Mitral Stenosis in the Young*

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Though mitral commissurotomy has now become a well-established operation for the treatment of mitral stenosis, opinions are still divergent as to the advisability of this operation in children and young adults. This is usually based on the danger of reactivation of the rheumatic process and a fear of early restenosis. The younger group formed only a very small percentage of the total number of mitral valvotomies reported in Western literature.

In India, rheumatic fever comes earlier, burns itself out sooner andstenotic effects after either a severe initial or repeated minor attacks are noted at younger ages almost a full decade earlier in our country than in the temperate climates.* Thus, a large number of cases of mitral stenosis below the age of 20 years present themselves for surgery.

Earlier reports from India indicated this trend. Sen* in 1956 reported six children below the age of 14 years operated for mitral stenosis, Karai* in 1958, five cases below the age of 14 years, and Bett* in 1959 two cases operated for mitral stenosis at the age of nine years.

In 1964, Cherian et al.* reported a larger series of 126 mitral valvotomies in young patients below the age of 20 years. In the series under report, 160 cases below the age of 20 years were operated for mitral stenosis in the King Edward VII Memorial Hospital, Bombay, during the last ten years, forming 26.6 per cent of a total of 600 mitral valvotomies.

Incidence
From the study of published literature it is evident that the incidence of mitral stenosis in children and young adults is low in the Western countries. Glover* from the United States, in a series of 1,500 cases of mitral valvular disease, found valvotomy indicated in less than 12 cases under the age of 18 years.

Bailey and Bolton,* in a series of 1,000 mitral commissurotomies, reported only 13 patients under the age of 20 years.

Angelino and associates' from Italy performed mitral valvotomy in 11 patients under 16 years of age in a total of 600 mitral valvotomies.

Bormann and co-workers' from Israel reported 13 mitral valvotomies below the age of 16 years from a total of 173 cases operated for mitral stenosis.

In India, the prevalence of mitral stenosis in the young is much higher as evidenced by reports from Cherian et al.* (126 cases) and our series of 160 cases. These young patients form about one-third to one-fourth of the total valvotomies performed.

Age:
Of the 160 patients, five were below the age of ten years, 40 were between 11 and 15 years and the remaining 115 cases between the ages of 16 and 20 years (Table 1). The youngest was an eight-year-old boy who presented with tight mitral stenosis.

Sex:
Wood* indicates the prevailing ratio of men to women in pure mitral stenosis as 1:4. In Bailey's series, it was 1:3, while in Vakil's* series in India, it was 2:1. In the present series there were 88 boys and 72 girls, a preponderance of boys in the ratio of 1.22:1.

Rheumatic Attack:
History suggestive of rheumatic fever with or without joint pains was present only in 103 patients, while in 57 patients

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there was no definite history of rheumatic attack. The time interval between rheumatic attack and the operation is shown in Table 2.

Though Wood\textsuperscript{17} mentions that total duration from initial attack of rheumatic fever to total incapacity is about 30 years, in India rheumatic process progresses more rapidly to critical mitral stenosis. Table 2 clearly shows that the latent period between rheumatic fever to the development of severe incapacity is much shorter compared to Western figures.

**CLINICAL FEATURES**

Dyspnea: All the patients came to the clinic complaining of various grades of dyspnea. Most of them could walk from 50 to 100 yards and climb one flight of stairs.

Dyspnea was graded from I to IV after Wood\textsuperscript{17}. Grade I represents slight incapacity, Grade II moderate incapacity, Grade III severe incapacity, and Grade IV total incapacity.

There was no patient in Grade I, 38 in Grade II, 96 in Grade III and 26 in Grade IV (Table 3).

Hemoptysis: Hemoptysis was present in 17.5 per cent of the total cases. Cherian \textit{et al.}\textsuperscript{18} reported an incidence of 18 per cent while Wood\textsuperscript{17} recorded an incidence of 44.5 per cent.

Chest pain: Vague chest and precordial pains were recorded in 48 cases, but none of them had the typical anginal pain.

**SIGNs**

The signs of mitral stenosis were the same as those in the adult cases. The majority of patients in this group were poorly nourished. Twenty-six showed evidence of congestive cardiac failure with a tender liver, engorged neck veins and edema of feet. Three showed clinical evidence of cyanosis, but no clubbing.

Apex was detected in the midclavicular line in 89 per cent of the cases and diastolic thrill felt over the apex in 60 per cent. Mid-diastolic murmur was heard in all the cases. Systolic murmur conducted to the axilla was heard over the mitral area in 7 per cent of the cases. Early diastolic murmur in the aortic area was heard in 10 per cent. The pulmonary second sound was accentuated and split in all.

**INVESTIGATIONS**

Routine blood studies were carried out in all the cases with special attention to

\textbf{Table 1—Showing the Age Incidence}

<table>
<thead>
<tr>
<th>Age in Years</th>
<th>Number of Cases</th>
</tr>
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<tbody>
<tr>
<td>5 - 10</td>
<td>5</td>
</tr>
<tr>
<td>11 - 15</td>
<td>40</td>
</tr>
<tr>
<td>16 - 20</td>
<td>115</td>
</tr>
<tr>
<td>Total</td>
<td>160</td>
</tr>
</tbody>
</table>

Wood\textsuperscript{17} in his series had found that the angina of effort was complained of by 12 per cent of his patients.

Congestive failure: Of 160 patients, 26 gave history of congestive cardiac failure. Of these, eight had more than one attack. Three of these patients had refractive failure not responding to any of the drugs and had to be operated upon while they were in congestive heart failure.

Embolism: None of the cases in this series had an embolic episode in the pre-operative period. Similar observations were made by Angelino and associates,\textsuperscript{1} Gray\textsuperscript{19} and Borman \textit{et al.}\textsuperscript{20} and Sellors and collaborators\textsuperscript{21} noted embolism in 9 per cent of the cases and Goodwin and coworkers\textsuperscript{22} reported that 16 per cent of the cases had an embolic episode prior to surgery.

\textbf{Table 2—Time Interval Between Rheumatic Attack and Operation}

<table>
<thead>
<tr>
<th>Time</th>
<th>Number of Patients</th>
</tr>
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<tbody>
<tr>
<td>1 year</td>
<td>6</td>
</tr>
<tr>
<td>2 - 5 years</td>
<td>48</td>
</tr>
<tr>
<td>6 - 10 years</td>
<td>38</td>
</tr>
<tr>
<td>11 - 15 years</td>
<td>11</td>
</tr>
<tr>
<td>Total</td>
<td>160</td>
</tr>
</tbody>
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\textbf{Table 3}

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Grade</th>
<th>Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slight incapacity</td>
<td>I</td>
<td>0</td>
</tr>
<tr>
<td>Moderate incapacity</td>
<td>II</td>
<td>38</td>
</tr>
<tr>
<td>Severe incapacity</td>
<td>III</td>
<td>96</td>
</tr>
<tr>
<td>Total incapacity</td>
<td>IV</td>
<td>26</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>160</td>
</tr>
</tbody>
</table>
the erythrocyte sedimentation rate. Eighty-five patients had an erythrocyte sedimentation rate between 0-10 mm., 44 between 11-30 mm., while 31 patients had a high rate between 31-80 mm. at the end of one hour (Westergren). Fluoroscopic studies with barium swallow showed that the left atrium was enlarged in all the 160 cases (Fig. 1). There was hilar congestion in 80 per cent, right ventricular hypertrophy in 81.2 per cent, and right atrial enlargement in 15 per cent. Calcification was seen in fluoroscopy in 15 per cent. Calcification was seen on fluoroscopy in 5.5 per cent of the cases.

Electrocardiographic studies were done on all the cases. Evidence of left atrial enlargement was found in 92 per cent, right atrial enlargement in 13 per cent, right ventricular enlargement in 78 per cent indicating significant and often high pulmonary hypertension, while evidence of left ventricular enlargement was seen in only 4 per cent operated on. Auricular fibrillation was present in 2 per cent.

One of the outstanding features was the high incidence of severe pulmonary hypertension, which was diagnosed clinically in most instances, and further confirmed by fluoroscopy and electrocardiography. Of the 160 cases in this study, 48 had severe pulmonary hypertension, 104 had moderate pulmonary hypertension and only eight had minimal pulmonary hypertension.

Preoperative Treatment
All patients were admitted a few days prior to surgery and treated with bed rest, diuretics and digitalis. A course of antibiotics, salicylates and cortisone was given when the erythrocyte sedimentation rate was high. Careful clinical examination of the patient with repeated erythrocyte sedimentation rate readings was done to assess the rheumatic activity. Twenty-one patients underwent tosillecctomy prior to surgery.

Operation
The operative approach was by a standard left lateral thoracotomy through the fifth interspace in our earlier cases, but recently in the last 70 cases it was through sixth rib bed after stripping the periosteum from the upper border of sixth rib. The pericardium was opened anterior to the
phrenic nerve in all the cases. The findings were as follows:

The left atrium was enlarged in all. A definite thrombus was found in the chamber in four. The pulmonary artery was large and tense in all the cases. In three, the pressure in the pulmonary artery appeared to be equal to that of the aorta.

The original orifice of the mitral valve (approximate finger determination) was 5 mm. or less in 50 cases, 5-10 mm. in 105 cases and 11-15 mm. in five cases. Subvalvular fusion was present in 30 cases; mobile cusps with only commissural fusion in 68 cases. The valves were elastic in 12 cases. Associated mild mitral incompetency jet was felt in 30, while moderate incompetence was present in four instances. Mild to moderate calcification was felt digitally in 30 cases while in five, the valve was heavily calcified.

As with the growth of techniques for relieving mitral stenosis, we too have employed different methods of surgical correction in this series. For facilitation introduction of the finger in the left atrium we have used a modified nasal snare around the atrio-appendicular junction as reported earlier. In our first 60 patients, we have used the method of digital fracture. In 11, a specially designed knife was introduced transventricularly to cut the commissures of the stenosed valve. The method of transventricular dilatation was employed in 87 patients.

The transventricular dilatation designed by the authors, though essentially resembling the Gerbode' type dilator, is much lighter, has narrower blades and has a longer handle (Fig. 2). The wound in the ventricle required for the introduction of the dilator is small and usually requires one or two interrupted sutures for closure. The intracardiac manipulations of the dilator can be performed with ease. Graded dilatation is possible with the help of controlling screw.

Recently we have been using a technique of "blind commissurotomy" in some of the patients with mitral restenosis in whom digital exploration of the left atrium was technically difficult or not possible because of the dense adhesions around it. Our experience has shown that the introduction and opening of the mitral valve dilator through the left ventricle unaided by a palpating finger in the left atrium is not as difficult and dangerous as may be thought. In nine out of the total number of ten patients operated by using this technique, satisfactory split was accomplished as noted from the postoperative clinical and roentgenologic improvement in these patients. One patient in the present series of young mitrals restenosed mitral valve

![Figure 2: Transventricular mitral valve dilator used by the authors.](http://journal.publications.chestnet.org/pdfaccess.ashx?url=/data/journals/chest/21431/ on 06/21/2017)
was satisfactorily split by using this technique.

The postoperative size of the mitral valve was between 20 to 30 mm. in 72 patients. In the majority of them the split was obtained either digitally or assisted with transventricular knife or scissors. A final opening of 31 to 35 mm. was obtained in 87 cases, a majority of whom were operated by using a transventricular dilator.

Mild to moderate incompetence was produced in 42 cases of whom 29 had some degree of incompetence. There were five cases of mild incompetence in whom the regurgitant jet disappeared after valvotomy. Severe incompetence was produced in two cases, one of whom died soon after the operation.

Mortality

Of the 160 cases operated, there were only six deaths, giving a mortality rate of 3.8 per cent. This mortality is relatively low as compared to the series reported by Cherian et al. (13 per cent) and Baker et al. (11 per cent).

Of the six deaths. The first was of an 18-year-old boy who died the day following of calcium plaques liberated from a heavily calcified valve during surgery (Figs. 3 and 4). The second death was due to purulent meningitis which the patient developed a week following surgery. This patient had an associated empyema. The third postoperative death was due to severe incompetence; the patient died four hours after surgery. The fourth died of uncontrollable congestive cardiac failure on the eight postoperative day. The last two cases died during follow-up.

Follow-up Results

In the present series, only 84 per cent of the patients could be traced and these were followed up for periods varying from one to ten years.

At follow-up, interrogation, detailed examination and investigation of each case were carried out (Figs. 5 and 6). Results of the operation were graded as excellent, good, fair and poor as suggested by Baker and Hancock.4

Results were excellent in 32 cases who improved by three grades, good in 70 who improved two grades, fair in 21 who improved by only one grade, while poor in

Figure 3: Necropsy specimen of the heart showing marked calcification of the mitral valve.
five who did not improve at all. There were four hospital deaths, two deaths three months after surgery and 26 patients were lost to follow-up.

**Rheumatic reactivation:**

Particular attention was paid to the assessment of rheumatic reactivation during follow-up. In the present series, only seven cases developed postoperative rheumatic fever with joint pains. Cherian et al. reported 15 per cent recurrence, while there was no incidence of rheumatic reactivation in the series published by Borman et al.

**Restenosis:**

The incidence of restenosis has also been relatively low. Of these available for follow-
up only five cases were found to have developed restenosis. Of these five of restenosis, only one has been reoperated with gratifying results, three others have refused the second operation, and one died during follow-up.

**DISCUSSION**

The basic aim of mitral commissurotomy is to relieve the obstruction to the flow of bloodstream from the left atrium to the left ventricle which exists due to the severe stenosis of the mitral valve. Yet there is a divergent opinion regarding undertaking this operation in childhood and young adults. The objections to performing this operation are two, namely (1) the danger of reactivation of rheumatic infection in the postoperative period and (2) greater danger of restenosis.

There are two important factors which interest the surgeon in mitral stenosis of this age group. One, the element of active rheumatic carditis and the other, the valvular factor. There is a danger of interfering with a heart in active rheumatic carditis, but this is outweighed by the valvular factor which is causing severe hemodynamic changes due to the extremely small mitral orifice shown by rapid development of severe pulmonary hypertension. The valvular factor, therefore, becomes a much more serious and urgent problem and is evident by the fact that the results of a successful mitral valvotomy are very gratifying in this group. Gray has suggested that after valvotomy the nutrition to the heart improves and rheumatic flare up is minimized or avoided.

A rather high incidence of rheumatic reactivation has been reported by Cherian et al. (15 per cent) while Borman et al. recorded no incidence of rheumatic activation in their series. All in Borman and associates’ series were on long-term penicillin prophylaxis. In our series, the incidence of reactivation has been 3.1 per cent. Only a few of the cases had been on long term penicillin therapy.

The second objection to surgery at this age group has been the danger of early restenosis. Gray has stated that the risk of restenosis after successful valvotomy is obviously much greater in the younger group of patients. Betts has pointed out that re-

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**FIGURE 6:** Pre- and postoperative electrocardiogram of a case of mitral stenosis showing the changes in the mean QRS axis, P waves and diminution in right ventricular hypertrophy.
stenosis in absence of recurrence of rheumatic process chiefly depended on the pathologic condition of the valves and the inadequacy of the split obtained at commissurotomy.

In the present series, five patients developed restenosis and in none of the above cases was there any history of rheumatic reactivation. Analysis of the operative findings show that the splitting of the commissures with the available measures was difficult and inadequately split due to advanced valvular disease.

All the 160 cases subjected to surgery in this series were in a state of respiratory distress and majority of them were in grades III and IV. These patients could have lingered for only three to four years. Our follow-up shows gratifying results in about 76 per cent of the cases.

We feel that age is no bar to surgery in a case of severe mitral stenosis and the fear of reactivation of rheumatic disease and early restenosis has been exaggerated.

SUMMARY
This is a report of 160 cases of mitral stenosis below the age of 20 years who underwent mitral commissurotomy. Clinical, radiologic and electrocardiographic findings and other data were presented. The outstanding features of this study are preponderance among boys, short duration of symptoms, high degree of incapacity, rapid development of severe pulmonary hypertension, low incidence of embolism and fibrillation. The results of mitral commissurotomy in these young patients have been gratifying with low mortality and low incidence of restenosis.

RESUMEN
El autor reporta 160 casos de estenosis mitral menores de 20 años en los que se practicó la comisurotomía con sus datos clínicos, radiológicos electrocardiográficos y de otro orden. Las particularidades más destacadas son: preponderancia entre los del sexo masculino, corta duración de los síntomas, alto grado de incapacidad, desarrollo precoz de la hipertensión pulmonar severa, baja incidencia de embolismo y de fibrilación. Los resultados de la comisurotomía en estos su

References
AMYLOIDOSIS IN PATIENTS WITH PULMONARY TUBERCULOSIS

The author studied 414 cases of pulmonary tuberculosis complicated by amyloidosis of internal organs, covering a period of 17 years (1965-1982). An increased incidence of amyloidosis during the last years was noted in patients with tuberculosis. During the last six to seven years, the peculiarity of amyloidosis in patients with tuberculosis consisted of its more benign and protracted course with prolongation of the proteinuria and edematous-hypotensive stages, and in this connection, a frequent transition into the azotemia stage (in 31.5 percent of deceased). The author also noted a more frequent concurrence of amyloidosis with cor pulmonale and atherosclerosis. In the pathogenesis of amyloidosis, a prominent role is attributed to autoimmune processes and to hypoxemia which often occurred in tuberculous patients as the result of pulmonary fibrosis.


SUCCESSFUL SURGERY ON RIGHT VENTRICULAR ANEURYSM

A huge right ventricular aneurysm, diagnosed by angiogram, developed eight months after the radical correction of tetralogy of Fallot in a 14-year-old boy. The operation involved right ventriculotomy, extensive infundibulectomy and closure of the ventricular septal defect of 1 cm in diameter, using a Teflon patch. The aneurysm was successfully removed using our thermo-disc oxygenator. Six months after the second operation, the patient was living a normal active life. Causes of aneurysm formation of the right ventricle are discussed and the literature reviewed.


MULTIPLE SITE PRIMARY BRONCHOGENIC CARCINOMA

The authors present detailed studies of 14 patients with multiple site primary bronchogenic carcinomas. All patients were male smokers with an average age of 53 years. In two instances, the tumors were unilateral and in the remaining 12 bilateral. The authors discuss etiology and treatment and conclude that while multiple site bronchogenic carcinomas are not common, physicians should be alerted to the possibility of their occurrence.


SURGICAL REMOVAL OF CAROTIC BODY IN ASTHMA

This paper reports results obtained when glossectomies were performed on eleven patients with bronchial asthma. In only two young patients could the result be considered good. In the remaining nine patients, the attacks continued and became progressively more severe.