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CLINICAL CASE REPORTS

BONE FLAP RESORPTION AFTER CRANIOTOMY IN ELECTIVE NEUROSURGERY (CASE STUDY)

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ABSTRACT

Craniotomy is an integral part of modern elective neurosurgery which involves cutting a free bone flap to provide access to pathological intracranial structures with its reimplantation at the end of surgery.
Bone flap grafting in the trepanation window with various fixation methods in the end of elective neurosurgery in the absence of severe cerebral edema or cancer-induced bone destruction is a standard procedure that restores the skull shape, cerebrospinal fluid dynamics and cerebral perfusion.
According to the literature, the incidence of aseptic inflammation with subsequent resorption of the bone flap after craniotomy in elective neurosurgery is not clearly defined.
An analysis of medical publications in the PUBMED database showed few reports of bone flap resorption after elective craniotomy, and no reports were found after the search in the eLibrary database.
Thus, the number of reports on the bone flap resorption after craniotomy in elective neurosurgery is limited, and the pathophysiology of this process remains unclear.
However, the described complication of craniotomy can lead to the dislocation of a bone flap, the development of a local pain syndrome, a cosmetic defect, and disturbances in cerebrospinal fluid dynamics.
The article describes an example of partial resorption of a bone flap after craniotomy for the removal of meningioma in the middle third of the superior sagittal sinus, which required a number of repeated neurosurgical interventions. The treatment was finished with the removal of a partially resorbed bone flap and implantation of an individual titanium mesh implant.

Keywords:
complications of osteoplastic trepanation, complications of craniotomy, resorption of a cranial bone flap, cranioplasty, postresection defect, accesses in neurosurgery, complications in neurosurgery

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КЛИНИЧЕСКОЕ НАБЛЮДЕНИЕ

РЕЗОРБЦИЯ КОСТНОГО ЛОСКУТА ПОСЛЕ КОСТНОПЛАСТИЧЕСКОЙ КРАНИОТОМИИ В ПЛАНОВОЙ НЕЙРОХИРУРГИИ (СЛУЧАЙ ИЗ ПРАКТИКИ)

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РЕЗЮМЕ

Костно-пластическая краниотомия, предполагающая выпиливание свободного костного лоскута для осуществления доступа к патологическому интракраниальному очагу с его реимплантацией в конце оперативного вмешательства, является неотъемлемой частью плановых операций в современной нейрохирургической практике.

Завершение плановой нейрохирургической операции установкой костного лоскута в трепанационное окно с использованием различных методик фиксации в условиях отсутствия выраженного отека головного мозга или опухолевой деструкции кости является стандартной процедурой и обеспечивает восстановление формы черепа, ликвородинамики и перфузии головного мозга.

По данным литературы, частота развития асептического воспаления с последующей резорбцией костного лоскута после выполнения костно-пластической краниотомии в плановой нейрохирургии четко не определена. Проведенный анализ базы медицинских публикаций PUBMED указывает на единичные сообщения о резорбции костного лоскута после выполнения плановой костно-пластической краниотомии. При анализе в отечественной базе E-Library сообщений о резорбции костного лоскута после плановых костно-пластических краниотомий не обнаружено.

Вследствие ограниченного числа сообщений о резорбции костного лоскута после выполнения костно-пластической краниотомии в плановой нейрохирургии на данный момент остается неясной патофизиология данного процесса.

Тем не менее, представленное осложнение костно-пластической краниотомии может привести к дислокации костного лоскута, развитию локального болевого синдрома, косметическому дефекту, нарушению ликвородинамики. В статье описывается пример частичной резорбции костного лоскута после костно-пластической краниотомии, по поводу удаления менингиомы верхнего сагиттального синуса в средней трети, что в последующем в свою очередь потребовало проведения ряда повторных нейрохирургических вмешательств. Лечение завершилось удалением частично резорбированного костного лоскута с последующей имплантацией индивидуально изготовленного сетчатого титанового имплантата.

Ключевые слова:
осложнения костнопластической трепанациии, осложнения костно-пластической краниотомии, резорбция краниального костного лоскута, краниопластика, пострезекционный дефект, доступы в нейрохирургии, осложнения в нейрохирургии

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According to the literature, the main attention is paid to the analysis of risk factors for resorption of auto bone subjected to preservation, long-term storage in various environments and temperature conditions due to the inability to complete surgery by installing a bone flap (brain edema, decompressive craniectomy). Under these conditions, the risk of resorption of the bone flap can reach 23% (1, 2, 3).

In elective neurosurgery, bone-plastic craniotomy (BPC) involves sawing out a free bone flap to provide access to a pathological focus, followed by its fixation at the end of surgery. When analyzing the PUBMED database of medical publications, there are isolated reports of bone flap resorption after planned BPC (4, 5, 6). When analyzing the national E-Library database, there were no reports of resorption of the bone flap after a planned BPC.

We present a clinical case of partial resorption of the bone flap after planned BPC, which in the future will require several surgical interventions.

CLINICAL CASE

Patient S., born in 1981, has been complaining of headaches and right hemihypesthesia since December 2017. An MRI of the brain in January 2018 revealed a meningioma of the upper sagittal sinus in the middle third on the left side, measuring 41x51x45 mm. (fig. 1). Upon admission, the patient underwent spiral computed tomography (SCT) of the neck, chest, abdominal cavity and pelvis: no pathology was detected.

In January 2018 FGBU RNIOI performed BPC in the parietal region, meningioma removal (Simpson I). Excision of the Dura mater (DM) with tumor tissue was performed. The plastic surgery was made using an artificial DM "Durepair Regeneration Matrix Medtronic". The duration of the operation was 240 minutes. The bone flap is not changed, stowed in the trepanation window is fixed on the perimeter with the help of non-resorbable Medtronic craniofixes.

When performing the control SCT on 1 day after the operation, no hemorrhagic postoperative complications were detected, and no subaponeurotic accumulation of liquor was detected. In the bone mode, the satisfactory position of the bone flap is determined (fig. 2). the Postoperative period is without features. Histological verification — meningotheliomatous meningioma.

After 5 months of the initial surgery, the patient began to complain about the mobility of the bone flap. When examining the area of the postoperative scar without signs of inflammation, palpation determines the instability of the bone flap. The additional examination inflammation markers in the blood are not determined: white blood cell count is normal, relating to stab neutrophile leucocytes is not increased, young forms and myelocytes are defined, the level of CRP is not elevated, the procalcitonin test is negative. During the bacteriological study of blood, the growth of microflora was not obtained. When performing SCT, an epidural accumulation of liquor is detected in the left parietal region. In the bone mode, there is no bone flap disposition. Diastasis is determined along the perimeter of the bone flap (fig. 3). The bone flap was refixed using Medtronic craniofixes. Visually, the bone flap did not differ from the bones of the skull. The presence of mobility of the flap was seen as insufficient fixation with craniofixes. When performing the control SCT, postoperative complications were not detected, and a satisfactory position of the bone flap was determined in the bone mode (fig. 4). The postoperative wound was healed by primary tension, with no signs of inflammation.

Since January 2019, the patient again began to notice a backlash of the bone flap, a feeling of" crunch " when palpating the left parietal area. When performing SCT, areas of resorption of the bone flap are determined (fig. 5). Physical examination again determines the mobility of the bone flap. The skin covering above the flap and the postoperative scar are not changed (fig. 5). markers of inflammation in the blood are not detected.

In February 2019, a bone flap was removed in the left parietal region. Intraoperatively, the mobility of the bone flap and the foci of destruction are determined. A bluish-colored bone flap (fig. 5). During the bacteriological study of the scar tissue surrounding the bone flap and the bone flap, the

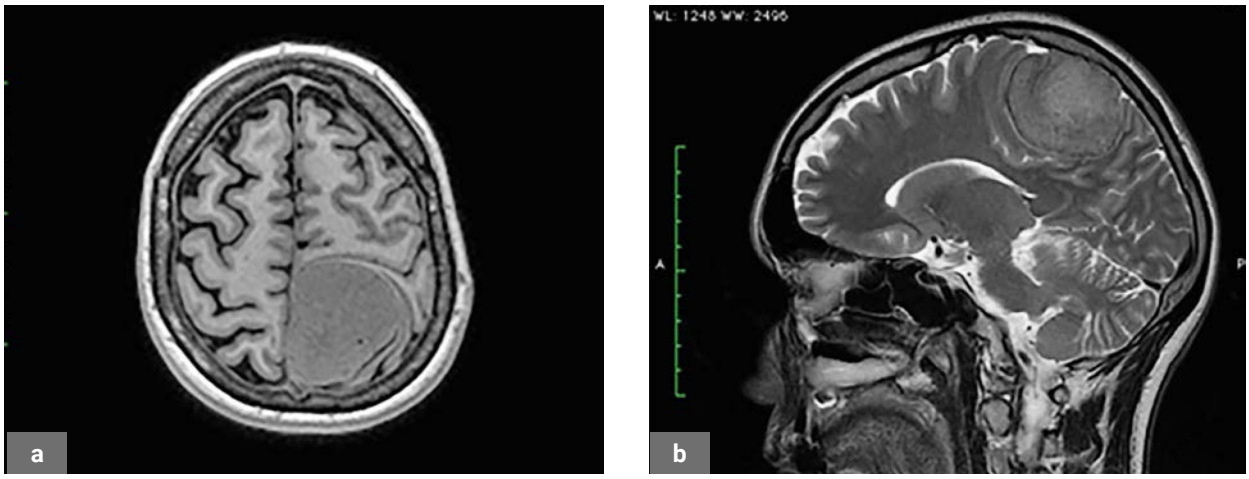

Fig. 1. On preoperative MRI of the brain from 01.2018, falx meningioma of the left parietal lobe is determined: a – axial projection in T1 mode; b – sagittal projection in T2 mode.

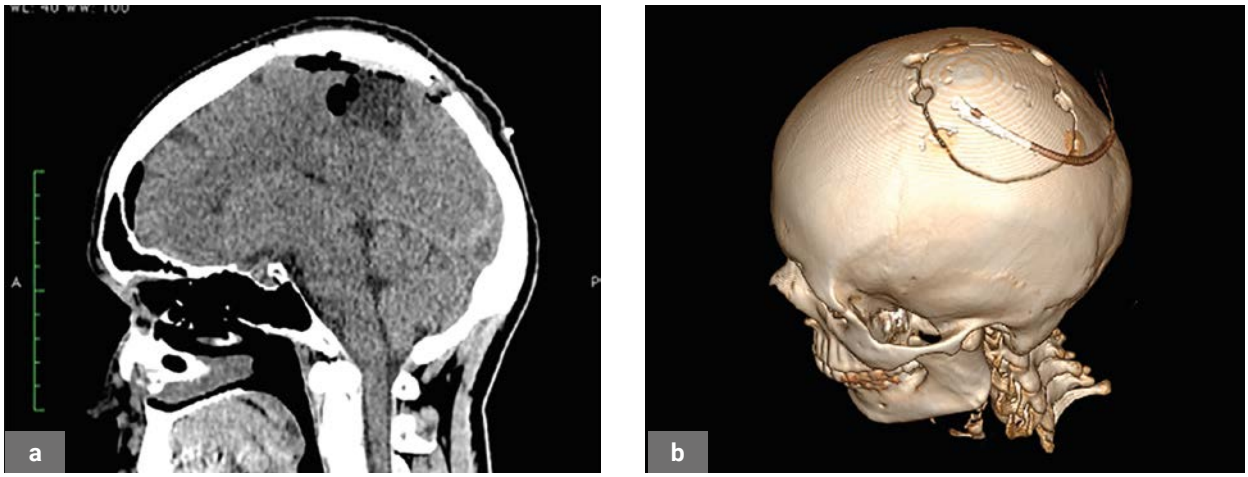

Fig. 2. Postoperative SCT of the brain: a – there are no postoperative hemorrhagic complications; b – during 3D reconstruction in the bone mode, the satisfactory standing of the bone flap is determined.

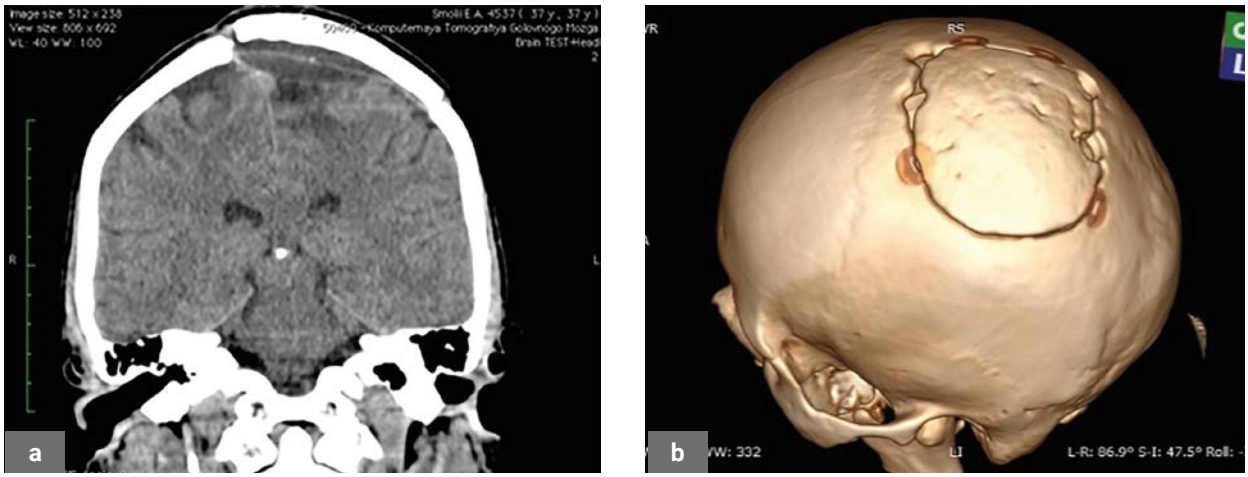

Fig. 3. SCT of the brain 5 months after surgery: a – determined epidural accumulation of liquor in the left parietal region in the projection of the bone flap; b – during 3D reconstruction, partial resorption of the bone flap along the line of the bone cut is determined.

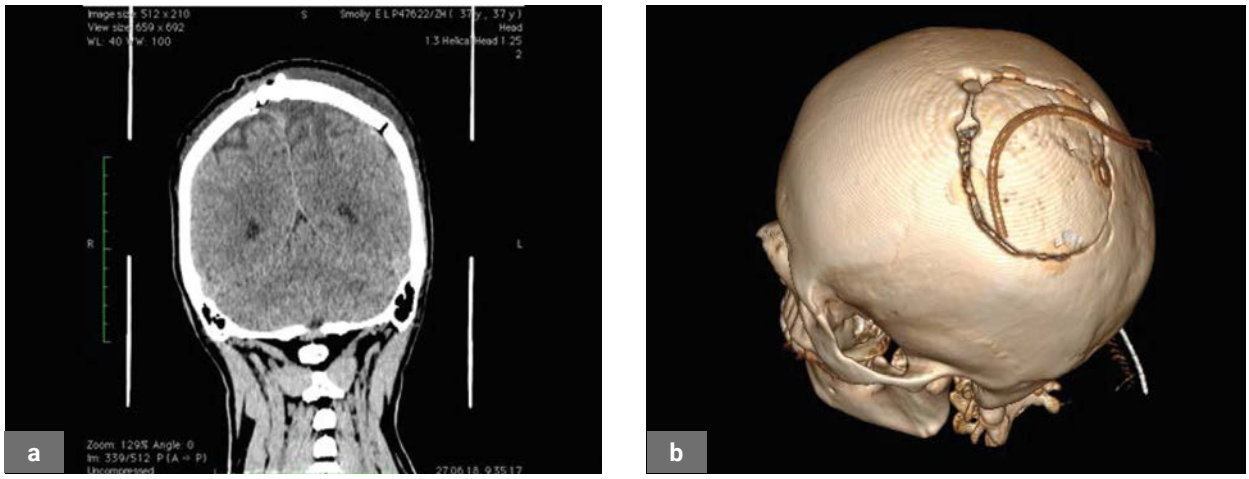

Fig. 4. Postoperative SCT of the brain after the operation of bone flap refixation using Medtronic craniofixes: a – there are no postoperative hemorrhagic complications; b – during 3D reconstruction in the bone mode, the satisfactory standing of the bone flap is determined.

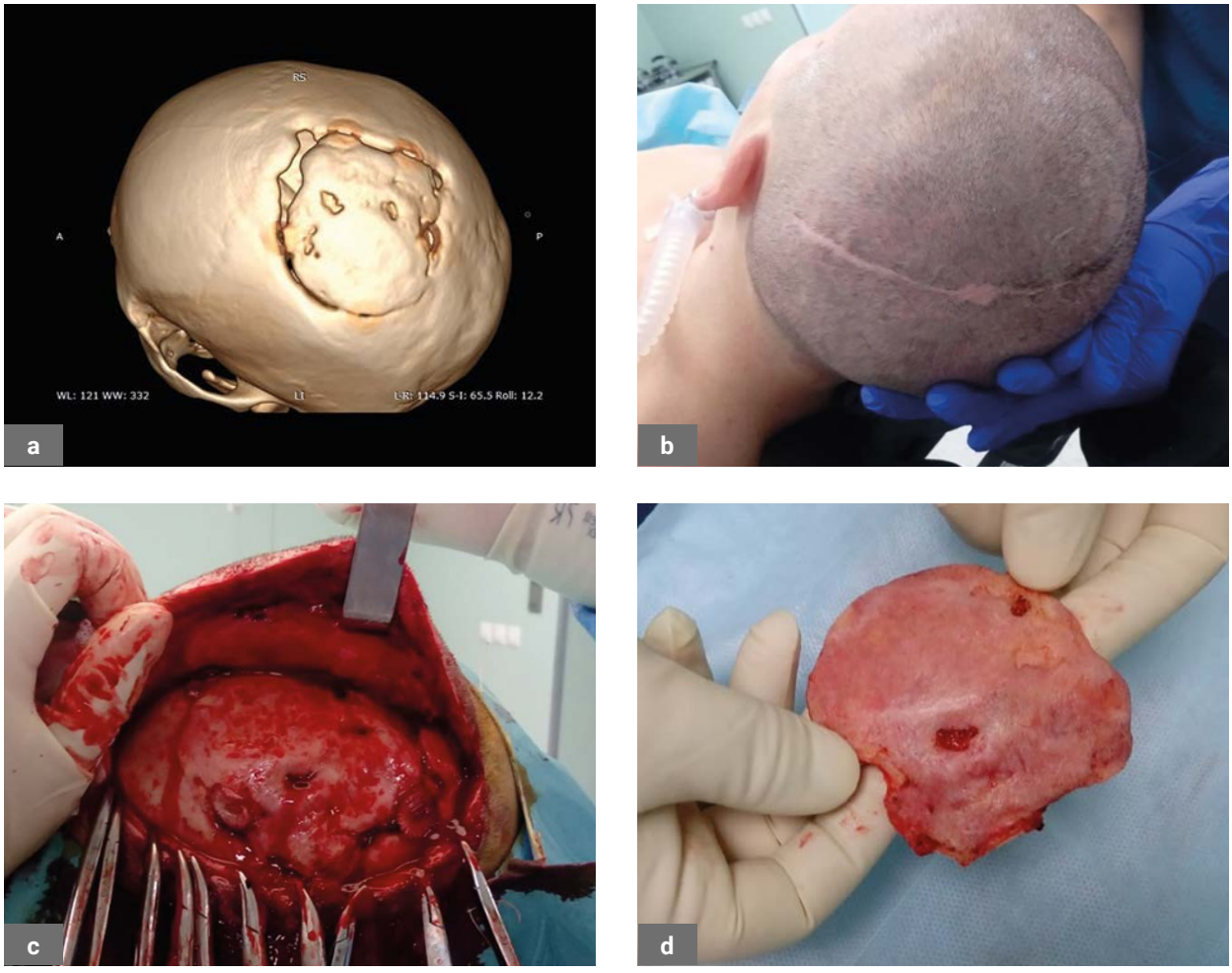

Fig. 5. a – 3D reconstruction in bone mode 6 months after repeated surgery. Bone resorption is determined along the line of the bone cut and in the thickness of the bone flap; b – the area of the postoperative scar and soft tissues of the head are not changed; c – intraoperatively determined mobile cyanotic flap, with multiple foci of resorption; d – removed bone flap.

growth of microflora was not obtained. Histological examination revealed non-specific changes in the bone tissue — pronounced dystrophy, foci of necrosis and small-focal hemorrhages, there are no signs of inflammation. The patient was discharged in a satisfactory condition. The planned step-by-step cranioplasty was completed using a custom-made titanium implant in August 2019.

DISCUSSION

In modern neurosurgery, most of the planned trepanations, in the absence of pronounced edema of the brain with prolapse into the trepanation window or tumor destruction of the bone, are completed with the installation of autostasis in the trepanation window using various fixation methods (7, 8). This procedure is standard and provides restoration of the shape of the skull, liquorodynamics and brain perfusion. Intraoperatively, it does not matter how the bone flap was processed and stored, since its blood supply is completely disrupted: the periosteum is detached, the diploic layer is crossed, and the perforants from the Dura mater are torn (10).

This clinical example shows partial resorption of the bone flap 12 months after performing BPC as planned. From the moment of CPT to the bone flap reimplantation, 2.5 hours passed. The wax was not used for hemostatic purposes. The bone graft was immersed in saline solution. Fixation of the bone flap was carried out using craniofixes company Medtronic.

Due to the limited number of reports of bone flap resorption, the pathophysiology of this process is not clear. A possible explanation for resorption can be observed in the presence of Gorham syndrome, in which progressive osteolysis is observed mainly in the tubular bones. During the examination of this patient, there were no additional foci of resorption or signs of osteoporosis in SCT of the skeleton.

Another likely predictor of resorption may be the use of wax during surgery or subaponeurotic accumulation of liquor in the postoperative period. As mentioned above, BPC destroys all sources of blood circulation in the bone, and the use of wax prevents the restoration of blood circulation after replantation through diploic veins. Subaponeurotic accumulation of liquor in the postoperative period also prevents the formation of scar tissue along the perimeter of the bone flap.

CONCLUSION

Nowadays, it is not possible to clearly determine the predictors of bone flap resorption after performing a planned BPC. The patient must be informed of the possibility of developing such a complication in the late postoperative period, and the neurosurgeon should avoid intraoperative use of wax and seal the Dura mater to prevent accumulation of liquor in the subaponeurotic space in the early postoperative period.

Authors contribution:
Rostorguev E.E. – research concept and design, manuscript writing, material processing, scientific editing.
Kuznetsova N.S. – collection, analysis and interpretation of data, surgical assistance, article preparation.
Yadryshnikova G.N. – collection, analysis and interpretation of data, article preparation.

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