis. Preoperative echocardiography revealed that 4 patients had moderate or severe aortic regurgitation, and 2 patients had mitral valve endocarditis as well.

Results: There were no operative deaths (≤ 30 days). Cardiac complications included paroxysmal atrial fibrillation in 3 patients and transient atrioventricular block in one. One patient died of multiple organ failure 66 days after the surgery. The overall in-hospital mortality was 12.5%. Patients were followed-up for 6 to 49 months (mean, 31 ± 19 months). There was no recurrent prosthetic valve endocarditis. One patient required reoperation (mitral annuloplasty and redo aortic valve replacement) mainly due to severe functional mitral regurgitation. There were 2 late deaths: lung cancer in 1 and multiple organ failure related to pneumonia after the aforementioned redo operation.

Conclusion: Our simple procedure for complicated prosthetic valve endocarditis yielded excellent early and mid-term outcomes.

Treatment of Prosthetic Valve Endocarditis Complicated with Destruction of the Aortic Annulus

Yuki Okamoto, MD¹

Kenji Minakata, MD, PhD¹

Tomoyuki Yunoki, MD¹

Masatake Katsu, MD, PhD¹

Shin-ichiro Chino, MD¹

Masahiko Matsumoto, MD, PhD²

¹Division of Cardiovascular Surgery, Tominaga Hospital, Osaka, Japan

²Second Department of Surgery, University of Yamanashi, Yamanashi, Japan

Corresponding author: Kenji Minakata

Mailing address: Department of Cardiovascular Surgery, Kyoto University Graduate School of Medicine, 54 Kawaharacho, Shogoin, Sakyo-ku, Kyoto, Japan 606-8507

Tel: +81-75-751-3780

FAX: +81-75-751-3098

Email: minakata@kuhp.kyoto-u.ac.jp

Key words: prosthetic valve endocarditis, aortic annular abscess, patch plasty

Abstract

Objective: It has been reported that surgical treatment for prosthetic valve endocarditis complicated with destruction of the aortic annulus is associated with high mortality and morbidity. We use a relatively simple procedure consisting of a patch plasty of the abscess cavity, in addition to complete removal of the infected tissue of the abscess cavity followed by a standard aortic valve replacement.

Methods: Between October 2003 and April 2009, 8 patients (7 males; mean age, 68.6 ± 9.8 years) with prosthetic valve endocarditis complicated with destruction of the aortic annulus were surgically treated at our hospital. All patients were in New York Heart Association functional class III or IV. All patients had active endocarditis. Preoperative echocardiography revealed that 4 patients had moderate or severe aortic regurgitation, and 2 patients had mitral valve endocarditis as well.

Results: There were no operative deaths (≤ 30 days). Cardiac complications included paroxysmal atrial fibrillation in 3 patients and transient atrioventricular block in one. One patient died of multiple organ failure 66 days after the surgery. The overall in-hospital mortality was 12.5%. Patients were followed-up for 6 to 49 months (mean, 31 ± 19 months). There was no recurrent prosthetic valve endocarditis. One patient required reoperation (mitral annuloplasty and redo aortic valve replacement) mainly due to severe functional mitral regurgitation. There were 2 late deaths: lung cancer in 1 and multiple organ failure related to pneumonia after the aforementioned redo operation.

Conclusion: Our simple procedure for complicated prosthetic valve endocarditis yielded excellent early and mid-term outcomes.

Introduction

Prosthetic valve endocarditis (PVE) is a serious complication that can follow aortic valve replacement, and severe PVE often destroys the aortic annulus, leading to “aorto-left ventricular discontinuity.” Periannular abscesses occur in a significant number of PVE patients, occurring in 56% to 100% of affected patients.^{1,2} Moreover, when destruction of the aortic annulus is present in patients with PVE, hemodynamic instability can easily occur as a result of the uncontrollable septic state associated with abscess formation, perivalvular leakage, prosthetic valve malfunction or conduction disturbances. These patients require complex surgical interventions in addition to aggressive antibiotic therapy.^{1,2} Therefore, multiple surgical techniques have been proposed for complex reconstruction to improve mortality and morbidity in PVE patients with destruction of the aortic annulus.

Previous studies have reported good outcomes with aortic root replacement using homografts, which are thought to be more resistant to bacterial or fungal infections than prosthetic valves.³⁻⁹ In Japan, the supply of homografts is very limited, and as an alternative approach, the Ross procedure has been performed in some institutions with excellent results.⁹ However, the Ross procedure is technically demanding and requires longer cross-clamp time and cardiopulmonary bypass time, potentially increasing mortality and morbidity.

Since 2003, we have performed a relatively simple procedure for PVE complicated with destruction of the aortic annulus. Our technique includes patch reconstruction of the aortic annulus followed by placement of a new prosthetic valve in addition to aggressive removal of the infected tissue and drainage of the abscess cavity.

The aim of this study was to evaluate the efficacy of our surgical strategy for PVE

complicated with destruction of the aortic annulus.

Patients and Methods

Patients

Between October 2003 and April 2009, 8 patients were admitted to Tominaga hospital with a diagnosis of PVE complicated with destruction of the aortic annulus. These patients formed the cohort for this study. In all of these patients, diagnosis was made based on the Duke criteria.^{1,10}

The patient demographics and clinical characteristics are summarized in Table 1. The mean age was 68.6 ± 9.8 years (range, 53 to 84 years) and 7 patients were male. All patients were in New York Heart Association (NYHA) functional class III or IV and had active infection. The median interval between the initial and the redo operation was 5.5 ± 6.1 months (range of 1.9 to 20.3 months). In terms of the onset of infection¹¹, there was 1 case of early PVE (onset within two months of the initial operation) and 7 cases of late PVE (onset more than 2 months after the initial operation). Two patients had had dental treatment within 1 month prior to the onset of the PVE episode.

For the initial aortic valve replacement (AVR), isolated AVR was performed in 4 patients and AVR with additional surgical procedures was performed in 4 (Table 1). A permanent pacemaker was implanted in patient 7 due to sick sinus syndrome and patient 8 had a minor stroke after the operation, while the other patients had no postoperative complications.

In terms of infectious agents, the microorganisms causing PVE were methicillin-resistant *Staphylococcus epidermidis* (MRSE) in 5 patients, methicillin-sensitive *Staphylococcus epidermidis* (MSSE) in 1, and unknown in 2.

1
2
3 The preoperative echocardiographic data are shown in Table 1. Left ventricular
4
5 function was relatively preserved in this cohort, with a mean left ventricular ejection
6
7 fraction (LVEF) of $57 \pm 18\%$, although 2 patients had significantly depressed LVEF
8
9 (25% and 35%). Visible vegetation on the aortic prosthesis was usually identified by
10
11 either transthoracic or transesophageal echocardiography. Perivalvular leakage was
12
13 common, with moderate or severe aortic regurgitation (AR) in 4 patients. Pressure
14
15 gradients across the prosthetic valve were commonly elevated because of restricted
16
17 mobility of leaflets and obstruction of left ventricular outflow due to the presence of
18
19 abscesses formation. Two patients were found to have vegetation on the mitral valve as
20
21 well.
22
23
24
25

26
27 Indications for surgery were advancing congestive heart failure in 1 patient and
28
29 uncontrollable infection despite aggressive antibiotic treatment in 7.
30
31
32

33 34 Surgical Technique

35
36 Surgery was performed via median sternotomy with the use of extracorporeal
37
38 circulation and mild systemic hypothermia. Myocardial protection was accomplished by
39
40 antegrade and, if feasible, retrograde cold blood cardioplegia. The left ventricle was
41
42 vented by cannulation through the right superior pulmonary vein.
43
44

45
46 Our surgical strategy for PVE complicated with destruction of the aortic annulus
47
48 consisted of radical debridement (complete removal of infected or necrotic tissue with a
49
50 curette) and irrigation of the abscess cavity with large amount of saline solution. Most
51
52 times, patch reconstruction of the left ventricular outflow tract at the level of and below
53
54 the aortic annulus was required using equine pericardium with a 5-0 polypropylene
55
56 running suture, and fibrin glue mixed with antibiotics (vancomycin or gentamicin) was
57
58
59
60
61
62
63
64
65

1
2
3 injected into the cavity. When the aortic annulus was reconstructed, AVR was performed
4
5 with pledgeted mattress sutures passed through both the patch and the aortic wall to
6
7 securely anchor the prosthetic valve to the reconstructed aortic annulus. Sometimes, the
8
9 sutures were passed from outside the aortic wall to pass through enough tissue to
10
11 stabilize the prosthesis. Postoperatively, sufficient antibiotics were administered
12
13 intravenously for at least 4 to 6 weeks, and then oral antibiotics were given for at least
14
15 several months.
16
17
18
19
20

21 **Results**

22 Operative and Early Postoperative Results

23
24 The operative results are shown in Table 2. There were no intraoperative nor operative
25
26 deaths (<30 days). As shown in Figure 1, abscess cavities were found in the entire aortic
27
28 annulus in 4 patients (this was classified as “aorto-left ventricular discontinuity”). None
29
30 of these patients had any abscess formation beyond the sinus of Valsalva or near the
31
32 coronary ostia. In 2 patients, direct closure of the cavity was feasible because the
33
34 abscess cavity was small (only a 3-5mm gap was identified). AVR was performed using
35
36 biological valves in 4 patients and mechanical valves in 4. Patient 6 had vegetation on
37
38 both aortic and mitral prostheses, which necessitated redo mitral valve replacement
39
40 using the standard technique. In patient 7, we removed vegetation attached to the native
41
42 mitral valve in addition to AVR.
43
44
45
46
47
48
49

50 All patients were successfully weaned from cardiopulmonary bypass, but 3 patients
51
52 required an intra-aortic balloon pump to achieve hemodynamic stability. The mean
53
54 cardiopulmonary bypass time was 213 ± 82 minutes (range, 112 to 367 minutes), and
55
56 the mean aortic cross clamp time was 145 ± 45 minutes (range, 86 to 232 minutes). All
57
58
59
60
61
62
63
64
65

1
2
3 the patients left the operation room without significant aortic regurgitation (AR; defined
4
5 as mild or less).
6

7
8 As shown in Table 2, patient 8 developed multiple complications, including general
9
10 prostration caused by infectious colitis, renal dysfunction and pneumonia, and
11
12 eventually died of multiple organ failure 66 days after the operation. The overall
13
14 in-hospital mortality rate was 12.5%. The median postoperative respiratory support time
15
16 was 27 hours (range, 12 to 184 hours) and the mean hospital stay, excluding the one of
17
18 hospital death, was 65 ± 22 days (range, 34 to 92 days). During the hospital stays, 3
19
20 patients developed paroxysmal atrial fibrillation and 1 patient developed transient
21
22 atrioventricular block which did not required permanent pacemaker implantation.
23
24 Patient 6 required sternal wound re-exploration for postoperative bleeding. Patient 7 had
25
26 refractory gastrointestinal bleeding and also required prolonged respiratory support. No
27
28 patients had recurrent infection on prosthetic valves or sepsis. Echocardiographic
29
30 examination on discharge revealed that two patients had developed moderate AR.
31
32
33
34
35
36
37
38

39 Mid-Term Follow-up Results

40
41 Patients were followed up for 6 to 49 months, with a mean of 31 ± 19 months. Patient 1
42
43 was lost to follow-up at 8 months after surgery. Patient 2 required re-operation (mitral
44
45 annuloplasty and redo AVR) mainly due to severe functional MR 32 months after the
46
47 previous redo AVR. This was essentially associated with poor left ventricular function
48
49 and a dilated left ventricle. Repeat AVR was also performed because this patient had
50
51 moderate AR due to perivalvular leakage. Of note, there was no evidence of recurrent
52
53 infection around the aortic root. This patient died of multiple organ failure related to
54
55 refractory pneumonia 3 months later. Patient 6 died of lung cancer 6 months after the
56
57
58
59
60
61
62
63
64
65

operation.

Follow-up echocardiography demonstrated that 2 patients had moderate AR without hemodynamic instability. Four patients continue to be followed up at our institution and are in NYHA functional class I or II with no signs of recurrent PVE.

Discussion

PVE complicated with destruction of the aortic annulus is a potentially fatal complication of AVR. The surgical treatment of this condition is challenging, with operative mortality rates ranging from 7.3% to 33%.^{1,2,12-14} This high mortality is associated with preoperative hemodynamic deterioration due to uncontrolled sepsis from abscess formation, valve malfunction, multiple organ involvement due to severe infection and low cardiac output, and the complexity of the surgical procedure.^{1,2} Because the surgical mortality rate of the third redo operation for recurrent PVE can be as high as 55.6%,¹⁵ it is very important to choose a surgical strategy that decreases the recurrence of PVE.

The surgical management of PVE complicated with an aortic annular abscess involves aggressive and complete debridement of all infected or necrotic tissue, reconstruction of the damaged annulus and restoration of valve function. Many authors have reported that extended debridement and resection of infected paravalvular tissue are more important than the materials used for the reconstruction of the aortic valve.^{7,17,18,20,21} Despite the fact that aggressive debridement may cause complete heart block requiring permanent pacemaker implantation, debridement of all infected tissue remains the first priority.

One way to minimize the risk of recurrent PVE may be the injection of fibrin glue

1
2
3 mixed with antibiotics into the abscess cavity. We employed this technique whenever
4
5 we performed patch reconstruction of the aortic annulus, because antibiotics mixed with
6
7 fibrin glue are thought to be delivered continuously into the surrounding tissue for the
8
9 first few days following surgery.¹⁶ There was no recurrence of PVE in our series,
10
11 although this does not conclusively prove the effectiveness of this technique.
12
13

14
15 Other surgical techniques that have been used in the past include valve replacement
16
17 with patch closure of the abscess cavity,¹⁷⁻¹⁹ aortic root replacement using a
18
19 homograft,³⁻⁷ autograft (the Ross procedure),^{8,9} composite-valve conduit,^{20,21} Freestyle
20
21 stentless bioprosthesis,^{13,22} and translocation of the aortic valve with saphenous vein
22
23 bypass grafts to the coronary arteries.^{23,24}
24
25

26
27 It is well known that both homografts and autografts offer excellent hemodynamic
28
29 performance and it is thought that they are resistant to infection. Indeed, the reported
30
31 incidence of recurrent PVE after aortic root replacement using homografts or autografts
32
33 range from 0% to 4.2% and 0% to 4%, respectively.³⁻⁹ However, persistent infection and
34
35 false aneurysms or valve degeneration requiring reoperation can occur even after aortic
36
37 root replacement using a homograft.^{18,25} Furthermore, the Ross procedure is technically
38
39 demanding and increases aortic cross-clamp time and cardiopulmonary bypass time, and
40
41 valve dysfunction can occur in both neo aortic valves (in the case of homografts) and
42
43 neo pulmonary valve (in the case of homografts or other prostheses).⁹ Also, the
44
45 longevity of homografts (either for AVR or for PVR in the Ross procedure) remains
46
47 unclear, and younger patients may require reoperation at a later date due to structural
48
49 valve deterioration. Repeat operation in patients with homografts can be very
50
51 challenging because homografts tend to become heavily calcified.²⁶
52
53
54
55
56

57
58 In Japan, the most important consideration is the relative scarcity of usable
59
60
61
62
63
64
65

homografts, particularly for emergent or urgent situations. This is the reason we designed a relatively simple procedure that consists of reconstruction of the aortic annulus using equine pericardium followed by AVR in patients with PVE complicated with destruction of the aortic annulus. David et al. reported that there were no recurrent infections after AVR and patch plasty in patients with PVE and aortic root abscesses,¹⁷ and Lytle et al. and d'Udekem et al. reported that standard AVR with pericardial patch reconstruction for PVE was not inferior to aortic root replacement using a homograft.^{18,19} Although we did not compare our procedure with any other surgical interventions, there were no cardiac-related deaths during hospitalization following our procedure. Moreover, since there was no recurrence of PVE during the mid-term follow-up period in our study, the recurrence rate may not be affected by the choice of the materials used for valve prostheses. Hagl et al. reported that the surgical outcome of aortic root replacement with a composite graft was superior to that of a homograft for PVE²⁰, and Leyh et al. reported that the outcome of aortic root replacement using a composite graft was not inferior to that of a homograft.²¹ Moreover, several authors have recently reported good outcomes for AVR in patients with PVE and aortic root abscess using a Freestyle stentless valve.^{9,13,22} Since the handling qualities and performance of a Freestyle valve are similar to those of a homograft, they recommend the use of a Freestyle valve.^{13,22} A composite graft or Freestyle stentless valve can serve as a good alternative to a homograft for aortic root replacement. However, because prosthetic valve infection does not usually extend to the sinus of Valsalva or coronary ostium in most patients with PVE complicated with aortic root abscess,^{2-9,12-15,17-25} we do not believe that aortic root replacement is always necessary.

Another technical issue to consider is where to anchor the prosthetic valve on the

1
2
3 fragile annulus for stability. We anchored the valve with mattress sutures that were
4
5 passed through both the patch and the aortic wall whenever we performed patch plasty
6
7 of the aortic annulus. There were no postoperative complications due to valve
8
9 dehiscence. Also, in early or mid-term follow-up, there were no re-reoperations,
10
11 excluding one case who underwent mitral annuloplasty and redo AVR mainly due to
12
13 severe functional mitral regurgitation.
14
15
16
17
18

19 **Conclusion**

20
21
22 Patients with PVE complicated with an aortic root abscess can be treated safely with
23
24 patch reconstruction of the aortic annulus and AVR. The early and mid-term outcomes
25
26 are satisfactory without any recurrence of endocarditis.
27
28
29
30

31 **References**

- 32
33
34 1. Bayer AS, Bolger AF, Taubert KA, Wilson W, Steckelberg J, Karchmer AW, et al.
35
36 Diagnosis and management of infective endocarditis and its complications. *Circulation*
37
38 1998;98:2936-48.
39
40
41 2. Baumgartner FJ, Omari BO, Robertson JM, Nelson RJ, Pandya A, Pandya A, et al.
42
43 Annular abscesses in surgical endocarditis: anatomic, clinical, and operative features.
44
45 *Ann Thorac Surg* 2000;70:442-7.
46
47
48 3. Petrou M, Wong K, Albertucci M, Brecker SJ, Yacoub MH. Evaluation of unstented
49
50 aortic homografts for the treatment of prosthetic aortic valve endocarditis. *Circulation*
51
52 1994;90:II 198-204.
53
54
55 4. McGiffin DC, Kirklin JK. The impact of aortic valve homografts on the treatment of
56
57 aortic prosthetic valve endocarditis. *Semin Thorac Cardiovasc Surg* 1995;7:25-31.
58
59
60
61
62
63
64
65

- 1
2
3 5. Dossche KM, Defauw JJ, Ernst SM, Craenen TW, De Jongh BM, de la Rivière AB.
4
5 Allograft aortic root replacement in prosthetic aortic valve endocarditis: a review of 32
6
7 patients. *Ann Thorac Surg* 1997;63:1644-9.
8
9
- 10 6. Yankah AC, Pasic M, Klose H, Siniawski H, Weng Y, Hetzer R. Homograft
11
12 reconstruction of the aortic root for endocarditis with periannular abscess: a 17-year
13
14 study. *Eur J Cardiothorac Surg* 2005;28:69-75.
15
16
- 17 7. Lopes S, Calvino P, de Oliveira F, Antunes M. Allograft aortic root replacement in
18
19 complex prosthetic endocarditis. *Eur J Cardiothorac Surg* 2007;32:126-30.
20
21
- 22 8. Pettersson G, Tingleff J, Joyce FS. Treatment of aortic valve endocarditis with the
23
24 Ross operation. *Eur J Cardiothorac Surg* 1998;13:678-4.
25
26
- 27 9. Okada K, Tanaka H, Takahashi H, Morimoto N, Munakata H, Asano M, et al. Aortic
28
29 root replacement for destructive aortic valve endocarditis with left ventricular-aortic
30
31 discontinuity. *Ann Thorac Surg* 2008;85:940-5.
32
33
- 34 10. Durack DT, Lukes AS, Bright DK. New criteria for diagnosis of infective
35
36 endocarditis: utilization of specific echocardiographic findings. Duke Endocarditis
37
38 Service. *Am J Med* 1994;96:200-9.
39
40
- 41 11. David TE. The surgical treatment of patients with prosthetic valve endocarditis.
42
43 *Semin Thorac Cardiovasc Surg* 1995;7:47-53.
44
45
- 46 12. Glazier JJ, Verwilghen J, Donaldson RM, Ross DN. Treatment of complicated
47
48 prosthetic aortic valve endocarditis with annular abscess formation by homograft aortic
49
50 root replacement. *J Am Coll Cardiol* 1991;17:1177-82.
51
52
- 53 13. Müller LC, Chevtchik O, Bonatti JO, Müller S, Fille M, Laufer G. Treatment of
54
55 destructive aortic valve endocarditis with the Freestyle Aortic Root Bioprosthesis. *Ann*
56
57 *Thorac Surg* 2003;75:453-6.
58
59
60
61
62
63
64
65

14. Wang A, Athan E, Pappas PA, Fowler VG Jr, Olaison L, Paré C, et al. Contemporary clinical profile and outcome of prosthetic valve endocarditis. *JAMA* 2007;297:1354-61.
15. Romano G, Carozza A, Della Corte A, De Santo LS, Amarelli C, Torella M, et al. Native versus primary prosthetic valve endocarditis: comparison of clinical features and long-term outcome in 353 patients. *J Heart Valve Dis* 2004;13:200-8.
16. Kram HB, Bansal M, Timberlake O, Shoemaker WC. Antibacterial effects of fibrin glue-antibiotic mixtures. *J Surg Res* 1991;50:175-8.
17. David TE, Komeda M, Bronfman PR. Surgical treatment of aortic root abscess. *Circulation* 1989;80:I269-74.
18. d'Udekem Y, David TE, Feindel CM, Armstrong S, Sun Z. Long-term results of operation for paravalvular abscess. *Ann Thorac Surg* 1996;62:48-53.
19. Lytle BW, Priest BP, Taylor PC, Loop FD, Sapp SK, Stewart RW, et al. Surgical treatment of prosthetic valve endocarditis. *J Thorac Cardiovasc Surg* 1996;111:198-207.
20. Hagl C, Galla JD, Lansman SL, Fink D, Bodian CA, Spielvogel D, et al. Replacing the ascending aorta and aortic valve for acute prosthetic valve endocarditis: is using prosthetic material contraindicated? *Ann Thorac Surg* 2002;74:S1781-5.
21. Leyh RG, Knobloch K, Hagl C, Ruhparwar A, Fischer S, Kofidis T, et al. Replacement of the aortic root for acute prosthetic valve endocarditis: prosthetic composite versus aortic allograft root replacement. *J Thorac Cardiovasc Surg* 2004;127:1416-20.
22. Fukui T, Suehiro S, Shibata T, Hattori K, Hirai H, Aoyama T. Aortic root replacement with Freestyle stentless valve for complex aortic root infection. *J Thorac Cardiovasc Surg* 2003;125:200-3.
23. Nottin R, Al-Attar N, Ramadan R, Azmoun A, Therasse A, Kortas C, et al. Aortic

valve translocation for severe prosthetic valve endocarditis: early results and long-term follow-up. *Ann Thorac Surg* 2005;79:1486-90.

24. Reitz BA, Stinson EB, Watson DC, Baumgartner WA, Jamieson SW. Translocation of the aortic valve for prosthetic valve endocarditis. *J Thorac Cardiovasc Surg* 1981;81:212-8.

25. Gabbieri D, Dohmen PM, Linneweber J, Grubitzsch H, von Heymann C, Neumann K, et al. Early outcome after surgery for active native and prosthetic aortic valve endocarditis. *J Heart Valve Dis* 2008;17:508-24.

26. Joudinaud TM, Baron F, Raffoul R, Pagis B, Vergnat M, Parisot C, et al. Redo aortic root surgery for failure of an aortic homograft is a major technical challenge. *Eur J Cardiothorac Surg* 2008;33:989-994.

Figure legend

Figure 1: Schemas of abscess cavity site (black shading)

LCA: left coronary artery ostium; NCC: non coronary cusp; RCA: right coronary artery
ostium

Table1

Table 1. Patients Demographics and Preoperative Echocardiographic Data (n=8)

No	Gender	Age	NYHA	Previous Operation	Cultures	LVEF (%)	AR Grade	Mitral valve	
								endocarditis	Indication for operation
1	M	68	IV	AVR (Mosaic23), CABG	Unknown	25	III	No	Worsening CHF
2	M	76	III	AVR (CEP23)	MRSE	74	III	No	Uncontrollable infection
3	M	74	III	AVR (CEP23)	MRSE	70	I	No	Uncontrollable infection
4	M	53	III	AVR (CEP27)	MSSE	59	I	No	Uncontrollable infection, peripheral emboli
5	M	63	III	AVR (CEP25), CABG	MRSE	56	IV	No	Uncontrollable infection, severe AR
6	M	60	IV	AVR (SJM23), MVR (CM31), TAP, MAZE	MRSE	65	III	Yes	Uncontrollable infection
7	M	71	IV	AVR(CEP25), MAP, TAP, MAZE	MRSE	35	I	Yes	Uncontrollable infection
8	F	84	IV	AVR (Magna19)	Unknown	68	II	No	Uncontrollable infection

AR: aortic regurgitation; AVR: aortic valve replacement; CABG: coronary artery bypass grafting; CEP: Carpentier-Edwards Pericardial; CHF: congestive heart failure; CM: CarboMedics; LVEF: left ventricular ejection fraction; MAP: mitral annuloplasty; MRSE: methicillin-resistant *Staphylococcus epidermidis*; MSSE: methicillin-sensitive *Staphylococcus epidermidis*; MVR: mitral valve replacement; NYHA: New York Heart Association; TAP; tricuspid annuloplasty

Table2

Table 2. Operative and Postoperative Results (n=8)

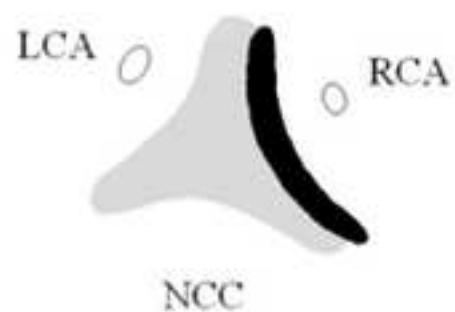
No	IABP	Aorto-LV discontinuity	Valve	Annulus Reconstruction	Combined Procedure	Complications	Follow up	Recurrent PVE
1	Yes	No	Mosaic 23	Direct	Graft replacement of ascending aorta	AF	8 months	No
2	No	Yes	CEP 21	Patch			32 months	No
3	No	No	CEP 21	Direct			49 months	No
4	No	Yes	CM 25	Patch	MVR, CABG (LAD)	Transient AV block	48 months	No
5	No	Yes	CM 21	Patch			45 months	No
6	Yes	Yes	CM 21	Patch		Reexploration for bleeding, AF, pneumonia	6 months	No
7	Yes	No	CEP23	Patch	Removal of vegetation from MV	Gastrointestinal bleeding, prolonged respiratory support	30 months	No
8	No	No	SJM17	Patch		AF, renal failure, pneumonia, tracheostomy	Died on POD 66	No

AF: atrial fibrillation; AV: artioventricular; CABG: coronary artery bypass grafting; CEP: Carpentier-Edwards Pericardial tissue prosthesis; CM: CardoMedics mechanical prosthesis; LAD: left anterior descending artery; MV: mitral valve; MVR: mitral valve replacement; PVE: prosthetic valve endocarditis; SJM: St Jude Medical mechanical valve

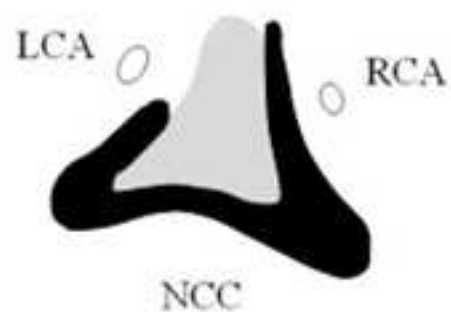
Figure

[Click here to download high resolution image](#)

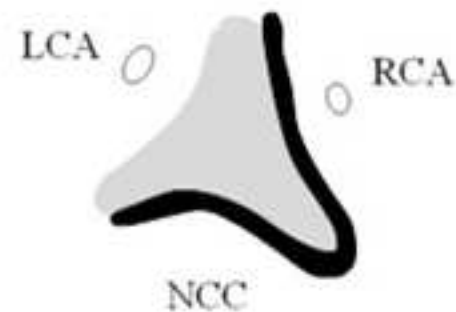
CASE 1



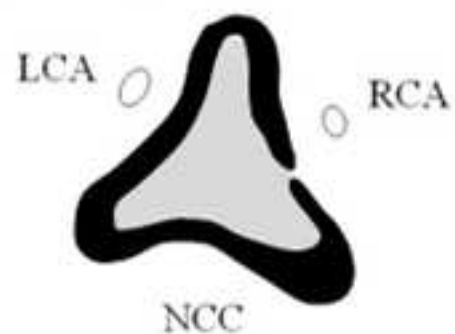
CASE 2



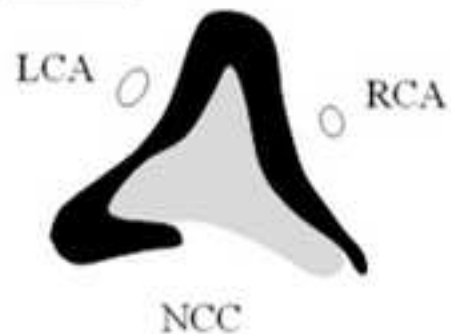
CASE 3



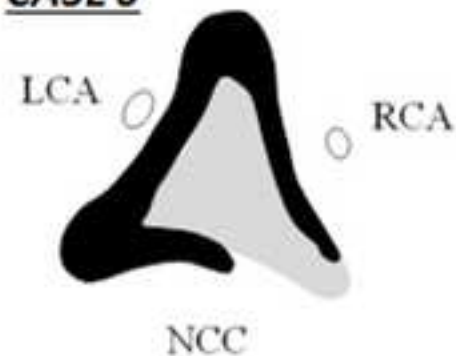
CASE 4



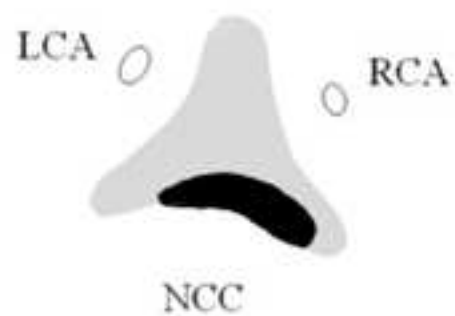
CASE 5



CASE 6



CASE 7



CASE 8

