OPEN MITRAL VALVOTOMY ON THE BEATING HEART

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For a successfull outcome in open mitral valvotomy (OMV), an effective intraoperative testing method, a sound understanding, and appraisal of the result is imperative.

Some of the testing methods for the succesful outcome in OMV are digital palpation and epicardial or transesophageal echocardiography. There are also a variety of others. In this study a subset of ten patients fullfilling the criterias for OMV had undergone OMV on an empty beating heart. Normothermic coronary perfusion was utilized for myocardial preservation. The outcome of mitral reconstruction on a beating heart could easily and immediately be appreciated. Three patients required mitral valve replacement (MVR) under standard cardiopulmonary bypass (CPB) technique and cardioplegic arrest. All patients were evaluated pre and post operatively by echocardiographic studies.

Keys words: open mitral valvotomy, intraoperative echocardiography, continuous coronary perfusion.

One of the most important causes of postoperative mortality and morbidity following a technically successful cardiac operation is intraoperative myocardial damage. Myocardial damage most often results from the imbalance beetween myocardial oxygen supply and demand. This damage could lead to subendocardial necrosis[1,2]. To prevent such an event, many methods have been tried and studied begining from the early days of cardiac surgery. The method of normothermic coronary perfusion on a beating empty heart was once widely used but is almost obsolete today[3]. We have used this method in a subgroup of patients planned for an open mitral valvotomy (OMV), and this technique has permitted us immediate appraisal of valve function at the end of reconstruction.

Materials and Methods

Ten patients were selected for OMV procedure on an empty beating heart with normothermic coronary perfusion. Eight patients were female and two were male; the mean age was 32.2 and most of the patients were in preoperative functional class II according to New

York Heart Association (NYHA) classification. Membrane oxygenator and roller pump were used during the operation. Additonal to an arterial line from the oxygenator, a second 1/4 inch line was brought and inserted to the aortic root via an aortic cardioplegia needle. In all cases left atrial and pulmonary arterial venting were employed. Cardiopulmonary bypass (CPB) was initiated under standart technique. Perfusion flow was kept around 2.2 to 2.4 L/m². Systemic moderate hypotermia (approximately 34°C) was used. Following aortic cross clamping, continuous coronary perfusion with oxygenated blood was obtained via the cardioplegia route, from the pump oxygenator. After a left atriotomy, mitral valvotomy was performed on an empty beating heart. Mitral valve competence was tested by filling of the left ventricle through the left ventricle apex. Both before and after the procedure, mitral valve area were measured. All patients were assessed echocardiographically pre and postoperatively. Following intraoperative inspection of the reconstructed valves, singnificant incompetence was detected in 3 patients. CPB was immediately constituted again and mitral valve replacement (MVR) was performed.

Results

Various parameters of the mitral valve were studied, and some of them were undertaken by direct measurements made intraoperatively.
The mean mitral valve areas measured intraoperatively both before and after OMV were 1.11±0.26 cm² and 3.09±0.38 cm² respectively. These results were in concordance with echocardiographic estimates. The preoperative echocardiographic estimates of the valve areas were approximately 0.94±0.7 cm², which postoperatively measured 3.5±0.39 cm². Intercommissural distance estimates were 15.67±1.7 mm preoperatively and 27.5±2.8 mm postoperatively. The measured transvalvular gradients were 17 mmHg preoperatively dropping to 4 mmHg after OMV procedure (Table 1)
Post operative echocardiographic studies revealed competent mitral valves in all cases.
The mean aortic cross clamp (ACC) time was 12.8±2.2 minutes and total perfusion (TP) time was 25.8±2.8 minutes. There were no postoperative complications. The results are shown in table I.

Discussion

It is mandatory to assess valvular competence after mitral valve reconstruction or commissurotomy. Residual valve dysfunction will increase postoperative morbidity and mortality, jeopardize successful longterm results, and prolong the learning curve of the surgeon. Currently available methods of intraoperative evaluation following OMV are digital palpation, measurement of the resultant orifice, observation of 'v' waves in left atrial or pulmonary capillary wedge pressure tracing,

Table I: Comparison of the patients, preoperative and postoperative

	Preoperative	Postoperative
Valve area (cm²)	0.94 ± 0.7	3.5 ± 0.39
Distance between commisures (cm)	15.6 ± 1.7	27.5 ± 2.8
Gradient (mm/Hg)	17	4
NYHA class	III	I
Mitral insufficiency	ø	ø

indicator dilution method, fluid filling of left ventricle, and echocardiography (M-mode or 2-D; contrast doppler, color flow; epicardial or transesophageal). Several of these methods were employed at different centers and in different times[4].

Assesment of valve competence by filling of left ventricular cavity after completion of mitral valve reconstruction is one of the most popular and simple approaches frequently used by many centers, including ours[5-7]. Eventhough, this could provide some insight on the status of the valve, it maybe misleading. Because the ventricular filling pressure is not known, this could lead to an erroneous assumption that the valve is competent which later may be shown echocardiographically[8].

Johnson et al[9] reported the first use of intraoperative M-mode echocardiography to assess the outcome of mitral valve surgery in 1972. Intraoperative echocardiography provides evaluation of the reconstructed valve under the physiological conditions of a beating ejecting heart against a natural afterload and preload. However, the information is obtained rather late, (after the termination of CPB) not when the procedure is being done.

In the light of these findings, mitral valve reconstruction on an empty beating heart with continuous coronary perfusion offers a better opportunity for the assesment of valve competence, and we would like to present this here as an alternative method in OMV procedures.

In spite of the surgical disadvantages, the earliest intracardiac operations were performed with normothermic coronary perfusion on empty beating hearts. Even as late as 1975, this technique was acclaimed as the optimal method for cardiac surgery[10]. Earlier experimental studies on animals had been interpreted as showing "normal left venticular function" after 30 minutes to 3 hours of CPB with the heart perfused, empty, and beating[11,12].

Present information indicates that the method is not ideal. First, water tends to accumulate in the myocardium during CPB. Buckberg et al. found that, as a result, ventricular distensibility in dogs is decreased nearly by 50% after 3 hours of CPB with the heart perfused, empty, and beating[3,10].

In addition, the perfusate entering the arterial system from the pump-oxygenator is heparinized, diluted blood with abnormal physiochemical properties.

We agree with all the unfavorable aspects of this method, but considering the short duration of an OMV, we don't believe that this would have an adverse effect on the myocardium.

Yacoub also has performed valve replacement by using continuous coronary perfusion technique with longer ACC times[13].

With this approach, the competence of valve could be assessed with further certainty and confidence compared to testing methods mentioned earlier. This is a factor which is crucial in the conduction of operation. As a matter of fact, three patients were identified to have mitral incompetence, and immediate MVR was carried out in all of them.

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