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## Clinical case of the postinfarction ventricular septum defect successful closure with occluder at the 4th day of the disease

The search of effective treatment of myocardial infarction complications remains a relevant issue. Despite the constant improvement of techniques and methods of surgical interventions and the improvement of medical treatment protocols, the mortality due to the postinfarction rupture of the interventricular septum remains quite high. The article presents a clinical case of successful endovascular closure of a postinfarction ventricular septum defect with an occluder with its subsequent surgical closure. The optimal timing of the intervention, the choice of the type of intervention, the optimal medical and hemodynamic support at the stage of preparing the patient for the correction of this complication and in the early postoperative period are described. Our experience shows that the timely use of endovascular techniques to close the defect allows you to create a bridge for open surgery and provide an effective treatment.

**Key words:** myocardial infarction, postinfarction ventricular septum defect, occluder, surgery.

**To cite this article:** Todurov BM, Rotar MF, Khokhlov AB, Boiko KS, Hutsuliak YuV. Clinical case of the postinfarction ventricular septum defect successful closure with occluder at the 4th day of the disease. *Cardiac Surgery and Interventional Cardiology*. 2021;3(34):44-48 (in Eng.)

**Посилання:** Тодуров Б.М., Ротарь М.Ф., Хохлов А.В., Бойко К.С., Гуцуляк Ю.В. Клінічний випадок успішного закриття післяінфарктного дефекту міжшлуночкової перегородки оклюдером на четверту добу захворювання // Кардіохірургія та інтервенційна кардіологія. – 2021. – № 3. – С. 44–48.

**P**ostinfarction ventricular septum defect (PVSD) is one of the most severe complications of myocardial infarction (MI), caused by rupture of the interventricular septum, with left-to-right shunt formation in the middle of the heart [1]. According to many authors, PVSDs occur in 1–3 % of patients after acute MI [1–3]. After introduction of the reperfusion therapy, the frequency of myocardial rupture of the interventricular septum decreased by 5–6 times and amounted 0.5 % of all cases of acute transmural MI [4–7] against 1–3 % without reperfusion treatment strategy. The term of this complication has also changed: from 3–5 days – without any reperfusion therapy, to the first day – in the case of primary endovascular intervention or thrombolytic therapy [8, 9]. In most cases (70 %), interventricular septal rupture (IBD)

occurs as a complication of anterior transmural MI. In 66 % cases, the localization of the rupture is apical, in 34 % – basal. The high risk of myocardial rupture cohort is characterized by the elderly age, first anterior transmural MI, concomitant diabetes mellitus, no reperfusion in the first 3–6 hours after onset of the disease, late drug or mechanical reperfusion [5, 7]. Rupture of the free wall of the left ventricle in the vast majority of cases is a fatal complication of transmural MI.

The treatment aimed at closing PVSD may reduce mortality to 35–45 % [3, 4]. The key issues of surgical and endovascular treatment in each case are: determining the optimal timing of the intervention, choosing the type of intervention, determining optimal drug and hemodynamic support during preparation of the patient to treat complications in

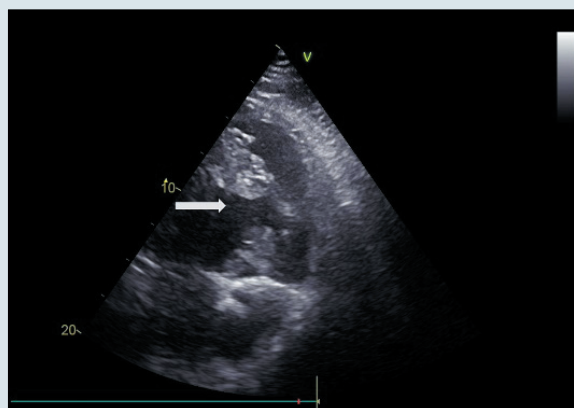


Fig. 1. PVSD with left-to-right shunt

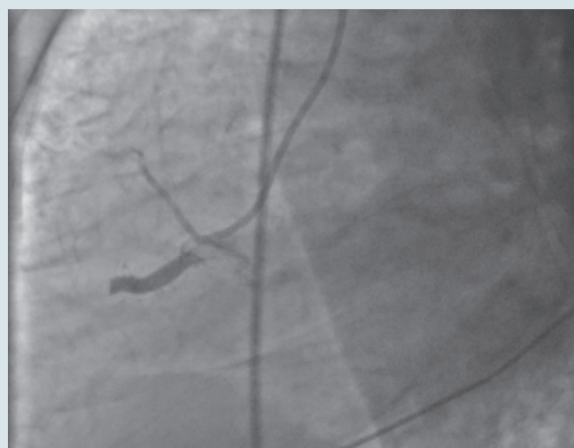
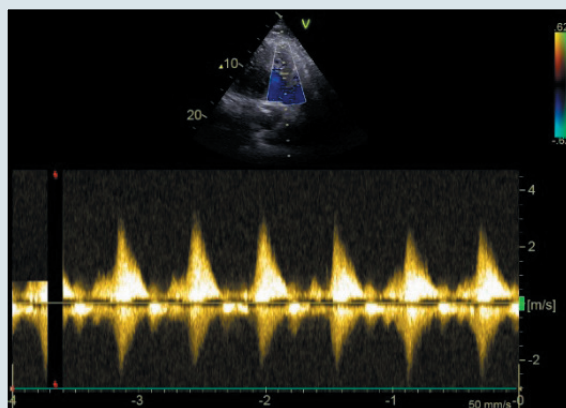
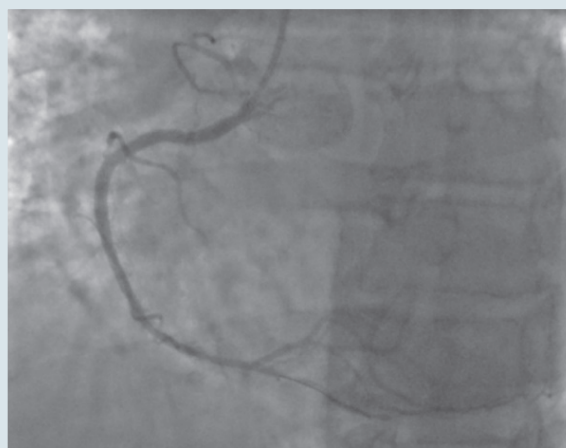


Fig. 2. Coronary angiography. RCA reperfusion



the early postoperative period. The article describes a clinical case of surgical treatment of a rare type of the PVSD using hybrid surgical treatment.

### Clinical case

Patient K., 58 years old, was hospitalized with acute posteroinferior MI complicated with PVSD. The patient had concomitant arterial hypertension stage 3, grade 2, risk 4, heart failure IIA stage with preserved left ventricular ejection fraction.

At admission, he complained of angina, shortness of breath with minimal exercise (walking 10 m), sometimes pain and shortness of breath at rest, blood pressure 150/90 mm Hg. The series of ECG revealed sinus tachycardia, up to 117 beats per minute, posterior wall focal changes. Pulmonary rales, intense systolic murmur with epicenter at the apex. Echocardiography revealed large PVSD in the area of the lower membranous segment of the left ventricle (Fig. 1). Inferior wall dyskinesia, mildly reduced left ventricular con-

tractile function, dilatation of right heart cavities and left atrium. Mitral insufficiency II–III degree, severe pulmonary hypertension. Mild pericardial effusion, moderate amount of fluid in the left pleural cavity, a small – in the right one.

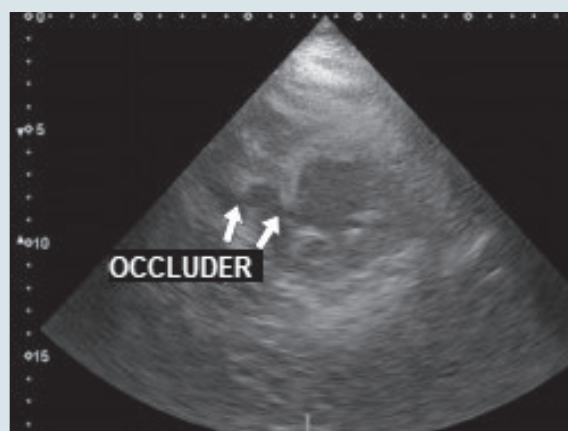
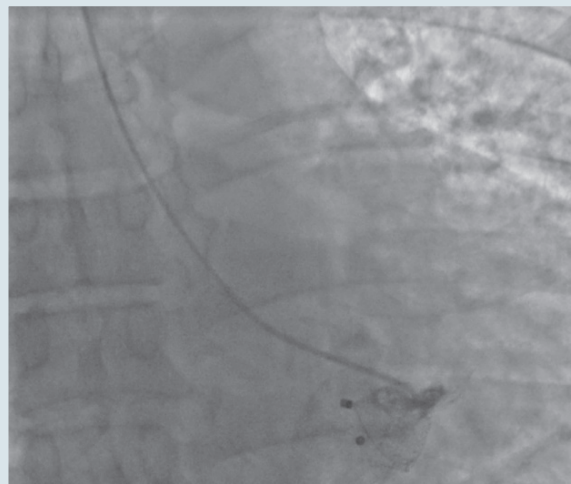
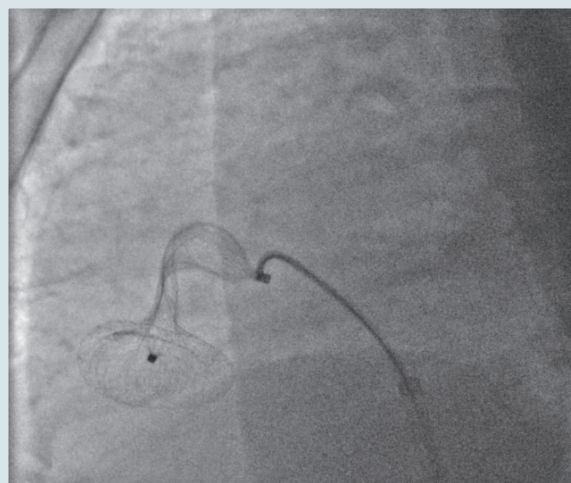


Fig. 3. Echocardiography after the procedure of PVSD closing



**Fig. 4. Attempts of endovascular closure of the PVSD. Installation of the Amplatzer occluder, diameter 30 mm. Removal of the occluder from the right ventricle through the jugular access. Amplatzer occluder installation in PVSD, diameter 40 mm**



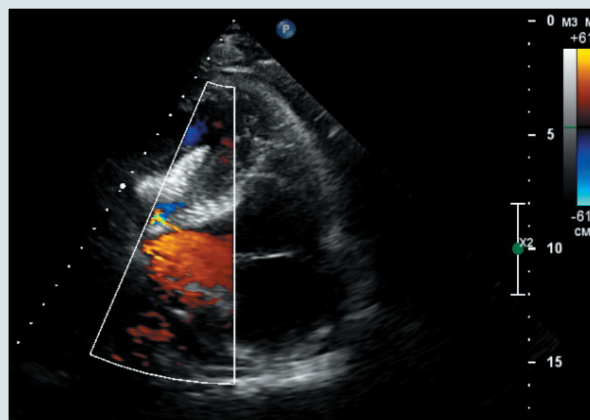
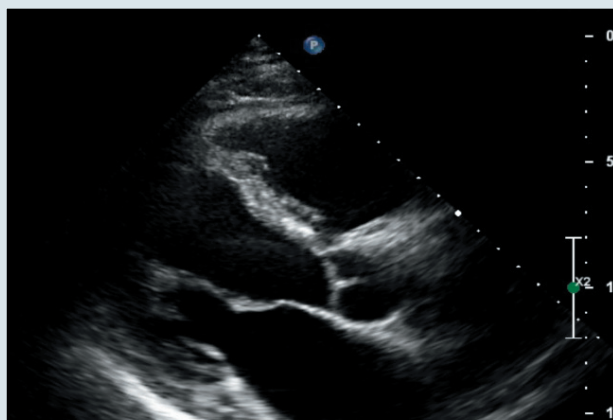
ВИПАДОК  
ІЗ ПРАКТИКИ

The results of the coronary angiography and ventriculography performed the same day: subocclusion of the proximal third of the anterior interventricular branch of the left coronary artery (LCA) was detected. Occlusion of the right coronary artery (RCA). Postinfarction ventricular septum defect. Recanalization and stenting of RCA, anterior interventricular branch of LCA through radial access was carried out by vital indications (Fig. 2).

Taking into account the «acute» nature of the rupture of the interventricular septum and the «incomplete» process of formation and limitation of left ventricular myocardial necrosis, an attempt was made to continue conservative therapy to achieve the safest time for surgical treatment. However, despite the complex therapy under the control of invasive indicators of central hemodynamics

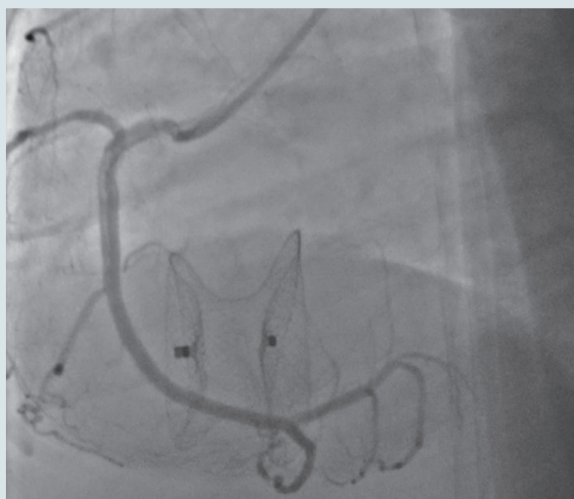
and blood gas composition, the patient's condition deteriorated, with increase of biventricular failure, refractory to conservative therapy.

Four days after admission and development of acute MI, it was decided to perform an attempt of



**Fig. 5. Echocardiography 14 days after the procedure**





**Fig. 6. Immediate angiographic result of the Amplatzer occluder implantation procedure**

endovascular closure of the ventricular septal defect. Using right radial access, the ventriculography was performed, the defect of the interventricular septum with diameter of 18 mm was detected. Through the right venous access, we passed 10 F arteriovenous loop through a ventricular septal defect and an Amplatzer occluder with a diameter of 30 mm was implanted. According to further echocardiography after endovascular intervention, the ejection fraction decreased from 56 % to 38 % (Fig. 3); two days after implantation, left-to-right shunt about 7–8 mm, VSD in the lower basal segment. Medium pressure in the pulmonary artery – 76 mm Hg.

A decision was made to attempt endovascular removal of the occluder from the right ventricle, as well as attempts to close it again. Due to the right radial 10F access, the occluder was removed from the right ventricle and disconnected (Fig. 4). Immediately after closing the defect, stabilization of hemodynamic parameters was noted. The echocardiography performed after the intervention revealed the correct position of the occluder, reduction of the linear sizes and volumes of left and right ventricles and the disappearance of high-

speed flow from left to right. At the same time diffuse slight reset due to the so-called hollow body of the occluder was maintained, with its subsequent progressive reduction and almost complete disappearance to the 14th day after endovascular intervention, medium pressure in the pulmonary artery – 49 mm Hg (Fig. 5, 6). The patient was discharged from the hospital in satisfactory condition with moderate symptoms of heart failure on the background of therapy.

After 6 months, he was re-admitted in order to perform planned surgery: mitral valve plastics by ring No 30, tricuspid valve plastic by ring No 34. A slight residual marginal defect of the interventricular septum near the wall of the occlude, size 3-4 mm was detected, the defect was sutured with U-shaped sutures using Teflon patches. Postoperative period was without special features. The wound healed with initial tension. The patient was discharged 14 days after surgery. In 2 months the patient's general condition was satisfactory, there were no new complaints. According to the echocardiography, no data regarding re-shunt of the ventricular septal defect. Lower wall aneurysm. Moderate dilatation of both atria and right ventricle. Slight mitral valve insufficiency, slight insufficiency of the tricuspid valve, contractile function of the left ventricle is satisfactory, of right ventricle slightly reduced, moderate pulmonary hypertension, ejection fraction – 56 %, medium pressure in pulmonary artery – 39 mm Hg.

## Conclusion

Features of this clinical case include a hybrid approach to the treatment, including endovascular closure of the PVSD in the early stages of the disease, when the spread of necrosis and demarcation may often worsen treatment results. Besides, the surgical tactics was used to correct dislocation of the occluder and for its re-implantation. The successful implementation of this approach created a bridge for further open surgery.

*There is no conflict of interest.*

*Participation of authors: concept and project of work – B.T., M.R.; collection of material – M.R., A.H., K.B., Y.H.; literature review, article writing – M.R., Y.H., K.B.; critical evaluation of the material, text editing – B.T.*

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### Клінічний випадок успішного закриття післяінфарктного дефекту міжшлуночкової перегородки оклюдером на четверту добу захворювання

Сьогодні актуальним залишається питання ефективного лікування ускладнень інфаркту міокарда. Незважаючи на постійне вдосконалення технік і методів оперативних втручань та вдосконалення протоколів медикаментозного лікування, летальність від такого ускладнення, як післяінфарктний розрив міжшлуночкової перегородки, залишається досить великою. У статті представлено клінічний випадок успішного ендovasкулярного закриття післяінфарктного дефекту міжшлуночкової перегородки оклюдером із подальшим хірургічним його закриттям. Описані оптимальні терміни втручання, вибір типу втручання, оптимальної медикаментозної і гемодинамічної підтримки на етапі підготовки пацієнта до корекції цього ускладнення і в ранній післяопераційний період. Наш досвід показує, що своєчасне використання ендovasкулярних методик для закриття дефекту дозволяє створити місток для відкритої операції і забезпечити ефективне лікування для пацієнта.

**Ключові слова:** інфаркт міокарда, післяінфарктний дефект міжшлуночкової перегородки, оклюдер, хірургія.

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### Клинический случай успешного закрытия постинфарктного дефекта межжелудочковой перегородки окклюдером на четвертые сутки заболевания

Сегодня актуальным остается вопрос эффективного лечения осложнений инфаркта миокарда. Несмотря на постоянное совершенствование техник и методов оперативных вмешательств и совершенствование протоколов медикаментозного лечения, летальность от такого осложнения, как постинфарктный разрыв межжелудочковой перегородки, остается достаточно большой. В статье представлены клинический случай успешного ендovasкулярного закрытия постинфарктного дефекта межжелудочковой перегородки окклюдером с последующим хирургическим его закрытием. Описаны оптимальные сроки вмешательства, выбор типа вмешательства, оптимальной медикаментозной и гемодинамической поддержки на этапе подготовки пациента к коррекции данного осложнения и в ранний послеоперационный период. Наш опыт показывает, что своевременное использование ендovasкулярных методик для закрытия дефекта позволяет создать мостик для открытой операции и обеспечить эффективное лечение для пациента.

**Ключевые слова:** инфаркт миокарда, постинфарктный дефект межжелудочковой перегородки, окклюдер, хирургия.