

New Surgical Approach to Device Closure of Multiple Apical Ventricular Septal Defects

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We present an alternative technique for closing multiple ventricular septal defects difficult to access during surgery. A guidewire is advanced through the right ventricular free wall and through the main apical defect to the left ventricle, and this approach is used to place an Amplatzer device to occlude the ventricular septal defects. The procedure is performed in the beating heart, under intraoperative transesophageal echocardiographic guidance, and without extracorporeal circulation. It appears to be a simple and reproducible procedure with excellent short-term results.

Key words: *Ventricular septal defect. Congenital heart disease.*

Cierre perventricular de la comunicación interventricular múltiple con dispositivo Amplatzer

Se presenta una técnica alternativa para el cierre de la comunicación interventricular de difícil acceso quirúrgico. Con el corazón latiendo y sin necesidad de circulación extracorpórea, se punciona el ventrículo derecho y se avanza una guía de alambre hasta el ventrículo izquierdo a través del defecto apical principal; esto permite colocar un dispositivo Amplatzer que ocluye completamente los defectos. El procedimiento se realiza con visión ecocardiográfica transesofágica, es simple y con excelentes resultados a corto plazo.

Palabras clave: *Comunicación interventricular. Defectos cardíacos congénitos.*

INTRODUCTION

Surgical treatment of multiple ventricular septal defects (VSDs) is complex, particularly with anterior and apical locations. Normally, several interventions are required, increasing the risk of adverse effects and death unrelated to the residual shunts. There is also a greater need for ventriculotomies and extensive sectioning to facilitate access. Percutaneous approach is also difficult, particularly in small children who have limited vascular access and may poorly tolerate the use of large devices. Percutaneous device placement under direct vision with extracorporeal circulation (ECC) and cardioplegia have not produced outstanding results.¹ Amin et al² reported perventricular closure with an Amplatzer device (AGA Medical Corporation, MN, United States of America) for VSD occlusion. The

technique was updated by Bacha et al³ with excellent results in the first consecutive series of patients studied. The self-expandable double-disk device is made from nitinol mesh with the disks joined by a 7 mm waist. The diameter of the disks determines the size of the Amplatzer device.

CASE STUDY

A 15-month-old girl weighing 8 kg with multiple VSDs (large posterior muscular VSD and apical "Swiss cheese" septal defects) had received a pulmonary artery (PA) band during the neonatal period. One year later, definitive corrective surgery was planned. The echocardiogram revealed a posterior muscular defect and three other apical defects measuring 3 mm to 6 mm. These apical defects were the only defect on the left side of the septum. The PA band was correctly positioned, with a gradient of 80 mm Hg. Moderate right ventricular (RV) hypertrophy was apparent.

Informed consent was obtained before implanting the Amplatzer device.

After medial sternotomy, the heart and great ves-

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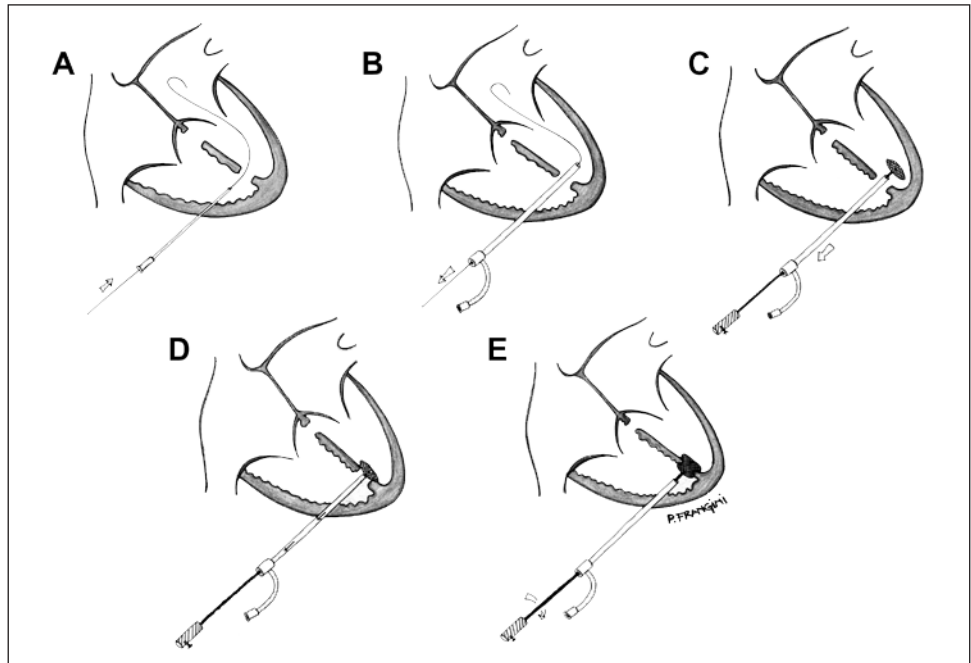


Figure 1. Schematic representation of periventricular closure of a ventricular septal defect with an Amplatzer device.

sels were exposed. Under transesophageal echocardiographic (TEE) guidance with the heart beating, the RV free wall was punctured with an 18 G needle, avoiding the papillary muscles. An ultraflexible guidewire was introduced into the left ventricle (LV) through the largest apical defect (Figure 1A). An 8 F sheaf was then introduced into the LV over the guidewire, which was subsequently retracted (Figure 1B). The size of the device had to be 1 to 2 mm larger than the main VSD, thus an 8 mm Amplatzer device was chosen. After immersion in unheparinized blood for 20 minutes to allow the pores in the nitinol mesh to become blocked, the device was screwed onto the release system (cable). A 7 F sheaf was introduced under watertight seal, and advanced over the introducer. The sheaf was then tensed to allow deployment of the left disk (Figure 1C). The whole system was then tensed (cable and sheaf) so that the disk lay against the septum (Figure 1D). Then the other sheaf was withdrawn and the right disk was deployed. Monitoring with TEE showed that there was no residual shunting and that the disks were correctly positioned (Figure 2). The cable was then unscrewed and the device released (Figure 1E). The RV puncture site was repaired and we proceeded to conventional closure of the posterior muscular VSD with a synthetic patch. Finally, with ECC and aortic clamps in place, the AP band was withdrawn.

The patient recovered with no evidence of ventricular dysfunction or arrhythmias. Chest x-ray showed that the device and the disks were correctly deployed

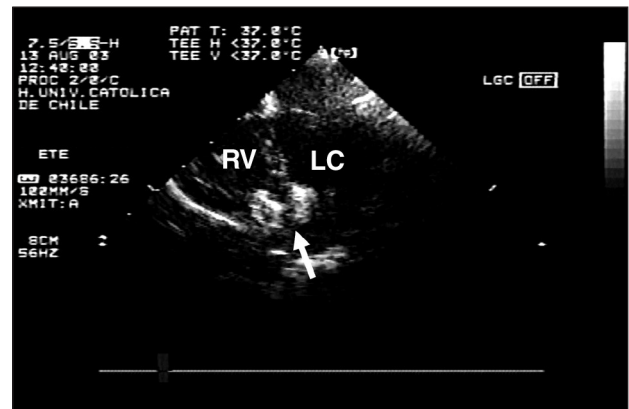


Figure 2. Four-chamber transesophageal echocardiogram showing that the device is appropriately positioned. Arrow indicates device attached to the release system; RV, right ventricle; LV, left ventricle.

(Figure 3) and the echocardiogram before discharge from hospital showed no residual shunt. The girl was discharged after 5 days and remains well after 6 months of follow-up.

DISCUSSION

Despite progress in surgery, repair of certain types of VSD remains a challenge, even in hospitals with extensive experience.^{4,5}

The technique we describe is reproducible and

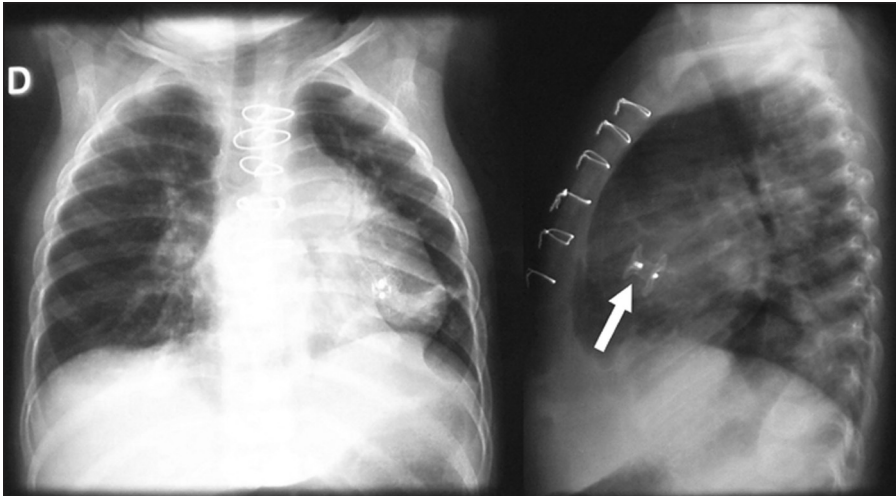


Figure 3. Postoperative chest x-ray. Arrow indicates device at apex of ventricular septum.

appears to be a promising alternative for patients with multiple VSDs, particularly with apical or anterior locations where access is difficult. It might also be an option in patients who have difficult vascular access but who are nevertheless candidates for percutaneous closure of VSD. Finally, it could be an interesting alternative for patients who require surgery for complex heart disease and who also have VSDs. This technique shortens ECC time and, more importantly, aortic clamping time, and so it represents an advance with respect to device placement techniques under direct vision. Despite the limited experience with this technique, the results are promising and it could become a treatment of choice.

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