Rescue atrial septal defect closure with the new GORE® cardioform atrial septal defect occluder

Alessandra Pizzuto, Magdalena Cuman, Massimiliano Cantinotti, Eliana Franchi, Giulia Corana, Cecilia Viacava, Nadia Assanta, Giuseppe Santoro

Department of Pediatric Cardiology and GUCH Unit, Heart Hospital "G. Pasquinucci", National Research Council Tuscany Region "G. Monasterio", Massa, Italy

ABSTRACT

Atrioventricular block (AVB) is an infrequent but life-threatening complication of transcatheter closure of atrial septal defect (ASD), accounting for 0.1%–6.2% of cases in large series. It has been related to unfavorable defect anatomy as well as size and intrinsic stiffness of the occluding device. In this setting, the new GORE® cardioform ASD occluder (GCA) device could be an appealing technical advance in ASD treatment. We report a case of complete AVB after ASD closure with an Amplatzer septal occluding (Abbott, Plymouth MN, USA) device successfully treated by its percutaneous retrieval and "rescue" deployment of GCA device few months later.

Keywords: Atrial septal defect, device, interventional cardiac catheterization

INTRODUCTION

Transcatheter closure is nowadays considered as the first-line therapeutic option of ostium secundum atrial septal defect (ASD).[1] To date, large defects can be treated only with self centering devices (Amplatzer septal occluder [ASO] or Amplatzer like devices), however these prosthesis have greater intrinsic stiffness, which is responsible for the vast majority of complications, such as arrhythmias, atrioventricular block (AVB), and cardiac erosion.[2-4] In particular, AVB following ASO® device (Abbott, Plymouth MN, USA) deployment has been reported in up to 6.2% of cases.[5,6] The new GORE® cardioform ASD occluder (GCA) device (WL Gore and Associates, Flagstaff, AZ, USA) has been claimed as a significant technical advance since it could close large defects at low mechanical stress on the surrounding structures.[7]

This paper reports a case of early complete AVB after ASD closure with ASO device, successfully treated by its percutaneous retrieval and "rescue" GCA device deployment some few months later.

Access this article online

Quick Response Code:

Website: www.annalspc.com

DOI: 10.4103/apc.apc_240_20

CASE REPORT

A 7-year-old, 27 kg child was electively admitted at our institution for percutaneous closure of large ASD. Twelve-lead electrocardiogram (EKG) showed sinus rhythm with normal AV conduction (PR interval 150 ms) and incomplete right bundle branch block (QRS duration 90 ms). Transthoracic echocardiogram (TTE) imaged a 14-mm large ASD, with adequate rims (anteroinferior 10 mm, retroaortic 5 mm, posterior 5 mm, and posteroinferior 7 mm) causing moderate left-to-right shunt and right chamber volume overload [Figure 1]. At cardiac catheterization, QP/QS was 2.1:1, with normal pulmonary arterial pressure and resistances. At dynamic sizing, the ASD-stretched diameter was 23.5 mm; however, as per our protocol, a slightly undersized device was selected. Thus, a 22-mm ASO device was successfully implanted (device/patient weight ratio 0.8). However, 24 h later, complete AVB with junctional escape rhythm was recorded [Figure 2a]. TTE confirmed the correct position of the device,

How to cite this article: Pizzuto A, Cuman M, Cantinotti M, Franchi E, Corana G, Viacava C, *et al*. Rescue atrial septal defect closure with the new GORE® cardioform atrial septal defect occluder. Ann Pediatr Card 2022;15:192-4.

Address for correspondence: Dr. Giuseppe Santoro, Via Camillo Sorgente, 31, 84125 – Salerno, Italy. E-mail: santoropino@tin.it

Submitted: 17-Oct-2020 **Accepted:** 19-May-2021 **Published:** 19-Aug-2022

without significant residual shunt, neither impact on the nearby structures nor pericardial effusion. Since the patient was asymptomatic and hemodynamically stable, a short trial of methylprednisolone (25 mg/day i.v.) was started, resulting in just a mild improvement of conduction (2nd-degree AVB with long periods of complete AV dissociation after 7 days of therapy). After counseling, the parents refused any surgical option. Thus, transcatheter removal of the device was planned, to attempt a further percutaneous procedure with the forthcoming marketed GCA device. The device was easily removed using a goose-neck catheter (ev3, Plymouth, Minnesota, USA) [Figure 2b], with sudden improvement of intracardiac conduction (1st-degree AVB with PR interval of 300 ms) that completely normalized in a few months. Then, the interventional procedure was rescheduled after a few months. At this second attempt, dynamic sizing confirmed the ASD diameter (23–24 mm), which was potentially treatable with either 37-mm or 44-mm large device based on the company's indications. However, the larger device was preferred due to perceived instability of the smaller one after several attempts of deployment [Figure 3]. After the final release, transient brief periods of advanced conduction delay were recorded and quickly replaced by stable sinus rhythm with 1st-degree AVB. Thus, she was discharged under oral methylprednisolone (16 mg/day) for a few weeks, with the device nicely positioned and without residual shunt [Figure 4]. At the 6-month follow-up evaluation, she remained asymptomatic without corticosteroid therapy, in sinus rhythm, and without conduction anomalies at EKG monitoring.

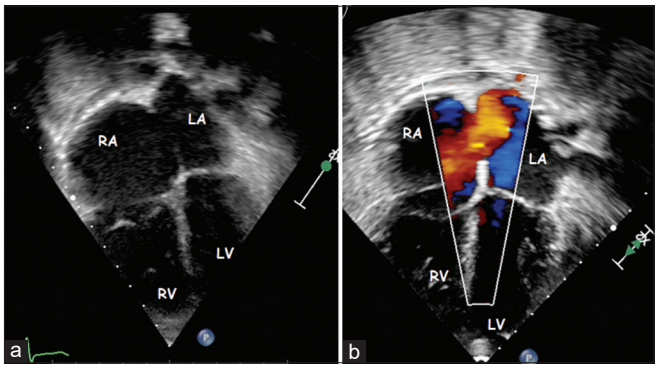

Figure 1: Transthoracic echocardiography in four-chamber view showing a large, hemodynamically significant ASD, with well represented rims (a), which causes a significant left-to-right shunt at color-Doppler analysis (b). LA: Left atrium, LV: Left ventricle, RA: Right atrium, RV: Right ventricle, ASD: Atrial septal defect

DISCUSSION

To date, AVB is a major adverse event of ASD closure with all marketed self-centering devices, accounting for 0.1%–6.2% of cases in large series.[2,4,6,8] The risk of this unpredictable complication seems to be higher in patients with deficient posteroinferior rims,[6] due to proximity between device and AV node that potentially causes local inflammatory response by mechanical pressure and/or friction.[5,9] AVB has also been related to size and intrinsic stiffness of the device, so advising, as a general rule, careful ASD sizing, and the use of undersized devices.[2]

The recently marketed GCA device, combining high softness and compliance, typical of nonself-centering devices, with the potential to close large defects thanks to an interdisc "adaptable" waist, could overcome this concern. These mechanical properties were crucial in our case, in which the local anatomy seemed favorable and the AVB was presumably due to intrinsic stiffness of the device possibly promoted by its size, resulting from a generous dynamic sizing. Despite this complication and the evolving trend[10] of percutaneous ASD closure only based on echocardiography, in our opinion, balloon sizing provides more accurate information about the real size of the defect and the dynamic sizing should be preferred to the static stop-flow technique since it more accurately details the texture of the defect rims, mainly in the case of floppy septum.

Finally, the relevance of the device stiffness as a cause of this complication could be further confirmed by the lack

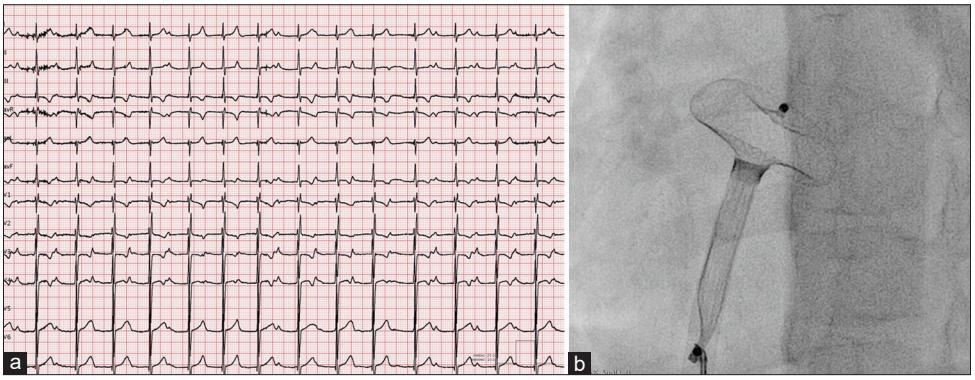

Figure 2: (a) Standard 12-lead electrocardiogram at 24 h from Amplatzer Septal Occluder device deployment showing complete atrioventricular block with junctional escape rhythm at 75 bpm. (b) The previously implanted 22 mm Amplatzer septal occluder device is snared and removed through a 12 Fr Mullins sheath

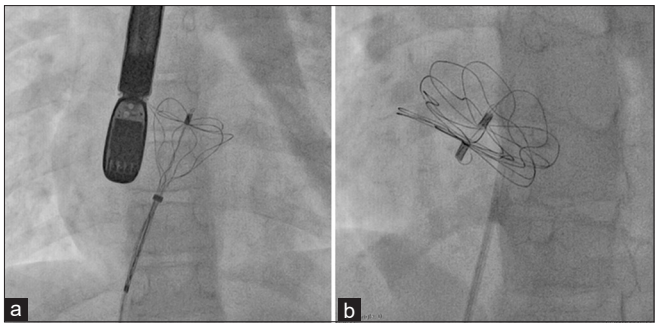

Figure 3: The second attempt of atrial septal defect closure using a 44 mm GORE® cardioform atrial septal defect occluder device is successfully performed. (a) Deployment of the left atrial disc and the soft central waist. (b) Final release of the device, well seated across the atrial septal defect

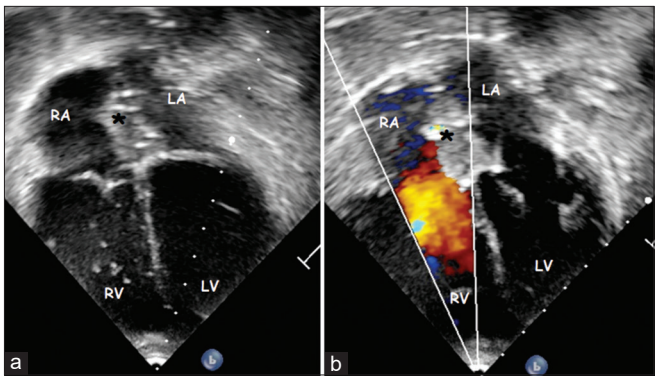

Figure 4: Transthoracic echocardiographic imaging of the GORE® cardioform ASD occluder device (asterisk) nicely located across the atrial septum (a) and completely abolishing the atrial shunt, as confirmed at color Doppler analysis (b). LA: Left atrium, LV: Left ventricle, RA: Right atrium, RV: Right ventricle, ASD: Atrial septal defect

of local impact on the conduction pathway of a similarly oversized GCA at the second procedure.

CONCLUSIONS

AVB is an infrequent but serious complication of ASD closure. In high-risk clinical/anatomic settings or as a rescue approach, the new GCA device could be a safer and innovative tool in alternative to the available technology.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Financial support and sponsorship

Nil.

Conflicts of interest

GS is Proctor Abbott, Italy, WL Gore, Italy, Occlutech, Italy.

REFERENCES

1. Baumgartner H, De Backer J, Babu-Narayan SV, Budts W, Chessa M, Diller GP, *et al.* 2020 ESC Guidelines for the Management of Adult Congenital Heart Disease The Task Force for the Management of Adult Congenital Heart Disease of the European Society of Cardiology (ESC); 2020. Eur Heart J 2021;42(6):563-645. [doi: 10.1093/eurheartj/ehaa554].
2. Moore J, Hegde S, El-Said H, Beekman R 3rd, Benson L, Bergersen L, *et al.* Transcatheter device closure of atrial septal defects: A safety review. JACC Cardiovasc Interv 2013;6:433-42.
3. Castaldi B, Santoro G, Di Salvo G, Gaio G, Palladino MT, D'Aiello F, *et al.* Impact of the Amplatzer atrial septal occluder device on left ventricular function in pediatric patients. Pediatr Cardiol 2013;34:1645-51.
4. O'Byrne ML, Gillespie MJ, Kennedy KF, Dori Y, Rome JJ, Glatz AC. The influence of deficient retro-aortic rim on technical success and early adverse events following device closure of secundum atrial septal defects: An Analysis of the IMPACT Registry®. Catheter Cardiovasc Interv 2017;89:102-11.
5. Wang Y, Hua Y, Li L, Wang X, Qiao L, Shi X, *et al.* Risk factors and prognosis of atrioventricular block after atrial septum defect closure using the Amplatzer device. Pediatr Cardiol 2014;35:550-5.
6. Al-Anani SJ, Weber H, Hijazi ZM. Atrioventricular block after transcatheter ASD closure using the Amplatzer septal occluder: Risk factors and recommendations. Catheter Cardiovasc Interv 2010;75:767-72.
7. Santoro G, Castaldi B, Cuman M, Di Candia A, Pizzuto A, Sirico D, *et al.* Trans-catheter atrial septal defect closure with the new GORE® Cardioform ASD occluder: First European experience. Int J Cardiol 2021;327:68-73.
8. Butera G, De Rosa G, Chessa M, Rosti L, Negura DG, Luciane P, *et al.* Transcatheter closure of atrial septal defect in young children: Results and follow-up. J Am Coll Cardiol 2003;42:241-5.
9. Suda K, Raboisson MJ, Piette E, Dahdah NS, Miró J. Reversible atrioventricular block associated with closure of atrial septal defects using the Amplatzer device. J Am Coll Cardiol 2004;43:1677-82.
10. Badano LP, Kolias TJ, Muraru D, Abraham TP, Aurigemma G, Edvardsen T, *et al.* Standardization of left atrial, right ventricular, and right atrial deformation imaging using two-dimensional speckle tracking echocardiography: A consensus document of the EACVI/ASE/Industry Task Force to standardize deformation imaging. Eur Heart J Cardiovasc Imaging 2018;19:591-600.