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Porcine bioprosthetic valve endocarditis is an infrequent but serious complication of valve replacement surgery. Ring (or annular) abscess is a frequent finding in mechanical valve endocarditis. In contrast, porcine valve endocarditis most often involves the cusps, and annular infection is uncommon. Porcine valvular dysfunction secondary to endocarditis usually takes the form of incompetence, whereas stenosis is less frequent. We report a case of a 76-year-old female who developed endocarditis with Staphylococcus epidermidis *nine months after placement of a Carpenter-Edwards porcine aortic valve. Her initial presentation included complete heart block and moderate aortic stenosis. Transesophageal echocardiography aided the diagnosis by demonstrating large vegetations, while transthoracic echocardiography showed only slight thickening of the valve leaflets. At operation, there was a circumferential abscess around the sewing ring causing valve dehiscence and virtual discontinuity of the aorta from the left ventricle. Valve degeneration and organisms within the cusps were observed on microscopy. This case illustrates two infrequent complications of porcine aortic valve endocarditis, namely massive annular abscess with invasion of the conducting system and aortic stenosis. It also demonstrates the utility and limitations of transesophageal echocardiography in the diagnosis of this disorder. (Henry Ford Hosp Med J 1991;39:123-5)*

Porcine bioprosthetic heart valves are utilized for valve replacement when anticoagulation is undesirable and, particularly in the elderly, when intrinsic prosthetic degeneration will not limit patient survival. As with mechanical devices, porcine heterografts have a low but significant incidence of infective endocarditis which carries a high risk of mortality despite aggressive medical and surgical management.

The development of sewing ring or annular abscesses and their serious sequelae is a common autopsy finding with mechanical valve endocarditis (1) but is noted less frequently in porcine valve endocarditis (2,3). Clinically, porcine prosthetic valvular dysfunction due to infection usually takes the form of incompetence. Particularly in the aortic position, it is rare for large vegetations to cause stenosis by obstructing the valve orifice (1-3).

Transesophageal echocardiography (TEE) has proved to be a useful tool in the diagnosis of endocarditis and particularly in prosthetic valve endocarditis (4).

We describe a patient with porcine bioprosthetic aortic valve endocarditis complicated by an extensive circumferential annular abscess and aortic stenosis, in whom TEE added to the accuracy of the preoperative diagnosis.

Case Report

A 76-year-old female presented with complaints of generalized weakness, easy fatigability, and low-grade fever of one-week duration. Nine months prior to admission, she had undergone aortic valve replacement with a 23 mm Carpenter-Edwards porcine bioprosthetic valve for aortic insufficiency secondary to aortic root dilatation from long-standing hypertension. On physical examination, her temperature was 37.4° C (99.3° F), blood pressure 97/56 mm Hg, and pulse 50 beats/min and regular. The cardiac examination was remarkable for a laterally displaced, diffuse, sustained apical impulse, a soft S2, and a III/VI systolic ejection murmur heard best at the second right intercostal space and radiating to the carotid arteries. The remainder of the examination was normal. The white blood cell count was 15.9 10^9/L (15,900/μL) with 79% polymorphs and 10% band forms. The hemoglobin was 95 g/L (9.5 g/dL), the platelet count 117 10^9/L (117,000/μL), and the sedimentation rate 31 mm (Westergren). Results of other routine laboratory tests were unremarkable. The electrocardiogram revealed complete heart block and a wide QRS complex with left bundle branch block morphology. A chest x-ray revealed cardiomegaly but no evidence of pulmonary congestion. On the evening of admission, the patient had a fever of 39° C (102.2° F) and rigors, and intravenous vancomycin and gentamicin therapy was started. Transthoracic echocardiography demonstrated slight thickening of the aortic valve cusps (Fig 1) and concentric left ventricular hypertrophy with good contractility.

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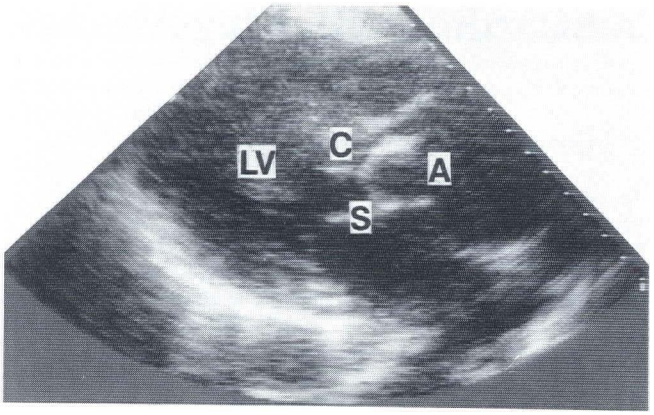


Fig 1—Two-dimensional echocardiogram, parasternal long axis view, demonstrating thickening of porcine aortic valve cusps (A = aorta, LV = left ventricle, S = porcine valve stent, C = valve cusp).

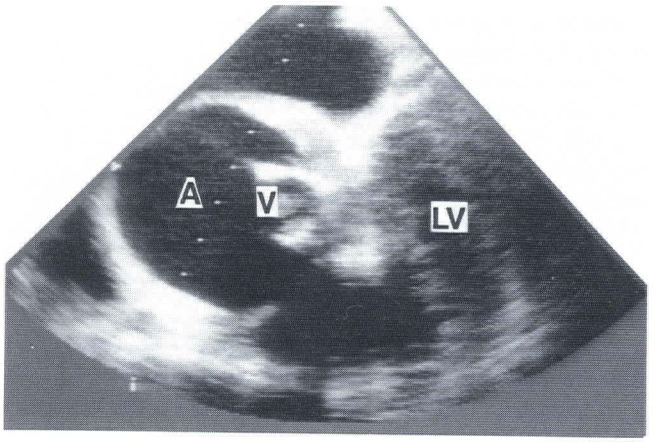


Fig 2—Transesophageal echocardiogram showing a large vegetation on the aortic valve. The distance between each white dot across the left side of figure represents 1 cm (V = vegetation, A = aorta, LV = left ventricle).

Doppler echocardiography showed increased velocity across the aortic valve with a maximum systolic gradient of 72 mm Hg, a mean gradient of 37 mm Hg, and an estimated valve area of 0.9 cm^2, suggestive of moderate aortic stenosis. No incompetence or vegetations were demonstrated. TEE revealed a large vegetation on the porcine aortic valve cusps, measuring 12 mm in diameter, which prolapsed into the outflow tract (Fig 2). In addition, the adjacent interventricular septum was thickened and hypoechoic suggestive of a septal abscess (Fig 3). Again, no aortic incompetence was noted. Subsequently, all six blood cultures drawn during the first 48 hours of hospitalization grew *Staphylococcus epidermidis*. By the third hospital day, bacteremia had cleared. The organism was resistant to oxacillin with a minimum inhibitory concentration (MIC) of > 8 μg/mL, but sensitive to vancomycin (MIC of 2 μg/mL). Rifampin (MIC of ≤ 1 μg/mL) was added to the antibiotic regimen but subsequently discontinued because of severe elevations of serum transaminases.

At operation, there was an abscess involving the entire circumference of the prosthetic valve sewing ring, causing virtual discontinuity

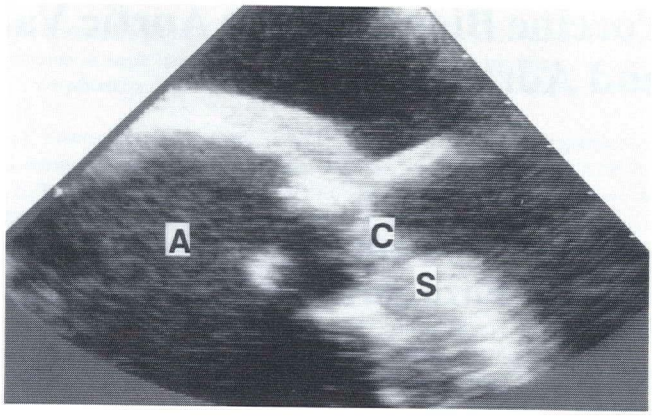


Fig 3—Transesophageal echocardiogram demonstrating thickened aortic valve cusps and thick hypoechoic interventricular septum (A = aorta, C = cusps, S = interventricular septum).

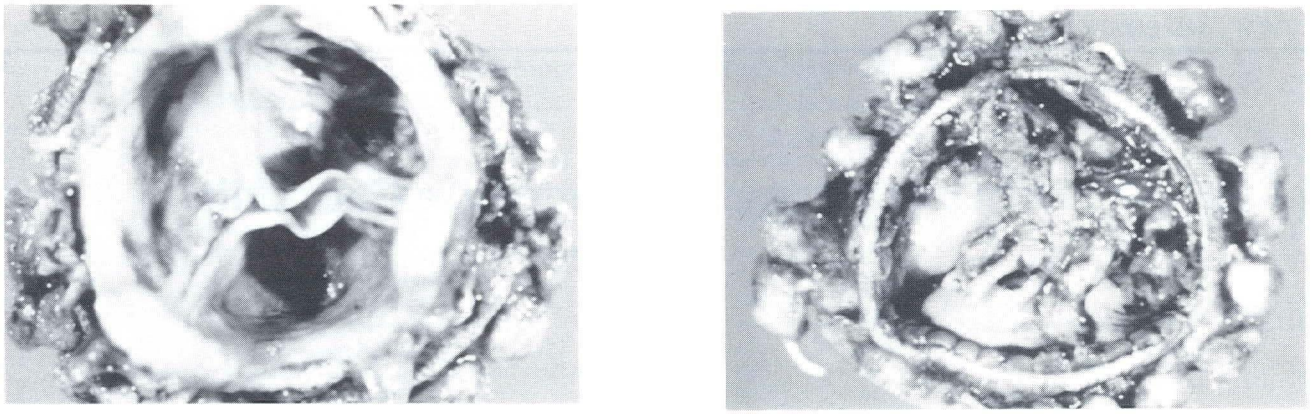
of the aorta from the left ventricle. A new Carpenter-Edwards valve was placed with attempts to reestablish aortoventricular continuity with the valve sutures. Grossly, the explanted valve had an irregular vegetation measuring 1.5 × 1.0 cm on the ventricular surface of the cusps, obstructing the valve orifice (Fig 4). Microscopically, the vegetations consisted largely of platelet fibrin thrombi admixed with colonies of gram-positive cocci. Bacterial colonies and acute inflammation were seen on the surface and within the substance of the cusps, consistent with infective endocarditis. In addition, there was collagen degeneration of the valve cusps (Fig 5). Cultures from the valve surface also grew *Staphylococcus epidermidis*.

Postoperatively, the patient was pressor dependent and died two weeks later from sepsis and renal failure. Blood cultures grew *Proteus mirabilis* five days postoperatively. Staphylococci were not isolated on any subsequent blood cultures. The source of the gram-negative bacteremia was unclear. Consent for autopsy was denied.

Discussion

The incidence of prosthetic valve infective endocarditis is 3.1% in patients receiving porcine valve heterografts, compared with 3.8% for mechanical valves (5). The overall mortality for both is about 29% (5).

Sewing ring (or annular) abscess is common in mechanical valve endocarditis. Arnett and Roberts (1) found annular infection in each of their 22 autopsy cases of infective endocarditis with mechanical prostheses. Since the synthetic materials used in mechanical valves cannot themselves support bacterial or fungal growth, infections are related not to the valve superstructure but rather to the sewing ring at the site of tissue attachment (6). In contrast, the preferred site of bacterial invasion with porcine valves appears to be the fibrin layer which forms on the cusp surface after denudation of the valve endothelium exposes the highly thrombogenic subendothelial connective tissue (2). Consequently, ring abscesses are less common in porcine valve endocarditis. Ferrans et al (2) found only three cases of ring abscess among 47 patients with porcine valve endocarditis. However, when ring abscess does occur, it obviates nonsurgical eradication of the infection (6).



(A) (B)

Fig 4—A: Aortic surface of porcine valve free of vegetations. B: Ventricular surface of valve with vegetative material obstructing valve orifice.

Valvular dysfunction in both types of prosthetic valve endocarditis usually takes the form of incompetence. With mechanical prostheses, valve dehiscence and perivalvular leak lead to regurgitation. In contrast, tears, perforations, or widespread destruction of the cusps is the usual mechanism of insufficiency with bioprosthetic heterografts (6). Occasionally, obstructing vegetations and/or thrombi can lead to stenosis with either type of prosthesis. This complication appears to be more common in the mitral position than in the aortic position (1-3). What is particularly unusual about the case reported here was the simultaneous occurrence of circumferential dehiscence of the prosthesis concomitant with hemodynamic evidence of stenosis rather than insufficiency.

The transesophageal location of the echocardiography probe, as compared to transthoracic, allows for better visualization of the aortic valve cusps in porcine bioprostheses (4,7). For this reason, bioprosthetic valve thickening and vegetations are more accurately observed (7,8). Sensitivity in the recognition of left-sided valvular vegetation is increased to near 90% by TEE compared to 58% with transthoracic echocardiography (4). Similarly, TEE offers a better window to the annulus in the search for abscess formation (8). Specificity of TEE for recognition of vegetations or annular abscess is unknown.

In our patient, the vegetation and annular abscess were detected by the transesophageal approach but not the transthoracic. However, we were unable to gauge the full extent of the circumferential abscess and therefore could not alert the surgeon preoperatively.

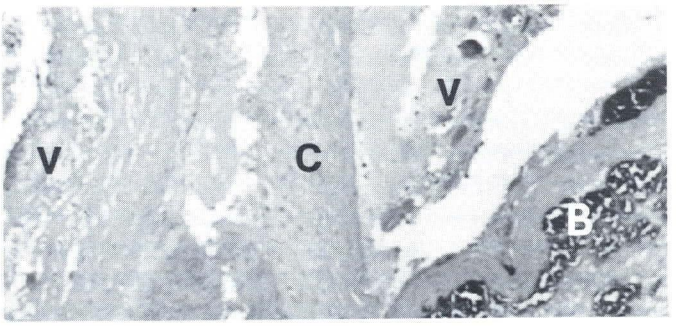


Fig 5—Histology of porcine valve (hematoxylin-eosin stain, 33X) (C = valve cusp with degeneration of collagen bundles, V = vegetative material on both sides of valve cusp, B = bacteria on surface and within substance of cusp).

Acknowledgment

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References

1. Arnett EN, Roberts WC. Prosthetic valve endocarditis: Clinicopathologic analysis of 22 necropsy patients with comparison of observations in 74 necropsy patients with active infective endocarditis involving natural left-sided cardiac valves. Am J Cardiol 1976;38:281-92.

2. Ferrans VJ, Boyce SW, Billingham ME, Spray TL, Roberts WC. Infection of glutaraldehyde-preserved porcine valve heterografts. Am J Cardiol 1979; 43:1123-36.

3. Bortolotti U, Thiene G, Milano A, Panizzon G, Valente M, Gallucci V. Pathological study of infective endocarditis on Hancock porcine bioprostheses. J Thorac Cardiovasc Surg 1981;81:934-42.

4. Mugge A, Daniel WG, Frank G, Lichtlen PR. Echocardiography in infective endocarditis: Reassessment of prognostic implications of vegetation size determined by the transthoracic and the transesophageal approach. J Am Coll Cardiol 1989;14:631-8.

5. Threlkeld MG, Cobbs CG. Infectious disorder of prosthetic valves and intravascular devices. In: Mandell GL, Douglas RG, Bennett JE, eds. Principles and practice of infectious diseases. New York: Churchill Livingstone, 1990:706-15.

6. Schoen FJ, Levy RJ. Bioprosthetic heart valve failure: Pathology and pathogenesis. Cardiol Clin 1984;2:717-39.

7. Alam M, Serwin JB, Rosman HS, Polanco GA, Sun I, Silverman NA. Transesophageal echocardiographic features of normal and dysfunctioning bioprosthetic valves. Am Heart J 1991;121:1149-55.

8. Jaffe WM, Morgan DE, Pearlman AS, Otto CM. Infective endocarditis, 1983-1988: Echocardiographic findings and factors influencing morbidity and mortality. J Am Coll Cardiol 1990;15:1227-33.