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Case report

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Successful Recanalization of the Superior Mesenteric Artery in Acute Mesenteric Ischemia

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ABSTRACT The article describes a clinical case of recanalization of the superior mesenteric artery during acute mesenteric ischemia in an 81-year-old patient who was admitted to the emergency hospital in Ryazan with a clinic for "acute" abdomen. As a result of a diagnostic study, collection of anamnestic data and clinical picture, a diagnosis was made: "Embolism of mesenteric vessels." Taking into account the early diagnosis (less than 4 hours from the onset of the disease), as well as the extremely complicated somatic status, selective angiography with mesentericography was performed, which revealed the patency of the main trunk of the superior mesenteric artery and complete occlusion of the distal segment of the intestine. Revascularization was performed ischemic area of the superior mesenteric artery. In the postoperative period, positive dynamics was observed, with complete relief of the clinical manifestations of mesenteric ischemia. On the 12th day, the patient was discharged for outpatient treatment under the supervision of a surgeon at her place of residence in satisfactory condition.

Keywords: acute mesenteric ischemia, superior mesenteric artery, arterial occlusion, angiography

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IHD – ischemic heart disease
RBBB – complete right bundle branch block
SMA – superior mesenteric artery

INTRODUCTION

Arterial mesenteric embolism is defined as a sudden acute arterial occlusion, with a critically low drop in circulating pressure in the mesenteric intestinal bloodstream. This pathological factor leads to a sharp hypoxic disruption of the metabolic needs of enterocytes and their death.

Embolic ischemic processes of the gastrointestinal tract account for approximately 1:1000 cases of acute hospitalization in Europe and Russia. Diagnosis of sudden mesenteric circulatory failure is extremely difficult and, in the absence of prompt treatment (no more than 6–8 hours from the vascular lesion), leads to mesenteric artery infarction, intestinal necrosis, development of systemic inflammatory response syndrome, and death [1].

When studying statistical data, one can note a tendency towards an increase in survival and life expectancy in patients with acute myocardial infarction, atherosclerotic lesions of the lower extremity vessels, but it is impossible to provide equally positive data for lesions of the mesenteric vessels. The average survival of patients with arterial mesenteric embolism varies from 6 to 10%, and the mortality rate in non-operated patients is 100% [2].

Of all possible causes, arterial embolism occurs in almost 95% of cases [3]. Its development can be facilitated by congenital and acquired defects of the valve apparatus, heart rhythm disturbances (atrial fibrillation), aneurysms of the thoracic and abdominal aorta, etc.

Regardless of the etiology, mesenteric vascular lesions occur at the level of the superior mesenteric artery, for well-known reasons. It is important to note that occlusion of the superior mesenteric artery at the site of its origin from the aorta does not occur as often as its individual segments at sites of natural constrictions [4].

With the development of intestinal ischemia, there is a complete occlusion and cessation of nutrition of the intestinal section, metabolic disturbance and further accumulation of metabolic products in the affected intestine. In a patient a acute pain syndrome develops, but peritoneal symptoms are still absent, which leads to diagnostic errors and distances surgeons from making the right tactical decisions, and this in turn reduces the likelihood of a favorable outcome for the patient [5, 6].

Tissue necrosis with blood recirculation through collateral vessels are two mutually aggravating processes. Initially, it affects the mucous layer with a simultaneous increase in the systemic inflammatory reaction, hypovolemia, multiple organ failure and subsequently leads to the development of peritonitis and abdominal sepsis [7–9]. The development of collateral circulation forms a hemorrhagic infarction and causes the process of blood oozing through the intestinal wall. This blood is a substrate for

contamination with microorganisms and plays a key role in the development of peritonitis.

Based on the above, it is worth noting that the speed and accuracy of diagnosis, as well as the choice in favor of using a minimally invasive X-ray - endovascular treatment method not only allows the patient to survive, but also fully shows the state of the vascular network of the mesenteric bed, which allows restoring blood flow in any area where embolism occurred [10, 11].

Clinical observation

Patient K., born in 1942, was admitted to the emergency surgery department of the City Clinical Hospital of the City of Ryazan on 12.04.23 at 09:12:00 with complaints of intense pain in all parts of the abdomen and an increase in body temperature to 37.4°C.

It is known from the anamnesis that she considers herself ill for about 2 hours, when she first felt a sharp pain in the abdomen, not associated with food and medication intake. It was also revealed that the patient was treated in the therapy department a month ago with the diagnosis: "Hypertension, IHD: atrial fibrillation tachysystolic form. Complete RBBB. Angina pectoris of the 2nd functional class, chronic heart failure 2B. Diabetes mellitus type II." It was also revealed from the anamnesis that the patient was taking antihypertensive therapy on an intermittent basis, as well as a direct oral anticoagulant, Xarelto, at a dosage of 5 mg 2 times a day (it is important to note that the dose of oral coagulants was not initially selected in accordance with national recommendations; the recommended daily dose of rivaroxaban is 20 mg 1 time per day).

On admission, the patient's condition is of moderate severity. Objectively: consciousness is clear, the patient strives to assume a forced position. Skin is pale, turgor is slightly reduced. Body temperature is 37.4°C. Vesicular breathing is weakened, heard on both sides, respiratory rate is 18 per minute. Heart sounds are muffled, the rhythm is irregular. Blood pressure is 160/90, pulse is 150 beats/min. The abdomen is slightly distended, does not participate in the act of breathing, sharply painful in all areas during palpation. Peristalsis is weakened during auscultation. Peritoneal symptoms are weakly positive. Pasternatsky's symptom is negative on both sides. Diuresis is unchanged. *Per rectum:* brown feces.

According to laboratory and instrumental research methods, leukocytosis of 17.0×10 ^{9}/l with neutrophilia up to 93.9%, an increase in creatinine levels to 120 nmol/l, urea to 10.00 mmol/l, blood glucose 12 mmol/l are noted. Other indicators of biochemical and general clinical blood tests, as well as coagulograms are within normal limits.

During an ultrasound examination of the abdominal organs, intestinal pneumatosis and a small amount of free homogeneous (up to 100 ml) fluid in the pelvis were noted.

Taking into account the anamnesis (ischemic heart disease: atrial fibrillation, tachysystolic form, RBBB), a vascular surgeon cardiologist was invited for consultation. During examination of the patient, no data for acute cardiac pathology were revealed. During joint examination with the vascular surgeon, the clinical diagnosis was established: "Embolism of mesenteric vessels. Abdominal ischemic syndrome". A decision was made to perform CT angiography with selective mesentericography, with possible subsequent thromboebolectomy.

After examination by related specialists and confirmation of the absence of other pathology that could cause such complaints (2 hours after the moment of treatment), the patient was taken to the operating room for endovascular intervention. Under local anesthesia, the right brachial artery was punctured. Using the Seldinger technique, a 6*F introducer was installed*. Catheterization and angiography of the SMA (superior mesenteric artery) were performed using the standard technique.

Angiography revealed occlusion in the proximal segment of the SMA, no contrast enhancement of the occluded sections (Fig. 1 *A*, *B*). Conductive recanalization with distant multiple catheter thrombus aspiration of the SMA was performed. Control angiography showed that the lumen of the SMA was

restored. The introducer was removed (Fig. 2, 3). The patient was transferred to the intensive care unit for further treatment. In the postoperative period, the patient was in a stable but serious condition. For therapeutic purposes, the patient was prescribed unfractionated heparins in a dosage of 30,000 IU per day through an infusion pump at a rate of 18 U×kg/hour under the control of activated partial thromboplastin time, antisecretory therapy, monitoring of vital signs, and coagulograms (during the entire observation period, the coagulogram parameters were within the reference values).

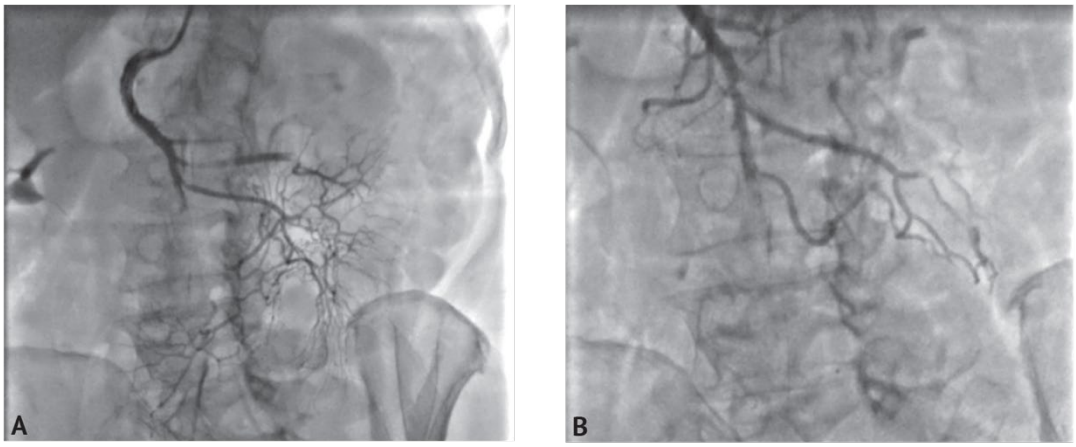

Fig. 1. Intraoperative photo. Computed tomography angiography visualizes occlusion of the superior mesenteric artery (A); the area of occlusion of the distal superior mesenteric artery is visualized (B)

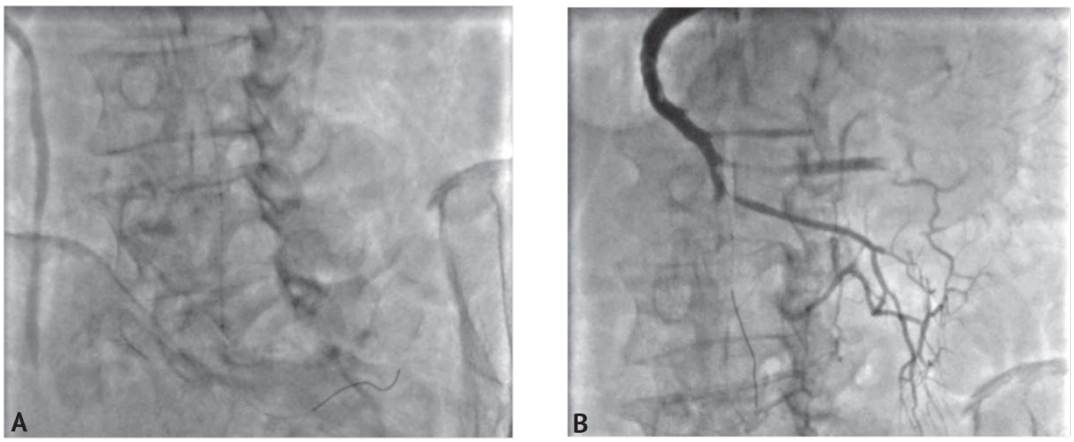

Fig. 2. Intraoperative photo. When performing selective mesentericography using the Seldinger technique, a 6 F introducer (A) was installed; catheterization of the superior mesenteric artery was performed (B)

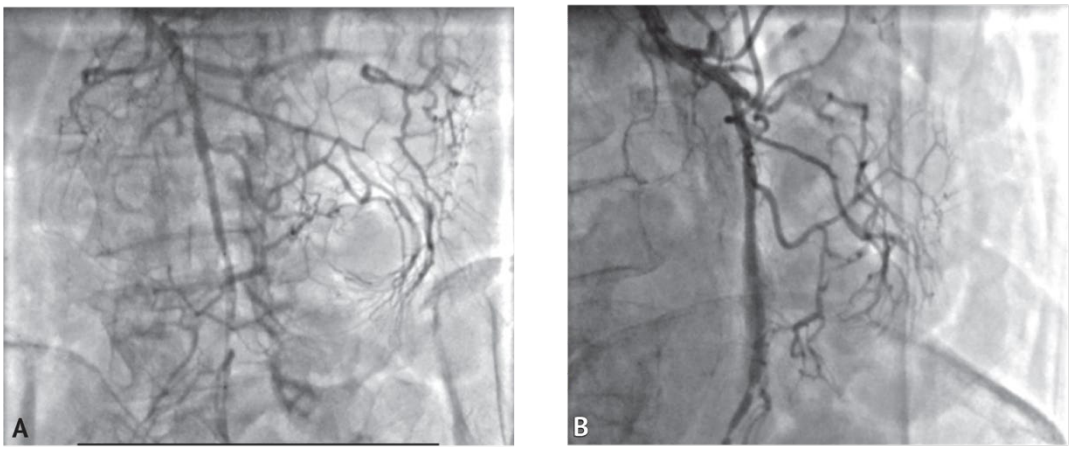

Fig. 3. Intraoperative photo. Performing recanalization (A); restoration of the lumen, thrombus aspiration, restoration of blood flow of the superior mesenteric artery (B)

During her stay in the intensive care unit on the 2nd day, the condition remained unchanged, however, at 13:57:00, the patient's respiratory and cardiac activity stopped, and she died clinically. During resuscitation measures, the heart rhythm was restored, and the pupils showed a positive photoreaction. Due to her aggravated cardiovascular history and the severity of cardiac disorders, the patient continued to be in the intensive care unit. On the 3rd–4th day, positive dynamics were observed, there was no pain, stool and gas were passed, an insignificant amount of serous discharge was coming through the drains, and diuresis was 2000 ml/day. On the 5th day, the drains were removed.

On the 7th day, patient K. was transferred to the general ward to continue treatment. During her stay in the ward, she was consulted by specialists: therapist, cardiologist, nephrologist, neurologist, gastroenterologist, endocrinologist. During the treatment, positive dynamics were noted: the patient moves independently, became more active, and her appetite returned. When examining the general status, normalization of temperature, diuresis, and physiological functions was also noted. When examining the local status: the abdomen is soft, painless in all areas, there are no peritoneal symptoms, the postoperative wound heals by primary intention. When analyzing laboratory data from 04/23/23: hemoglobin 124 g/l, erythrocytes 3.9 × 10^{12}/l, leukocytes 8.1 × 10^{9}/l, platelets 178 × 10^{9}/l; total protein 62 g/l, urea 6.0 mmol/l, creatinine 118 μmol/l, glucose 6.1 mmol/l, ALT 42 units/l, AST 15 units/l. On 24.04.23, on the 12th day, the patient was given further recommendations for vascular and cardiac therapy (lisinopril 5 mg 2 times a day, metoprolol 50 mg 2 times a day, eliquis 10 mg 2 times a day, lancid 30 mg 1 capsule 2 times a day, torasemide 5 mg 1 time per day in the morning, veroshpiron 50 mg 1 time per day in the afternoon, melaxen 1 tablet in the evening for a month), as well as recommendations on diet, general care and activating the patient, with which she was discharged from the hospital in a satisfactory condition for outpatient observation at her place of residence.

DISCUSSION

When analyzing the literature data over the past 5 years, one can note a tendency to increase the number of minimally invasive endovascular methods recommended for the treatment of chronic abdominal ischemia, however, these methods are not so highly applicable in the conditions of urgent surgery, which is due to a number of factors, in particular: late patient referral, untimely final clinical diagnosis, lack of necessary equipment and skills of specialists in the field of vascular surgery, routine use of laparotomy access and intraoperative assessment of the patency of the branches of the abdominal aorta.

The main link in the treatment of patients with acute mesenteric ischemia to this day remains surgical intervention. Any attempts at conservative thrombolytic therapy without surgery do not lead to a positive result [12, 13].

The use of classical laparotomic access with revision of the superior mesenteric artery is a fairly frequently used technique in surgical hospitals. However, according to modern foreign literature, a complete revision of all sections of the superior mesenteric artery, including distal ones, from this access is extremely difficult [14, 15].

Based on this clinical observation, as well as on the experience of working with similar patients, we want to show that the use of X-ray endovascular diagnostics is necessary for all patients with an established diagnosis of acute mesenteric ischemia. First of all, this technique provides an opportunity to evaluate all sections of possible thrombosis/embolism of the branches of the abdominal aorta, which allows for an adequate assessment of the scope of further surgical intervention.

It is also important to note that patients with abdominal ischemic syndrome, both in the chronic and acute stages, do not have any specific symptoms or changes in laboratory parameters that can reliably indicate the presence of this pathology. This area of laboratory diagnostics is extremely important in further study and creation of marker systems for assessing the condition of the gastrointestinal tract and making decisions on surgical intervention, especially in somatically burdened patients.

CONCLUSION

Early diagnosis and timely surgical intervention are fundamental factors in achieving a positive outcome in the treatment of patients with acute mesenteric ischemia.

Endovascular intervention reduces the postoperative period in patients with concomitant comorbid status.

The advent of endovascular techniques in combination with modern imaging methods opens up new possibilities in the diagnosis and treatment of patients with critical arterial intestinal ischemia.

At this stage, it is necessary to develop laboratory research methods to facilitate clinical diagnosis and reduce surgical trauma to patients as a result of untimely interventions.

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