Mitral Stenosis: Unexpected Improvement After Inadequate Valvotomy

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In a review of the results of mitral valvotomy (Fraser and Kerr, 1961) we were surprised to find that many of the early cases in the series had a good result in spite of what would be considered, by present standards, to be an inadequate operation. This group of cases seemed to merit further study; thus the fate of all cases with a final valve size of 2.5 cm. or less was investigated.

Material and Method

Out of 150 consecutive valvotomies performed by one of us (K. F.) during 1951-7, 68 had a final valve size of 2.5 cm. or less. All operations were performed by the transatrial route, using the finger or a Brock's knife to achieve the "split." Eleven (16%) patients have died since operation: the cause of death was congestive cardiac failure in nine and cerebral embolus in two. Twenty-one cases have had re-operation, the details of which have already been published (Fraser and Kerr, 1962). Of the remaining 36, 35 have been traced and reviewed. When the patients were seen at the follow-up, account was taken of their exercise tolerance, liability to bronchitis, haemoptysis, and chest pain, and their digitalis requirements. Clinical, electrocardiographic, and chest x-ray examination of each patient was carried out. The results of the operation were graded as poor, good, or very good, depending upon our assessment of exercise tolerance. Fifteen cases were graded as poor and 20 as good or very good. In an attempt to explain the variation in results these two groups were compared under the following headings: (1) duration of symptoms before operation; (2) age at operation; (3) findings at operation; (4) time interval between operation and assessment; (5) clinical findings at assessment; (6) chest x-ray findings; (7) E.C.G. records; (8) histology of pulmonary lingula biopsies.

Results

Duration of Symptoms Before Operation (Table I).—Of the 20 patients with good results 10 had had symptoms for less

TABLE I.—Duration of Symptoms Before Operation

Years:	2-	4-	6-	8-	10+	Total
Good result ..	5	5	4	1	5	20
Poor " ..	0	2	1	3	9	15

than six years before operation. Of the 15 with poor results only two had had symptoms for less than six years and nine for 10 years or more before operation. Bannister (1960) stressed the dangers of delaying operation in cases of mitral stenosis. It would be reasonable to expect that the longer the "back-pressure" effects of mitral obstruction are operative the more damaging would be the effects on pulmonary circulation.

Age at Operation (Table II).—We could find no evidence that the prognosis was affected by the patient's age at operation.

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Findings at Operation.—Our main interest was in the state of the mitral-valve cusps and the effect of fibrosis and calcification on the result (Table III). Of the 20 cases with a good result 18 (90%) had no or slight calcification and two had moderate calcification, whereas of the 15 with a poor result five had moderate or severe calcification.

Time Interval Between Operation and Assessment.—As time passes, the proportion of good results declines (Table IV). Lowther and Turner (1962) showed that valvotomy benefits most patients for five or six years, but thereafter the proportion deteriorating steadily increases.

Chest X-ray Findings at Follow-up.—Table V summarizes the main findings. The cardiothoracic ratio was greater than 60% in six (30%) of the cases with a good result and in nine (60%) with a poor result. Three of the four patients with severe enlargement of the left atrium had a poor result. The two cases with severe enlargement of the right ventricle and

TABLE II.—Age at Operation

	20-30 Years	31-40 Years	41-50 Years
Good result (20)	4	11	5
Poor " (15)	4	6	5

TABLE III.—Calcification of Valve Related to Results at Assessment

Calcification:	Absent	Slight	Moderate	Severe
Good result (20)	16	2	2	0
Poor " (15)	6	4	3	2

TABLE IV.—Time Interval Between Operation and Assessment

	5-7 Years	7-9 Years	9-10 Years
Good result (20)	9	8	3
Poor " (15)	4	7	4

TABLE V.—Correlation Between X-ray Findings at Assessment and Clinical Result

X-ray Findings	Good Clinical Results (No. of Cases)	Poor Clinical Results (No. of Cases)
Cardiothoracic ratio:		
< 50%	1	0
50-60%	13	6
> 60%	6	9
Left atrial enlargement:		
Slight	10	5
Moderate	9	7
Severe	1	3
Left ventricular enlargement:		
Nil	15	9
Slight	5	5
Moderate to severe	0	1
Right ventricular enlargement:		
Nil	7	0
Slight to moderate	13	13
Severe	—	2
Pulmonary artery enlargement:		
Nil	6	2
Slight to moderate	14	11
Severe	0	2

pulmonary artery had poor results, and in the only case with severe enlargement of the left ventricle the result was poor.

Electrocardiogram Results (Table VI).—Pre-operative E.C.G.s were available in 30 of the 35 cases. The E.C.G. at the time of

TABLE VI.—E.C.G. Findings

	Clinical Assessment		
	L.V.H.	R.V.H.	A.F.
Improved (20)	9 (45%)	7 (35%)	10 (50%)
Worse (15)	6 (40%)	8 (53%)	9 (60%)

assessment was examined for left ventricular hypertrophy, right ventricular hypertrophy, and atrial fibrillation. Deterioration was thought to have taken place if right ventricular hypertrophy had developed or increased, or left ventricular hypertrophy or atrial fibrillation had appeared since operation. In the 20 patients who had done well the E.C.G. was worse in 12, better in two, and unchanged in three; in three the pre-operative tracings were unavailable. Of the present E.C.G.s nine showed left ventricular hypertrophy, seven right ventricular hypertrophy, and 10 atrial fibrillation. In the 15 patients who had done badly the E.C.G. was worse in 11 and unchanged in two; two of the pre-operative tracings could not be obtained. Of the present E.C.G.s six showed left ventricular hypertrophy, eight right ventricular hypertrophy, and nine atrial fibrillation.

Clinical Findings at Assessment.—All patients examined had clinical signs of mitral stenosis. Of the 20 who had done well 10 had additional valve lesions. Of these, two had mitral incompetence, five had aortic incompetence, two had both plus aortic stenosis, and one had aortic incompetence and stenosis. Of the 15 who had done badly other valves were affected in nine—four had mitral incompetence, two had aortic incompetence, one had both plus aortic stenosis, and two had aortic stenosis and incompetence (Table VII). The grading of the second pulmonic sound is shown in Table VIII. In both groups the presence of a clinically detectable aortic-valve lesion

TABLE VII.—Valvular Lesions Present in Addition to Mitral Stenosis

Clinical Assessment	Mitral Incompetence	Aortic Incompetence	Aortic Stenosis
Improved (20)	4 (20%)	8 (40%)	3 (15%)
Worse (15)	5 (33%)	5 (33%)	3 (20%)

TABLE VIII.—Clinical Result Related to Grading of Pulmonic Second Sound

Result	Grade 0	Grade I	Grade II	Grade III	Grade IV
Good (20)	1	5	11	3	
Poor (15)	2	1	7	4	1

or mitral incompetence was associated with left ventricular hypertrophy in the E.C.G.

Lingular Biopsy Findings.—In 26 of the 35 cases paraffin blocks taken from the lingula at operation were available for histological examination. The slides were stained by the Verhoeff-van-Gieson method and arterial changes classified according to the method of Heath and Edwards (1958). Of the 26 biopsies, 11 showed no evidence of vascular change, 5 showed slight changes of pulmonary arterial hypertension (grade 2 of Heath and Edwards, 1958), and 10 moderate changes (grade 3 of Heath and Edwards, 1958). In common with Harris and Heath (1962) no changes beyond those of grade 3 were seen. We could find no correlation between the biopsies and the clinical state at assessment, but the results should be viewed with caution, since Heath and Best (1958) have shown that biopsy of the lingula is unsatisfactory for vascular studies. In addition, Gough (1960) has shown that the lingula is not representative of the degree of haemosiderosis present elsewhere in the lung.

Discussion

It is difficult to understand why so many cases having an inadequate valvotomy should have a good clinical result. The assessment of results of any operation presents many problems. Patients are asked to compare their present health with the pre-operative condition, and frequently the most disabling phase of the pre-operative period is most vividly recalled, thus making the comparison inaccurate. Furthermore, the post-operative assessment may be biased, for the patients expect the operation to be successful and tend to ignore residual disabilities. With these reservations in mind we have tried to find as many objective signs as possible by comparing the good and bad results and relating them to the duration of symptoms before surgery, the findings at operation, and the clinical, radiological, and electrocardiographic picture at follow-up.

One would expect that the longer the symptoms were present before operation the more damaging would be the effect on the pulmonary circulation, and our results tend to support this.

In respect of the findings at operation, it became apparent that a good result was more likely to occur where the valve was not calcified; nevertheless considerable improvement can be obtained in some patients, and we feel that calcification should not be regarded as a contraindication to operation.

Severe enlargement of the heart chambers on x-ray examination was associated with a poor result in all but one case.

It was impossible to distinguish between the two groups by means of the E.C.G. Similarly there was no obvious difference between the groups when the clinical findings were compared. The loudness of the second sound at the pulmonic area did seem to be related to the severity of the symptoms as shown in Table VIII; this is in accord with the observations of Bishop and Wade (1963).

With the passage of time the proportion of cases in which the results are regarded as good will probably fall and the number of cases of recurrent stenosis will rise; but our experience, so far, is not too discouraging when it is remembered that all the patients in this series had a technically inadequate operation. Arnott (1963) has stressed the importance of the lungs in mitral stenosis. Until now most interest has centred on the effect on the patient's symptoms of relieving the obstruction of the mitral valve, but with increasing experience it is apparent that, in some cases, when the relief of obstruction is carried out the lungs have already suffered severe or even irreversible damage. In such cases only slight or temporary benefit can be expected even when an adequate valvotomy is obtained.

Summary

The fate of 68 patients thought to have a technically inadequate mitral valvotomy has been investigated: 11 (16%) have died since operation, 21 (31%) have had a repeat valvotomy, and 35 of the remaining 36 have been traced and reviewed. The time interval between operation and assessment was 5 to 10 years.

At follow-up 20 cases had a good clinical result, and in 15 it was regarded as poor; the clinical result was employed to divide the cases into two groups.

When the duration of symptoms before surgery, age at operation, findings at operation, and findings at assessment were compared in the two groups two factors—namely, the duration of symptoms before operation and calcification of the valve—were seen to bear some relation to the result. In addition the loudness of the second pulmonic sound at assessment seemed to correlate fairly closely with the severity of the patient's disability.

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Prevention of Urinary Infection in Gynaecology

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Drainage of the bladder after gynaecological operations is most conveniently performed by indwelling catheter, but this method has recently come into disrepute because it nearly always gave rise to urinary infection. Infection can usually be avoided, however, by combining closed aseptic bladder drainage with measures to prevent bacteria from reaching the bladder via the space between the catheter and the urethral wall. After the removal of the indwelling catheter, the susceptibility of the bladder to infection may be temporarily increased, and special care must therefore be taken to avoid infection if intermittent catheterization subsequently proves necessary before the patient leaves hospital.

We have previously described how application of these principles reduced the post-operative infection rate (Linton and Gillespie, 1962). Having subsequently simplified the methods, we here describe them in more detail and report the results of treating a larger number of patients. We also report observations on the causative bacteria and on the after-effects of infection.

Method

Immediately before the patient went to the theatre the urethra was lubricated and disinfected with about 1 ml. of 1% chlorhexidine (Hibitane) obstetric cream, instead of the special disinfectant jelly previously used (Gillespie *et al.*, 1962). The cream was dispensed in urethral syringes¹ in the hospital pharmacy and a separate syringe was kept for each patient.

The indwelling catheter for post-operative drainage consisted of a Foley catheter fitted tightly with a collar of plastic foam sponge (Fig. 1). Circular pads were cut and shaped in the central sterile supply department (C.S.S.D.) from a 1-in. (2.5-cm.) thick sheet of polyurethane plastic foam.² A fine pair of forceps (Halsted's mosquito forceps) was thrust through the centre of the pad. The tip of the catheter was grasped and pulled back through the pad, which formed a very tight-fitting collar on the catheter.

This catheter was passed into the bladder before the patient left the operating-theatre (Fig. 2), and, after inflating the bulb, the pad was pushed along the catheter to rest firmly against the external urethral meatus and was well smeared with chlorhexidine obstetric cream. The catheter was thus

prevented from moving in the urethra and a disinfectant barrier was maintained at the urethral orifice. The bladder was then disinfected by the method of Paterson *et al.* (1960), in which 2 oz. (57 ml.) of 1 in 5,000 aqueous solution of chlorhexidine digluconate was instilled into the bladder. The solution was usually run in by gravity from the barrel of a

FIG. 1.—Foley catheters with pads of plastic sponge. (The balloon of the lower catheter is shown inflated, with the pad in approximately its final position.)

FIG. 2.—Sponge pad being pressed against urethral orifice, with tension on catheter.

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¹ Plastic urethral syringes can be obtained from Messrs. Flexile Metal Co. Ltd., Bessemer Drive, Stevenage, Herts.

² Polyurethane plastic foam can be obtained from Messrs. Ranwal Ltd., Craddock Road, Skimpot Industrial Estate, Luton, Bedfordshire.