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## TRAUMA INDUCED MYOCARDIAL INFARCTION: A CLINICAL CASE

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### Abstract

Traumatic injury of the coronary arteries with the development of myocardial infarction is often caused by arterial dissection, while about 10% of patients may have atherothrombosis. At the same time, coronary atherosclerosis can act as one of the triggering factors.

Patient A, 52 years old, was urgently admitted to the Emergency Hospital after a road traffic accident (RTA). Based on the given clinical data, an acute coronary syndrome is suspected, its traumatic genesis was not excluded. However, the usual patient management strategy in this case was not applicable because of blunt abdominal trauma with internal bleeding. A hybrid operation was decided, the first stage of which included coronary angiography, followed by selective angiography of the celiac trunk to determine further tactics.

As a result of the hybrid intervention and medication therapy, the patient was discharged on the 8th day in a satisfactory condition.

**Keywords:** heart trauma, myocardial infarction, angiography.

### Резюме

## ТРАВМАТИЧЕСКИЙ ИНФАРКТ МИОКАРДА: КЛИНИЧЕСКИЙ СЛУЧАЙ

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Травматическое повреждение коронарных артерий с развитием инфаркта миокарда чаще обусловлено диссекцией артерии, при этом около 10% пациентов могут иметь атеротромбоз. В то же время коронарный атеросклероз может выступать в качестве одного из провоцирующих факторов.

Пациент А, 52 лет, был экстренно госпитализирован в Больницу скорой медицинской помощи после дорожно-транспортного происшествия (ДТП). При клинико-лабораторном обследовании пациента был диагностирован острый инфаркт миокарда, при этом не исключался травматический генез. Однако рекомендованная стратегия ведения пациента в данном случае была неприменима из-за сопутствующей тупой травмы живота с внутренним кровотечением. Было принято решение о проведении гибридной операции, первый этап которой включал коронарную ангиографию с реваскуляризацией инфаркт-связанной артерии, а затем селективную ангиографию чревного ствола для определения дальнейшей тактики.

В результате гибридного вмешательства и медикаментозной терапии пациентка была выписана на 8-й день в удовлетворительном состоянии.

**Ключевые слова:** травма сердца, инфаркт миокарда, ангиография.

### Түйіндеме

## ТРАВМАТИКАЛЫҚ МИОКАРД ИНФАРКТІСІ: КЛИНИКАЛЫҚ ЖАҒДАЙ

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Миокард инфарктісінің дамуымен коронарлық артериялардың жарақаттануы көбінесе артерияның диссекциясына байланысты, шамамен 10% -пациенттерде атеротромбоз болуы мүмкін. Сонымен қатар, коронарлық атеросклероз қоздырғыш факторлардың бірі бола алады.

Пациент А, 52 жастағы жол-көлік оқиғасынан (ЖКО) кейін жедел медициналық жәрдем ауруханасына шұғыл жатқызылды. Науқасты клиникалық және зертханалық тексеру кезінде жедел миокард инфарктісі диагнозы

қойылды, травматикалық генез жоққа шығарылмады. Алайда, бұл жағдайда пациентті жүргізудің ұсынылған стратегиясы қосымша ішкі қан кетумен бірге іштің жарақаттануына байланысты қолданылмады. Гибридті ота жасау шешімі қабылданды, оның бірінші кезеңі инфарктпен байланысты артерияның ревазуляризациясымен коронарлық ангиографияны, содан кейін одан әрі тактиканы анықтау үшін целиак діңінің селективті ангиографиясын қамтыды.

Гибридті араласу және дәрі-дәрмек терапиясының нәтижесінде пациент 8-ші күні қанағаттанарлық жағдайда шығарылды.

**Түйінді сөздер:** жүрек жарақаты, миокард инфарктісі, ангиография.

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#### Introduction:

According to the definition accepted today, a myocardial infarction (MI) implies the presence of acute damage to the myocardium, defined by the regular dynamics of heart markers, primarily the highly sensitive troponins T and I, with proven myocardial ischemia [1]. In the classical understanding, MI is associated with the rupture or erosion of an unstable atherosclerotic plaque, leading to atherothrombotic damage to the myocardium (occlusion or subocclusion). However, in the last decade, another pathophysiological variant of MI has been identified, caused by the mismatch between oxygen delivery and demand due to cardiac and extra-cardiac causes [2].

One such form can be classified as myocardial injury that occurs with chest trauma. Traumatic myocardial injury and traumatic myocardial infarction are clinical conditions that are difficult to study in the population due to the absence of clear diagnostic criteria. A number of studies based on increased cardiac specific markers and characteristic dynamics of electrocardiography (ECG) have shown a wide variation in identifying patients with blunt heart trauma, ranging from 3 to 76% with trauma of different localizations [3]. This condition is associated with a worse outcome, as heart trauma, including traumatic MI, is the cause of approximately 20% of fatal cases in patients after road traffic accidents [4].

Thus, it appears important to publish a case report of the development of traumatic myocardial infarction in a patient with a combined injury.

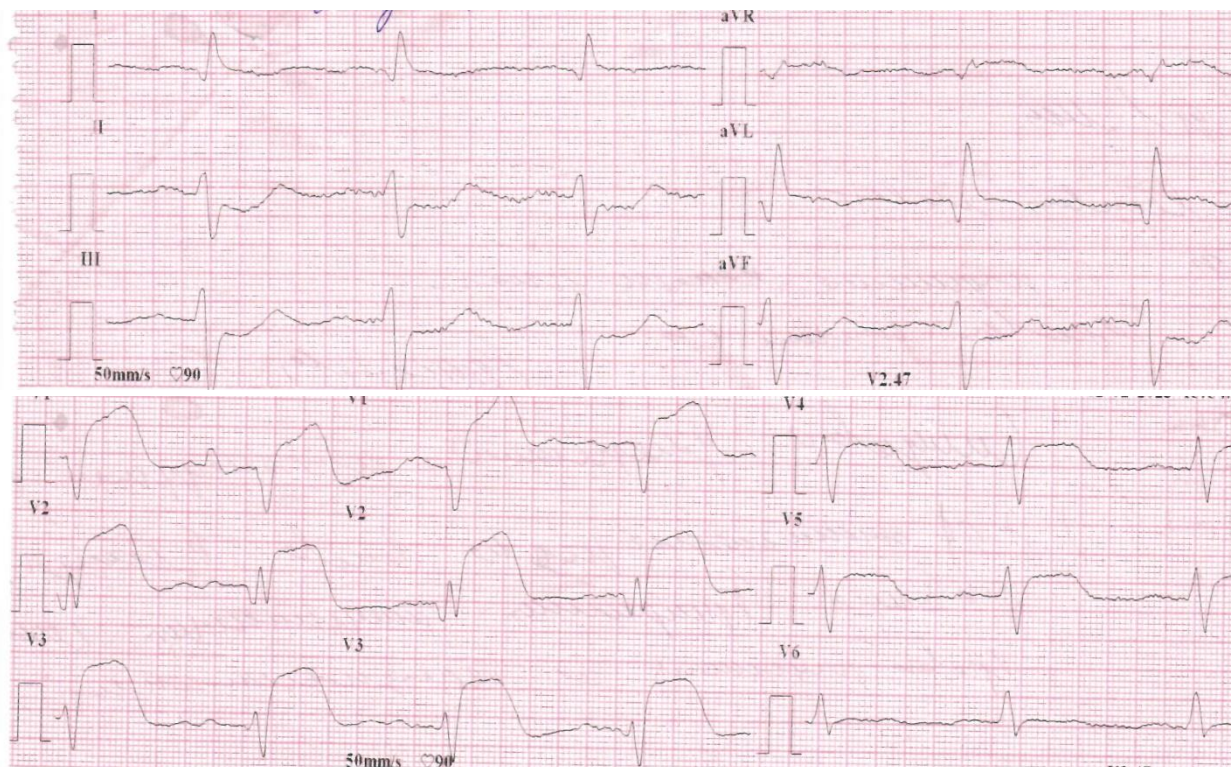
#### Clinical case

Patient A, 52 years old, was urgently admitted to the Emergency Hospital, after a road traffic accident (RTA). At the time of the RTA, as the driver of the car, there was an impact to the left half of the chest and left hypochondrium region against the steering wheel. In anamnesis, the patient reported the presence of arterial hypertension with a target blood pressure achieved on the background of taking candesartan 16 mg/day, as well as type 2 diabetes, for which he was taking metformin 1000 mg/day. Upon arrival,

he reported pain in the left side of the abdomen, marked weakness, and during the transportation in the ambulance there was a brief episode of loss of consciousness. At this stage, his condition was considered serious. There were no visible bone fractures. No dyspnea and cyanosis, respiratory rate of 18 breaths per minute. Over the lungs, there is tight breathing, no wheezing. Hemodynamics at a blood pressure level of 110/70 mm Hg, heart rate of 88 beats per minute. Heart tones are muffled, rhythmic. The abdomen is of normal shape, lagging behind in the act of breathing, with surface palpation, pain was mostly felt in the left hypochondrium, with a weak positive symptom of Shchetkin-Blumberg. The patient was examined by a neurosurgeon and a computed tomography scan of the head ruled out a head injury.

It seems that the patient has been diagnosed with anemia of mild degree with a hemoglobin level of 102 g/L and hyperglycemia of 24.6 mmol/L. An ECG revealed a sinus rhythm with a heart rate of 85 beats per minute and signs of left ventricular hypertrophy. An ultrasound examination revealed diffuse changes in the liver, pancreas and free fluid in the abdominal cavity. A chest CT scan showed a closed fracture of the 4-th rib on the left anterior segment without displacement of fragments. Considering the clinical data, a team of surgeons has diagnosed a rupture of the spleen with internal bleeding. Surgical treatment has been recommended.

During the preoperative preparation, the patient experienced burning pain in the chest radiating to the left arm, lower jaw, accompanied by cold, sticky sweat. At the same time, the hemodynamics at the level of BP 90/60 mm Hg, heart rate 92 beats per minute. Electrocardiography while the pain syndrome was registered a sinus rhythm, ST segment elevation in leads V1-V5 (Fig 1). Troponin T upon admission was 0.1 ng/mL (norm up to 0.3 ng/mL). An echocardiogram was performed, which demonstrated a preserved ejection fraction of the left ventricle with areas of local hypokinesia (1,2,7,8 segments). A re-evaluation of troponin T after 2 hours revealed a significant increase to 13.0 ng/mL.

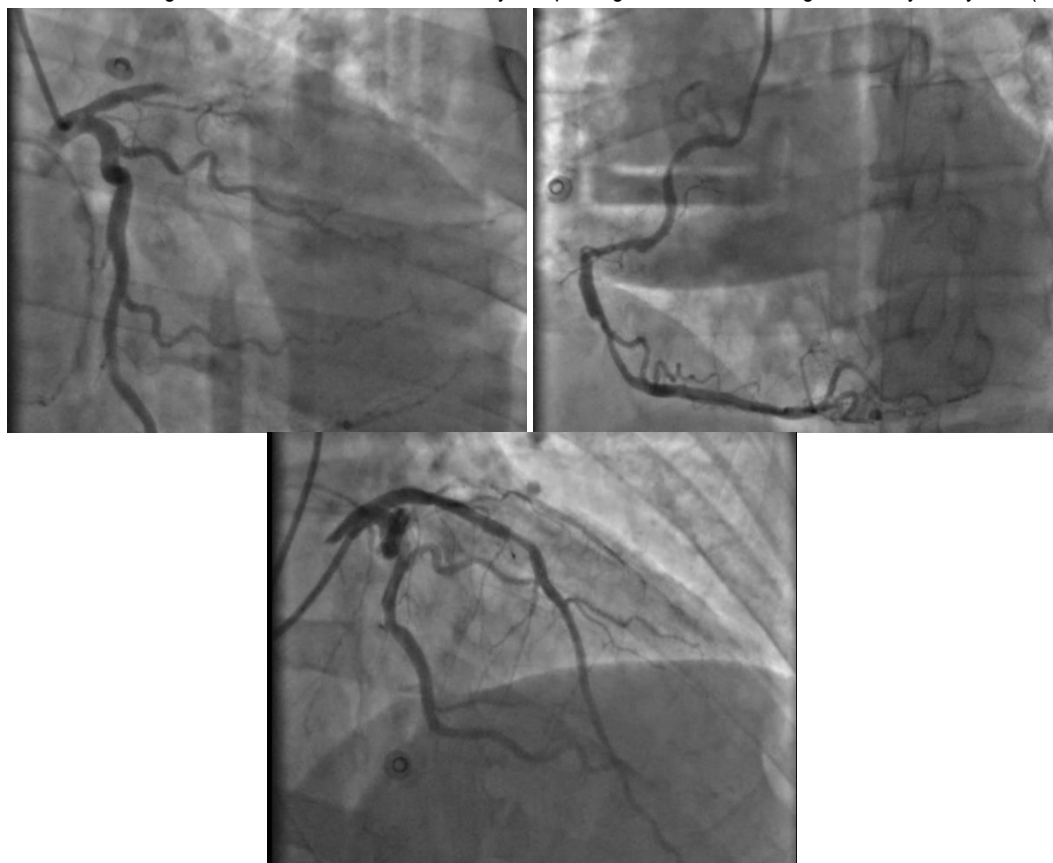


**Figure 1. Electrocardiography.**

Based on the given clinical data, an acute coronary syndrome is suspected, its traumatic genesis was not excluded. However, the usual patient management strategy in this case was not applicable because of blunt abdominal trauma with internal bleeding. A hybrid operation was decided, the first stage of which included coronary

angiography, followed by selective angiography of the celiac trunk to determine further tactics.

The patient's coronary angiography revealed an occlusion of the anterior interventricular artery, the left main coronary artery and circumflex branch were intact, and there was a prolonged stenosis of the right coronary artery 80% (Fig 2).



**Figure 2. Angiography (before and after PCI).**

Subsequently, angioplasty was performed (with a PowerLine 3.0x15 mm balloon catheter at 10 atm) with LAD stenting using one stent with a drug-coated (Biofreedom 3.5x18 mm stent at 12 atm) with a satisfactory result, blood flow in the artery TIMI III. Revascularization in the right coronary artery pool is recommended in a planned manner.

Next, selective catheterization of the celiac trunk was performed, which revealed leakage of contrast material in the projection of the splenic pedicle, indicating a rupture of the spleen in the projection of its pedicle and is a contraindication for an angioembolization of the splenic artery. Thus, the second stage of the hybrid operation was a supraceliac laparotomy, which confirmed the rupture of the spleen (3 by 2 cm in size) in the projection of the vascular pedicle with intrahepatic hemorrhage. As a result, a splenectomy with drainage of the abdominal cavity was performed.

The postoperative period went without any special features. Correction of anemia required a single blood transfusion. Given the myocardial revascularization performed, the patient required double antiplatelet therapy (DAPT), but the splenectomy made it difficult. It was decided to perform DAPT in a shortened form (for 1 month), including aspirin and clopidogrel. Later, the patient continued monotherapy with clopidogrel 75 mg and statins. In addition to the comprehensive treatment, antibacterial therapy, proton pump inhibitor (pantoprazole 40 mg intravenously then orally), correction of hyperglycemia with short-acting insulin, followed by the administration of metformin 1000 mg and empagliflozin 25 mg starting from the 3rd day after the postoperative period, therapy with valsartan 40 mg/day was titrated to 80 mg/day.

As a result of the hybrid intervention and medication therapy, the patient was discharged on the 8th day in a satisfactory condition.

### Discussion

In classical literature, it is more often indicated that traumatic myocardial infarction (IM) develops more often in the elderly, with the presence of atherosclerotic lesions in the coronary arteries [5]. Among the possible pathophysiological causes of traumatic IM, the most commonly described is the dissection of the coronary arteries with subsequent thrombosis. There are also options for the development of epicardial hematomas with external compression of the coronary arteries [6]. Only about 10% were associated with ischemic changes, i.e., erosion of the atherosclerotic plaque with subsequent atherothrombosis of the coronary artery [7]. In the work of Christensen M.D., only 15.8% of 77 patients with traumatic MI had intact coronary arteries according to angiography data [6]. In the presented case, a thrombotic occlusion was identified in the AIVB, which corresponds to the literature data. Thus, coronary artery thrombosis was most commonly identified in the anterior interventricular artery basin (71.4%), less often in the right (19.0%) and trunk of the left coronary artery (6.4%), and the most rare localization was the circumflex artery (3.2%) [6]. Thus, the results of CAG confirmed the suspected diagnosis - myocardial infarction. In this case, it is appropriate to consider it as MI of type 2, i.e., traumatic origin, whose pathophysiological mechanism is most likely to have included the rupture of an existing atheromatous plaque with subsequent atherothrombosis of the coronary

artery. The traumatic origin of MI in this case is confirmed by the presence of a fracture of 4 ribs on the left side in the patient.

The diagnostic algorithm proposed by Jeremy S. Bock and others has been repeatedly used in clinical recommendations for heart injuries [4]. According to this document, the diagnosis of blunt heart injury, including traumatic MI, primarily involves the study of cardiospecific markers (mainly troponin I) and ECG. The detection of local hypokinesia based on echocardiography is fundamentally important, especially if it coincides with the localization of ECG changes. Only when there is a suspicion of traumatic MI is it recommended to perform angiography of the coronary arteries with subsequent myocardial revascularization [8]. In some cases, the use of non-invasive visualization methods, such as cardiac computer tomography and CT-coronaroangiography, is possible, especially among patients with a high risk of invasive intervention [9].

Confirmation of acute dissection or occlusion of the coronary artery requires coronary revascularization, i.e., coronary artery stenting or aorto-coronary shunting. Published clinical cases are increasingly allowing for interventional interventions [5,7]. This raises the question of further management of patients, balancing the need for antithrombotic therapy, recommended after coronary artery stenting, and the high risk of bleeding. This question requires further systematic analysis and initiation of clinical trials. In the present case, considering the high risk of bleeding, a Biolimus A9 drug-eluting stent without polymer was chosen, the results of which allow for DAPT duration up to 1 month [10].

### Conclusions

Traumatic injury to the coronary arteries leading to myocardial infarction is not a common condition, but is associated with a high risk of death. Given the absence of specific clinical symptoms, the creation of local diagnostic algorithms, incorporating a comprehensive use of cardiospecific markers (first of all, troponin I), ECG and EchoCG, can contribute to the earlier diagnosis of traumatic myocardial infarction. Interventional methods of treatment have shown their effectiveness among these patients. The presented clinical case demonstrated the effectiveness of hybrid technologies in the treatment of patients with combined trauma, characterized by a high risk of bleeding. However, the long-term effects of such interventions remain unclear, requiring further research.

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