

# The Ultimate Development of Mitral Valve Endocarditis: Atrioventricular Separation, Atrioventricular Groove Abscess and Hemorrhagic Pericarditis

Fernando A. Atik<sup>1</sup>, Gosta B. Pettersson<sup>1</sup>, Gardar Sigurdsson<sup>2</sup>, Gonzalo V. Gonzalez-Stawinski<sup>1</sup>, Ellen Mayer Sabik<sup>2</sup>, Alice Kim<sup>3</sup>, Lars G. Svensson<sup>1</sup>

Departments of <sup>1</sup>Thoracic and Cardiovascular Surgery, <sup>2</sup>Cardiovascular Medicine and <sup>3</sup>Infectious Diseases, The Cleveland Clinic Foundation, Cleveland, Ohio, USA

A 52-year-old non-insulin-dependent diabetic man presented with cerebral emboli and mitral valve endocarditis with posterior leaflet vegetations and perforation. Surgical intervention demonstrated hemorrhagic pericarditis and an atrioventricular groove abscess. Extensive debridement of the pericardium, valve and abscess cavities, reconstruction of the mitral annulus with a patch of fresh autologous

pericardium, and mitral valve replacement with a pericardial bioprosthesis was performed. The chest was left open. Postoperatively, the patient required dialysis and prolonged mechanical ventilation, but recovered well without recurrent endocarditis and was discharged home after 40 days.

The Journal of Heart Valve Disease 2005;14:29-32

Annulus abscess is a rare (1) and severe complication of mitral valve endocarditis. The early diagnosis of abscess or pseudoaneurysm has clinical and therapeutic importance, and prognosis without surgery is poor. Understanding of the pathology is a condition for diagnostic success, and accurate studies are extremely helpful in providing the surgeon with information to develop an appropriate intraoperative strategy. Fatal heart rupture from a mitral annulus abscess is rare, but has been reported (2).

Here, the case is reported of bacterial mitral valve endocarditis presenting with stroke and complicated by atrioventricular groove abscess formation and hemorrhagic pericarditis, emphasizing the diagnostic difficulties and surgical treatment.

## Case report

A 52-year-old man with non-insulin-dependent diabetes presented with a history of fever, chills and persistent hyperglycemia 10 days before hospital admission. Transesophageal echocardiography (TEE) demonstrated the presence of vegetations on the posterior mitral valve leaflet and grade 1-2+ mitral regurgitation. Blood cultures grew methicillin-sensitive *Staphylococcus aureus*. The patient was mildly con-

fused, but demonstrated no focal deficits and was following commands. Computed tomography of the brain detected multiple small non-hemorrhagic cerebral infarctions. No mycotic aneurysm was found on cerebral angiography.

Repeat TEE showed several vegetations attached to the mitral leaflets; the largest was a sessile vegetation on the posterior mitral annulus, approximately 6 × 14 mm in size. In addition, small linear hypermobile densities were present in and around this area, mainly on the left atrial side of the posterior mitral leaflet. On the ventricular side, an area of echolucency along the endocardium of the left ventricle suggested the development of an abscess. In the same area there was also increased mobility of the posterior annulus with increased distance from the annulus to the endocardium of the posterior wall. In addition, there was some posterior annular calcification. The mitral regurgitation was still only mild (grade 1-2+), with one central leak and a small perforation of the posterior leaflet. No evidence of aortic valve endocarditis was detected. The patient had normal coronary arteries and good left ventricular function.

Indications for surgery were continued uncontrolled infection/sepsis, large vegetations, peripheral embolism, and a suspicion of invasion and annular abscess.

Intraoperative TEE confirmed the preoperative diagnosis, emphasizing the increased mobility of the posterior leaflet annulus and the possibility of a subvalvular abscess in relation to a subannular calcification, as well as a moderate circumferential pericardial effusion with

---

Address for correspondence:  
Gosta B. Pettersson MD, The Cleveland Clinic Foundation, 9500  
Euclid Ave., Desk F25, Cleveland, Ohio 44195, USA  
e-mail: petterg@ccf.org

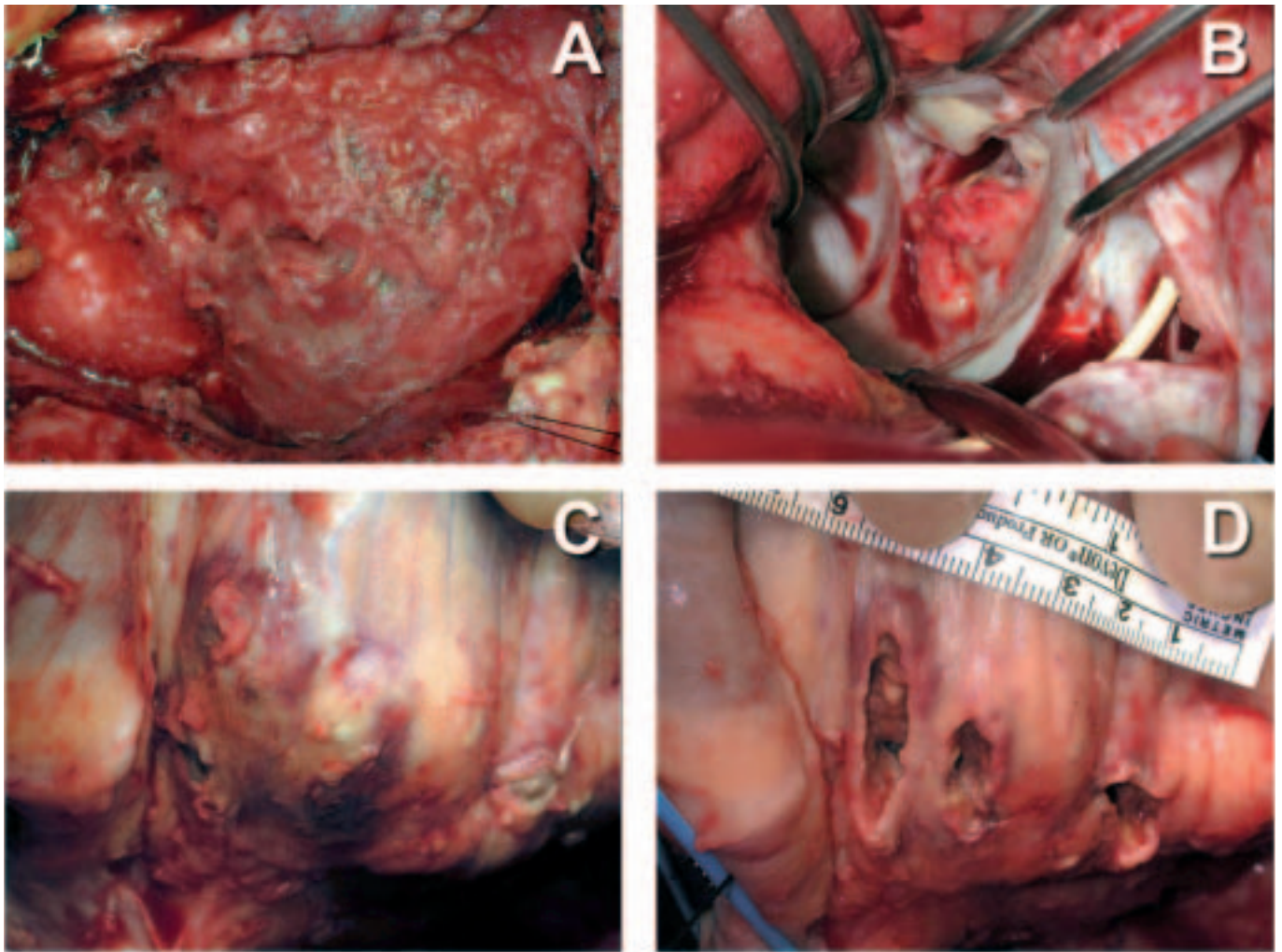


Figure 1: A) Severe hemorrhagic pericarditis with a thick fibrin coat on the heart; B) left atrial view, showing vegetation on the posterior leaflet of the mitral valve; C) outside view of the inferior basal wall of the left ventricle, showing atrioventricular groove abscess; D) outside view of the atrioventricular groove after debridement, showing three contiguous areas of perforation related to mitral valve abscess.

marked organization posteriorly.

Surgery was carried out via a median sternotomy. Opening the pericardium revealed a severe hemorrhagic pericarditis with a thick fibrin coat on the heart (Fig. 1A). Cardiopulmonary bypass (CPB) was initiated and the heart arrested with cold antegrade and retrograde blood cardioplegia. The thick fibrin coating was cautiously and completely peeled from the heart. When inspecting the base, extensive swelling and induration along the atrioventricular groove with three necrotic areas were seen, and manipulation produced pus (Fig. 1C).

The mitral valve was approached through the atrial septum and the dome of the left atrium, thus exposing the mitral valve with a vegetation and perforation in the posterior leaflet (Fig. 1B). The posterior leaflet was released from the annulus. Vegetations were seen to be located along the two-thirds-posteromedial portion of

the mitral annulus. Debridement opened a large abscess along the atrioventricular groove. No involvements of the anterior mitral leaflet or the aortic valve were identified. Careful debridement was performed from the inside and outside of the heart, cleaning away all pus and necrotic tissue from the abscess cavities. The abscess was open both to the atrium and ventricle and the pericardium. Very generous irrigation was performed repeatedly. A piece of autologous pericardium was harvested and a double-layer patch used to cover the annulus defect and the atrioventricular groove perforation. The pericardial patch was sutured to the muscle with a running 4-0 Prolene suture. The anterior mitral leaflet was detached from the annulus and transferred posteriorly and also used to support the annulus. Pledged valve sutures were placed from the ventricular side. In the abscess area, the sutures were taken through the transposed anterior mitral

valve leaflet, through the pericardial patch, and through the atrial side of the annulus. The three epicardial openings of the abscess were left for drainage (Fig. 1D). A 29-mm mitral Carpentier-Edwards Perimount (Edwards Lifesciences, Irvine, CA, USA) pericardial bioprosthesis was implanted. The patient was weaned from CPB without difficulty. Bleeding was a problem and the pericardial cavity was eventually packed with sponges and the chest left open. There was no bleeding from the abscess openings.

Multiple blood product transfusions were administered to correct coagulation disturbances. Vasopressors were required during the first postoperative day. Over two days, the patient was stabilized and returned to the operating room, where the chest was successfully closed.

The subsequent postoperative course was complicated by sepsis, acute renal failure requiring dialysis and prolonged mechanical ventilation. The antibiotic treatment (including vancomycin) controlled the infection and was continued for 12 weeks. Repeated postoperative TEE and transthoracic echocardiography showed complete resolution of the abscess, with no signs of recurrent endocarditis. The patient's renal function recovered after three weeks of dialysis. Neurological recovery was slow, but eventually very good. The patient was discharged from the intensive care unit after 23 days and sent home after 40 days in good condition with normal renal function and the tracheostomy removed.

## Discussion

The present case illustrates the less well-described ultimate development of advanced mitral valve endocarditis with annular breakthrough in the atrioventricular groove and the development of an atrioventricular groove abscess and associated hemorrhagic fibrinous pericarditis. Mitral annular calcification is a condition that is commonly observed among the elderly, and is associated with aortic calcification and atherosclerosis. The presence of bacterial endocarditis may or not be predisposed by annular calcification, as few autopsy studies (3,4) have suggested such an association. In theory, this disorder provides a good field to bacterial adhesion when endothelial erosion exposes the calcification to transient bacteremia (5). Due to the avascular nature of the calcification, antibiotics may not adequately reach the infection, allowing abscess formation (5). *Staphylococcus aureus* is the most frequent infective agent; the infection frequently perforates the posterior leaflet, forming ring and myocardial abscesses.

In the present case, the aggressive infection led to annulus breakthrough and abscess formation in the

atrioventricular groove fat adjacent to the posterior mitral annulus. The pathogenesis is related to bacterial destruction, tissue weakening, and subsequent dissection and expansion (6). Despite annulus invasion and perivalvular abscesses and/or cavities being relatively common with mitral valve bacterial endocarditis, the ultimate development of an atrioventricular groove abscess or pseudoaneurysm is rare (1), and the present entity is neither well recognized nor described. The occurrence of a pericardial effusion during the course of an acute endocarditis is related to the severity of the infection and is suggestive of advanced pathology (7).

Early and accurate diagnosis is particularly important. As shown by the present case, preoperative diagnosis is often difficult. Transthoracic echocardiography may miss the abscess or pseudoaneurysm because of poor imaging conditions and artifacts generated by the calcifications or a prosthetic valve. TEE - especially in multiplane format (7,8) - provides an optimal view of the whole mitral annulus, and particularly of its posterior aspect, which is most often the site of calcification. An abscess is defined as a localized and poorly delineated accumulation of pus, with echo-rich tissue induration. In the present case, TEE also failed to provide an accurate preoperative diagnosis. A pseudoaneurysm appearing as a perivalvular cavity with blood flow and a well-defined communication to the cardiovascular lumen is easier to see (6). Not even the intraoperative TEE findings were impressive, and the mitral regurgitation was only mild, with one central leak and a small perforation of the posterior leaflet. No echocardiographic evidence of abscess or pseudoaneurysm was found, and the only suggestive finding was an increased mobility of the posterior leaflet annulus. The definitive diagnosis was surgically derived in the present case.

The value of other diagnostic modalities such as dynamic computed tomography scanning and magnetic resonance imaging is yet to be proven.

Only surgery can salvage a patient in this condition, before fatal rupture occurs (1). An aggressive surgical approach with removal of all infected and necrotic tissue, generous irrigation and annulus and ventricular reconstruction is required for success. The intracavitary patch repair is the adopted technique, and this minimizes wall tension on the left ventricle. The preferred patch material is fresh autologous pericardium because of its ready availability, better hemostasis, less thrombogenicity and - presumably - a greater resistance to infection. Bovine pericardium is a possible alternative, however. An extracardiac approach is not an alternative because of limited exposure and a potential for injury of the coronary arteries and atrioventricular groove rupture.

## References

1. Kim HS, Weilbaecher DG, Lie JT, Titus JL. Myocardial abscesses. *Am J Clin Pathol* 1978;70:18-23
2. Oosterbosch L, Oei F, Rogiers P, Vaerenberg M, Ranquin R, Nagler J. *Escherichia coli* endocarditis of a native mitral valve with paravalvular pseudoaneurysm formation and fatal hemopericardium. *Acta Cardiol* 1996;51:535-540
3. Burnside JW, Desanctis RW. Bacterial endocarditis on calcification of the mitral annulus fibrosus. *Ann Intern Med* 1972;76:615-618
4. Arnett EN, Roberts WC. Valve ring abscess in active infective endocarditis. Frequency, location, and clues to clinical diagnosis from the study of 95 necropsy patients. *Circulation* 1976;54:140-145
5. Fulkerson PK, Beaver BM, Auseon JC, Graber HL. Calcification of the mitral annulus. Etiology, clinical associations, complications and therapy. *Am J Med* 1979;66:967-977
6. Tingleff J, Egeblad H, Gotzsche CO, et al. Perivalvular cavities in endocarditis: Abscesses versus pseudoaneurysms? A transesophageal Doppler echocardiographic study in 118 patients with endocarditis. *Am Heart J* 1995;130:93-100
7. Wisbar A, Keim MW, Momper R, Eschenbruch EM, Braun B, Hust MH. Value of repeated multiplane transesophageal echocardiography in a patient with mitral valve ring abscess and left ventricular pseudoaneurysm. *J Am Soc Echocardiogr* 2001;14:750-753
8. Eicher JC, Falcon-Eicher S, Soto FX, et al. Mitral ring abscess caused by bacterial endocarditis on a heavily calcified mitral annulus fibrosus: Diagnosis by multiplane transesophageal echocardiography. *Am Heart J* 1996;131:818-820