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Pediatric Bioprosthetic Valve Bacterial Endocarditis - Is the Surgical Approach always Preferred?

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Abstract

Bioprosthetic Valve Infective Endocarditis (BP-IE) in children is a major risk for heart valve surgery carrying a high mortality rate. Although a surgical approach is considered primary treatment, some data suggest conservative treatment may be sufficient in selected patients. We present five cases of BP-IE in children with congenital heart disease with BP-IE treated conservatively. Pathogens identified in blood cultures were Streptococcus abiotrophia defectiva, Methicillin-resistant *Staphylococcus aureus*, *Streptococcus viridans*, and *Streptococcus gallolyticus*. Treatment included prolonged parenteral antibiotics under close follow-up of pediatric cardiologic and infectious diseases specialists. Two of our patients were treated with recombinant Tissue Plasminogen Activator (rTPA), with favorable outcomes. We suggest conservative treatment may lead to equivalent outcomes and may be considered in selected pediatric patients.

Keywords: Bioprosthetic valve infective endocarditis; *Congenital heart disease;* Plasminogen activator (rTPA)

Introduction

Bioprosthetic valve infective endocarditis is a major risk of congenital heart disease surgical repair carrying a high mortality rate [1,2]. Surgically created conduits, especially of bovine origin, are prone to complications of endocarditis [3]. Notably; clinical presentation in this population is often atypical [4].

Although a surgical approach is considered the principal treatment modality, it carries a mortality risk of up to 25% [5]. Some data suggest conservative treatment may be sufficient in selected patients [2], though data regarding pediatric patients are scarce.

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The demographic and clinical characteristics of patients are summarized in Table 1. Diagnosis of endocarditis was made according to Duke's criteria. Treatment included prolonged course of parenteral antibiotics and adjunctive recombinant Tissue Plasminogen Activator treatment in two patients. The minimal Follow-up was two years.

Case 1

A 14-year-old male with a history of Tetralogy of Fallot repair surgery at the age of 1 year using a pulmonary homograft, and a conduit replacement at the age of 10 years, due to severe pulmonary stenosis. He presented with fever, malaise, and elevated C-reactive protein (124 mg/L: Normal range <3 mg/L). Three blood cultures were positive for Streptococcus abiotrophia defectiva. On day 5 of fever, an echocardiogram showed a pulmonary valve mass. He was treated with gentamicin for two weeks and ceftriaxone for six weeks, with full resolution within six weeks. Follow-up echocardiograms showed a gradual reduction in the mass. Currently, two years post endocarditis, the patient is feeling well.

Case 2

A 2-year-old female with a history of Tetralogy of Fallot and absent pulmonic valve repair surgery at age 45 days, using a bovine homograft. At age ten months, she was hospitalized due to bronchiolitis and developed cellulitis. Five blood cultures were positive for Methicillin-resistant *Staphylococcus aureus*. A large pulmonary valve vegetation was observed, and treatment with

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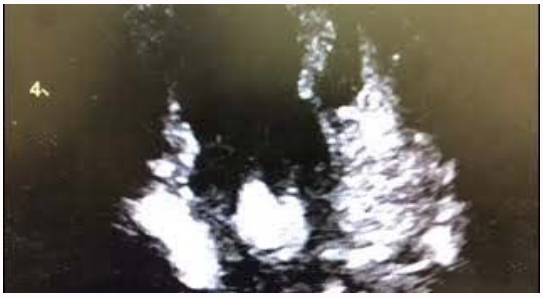
Table 1: Demographic and clinical characteristics of patients.

	Patient 1	Patient 2		Patient 3	Patient 4	Patient 5
Age at presentation	14 years	10 months	2 years	14 years	5 months	2 years
Gender	Male	Female		Male	Male	Female
Time to IE	13 years	8 months	1.10 years	4 years	4 months	1.11 years
Background diagnosis	TOF	TOF with absent pulmonic valve		TOF	Truncus arteriosus	TOF
Type of valve involved	Homograft	Homograft		Melody	Contegra	Contegra
Pulmonic peak gradient (mmHg)	45	27	21	45	72	31
Prior history of IF	No	No	Yes	No	No	No
Causative microorganism	*Steptococcus Abiotropia* defectiva	Methicillin-resisatnt *Staphylococuus Aureus*		*Streptococcus Viridans*	*Streptococcus Gallolyticus*	Not identified
Antibiotic treatment	Gentamicin, Ceftriaxone	Gentamicin, Vancomycin, Rifampicin, Linezolid	Ceftriaxone, Vancomycin, Gentamicin	Gentamicin, Ceftriaxone,	Gentamicin, Ceftriaxone,	Gentamicin, Ceftriaxone,
Length of antibiotic treatment	6 weeks	9 weeks	6 weeks	9 weeks	6 weeks	5 Weeks
Additional treatment	None	Recombinant TPA	None	None	None	Recombinant TPA



Video 1: Right ventricular outlet vegetation; parasternal short axis view.

gentamicin, vancomycin, and rifampicin was initiated. Due to the high surgical risk, she was treated with Recombinant Tissue Plasminogen Activator, with a subsequent decrease in vegetation size. After four weeks, the patient was discharged on Linezolid. At age two years, she was readmitted for respiratory distress and fever. She was prior treated with amoxicillin. An echocardiogram demonstrated a pulmonary valve vegetation-sized 17 mm × 12 mm. Blood cultures were negative, presumably due to prior antibiotic therapy. She was treated as a second event of infective endocarditis with ceftriaxone, vancomycin, and gentamicin for six weeks with full resolution.

Case 3

A 14-year-old male with a history of Tetralogy of Fallot had Blalock-Taussig shunt surgery at the age of 2 months, a total repair at the age of 1 year, and a Melody pulmonary valve implantation due to right ventricular dilatation at the age of 10 years. He presented with fever, fatigue, and elevated C-reactive protein of 93 mg/L. Three blood cultures were positive for *Streptococcus viridans*, with no visible vegetation on the echocardiogram. He was treated with gentamicin for 17 days and ceftriaxone for nine weeks with a complete recovery. Subsequent blood cultures were sterile, and C-reactive protein was normalized after one month.

Case 4

A 5-month-old male with a history of Truncus arteriosus repair at the age of 3 months using a Contegra conduit with pulmonary artery stenosis. He presented with fever, vomiting, and dyspnea. Laboratory results showed elevated C-reactive protein (70 mg/L). Two blood cultures were positive for *Streptococcus gallolyticus*. An echocardiogram demonstrated an unchanged right pulmonary artery narrowing with a maximal gradient of 72 mmHg without visible vegetation. He was treated for two weeks of gentamicin and six weeks of ceftriaxone with clinical improvement.

Case 5

A 2-year-old girl with a history of Tetralogy of Fallout repair using Contegra conduit at age one month and severe pulmonary artery stenosis treated with stent implantations. She presented two months after cardiac catheterization with fever, leukocytosis (17 × 10^3/ul, normal range 5-15.5 × 10^3/ul), and elevated C-reactive protein (75 mg/L). She was prior treated with Amoxicillin/clavulanic acid for a week. Blood cultures were negative. An echocardiogram demonstrated a fluctuating mass sized 8.6 cm × 7.6 cm on the lateral leaflet of the pulmonary valve (Video 1). She was treated with gentamicin for two weeks and ceftriaxone for five weeks. Additionally, she was treated with two doses of recombinant Tissue Plasminogen Activator with the gradual disappearance of the mass.

Discussion

We present five cases of Bioprosthetic valve infective endocarditis treated conservatively. All patients had no other comorbidities, were hemodynamically stable during treatment, showed a rapid response, and eventually had complete recovery without residual graft dysfunction. None of our patients presented with complications such as acute heart failure, systemic thromboembolic phenomena, or irreversible structural damage. Antibiotic therapy was selected according to pathogen susceptibilities or based on potential pathogens in cases of negative-culture infective endocarditis.

Operating on a bioprosthetic valve infective endocarditis depends on several considerations, including age, hemodynamic stability, specific pathogen, the extent of infection, and time from primary surgery [3,5].

Early infections after surgery, especially with *Staphylococcus aureus* [6], are more common and aggressive and may lead to complications such as root abscesses and dehiscence, usually requiring surgery. In contrast, late infections are characterized by a microbial spectrum similar to native valves. Tissue destruction is less common; thereby, early antibiotic therapy is sufficient in many patients [5].

Several studies in adults have shown equivalent outcomes between surgical and conservative treatment, such as recurrence, late mortality, and reoperation. They suggested that carefully selected patients with non-Staphylococcal infection, without congestive heart failure, large abscesses, or valve dehiscence, may be managed conservatively [7]. In a study that included children with bioprosthetic valve infective endocarditis, patients treated conservatively had no mortality, including a 16-year-old patient with *Staphylococcus aureus* infection [8]. The use of recombinant Tissue Plasminogen Activator as adjunctive therapy in treating infective endocarditis in children was previously described as beneficial in facilitating the faster resolution of infection [9]. Two of our patients were treated with recombinant Tissue Plasminogen Activator and antibiotic therapy and had a substantial decrease in the size of vegetation.

Conclusion

Conservative treatment may lead to equivalent outcomes and may be considered in carefully selected pediatric patients with bioprosthetic valve infective endocarditis. It offers a safe, non-invasive approach for high-risk patients. Further research on larger cohorts of pediatric patients is required.

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