Open Heart Surgery in Infective Endocarditis

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SUMMARY
Fourteen patients with bacterial endocarditis had open heart surgery. Thirteen
were operated upon because of congestive heart failure, and in one the indication
for surgery was persistent infection. The aortic valve alone was involved in six
patients; two patients had both aortic and mitral valve endocarditis. Five patients
had infection of the mitral valve, and one patient had tricuspid valve involvement.
All the patients received preoperative antibiotics for a variable period.
Ten patients left the hospital and four died in the hospital. Of the 10 patients
discharged, one died 9 months later of congestive heart failure. Seven patients
developed valvular leaks either through the suture line or the homograft, and
two deaths resulted. Nine patients are alive and in good functional status. Antibiotics
were given for 5 to 10 days postoperatively; one patient, however, received
antibiotics for 49 days.
Early open heart surgery is recommended in bacterial endocarditis if heart failure
is progressive. Shorter postoperative antibiotic therapy is proposed once the source
of residual infection is removed.

Additional Indexing Words:
Aortic regurgitation Mitral annuloplasty Tricuspid regurgitation
Paraprosthetic regurgitation Replacement of aortic valve with aortic homograft

INFECTIVE ENDOCARDITIS resulted in
a high mortality in the pre-antibiotic era;
with the introduction of antibiotics, the
mortality has been reduced.\(^1\) Presently, most
deaths are due to heart failure secondary to
destruction of the cardiac valves.\(^2\) Early
surgical correction or replacement of such
valves may be lifesaving.\(^3\)\(^-\)\(^12\) We report here
our experience with 14 patients with infective
endocarditis. Surgery was necessitated be-
cause of rapid clinical deterioration.

Clinical Material
From October 1961 to June 1969, 14 patients
underwent open heart surgery for infective
endocarditis. The ages ranged from 9 to 67 years.
Nine patients were males and five females. Seven
patients had known preexisting underlying heart
disease. The other seven patients were without
clinical evidence of a cardiac lesion prior to the
onset of endocarditis. Blood cultures taken at
varying time intervals before surgery were
positive in all patients. All patients received
preoperative antibiotics ranging from 5 days to 9
months. Table 1 shows the clinical course and
antibiotic therapy in these patients.

The main indication for operation in 13
patients was congestive heart failure; three had,
in addition, repeated embolic episodes (cases 4,
7, and 14) and one had persistent fever (case
12). Patient J. G. (case 6) was operated upon for
persistent infection; she also developed toxic
reactions to antibiotics. The time interval between
onset of endocarditis and surgery ranged from 2
weeks to 15 months; in seven patients this
interval was 6 weeks or less.
Surgery was performed with the aid of a
rotating disc pump oxygenator. Six patients
underwent aortic valve replacement; three re-
ceived a homograft aortic valve and three a Starr-
Edwards prosthesis. Two patients had aortic

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### Table 1

**Preoperative and Postoperative Antibiotic Treatment**

<table>
<thead>
<tr>
<th>Case no.</th>
<th>Patient’s name, age, sex</th>
<th>Blood culture</th>
<th>Preexisting heart disease</th>
<th>Diagnosis after endocarditis</th>
<th>Antibiotic treatment Preoperative</th>
<th>Antibiotic treatment Postoperative</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>G.C. 29 M</td>
<td>Org: Strept. viridans onset: subacute</td>
<td>CHD</td>
<td>Mitral regurgitation</td>
<td>Penicillin — iv &amp; oral; 1 mo</td>
<td>Penicillin — im; 7 days Streptomycin — im; 7 days</td>
</tr>
<tr>
<td>2.</td>
<td>M.B. 39 F</td>
<td>Org: Strept. viridans onset: subacute</td>
<td>RHD with valvular lesion</td>
<td>Mitral regurgitation</td>
<td>Penicillin — iv &amp; oral; 4 wk</td>
<td>Cephalothin* — iv; 4 days</td>
</tr>
<tr>
<td>3.</td>
<td>M.F. 58 M</td>
<td>Org: Staph. aureus onset: acute</td>
<td>None</td>
<td>Aortic insufficiency</td>
<td>Vancomycin — iv; 11½ wk Cloxacillin — oral; 11½ wk</td>
<td>Methicillin — iv; 10 days Cloxacillin — oral; 8 days Kanamycin — iv; 1 day Chloramphenicol* — oral; 1 mo</td>
</tr>
<tr>
<td>4.</td>
<td>Z.K. 40 M</td>
<td>Org: Pneumococcus onset: acute</td>
<td>None</td>
<td>Aortic insufficiency &amp; cerebral embolism &amp; coronary embolism (?)</td>
<td>Cephalothin — iv; 2 wk</td>
<td>Died in surgery</td>
</tr>
<tr>
<td>5.</td>
<td>D.M. 31 M</td>
<td>Org: Strept. anaerobius onset: acute</td>
<td>None</td>
<td>Aortic &amp; mitral insufficiency</td>
<td>Cephalothin — iv; 5 days</td>
<td>Cephalothin* — iv; 4 days Colistin — 4 days</td>
</tr>
<tr>
<td>6.</td>
<td>J.G. 27 F</td>
<td>Org: Serratia marcescens onset: subacute</td>
<td>None</td>
<td>Tricuspid insufficiency</td>
<td>Kanamycin — iv; 9 wk Chloramphenicol — oral; 9 wk</td>
<td>Kanamycin — iv; 1 day Chloramphenicol — oral; 5 days</td>
</tr>
<tr>
<td>7.</td>
<td>A.A. 55 M</td>
<td>Org: hemolytic strept. onset: subacute</td>
<td>Systolic murmur</td>
<td>Mitral insufficiency</td>
<td>Sulfisoxazole* — oral; 9 wk Lineomycin — iv &amp; oral; 4 wk</td>
<td>Penicillin — iv; 5 days Cephalothin* — iv; 5 days Colistin — im; 5 days</td>
</tr>
<tr>
<td>8.</td>
<td>L.C. 50 F</td>
<td>Org: enterococci onset: subacute</td>
<td>RHD; Gott mitral valve prosthesis &amp; aortic homograft</td>
<td>Aortic insufficiency</td>
<td>Penicillin — oral; 1 wk Ampicillin — oral; 3 wk Streptomycin — iv; 2 wk</td>
<td>Cephalothin* — iv; 5 days Colistin — im; 5 days</td>
</tr>
<tr>
<td>9.</td>
<td>T.B. 27 F</td>
<td>Org: Staph. aureus onset: acute</td>
<td>None</td>
<td>Aortic insufficiency</td>
<td>Cephalothin* — iv; 3 wk</td>
<td>Cephalothin* — iv; 5 days Colistin — im; 5 days</td>
</tr>
</tbody>
</table>
valve replacement combined with either mitral valve replacement or mitral annuloplasty. Five patients were operated on for the mitral valve disease; two underwent valve replacement and three had annuloplasty with or without valvuloplasty. Tricuspid valve debridement and tricuspid annuloplasty were performed in one patient. Involvement of the sinus of Valsalva with abscess formation, aneurysmal dilation, or fistulous communication with atria or ventricles is a serious complication of aortic valve endocarditis. This pathologic condition was seen in three patients. In case 14, a fistula of the noncoronary sinus opening into the right atrium was present. An intracardiac patch was necessary for its closure and to this patch the Starr-Edwards prosthesis was sewn. All patients received antibiotics postoperatively for a variable period ranging from 5 to 10 days. Only one patient was given more prolonged antibiotic therapy of 49 days.

**Results**

Table 2 shows the results of surgery. There were four hospital deaths; one patient died in surgery, and three died in the hospital 1 to 4 days following surgery. Patient Z. H. (case 4) was so ill that he had a cardiac arrest in the cardiac catheterization laboratory; he was rushed to the operating room and placed on bypass. Emergency aortic valve replacement was done, but he could not be taken off bypass. Another patient (case 12) never regained consciousness and died of cardiogenic shock 1 day after surgery. Autopsy revealed multiple cortical infarcts in the brain secondary to septic emboli; also necrotic foci were seen in the left ventricular wall and in the papillary muscles. Case 5, who was operated on during the acute stage, developed a leak around the mitral valve prosthesis requiring reoperation 3 days later; he died 1 day after reoperation due to a low output syndrome.

One patient (case 11) died 9 months after surgery from congestive heart failure secondary to regurgitation from an aortic homograft. At postmortem examination one of the homograft leaflets was ruptured at the commissure; mycoplasma was cultured from the homograft leaflet. Also the posterior leaflet of the mitral valve was perforated. In addition a sinus posterior to the homograft was found which did not communicate with the ventricular chambers. This man died due to a failure...
### Table 2

**Hospital Course**

<table>
<thead>
<tr>
<th>Case no.</th>
<th>Indication for surgery</th>
<th>Interval between onset of endocarditis &amp; operation</th>
<th>Operative remarks</th>
<th>Histology &amp; valve culture</th>
<th>Postoperative course</th>
<th>Follow-up</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case</td>
<td>Diagnosis</td>
<td>Duration</td>
<td>Symptoms/Procedure</td>
<td>Complications</td>
<td>Outcome</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>Toxic reaction</td>
<td></td>
<td>to antibiotics.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(A.A.)</td>
<td>Embolic episodes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(L.C)</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(T.B.)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(B.M.J.)</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>CHF</td>
<td>12 mo</td>
<td>Right coronary cusp destroyed &amp; detached. Replacement of aortic valve with homograft &amp; mitral annuloplasty.</td>
<td>Fibrosis &amp; calcification of aortic valve. Valve culture not done.</td>
<td>Developed AI; died 9 mo later of CHF.</td>
<td></td>
</tr>
<tr>
<td>(L.E.)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(G.M.)</td>
<td>Persistent fever</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The most difficult decision in the treatment of infective endocarditis is when to operate. Early surgical intervention engenders concern about the holding power of sutures placed in inflamed and friable tissue and an increased chance of leaving residual infection in the area of the prosthesis. Systemic dissemination of septic emboli is another complication.

### Discussion

**Case 13.** CHF
- **Interval between onset of endocarditis & surgery:** 8 wk
- **Operative remarks:** Perforations along the edges of anterior & posterior leaflets. Valvuloplasty and postero-medial annuloplasty done.
- **Histology & valve culture:** Organizing endocarditis. Colonies of gran-positive cocci seen. Negative valve culture.
- **Postoperative course:** Uneventful
- **Follow-up:** Alive & well at 1 yr. Asymptomatic.

**Case 14.** CHF
- **Interval between onset of endocarditis & surgery:** 5 1/2 wk
- **Operative remarks:** Both cusps covered with extremely friable vegetations; fistula arising from noncoronary sinus & communicating with right atrium. Replacement of aortic valve with Starr-Edwards valve; excision & repair of sinus of Valsalva fistula.
- **Histology & valve culture:** Granulation tissue & fibrosis. Diphtheroids cultured from valve.
- **Postoperative course:** Multiple episodes of ventricular fibrillation. III/VI murmur of AI at discharge.
- **Follow-up:** IV/VI murmur of AI. Symptomatic on exertion.*

*Successfully reoperated upon with removal of valve and replacement with Starr-Edwards prosthesis.

**Abbreviations:** CHF = congestive heart failure; AI = aortic insufficiency; AS = aortic stenosis; MI = mitral insufficiency; TI = tricuspid insufficiency; DOE = dyspnea on exertion.
hazard; this was seen in case 12. While these risks must be carefully weighed, patients with grossly disturbed hemodynamics and intractable congestive failure leave little alternative to emergency surgery if the situation is to be salvaged. The most pressing determinant of timing is the hemodynamic state of the patient. If the severity of congestive heart failure is attributable to valve destruction, surgery would appear justified despite the presence of a positive blood culture. Obviously, if delay can be effected without serious risk to the patient, then one may be willing to buy time for bacteriologic sterilization and for inflamed tissue to become more fibrous. Obviously at times one walks a narrow rope between what is desirable and the urgency of the clinical situation. It is apparent that the desperate status of some patients may be related, partly or mainly, to septic myocardial emboli with small abscesses and myocardial destruction. Operative mortality in such patients will be high. Unfortunately, most of these patients cannot be separately identified.

The exact portal of bacterial entry in many of our patients is unknown. According to some, the most frequent route of entry is from respiratory tract infections. Bacteria entering the blood stream directly through intravenous injections or from infected cutdown sites often lodge on the tricuspid valve. Patient J. G. (case 6) who was addicted to intravenous use of amphetamines is one such example. She developed Serratia endocarditis of the tricuspid valve leading to destruction of one of the leaflets and tricuspid regurgitation. The main indications for surgery were persistent fever, septicemia, and the development of toxic reactions to kanamycin and chloramphenicol (Chloromycetin). Faced with the hardened drug addict who evidences little chance of rehabilitation, a discouraging transient thought is whether the surgical effort will be worthwhile. If one could be assured that the valvular lesion would be correctable by a plastic procedure a stronger point might be made for surgery. However, the use of a prosthetic valve would seem to enhance the chances of a subsequent reinfection. Patient M. F. (case 3) is also interesting because endocarditis developed secondary to an infected shunt for chronic hemodialysis. Such instances have been reported previously and can be expected at centers where large numbers of patients are on a chronic hemodialysis program.

Valvular leaks through the suture line or through homograft valves have been the major problem in the postoperative period. Seven patients developed this complication and two died. The remaining five patients have murmurs of valvular insufficiency which are hemodynamically insignificant. Stason and associates encountered this complication in four of 13 patients; one of these four died. The high incidence of valvular leaks in these patients is living testament to the friability of the tissues. In most of our patients the leak has been minor and well tolerated. If reoperation becomes necessary in the future, the tissues will be less friable and hold sutures better.

In the postoperative period all patients received antibiotics for 5 to 10 days; one patient (case 3), however, received antibiotics for 49 days. His course was complicated by chronic renal failure and multiple sites of infection, including groin cutdown, tracheostomy, shunt on the ankle, and peritonitis. We feel that a long period of antibiotic therapy is not essential after excision of the infected valve. Additionally, prolonged use of antibiotics increases the chances of superinfection which is even more difficult to eradicate. Brainbridge reviewed 40 cases from the literature of patients operated on during active endocarditis, six of whom developed reinfection of the artificial valve. In only one of these six patients was the organism the same as the one that had caused the endocarditis; in the remaining five it was either Candida or different bacteria. In this connection four patients (cases 6, 10, 13, and 14) are of particular interest because their valve cultures were either positive (cases 6, and 14) or the valve showed bacterial colonies microscopically. Each received antibiotics for
a short period only and had an uneventful postoperative course.

References
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