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CLINICAL CASE

# Transcatheter ventricular septal defect closure with two devices for the residual shunt in a child with repaired tetralogy of Fallot. Case report

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**Summary**

Tetralogy of Fallot (TOF) is most common cyanotic congenital heart disease (CHD), representing up to 7% of all CHDs. The prevalence of ventricular septal defect (VSD) patch leakage after the surgical repair of TOF is reported to be around 9%. VSD patch leakage after TOF repair, depending on the size and remaining pulmonary stenosis can lead to several complications as like native VSD. Thranscatheter closure of a such defects always challenging.

**Key words:** VSD, patch leakage, TOF

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КЛИНИЧЕСКИЙ СЛУЧАЙ

# Транскатетерное закрытие дефекта межжелудочковой перегородки двумя устройствами для остаточного шунта у ребенка с восстановленной тетрадой Фалло

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Conflict of interests
The authors declare that there is no conflict of interest

**Резюме**

Тетрада Фалло (ТФ) является наиболее распространенным цианотичным врожденным пороком сердца (ВПС), составляющим до 7% всех ВПС. Распространенность утечки заплаты из дефекта межжелудочковой перегородки (ДМЖП) после хирургического восстановления TOF, как сообщается, составляет около 9%. Утечка заплаты из ДМЖП после восстановления TOF, в зависимости от размера и остаточного стеноза легочной артерии, может привести к нескольким осложнениям, как и при нативном ДМЖП. Транскатетерное закрытие таких дефектов всегда является сложной задачей.

**Ключевые слова:** ДМЖП, утечка заплаты, TOF

**Для цитирования:** Юсубов Алишер, Умаров Бахтиёржон, Салахитдинов Шухратжон, Сабиров Джахонгир, Эргашев Аббос, Максумов Отажон, Ко Хун. Транскатетерное закрытие дефекта межжелудочковой перегородки двумя устройствами для остаточного шунта у ребенка с восстановленной тетрадой Фалло. Архив педиатрии и детской хирургии. 2024; 2(4):43–45. doi: 10.31146/2949-4664-apps-2-4-43-45

A 6-year-old girl presented to our cardiology clinic with complaints of easy fatigability and shortness of breath on exertion. She had a history of TOF repair and underwent five operations: 1) at 3 years of age left modified Blalock-Taussig (mBT) shunt placed; 2) at 4 years of age, due to previous mBT shunt thrombosed, right mBT shunt placed; 3) at 4 years of age TOF radical correction was performed. The rest is stated below. During examination, transthoracic echocardiography showed ventricular septal defect (VSD) patch leak measuring 5 mm in diameter, with left-to-right shunt. The peak velocity across the VSD was 3.7 m/s and dilatation of left heart. No significant right ventricular outflow tract obstruction was noted. After discussing treatment options with the family, transcatheter closure of the VSD patch leakage was planned. Under general anesthesia, right and left heart catheterization was performed. Angiography confirmed a VSD patch leakage, measuring 4.9 mm. The Qp/Qs ratio was calculated to be 1.6:1. An 8x6 mm Lifetech Konar-MF Occluder (Lifetech) was selected for closure. The device was deployed across the VSD under fluoroscopic and transesophageal echocardiographic (TEE) guidance. Post-deployment angiography showed good device position but a mild residual 3mm shunt persisting through a separate small defect adjacent to the device (*fig. 1*). Due to the absence of tissue inside of this device, residual shunt accepted, decided to follow.

The patient was extubated in the catheterization laboratory and transferred to the ward for monitoring. Transthoracic echocardiography on the following day confirmed residual shunt at the same size. The patient was discharged home after 3 days. At 1-month and 6-month follow-up visits, residual shunt persisted and left heart dilatation was preserved. After 6 months, patient underwent again VSD device closure. On left ventriculography residual shunt confirmed, size was 3.8mm. Same technique and device 7x5mm was used for closure of the defect (*fig. 2*).

Echocardiography showed both devices in good position with no residual shunt. On following day devices position were good with no leakage. Electrocardiography revealed no new onset abnormalities.

**Figure 1.**
Transcatheter closure of VSD leakage in a TOF repaired patient.

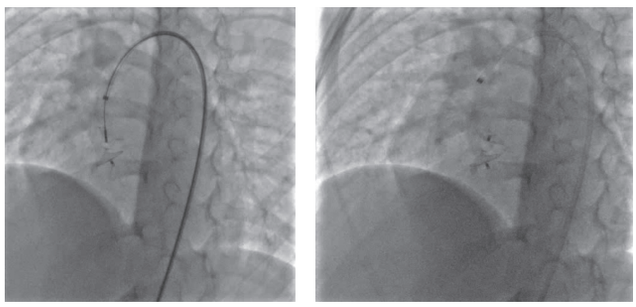
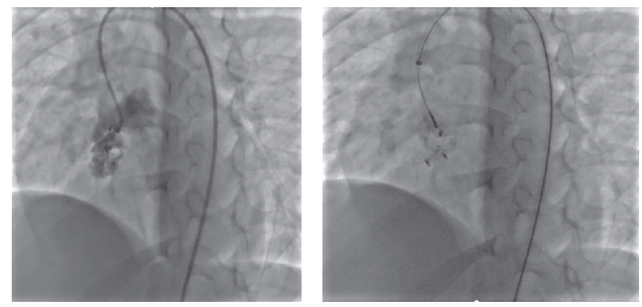


**Figure 2.**
Residual shunt after transcatheter device closure in patient with VSD patch leakage after TOF repair and second device implantation.



## Discussion

Percutaneous device closure VSD is well-documented in the literature and has now become a standard practice. Most residual VSDs related to the surgical patch are located near the posteroinferior and superior margins of the patch, where sutures are susceptible to tearing[6].

Reoperation for residual VSDs may lead to unfavorable outcomes, especially following intricate congenital heart surgeries, such as those involving the baffling of the VSD to the aorta in cases of complex right ventricular outflow tract (RVOT) obstruction. For this reason, surgical intervention for residual VSD should be limited to patients for whom catheterization attempts have been unsuccessful or whose remaining defects are substantial enough that they cannot be addressed through cardiac catheterization[7].

## Conclusion

This case highlights the feasibility and efficacy of using multiple transcatheter devices to achieve complete closure of complex residual VSDs following TOF repair. This approach avoided the need for repeat sternotomy and cardiopulmonary bypass,

which would have been associated with higher morbidity. In conclusion, transcatheter closure using multiple devices can be a safe and effective option for managing residual VSDs in patients with repaired TOF. Careful patient selection, appropriate device choice, and meticulous procedural technique are crucial for achieving optimal outcomes in these complex cases.

## References | Литература


1. Perry L.W., Neill C.A., Ferencz C., EUROCAT Working Party on. Congenital Heart Disease: Perspective in Pediatric Cardiology. Epidemiology of congenital heart disease, the Baltimore-Washington Infant Study 1981–89 Armonk, NY: Futura; 1993:33–62.
2. Oechslin E.N., Harrison D.A., Harris L., Downar E., Webb G.D., Siu S.S., Williams W.G. Reoperation in adults with repair of tetralogy of fallot: indications and outcomes. *J Thorac Cardiovasc Surg*. 1999 Aug;118(2):245–51. doi: 10.1016/S0022–5223(99)70214-X.
3. Penny D.J., Vick G.W. 3rd. Ventricular septal defect. *Lancet*. 2011;377(9771):1103–1112.
4. Hoffman J.I., Kaplan S. The incidence of congenital heart disease. *J Am Coll Cardiol*. 2002;39(12):1890–1900. doi: 10.1016/s0735–1097(02)01886–7.
5. Butera G., Carminati M., Chessa M. et al. Transcatheter closure of perimembranous ventricular septal defects: early and long-term results. *J Am Coll Cardiol*. 2007 Sep 18;50(12):1189–95. doi: 10.1016/j.jacc.2007.03.068.
6. Knauth A.L., Lock J.E., Perry S.B. et al. Transcatheter device closure of congenital and postoperative residual ventricular septal defects. *Circulation*. 2004 Aug 3;110(5):501–7. doi: 10.1161/01.CIR.0000137116.12176.A6.
7. Zhou W., Li F., Fu L., Gao W., Guo Y., Liu T., Huang M., Zhang Y. Clinical Experience of Transcatheter Closure for Residual Ventricular Septal Defect in Pediatric Patients. *Congenit Heart Dis*. 2016 Jul;11(4):323–31. doi: 10.1111/chd.12357.
8. Arora R., Trehan V., Kumar A., Kalra G.S., Nigam M. Transcatheter closure of congenital ventricular septal defects: experience with various devices. *J Interv Cardiol*. 2003 Feb;16(1):83–91. doi: 10.1046/j.1540–8183.2003.08006.x.
9. Chessa M., Butera G., Negura D. et al. Transcatheter closure of congenital ventricular septal defects in adult: mid-term results and complications. *Int J Cardiol*. 2009 Mar 20;133(1):70–3. doi: 10.1016/j.ijcard.2007.11.098.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