CHIRURGIE CARDIAQUE / CARDIAC SURGERY

HOW TO DO IT : CLOSED MITRAL COMMISSUROTOMY

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Introduction

Closed mitral commissurotomy (CMC) for mitral stenosis has been performed since 1923 after the successful work of Cutler and Levin, followed by Souttar in 1925(1, 2). At our centre, we have been performing closed mitral commissurotomy since 1962. In the present era of percutaneous mitral balloon valvotomy (PMBV), we perform more than 100 CMC's per year due to a large waiting list and decreased cost.Our current technique of CMC, modified over many years, is described.

Technique

Selection of patient with a classical diastolic rumble with a sharp opening snap on auscultation, and a Wilkins's score (Table 1)of <8 is considered essential to a good outcome(3). Relative contraindications include the presence of left atrial clot, or previous embolic episodes. If the patient is anticoagulated then warfarin is discontinued at least 48 hours prior to surgery.

The patient is intubated under general anesthesia with a single lumen endotracheal tube and positioned in a semi-lateral position with a small sand bag placed behind the left shoulder and the left arm placed anteriorly above the head with the support of sandbags(Fig 1).Intravenous access is gained by placing avenous catheter in the right arm. An arterial line is placed in the right radial artery to monitor arterial pressure. The patient is prepped with anti-septicbetadine solution from the left axilla to the subcostal space along the anterior axillary line and one inch to the right of midline anteriorly to the spine over the left hemi-thorax.

A left anterolateral curvilinear skin incision of 8-10cms is made over the 5th intercostal space upto the subcutaneous plane. In women, a sub-mammary incision is selected 1 cm below the mammary fold. After raising the subcutaneous flap the apical heart beat is sought anteriorly, and the intercostal space where the apex beat is palpated is selected for entering the chest cavity. This is usually the 5th intercostal space. A rib spreader with the rachet placed posterially is used, and the pleural space entered. Care is taken to avoid injury to the left internal mammary artery anteriorly which may be injured due to excessive rib spreading.The left lung is packed laterally with a large moist pad or sponge to expose the pericardium medially, and the pericardium is picked between forceps and opened 1 cm anterior to the phrenic nerve. The pericardium is opened enough to expose the apex of the heart inferiorly and the pulmonary artery superiorly. The pericardium is marsupialized to the skin with 2-3silk stay sutures on bothsides. Occasionally the left thymus gland or fat pad may need to be resected to allow better exposure superiorly. The pulmonary artery pressure is felt by digital palpation as a rough guide to compare with the post commissurotomy pulmonary artery pressure.The left atrial appendage (LAA) is palpated gently to feel for clot. If felt or suspected, then 3 approaches can be made: Firstly, after the

purse string is placed the appendage is opened and the clot extracted with increased sustained respiratory inhalation prior to placing the index finger. Secondly, a pursestring suture can be placed in the body of the left atrium. Thirdly, the entry can be made through the left superior pulmonary vein if it is large enough.

If the left ventricle (LV) apex is not visualized a moist gauze pack is placed below the heart along the intra-diaphragmatic pericardium. Using a 2-0 Ethibond(Ethicon, Somerville, New Jersey, USA)braided polyester suture a Ustitch purse string is made over a bare area at the apex of the heart on the left ventricular side lateral to the left anterior descending coronary artery (Fig 2). Another 2-0 Ethibondbraided polyester suture purse string is placed around the base of the left atrial appendage. A Statinsky vascular side biting clamp is placed at the base of the appendage (Fig 3). Care is taken not to apply the clamp over the A-V groove, thus avoiding injury to the circumflex coronary artery.

The left atrial appendage is opened using a #11 blade and any clot or particulate matter are thoroughly washed out. The surgeon prepares his right index finger by washing with antiseptic solution. The Tubb's dilator is checked and is set at 2.5 cms.diameter. It is important to have three sizes ofTubb's dilator available i.e. adult, medium, and pediatric, and selection depending on the patient's LV heart size (Fig. 4). It is essential that the Tubb's dilator shoulder be completely within the left ventricular cavity when the Tubb's dilator engages the leaflet, and the commissurotomy is performed.

While the assistant holds the two lips of the left atrial appendage wall, the surgeon introduces the right index finger into the LA and removes the clamp with his left hand. It is stressed to gently insert the finger making sure pectinate muscle is not obstructing the orifice. A tear in the LAA can create a major problem. The tip of the index finger then identifies the mitral valve orifice and size, as well as the presence of nodules, calcium, and any mitral regurgitation jet. The surgeon then attempts to break the stenosis by finger, and generally this gives an adequate finger split. The index finger should not occlude the orifice for more than a few ventricular beats.

The other three fingers of his right hand are used to elivate the left ventricle and stabilize the apex. Using the left hand and a #11 bladescalpel the LV apex is stabbed and a small Hegar dilator or blunt end of the scalpel is introduced through the stab wound. In cases of critical mitral stenosis aHegardilator is advanced through the LV and into the LA and the mitral orifice is enlarged. Care is taken that the mitral orifice is not occluded for a long time at any point of time by the finger, the Hegar dilator, or the Tubbs dilator.

Once the Hegar dilator is employed it is removed and the Tubb's dilator is introduced into the LV with the handle towards the superior aspect and rotated so the handle lies in a horizontal plane and the tip of the dilator is gently guided through the mitral valve orifice(Fig 5). It is important that the shoulder of the Tubb's dilator be fully inside the LV cavity and the dilator not held within the chordae of the mitral valve apparatus. The anesthetist is cautioned, and both carotids are felt and compressed briefly when the split is made.The split is madeagainst the valve leaflets and not against the commisures (Fig 6).The slit should be fully in a slow but forceful motion. If required, the split is repeated with increasing the Tubb's dilator size by adjusting the screw, and an additional 3cm. split is performed. Progressive splits from lower to higher openings are not routinlydone. The Tubb's dilator is removed after the arms are closed and the first assistant immediately secures the purse string. If the suture breaks or there is a LV tear then a Hegardilater is placed through the tear to control bleeding and a pledgeted horizontal mattress suture placed to secure the bleeding. Next, the finger in the LA is removed and LA purse string is secured. Digital palpation of pulmonary artery pressures are again made to compare with the pre-split status. The anesthetist may be able to appreciate more lung compliance and decreased airway pressure after an adequate split.

Following adequate hemostasis, a32French intercostal drain is placed through a separate lower left chest stab wound incision. The pericardial cavity is irrigated with saline and the pericardium approximated with a separate cruciate pericardial window fashioned posterior to the left phrenic nerve.

An intercostal nerve block is given for two ribs above and two ribs below the incision and the wound is closed in layers. The patient is generallyextubated in the operating room. The patient is usually discharged on the 3rd or 4thpostoperative day. A transthoracic echocardiogram (TTE) is obtained prior to discharge and on clinic return in 3-4 weeks.

Discussion

Since 1948 a number of series have been reported with excellent long term results from closed mitral commissurotomy (CMC)(4, 5).Several recent monographs have described the contemporary operative technique of CMC(6, 7, 8). Despite the advantages and satisfactory

long term results of the interventional PMBV, CMC remains a low risk, inexpensive approach, not requiring cardiopulmonary bypass (CPB), applicable for pregnant patients not amenable to PMBV, and readily performed in emerging economies and developing countries. CMC may also have advantages in patients with severe pulmonary hypertension, since it avoids CPB and the systemic inflammatory response syndrome (SIRS)(9).

In our institution we have performing closed mitral commissurotomies since 1963 with good results. The postoperative morbidity is less than 1% and patient is followed with serial follow-up, and is evaluated for redo-closed mitral commissurotomy or mitral valve replacement depending on the valve morphology and suitability for commissurotomy. In our government general hospital , due to the long waiting list of patients for balloon mitral valvotomy, closed mitral commissurotomy is performed with good results. With the aid of trans-esophageal echocardiography (TEE) the commissurotomy can be guided and assessed on theoperating table.

The finger fracture technique via the left chest and left atrial appendage was improved by Logan (10) in 1959 with the development of the Tubbs mechanical dilator and the concomitant combined left atrial left transventricular approach, and was subsequently adopted by other centers.

There are several technical aspects of the traditional left chest approach that deserve emphasis. The left chest is usually entered through the 5th intercostal space. The pericardium is opened anterior to the phrenic nerve. The left atrial appendage is entered, unless clot is palpated. If clot is suspected or confirmed,then an alternative entry can be made in the body of the left atrium or through the left superior pulmonary vein if it is large enough to admit the right index finger.

If TEE is available, the position of the dilating index finger, or baby finger in redo cases, and the Tubbs dilator can be visualized, as well as assessing the presence of air, completeness of dilatation and residual significant MR. Other approaches to the left atrium have been described. It is not uncommon to have an incomplete split of one of the commissures. This can be assessed digitaly, and additionally split with the exploring finger.

De et al. (11) from Vietnam described the finger fracture technique for redo CMC via the right chest approach. Cooley et al. (12), in 1959, described the right thoracotomy and transternal approach. Cosio Pascal and Ibarra-Perez (13), in 1974, described the median sternotomy approach. This had the advantage of easier conversion to OMC, when CMC was not feasible secondary to inadequate exposure, unstable hemodynamics, a friable or torn left atrial appendage, the presence of palpable left atrial clot, or a MVA < 0.6, making finger or dilator dilatation difficult or hazardous.

If the anteromedial commissure alone is opened, then further attempts to dilate the posterlateral commissure should be abandoned. Also, if MR is encounterd with intial dilatation, then further dilatation attempts should not be attempted. There is no consensus regarding the degree of dilatation. We employ 2.5 cmm diameter of the Tubbs dilator. Khonsari and Sintec (5) employ 3.5to 4.5 cm, whereas Kumar (6) recommends 2.0 to 2.5 cm. Antunes (8) averages 3.6 to 3.8 cm in females and 3.9 to 4.1 cm in males.

Conversion of CMC to OMC during the left chest approach requires the use of CPB. The anterior left chest incision can be extended posteriorly for easier cannulation. This necessitates cannulation of the left femoral artery or the descending or inferior arch thoracic aorta for arterial flow, and left femoral vein, or retrograde cannula placement into the right ventricle via the main pulmonary artery and pulmonary valve for venous return. Exposure of the mitral valve can be obtained with a longitudinal opening of the left atrial appendage with extension into the left superior pulmonary vein (8).

Presently, the OPCAB apical suction device may make exposure of the left atrium even more feasible, as well as access to the LV apex. The most recent advance in CMC, is employing intra-operative TEE to better assess and approach the anatomy, guide the operating finger and Tubbs dilator during the commissurotomy, and assess the intra-operative result i.e. residual stenosis and/or new or increased regurgitation (14-16). The long term results of CMC and PMBV remain debated, yet the consensus is that both procedures remain comparable (17, 18).

Khonsari and Sintec(7) emphasize several technical points: gentle entry of the LAA to avoid tearing and bleeding; beware of LAA clot; premature opening of the Tubbs dilator may tear or injure the subvalvular apparatus; complete closure of the dilator before removal; assess any mitral regurgitation with the index finger before removal; and preventing air from entering the LA. Conversion to the open technique must also be considered if warranted.

In view of the young age of patients presenting with isolated mitral stenosis, PBV is currently the first option, and CMC the alternate procedure,

thus giving the patient the longest possible result with conservative surgery. This is especially important for adolescent young females since these two procedures may carry them through their maternal reproductive life without complications.

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Figure 1. Patient in the semi-lateral position to expose left anterolateral chest.

Figure 2. Left chest opened with exposure of left ventricle apex.

Figure 3. Statinsky vascular clamp at base of left atrial appendage.

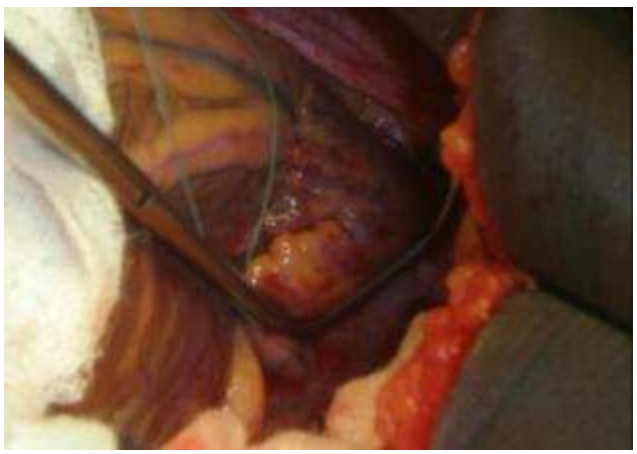
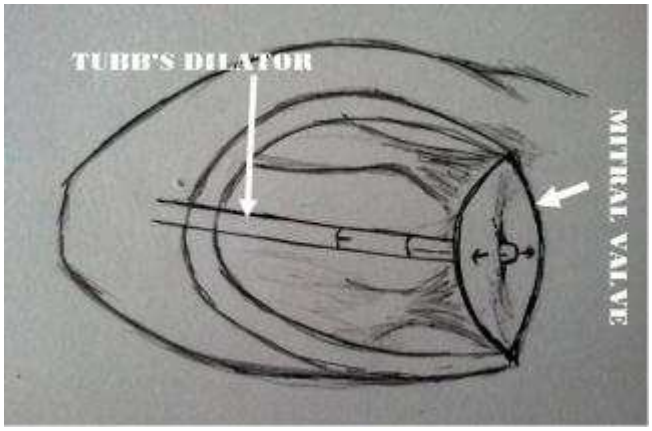


Figure 4. Small, Medium, and Large Tubbs dilators.

Figure 5. Tubbs dilator, positioned through apical left ventricular stab incision, at orifice of mitral valve.



Mitral Valve split is made against leaflets not against commissures

Table 1. WILIKINS MITRAL STENOSIS ECHO SCORE (3)

LEAFLET MOBILITY	Score
• Highly mobile valve with restriction of only the leaflet tips	1
• Mid portion and base of leaflets have reduced mobility	2
• Valve leaflets move forward in diastole mainly at the base	3
• No or minimal forward movement of the leaflets in diastole	4
VALVAR THICKENING	
• Leaflets near normal (4-5 mm)	1
• Mild leaflet thickening, pronounced thickening of the margin	2
• Thickening extends through the entire leaflets (5-8 mm)	3
• Pronounced thickening of all leaflet tissue (> 8-10 mm)	4
SUBVALVAR THICKENING	
• Minimal thickening of chordal structures just below the valve	1
• Thickening of chordae extending upto one third of chordal length	2
• Thickening extending to the distal third of the chordate	3
• Extensive thickening and shortening of all chordae extending down to the papillary muscle	4
VALVAR CALCIFICATION	
• A single area of increased echo brightness	1
• Scattered areas of brightness confined to leaflet margins	2
• Brightness extending into the mid portion of leaflets	3
• Extensive brightness through most of the leaflet tissue	4
MAXIMUM TOTAL SCORE	**16**