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Alternative Method of Surgical Treatment of Post-Infarction Left Ventricular Free Wall Rupture. Case Report

Abstract. Acute myocardial infarction (AMI) is one of the causes of death in developed countries, despite the latest medical technologies. AMI is usually accompanied by numerous fatal complications. One of these complications is left ventricular free wall rupture (LVFWR). Myocardial rupture after AMI can occur from 1 day to 3 weeks after the infarction. Most ruptures occur 3-5 days after a heart attack. Left ventricular free wall rupture requires only emergency surgical intervention, which in most cases consists in applying U-shaped sutures or wrapping sutures using Teflon patch.

The aim. To demonstrate an example of alternative surgical tactics and intraoperative management of a patient with myocardial infarction complicated by rupture of the free wall of the heart with the transition to cardiogenic shock.

Case report. We presented the clinical case of patient V, 72 years old, who was delivered by ambulance on January 10, 2023 to the intensive care department of the National Amosov Institute of Cardiovascular Surgery (Kyiv, Ukraine). Main diagnosis: ischemic heart disease, acute coronary syndrome with ST-elevation myocardial infarction, cardiogenic shock.

Conclusion. The only effective method of treatment of rupture of the free wall of the heart is surgical intervention. Using a sandwich patch with resection of necrotic areas of the myocardium and U-shaped sutures with Teflon patch passed from the side of the left ventricular cavity through the myocardium in the peri-infarct zone and through a patch from a vascular prosthesis allows hermetically sew up the LVFWR.

Keywords: *myocardial ischemia, myocardial rupture, cardiogenic shock, ischemic heart disease, hemopericardium, Teflon patch, vascular prosthesis, peri-infarct zone, acute heart failure, case report.*

Introduction. Free wall cardiac rupture is a rare phenomenon, occurring in 0.2-7.6% of patients who have experienced an acute myocardial infarction (AMI) [1]. The reported mortality rate is between 75% and 90%, and it accounts for about 20% of deaths in patients with AMI, despite newer reperfusion strategies for AMI, including thrombolysis and percutaneous coronary intervention [2, 3]. Left ventricular free wall rupture (LVFWR) during the first episode of heart attack leads to the rapid development of acute heart failure [4, 5, 6]. In this case, the only effective method of treatment is surgical intervention [7, 8, 9]. Rupture of the left ventricle (LV) requires emergency surgical intervention, which in most

cases consists in applying U-shaped sutures or wrapping sutures using Teflon patch. Such LV sealing techniques are not always effective, taking into account myomalacia in the area of a fresh myocardial infarction [10].

The aim. To demonstrate an example of alternative surgical tactics and intraoperative management of patients with myocardial infarction, complicated by rupture of the free wall of the heart.

Clinical case. Patient V., 72 years old, was delivered by ambulance on January 10, 2023 to the intensive care unit of the National Amosov Institute of Cardiovascular Surgery with complaints of burning pain in the heart area irradiating to the lower jaw within 4 hours. Main diagnosis: ischemic heart disease, acute coronary syndrome with ST-elevation myocardial infarction, cardiogenic shock. Associated diagnosis: grade 3 hypertension, stage 3 heart failure, NYHA class III.

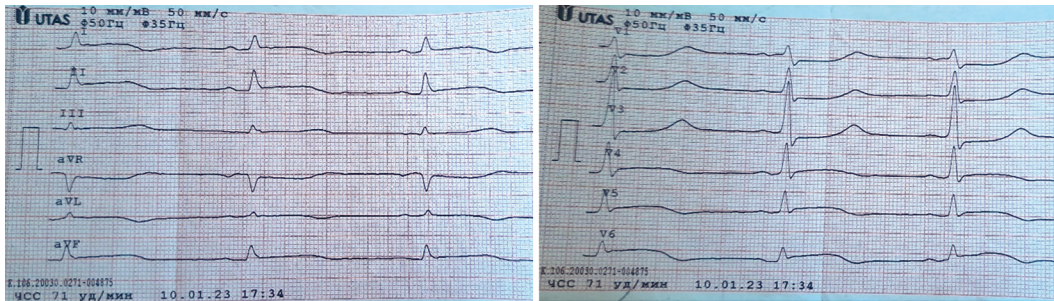


Fig. 1. Electrocardiogram of the patient V.

Therapy at the preoperative stage: nitroglycerin, clopidogrel 300 mg, acetylsalicylic acid 250 mg per os, Sol. Morphini 1% 1.0 mL and dopamine 5 $\mu\text{g}/\text{kg}/\text{min}$. On admission, the patient's condition was severe, Glasgow Coma Scale score was 13, the skin was pale, moist, and cold to the touch. Pulse 80 beats per minute, regular. Blood pressure 80/40 mm Hg, oxygen saturation 90%. Auscultatory findings: muffled heart sounds. Breathing was self-controlled. Respiratory rate 27 breaths per minute. Hard breathing was heard over the lungs, with moist fine-vesicular rales in the lower parts of both lungs.

Electrocardiography findings: ST segment elevation along the lower lateral wall of the LV (Fig. 1).

An echocardiographic study was carried out: an examination in the forced position. Aortosclerosis. Moderately reduced LV contractility (ejection fraction 43%) with hypokinesia of the posterior-lateral wall of the LV was noted. In the pericardial cavity along the perimeter of the heart, a layer of fluid of heterogeneous content with a thickness of 0.8-2.4 cm was visualized, collapsing the wall of the right ventricle during diastole (Fig. 2).

Slight insufficiency of the mitral valve. Slight insufficiency of the tricuspid valve. The stroke volume 32 mL, the minute volume of blood circulation 2.5 L/min, cardiac index 1.3 L/min/m².

In the intensive care unit, a central venous catheter was placed and an infusion was started: dobutamine 5.8 $\mu\text{g}/\text{kg}/\text{min}$.

Computed tomography (CT) was performed: a rupture of the posterior-lateral wall of the LV was revealed (Fig. 3).

The findings of biochemical blood test in the intensive care unit were as follows: troponin I 28.81 ng/mL (normal range: 0.0-0.3), total protein 64.1 g/L (normal range: 65-85), glucose 14.2 mmol/L (normal range: 3.3-6.1), creatinine 219 $\mu\text{mol}/\text{L}$ (normal range: 40-110), urea 14.1 mmol/L (normal range: 2.5-8.3), lactate dehydrogenase 802 g/L (normal range: 180-420), aspartate aminotransferase 158 U/L (normal range: 6-30), alanine aminotransferase 57 U/L (normal range: 6-42), lactate 3.0 mmol/L (normal range: 0-2). Coagulogram: prothrombin index 72%, platelets $327 \times 10^9/\text{L}$. Acid-base state of

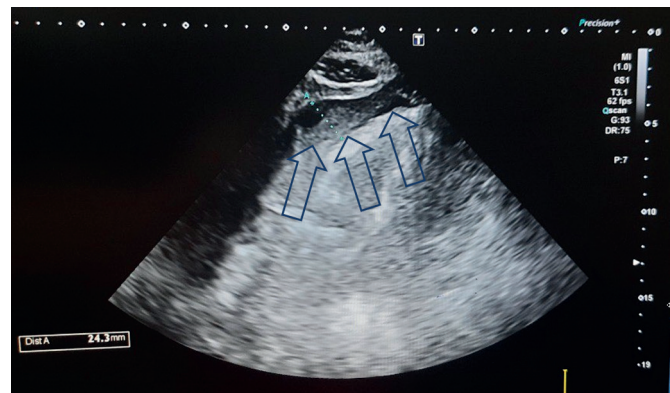


Fig. 2. Suspicion of LVFWR due to compression of the right ventricle by fluid in the pericardium. Arrows indicate the place of the break

arterial blood: pH 7.49, pO₂ 268 mm Hg, pCO₂ 25.3 mm Hg, sO₂ 99.7%, HCO₃ 19.7 mmol/L, base excess (BE) 3.0 mmol/L, hematocrit (Hct) 0.25%, total hemoglobin concentration (tHb) 83 g/L.

Based on clinical and laboratory data, stage D cardiogenic shock was diagnosed according to the Society for Cardiovascular Angiography & Interventions classification of cardiogenic shock.

Coronary angiography showed multivessel lesion of the coronary arteries: right coronary artery (RCA) multiple stenoses up to 50%, right marginal artery of RCA 70%, left main coronary artery 70%, left anterior descending (LAD) of left coronary artery (LCA) 90%, diagonal and LCA stenosis up to 50%, circumflex LCA 70%, marginal branch (M1) 100%. Considering the unstable and severe condition of the patient, a decision was made to use intra-aortic balloon pump (IABP) followed by surgical intervention. After the start of IABP, the patient was immediately taken to the operating room (January 10, 2023). The patient's condition was classified as the American Society of Anesthesiologists class V. The EuroSCORE II score was 56.25%.

Intraoperatively: After a standard median sternotomy, a large amount of fresh thrombus 250 mL and about 300 mL of fresh blood were evacuated from the pericardial

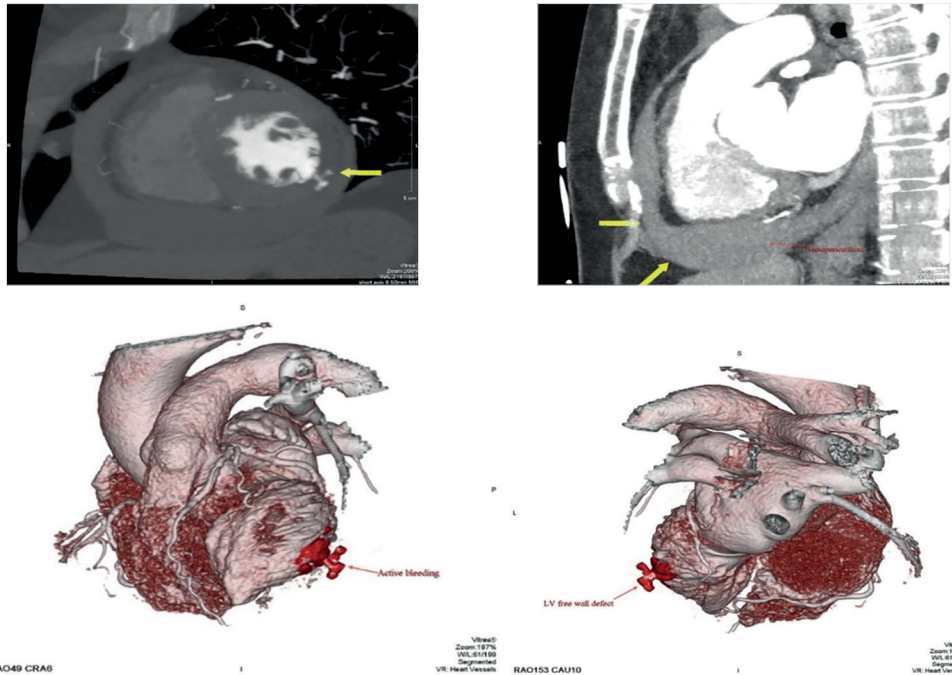


Fig. 3. A series of CT images shows a rupture along the posterior-lateral wall of the LV with a fluid inclusion around the heart. Arrows indicate the place of the break

cavity. During the LV revision, 2 tears of the LV lateral surface were visualized, with a diameter of 0.5 cm and 0.6 cm (Fig. 4).

Heart-lung machine was connected by central cannulation followed by cooling to 29 °C, and cardiac arrest was achieved by pharmacocold cardioplegia with Custodiol solution. Acid-base state of venous blood after starting bypass: pH 7.54, pO₂ 44 mm Hg, pCO₂ 28.5 mm Hg, HCO₃ 24.8 mmol/L, BE 2.0 mmol/L, Hct 0.18%, tHb 60 g/L. Coronary artery bypass grafting using saphenous vein was performed to LAD of LCA. LV tears were sewn up with U-shaped sutures with Teflon patch. After the restoration of cardiac activity, bleeding was noted from the place of suturing of tears due to the cutting of sutures in the area of suturing. Cardiac arrest was performed again. The sutures with Teflon patch were removed. Resection of the necrotic tissue of the LV wall was performed. Intergard vascular prosthesis patch measuring 4x4x3cm was sewn using the sandwich technique, with the help of 10 n-shaped Ti-Cron 2-0 sutures with Teflon patch. U-shaped sutures with Teflon patch were passed from the side of the LV cavity through the myocardium in the peri-infarction zone and through a patch from a vascular prosthesis. In this way, the patch was fixed on the outer surface of the LV wall. The edges of the patch were additionally doubled with a continuous Prolene 3-0 wrapping suture with Teflon patch (Fig. 5).

After re-restoration of cardiac activity, minimal bleeding was observed. The pericardial cavity was tamponated

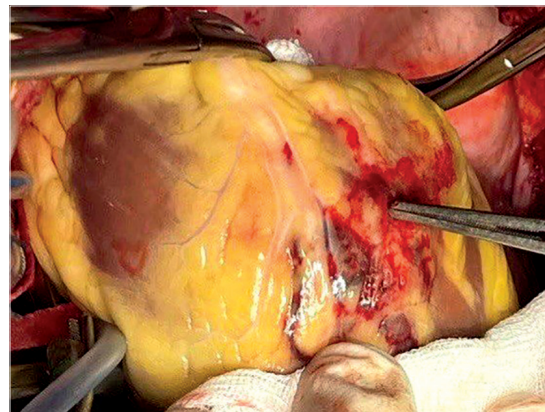


Fig. 4. Tears of the LV lateral surface

using gauze tampons. The primary closure of the post-operative wound was performed with the placement of drains to control blood loss. The total time of operative intervention was 440 min, bypass time 280 min, aortic cross-clamp time 55+77 min. Blood loss was about 700 mL. Acid-base state of arterial blood: pH 7.56, pO₂ 73 mm Hg, pCO₂ 25.3 mm Hg, sO₂ 96.7%, HCO₃ 24.6 mmol/L, BE 2.3 mmol/L, Hct 0.20%, tHb 70 g/L. During the intervention: erythrocyte mass 1470 mL, fresh frozen plasma 670 mL. Hemodynamics was stable, without the need for infusion of sympathomimetics.

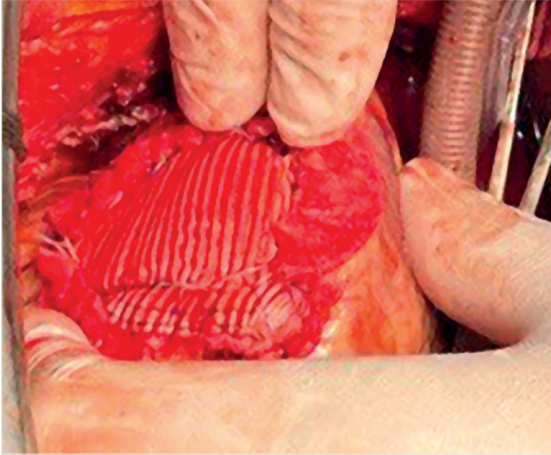


Fig. 5. Patch fixation technique

In the postoperative period, the volume of extravasate from drains was 280 mL on day 1 and 200 mL on day 2. According to echocardiography data, a layer of fluid of 0.5 cm was visualized on the back wall of the pericardium. On the second day after the initial intervention, taking into account the satisfactory hemodynamic parameters, absence of sympathomimetic and vasopressor support, the IABP balloon was disconnected and removed.

Taking into account all the above indicating the achievement of successful hemostasis, on day 3 after the primary intervention, a decision was made to remove tampons from the pericardial cavity. During the second operation, all the blood clots with the volume of 25 mL and remnants of blood with the volume of 75 mL from the pericardium were visualized and removed, tampons were removed from the pericardial cavity. The tightness control of previously applied suture on the LV was carried out, the sutures were sealed. In addition, Surgicel hemostatic sponge was applied to the place of suturing.

On day 10 after the intervention: hemodynamics was stable, ejection fraction 37% end-diastolic volume 97 mL, end-systolic volume 61 mL, stroke volume 36 mL). There was no free fluid in the pericardial cavity.

Conclusions

1. The only effective method of treatment of rupture of the free wall of the heart is surgical intervention.
2. Using a sandwich patch with resection of necrotic areas of the myocardium and U-shaped sutures with Teflon

patch passed from the side of the LV cavity through the myocardium in the peri-infarct zone and through a patch from a vascular prosthesis allows hermetically sew up the LVFWR.

Patient consent. Obtained.

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Альтернативний спосіб хірургічного лікування постінфарктного розриву вільної стінки лівого шлуночка. Клінічний випадок

Іващенко В. С., хірург відділення хірургічного лікування ішемічної хвороби серця

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Резюме. Гострий інфаркт міокарда є однією з причин смерті в розвинених країнах, незважаючи на новітні технології та швидке реагування медичного персоналу. Гострий інфаркт міокарда зазвичай супроводжується численними летальними ускладненнями. Одним з таких ускладнень є розрив вільної стінки лівого шлуночка. Розрив міокарда після гострого інфаркту міокарда може статися від 1-го дня до 3 тижнів після інфаркту. Більшість розривів відбувається через 3–5 днів після інфаркту. Розрив на зовнішній поверхні стінки лівого шлуночка потребує виключно екстреного хірургічного втручання, яке в більшості випадків полягає у накладанні П-подібних швів або обвивних швів з використанням тefлонових латок.

Мета – продемонструвати приклад альтернативної хірургічної тактики та інтраопераційного ведення пацієнтів з інфарктом міокарда, який ускладнений розривом вільної стінки серця з переходом у кардіогенний шок.

Клінічний випадок. Ми представили клінічний випадок пацієнтки В., 72 років, яка була доставлена каретою швидкої медичної допомоги 10.01.2023 року у відділення інтенсивної терапії та реанімації ДУ «НІССХ ім. М. М. Амосова НАМН України». Основний діагноз: ішемічна хвороба серця, гострий коронарний синдром з елевацією ST, кардіогенний шок.

Висновки. Єдиним ефективним методом лікування розриву вільної стінки серця є оперативне втручання.

Використання латки за типом «Sandwich», з резекцією некротизованих ділянок міокарда, та виконання П-подібних швів з тefлоновими латками з боку порожнини лівого шлуночка через міокард у періінфарктній зоні та через латку із судинного протеза дозволяє герметично зашити розрив стінки лівого шлуночка.

Ключові слова: ішемія міокарда, розрив міокарда, кардіогенний шок, ішемічна хвороба серця, гемоперикард, тefлонова латка, судинний протез, періінфарктна зона, гостра серцева недостатність.

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