

Transventricular ventricular septal defect closure with device as hybrid procedure in complex congenital cardiac surgery



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Read at the 104th Annual Meeting of The American Association for Thoracic Surgery, Toronto, Ontario, Canada, April 27-30, 2024.

Data Availability Statement: All relevant data are available in the article. The raw data underlying this article will be shared on reasonable request to the corresponding author.

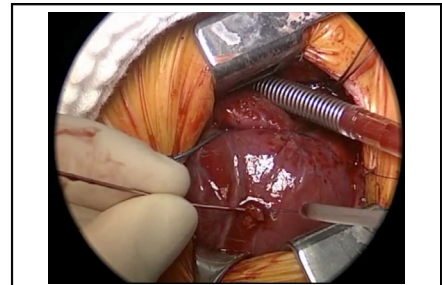
Received for publication April 26, 2024; accepted for publication May 6, 2024; available ahead of print June 12, 2024.

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JTCVS Techniques 2024;26:79-81
2666-2507

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<https://doi.org/10.1016/j.xjtc.2024.05.026>



Puncture of the right ventricle and advancement of a wire through the VSD.

CENTRAL MESSAGE

Concomitant transventricular VSD closure with a device as a hybrid procedure in patients with complex congenital heart defects is a good option in infants and can lead to earlier complete repair.

Video clip is available online.

To view the AATS Annual Meeting Webcast, see the URL next to the webcast thumbnail.

In patients with congenital heart defects, the aim is to repair the defect completely at a young age.¹ However, some defects, like multiple ventricular septal defects (VSDs) or muscular VSD are not always accessible in neonates and young infants. Aiming to repair complex heart defects at a young age, we closed muscular VSD at the time of repair of the heart defect with a device in a hybrid fashion.

PATIENTS AND METHODS

Between 2013 and 2023, we adapted this method in 7 patients. Patients' characteristics are depicted in Table 1. Six patients were neonates, 2 had had a previous operation, including a banding of the pulmonary artery. The ethics committee of the Technical University Munich approved the study protocol and publication of data (approval

No. 2024-204-S-KK; May 15, 2024). Patient written consent for the publication of the study data was waived due to the retrospective nature of the study.

Surgical approach was a midline sternotomy. First, the VSD was closed with a device. After administrating heparin, a purse string suture was placed on the free wall of the right ventricle, keeping enough distance from the coronary arteries. Under transesophageal guidance, the right ventricle was punctured and a wire advanced slowly through the VSD into the left ventricle. Once in place, a sheath was pushed over the wire and positioned into the left ventricle. Finally, the occluder was advanced and positioned over the VSD. After checking for correct positioning, the occluder was released (Video 1). The repair of the heart defect was then accomplished in a usual manner. All patients had an uneventful postoperative course and could be discharged from hospital with the device in place (Figure 1). Depending on the underlying heart defect, 1 patient required a repair of an atrioventricular septal defect and 1 patient required a Ross-Konno operation during follow-up.

TABLE 1. Patient characteristics

Patient	Diagnosis	Surgery performed	Age (d)	Weight (g)	Occluder type	Occluder size
1	Hypop. LV, AS, HAA, VSD, ASD, PDA	VSD closure, partial ASD closure, bilateral banding of PAs	7	3300	Konar MFO	6/4
2	Mult. VSD, s.p. PAB, Coa repair	pVSD closure, mVSD closure, Debanding	125	6735	Konar MFO	5/3
3	TGA, mult. VSD, PDA	ASO, VSD closure	13	2620	Amplatzer Duct Occluder II	6/4
4	CAT, mVSD	CAT repair, VSD closure	33	3035	Amplatzer Duct Occluder II	3/4
5	Coa and VSD, s.p. coa repair and PAB	VSD closure, Debanding	18	3120	Amplatzer muscular VSD Occluder	6/7
6	CAVSD, mVSD	VSD Closure, PAB	30	3020	Amplatzer Duct Occluder II	6/4
7	HAA, Coa, VSD, PDA	VSD closure, Aortic arch repair	8	3100	Konar MFO	6/4

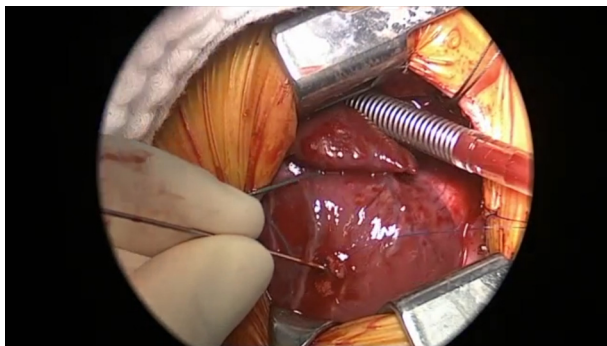
Hypop., Hypoplastic; *LV*, left ventricle; *AS*, aortic stenosis; *HAA*, hypoplastic aortic arch; *VSD*, ventricular septal defect; *ASD*, atrial septal defect; *PDA*, patent ductus arteriosus; *PAs*, pulmonary arteries; *mult.*, multiple; *s.p.*, status post; *PAB*, pulmonary artery banding; *Coa*, coarctation of the aorta; *pVSD*, perimembranous VSD; *mVSD*, muscular VSD; *TGA*, transposition of the great arteries; *ASO*, arterial switch operation; *CAT*, common arterial trunk; *CAVSD*, common atrioventricular septal defect.

DISCUSSION

We report on 7 patients in whom we closed a VSD trans-ventricularly with a device and repaired the complex congenital heart defect concomitantly. This method aimed at repairing the heart defect in small infants in whom the VSD was not accessible for surgical closure due to their young age. Transventricular VSD closure has been described previously as an alternative to standard surgical closure with good results.^{2,3} Especially in neonates with additional muscular VSD who need repair of a complex heart defect, a hybrid VSD closure is a good option.

Webcast 

You can watch a Webcast of this AATS meeting presentation by going to: <https://www.aats.org/resources/transventricular-closure-of-a-7372>.



VIDEO 1. Transventricular ventricular septal defect closure under trans-esophageal echocardiography guidance. Video available at: [https://www.jtcvs.org/article/S2666-2507\(24\)00249-9/fulltext](https://www.jtcvs.org/article/S2666-2507(24)00249-9/fulltext).

Conflict of Interest Statement

The authors reported no conflicts of interest.

The *Journal* policy requires editors and reviewers to disclose conflicts of interest and to decline handling or reviewing manuscripts for which they may have a conflict of interest. The editors and reviewers of this article have no conflicts of interest.



FIGURE 1. Angiography showing the ventricular septal defect occlude (Konar MFO 6/4) 6 months after placement and concomitant aortic arch repair.

References

1. Eriksen G, Liestøl K, Seem E, et al. Achievements in congenital heart defect surgery: a prospective, 40-year study of 7038 patients. *Circulation*. 2015;131(4):337-346.
2. Haponiuk I, Chojnicki M, Jaworski R, et al. Hybrid approach for closure of muscular ventricular septal defects. *Med Sci Monit*. 2013;19:618-624.
3. Chen Q, Cao H, Zhang GC, Chen LW, Li QZ, Qiu ZH. Closure of perimembranous ventricular septal defects with intraoperative device technique: another safe alternative to surgical repair. *Thorac Cardiovasc Surg*. 2013;61(4):293-299.