**DOI: 10.23934/2223-9022-2018-7-2-160-164**

# THE REMOVAL OF A FOREIGN BODY FROM THE LEFT TEMPORAL LOBE AND STRUCTURES OF THE MIDDLE CRANIAL FOSSA

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**ABSTRACT** Penetrating brain injury is a rare but serious type of brain trauma. This article describes a successful surgical treatment of a victim with a wound of the left temporal lobe, great vessels and cranial nerves. Patients with damaged structures of the middle cranial fossa have to undergo surgical treatment in a specialized hospital with the possibility of comprehensive preoperative examination the availability of intensive care for neurosurgical patients with a full range of necessary medicines. Effective hemostatic materials are to be used to prevent intraoperative bleeding. In the absence of hemostatic materials, the operation is impractical.

**Keywords:** penetrating brain injury, temporal lobe injury, skull base trauma, a foreign metal body in the cranial cavity
**For citation** Lukyanchikov V.A., Kordonsky A.Y., Tokarev A.S. The removal of a foreign body from the left temporal lobe and structures of the middle cranial fossa. *Russian Sklifosovsky Journal of Emergency Medical Care.* 2018; 7(2): 160–164. DOI: 10.23934/2223-9022-2018-7-2-160-164 (In Russian)
**Conflict of interest** Authors declare lack of the conflicts of interests
**Acknowledgments** The study had no sponsorship
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BA — basilar artery
CT — computed tomography
CSF — cerebro-spinal fluid
FB — foreign body
GCS — Glasgow Coma Scale
ICA — internal carotid artery
MCA — middle cerebral artery
PCA — posterior communicating artery
TBI — traumatic brain injury

## INTRODUCTION

Penetrating trauma comprises 1.5-3% of all observations of severe TBI [1, 2]. The relative infrequency of the description of the course of treatment in patients with injuries to the main cerebral vessels is explained by the high mortality rate of victims with a similar trauma at the site of the accident [3, 4]. There are few descriptive articles for penetrating wounds of the brain with damage to large vessels [1, 4, 5, 7, 8].

So there are oblective difficulties in developing the diagnostic algorithm and choosing the optimal tactics for surgical treatment of patients with injuries to the main arteries of the brain. We report a rare clinical observation of a successful surgical treatment in a victim with a penetrating stab and slash wound of the left temporal lobe, structures of the base of the middle cranial fossa and lateral wall of the cavernous sinus.

Clinical observation.

A 32-year-old male patient P. entered the hospital by transfer from a regional hospital. According to the patient, he suffered the night before, having received a knife blow to the head from an unknown person. The first aid in the scope of the primary surgical treatment of the wound was provided in the medical institution at the place of residence. After the computed tomography (CT) of the head, the patient was transferred to the N.V. Sklifosovsky Research Institute for Emergency Medicine the next day after the injury.

The patient's condition was serious and stable upon arrival. Skin and visible mucous membranes were pale pink. Auscultation: vesicular respiration heard throughout all lung fields, no rales, respiratory rate 16 bpm. The heart sounds were muffled, the rhythm was correct, Ps 84 bpm. Blood pressure 130/50 mm Hg, soft abdomen, painless palpation. Unimpaired peristalsis. The functions of the pelvic organs were not violated. Neurological status: fully conscious (according to the Glasgow Coma Scale score 15), general cerebral symptoms in the form of a headache. Meningeal syndrome was not defined. Pupils OD=OS, photoreaction, corneal reflexes preserved. Paresis of the left abducens nerve, peripheral paresis of the orbital branches of the left facial nerve. Horizontal fine nystagmus. The face was asymmetric due to the edema of the soft tissues on the left, the left nasolabial fold was flattened, the tongue deviated to the left. Tendon and periosteal reflexes from the extremities D⩽S. Paresis of the left chewing muscle. Right-sided hemiparesis up to 4 points. There were no pathological reflexes. Insensitivity in the left near-orbital zone and in the region of the left half of the lower jaw bone. There was no aphasia.

Locally: a sutured cut wound 3.0 cm long without signs of bleeding.

The CT showed a foreign body (FB) in the left temporal lobe, which lied at the base of the middle cranial fossa and penetrated into the posterior cranial fossa, the intracerebral hematoma of the left temporal lobe with of a volume 19 $cm^3$ (without dynamics in comparison with the previous study) (Fig. 1 ).

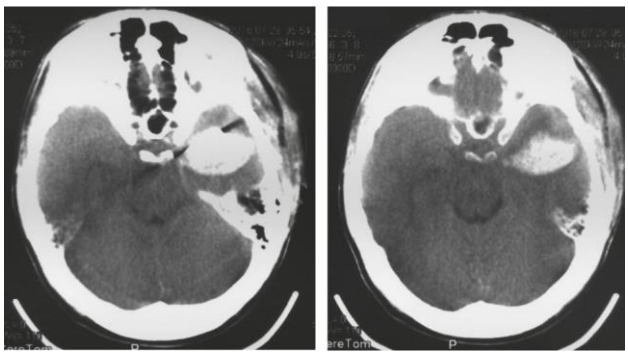

Fig. 1. Computed tomography (CT) of the brain, axial plane, soft tissue mode. CT of the brain upon admission: an intracerebral hematoma in the left temporal lobe of 19 $cm^3$, a foreign body (the knife blade) in the left temporal lobe, no lateral and axial dislocation

In CT angiography, it was revealed that the left internal carotid artery (ICA) was displaced by the foreign body medially, there were no defects in the contour of the left ICA and basilar artery (BA) (Fig. 2, 3).

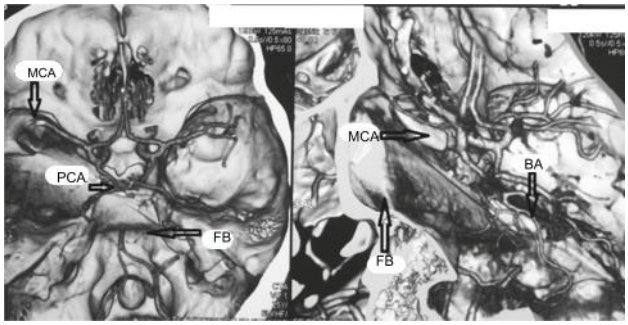


Fig. 2. Computed tomography and angiography of the brain, 3D-reconstruction. The metallic foreign body (the knife blade) is visualized, penetrating from the middle to the posterior cranial fossa.
Notes: MCA — middle cerebral artery; PCA — posterior communicative artery; BA — basilar artery; FB — foreign body

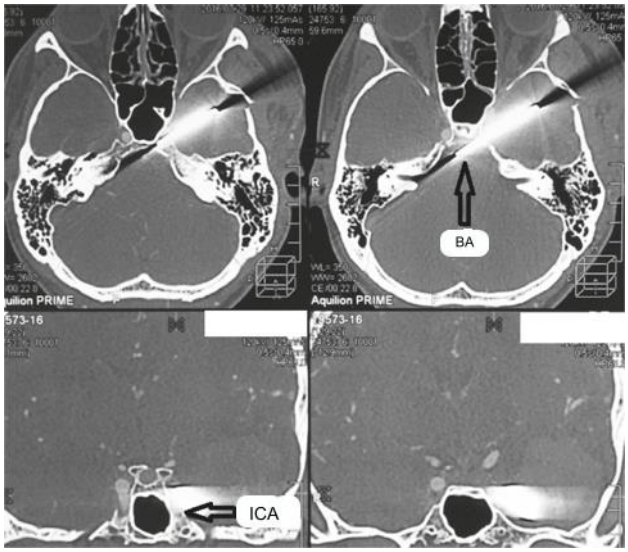


Fig. 3. Computed tomography (CT) of the brain with CT angiography, bone mode. The foreign body adjacent to the left internal carotid artery and displacing it medially is visualized. The tip of the foreign body is in the region of the posterior cranial fossa and is adjacent to basilar artery bifurcation.
Notes: ICA — internal carotid artery; BA — basilar artery

The patient underwent lumbar puncture: cytosis 600 cells/ μL, erythrocytes 2000 cells/ μL, glucose 8.8 mmol/l, lactate 3 mmol/l. Lumbar drainage was installed.

The urgent neurosurgical intervention, particularly trepanation, removal of intracerebral hematoma and FB were indicated for a patient with a penetrating head injury, the presence of FB (knife blade) in the area of the middle and

posterior cranial fossa to prevent intracranial arterial and venous bleeding, the development of an irreversible neurological deficit, the progression of the dislocation syndrome and the threat of death.

Despite the absence of continuous venous bleeding according to CT of the head, but considering the clinical data indicating damage to the left adductor nerve and the first branch of the left trigeminal nerve, the patient was expected to have a left cavernous sinus wound. To control bleeding, a wide range of hemostatic materials was prepared for the operation. Due to the CT data on the displacement of the cavernous section of the left ICA medially, it was impossible to exclude its damage, so it was suggested to control the bloodflow proximally and tie the cervical left anterior carotid artery and the left common carotid artery. As part of the FB perforated the apex of the pyramid of the left temporal bone and the clivus of the underlying bone, there was a risk of damage to the BA or superior cerebellar artery. Clips were prepared to control bleeding from these arteries. Before the beginning of the operation, in the case of massive blood loss, a cell-saver apparatus was connected.

The operation was performed on the 1st day after hospitalization (the 2nd day after the trauma). The first step was access to bifurcation of the left common carotid artery (Fig. 4), while the left common carotid artery and left ICA were clamped.

Fig. 4. Preoperative mapping. The incision on the neck is for the preparatory stage, the incision on the head is for the main stage. The supposed site of craniotomy is also shown

The second stage was performed by the expanded left-sided pterional craniotomy, the left temporal squama was additionally removed to the base of the skull. In the course of the wound channel in the brain substance at a distance of 25 mm from the cerebral cortex, FB was found, which extended to the base of the skull (Fig. 5). Skull base structures were visualized and prepared.

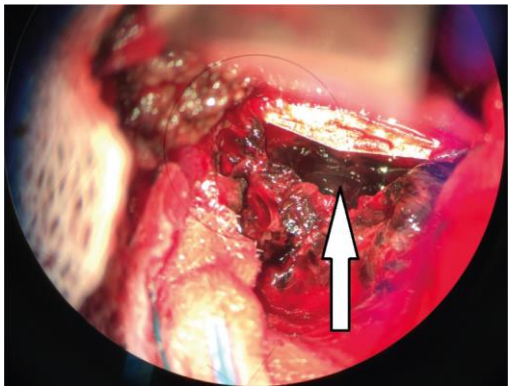

Fig. 5. Microsurgical stage (view through the operating microscope). The foreign body (marked by an arrow) is visualized, surrounded by detritus and hematoma

With the removal of FB (Fig. 6), intensive venous bleeding from the cavernous sinus developed, which was significantly reduced when the left ICA was tied. Hemostasis was carried out with hemostatic materials.

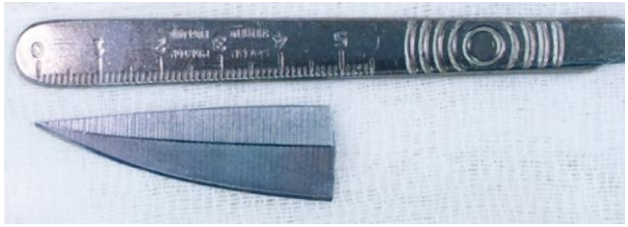

Fig. 6. The foreign body (a knife blade fragment) of 5 cm

Total blood loss was 3 liters, reinfusion was 1300 ml. Given the occurrence of cerebral edema, the operation was terminated by decompressive trepanation of the skull with free plasty of the dura mater.

In the postoperative period, the patient was subjected to antibacterial, anti-inflammatory, vascular, symptomatic therapy. Cerebrospinal fluid (CSF) was constantly drained through the lumbar drainage. After the surgery, the patient complied with bed rest; there were no episodes of bleeding and liquorrhea (Fig. 7).

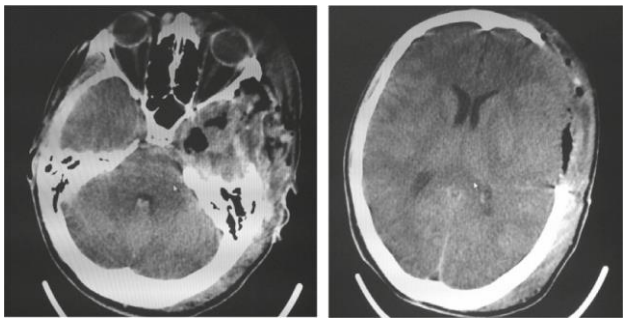

Fig. 7. Computed tomography (CT) of the brain, axial plane, soft tissue mode. CT of the brain after surgery (day 1): the hemostatic material is visualized in the operation area. Cerebral edema. No lateral or axial dislocation

On the third day after the operation, there was an increase in CSF cytosis to 3500/μL (neutrophils 80%), so the systemic inflammatory reaction developed, an increase in blood leukocytosis (18,400/μl) with a shift of the formula to the left, hyperthermia up to 39.0 °C. The situation was regarded as secondary meningitis. Antibacterial therapy was supplemented with intrathecal administration of Meronem 0.08 g/day. Sanitation of the CSF was observed on the 7$^{th}$ day after the operation.

The patient's condition at discharge was relatively satisfactory. The patient did not have any complaints. Neurological status: fully conscious, GCS score 15. Meningeal syndrome was not defined. Pupils OD=OS, photoreaction, corneal reflexes preserved. Paresis of the third and sixth nerves remained on the left. The face was asymmetric due to a skull defect. The tongue didn't deviate. Brisk tendon reflexes from the extremities D⩽S. There were no pathological reflexes. No confirmed paresis. Insensitivity in the left near-orbital zone and in the region of the left half of the lower jaw. Locally: the postoperative scar is good, the skin-aponeurotic flap does not bulge and pulsates (Fig. 8).

Fig. 8. A patient performing the Barre test before discharge

## DISCUSSION

Despite the large number of publications devoted to penetrating wounds to the head, hospitalization of the injured with damage to the structures of the base of the middle cranial fossa and the lateral wall of the cavernous sinus caused by knife impact is very rare.

To determine the correct tactics for treating a victim with a penetrating trauma to the head, the complete examination, including a thorough visual as well as neurological and instrumental studies is especially important, which fully confirms the given clinical observation [1, 7]. Thus, the presence of paresis of the left oculomotor and left abducens nerve, as well as insensitivity of the first branch of the trigeminal nerve, confirm the lesion of the lateral wall of the left cavernous sinus, where the trunks of all the listed nerves are located, although there were no direct X-ray signs of this injury.

At the slightest suspicion of damage to the main vessels, angiography is necessary. The method of choice, of

course, is CT angiography, since it is not always possible to establish anamnestically the material of FB [1, 7, 9, 10]. Thus, all those affected with injuries of the structures of the middle cranial fossa should receive surgical treatment in a specialized hospital with the possibility of comprehensive preoperative examination (CT of the head, CT angiography, digital subtraction angiography) and the presence of an intensive care unit for neurosurgical patients with a full set of necessary preparations.

When planning operations for the removal of IT, located near large vessels of the base of the skull, proximal bleeding control should be provided: the clamp is applied to the ipsilateral ICA or endovascular assistants are used, as well as devices for autohemotransfusion. An operating microscope is an obligatory condition for performing adequate intervention.

For the purpose of intraoperative bleeding control, it is necessary to use modern haemostatic materials, in the absence of which the operation is impractical. In the literature there is a description of such rare options of management for wounded large vessels, such as bypass and prosthetics, which also need to be taken into account when planning an operation.

## CONCLUSION

This example shows that the best results of surgical treatment of patients with foreign bodies in the cranial cavity (provided there is no active bleeding) can be achieved by transporting them to a specialized neurosurgical hospital, where full examination and thorough preoperative planning are possible. The removal of foreign bodies from the base of the skull is an extremely difficult task, requiring modern technical support.

The team of authors expresses gratitude to the employees of the Department of Computed and Magnetic Resonance Imaging of the N.V. Sklifosovsky Research Institute for Emergency Medicine.

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**Received on 11.01.2018**
**Accepted on 01.02.2018**