Case Report

Newly Designed Custom-Made Occluder for Transcatheter Closure of Postinfarction Ventricular Septal Rupture: A Cutting-Edge Technology

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ABSTRACT

Postinfarction ventricular septal rupture remains a lethal complication of acute myocardial infarction. Percutaneous closure is feasible and may provide an alternative treatment option to surgical repair, particularly in the nonacute phase. Transcatheter closure of postinfarction ventricular septal rupture using innovative custom-made devices may be a promising alternative to high-risk surgery.

RÉSUMÉ

La rupture du septum interventriculaire est une complication mortelle de l'infarctus du myocarde aigu. Il est possible de fermer la rupture par voie percutanée, ce qui constitue une option de rechange intéressante à la réparation par voie chirurgicale, particulièrement lorsque le patient n'est pas en phase aiguë. La fermeture transcathéter d'une rupture du septum interventriculaire secondaire à un infarctus à l'aide de dispositifs novateurs fabriqués sur mesure pourrait être une solution prometteuse pour remplacer une intervention chirurgicale risquée.

We present the case of an 81-year-old woman who underwent percutaneous closure of postinfarction ventricular septal rupture (PIVSR) 3 weeks after the index event with a newly designed custom-made occluder.

Case Description

This female diabetic patient presented at emergency department 36 hours after anterior ST-elevation myocardial infarction. Transthoracic echocardiography (TTE) revealed left ventricle (LV) anterior wall hypokinesia with dyskinetic apical segment, ejection fraction of 40% with angiographically normal coronary arteries. Rapid deterioration of the clinical condition occurred few days later. 2D color Doppler TTE showed normal right ventricle (RV) function and dimensions, moderate tricuspid regurgitation, systolic pulmonary pressure of 55 mm Hg, and a 12-mm ventricular septal rupture (VSR) located at the apical segment with significant left-to-right shunt (Fig. 1, A and B). Magnetic resonance imaging with gadolinium contrast showed

an apical myocardial dyskinesia without late enhancement excluding necrosis. On day 23, after heart team discussion, we decided to perform transcatheter closure of the rupture with a newly designed custom-made occluder (post infarction ventricular septal defect [PIVSD]; Occlutech Holding AG Company, Schaffhausen, Switzerland) (Supplemental Table S1; Supplemental Figs. S1 and S2). The waist size of the occluder was 8 mm larger than the VSR size. The device consists of 2 self-expanding discs (left 32 mm, right 30 mm) composed of a nitinol-wire mesh with “shape-memory” properties joined together by a flexible elliptical waist 10 mm in length and 20 mm in diameter. The procedure was performed under fluoro-angiography and TTE guidance. The PIVSR was crossed from LV to RV using a retrograde arterial approach (left femoral artery) with a 5F multipurpose catheter and a Terumo wire that was advanced into the superior vena cava, where it was snared via the right jugular vein establishing an arteriovenous rail. The occluder was placed at the appropriate site across the rupture and then released. Successful implantation was confirmed by TTE and LV angiography (Fig. 2). The following day, the clinical conditions improved significantly. 2D color Doppler TTE showed trace of left-to-right shunt (Fig. 1, C and D), whereas systolic pulmonary pressure dropped to 31 mm Hg. The pulmonary/systemic shunt ratio was 1.1/1 with no RV overload. On day 36, the patient was discharged home without complications. Six months later, she remained symptom free and TTE showed the correct position of the device with no residual shunt.

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Ethics Statement: This reported research has adhered to the relevant ethical guidelines.

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Figure 1. Intraprocedural transthoracic color Doppler echocardiography (TTE). (A, B) Apical 4-chamber views show a 12-mm (bracket) ventricular septal defect located at the apical segment with left-to-right shunt (yellow arrow). (C, D) TTE color Doppler 4-chamber views 24 hours after the procedure showing the device (arrowhead) in stable position with only trace left-to-right shunt (white arrow). LA, left atrium; LV, left ventricle; RV, right ventricle.

Discussion

Transcatheter closure of PIVSR has been reported with different devices, some of them not designed for this purpose with mixed results.¹⁻⁵ The Amplatzer PI Muscular VSD Occluder, specifically designed for post-myocardial infarction VSR repair, showed implantation success and short-term results superior to the formerly used devices.

The Occlutech PIVSD is a newly designed custom-made device with several innovative features compared with previously technologies. They include unique braiding technology, no distal hub, soft atraumatic self-expanding discs, a welded ball structure on the proximal disc that serves as an adapter for the Flex pusher allowing device self-alignment, and a 10-mm compliant, elliptical connecting waist with no radial strength to prevent tearing of the defect borders, resulting in a smooth conformability to the septal rupture contours. The shape of the waist has been conceived with the aim of transforming the circular configuration into an ellipsoidal one for safe self-expansion into the rupture and for better adaptation to the irregularly serpiginous rupture track.

Conclusions

The reported successful case is the result of good clinical preprocedural management, an innovative device, and excellent teamwork.

Novel Teaching Points

- Occlutech post infarction ventricular septal defect occluder is a newly designed custom-made device with several innovative features compared with previous technologies.
- It may represent a cutting-edge technology to be added to the device armamentarium for postinfarction ventricular septal rupture treatment when haemodynamic condition and rupture morphology are suitable to device closure.

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Disclosures

EMO is a consultant for Occlutech, manufacturer of the device. The rest of the authors have no conflicts of interest to disclose.

Figure 2. Fluoro-angiography images showing the transcatheter closure procedure “step by step.” Baseline left ventricle angiogram demonstrating a significant left-to-right shunt (**white arrow**) through a ventricular septal rupture of the apical segment (**A**). The delivery sheath (**arrowhead**) was advanced from the right jugular vein across the rupture, and the distal disc (**black arrow**) was opened in the left ventricle (**B**). Left ventriculography confirming the correct distal disc position toward the septum (**C**). Connecting waist and proximal disc (**black arrow**) were opened by retrieving the delivery sheath (**D**). Postprocedure left ventriculography showing the post infarction ventricular septal defect device (**white arrow**) still attached to the delivery cable (**E**) and after final release (**F**).

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Supplementary Material

To access the supplementary material accompanying this article, visit *CJC Open* at <https://www.cjopen.ca/> and at <https://doi.org/10.1016/j.cjco.2020.05.007>.