Negative results - Congenital

Device migration in hybrid technique for apical muscular ventricular septal defects closure

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Abstract

Muscular ventricular septal defects still require complex surgical procedures for their repair. We have used a hybrid approach for closure of these ventricular septal defects in patients needing open-heart surgery. It consists of the deployment of a ventricular septal occluder, as used in transcatheter procedures inside the defect under direct vision after cardiopulmonary bypass establishment. Through this paper, we report a case to illustrate a new and simple technique to avoid one of the most dramatic complications after this procedure: the migration of the closure device.

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1. Background

Defects after birth of the ventricular septum (VSD) include a wide classification of anatomic variants. Many surgical techniques have been reported and widely used for their treatment. Today, transcatheter techniques and the new septal occluders may reduce the need of surgery. Nevertheless, multiple muscular VSD remains a challenge for both cardiologists and cardiac surgeons due to their difficult repair. Classical surgery, often needing a ventriculotomy, has been associated to a high risk of residual shunt, arrhythmias and ventricular dysfunction [1, 2]. In recent years, hybrid procedures have emerged as an alternative for those patients needing an open-heart procedure associated to the treatment of a muscular VSD [3]. These techniques have the advantage of avoiding a ventriculotomy, allowing these repairs from a right atriotomy or a closed peryventricular approach, significantly reducing the time of aortic cross-clamping and cardiopulmonary bypass (CPB) [4]. However, there is very little information in the literature about peri-operative complications and long-term results related to these procedures.

2. Case report

A newborn girl was diagnosed with multiple muscular ‘Swiss cheese’ VSD. A pulmonary artery banding was performed to control heart failure and allow physical development for eventual anatomic correction at an older age. One year after, all the small VSD were almost closed, except the largest one. It was decided to reoperate the patient for debanding, pulmonary artery patch enlargement and closure of the mentioned VSD. After midline sternotomy, CPB and cardioplegic arrest were established. A right atriotomy was performed and the main VSD, located in the apical septum was well identified through the tricuspid valve. Preoperatively, by echo, the diameter of the VSD was calculated to be 8 mm and, in consequence, a 10-mm Amplatzer septal occluder (ASO; AGA Medical Corporation, Golden Valley, MN, USA) was placed into, passed from the patent foramen oval and the mitral valve orifice. The device was successfully deployed, the banding was removed and the pulmonary artery was enlarged with a heterologous pericardial patch (CardioFix CarboMedics, Austin, TX, USA). The girl was uneventfully weaned from CPB after 80 min, with a cardioplegic arrest time of 52 min.

A peri-operative epicardial ultrasonography confirmed the adequate placing of the septal occluder and an absence of residual shunt (Fig. 1). The girl was extubated in the operating room and transferred to the intensive care unit for initial postoperative care. Two hours after surgery, a routine transthoracic echocardiography showed that the ASO was floating away among the trabeculae of the right ventricle (Fig. 2), though partially occluding the VSD. Emergency surgery was performed and the device was extracted without difficulties through the right atriotomy and tricuspid orifice, under CPB and cardioplegic arrest.
The main VSD was then re-explored and the orifice was estimated to be larger than suspected in the previous explorations and during the first intervention (over 10–12 mm). It was decided to implant a new ASO using the same approach, this time oversizing the diameter up to 14 mm. In addition, four polypropylene interrupted stitches were placed in the cardinal points along the right aspect of the device to reinforce the attachment to the surface of the interventricular septum. The patient was again successfully weaned from CPB and showed a good recovery. No evidence of detachment of the device was observed in the later ultrasonographies and the girl could be discharged home uneventfully.

3. Discussion

Septal occluders have shown to be fast and safe techniques for the repair of some muscular VSD [5]. Initial experience with hybrid surgery has encouraged cardiologists and cardiac surgeons to implement and study this approach, although prospective randomized trials are necessary to assess the real advantage of these techniques.

Hybrid techniques have been described as transcatheter procedures performed in the cathlab followed by conventional surgery or percutaneous implantation of septal occluders in the operating room [3]. Our concept is using septal occluders for the repair of muscular VSD in those patients needing open-heart surgery for associated defects. This approach takes benefit of both CPB and septal occluders to deliver the device under direct vision into the septal defect from the right atrium with no need of ventriculotomy. We also consider that this manoeuvre is technically easier than suturing a patch to the apical septum from the right atrium. Likewise, the ASO structure, consisting of a Nitinol wire mesh, provides a good substrate for the active anchorage with stitches to the septal wall, avoiding device migration.

Hybrid surgery carries complications associated to transcatheter procedures, in addition to those strictly related to surgery. The most important problems after percutaneous techniques are embolic stroke, cardiac perforation and device migration and embolization [6].

Hybrid techniques performed in the operating room also carry a risk of device migration. This case shows the critical importance of a correct measurement of both VSD and septal occluder diameters. Underestimation of the VSD led us to deploy a too small device that facilitated the posterior dislodgement. Suturing the device to the interventricular septum, as we did during the reoperation, is a simple and brief manoeuvre that should preclude occluder migration. Probably the detachment would have been avoided if the first ASO had been surgically fixed to the septum. We do advise this practice to all surgeons performing these procedures in the near future.

In spite of the fact that we are reporting a complication of this technique, this has been the only one reported in our case series (unpublished data). We think that, in these selected patients, our hybrid approach for muscular VSD closure is safer and more effective than classical surgery, new interventional techniques and hybrid closed procedures, although it needs to be further studied to definitively validate the technique [7].

References

