

PROSTHETIC REPLACEMENT OF THE MITRAL VALVE

NORMALLY, the mitral valve is closed mainly by the freely mobile anterior cusp.^{1 2} In most patients with acquired mitral-valve disease the anterior cusp is mobile enough to allow adequate correction of the defect by some plastic procedure, with or without the insertion of an immobile posterior prosthesis.^{1 2} But in some patients extensive disease of the anterior leaflet of the mitral valve immobilises this important cusp permanently. In such patients only partial or complete replacement of the valve with some form of *mobile* prosthesis restores adequate function.

This is a preliminary report of two patients in whom it was necessary to replace the mitral valve completely to obtain satisfactory hæmodynamic function. This was done by means of the University of Cape Town lenticular mitral prosthesis.

DESIGN OF THE VALVE

The prosthesis has a fixed portion and a mobile portion.

The fixed unit is fashioned from a single piece of 16 G stainless steel, grade 18/8-316, and is coated with 'Teflon'.* It consists of a ring and suspension bar (fig. 1A). The ring is

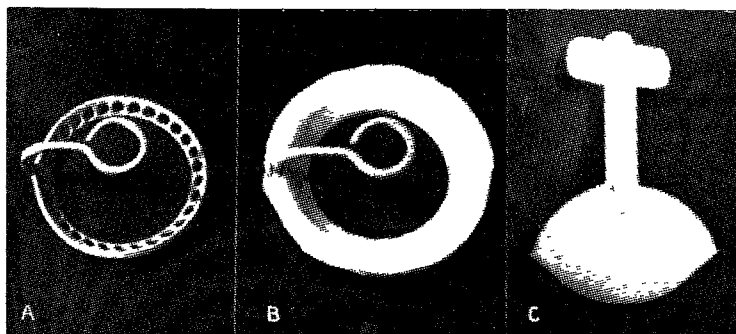


Fig. 1—University of Cape Town lenticular mitral prosthesis. (A) Fixed portion; (B) fixed portion with ring covered with compressed polyvinyl sponge; (C) mobile portion.

pierced with many holes; this portion of the unit is covered with compressed polyvinyl sponge (4.5/1 compression) (fig. 1B). The 'Ivalon' covering allows fixation of the unit on the ventricular surface of the mitral annulus. The suspension bar, which remains uncovered, projects into the atrial cavity.

The mobile unit of the prosthesis is moulded by pressure injection with subsequent vulcanisation and curing, from 'Silastic' X-30146.† It is lens-shaped with a flexible stem, and a cross-bar (fig. 1C).

In the assembled position, the cross-bar is passed through the ring of the suspension bar (fig. 2). The lenticular modification of the ball and the incorporation of a suspension unit positioned in the atrium eliminates the need for a cage and ball, and thus diminishes the dangers of obstruction to the left ventricular outflow and of trauma to the myocardium of the left ventricle.

INSERTION OF THE VALVE

The left pleural cavity is entered through an anterolateral thoracotomy at the level of the bed of the 5th rib. The lung is retracted backwards and the pericardial sac is entered through a longitudinal incision, anterior to the left phrenic nerve. A transverse incision in the right flap

may be needed to gain a better view of the right side of the heart. The mitral valve is explored through the left atrial appendage to determine the mobility of the anterior leaflet and to find out whether the valve needs to be completely replaced.

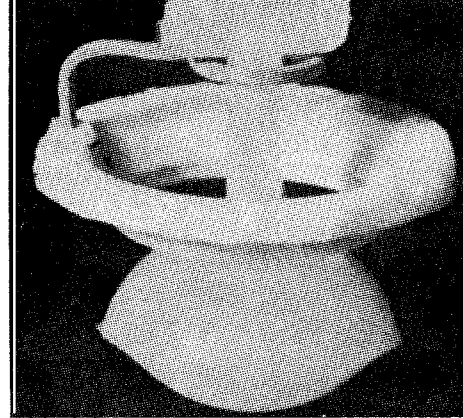


Fig. 2—Prosthesis assembled for insertion.

The left common-femoral artery is exposed and, after systemic heparinisation (90 mg. per sq. m. body-surface area), catheterised, and connected to the arterial line of the oxygenator. The venous blood is drained either by means of a catheter inserted into the right atrium via the atrial appendage, or by means of a catheter in the right ventricle via the right ventricular outflow tract. Partial bypass and cooling then begin.³ As soon as the heart is hypothermic failure of the heart, the left atrium is opened to aspirate the blood from the left chambers of the heart and to prevent overdistension. The pulmonary artery and aorta are cross-clamped, and the heart is packed with iced saline sludge. The left atrial incision is extended down around the opening of the left inferior pulmonary vein. The atrial margin nearest the atrioventricular groove is then grasped with two Millier prostectomy forceps and pulled upwards. In this way an excellent view of the mitral valve is obtained.

The anterior and posterior cusps of the mitral valve are excised with their chordæ and part of the papillary muscle, if these structures are hypertrophied. Care must be taken not to damage the mitral annulus or the aortic valve. A prosthesis of suitable size is selected, and the Ivalon ring is trimmed to fit snugly on the ventricular surface of the annulus without obstructing left ventricular outflow. The prosthesis is sutured in position with twelve to fifteen interrupted O silk mattress sutures. After being passed through a compressed Ivalon ring, these sutures are tied on the atrial side of the annulus.

Rewarming is begun and the left ventricle is allowed to fill with blood, the ball of the prosthesis being held in the open position. When the heart resumes beating and all air is expelled from the left ventricle, the left atrium is allowed to fill with blood and the incision into the atrium is closed. As soon as the cardiac beat is satisfactory bypass is discontinued and the pressures in the left atrium and left ventricle are measured. When the heparin has been neutralised the venous and arterial catheters are removed. The pericardial sac and left pleural cavity are drained, and the pericardium is closed. The wound in the chest wall is sutured.

Postoperative care is the same as for any patient who has undergone open heart surgery, except that anticoagulants are started on the 4th day. We do not know how long this should be continued but we intend to maintain our patients on anticoagulants indefinitely.

RESULTS

Two patients have had total mitral valve replacement so far, without mortality.

Case 1

A male of 29 was first seen in 1959. He had rheumatic fever as a boy, but was completely free from symptoms until 1958. Progressive dyspnoea on effort then began and was followed by cough and hæmoptysis, forcing him to give up work. Atrial fibrillation came on in 1960, and by 1962 he was severely disabled with paroxysmal cardiac dyspnoea, orthopnoea, and very limited effort tolerance, though at no time was there frank congestive failure.

3. Barnard, C. N., Terblanche, J., Ozinsky, J. *S. Afr. med. J.* 1961, 35, 1

* Coated by the Land, Sea, and Air Equipment Co., Wynberg, C.P., South Africa.

† Manufactured by Dow Corning Corp., Midland, Michigan, U.S.A.

1. Barnard, C. N., McKenzie, M. B., Schrire, V. *Brit. J. Surg.* 1961, 48, 655.

2. Barnard, C. N., Schrire, V. *Postgrad. med. J.* 1961, 37, 666.