Endocardial Abscesses in Children: Case Report and Review of the Literature

Falguni S. Shah, Glenn Fennelly, Jacqueline Weingarten-Arams, L. Yang, and Julie Glickstein

The rarity of perivalvular abscesses arising as a complication of bacterial endocarditis in the pediatric population limits its recognition and awareness of its often malignant course. The diagnosis depends on a combination of clinical criteria, including persistent fever and bacteremia, the presence of an atrioventricular block and persistent embolic phenomenon, and transthoracic or transesophageal echocardiographic confirmation. Because of the infrequency of perivalvular abscesses in children, there is no consensus on a treatment strategy. Early detection and intervention with antibiotics and surgical debridement are recommended to decrease the morbidity and mortality associated with this disease. A case of a 14-year-old boy with an aortic root abscess is presented, along with review of other cases reported in the last 20 years in children in relation to risk factors, clinical features, diagnosis, therapy, and mortality.

Bacterial endocarditis is severe and often fatal in children. Perivalvular extension of infection is one of the serious complications of endocarditis [1]. Reports of this disease are rare in children, and therefore its incidence is difficult to estimate [1]. In addition, there is no standard treatment protocol. We describe the case of a 14-year-old boy with an endocardial abscess that occurred as a complication of bacterial endocarditis and discuss its clinical course. We also review the clinical characteristics and outcomes of 15 other cases of endocardial abscesses in children reported in the last 20 years.

Case Report

A 14-year-old African-American boy presented with complaints of a 10-pound weight loss, intermittent fever, chills, generalized arthralgia, and tender swelling of third and fourth digits of his left hand following extraction of a molar 6 weeks earlier. He reported taking oral penicillin for 5 days after the procedure. His past medical history had been uneventful and there was no personal or family history of heart disease. He denied using iv drugs.

On presentation, his examination was significant for the following values: temperature, 39°C; pulse, 120 per minute; respiration, 20 breaths per minute; and blood pressure, 133/68 mm Hg. His lungs were clear to auscultation and his cardiac examination demonstrated normal first and second heart sounds and a grade III/VI decrescendo diastolic murmur of aortic insufficiency along the left sternal border. The liver appeared to be of normal size and a spleen tip was palpable. Erythematous and tender swelling of the fourth digit of his left hand was noted. He had a Janeway lesion on his left palm.

His peripheral WBC count was 11,800/mm³, with 77% neutrophils and 7% band forms. His hemoglobin level was 10.5 g/dL. Urinalysis showed 3–4 RBCs per high-power field. His erythrocyte sedimentation rate was 76 mm/h. Initial radiography of the chest revealed mild cardiomegaly and normal lung fields.

He was admitted with the diagnosis of infective endocarditis, and therapy was initiated with intravenous vancomycin and gentamicin. Culture of blood drawn on presentation was reported to yield Streptococcus sanguis. Electrocardiography of the heart demonstrated mild left ventricular hypertrophy with a normal sinus rhythm. Transthoracic echocardiography (TTE) revealed a dilated left ventricle with decreased function and a bicuspid aortic valve with vegetations on the leaflets causing severe aortic insufficiency. A thin-walled endocardial abscess was seen at the aortic root, extending from the perivalvular area superiorly and posteriorly into the atrial septum. Transesophageal echocardiography (TEE) confirmed the above findings (figure 1).

The S. sanguis isolate obtained from the blood culture was found to be sensitive to vancomycin (MIC, 0.5 µg/mL). Despite therapeutic serum antibiotic levels, cultures of blood continued to yield persistently positive results, and the patient continued to have fever and chills. His total WBC count rose to 18,700/mm³. TEE on the third day showed the abscess unchanged from before. However, he became hemodynamically unstable, with atrial and ventricular ectopy and hypotension, and needed pressor support.

On the fourth hospital day, at surgery, an aortic root abscess measuring ~2 cm, bulging into the left atrium, was found. After debridement of the abscess, the Ross procedure was performed...
which involved replacing the infected aortic valve with the patient’s native pulmonic valve. A cadaveric valve was placed in the pulmonic root. A postoperative TEE revealed mild aortic insufficiency and left ventricular dysfunction. Within minutes after the completion of the surgery, the patient developed pulmonary artery hypertension and had a fatal cardiac arrest.

Postmortem evaluation revealed an enlarged heart with a hypertrophied left ventricular wall. The neoaortic valve was intact. The site of the abscess was seen as a large ragged aneurysmal cavity measuring 1.8 cm deep into the left coronary cusp. Other findings included bronchopneumonia of the right lung, microinfarcts of the kidney, and reactive changes in the spleen. Cultures of blood samples obtained just prior to surgery remained negative.

This case highlights the severity of and difficulty in managing endocarditis complicated with abscess formation in children. To better define a consensus on diagnostic and treatment strategy, we reviewed all cases of endocarditis complicated with endocardial abscesses containing at least 1 case in a child <20 years old. A summary of the data from the 15 individual cases thus identified, plus the present report, is provided in table 1.

Results

Since these cases have been reported over a 20-year period, different diagnostic and therapeutic options were applied, making it difficult to make any statistical interpretation of the data. The mean age of the children included in our review is 15.8 years (range, 8–19 years). The majority of the patients had native aortic valve involvement. Five of 16 patients had an underlying native valve abnormality. *Staphylococcus* appears to be the predominant organism. In 9 of 10 patients for whom echocardiographic findings are described, the diagnosis of an abscess was made with the help of a two-dimensional echocardiograph before surgery [5–7, 10, 11] (present report). In only 1 of these patients was a TEE deemed to be more sensitive than a TTE [9]. Eight of 11 patients who underwent debridement of the abscess were reported to be doing well at least 1 year after the surgery, whereas 3 died within 3 months after surgery [2, 3, 5, 7–10] (present report). Among the 5 patients who did not undergo surgery, 3 died, 1 showed resolution of the abscess 1 month after medical treatment, and 1 was alive and well at a 3-year follow-up [4–6, 11].

Discussion

The incidence of endocardial abscesses in adults is reported to be ~30%–40% with native aortic valve infective endocarditis [1, 10, 12–15] and 60% with prosthetic valve endocarditis [1, 13, 14]. The true incidence in children is not known; however, it is presumably rare, since only 15 cases have been reported in the past 20 years. The most common valve affected is the aortic valve, which is in agreement with our observation in children [11, 12, 16–18]. The predominant organism isolated in both adults and children appears to be *Staphylococcus* [6, 12, 14, 19], although some series report *Streptococcus* as the most commonly isolated organism in adults [3, 5, 9, 16, 17].

The preoperative and premortem diagnosis of a perivalvular abscess traditionally has depended on a combination of clinical and echocardiographic criteria [13]. Specifically, in adult patients, indications for an extensive search for an endocardial abscess are considered to be fulminant presentation and aortic or prosthetic valve involvement, with one or more of the following: a new pathologic murmur, pericarditis, persistent fever, recurrent embolic phenomena, and/or persistent bacteremia, in spite of appropriate antibiotic therapy [1, 4, 13]. Since these specific clinical features were not described in all of the pediatric cases reviewed here, we cannot say whether the above factors hold true for children as well.

The findings of new persistent bundle branch block or complete heart block on an electrocardiograph are considered highly specific for the presence of a perivalvular abscess [1, 20]. Most authors estimate the specificity of a two-dimensional echocardiograph for this diagnosis to be ~90%, but the sen-
<table>
<thead>
<tr>
<th>Reference</th>
<th>Age, y (sex)</th>
<th>Valve</th>
<th>Presentation</th>
<th>Organism</th>
<th>Surgical and/or echocardiographic findings</th>
<th>Procedure</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>[2]</td>
<td>15 (M)</td>
<td>Native aortic</td>
<td>Fever, chills, weight loss, vomiting, diarrhea, cardiomegaly, aortic insufficiency, no conduction defects or signs of systemic emboli</td>
<td><em>Staphylococcus epidermidis</em></td>
<td>Aortic cusps replaced by granulation tissue, abscess in the aortic root</td>
<td>Aortic root debrided, prosthetic aortic valve placed</td>
<td>Prosthesis detached from the annulus, abscess reformed between aorta and the mitral valve, death from cardiac failure 4 mo after redebridement and insertion of a new prosthesis</td>
</tr>
<tr>
<td>[3]</td>
<td>16 (M)</td>
<td>Native aortic</td>
<td>Aortic insufficiency, no conduction defects or signs of systemic emboli</td>
<td><em>Staphylococcus aureus</em></td>
<td>Aortic root abscess</td>
<td>Debridement and insertion of prosthesis</td>
<td>Well at 12-month follow-up</td>
</tr>
<tr>
<td>[3]</td>
<td>15 (M)</td>
<td>Native aortic</td>
<td>No conduction defects or signs of systemic emboli</td>
<td><em>S. aureus</em></td>
<td>Aortic root abscess</td>
<td>Debridement and insertion of prosthesis</td>
<td><em>Candida albicans</em> septicemia in the postoperative period, well at 30-month follow-up</td>
</tr>
<tr>
<td>[3]</td>
<td>16 (M)</td>
<td>Native aortic</td>
<td>No conduction defects or systemic emboli</td>
<td><em>Viridans streptococci</em></td>
<td>Aortic root abscess</td>
<td>Debridement and insertion of prosthesis</td>
<td>Well at 48-month follow-up</td>
</tr>
<tr>
<td>[4]</td>
<td>17 (M)</td>
<td>Native aortic</td>
<td>Aortic regurgitation and right bundle branch block</td>
<td><em>S. epidermidis</em></td>
<td>NA</td>
<td>No surgery performed</td>
<td>Died 28 days after onset of symptoms; autopsy showed ring coronary abscess behind right cusp and perforated ventricular septum</td>
</tr>
<tr>
<td>[5]</td>
<td>21 (M)</td>
<td>Bicuspid aortic</td>
<td>NA</td>
<td><em>Streptococcus</em> species</td>
<td>Thickened aortic valves, left coronary sinus abscess, aortic ring pseudoaneurysm</td>
<td>No surgery performed</td>
<td>Well at 3-year follow-up</td>
</tr>
<tr>
<td>[5]</td>
<td>8 (M)</td>
<td>Native aortic</td>
<td>NA</td>
<td><em>S. aureus</em></td>
<td>Vegetations on aortic and mitral valve, left coronary sinus abscess</td>
<td>Debridement and insertion of prosthesis</td>
<td>Died 5 days after surgery</td>
</tr>
<tr>
<td>No.</td>
<td>Age</td>
<td>Gender</td>
<td>Valve Type</td>
<td>Clinical Features</td>
<td>Pathogen</td>
<td>Pathologic Findings</td>
<td>Management</td>
</tr>
<tr>
<td>-----</td>
<td>------</td>
<td>--------</td>
<td>------------</td>
<td>-------------------</td>
<td>-----------</td>
<td>---------------------</td>
<td>------------</td>
</tr>
<tr>
<td>6</td>
<td>18 (M)</td>
<td>Stenotic aortic</td>
<td>6 w of fever, sweats, and fatigue</td>
<td>Viridans streptococci</td>
<td>Vegetations on aortic valve, pseudoaneurysm of aortic ring, aortic valve ring abscess</td>
<td>No surgery performed</td>
<td>Developed fever, weight loss, hemiparesis, and aphasia 9 months after discharge and died after respiratory arrest; no autopsy performed</td>
</tr>
<tr>
<td>6</td>
<td>19 (M)</td>
<td>Native tricuspid</td>
<td>2.5-w history of fever and arthralgia</td>
<td>S. aureus</td>
<td>Vegetation on tricuspid valve, tricuspid valve ring abscess</td>
<td>No surgery performed</td>
<td>Abscess cavity smaller at 1-month follow-up</td>
</tr>
<tr>
<td>7</td>
<td>14 (M)</td>
<td>Native aortic</td>
<td>NA</td>
<td>Haemophilus influenzae</td>
<td>Aortic root abscess (cavity beneath right coronary sinus)</td>
<td>Debridement of abscess</td>
<td>Well at 8 months after surgery</td>
</tr>
<tr>
<td>7</td>
<td>9 (M)</td>
<td>Native aortic</td>
<td>NA</td>
<td>Viridans streptococci</td>
<td>Aortic root abscess, posterior to the aorta</td>
<td>Debridement of abscess</td>
<td>Well at 3 months after surgery</td>
</tr>
<tr>
<td>8</td>
<td>15 (M)</td>
<td>Prosthetic aortic</td>
<td>Fever, tachycardia, tachypnea, systolic murmur</td>
<td>Staphylococcus species</td>
<td>Aortic valve vegetations, aortic insufficiency, perianular abscess at operation after 4 weeks of medical therapy</td>
<td>Aortic valve and aortic root replaced with a valved conduit</td>
<td>Well at 46 months after surgery</td>
</tr>
<tr>
<td>9</td>
<td>18 (M)</td>
<td>Bicuspid aortic</td>
<td>NA</td>
<td>S. aureus</td>
<td>Aortic regurgitation, mitral-aortic intervalvular fibrosa abscess</td>
<td>Aortic valve replacement</td>
<td>Well at follow-up (time unknown)</td>
</tr>
<tr>
<td>11</td>
<td>19 (M)</td>
<td>Bicuspid aortic</td>
<td>Fever, chills, dysuria, right bundle branch block</td>
<td>S. epidermidis</td>
<td>Aortic root abscess penetrating into right atrium and right ventricle</td>
<td>No surgery</td>
<td>Died following cardiac arrest</td>
</tr>
<tr>
<td>Present report</td>
<td>14 (M)</td>
<td>Bicuspid aortic</td>
<td>Fever, weight loss, arthralgia, aortic regurgitation</td>
<td>Streptococcus sanguis</td>
<td>Aortic root abscess bulging into the left atrium, vegetations on the aortic valve leaflets, aortic insufficiency</td>
<td>Debridement of the abscess, resection and replacement of aortic valve with native pulmonic valve</td>
<td>Immediate postoperative death</td>
</tr>
</tbody>
</table>

NOTE. F, female; M, male; NA, not available.
sitivity is considered to be markedly lower and definitely inconsistent [1, 5–7, 12, 13, 16]. This contrasts to the findings from our review, which shows that 9 of 10 patients had their diagnosis made by two-dimensional echocardiography prior to surgery. Previous reports have concluded that a TEE may be more sensitive and give better information about the exact location and dimensions of the abscess cavity [1, 9, 13, 15, 21, 22], which is instrumental for the surgery. Other diagnostic modalities, such as CT, MRI, cardiac catheterization, and angiography, all have been used, albeit rarely in adults [12, 19, 23].

In general, the accepted indications for surgery in addition to intensive antibiotic therapy for cases of bacterial endocarditis are intractable congestive heart failure with or without hemodynamic instability, recurrent arterial embolism [10], and persistent bacteremia despite appropriate antibiotic therapy. Although antibiotics may occasionally sterilize an aortic root abscess [6, 24], most patients with this complication require surgical intervention. Most authors agree that even though the surgical mortality is high in the abscess group, overall mortality is lowered by timely surgical intervention [2, 3, 8, 12, 14, 15, 17, 18, 25]. Although our patient did not benefit from the surgery, his disease had already progressed to a very late stage at the time of presentation. It should be noted that the infection of the aortic root was ultimately eradicated and at autopsy the surgical site was thought to be intact, and thus the immediate cause for his death remained unclear.

We speculate, on the basis of our observations, that a high degree of suspicion and prompt investigations for the presence of an endocardial abscess are warranted when a patient with endocarditis demonstrates native aortic or prosthetic valve involvement, infection with *Staphylococcus aureus*, persistent fever and/or bacteremia in spite of appropriate medical treatment, or a persistent bundle branch block or complete heart block on electrocardiography. Intensive antibiotic treatment followed by urgent surgical intervention and aggressive debridement of all infected material may lower the mortality associated with this complication.

Granted the rarity of this complication in children, several retrospective reviews on this subject are needed before more definite recommendations regarding the diagnosis and management can be made.

References