Complex interventional treatment in patient with atrial fibrillation and stroke caused by large carotid artery thrombus- a case report.

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Abstract

Introduction. The treatment option for acute ischemic stroke depends on the duration of symptoms, the dynamics of neurological condition changes, the etiology type of the stroke as well as results of angiographic and neuroimaging tests.

Case presentation. In the paper, the case of Caucasian 60-year old male patient was presented with progressive left hemisphere stroke caused by extensive cardiogenic embolism of the common carotid artery and a thrombus closing the internal carotid artery from its ostium to the level of its intracranial division. The applied complex revascularization therapy involving surgical embolectomy of the common carotid artery, thrombectomy of the internal carotid artery and intra-arterial thrombolysis has led to the improvement of arterial patency and has countered the progression of acute cerebral ischemia. The article presents the significance of selected revascularization methods in the acute stroke phase, together with a discussion of indications for their use.

Conclusion Emergency carotid embolectomy together with thrombectomy and local thrombolytic rt-PA treatment may be a reasonable rescue therapy for carefully selected patients with large-vessel acute stroke. Further trials are needed to establish the advantages and safety of surgical thrombectomy in patients with acute embolic occlusion of the carotid artery and ineffective or contraindicated systemic thrombolytic treatment.

Keywords: stroke, atrial fibrillation, arterial thrombolysis, embolectomy, thrombectomy,
Introduction

Interventional treatment based on cerebral vascular thrombectomy or on local thrombolytic therapy constitutes a modern method of treating acute cerebral ischemia. Most procedures in patients qualified for quick invasive unblocking of cerebral vessels refer to intracranial circulation, while the technological progress in recent years has significantly increased the possibility of effective intracranial intervention in this regard. The application of thrombectomy as well as the locoregional thrombolytic treatment are recommended in strictly selected patients who do not qualify for, or benefit from, intravenous thrombolysis. When planning this type of treatment, one must bear in mind both the general condition and degree of neurological dysfunction of the patient, as well as the presence of potential contraindications, especially related to the ost thrombolytic treatment. In the aspect of the procedure’s success, of decisive significance is the duration of the ischemia, location (accessibility) and extent of lesions, as well as the technical capabilities of achieving patency of the vascular tree. In the case of patients with acute ischemia in cerebral circulation due to embolic complications, one should consider especially the cardiogenic background of the embolism. Another reason for embolism may be material moving from unstable plaques. Due to the size of embolic material, the majority of such lesions are located in intracranial vessels or in the internal carotid artery – especially in its distal segments or in intracranial branches. In the case of large-volume embolic material, occlusion may pertain more to vessels in the proximal section – e.g. in the common carotid artery bulb. The presence of such extensive lesions, most often with thrombosis of arteries located above, as well as the embolic nature of occlusion may constitute a significant problem with performing a quick and effective intravascular procedure of restoring patency of internal carotid arteries.

Case report

A 60-year old Caucasian male patient was admitted to the Neurology Department in Academic Medical Centre because of speech impairment and weakness of right limbs. The onset of ailments was sudden, while the duration of the symptoms at the moment of admission to the department was approx. 4 hours. The patient’s medical history revealed long-standing arterial hypertension, ischemic heart disease and nicotinism.

An examination carried out after hospital admission revealed right n.VII paresis, mixed aphasia which considerably hampered verbal communication, as well as paresis of right limbs (the patient overcame gravity with difficulty); the symptoms were of increasing nature. The
performed Computed Tomography (CT) of the head revealed a newly shaping ischemic focus in the left hemisphere and disseminated brain injury of the vascular origin. The electrocardiogram recorded atrial fibrillation with a ventricular rate of 70/min. The ultrasound examination and angio-CT scan of the head revealed a left-sided occlusion of arteries: common carotid artery (CCA), external carotid artery (ECA) and internal carotid artery (ICA) to the cavernous section (with an extended thrombus in the internal carotid artery above the embolism). (Figures 1,2) At the moment of performing the angio-CT after the patient’s admission to hospital, preservation of flow in the middle cerebral artery (MCA) and anterior cerebral artery (ACA) on the left side was stated (Figure 3).

Due to the duration of the symptoms, the unstable neurological condition of the patient, the extent and nature of lesions occluding the arteries and the newly created cerebral ischemia focus, a decision was made regarding combined interventional treatment involving surgical and endovascular therapy. The procedure was performed in conditions of a hybrid operating room under fluoroscopic control (start of procedure in the 6th hour from the manifestation of cerebral ischemia symptoms). From the incision on the front edge of the left sternocleidomastoid muscle, the internal carotid artery and its division were dissected. A transverse cut on the common carotid artery was made, just below the ostium of the internal carotid artery. Through arteriotomy, an extensive embolism of the bulb of CCA sin was removed, size 10 x 7 mm – hard, with a fibrous structure. After removing the embolism, a good inflow and lack of back flow were stated. Using a 3F Fogarty catheter, a 10-cm thrombus was removed from the internal carotid artery– after removing the embolus, arteriography showed the flow in the internal carotid artery as well as the lack of contrasting of the cerebral circulation with regard to anterior cerebral artery and middle cerebral artery (despite a patent internal carotid artery after thrombectomy up to the height of ACA and MCA origin). (Figure 4) In relation to the arteriographic image, a decision was made to implement thrombolytic treatment – 0.3 mg/kg of recombinant tissue plasminogen activator (rt-PA; Actylise, Behringer Ingelheim, Germany) per body mass was administered through a catheter placed in the internal carotid artery.. The follow-up angiography revealed flow in the internal carotid artery, the anterior cerebral artery (Figure 5). The arteriotomy was sutured using a vascular suture (Prolen 5-0). Due to parenchymatous bleeding from the wound caused by administering rt-PA and heparin (2,500 IU of heparin were administered during the procedure), the wound was left with a hemostatic dressing and a suture with closure delayed until the next day after normalization of clotting difficulties. The post-surgery period occurred
without complications, with systematic improvement of the neurological condition. During the anticoagulant therapy, unfractioned heparin was used in an initial daily dose of 15,000 IU/24 h, later changed to 25,000 IU/24 h under the activated partial thromboplastin time control. Through continuous heart rate monitoring, atrial fibrillation was observed. Follow-up ultrasound and angio-CT of the head (7th day following the intervention) revealed proper blood flow in the arteries subjected to intervention but CT scan of the head revealed a shaped ischemic focus (Figure 6). In the 10th day since the onset of the illness, the patient left the Neurological Ward in a neurologically good condition (with discrete aphasia, moving independently on his own). Based on the clinical course and results of additional tests (imaging and electrophysiological testing) it was determined that the stroke occurred in the patient as a result of cardiogenic embolism in the course of atrial fibrillation (diagnosed de novo during hospitalization). In secondary prophylaxis of the stroke, dabigatran was used, implemented in the 10th day since the cerebral stroke. The written informed consent for participation in the study and publish this case was obtained from patient.

Discussion

The treatment option for acute ischemic stroke depends on the duration of symptoms, the dynamics of neurological condition changes, the etiology type of the stroke as well as results of angiographic and neuroimaging tests. As per current recommendations, initial considerations include reperfusion methods based on intravenous thrombolysis (rt-PA iv) or, in selected cases, intra-arterial thrombolysis (rt-PA ia). Benefits from applying mechanical thrombectomy as the only form of treatment or as combined with pharmacological thrombolysis are currently the subject of researches. According to updated and guidelines, thrombectomy may be performed in patients with cerebral stroke induced by acute critical narrowing or occlusion of intracranial arteries which do not qualify for, nor benefit from, intravenous thrombolysis. [1] Cerebral stroke due to acute cerebral and/or carotid artery occlusion is characterized by a serious course and poor outcome. [2] In such cases, complete arterial recanalization after rt-PA iv is observed in as little as 10–11% of patients. [3, 4, 5, 6,] In the so-called carotid T-occlusion (thrombolytic occlusion from the proximal ICA section to ACA and MCA), the prognosis is serious even if recanalization is performed within a few hours. Brekenfeld et al. inform about a favorable condition in only 17% of the patients in the 3rd month since the stroke (mRankin ≤ 2) despite observed ICA, MCA and ACA recanalization in 63%, 17% and 33% of cases, respectively. [7]
The scope of cerebral ischemia depends on the compensatory capabilities of collateral circulation in the circle of Willis or leptomeningeal anastomosis, as well as on the individual capability to restore brain circulation within the therapeutic window. Endovascular intervention in such cases may be more effective compared to intravenous and/or intra-arterial thrombolysis. [8] Endovascular methods may be implemented in the extended therapeutic window, 8–12 hours from the onset of the stroke, although there is no doubt that, when applied within short time of the onset of the disease, it is linked to more favorable prognosis. Taking into consideration the fact that more than half of patients with cerebral stroke are admitted to hospital within a time that excludes thrombolysis, endovascular therapy is perceived as a favourable alternative option for the majority of occluded arteries.

However, emergency surgical embolectomy in patients with carotid artery occlusion in the acute stroke phase is rarely considered. It is worth noting that 10–20% of all strokes within the anterior part of the circle of Willis are related to ICA pathology. [9] In such cases, the occluded downstream intracranial vessels (e.g. MCA) may be recanalized by systemic or local thrombolysis. The effect of unblocking intracranial vessels caused by the action of the thrombolytic drug in the case of a residual occlusion of the internal carotid artery may be only temporary. Achieving permanent improvement of cerebral artery patency depends on the condition of the carotid artery which feeds it. This is true especially in cases with T-occlusion which is exemplified by the presented patient. The dynamics of intravascular lesions in our patient may be tracked based on radiographic examinations. Within 2 hours between the angio-CT examination upon admission to hospital and the performed procedure, an expansion of the occlusion occurred from the level of the ICA cavernous section to ACA and MCA. Only a comprehensive reperfusion strategy – common carotid artery embolectomy with internal carotid artery thrombectomy and local thrombolysis provided an opportunity for quickly restoring the patency of the mentioned vessels as well as for preventing further progression of cerebral ischemia, noted in the CT scan of the head. The decision to select a combination revascularization treatment was based on the belief that the effectiveness of thrombolytic treatment in the case of “old” fibrous embolic lesions is limited and that their size significantly limits the possibility of complete embolism removal. Observations to date with the use of carotid artery embolectomy in treating strokes are scarce, and their results – divergent. The interpretation of those results is all the more difficult as reports involve both patients with cardiogenic carotid artery embolism, as well as patients with an occlusion of the internal carotid artery as a result of thrombosis due to atherosclerotic lesions and progression.
of thrombotic lesions to intracranial vessels. [9, 10, 11] On the other hand, some reports describe the positive effect of thrombectomy and surgical embolectomy in patients previously not subjected to thrombolytic therapy or in the case of its inefficiency. [9,12,13]

Descriptions of surgical embolectomy of the internal carotid artery and its branches are still rare, which results both from diagnostic difficulties as well as from the necessary time window. Touho (1999) presented results of effective CCA unblocking with the aid of surgical embolectomy in 4 patients, which constituted 66.7% of performed interventions. [4] Murata (2010) describes 3 cases of effective surgical embolectomy of the common and internal carotid arteries. [14] Inoue (2013) presented very promising results of surgical treatment (embolectomy) based on a retrospective analysis of 23 patients with occlusion of the internal carotid artery and/or its branches. [15]

Due to the dynamics of clinical and radiological lesions, the presence of a multi-level acute occlusion of both CCA as well as ICA and its branches, in the presented case a decision was made to remove it surgically with subsequent rt-PA ia. The decision to undertake treatment was dictated by the nature of stated lesions. Very often, cardiogenic embolisms have the form of “hard”, fibrous lesions, which considerably impacts the effectiveness of thrombolytic treatment. The effect of intravenous thrombolysis depends on the size of the embolism, and the chance for recanalization of an artery with a cardiogenic embolism with a size of > 8mm$^2$ is slight. [16] On the other hand, due to the size and nature of the embolism (hard, fibrous masses), the application of percutaneous mechanical thrombectomy had little chance of success with regard to the possibility of complete removal from the area of the common carotid artery. Moreover, it could lead to the fragmentation of the embolic material as a result of manipulation of endovascular catheters and its further transmission with the blood stream to smaller arteries and further cerebral ischemia. The performance of a surgical procedure under fluoroscopic control, as well as simultaneous application of intracranial treatment in the form of thrombectomy as well as intra-arterial thrombolytic treatment has enabled obtaining quick recanalization of treated vessels not only on the level of primary closure by the embolic material, but also with regard to intracranial vessels.

**Conclusion**

Emergency carotid embolectomy together with thrombectomy and local thrombolytic rt-PA treatment may be a reasonable rescue therapy for carefully selected patients with large-vessel acute stroke. Further trials are needed to establish the advantages and safety of surgical
thrombectomy in patients with acute embolic occlusion of the carotid artery and ineffective or contraindicated systemic thrombolytic treatment.

List of abbreviations:

CT - computed tomography
CCA- common carotid artery
ECA- external carotid artery
ICA- internal carotid artery
MCA- middle cerebral artery
ACA- anterior cerebral artery
rt-PA- recombinant tissue plasminogen activator

The authors declare that they have no competing interests

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Figures

Figure 1. Thrombus in the left internal carotid artery (cavernous part)

Figure 2. Occlusion of left internal carotid artery

Figure 3. Preserved blood flow in left side intracranial arteries

Figure 4. Occlusion in region of internal carotid artery bifurcation

Figure 5. Occlusion of middle cerebral artery

Figure 6. Ischaemic focus in left brain hemisphere