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Comparative analysis of the results of surgical treatment of cranial arch bone defects.

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Abstract: The analysis of the results of surgical treatment of 67 patients with defects of the bones of the cranial vault previously operated for traumatic brain injury. Indications for surgical treatment are indicated depending on the size of the bone defect. Titanium mesh, 3D bone reconstruction and carbon composite material were used as bone-plastic material. In most cases, a good result was obtained - 86.5%.

Keywords: skull arch fracture, bone defect, titanium mesh, 3D reconstruction, carbon implant, primary cranioplasty, delayed cranioplasty, reconstructive surgery.

Relevance. Surgical interventions for the removal of brain tumors, traumatic brain injury are characterized by the formation of postoperative defects in the bones of the cranial vault. Despite the continuous creation of new techniques and materials for the reconstruction of cranial arch defects, the problem of cranioplasty is still relevant. To date, there is no consensus and algorithm for choosing materials and deadlines for cranioplasty.

When performing reconstructive surgical interventions, it is necessary to take into account the requirements for modern plastic materials:

1. Biological compatibility;
2. No carcinogenic properties;
3. Plasticity;
4. The possibility of sterilization and combination with adaptive technologies;
5. Compatibility with neuroimaging methods;
6. Resistance to physical and mechanical loads;
7. Low level of thermal and electrical conductivity;
8. Optimal cost;
9. Low risk of infectious and inflammatory complications.

The purpose of the study. The aim of this study is to improve the results of surgical interventions by using various (carbon, titanium mesh and 3D) implants for cranioplasty.

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Material and methods of research.

This work is based on the analysis of the results of surgical treatment of 67 patients with traumatic brain injuries treated in the neurosurgical department of the Andijan branch of the RNCEMP from 2013 to 2019. By gender distribution: men – 53 (79.1%), women – 14 (20.9%). The age of patients is from 25 to 55 years. According to the mechanism of the injury received: road – 34 (50.7%), beatings – 21 (31.3%), household – 9 (13.4%) and industrial – 3 (4.5%) patients. Due to the injury and signs of intracranial hematomas, decompressive bone resection trepanation of the skull was performed in all patients. According to the location of the skull arch bone defect: frontal – 5 (7.4%), temporal – 21 (31.3%), parietal - 39 (58.2%) and occipital – 2 (2.9%) patients. The reasons for the repeated treatment of patients were: persistent headaches, epileptic-like seizures, fear of repeated traumatization of the brain, the presence of a cosmetic defect.

All patients underwent a comprehensive clinical and instrumental examination, craniography, and multispiral computed tomography (MSCT) was performed in 62 (92.5%) patients. According to the size of the skull bone defects are divided into: small (up to 10 cm2) — in 25 (37.3%) patients, medium (10 to 30 cm2) — in 36 (53.7%), large (30 to 60 cm2) — in 6 (8.9%). Reconstructive surgical interventions for skull bone defects were carried out within a period of 24 days to 3 years from the moment of injury. Primary cranioplasty was performed in 3 (4.4%) patients, 48 (71.6%) were operated on within 6 months after the injury, 13 (19.4%) from 6 to 12 months, and 3 (4.5%) patients were operated on later than 12 months after the injury.

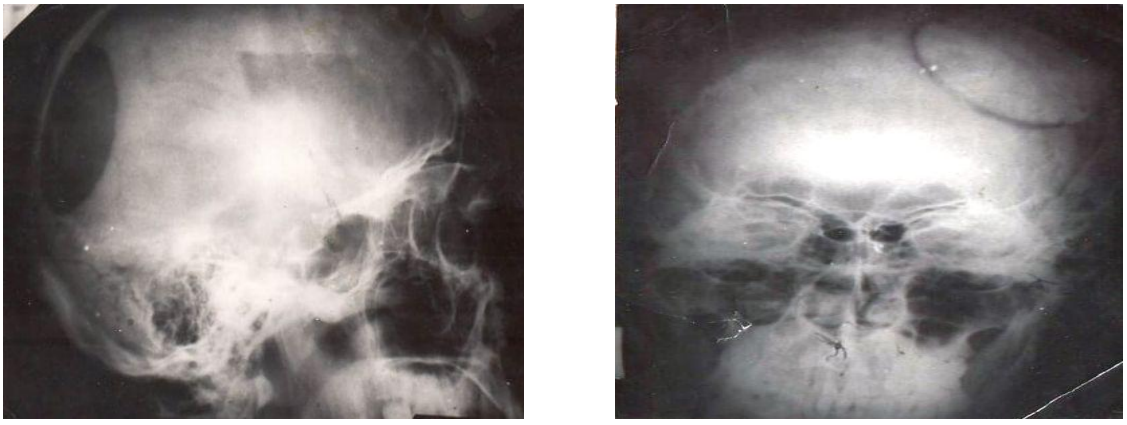

Fig.1 X-ray of a patient with a defect in the bones of the cranial vault (before and after surgery for defect repair).

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Primary cranioplasty was performed under the condition that there were no signs of significant damage to the brain substance and pronounced cerebral edema. The rest of the patients underwent repeated surgical interventions to eliminate defects in the bones of the cranial vault within the specified time frame.

In order to eliminate defects in the bones of the cranial vault, titanium mesh, 3D bone reconstruction and carbon implants of 2 types were used:

1 non-contrast carbon composite implants;

2 contrast carbon composite implants.

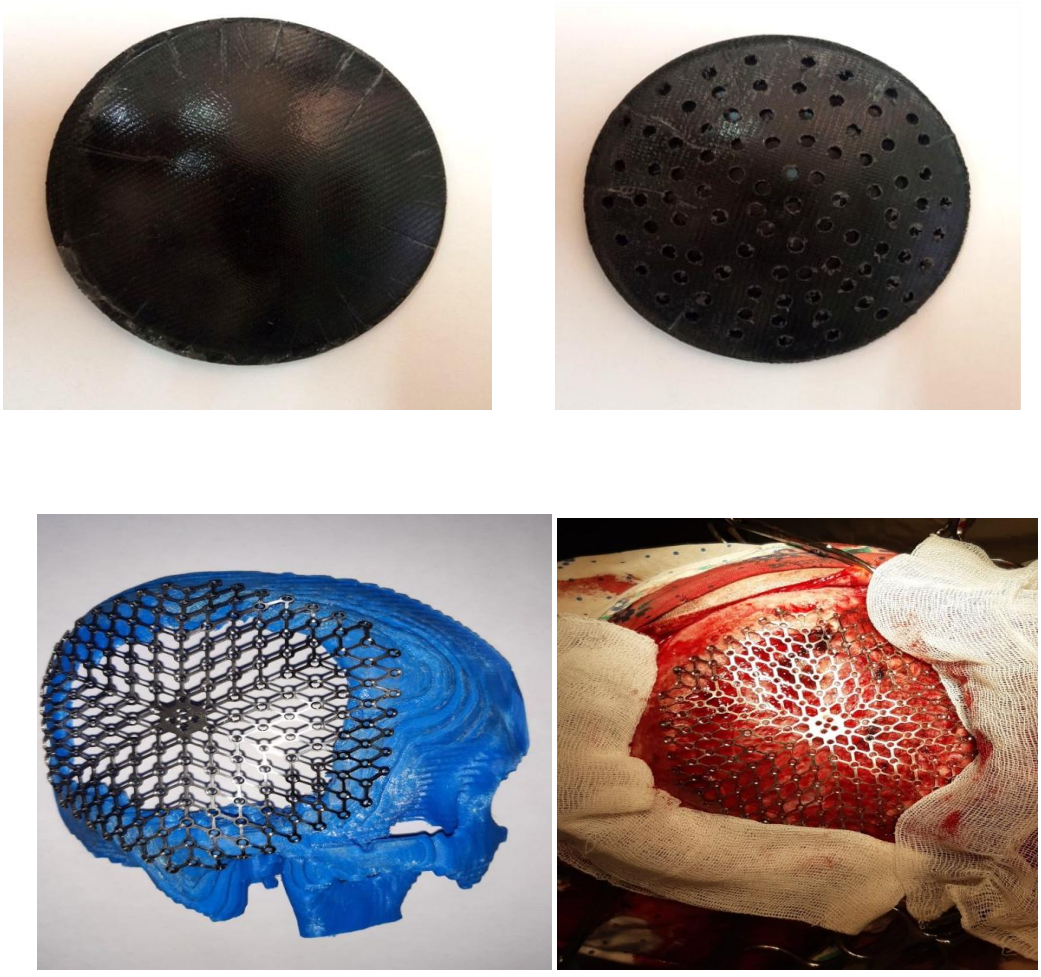

Fig. 3 Type of titanium mesh and its modeling.

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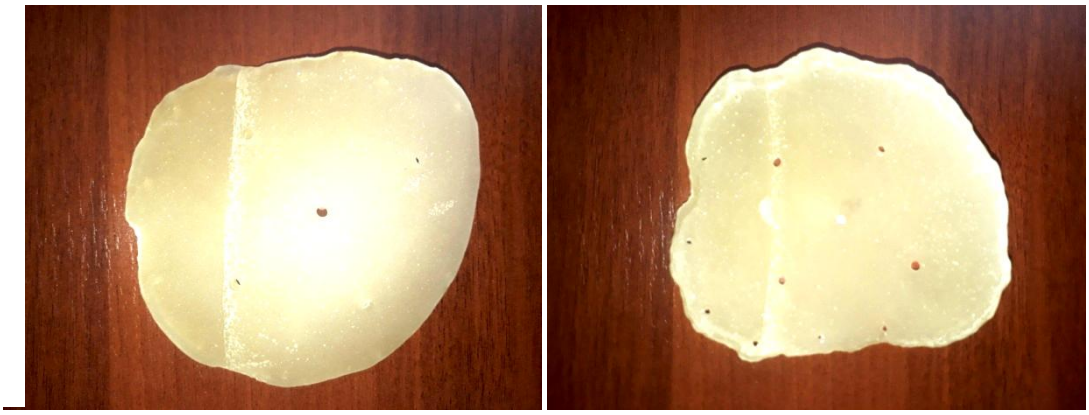

Fig.4 Three-dimensional trace of a polyetherketone implant.

All surgical interventions were performed under general anesthesia. Surgical technique for performing cranioplasty in all patients is standard. Initially, external meningeolysis was performed, followed by implantation of plates: 3D reconstructive (made individually for each patient) and carbon implants were installed in the defect joint to joint and fixed with bone sutures, titanium meshes after formation were installed in the defect and fixed with 6-8 screws. The sutures were removed 8-10 days after the operation.

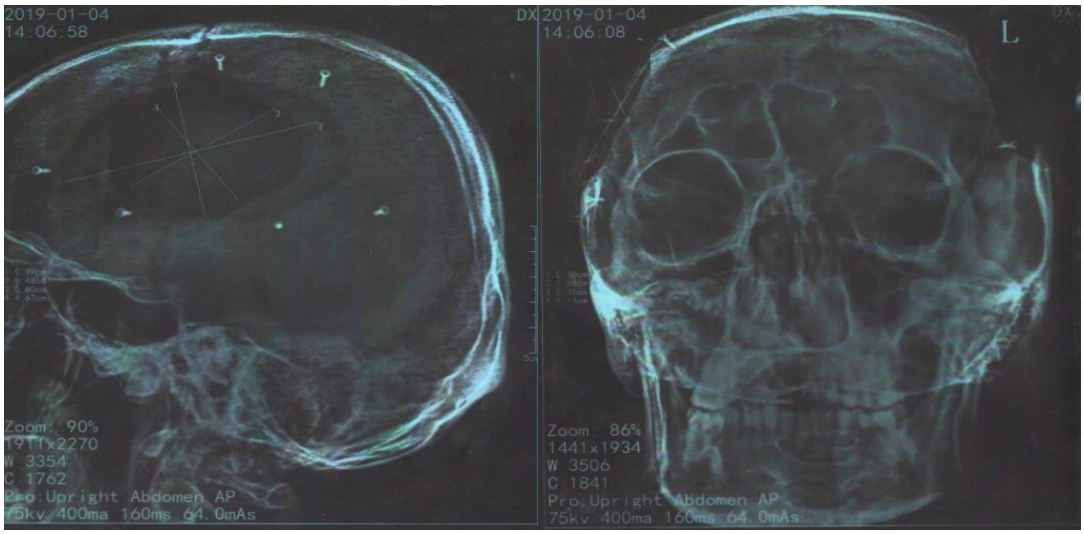

Fig. 3 Radiograph of the patient after surgery (fastening of the carbon implant with titanium screws)

Results and their discussion.

When analyzing the effectiveness and advantages of using implants, attention was paid to the possibility of intraoperative modeling of the implant shape. Titanium mesh and carbon implants require intraoperative formation, which lengthens the time of surgical intervention. 3D bone reconstruction made according to the contour of the defect can be implanted without spending time for modeling. The clinical efficacy of cranioplasty was evaluated by analyzing the quality of life of patients using a unified, generally accepted for patients in the intermediate and long-term period of TBI, the Glasgow outcome scale. Taking into account the single pathogenetic mechanism of the effect of the closure of the skull bone defect on the patient's condition, the clinical response to surgery was evaluated in all patients.

The restoration of the tightness of the skull and the elimination of the cosmetic defect caused the elimination of the “trepanned" skull syndrome. In the postoperative period, in order to identify the effect of cranipoplasty, electroencephalography was performed on all patients. In all observations, there was a decrease in diffuse rhythm disorganization with smoothing of the asymmetry of the cerebral hemispheres.

The cosmetic result of 58 (86.5%) patients was assessed as good, 9 (13.4%) — satisfactory, due to pronounced scarring of soft tissues. Reactive seroma occurred in 6 (20.6%) patients 3-7 days after surgery, single or double percutaneous aspiration was performed. After surgery, complications were observed in 4 (5.9%) patients, including hemorrhagic — in 1 (1.4%), infectious and inflammatory — in 3 (4.4%). Superficial wound infection was eliminated in 2 (2.9%) cases with the help of antibacterial therapy.

Conclusions 1. Analysis of the results of neurosurgical treatment of 67 patients for post-traumatic defects of the skull bones indicates the possibility of using titanium mesh, 3D bone reconstructions and carbon composite materials for cranioplasty.

2. Carbon implants are more applicable for defects of the temporal, parietal regions, titanium mesh for defects of the cranial vault, and 3D bone reconstruction in all departments and complex cranio-orbital defects of the bones of the cranial vault.

3. The use of implants is not indicated for patients in the presence of infectious and inflammatory complications with lesions of the soft tissues of the head, skull bones, central nervous system in the anamnesis, regardless of their prescription.

4. The inclusion of antibacterial agents in the structure of carbon materials will allow the use of these implants at a high risk of inflammatory complications. The introduction of

carbon composite material will create conditions for the use of this material in emergency and elective neurosurgery.

List of used literature.

1. Koporushko N.A., Stupak V.V., Mishinov S.V., Orlov K.Yu., Astrakov S.V., Vardosanidze V.K., etc. Etiology and epidemiology of acquired defects of the skull bones obtained with various pathologies of the central nervous system, and the number of patients in need of their closure, on the example of a large industrial city. Modern problems of science and education. 2019;(2):120.

2. Sinbukhova E.V., Kravchuk A.D., Chobulov S.A. The emotional state of the patient at the stage of reconstructive surgery. Vyatka Medical Bulletin. 2017;(2):85-7.

3. Likhterman L.B., Potapov A.A., Klevno V.A., Kravchuk A.D., Okhlopkov V.A. Consequences of traumatic brain injury. Forensic medicine. 2016;2(4):4-20.

5. Stupak V.V., Mishinov S.V., Sadovoy M.A., Koporushko N.A., Mamonova E.V., Panchenko A.A., etc. Modern materials used to close skull bone defects. Modern problems of science and education. 2017;(4):38.

6. Kravchuk A.D., Sinbukhova E.V., Potapov A.A., Stepnova L.A., Lubnin A.Yu., Danilov G.V., etc. Clinical and neuropsychological study of patients with traumatic brain injury before and after reconstruction of skull defects. Acmeology. 2018;(4):71-82.

7. Mishinov S.V., Stupak V.V., Koporushko N.A. Cranioplasty: a review of techniques and new technologies in the creation of implants. The current state of the problem. Polytrauma. 2018;(4):82-9.

8. Konovalov A.N., Pilipenko Yu.V., Eliava Sh.Sh. Technical features and complications of cranioplasty in patients after decompressive trepanation of the skull in the acute period of subarachnoid hemorrhage. Questions of neurosurgery named after N.N. Burdenko. 2018;82(5):88-95.

9. Potapov A.A., Konovalov A.N., Kornienko V.N., Kravchuk A.D., Lichterman L.B., Pronin I.N., etc. Modern technologies and fundamental research in neurosurgery. Bulletin of the Russian Academy of Sciences. 2015;85(4):299

10. Chobulov S.A., Kravchuk A.D., Potapov A.A., Lichterman L.B., Maryakhin A.D., Sinbukhova E.V. Modern aspects of reconstructive surgery of skull defects. Questions of neurosurgery named after N.N. Burdenko. 2019;83(2):115-124.