

## Percutaneous Closure of the Acquired Gerbode Shunt Using the Amplatzer Duct Occluder in a 3-Month Old Patient

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The Gerbode shunt, known as the left ventricle to the right atrial communication, is a rather rare finding, following surgical closure of septal defects. Even though the surgical closure is accepted as a treatment of choice, we report a successful percutaneous transcatheter closure of the Gerbode shunt in a 3-months old baby who weighed 3 kilograms. (**Korean Circ J 2013;43:429-431**)

**KEY WORDS:** Heart septal defect; Septal occluder device.

### Introduction

Gerbode et al.<sup>1)</sup> originally described the ventricular septal defect (VSD) regarding the communication between the left ventricle and right atrium in 1958. A few acquired cases have been reported, mostly due to endocarditis, trauma, myocardial infarct, and post cardiac surgery<sup>1)2)</sup> complications. Even though there are very few reports of a device closure of this defect,<sup>3)</sup> this is the first case of the device closure in an infant.

### Case

A 1-month old male with a large perimembranous VSD, secundum atrial septal defect (ASD), and patent ductus arteriosus (PDA), and diagnosed as having 18 trisomy by chromosome analysis underwent a patch closure of a VSD, a primary closure of an ASD, and a ligation of the PDA. The post-operative course was smooth and

the extubation was uneventful. One month later, he was presented with progressive dyspnea and tachypnea, and grade 3 of a holosystolic murmur was detected. His chest X-ray showed moderate cardiomegaly that had changed from before, and a large amount of shunt from the left ventricle to the right atrium with a dilated left ventricular dimension was identified by a two dimensional echocardiography (Fig. 1). The amount of shunt (Qp/Qs) was measured as above 2.0 by radioisotope cardiac scan. He required ventilator care due to congestive heart failure for 1 month and the medical treatment was not effective. When he turned 3 months old and his body weighed 3.0 kilograms, we decided to close the shunt using the transcatheter technique with an Amplatzer duct occluder because his parents did not want a correction by sternotomy. The longest dimension of the defect on a two-dimensional echocardiogram was 2.5 mm. After we examined the left ventriculogram on the four-chamber image (Fig. 2A), 5 Fr Judkins right catheter was approached to the left ventricle retrogradely. A 0.035 mm Terumo guide wire was introduced inside the Judkins right catheter and selected the Gerbode defect. After Terumo guide wire passed through the defect and was located in the superior vena cava, we snared it with a snaring catheter successfully. Thereafter, a 5 Fr introducing catheter for a 5-4 mm Amplatzer duct occluder was passed through the defect on the wire into the femoral vein and located in the ascending aorta, and the Amplatzer duct occluder was positioned successfully in the defect under the guidance of the transthoracic echocardiography (Fig. 2B). Even though a small residual leak was found immediately in transthoracic echocardiography, a complete closure was confirmed 2 weeks later. The cardiomegaly decreased and extubation was successful 2 weeks after the procedure (Fig. 3).

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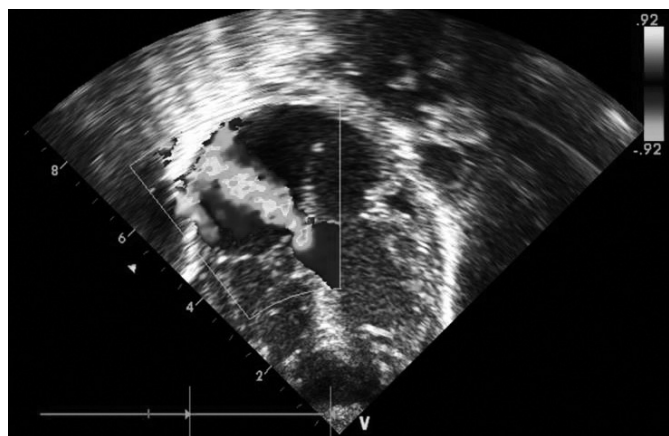
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We reported the closure of the Gerbode shunt in a 3-months old patient by a transcatheter technique using the Amplatzer duct occluder.

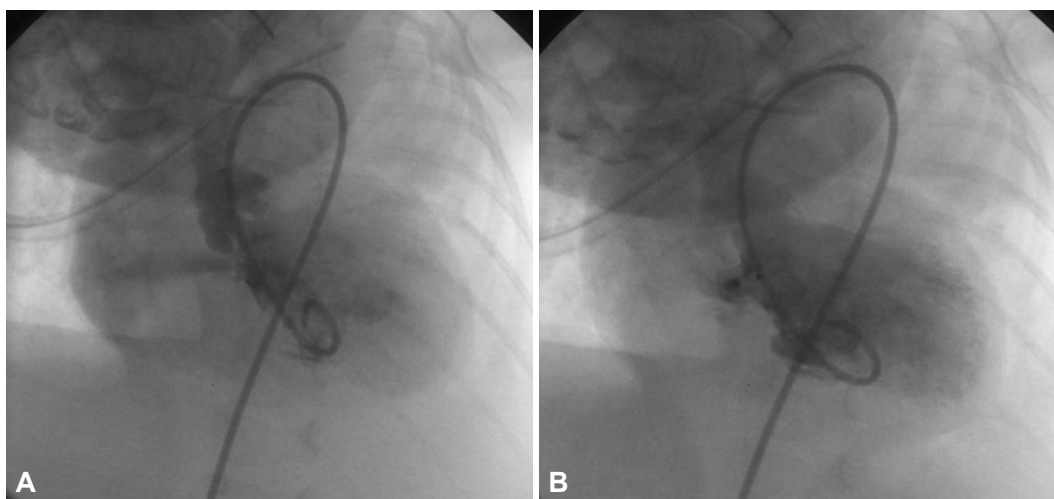


**Fig. 1.** A large amount of shunt from the left ventricular to the right atrium in transthoracic echocardiography.

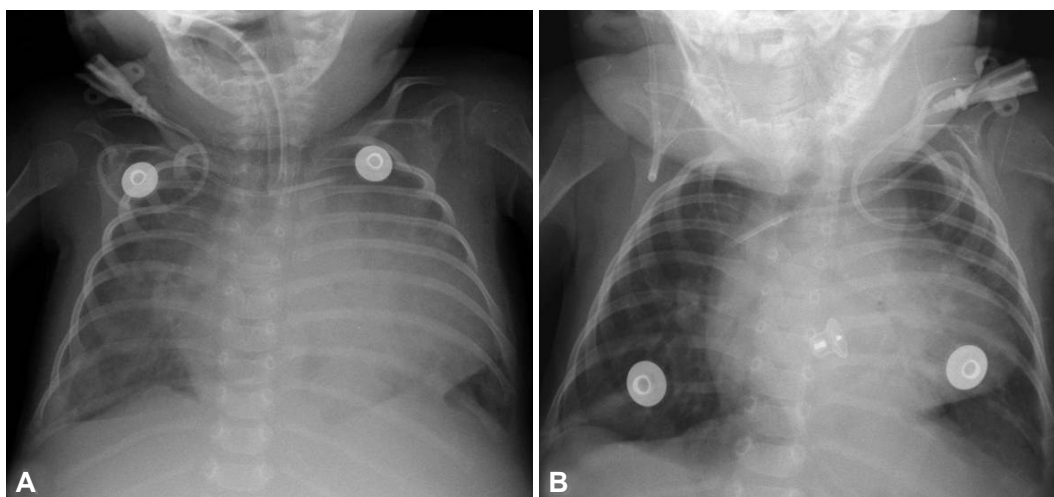
## Discussion

It was Gerbode et al.<sup>1)</sup> and his colleagues who collected together the first series of patients undergoing the surgical correction of the left ventricular-to-right atrial shunts. According to the previous reports, there are two routes for blood to travel from the left ventricle to the right atrium.<sup>4)</sup> The more common, indirect, type of communication occurs via a perimembranous VSD when there is an additional defect in the leaflets of the tricuspid valve. In this variant, the shunting is initially below the attachment of the leaflets of the tricuspid valve. In the second, the blood in the left ventricle flows directly to the right atrium, through a congenital defect in the atrioventricular component of the membranous septum, this communication being above the hinge of the leaflets of the tricuspid valve.

The acquired Gerbode shunt is rare and the surgical closure remains the mainstay. The indications of the intervention might be the same as those in the left to right shunt lesion. Our patient had Ed-



**Fig. 2.** The left ventriculography on the four-chamber view before (A) and after device closure (B) by using 5-4 mm Amplatzer duct occluder.



**Fig. 3.** The chest X-ray before (A) and after device closure (B).

ward syndrome, which was a big concern; as such, aggressive intervention was necessary. After the surgical corrections of VSD, ASD, and PDA, the Gerbode shunt was perceived as a rare surgical complication.<sup>25)</sup> Because of the prolonged need for ventilator support, we decided to close the Gerbode shunt of our patient. In our case, we expected that the device closure of the Gerbode shunt would be safe from a conduction block because the Gerbode shunt was induced by leakage of the VSD and previously sutured sites. Successful device closures in the Gerbode shunt have been reported in adults by using the Amplatzer septal occluder and Amplatzer muscular septal occluder.<sup>23)</sup> However, we used the Amplatzer duct occluder, because the Amplatzer septal occluder has a long retention disc in both sides and the Amplatzer muscular septal occluder could not be available. Being experienced with a perimembranous VSD closure with Amplatzer duct occluder, we were assured that it would be safe and effective. Moreover, the Amplatzer duct occluder needed a smaller sheath and introducing catheter than other Amplatzer devices that is more advantageous for a small baby.<sup>6)</sup> The technique for this procedure was the same as that in the device closure of the perimembranous VSD. In general, we chose a device that was twice the size of the defect in the VSD closure. In our previous experience with the device closure of perimembranous VSD, we chose a device size that was twice than that of the narrowest diameter of the defect. We applied our experience to this case even though the device looked large for a small heart. The transesophageal echocardiography during the procedure showed no troubles to the adjacent structures.

After the successful implantation, no complications were found and successful extubation was possible. Hemolysis has been described in patients after the device closure of VSD and PDA.<sup>57)</sup> As th-

rombus formation is an important complication as well, we started providing aspirin. Even though arrhythmia should be taken care of after the implantation, there was no arrhythmia.

In conclusion, percutaneous device closure offers an alternative to surgical closure in patients with Gerbode defects even in a small child. The Amplatzer duct occluder can be considered just as safe and effective as other types of Amplatzer occluders.

## References

1. Gerbode F, Hultgren H, Melrose D, Osborn J. Syndrome of left ventricular-right atrial shunt; successful surgical repair of defect in five cases, with observation of bradycardia on closure. *Ann Surg* 1958;148:433-46.
2. Newman JN Jr, Rozanski L, Kreulen T. Acquired left ventricular to right atrial intracardiac shunt after myocardial infarction: a case report and review of the literature. *J Am Soc Echocardiogr* 1996;9:716-20.
3. Rothman A, Galindo A, Channick R, Blanchard D. Amplatzer device closure of a tortuous Gerbode (left ventricle-to-right atrium) defect complicated by transient hemolysis in an octogenarian. *J Invasive Cardiol* 2008;20:E273-6.
4. Kelle AM, Young L, Kaushal S, Duffy CE, Anderson RH, Backer CL. The Gerbode defect: the significance of a left ventricular to right atrial shunt. *Cardiol Young* 2009;19 Suppl 2:96-9.
5. Spence MS, Thomson JD, Weber N, Qureshi SA. Transient renal failure due to hemolysis following transcatheter closure of a muscular VSD using an Amplatzer muscular VSD occluder. *Catheter Cardiovasc Interv* 2006;67:663-7.
6. Choi DY, Kim NY, Jung MJ, Kim SH. The results of transcatheter occlusion of patent ductus arteriosus: success rate and complications over 12 years in a single center. *Korean Circ J* 2010;40:230-4.
7. Trehan V, Ramakrishnan S, Goyal NK. Successful device closure of an acquired Gerbode defect. *Catheter Cardiovasc Interv* 2006;68:942-5.