Instrumental Transatrial Mitral Valvotomy

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With the extending practice of open heart surgery, there is a tendency towards the conception of relieving stenosis of the mitral valve by open operation under direct vision. In theory, this is the goal to be aimed at, and indeed may be the only way of obtaining an effective competent opening in severe fibrotic and calcific disease, but the results obtained by the closed splitting of the valve, using a mechanical splitter, still justify persistence with this method in the greater proportion of cases.

The parallel blades of the valve splitter separate the cusps through the fibrous tissue of the line of tissue, which is usually weaker than the cusp tissue itself. This method has been found to produce less damage to the heart than the use of the finger with which counterpressure is applied albeit unconsciously, against the thumb lying on the ventricular side of the atrioventricular groove, resulting often in bruising of the myocardium and occasionally rupture.

Many surgeons now use a valve splitter in all cases in which the fusion fails to yield to gentle finger pressure, because it has been found that the percentage of effective openings, with the left atrial pressure reduced to normal, is much higher than when the finger alone is used. In order to obtain normal emptying of the left atrium an opening of at least 3.5 cm. and in many, well over 4.0 cm. is necessary, depending upon the size of the heart and the patient. This figure is double the width of the forefinger at the level of the distal interphalangeal joint. Provided that fibrosis or calcification of the cusp is not extreme, the mobility of the cusp produced by such an opening should mitigate strongly against a refusion.

A further advantage of the use of a splitter is that in addition to the lateral fusion, the medial fusion is almost always well separated, a procedure which is particularly difficult to achieve with the finger as no convenient point of counter-pressure can be found.

A splitter can be inserted into the mitral valve either via the ventricle or the atrium. It is well recognized that a procedure undertaken via the atrium, provided that it is equally effective, is better tolerated by the heart than a transventricular manipulation, owing to the less fundamental reflexes stimulated by trauma.

In 1954, Dubost designed a mitral valve splitter to be inserted through the atrial appendage, but owing to its size it is not possible to guide it easily through the valve with the finger and its blind insertion may be responsible for the detachment of loose calcific thrombi lying on the surface of the cusps. Furthermore, the degree of regurgitation which may be being produced by the process of separation of the cusps, cannot be assessed without withdrawing the instrument and re-inserting the finger.

In 1959, Logan and Turner published their experience of a number of years’ use of a splitter passed through the apex of the left ventricle into the valve and controlled by the intra-atrial finger. Tubbs (personal communication) modified this instrument to give a wider opening (up to 5 cm. if necessary) and utilized the same technique. Both these instruments have been used widely with success.

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The use of an instrument which can be passed into the atrium and which can still be controlled by the finger inserted through the atrial appendage, would appear to offer some advantages.

In 1962, I described such an instrument and gave an account of its use in 115 patients. The instrument can be inserted through the atrial wall on a level with the valve, and the mechanism for producing a parallel opening of the blades can then be simple and evenly progressive. This permits the use of a lighter construction than the trans-ventricular instruments and the retention of some degree of 'feel' of the resistance of the tissue being separated. Closure of the atrial incision is no problem and any leakage can be controlled from within the atrium by the intra-atrial finger. When the chordae tendineae are fused they may be damaged during the insertion, spreading, or withdrawal of a trans-ventricular instrument, or, when cross-fusion of the chordae is present, difficulty may occur in engaging the blades in the stenosed valve opening. With the transatrial instrument, such an event is unlikely, and the fused chordae can usually be split slowly with the finger after the cusps have been separated. Traumatic stimulation of the ventricle is avoided, giving a relative freedom from ventricular arrhythmias, and there is no ventricular scar to become a source of subsequent weakness, particularly in patients with a severe degree of myocarditis.

**THE INSTRUMENT**

The transatrial splitter (Fig. 1) consists of two parallel blades 25 mm. in length sliding on each other; they are opened by a simple pull on one end and a push on the other. There is a certain amount of lateral movement of the blades on each other to allow for any curvature of the valve opening. The width of the blades is 3 mm. and when lying together they will enter the smallest stenotic valve opening. The shaft is 3 mm. in diameter, requiring an atrial incision of the same size. The stem is marked in centimeters so that the degree of split is indicated.

**Method of Use**

The normal exposure of the heart for mitral valvotomy is used. A purse-string suture is inserted in the narrow area of the atrium between the center of the base of the appendage and the atrio-ventricular groove. This corresponds in position to the end of the antero-lateral commissure between the two mitral valve cusps. The suture can be inserted into a Rummel tourniquet or any other form of tightening device.

The finger is then introduced into the atrium through the appendage with purse-string control, and the valve is examined. A 3 mm. incision is made within the circumference of the purse-string suture, and the valve splitter, held in the left hand, is introduced through the incision into the atrium and the purse-string is tightened. The closed blades of the instrument are directed through the stenosed opening of the valve by the finger in the atrium, and then the blades are slowly separated to the requisite distance (Fig. 2). If some degree of regurgitation was originally present, the

![Figure 1: The mitral valve splitter in the opened position.](image-url)
blades can be withdrawn intermittently into the atrium to check that this is not increasing. The spring on the handle will cause the blades to close automatically between each maneuver. When the requisite split has been obtained, the splitter is removed and the atrial incision closed with the purse-string suture, any bleeding being controlled by the finger from within the atrium during the suturing.

The usual precautions against cerebral embolism have to be taken in passing and opening the splitter in the presence of calcific thrombi on the edges of the valve cusps or of intra-atrial clot. Alternatively, the splitter can be inserted alongside the finger through the appendage, but this may cause some leakage of blood around the finger and the angle of the splitter to the valve is not quite so comfortable for manipulation as when a separate atrial incision is made.

When no appendage is available to pass the finger into the atrium, as in operations for re-stenosis, and the finger has to be introduced directly through the atrial wall, the use of a second tiny atrial incision to pass the splitting instrument instead of an additional ventricular incision simplifies what is frequently quite a difficult technical procedure. On five occasions the instrument was inserted blindly with successful splitting of the valve after attempts to insert the finger through a friable atrial wall had had to be abandoned because of the impending development of uncontrolled hemorrhage.

The instrument has now been used in 217 patients, including 21 re-operations on original 'finger-split' operations. Ten patients died (two were re-operations) giving a mortality rate of 4.6 per cent.

The causes of death were:

1) Ventricular failure
2) 'Myocardial failure'
3) Sudden cardiac onset
4) Transoperational cerebral embolism
5) Transoperational cerebral embolism
6) Transoperational cerebral embolism
7) Transoperational cerebral embolism
8) B. vulgaris pneumonia and right sided empyema
9) 'Myocardial failure'—no clear cause at necropsy
10) Staphylococcal pneumonia and empyema

Two patients had emboli in the postoperative course, one on the fifth day with a transient hemiparesis, and one on the 16th day who developed a saddle embolus over the aortic bifurcation which was successfully removed.

It is believed that the light construction of this instrument minimizes damage to the valve cusps and chordae, and there has been no production of mitral incompetence of serious consequence in this series of patients.

References