Case report

Modified approach to close multiple apical ventricular septal defects

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Abstract

The fish-mouth incision of the left ventricular apex is the established incision to access and close apical ventricular septum defect. A long diagonal branch may render this incision dangerous. In such a case, we performed a more anterior incision on the left ventricle, and fashioned a patch to exclude the whole defective area. © 1999 Elsevier Science B.V. All rights reserved.

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1. Introduction

An incision on the ventricle creates more significant morbidity than on the atrium, among which, ventricular arrhythmia and geometrical deformation have the most serious consequences. The surgical approach to congenital apical septum defects may, however, require an incision through the left ventricle [1–3]. The correct choice of incision and method of closure are crucial in order to reduce the mentioned risks, especially when a classical fish-mouth incision cannot be performed as described here.

2. Case report

A 3.2-kg baby was admitted 3 months after birth in our paediatric clinic because of a systolic murmur and signs of increasing congestive heart failure. Transthoracic echocardiography revealed the presence of multiple ventricular septum defects located at the heart apex and along the anterior half of the septum. The left ventricle appeared relatively small (both ventricles formed the cardiac apex). Due to the low birth weight and relatively underdeveloped left ventricle, temporary banding of the pulmonary artery was preferred to neonatal correction. Surgical correction was scheduled at the seventh month of live. At that time, the child had no signs of congestive heart failure and weighed 4.7 kg. The operation was performed during cardiopulmonary bypass and cardioplegic arrest of the heart. The band on the pulmonary artery was removed as well as the fibrotic tissue surrounding it. A right atriotomy was initially performed for dilatation of the banded pulmonary artery with Hegar dilators and for analysis of the ventricular septum. Due to the hypertrophy of the septum and ventricular bands, the defects were difficult to circumscribe, although communications between the ventricles could be demonstrated with forceps in the trabecular septum. The moderator band was not divided. The defects were approached through a left ventriculotomy. The epicardial coronary arteries did not, however, allow performance of a typical fish-mouth incision. A long, well developed diagonal branch was coursing parallel to a small left anterior descending artery down to the apex of the heart where both vessels seemed to converge. A small ventriculotomy was performed higher on the left ventricle, between and parallel to both vessels. Multiple defects were found along the junction of the septum and ventricular free wall and in the apical part of the septum. The insertion of the anterolateral papillary muscle was only a few millimetres away from the incision. Although the incision, which measured no longer than 15 mm, did not allow direct exposure of the whole defect area, the borders of the defective area could be reached, thanks to the tissue elasticity, by retracting the ventriculotomy edges. A thin Gore-Tex patch (Bard Medica S.A., Geneva, Switzerland) was used to cover the defective area. The patch was oversized and inserted lateral to the defect area in order to reduce the risk of residual flow along fine left ventricular trabeculae. At the level of the ventriculotomy, the patch was sutured on the epicardium. A second narrow patch of Gore-Tex was used to close the ventriculotomy to prevent distortion of the epicardial coronary arteries, displacement of the anteromedial papillary...
muscle against the septum, and reduction of the size of the already small left ventricle (Fig. 1). Aortic crossclamp time lasted 45 min. The heart resumed function rapidly, and weaning from cardiopulmonary bypass was possible without inotropic support. Direct measurements of oxygen saturation of hemoglobin in the right heart cavities did not reveal a step up in saturation. Operative transesophageal echocardiography confirmed the effective closure of the septal defects, and revealed a preserved left ventricular geometry without paradoxical motion of the patch, and a competent mitral valve. Similar results were found with a transthoracic echocardiography 6 months later. The child had a smooth recovery and was discharged after 10 days.

3. Comment

The surgical treatment of multiples muscular ventricular septum defects (the so-called Swiss cheese septum) has remained less than optimal, primarily due to difficulties in obtaining adequate exposure and hence complete closure of the defects [1–3]. In this respect, apical and anterior muscular defects are the most difficult to handle. The approach to apical septal defects is often not possible through a right atriotomy, even in neonates who have a non-hypertrophied septum and non-hypertrophied trabeculae, and more elastic tissues than older children [1,2]. Although some defects can still be obliterated with a devise through a right atriotomy, a left ventriculotomy is often necessary. In low birth-weight babies, when the apical septum is defective, we prefer to temporary band the pulmonary artery before undergoing definitive repair. In the other situations, we favour neonatal repair of the multiple ventricular septum defects. In the younger age group, the defect edges are easier to delineate than when significant hypertrophy of the right ventricle has developed [1,2]. An older age, more extensive division and resection of right ventricular trabeculations are necessary to correctly expose the defects and may adversely affect ventricular function after operation [2].

The relatively small size of the left ventricle in this case was a further argument to delay surgical correction. Indeed, it was felt that a left ventriculotomy, however small it might be, would result in reduction of the ventricular function. This element and the presence of an unusual pattern of coronary arteries imposed modification of the opening and closure of the left ventricle. Ventriculotomy could not be performed around the heart apex because of the convergence of a rather large and long diagonal artery to the distal left anterior descending artery. The incision was made more proximal between both arteries. Because of the proximity of the anterior papillary muscle (which often lies underneath the course of a large epicardial coronary branch), the incision was started as distally as possible and extended proximally under direct vision. An oversized Gore-Tex patch was used to cover the whole defective area as illustrated in Fig. 1. Closure of the ventriculotomy was also modified and performed with another narrow patch of Gore-Tex. The patch could be sutured on the ventriculotomy borders with very small bites using a 6/0 Prolene suture (Ethicon, Johnson and Johnson, Spreitenbach, Switzerland). This prevented distortion of local anatomy: the size of the left ventricle was not reduced, the course of the coronary arteries not disturbed and the anteromedial papillary muscle not displaced toward the septum. Because it was only aimed

Fig. 1. Closure of multiple apical septal defects using a modified left ventriculotomy. Note the course of a long diagonal branch, which precluded a fish mouth incision and the application of the Gore-Tex patch on the septum. Inlets show the incision between the coronary arteries, and the defective septum.
at preventing reduction of the space between both coronary arteries (that would have resulted with a direct closure), it was important that the patch be narrow. Too large a patch would have resulted in local paradoxical motions during heart cycles and reduced ventricular performance. Postoperative echocardiographic controls confirmed complete closure of the defects, absence of paradoxical motion of the patch, and preservation of the left ventricle geometry and mitral valve function. Longer follow-up regarding adequate growth of the left ventricle and electrophysiologic stability is, however, required before the approach can be considered safe.

References