An extranatomical inflow for the left ventricle was created using a valve-containing conduit between left atrium and left ventricle.

We concluded that severe mitral stenosis produces considerable clinical improvement by this technique, and relief of myocardial damage caused by mitral stenosis is often difficult to achieve by conventional methods.

The procedure was performed on 20 mongrel dogs through a left thoracotomy without use of cardiopulmonary bypass. Intraoperative blood flow determination revealed 400ml/min. across the left atrium to left ventricle conduit at the aortic blood flow of 1000ml/min. Both postoperative angiography and post mortem examination confirmed patency of the bypass grafts and good function of the prosthesis.

Most patients who have obstruction between the left ventricle and the aorta that necessitates surgical treatment enjoy marked improvement following operation by established method. In certain patients, however, the obstruction is not amenable to such operations. Included in this group are patients with diffuse hypoplasia of the ascending aorta, hypoplasia of the aortic ring and subvalvular stenosis. In view of long experience with left ventricular assist devices placed between the apex and the descending aorta, we have devised valved conduits to be inserted from the left ventricular apex to the aorta in certain patients with severe left ventricular outflow obstruction. On the other hand, in certain cases with severe mitral stenosis and combined valvular disease like mitral stenosis with aortic stenosis, the left ventricular myocardium are apt to be greatly damaged and the surgical results are not well. Therefore we concluded extranatomical bypass (Fig 1).

The report of left atrium to left ventricle conduit for mitral stenosis, is not known until now. In this method, the time of cardiopulmonary bypass is very short and the myocardial protection is well controlled.

Conduit

The prosthesis is a Bjork-shiley#17 mitral valve mounted into a 16mm woven tubular Dacron graft. Anastomosis to the apex of the left ventricle is accomplished with a semirigid, hard glass and stainless elbow stent (internal diameter 6mm and 10mm) which projects 10mm into the left ventricular cavity. The apical stent is of paramount importance in the function of the conduit. Its rigidity prevent collapse during ventricular systole as well as kinking of the conduit as it negotiates a right-angled turn at the left ventricular apex. The stent's external surface is covered with Dacron graft to facilitate tissue ingrowth and provide a s-
Experimental methods
Twenty mongrel dogs weighing between 15 and 20 Kg were anesthetized with phenobarbital and mechanically ventilated with oxygen through a cuffed endotracheal tube. A left thoracotomy through the bed of the fifth or sixth rib was performed. The pledgeted string was placed along the atrioventricular sulcus because mitral stenosis (supravalvular) must be created. The end-to-end atrial anastomosis was done using a partially occluding vascular clamp and running suture technique. The dogs were heparinized (1mg/Kg body weight) prior to removal of the vascular clamp, and blood was allowed to enter the distal portion of the conduit. And the ventricular apex is exposed and incised. The ventriculotomy was dilated by surgical knife, and the ventricular end of the previously fabricated and precollotted left ventricular inflow prosthesis was inserted into the apex. Pledgeted sutures were placed at equidistant points about the ventriculotomy and through the sewing ring on the stent, thus fixing the stent to the apex. Residual air in the conduit was removed by placing a needle in the prosthetic graft at its highest point.

Results
Intraoperative blood flow pattern of the left atrium to left ventricle bypass shows same as its of normal mitral valve (Fig 3). Using the apical tube of 10mm diameter, blood flow revealed 440ml/minute across the LA-LV conduit at the aortic flow of 1000ml/minute. And it's flow revealed 300ml/minute at the tube of 6mm.

Fig 4. Blood flow revealed 440ml/minute across the LA-LV conduit using the apical tube of 10mm diameter and it's flow revealed 300ml/minute using the tube of 6mm, at the aortic flow of 1000ml/minute.
After creation of mitral stenosis, elevation of left atrial pressure and increase of LA-LV bypass flow were shown but aortic pressure and blood flow presented no remarkable change (Fig 5). Postoperative angiography and postmortem examination confirmed satisfactory prosthetic function (Fig 6).

Comment

The concept of extraanatomical bypass of the aortic root is not new. In 1910, Carrel inserted a paraffin rubber tube and jugular vein conduit from the left ventricular apex to the descending thoracic aorta in dogs and suggested its use in dealing with aneurysmal disease of the aortic arch. Several other investigators attempted, with variable degrees of success, to perform this technique experimentally. Sarnoff could perform apicoaortic anastomosis and occlusion of the ascending aorta in dogs, with survival for as long as six months, in 1955. The Sarnoff prosthesis was composed of a rigid Lucite tube in continuity with a Hufnagel valve. Although no postoperative hemodynamic assessment was made of the technique, that dogs were reported to have normal function. Thromboemboli and hemolysis were major complications, they were reportedly the cause of death in all dogs surviving the early postoperative period. Apicoaortic anastomosis awaited clinical application until 1962, when Thompson performed apicoaortic anastomoses on patients with valvular aortic stenosis.

Cooley and associates sutured the deformable Dacron conduit directly to the left ventricle. Although satisfactory management was achieved, postoperative angiograms showed compression of the grafts by the myocardium during mid systole, and a special rigid insert was subsequently developed. The desirability of a rigid inlet tube for the ventricle is also suggested by the laboratory work of Brown and co-workers, who demonstrated eventual muscular occlusion of an apical prosthesis that didn’t reach the endocardial surface. Left ventricular apical insert prostheses methyl methacrylate, stainless steel, carbon and polyurethane have been reported in clinical use. (Fig 2B)

We undertook an extensive evaluation of the new concept (left atrium to left ventricle bypass) using prosthetic materials, and suggested its application in unusual forms of severe mitral stenosis over the age of 60 years and congenital mitral stenosis.

New extraanatomical bypass by means of LA-LV anastomosis should be considered as an alternative technique in the treatment of severe mitral stenosis and in it of mitral stenosis with aortic stenosis.

The report of this method for mitral stenosis is not known until now.

References


