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. Presently, most deaths are due to heart failure secondary to destruction of the cardiac valves. Early surgical correction or replacement of such valves may be lifesaving. We report here our experience with 14 patients with infective endocarditis. Surgery was necessitated because 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 received a homograft aortic valve and three a Starr-Edwards prosthesis. Two patients had aortic...
### 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>Freeexisting heart disease</th>
<th>Diagnosis after endocarditis</th>
<th>Preoperative Antibiotic treatment</th>
<th>Postoperative Antibiotic treatment</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</td>
<td>Methicillin – iv; 10 days Cloxacillin – oral; 8 days Kanamycin – iv; 1 day Chloramphenicol* – oral; 1 mo</td>
</tr>
<tr>
<td>5.</td>
<td>D.M. 31 M</td>
<td>Org: Strept. anerobius onset: acute</td>
<td>None</td>
<td>Aortic &amp; mitral insufficiency</td>
<td>Cephalothin – iv; 5 days</td>
<td>Cephalothin* – iv; 4 days Colistin – im; 4 days</td>
</tr>
<tr>
<td>6.</td>
<td>J.G. 27 F</td>
<td>Org: Serrata marcescens onset: acute</td>
<td>None</td>
<td>Tricuspid insufficiency</td>
<td>Kanamycin – iv; 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>Chloramphenicol – oral; 9 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 Erythromycin – 1 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>
<tr>
<td>Case No.</td>
<td>Patient</td>
<td>Gender</td>
<td>Age</td>
<td>Diagnosis</td>
<td>Therapy</td>
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<td>10</td>
<td>B.M.J. 29 F</td>
<td></td>
<td></td>
<td>Cong. bicuspid aortic valve</td>
<td>Penicillin — iv; 2 wk</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Aortic insufficiency</td>
<td>Cephalothin* — iv; 5 days</td>
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<td></td>
<td></td>
<td>Colistin — im; 5 days</td>
<td></td>
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<tr>
<td>11</td>
<td>L.E. 31 M</td>
<td></td>
<td></td>
<td>Cong. bicuspid aortic valve</td>
<td>Penicillin — iv; 6 wk</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Aortic &amp; mitral insufficiency</td>
<td>Cephalothin — oral; 9 mo</td>
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<td></td>
<td></td>
<td></td>
<td>Cephalothin* — iv; 5 days</td>
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<td></td>
<td></td>
<td></td>
<td>Colistin — im; 5 days</td>
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<tr>
<td>12</td>
<td>G.M. 9 M</td>
<td></td>
<td></td>
<td>Org: B hemolytic strept.</td>
<td>Penicillin — iv; 12 days</td>
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<td></td>
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<td></td>
<td></td>
<td>Mitral insufficiency</td>
<td>Cephalothin — 1 wk</td>
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<td></td>
<td></td>
<td></td>
<td>&amp; myocarditis (?)</td>
<td>Methicillin — im; 1 day</td>
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<td></td>
<td>Cephalothin* — iv; 5 days</td>
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<td></td>
<td></td>
<td></td>
<td>Colistin — im; 5 days</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>B.R. 35 M</td>
<td></td>
<td></td>
<td>Org: Staph. aureus</td>
<td>Penicillin — iv; 11 days</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Mitral insufficiency</td>
<td>Cephalothin — im; 5 days</td>
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<td></td>
<td></td>
<td>Colistin — im; 5 days</td>
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<tr>
<td>14</td>
<td>H.G. 47 M</td>
<td></td>
<td></td>
<td>Org: Strep.</td>
<td>Penicillin — iv; 23 days</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Viridans</td>
<td>Cephalothin* — iv; 10 days</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>onest: subacute</td>
<td>Streptomycin — im; 9 days</td>
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<td></td>
<td></td>
<td></td>
<td>Colistin — im; 10 days</td>
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</tr>
</tbody>
</table>

*Certaphothin (Keflin); Chloramphenical (Chloromycetin); Cephalordine (Lordin); Sulfisoxazole (Gantzin).

Abbreviation: org = organism; iv = intravenous; im = intramuscular; CHD = congestive heart disease; RHD = rheumatic heart disease.

Table 2 shows the results of surgery. There were four hospital deaths: one patient died in surgery, and three died in the hospital (case 1 to 4). One patient died postoperatively for a variable period ranging from 5 to 10 days. Only one patient was given more prolonged antibiotic therapy of 40 days.

In case 14, a fistula was seen in endocarditis. In case 10, an abscess of the valvular endocarditis was seen. In case 14, a fistula was seen in the mitral valve endocarditis. This complicates condition of the mitral valve endocarditis. The abscess of the valvular endocarditis was seen.

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### 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>1.</td>
<td>CHF</td>
<td>15 mo</td>
<td>Torn anterior leaflet with ruptured chordae.</td>
<td>Scarred mineralized valve.</td>
<td>Uneventful</td>
<td>Grade II/VI systolic murmur of MI. No evidence of decompen- sation for 8 yr.</td>
</tr>
<tr>
<td>(M.B.)</td>
<td></td>
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<tr>
<td>(M.F.)</td>
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<td>(Z.H.)</td>
<td>Embolic episodes</td>
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<tr>
<td>(D.M.)</td>
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</tbody>
</table>
6. **Persistent infection.** Toxic reaction to antibiotics.

   **(J.G.)**
   10 wk
   Friable vegetation on anterior & posterior leaflets of tricuspid valve. Excision of involved leaflets & tricuspid annuloplasty.
   Acute & chronic valvulitis. Serratia cultured from valve.
   Right lower lobe pneumonia.
   Alive & well 1½ yr. Grade III/VI systolic murmur of TI. No signs of decompensation.

7. **CHF**

   **(A.A.)**
   11 mo
   2 perforations in anterior leaflet of mitral valve; ruptured chordae of posterior leaflet. Valvuloplasty & posteromedial annuloplasty.
   Thickening & fibrosis. Negative valve culture.
   Uneventful
   Alive & well at 1 yr. No symptoms or murmurs.

8. **CHF**

   **(L.C.)**
   5 mo
   Tear in left coronary cusp near its junction with right coronary cusp. Replacement of aortic homograft with homograft & tricuspid annuloplasty.
   Fibrosis with chronic inflammation. Negative valve culture.
   Uneventful
   Alive & well at 2 yr. Has grade II/VI systolic murmur in aortic area.

9. **CHF**

   **(T.B.)**
   6 wk
   Acute & chronic valvulitis. Negative valve culture.
   Uneventful
   Alive & well at 2 yr. II/VI murmurs of AS & AI. Has mild DOE.

10. **CHF**

    **(B.M.J.)**
    15 wk
    Replacement of aortic valve with pulmonic homograft.
    Chronic & active endocarditis. Numerous gram + ve cocci seen.
    Valve culture not done.
    Uneventful
    Alive & well at 1 yr. Asymptomatic.

11. **CHF**

    **(L.E.)**
    12 mo
    Right coronary cusp destroyed & detached. Replacement of aortic valve with homograft & mitral annuloplasty.
    Fibrosis & calcification of aortic valve. Valve culture not done.
    Uneventful
    Developed AI; died 9 mo later of CHF.

12. **CHF**

    **(G.M.)**
    Persistent fever
    2 wk
    Chronic & acute endocarditis. Negative valve culture.
    Died on 1st postop. day because of low output syndrome. Autopsy – septic infarcts in brain & necrotic foci in myocardium & papillary muscle.
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### Table: Operative Details and Postoperative 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>
</table>

*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.

### Discussion

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 prosthetic valve. Systemic dissemination of septic emboli is another concern about the holding power of sutures placed in inflamed and friable tissue. The holding power of sutures placed in inflamed and friable tissue is another concern about the holding power of sutures placed in inflamed and friable tissue.

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Ten patients were operated on during the acute stage. Streptococcus viridans or streptococcal abscess were found in five of these (50%); Staphylococcus aureus in three (30%); and pneumococci and serratia in the others. Of 14 patients, two had positive valve cultures and seven had negative ones; no valve cultures were done in the remaining five patients. Of 12 patients who had no growth on valve culture or no valvuloplasty, bacterial colonies were seen microscopically in five.

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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,13 the most frequent route of entry is from respiratory tract infections. Bacteria entering the blood stream directly through intravenous injections or from infected cut-down sites often lodge on the tricuspid valve.6 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 previously14 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 associates12 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. Brainbridge15 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

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a short period only and had an uneventful postoperative course.

References
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