Prosthetic Aortic Valve Replacement Complicated by Diphtheroid Endocarditis and Aortopulmonary Fistula*

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Despite routine antibiotic prophylaxis and improvements in the design and techniques of implantation, endocarditis and disruption of the intracardiac prosthetic valves continue to be a real threat. Adequate control of infection with antibiotics or successful replacement of the infected prosthesis have been rare. Early diagnosis, specific antibiotic therapy, and surgical intervention offer the only hope of salvage of such patients.

Thromboembolism and infection are probably the most feared complications of intracardiac prosthetic surgery. Despite the usual precautions against infection, meticulous surgical technique, and antibiotic prophylaxis, the frequency of serious infection has been estimated to be approximately 1 percent. The umbrella of usual antibiotic protection has kept the occurrence of staphylococcal and streptococcal endocarditis to a minimum, but it has brought forth the malignant nature of some of the usually benign inhabitants of the atmosphere, oropharyngeal, gastrointestinal, and genitourinary tracts. Endocarditis caused by the common as well as uncommon pathogens has occurred more frequently where intracardiac prostheses were used. For reasons yet unknown, aortic valve prostheses have been the sites of such infections, more frequently than prostheses in the mitral area.

Therapeutic measures, whether surgical or medical, have carried a dismal outlook in prosthetic endocarditis. Most of such patients with established prosthetic endocarditis have had a fatal outcome as a result of systemic manifestations or mechanical dysfunction of the valve. The following concerns the report of the successful management of a patient who developed diphtheroid endocarditis of an aortic valve prosthesis and a subsequent mycotic aorto-pulmonary fistula with intractable heart failure (Fig 1). There are no reports in the literature of the successful management of diphtheroid endocarditis complicated by bacterial necrosis of the left coronary sinus and development of a left to right shunt at this level, although mycotic aneurysms at the aortic root have been reported as a complication.

Case Reports

A 46-year-old white man (school teacher) underwent aortic valve replacement for severe calcific aortic stenosis at the Veterans Administration Hospital, Kansas City, Missouri on June 10, 1969. Preoperatively he had noted progressive dyspnea, fatigue, and occasional angina pectoris. Cardiac catheterization had demonstrated a gradient of 100 mm Hg across the aortic valve, with a cardiac index of 2.9 L/M²/min and an estimated aortic valve area of 0.7 cm calculated by Gorlin's formula. Preoperative preparation designed for the control and prevention of infection included the following: nose, throat, and sputum cultures were obtained to identify potentially infecting organisms. Hexachlorophene washes twice daily were initiated four days preoperatively. The patient was started on prophylactic sodium oxacillin and ampicillin 500 mg of each every six hours the day before operation. During the operative procedure the intravenous infusion of lactated Ringer's solution contained ten million units of aqueous penicillin. The cloth-covered Starr-Edwards valve (model 2300) selected for insertion was briefly soaked in 1 gram of ampicillin while the initial commissural sutures were being placed. Oxacillin and ampicillin were continued for five days postoperatively. The initial postoperative course was uncomplicated except for bleeding from a previously known duodenal ulcer when anticoagulant therapy with

Figure 1. Summary of the patient's hospital course showing the time relation of antibiotic therapy and reoperation to the blood culture studies.

Figure 2. Diagrammatic representation of site of fistula on aortic root in the left coronary sinus, medial to the opening of the left coronary artery.
Coumadin was started. This was controlled by antacids and discontinuation of anticoagulants. The patient was discharged on his 15th postoperative day, with no unusual symptoms.

On July 5, 1969, the patient was readmitted to the hospital with complaints of fever 104-105°F and the onset of numbness and weakness in the left upper extremity. On examination, petechiae, splenomegaly, and splinters in the nail beds were noted. Funduscopic examination was normal. Pulse rate varied between 114 and 130 per minute while the blood pressure was 90/60 mm Hg supine and 80/60 mm Hg in the sitting position. Cardiac auscultation revealed a grade II/VI systolic murmur in the aortic area and normal sounds of the prosthetic ball. A clinical diagnosis of prosthetic valve endocarditis was made. Numerous blood cultures were obtained. Most of these yielded gram positive aerobic coccobacilli consistent with diphtheroids. Initial cultures suggested sensitivity to cephalothin and kanamycin and intensive therapy with these agents was started. Over several days the patient became afebrile, cultures became negative, but his clinical status failed to improve. Blood pressure remained low, tachycardia persisted and a grade II/VI diastolic murmur appeared in the aortic area. Kanamycin was discontinued because of the development of toxicity manifested by tinnitus and hearing loss. Fever gradually recurred with increasing severity and simultaneously the patient developed a generalized rash forcing discontinuation of cephalothin therapy. Blood cultures again became positive, but the organism now showed sensitivity only to gentamycin sulfate. After therapy with gentamycin 4 mg/kg body weight daily for two weeks, inhibition studies showed that the bactericidal activity had decreased to 1:2 dilutions. Fever again declined, but the patient's condition continued to deteriorate as manifested by the development of frank congestive heart failure, the development of increasingly frequent premature ventricular contractions and the appearance of a continuous murmur in the aortic area. Blood cultures continued to grow diphtheroids.

On August 27, 1969 reoperation was carried out as a desperate measure to control the source of infection and reverse cardiac decompensation. At operation, a marked continuous thrill was palpable in the root of the main pulmonary artery. Utilizing a disposable bubble oxygenator, non-blood prime, moderate hypothermia and total anoxic arrest, the aorta was opened for replacement of the infected prosthesis. The prosthesis was covered with greyish white friable material and following the resection of the valve, a fistulous tract 3-4 mm in diameter was seen to connect the left coronary sinus to the root of the main pulmonary artery (Fig 2). Debridement of the annulus and fistulous tract were carried out. The fistula was closed using a pericardial patch and 4-0 synthetic sutures. A new Starr-Edwards cloth-covered prosthesis (model 2300) soaked in concentrated gentamycin solution was sutured in place using interrupted 2-0 figure-of-eight synthetic sutures. After 65 minutes of total cardiopulmonary bypass, effective cardiac activity was restored by one direct current countershock.

Cultures of the prosthesis and tissue debrided from the fistulous tract showed numerous colonies of aerobic diphtheroids. The postoperative course was uneventful except for the development of serum hepatitis. The patient received gentamycin sulfate until September 17, 1969 when it was discontinued because of toxic symptoms. Phonocardiogram prior to his discharge on October 11, 1969 showed tracings consistent with a normally functioning aortic prosthesis. The patient has since returned to full physical activity and continues to be asymptomatic on follow-up (Fig 3A and B).

**DISCUSSION**

Bacteremia of no major clinical significance, usually transient, occurs with significant frequency. Intracardiac prostheses with a metal frame and cloth fixation ring may be easily susceptible to serious infection because of the creation of an area of turbulence and the
ability of the cloth covering to harbor infection. Barney and co-workers demonstrated that 100 percent of animals inoculated with a predetermined dose of *Streptococcus mitis* developed endocarditis if a prosthesis was placed or if the aortic valve was damaged, while no infection developed in a control group exposed to the same dose of bacteria. Initial hopes that totally cloth covered prostheses would be more resistant to bacteria and fungi when blood cultures are negative is not substantiated in calf studies by Detmer et al. Present regimens of antibiotic therapy may be required to demonstrate the source of infection if routine studies are unrevealing. Disruption of sutures from the annulus has been frequent following prosthetic endocarditis.

Diphtheroids are ubiquitous in distribution and are frequently present as normal flora of the human skin and mucus membranes. These pleomorphic corynebacteria are notorious for aerobic, anerobic, gram positive as well as gram negative manifestations on culture and stain studies. An awareness of such variable manifestations of bacteria and fungi when blood cultures are negative is vital to the early and successful management of postoperative endocarditis after cardiac valve replacement. Specialized cultural techniques designed to enhance the growth of fastidious organisms may be required to demonstrate the source of infection if routine studies are unrevealing. Disruption of sutures from the annulus has been frequent following prosthetic endocarditis. Involvement of the aortic closure has been fatal in most reported instances. Development of mycotic aneurysms in the peripheral vascular system particularly in the brain may occur with the risk of bleeding on anticoagulant therapy. Bacterial as well as fungal invasion in postmortem studies has shown a characteristic pattern of endocardial invasion with granulation tissue and vegetations incorporating the prosthetic valve annulus and cagae. Microorganisms were also demonstrable deeply embedded within the vegetative excrescences, making it inaccessible to antibiotic therapy. Hairston and Lee showed a depression of bactericidal activity and humoral defense mechanism in the serum of patients undergoing open heart surgery utilizing the non-membrane oxygenators.

Although there have been reports of diphtheroid endocarditis with prosthetic valves, the development of mycotic fistula and successful management have not been reported. One of the two cases reported by Johnson et al developed an aneurysm of the left coronary sinus due to diphtheroid endocarditis. Despite reoperation, both of their patients expired shortly after surgery. The jet effect of the left ventricular ejection and bacterial necrosis of the aortic root may explain the development of aneurysms and fistulae in these locations. An aggressive surgical approach may be the only means of salvage of patients with prosthetic endocarditis once resistance to antibiotics and evidence of mechanical and hemodynamic dysfunction has become obvious. Debridement of the necrotic tissue and presoaking of the prosthesis in specific antibiotic solution may be important in the success of reoperation. The feasibility of using autogenous or homograft tissue may have additional merit over a prosthesis in the presence of infection as reported by Mulder and Johnson. Lavin et al reported one case of successful medical management of diphtheroid endocarditis, while all ten patients in the series of Stein et al on medical treatment had fatal complications.

Baba and McKissick, Mulder and Johnson and others have reported rupture of mycotic aneurysms of the root of the aorta secondary to bacterial and fungal infestation. King and coworkers reported an outbreak of diphtheroid endocarditis affecting 15 percent of all patients subjected to prosthetic valve replacement in their institution during a nine-month period in 1969. Although prolonged and specific antimicrobial therapy is the backbone in such management of patients, replacement of the infected prosthesis in intractable cases is the only reasonable opportunity for cure and prevention of the usually fatal complications.

**References**

3. Hairston P, Lee WH: Management of infected prosthetic...
Idiopathic Muscular Hypertrophy of the Lower Esophagus and Pylorus in an Adult*

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Idiopathic muscular hypertrophy of the lower esophagus is a distinctly uncommon and at times unexpected finding at autopsy. Only 25 instances of esophageal involvement in adult patients and four in children have been recorded to date. The condition is usually seen in elderly men and is associated with a variety of chronic debilitating diseases. In contrast to the localized lesions in adults, muscular hypertrophy of the gastrointestinal tract in children is usually extensive. Some cases are congenital, others idiopathic and acquired. The relationship of the latter to lower esophageal spasm is discussed.

Idiopathic muscular hypertrophy with stenosis of the lower esophagus and pylorus in an adult is a distinctly uncommon and poorly understood anomaly. No reference to this condition could be found in the latest editions of medical texts.1,2 This condition has received very little attention in the United States and most of the reported cases are from England and Germany.

In reviewing the literature, Spencer and Hudson3 found 18 instances of esophageal involvement in adult patients. In three of these, the pylorus also showed hypertrophied muscularis. Sloper4 added seven cases of his own and briefly recorded 25 cases from the world literature. In contrast to the extensive lesions in children, muscular hypertrophy of the gastrointestinal tract in the adult is usually limited to the esophagus of elderly men.

The present case is unique in that the patient had marked dysphagia to the extent that he was unable to eat anything, while in most of the reported cases the condition appeared to have been asymptomatic. Of added interest was its association with amyotrophic lateral sclerosis, the first such recorded case, and the presence of muscular hypertrophy of the pylorus. It is hoped that continuous reports of similar cases will stimulate interest and further investigations in the still obscure etiology of this entity.

CASE REPORT

The patient was a 64-year-old white man admitted to Mercy Hospital on September 21, 1968, because of progressive difficulty in swallowing for the past two weeks to the extent that he was unable to eat anything in the last four days. Nine months earlier, he began to develop weakness and atrophy of the muscles of the upper extremities with fasciculations of the interossei muscles. He also noted a change in his voice over the past year which led to his illness, the patient lost approximately 40 pounds.

Physical examination revealed a cachectic white man in no acute distress. Blood pressure was 120/70 mm Hg, pulse rate 120/min, respiration rate 24/min. Heart tones were distant with no murmurs. Lungs revealed decreased respiratory excursions and breath sounds, with bilateral rales and rhonchi. There were no abdominal findings. Neurologic examination revealed an asthenic elderly man with a dysarthric voice and atrophy of the tongue muscles. There was atrophy, weakness and fasciculations of the small hand muscles with minimal weakness of the lower extremities, and hyperreflexia with bilateral Hoffmann's sign. The plantar reflex and sensory system were within normal limits.

Course

The clinical impression was that the patient had amyotrophic lateral sclerosis. He developed respiratory arrest that necessitated tracheostomy, therefore preventing x-ray examination of his esophagus and stomach. He became febrile and comatose and expired 18 days after admission.

Postmortem Examination

There was hypertrophy without dilatation of the esophagus, gradually increasing from the midportion (0.3 cm thick) to the lower end (1.1 cm thick) but without any additional thickening at the cardia. The overlying mucosa was grossly normal and the lumen markedly narrowed (Fig 1). A similar localized muscular hypertrophy was present in the region of the pylorus (Fig 2), maximal in its midportion (up to 1.3 cm thick) and fairly marked in the remainder (0.9 cm thick), but not obviously involving the antrum or the duodenum. The internal circumference measured 1.8 cm. Microscopic examination of the esophagus revealed the surface squamous...