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Emergency roentgen-endovascular clot aspiration in cardioembolic stroke

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ABSTRACT

A case report of successful intravascular aspiration in a patient with acute cardioembolic stroke is presented. Non-occlusive critical thrombosis of the extracranial segment of the left internal carotid artery with distal total embolization of the medial cerebral artery was verified. During the intervention, the dislocation of thrombotic masses into the supraclinoid segment occurred.

Key words: atrial fibrillation, cardiac embolism, ischemic stroke, cerebral angiography, thromboembolism, thrombectomy, internal carotid artery.

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Неотложная рентгенэндоваскулярная тромбаспирация при ишемическом кардиоэмболическом инсульте

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РЕЗЮМЕ

Представлено клиническое наблюдение успешной внутрисосудистой аспирации у пациента с острым ишемическим инсультом кардиоэмболического генеза. Верифицирован неокклюзивный критический тромбоз экстракраниального сегмента левой внутренней сонной артерии с дистальной тотальной эмболизацией средней мозговой артерии. В ходе проведения вмешательства произошла дислокация тромботических масс в супраклиноидный сегмент.

Ключевые слова: фибрилляция предсердий, кардиоэмболия, ишемический инсульт, внутренняя сонная артерия, тромбоаспирация, тромбоэкстракция.

Конфликт интересов. Авторы декларируют отсутствие явных и потенциальных конфликтов интересов, связанных с публикацией настоящей статьи.

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INTRODUCTION

Stroke remains one of the leading causes of death worldwide, being only slightly behind coronary heart disease. Disability, rehabilitation costs, loss of social activity and work capacity are factors that strike both the patient's family and the economy of the state as a whole.

Annually in the United States, about 800,000 strokes are recorded, in the European Union there are about 1,000,000 [1], and in Russia, more than 450,000. Ischemic stroke accounts for 80% of them. Elimination of acute thrombogenic occlusion of the intracranial artery as a cause of cerebral infarction is the main goal of endovascular intervention [2], and introduction of intravascular methods for treating ischemic stroke (IS) in the last decade has led to a decrease in mortality from acute ischemic cerebrovascular accident (CVA) of cardioembolic or atherothrombotic genesis [1].

Restoration of blood flow through a stroke-dependent artery at the early stages provides reduction of the infarction area due to preservation of the penumbra, the zone of damage to the brain matter. The immediate outcome of patient's rehabilitation depends on this restoration [3].

Intravenous thrombolytic therapy (ITT) is recommended as a standard method of treatment in the absence of contraindications in the acute period of IS [4, 5]. Thrombolysis within 4.5 hours from the onset of clinical manifestations significantly improves the outcome of the disease [6].

Endovascular contact (aspiration) thromboextraction and mechanical thrombectomy (MTE) are modern methods of treating IS contributing to rapid recovery of patients and reducing the risk of an unfavorable outcome.

CLINICAL CASE

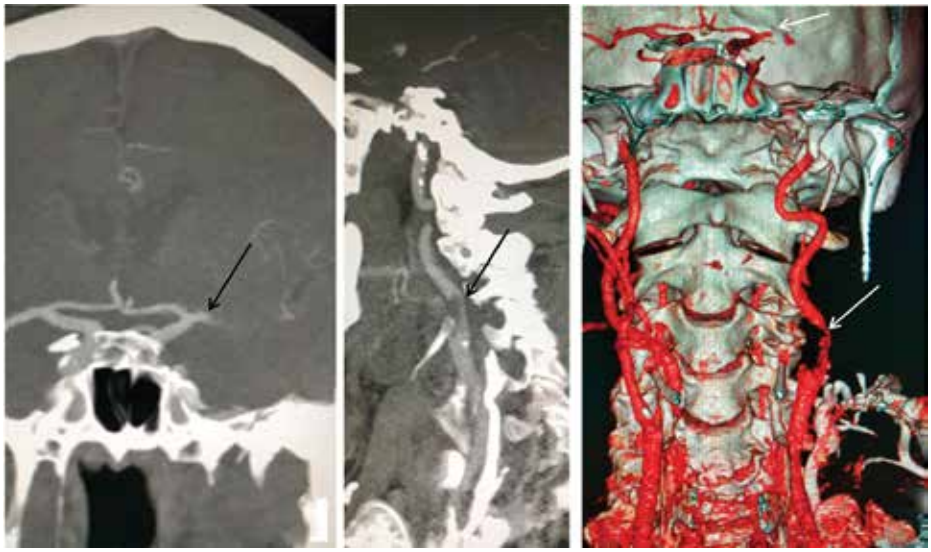
A 64-year-old patient was delivered by an ambulance team to the Irkutsk Regional Clinical Hospital with the acutest stage of ischemic stroke, 1 hour 45 minutes after the onset of clinical manifestations. Examination by a neurologist revealed right-sided hemiparesis, aphasia, and stupefaction. Medical history included persistent atrial fibrillation and irregular intake of anticoagulants.

Computed tomography (CT) of the brain was performed, including CT angiography. According to clinical guidelines, blood was taken to perform a set of emergency laboratory tests.

CT angiography showed thrombosis of the M1 segment of the middle cerebral artery (MCA) on the left, critical stenosis with signs of an ulcerated plaque in the initial segment of the internal carotid artery (ICA) on the left with a loss of lumen up to 90%, and occlusion of the external carotid artery on the left (Fig. 1).

The assessment of early signs of cerebral ischemia according to the Alberta Stroke Program early computed tomography scale (ASPECTS) [7] reached 8 points. The total score according to the National Institutes of Health Stroke Scale (NIHSS) was 19, according to the Glasgow Coma Scale, it was 10–14 (moderate to severe stupefaction). The index according to the modified Rankine scale was 5 (dramatically impaired vital activity, the patient is bedridden and constantly needs assistance of medical personnel).

The main vital signs were assessed: the level of blood pressure, heart rate, and an ECG was performed.



a *b* *c*

Fig. 1. CT angiogram upon admission: occlusion of the M1 segment of the middle cerebral artery (arrow, *a*); clot in the internal carotid artery (arrow, *b*); 3D reconstruction, occlusion of the M1 segment of the middle cerebral artery and clot in the internal carotid artery (arrows, *c*)

The principal diagnosis: ischemic (probably cardioembolic) stroke in the MCA basin on the left; atherosclerosis of the cerebral vessels; hypertensive disease, stage 3-1, risk 4; severe right-sided hemiparesis; aphasia; stupefaction. Secondary diagnosis: ischemic heart disease; persistent atrial fibrillation; hypertension, stage 3, risk 4.

Taking into account the clinical data and the results of X-ray and laboratory studies (the international normalized ratio of 1.5; VTT is contraindicated), it was decided to carry out endovascular reperfusion. The patient was delivered to the interventional radiology suite.

Puncture of the femoral artery was performed 3 hours after the onset of clinical manifestations of IS. After insertion of the 8F-introducer, under intravenous sedation, polypositional carotid angiography was performed on the left. Common carotid artery (CCA) was without pathology. External carotid artery showed occlusive thrombosis. In the projection of the initial extracranial segment of the ICA from the orifice, non-occlusive 18 × 5 mm thrombosis with a loss of arterial lumen up to 90% was visualized (blood flow according to the arterial occlusive lesion (AOL) score was 1). Pronounced tortuosity of the extra- and intracranial segments of the ICA was detected without stenotic-occlusive lesions. The blood flow through the anterior cerebral artery (ACA) was without changes. Occlusive thrombosis of the M1 segment of the MCA was visualized (AOL score – 0). There were no visible collaterals in the ischemic zone (collateral flow grading system – 0).

It was decided to perform contact thromboaspiration (CTA) under endotracheal anesthesia. Blood pressure was 140–150 mm Hg. A Neuron MAX guiding catheter (Penumbra, USA) was placed in the left CCA. An ACE68 reperfusion catheter (Penumbra) and a 3MAX microcatheter (Penumbra) were passed to the ICA thrombosis using a Fielder FC coronary guide wire (Asahi). After removing the microcatheter and the guide wire, the aspiration catheter was fixed at the blood clot and connected to the Penumbra MAX pump. Aspiration took place for 5 min. The catheter was removed, no thrombotic masses were produced. Control angiograms showed displacement of the blood clot into the supraclinoid segment of the ICA. ACA and MCA on the left are not contrasted (Fig. 2).

A triaxial system was installed in the ICA, an aspiration catheter was passed to the clot, and double thromboaspiration (up to 4 min) was performed from the supraclinoid section of the ICA. During the second attempt, a clot up to 4 cm long was aspirated (Fig. 3).

Control carotid angiography revealed restoration of blood flow along the ICA and ACA. MCA was occluded in M1. Intravascular thromboaspiration was performed from the MCA basin (M1) for 4.5 minutes. A blood clot up to 7 cm long was aspirated. Control angiograms showed complete restoration of blood flow in the ICA, ACA, and MCA on the left (AOL

score – 3, mTICI scale – 3). There was no extravasation of the contrast, and the venous phase of contrasting occurred in a timely manner (Fig. 4).

Blood pressure at the time of recanalization was 110–115 mm Hg. The time from the onset of IS to complete restoration of blood flow in the basin of the left internal carotid artery was 4 hours 47 minutes.

The patient was transferred to the intensive care unit and extubated 15 hours later. The patient's status was adequate and he was available for contact. Speech disorders included dysarthria and elements of aphasia with pronounced regression. Right-sided hemiparesis decreased to moderate.

CT was performed: hemorrhagic transformation in the area of the basal nuclei on the left (size 14 × 13 mm), manifestation of cerebral atherosclerosis and dyscirculatory encephalopathy, external and internal hydrocephalus (Fig. 5).

Fig. 2. Initial carotid angiography on the left, clot in the internal carotid artery and occlusion of the M1 segment of the middle cerebral artery (arrows, *a*); displacement of a clot in the internal carotid artery into the supraclinoid section of the internal carotid artery (arrow, *b*)

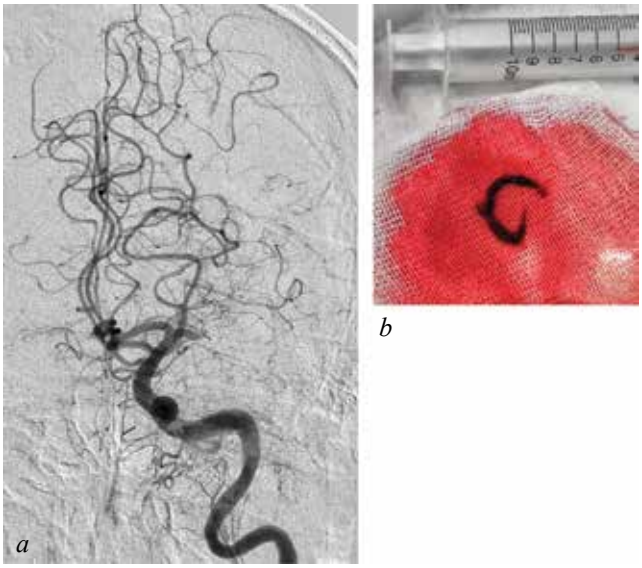


Fig. 3. Carotid angiography on the left after thromboaspiration from the supraclinoid section of the internal carotid artery (*a*); aspirated clot (*b*)

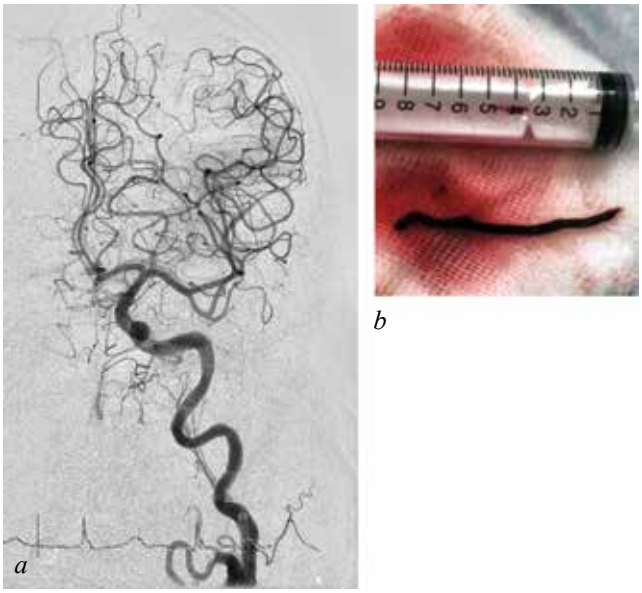


Fig. 4. Carotid angiography on the left after thromboaspiration from the M1 segment of the middle cerebral artery on the left (*a*); aspirated clot (*b*)

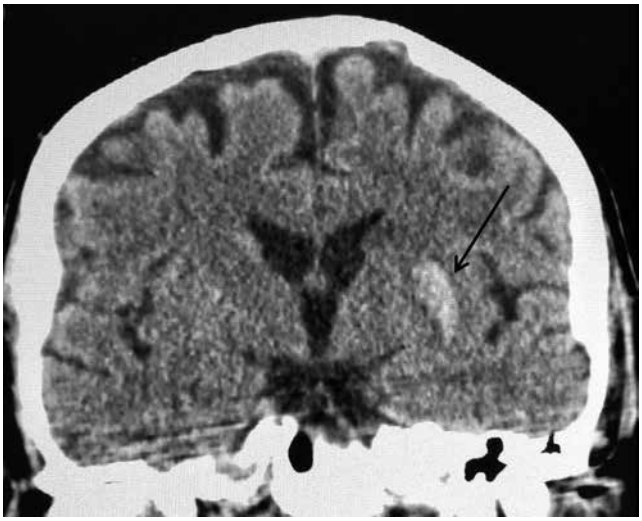


Fig. 5. CT scan 1 day after endovascular thromboaspiration. The focus of hemorrhagic transformation (arrow)

After 3 days the patient was transferred from the intensive care unit to the hospital. At the time of discharge, no speech disorders were detected. Moderate right-sided hemiparesis was observed. The total score according to the NIHSS Stroke Severity Scale was 7. The index according to the modified Rankine scale was 3.

DISCUSSION

The cardioembolic type of acute cerebrovascular events makes up to 20% of all transient ischemic attacks and 12–31% of all IS. The main risk factors for cardioembolic strokes are atrial fibrillation and myocardial infarction [8, 9].

In the presented clinical case of a patient with atrial fibrillation against the background of irregular intake of anticoagulants, an acute cerebrovascular event developed, which made it possible to suspect the cardioembolic nature of IS. The hypothesis was confirmed by the results of CT angiography, where both occlusion of the external carotid artery and tandem lesion of the ICA (non-occlusive thrombosis in the initial section with distal total MCA embolization) were found. Taking into account the therapeutic window, it was decided to perform reperfusion of the target artery. In the presence of contraindications to ITT, on the one hand, and low efficiency of ITT with cardioembolic lesions, on the other, endovascular reperfusion is the most substantiated method.

Endovascular thrombectomy should be performed by experienced interventional radiologists in an operating room equipped with the necessary angiographic equipment and supplies. Endotracheal anesthesia is often required. During the intervention, a hard-to-stop spasm of the carotid artery may occur along with a need for its dissection and fragmentation of a clot with distal embolization and aggravation of neurologic deficit.

To date, two most well-studied methods of endovascular reperfusion in IS are contact thromboaspiration and mechanical thrombectomy (MTE). MTE showed the most promising results when using the Solitaire FR (EV3, USA) and Trevo Pro (Stryker, USA) stent retrievers. No significant differences were established between the Penumbra thromboaspiration system and stent retrievers [10].

In the "Trevo versus Merci retrievers for thrombectomy revascularization of large vessel occlusion (TREVO-2)" study, the Trevo stent retriever achieved TICI 2–3 recanalization rate in 86% of cases, and a good clinical outcome after 90 days was noted in 40% of patients with 90-day mortality of 34.1% [4, 11]. The use of the Penumbra aspiration system in a clinical trial allowed for recanalization of the obstructed artery to TIMI 2–3 rate in 87% of cases with a good clinical outcome after 90 days in 41% of patients and a mortality rate of 20% [2, 12, 13].

At the initial stage, the tactics of contact thromboaspiration with the use of a Penumbra large-bore aspiration catheter was chosen (the unit has necessary tools for performing mechanical thrombectomy, including a balloon guide catheter). After the catheter was passed through to the clot and aspiration was performed, a complication arose: dislocation of the clot with total occlusion of the supraclinoid segment. It is possible that MTE with a stent retriever against the background of reverse blood flow using a balloon catheter made it possible to perform the intervention more effectively at the initial stage. However, another strategy was chosen. At the same time, after three additionally performed sessions of thromboaspiration, complete restoration of cerebral blood flow in the left carotid basin was achieved with regression of neurologic deficit and restoration of the main vital functions.

CONCLUSION

The presented clinical case demonstrates the likelihood of dislocation of thrombotic masses during contact thromboaspiration in patients with complicated tandem lesions of ICA. Only multiple, sequential thromboextractions can help restore the main blood flow.

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