

A New Operation for *d*-Loop Transposition of the Great Vessels

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ABSTRACT Transposition of the great vessels remains a major problem for the cardiac surgeon. Although the Mustard (intraatrial baffle) procedure has provided the means for physiological correction of this anomaly, there are many complications that plague the lives of the survivors. This report describes an operation that is essentially extracardiac and achieves the desired goal of simple switching of the great vessels. Future revisions of the outflow tract prosthesis may become a major problem, but probably less of one than the complications that have been and will be associated with the intraatrial baffle procedure.

The intraatrial baffle procedure represents a monumental breakthrough in the management of transposition of the great vessels. Although it provides complete physiological repair of this complex anomaly, it is associated with many complications. There is an operative mortality of approximately 15% when the procedure is applied to the so-called simple *d*-loop transposition. Pulmonary venous obstruction, inferior or superior vena caval obstruction, tricuspid insufficiency, and often serious arrhythmias are seen with alarming frequency in survivors [1]. Also, while it produces complete physiological repair, following the intraatrial baffle procedure the anatomical right ventricle, guarded by the tricuspid valve, becomes the systemic ventricle. This combination may eventually lead to a high incidence of tricuspid insufficiency and associated systemic ventricular failure.

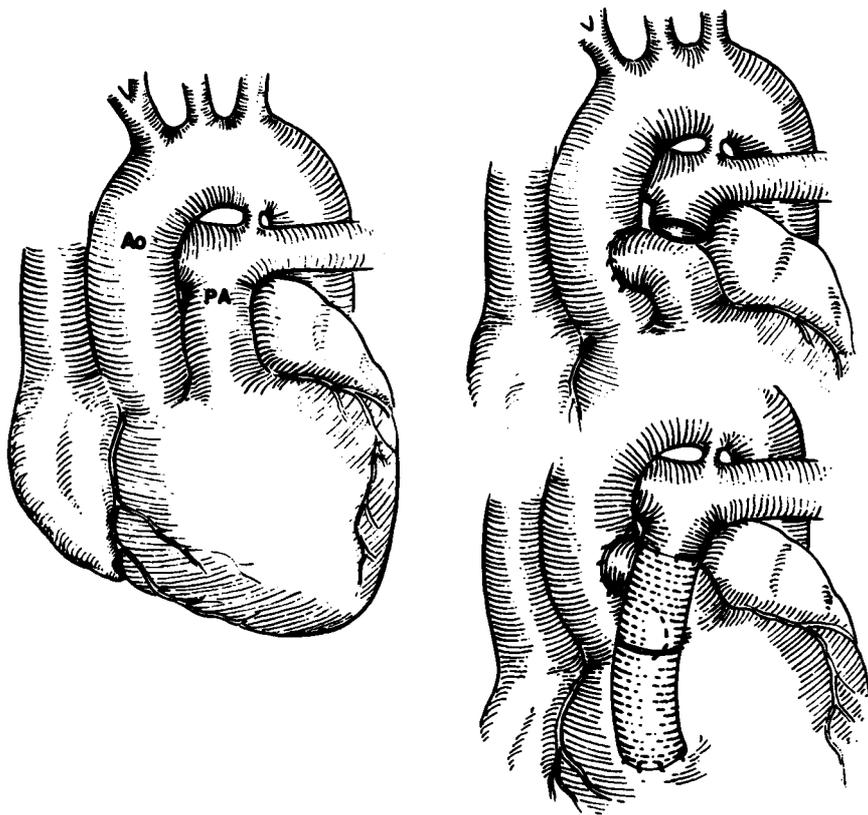
Because of these limitations, many individuals have pursued alternative methods of correction. Since the coronary arteries arise from the aorta, simple switching of the great vessels is extremely difficult and thus far has not been successful. The purpose of this communication is to describe a procedure for simple switching of the great vessels that produces complete physiological repair

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Accepted for publication Aug. 27, 1974.

of the transposition complex and should avoid many of the complications of the intraatrial baffle procedure described above.

In this procedure the main pulmonary artery is divided near its bifurcation with the proximal end anastomosed to the side of the ascending aorta. A simple ventriculotomy is then performed on the anterior surface of the right ventricle, and a prosthesis is sutured in place to allow the right ventricle to communicate with the distal pulmonary artery. These two steps achieve total physiological repair of the transposition complex, and associated atrial communications can then be simply closed (Figure). The aortic valve will stay permanently closed as long as right ventricular pressure is significantly lower than aortic pressure. With right ventricular systole the blood will take the path of least resistance out through the conduit to the lungs. The left ventricle will eject its oxygenated blood out the proximal pulmonary artery directly into the aorta, maintaining pressure in the aorta, which at all times will be higher than the pressure generated by the right ventricle. In turn, this will maintain permanent closure of the aortic valve and



New procedure for d-loop transposition of the great vessels. (Left) Anomaly before correction. (Right, top) Main pulmonary artery (PA) is divided near its bifurcation and the proximal end is anastomosed to the side of the ascending aorta (Ao). (Right, bottom) A simple ventriculotomy is performed on the anterior surface of the right ventricle, and the prosthesis sutured in place allows the right ventricle to communicate with the distal pulmonary artery.

provide oxygenated blood for coronary artery perfusion. Associated ventricular septal defects could readily be closed through the ventriculotomy prior to suturing of the conduit to the right ventricle.

Experimental procedures on postmortem specimens confirm that with suitable tailoring, anastomosis of the pulmonary artery to the aorta seems entirely feasible. Of course, the anastomosis was much easier to perform without apparent kinking on larger specimens than on infant hearts. In certain patients in whom elevated right ventricular pressures might be expected to persist, permanent closure of the aortic root may be easily accomplished by patching the subaortic valve region through the ventriculotomy. This step would not only prevent opening of the aortic valve but would ensure that aortic regurgitation does not become a problem.

This procedure achieves complete physiological repair of the *d*-loop transposition complex and restores the normal physiological function of the right and left ventricles as well as the tricuspid and mitral valves. Supraventricular arrhythmias, which are so common with the intraatrial baffle procedure, should be largely eliminated; complete right bundle-branch block, however, would probably occur related to the ventriculotomy. When this procedure is performed in an infant, it is likely that revision of the prosthesis will become necessary at some point when the child's growth exceeds the capacity of the conduit. This should be readily recognizable because as the right ventricular pressure begins to approach systemic pressures, opening of the aortic valve would be expected to occur, thus producing some early desaturation. Although this revision is undesirable, the same thing would probably happen to most patients who have undergone the intraatrial baffle procedure, especially if they were operated upon as infants. In those children in whom operation can be delayed until they reach 10 to 15 kg of weight, the distal main pulmonary artery might be of sufficient diameter that an adequate-sized prosthesis could be utilized; this would eliminate the necessity of future revisions.

The proposed procedure seems to offer an alternative to many of the problems associated with the intraatrial baffle procedure.

Reference

1. Balderman, S. C., Athanasuleas, C. L., and Anagnostopoulos, C. E. The atrial baffle operation for transposition of the great arteries. *Ann Thorac Surg* 17:114, 1974.

Editor's Note: The author's proposed procedure for correction of transposition is appealing in its simplicity and ingenuity. The problems with the Mustard procedure are overstated, however, and complications cited by Dr. Stansel are occurring less frequently as technical experience grows. The technique described is one of several that have been proposed to replace the Mustard procedure, and it deserves attention.