Indications and Contraindications for Surgical Treatment of Mitral Stenosis*

FRANK GLENN, M.D.

New York, New York

From the Department of Surgery of The New York Hospital-Cornell Medical Center, New York, New York

IN 1925, SIR HENRY SOUTTAR[6] successfully operated upon a patient with mitral stenosis. Almost 25 years later, Bailey and his coworkers, Glover and O'Neil,[1] and then Harken[3] and his group in Boston, using a similar approach, initiated in this country what has proved to be one of the widely used advancements in cardiac surgery; namely, commissurotomy for mitral stenosis. Since Bailey and Harken began their work in 1946, many surgeons in various medical centers and clinics throughout the country have interested themselves in the surgical treatment of mitral stenosis. Over the past eight years, a few thousand patients have been operated upon.

At first, there was a tendency for only the poor-risk patient to be operated upon. In all fairness, it should be said this was not attributed to the surgeons but rather to the medical men who were reluctant to have their patients subjected to operation. Once it had been established, however, that there was immediate benefit to be gained and that the risk was reasonable, there then followed a trend to operating on patients who did not present much risk and, in some instances, it was questionable whether or not their condition warranted surgery.

The large number[2] of articles in the surgical literature over the past eight years attest to the variety of approaches that have been employed in the consideration of the patient with mitral stenosis. It was a common evolutionary step for the surgeons to list and to consider the indications and the contraindications for operation. These have become relatively well established, although there are some variations from one part of the country to another, and between individual clinics and surgeons. In our experience in the selection of patients, the mere listing of the indications and contraindications does not provide an adequate guide. There are many gradations between the two that add to the complexity of evaluation. It is my purpose to discuss the indications and contraindications for operation for the surgical treatment of mitral stenosis, together with the more frequently encountered situations which require individual consideration.

Indications for Operation. Patients with mitral stenosis who have had progressive disability and continue to develop increasing disabling symptoms should be looked upon as possibly deserving surgery of the mitral valve. In their evaluation, it is necessary to employ all methods of obtaining information that will enable us to arrive at a proper conclusion. The clinical picture and the background provided by an accurate history are of equal importance when correlated with the specific information that is needed to enable us to determine readily whether or not surgical therapy is indicated. This specific and exact information includes an evaluation of the general physical status as well as that of the heart. Roentgenographic studies, including angiocardiography, provide a more accurate determination of the size, shape and contour of the heart and its chambers. Electrocardio-

* Presented before the Southern Surgical Association, Hollywood Beach, Florida, December 8, 1954.

graphic tracings are of distinct value in recording the rhythm, rate of contraction and variation in transmission of impulse. Hemodynamic studies obtained by cardiac catheterization may, in some instances, provide critical information, although when employed routinely such data usually confirm what seems evident clinically. In patients with multiple valve involvement and possible congenital anomalies or other complications, information obtained by cardiac catheterization may reveal the basis for the course up to the present, and in turn indicate what may be expected in the future with or without surgery.

Commissurotomy for Mitral Stenosis Indications.

The New York Hospital—Cornell Medical Center
1951–1954

1. Progressive disability
2. Reduced cardiac reserve
3. Pulmonary edema
4. Hemoptysis
5. Peripheral embolization

The ideal patient for commissurotomy is one whose mitral lesion is chiefly stenosis without, or with a minimal degree, of insufficiency, and who is experiencing progressive disability. In general, the younger the patient and the shorter the history since the first episode of rheumatic fever, the more satisfactory will be the correction of the stenosis of the mitral valve. On physical examination, the clinical findings of mitral stenosis are clear-cut, and there is minimal evidence of deterioration from prolonged invalidism. Roentgenologic examination reveals enlargement of the left ventricle, which is observed more readily fluoroscopically while at the same time a swallow of barium is given to outline the distortion of the esophagus. Roentgenologically, the lung fields may indicate right heart failure, pulmonary hypertension, or infarction. Information derived from electrocardiograms may confirm a regular rhythm or an auricular fibrillation; it usually indicates right heart involvement with some myocardial failure. Cardiac catheterization[4] provides specific information that permits a more comprehensive understanding of the abnormal circulatory patterns caused by disease of the mitral valve. Where the mitral valve orifice has been reduced more than 50 to 60 per cent, the circulation is greatly modified. The left atrial pressures are found to be increased in order that the blood be propelled through the narrowed mitral valve. This, in turn, places an increased back pressure in the pulmonary circulation. The cardiac output is reduced and the normal increase from exercise is diminished. In time, a pulmonary vascular sclerosis develops, and the burden on the right ventricle is increased. Data obtained by cardiac catheterization may seem more often than not to confirm what may be expected from clinical findings. Of greater significance, however, is its value in the critical study of the problem patients.

Contraindications for Operation. At present we consider as frank contraindications for operation: (1) bacterial endocarditis; (2) clinically active rheumatic fever; (3) severe mitral regurgitation, and (4) severe involvement of other valves.

Commissurotomy for Mitral Stenosis Contraindications.

The New York Hospital—Cornell Medical Center
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1. Subacute bacterial endocarditis (6 months).
2. Clinically active rheumatic fever.
3. Co-existent mitral insufficiency when associated with more than "moderate" left ventricular hypertrophy.
4. Co-existent valvular disease when effect of the concomitant lesion is judged to be equal or greater than those of the mitral stenosis.
5. Such advanced intractable failure or concurrent disease that the patient is too poor an operative risk.

Bacterial Endocarditis. In the evaluation of patients for operation in a group from which over 150 were selected, we have encountered only four with bacterial endocarditis. They should be given intensive chemotherapy for six weeks or longer, and if otherwise suitable may be operated upon within three months.

Acute Rheumatic Fever. Patients with mitral stenosis are to be suspected of active rheumatic fever if there is clinical evidence

compatible with its presence. That there may be varying degrees of activity of this poorly understood infection, we are well aware. In patients with severe mitral stenosis it may be impossible to distinguish between disability due to rheumatic fever activity, carditis, and the results of long-standing and progressive mitral stenosis and its complications. Patients with low-grade rheumatic fever have been operated upon with marked improvement because of the correction of the mitral stenosis, and little apparent reaction as the result of the rheumatic activity. One death in our series, the first one, we believe went into cardiac failure over a three-day period after operation because of rheumatic carditis. However, of this we are by no means certain because an autopsy was not obtained. When rheumatic fever is evident, we believe operation should be postponed.

Co-existent Severe Mitral Regurgitation. When associated with more than "moderate" left ventricular hypertrophy, some slight mitral regurgitation may be present with mitral stenosis. If it is not marked, commissurotomy that corrects the stenosis will usually be accompanied by a decrease, or even a complete disappearance, of the regurgitation. Seldom if ever have we observed it to be increased. If the regurgitation is marked, if it approaches being greater in degree than the stenosis, then it is highly unlikely that any benefit will be gained by surgery. It is, therefore, of considerable importance in evaluation of patients to determine the comparative severity of stenosis and regurgitation present. This may be difficult.

Pure mitral stenosis is not difficult to recognize, but severe mitral stenosis with regurgitation is hard to assess as to which is the greater. If there is much regurgitation, the left ventricle is enlarged, the wall hypertrophied, and there is pulmonary congestion. Systolic expansion of the left auricle on fluoroscopic examination, held by some to indicate a predominance of regurgitation, has not been a true index in our experience, for we have found it in patients with marked stenosis and minimal regurgitation. Pressure readings obtained by cardiac catheterization have not given us the critical information we once thought they would. Severe mitral stenosis with a tense and distended left auricle and markedly incompetent valve with a free regurgitation are not to be distinguished by pressure readings, for both may be equally elevated. Perhaps our best index of regurgitation is the intensity of the apical systolic murmur, coupled with a muffling of the first sound.

Co-existent valvular disease when effects of the concomitant lesion is judged to be equal or greater than those of the mitral stenosis. In general, it may be said that the greater the involvement of the other valves of the heart, the less favorable will be the results of correcting a stenosis of the mitral valve and the greater the risk associated with such an operative procedure.

(a) *Aortic Valve.* Aortic stenosis and regurgitation both place an additional load on the left ventricle. If either is slight, neither is a contraindication for operation on the stenosed mitral valve. But if severe and if the left ventricle is enlarged and failing, then correction of a mitral stenosis may be followed by increased failure that is apt to be fatal.

(b) *Tricuspid Valve.* Some degree of tricuspid regurgitation is commonly present in far-advanced mitral stenosis. It may be functional due to back pressure, and may decrease after correction of the mitral stenosis. It is not in itself a contraindication for operation. Tricuspid stenosis, on the other hand, although less frequent, is of greater concern and may become more disturbing after mitral commissurotomy. When suspected, its presence may be confirmed by cardiac catheterization revealing a higher pressure in the right auricle than in the left ventricle. We have had two patients with marked stenosis of both the tricuspid and mitral in severe decompensation. They were markedly im-

proved by correcting first the mitral stenosis, and a few weeks later, the tricuspid stenosis. Pulmonic stenosis or regurgitation have not been of significance in our experience.

Conditions Requiring Individual Evaluation in Relation to the Over-all Status of the Patient. We have, with others, come to consider that commissurotomy is indicated for patients who have mitral stenosis predominately, and only a minimal degree of mitral insufficiency, and who are experiencing progressive disability. Auricular fibrillation, cardiac enlargement, minimal aortic lesions, age and controllable congestive failure are not contraindications to operation.

Commissurotomy for Mitral Stenosis
Conditions Requiring Individual Evaluation in Relation to the Over-all Status of the Patient.

The New York Hospital—Cornell Medical Center
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1. Mega-auricle (left).
2. Tricuspid stenosis with insufficiency.
3. Calcification—mitral valve.
4. Advanced age.
5. Pregnancy.
6. Associated renal insufficiency.

In addition to these items that lend themselves to rather clear-cut classification, there are several others that require consideration in relation to the over-all status of the patient. These may, under one circumstance, be an indication for operation, and under another, a contraindication. We will briefly consider six of these—mega-auricle, tricuspid stenosis and insufficiency, advanced age, pregnancy, calcification of mitral valve, and renal insufficiency.

Mega-auricle (Left). The degree of enlargement of the left auricle in mitral stenosis may be marked. On roentgenologic examination this may be very evident. We believe it to be an indication for careful evaluation, with particular reference to an associated severe mitral regurgitation. We have been mistaken in our preoperative estimation, as later demonstrated at operation, even with the aid of cardiac catheterization data and angiocardiography. Also we have found it difficult to gain much help by observing the expansile pulsations on ventricular systole, since these may be indistinguishable from causes other than mitral regurgitation. At present we rely chiefly on the physical signs of mitral insufficiency, and if these be absent we do not consider mega-auricle (left) a contraindication to operation.

Tricuspid Stenosis and Insufficiency. Tricuspid regurgitation may be expected to improve and even disappear upon correction of a severe mitral stenosis if it has been the result of back pressure. If, however, there has been a stenosis and a regurgitation as the result of rheumatic disease, then improvement may not result. Mild stenosis and insufficiency of the tricuspid valve are not a contraindication to operation on the mitral valve. It may be expected to reduce the degree of regurgitation. On the other hand, a stenosis will not be changed, and should be attacked directly. Many advocate that this be done at the same time that mitral commissurotomy is done. We believe it may be postponed for a short period under certain circumstances. The presence of a stenosis of the tricuspid valve requires additional care in the management of the mitral stenosis.

Advanced Age. Young individuals with short histories of rapidly developing disability due to mitral stenosis tolerate operation well, and receive the greatest benefit because commissurotomy is readily accomplished with valve function that approaches normal. The older the patient and the older the process involving the valve, the less likely is this degree of satisfactory result to be obtained. For example, the patient over 50, who has been so disabled as to be a bed patient for several years, has the complications of long-standing pulmonary hypertension and myocardial failure. Such a patient may be carried safely through operation and be improved. That the degree of improvement anticipated is not comparable to that in the young patient does not constitute a contraindication to operation. Age alone should not be a criterion for operation.

Calcification of the Mitral Valve. Calcification of the mitral valve may be observed on roentgenologic examination. It is found more frequently in older patients, and in those who have a long history of rheumatic fever. While it is generally indicative of a very distorted, scarred valve, the result of advanced disease, it is not to be interpreted as a contraindication to operation. In particular is this true if the findings are those of predominate stenosis. We have been agreeably surprised with the improvement following fracture and commissurotomy of some of the valves where calcific deposition was observed prior to operation. It is to be emphasized that no two mitral valves are identical, and that one with considerable calcium in it may be easily enlarged by commissurotomy, while another, with what on roentgenologic examination may seem no more or even less, is completely unamenable to correction.

Pregnancy. Over a period of 21 years in The Lying-in-Hospital of The New York Hospital-Cornell Medical Center,[5] there have been 2,932 cardiac patients among 75,527 pregnancies. There were 29 deaths in the 2,932 cardiac patients. Twenty-three per cent of all maternal deaths have been due to heart failure.

Clinical experience and laboratory investigations have indicated there is a predictable hemodynamic burden of pregnancy which starts early in the second trimester, rises to a peak early in the third trimester, and returns to or near normal at term. The burden rises again during labor, and immediately postpartum but usually to a much lesser degree than previously. Antepartum increase in cardiac work is largely due to rises in cardiac output, blood volume and oxygen consumption.

A patient with mitral stenosis who has been in failure in previous pregnancy or who has had an episode of pulmonary edema should be considered for commissurotomy within the first five to six months of gestation. It is our contention that such patients compose the category that contributes the most to deaths due to heart disease in pregnancy. They withstand operation well in the first two trimesters of pregnancy. We have operated upon ten pregnant women without fatality or major complication.

Commissurotomy for Mitral Stenosis
Commissurotomy and Pregnancy.

The New York Hospital—Cornell Medical Center
1951–1954

Case	Age	C.R.P.	Carditis	
1.	35	4 plus	+	Transient myelitis due to efocaine paravertebral nerve block. Term vaginal delivery.
2.	40	0	0	Vaginal delivery at 35 weeks. Transient puerperal fibrillation with pulmonary embolus. Mother and baby well.
3.	24	2 plus	+	Transient fibrillation. Term vaginal delivery. Mother and baby well.
4.	32	0	0	Transient fibrillation. Pulmonary edema at 27 wks. Vaginal delivery at 28 wks. Puerperal psychosis. Mother well. Baby (1070 gm.) died.
5.	21	0	0	Term vaginal delivery. Mother and baby well.
6.	39	3 plus	0	Transient fibrillation. Term cesarean section for fetal distress. Mother and baby well.
7.	26	3 plus	+	Term vaginal delivery. Mother and baby well.
8.	27	0	0	Transient fibrillation. Vaginal delivery at 36 weeks. Mother and baby well.
9.	36	0	0	Transient fibrillation. Term vaginal delivery. Mother and baby well.
10.	32	0	0	Term vaginal delivery. Mother and baby well.

Commissurotomy for Mitral Stenosis.
Commissurotomy and Pregnancy.

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	Literature	Lying-In Hospital
Before Pregnancy		
Cases	15	1
Deaths	0	0
During Pregnancy		
Cases	50	10
Deaths	2	0

There are reports of 16 patients (including one from The New York Lying-In Hospital) who have become pregnant follow-

ing commissurotomy, and all have delivered without cardiac difficulty. Sixty patients (including the ten from this Center) have undergone commissurotomy during pregnancy.

Renal Insufficiency. The patient with mitral stenosis who has impaired renal function merits specific consideration. If it is primarily due to myocardial weakness and a reduced cardiac output so that the blood flow through the kidney is reduced, then commissurotomy may be followed by immediate improvement. This is not infrequent. If, however, the reduced renal function is due primarily to changes within the kidney, then the burden of the operation and minor unfavorable changes in the circulation may be followed by acute renal failure. Demonstration of primary renal disease in a patient being considered for surgery of the mitral valve is an indication for caution and individualization in preoperative preparation and postoperative management. Werko and his associates[7] have pointed out that in mitral valve disease the blood flow is diverted from the kidneys, owing to changes within the kidneys, even before any signs of heart failure are apparent.

In the selection of 150 patients for commissurotomy, we have come to give the above our greatest consideration.

Commissurotomy for Mitral Stenosis

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Sex

Males	31
Females	119
	150

Age

0-10 yrs	11-20 yrs	21-30 yrs	31-40 yrs	41-50 yrs	51-60 yrs
0	2	29	65	47	7

Youngest 19 years
Oldest 56 years

There were 119 females and only 31 males. The latter included a higher proportion of "poor risks" than the former. The youngest patient was 19 and the oldest was 56. Fifty-four patients were over 40 years of age. This group, it may be said, were older not only in actual years but also the majority were considered to have long-standing, well-advanced changes as a result of their rheumatic fever. One would do well to bear in mind that this group of patients, although occasionally spectacularly improved, for the most part are not benefited to the degree that the young group are. There has been a general attitude, both among physicians and surgeons interested in this subject, that the patient beyond any hope of help from previously employed medical means should undergo surgery with little hesitation. It seems to us that surgery should be used when there is some assurance that it will benefit the patient's condition.

Commissurotomy for Mitral Stenosis.
Six Deaths Among 150 Patients.

The New York Hospital—Cornell Medical Center
1951–1954

1. (#4) Male, 25 years old, died on 3rd postoperative day of possible active rheumatic carditis.
2. (#8) Female, 35 years old, died on 23rd postoperative day of cerebral hemorrhage (A)*.
3. (#103) Male, 33 years old, died during operation—cardiac arrest following valvuloplasty—? conduction disturbance (A).
4. (#131) Male, 44 years old, died on 3rd postoperative day —cardiac failure due to aortic stenosis and insufficiency (A).
5. (#135) Female, 51 yesrs old, died on 21st postoperative day following slowly progressive myocardial failure associated with aortic stenosis and tricuspid stenosis and insufficiency (A).
6. (#142) Female, 39 years old, died during operation—death immediately following evacuation of large clot from left auricle, concomitant cardiac arrest and cessation of encephalographic activity (A).

*(A) indicates that an autopsy was performed.

At the same time, we must always allow considerable lattitude in arriving at any conclusion as to whether or not to operate because we are unable to forecast exactly what we may encounter in the valve itself. Patients who have advanced cardiac damage, as I have pointed out above, are likely to have a high mortality rate, and those who survive will have the least improvement. The surgical approach to mitral stenosis should be directed to the early selection of the ideal patient. In the future we may anticipate that the patients who develop symp-

toms that are relatively rapidly progressive due to mitral stenosis will be directed to the surgeon.

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DISCUSSION.—DR. E. F. PARKER, Charleston, S. C.: I rise to thank Dr. Glenn for presenting this work to this Association. It brings out the salient features of diagnosis and treatment of mitral disease. All the contraindications he mentioned are fairly easily recognizable, with the exception of mitral insufficiency. We feel that we see three classes of patients with mitral disease; those with obvious stenosis, those with obvious insufficiency, and a third group in which we have no way of telling which is predominant. Of the 31 patients upon whom we have operated for mitral disease, five have had insufficiency predominating, so that we were not able to accomplish anything by operation.

We feel that there are two additonal means of investigation which we might carry out in the study of patients with mitral valvular disease in an attempt to distinguish between stenosis and insufficiency in the doubtful cases prior to operation. One is cardiac catheterization. Originally, we did cardiac catheterization routinely. Then we felt it was unnecessary. Then we began to see patients with recurrence of acute rheumatic fever following mitral operation in which there was a return of many or all of the preoperative symptoms. In such cases, cardiac catheterization is extremely valuable in trying to decide whether or not there has been a recurrence of stenosis. In view of the frequency of rheumatic fever following operations for mitral stenosis, and in an attempt to try to distinguish insufficiency from stenosis in doubtful cases, we believe we will resume the performance of cardiac catheterization as a routine study in all patients with mitral disease.

The second means of study is angiocardiography. We intend to carry out this study, either by intravenous injection or by injection through a catheter placed in the right ventricle or in the pulmonary artery. If there is no retention of the dye in the left auricle, it may mean that insufficiency is predominant. If there is retention of the dye in the left auricle, it should mean that there is a high degree of stenosis. If the results are inconclusive, we will probably advise further observation before making a final decision concerning the desirability of operation.

DR. FRANK GLENN, New York, N. Y. (closing): I should like to thank Dr. Parker for his discussion and to point out that the problem of mitral insufficiency is one that still defies us in estimating it accurately. When we can do this we shall have crossed another hurdle. I think there is another question to be considered in the twilight zone, that is refusion evidence of recurrent mitral stenosis. We have had two patients in our series who have had cardiac catheterization prior to operation; one went 18 months and then had recurrence and was recatheterized; another went two years and four months. Then over a period of approximately six months both these patients approached the condition they were in prior to operation. In both, there was a decrease in the estimated size of the valve as compared with that preoperatively. Both these patients have been reoperated upon, and it is my impression that in neither of them was there a refusion of the commissurotomy, but because of involvement of the entire valve the area of the orifice became small again. I know that there have been cases reported in the literature showing some resealing, but I have not seen it first hand. Therefore, it is well to keep in mind that although you may have a very satisfactory result, this rheumatic process, with which we are not too familiar, may be continuous, and further involvement of the valve may occur.