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Research Article

PLANNING AND SURGICAL TREATMENT OF A POST-TRAUMATIC DEFECT OF THE ORBITAL FLOOR

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ABSTRACT

This article devoted to the planning and surgical treatment of patients with post-traumatic defects of the lower wall of orbit. Despite a significant amount of work, developments concerning the choice of planning methods and surgical treatment are rather fragmentary and not systematized, which allows to orient the activity of the maxillofacial surgeon and scientific research to develop and improve methods of diagnostics, planning and surgical treatment of post-traumatic defects of the lower orbit wall.

KEYWORDS

Zygomatic-orbital, aesthetic, enophthalmos, binocular diplopia, limitation, maxillofacial surgery, nasal trauma.

INTRODUCTION

Fractures of the orbital floor are found among of all injuries of the middle zone of the face in 20-35% of cases, they take second place after nasal trauma [6,8].

Up to 91% of traumatic injuries of the zygomatic-orbital complex mainly occur at the working age of 18–50 years [2,9]. All of the above dramatically reduces the patient's quality of life, leading to his maladjustment in society and possible mental disorders. Despite a significant number of patients with this pathology, there are a number of errors in diagnosing the volume and nature of injuries, which does not allow choosing the optimal treatment tactics in the shortest possible time and leads to increase in potential complications.

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Damage to the lower wall of the orbit occupies a special position, since the requirements for the aesthetic and functional results of the treatment of this pathology are high. A significant number of unsatisfactory results of treatment associated with inaccurate diagnosis of damage to the lower wall of the orbit, the use of ineffective methods of treatment, lead to the development of various complications: enophthalmos, binocular diplopia, limitation of the mobility of the eyeball, neuritis of the infraorbital nerve, deformation of the lower wall of the orbit [5,11].

THE MAIN FINDINGS AND RESULTS

With the destruction of the bone walls of the orbit, its volume increases due to changes in the size of the maxillary sinus and cells of the ethmoid labyrinth. In this case, the redistribution of fiber from the orbit to the paranasal sinuses occurs, as a result of which the eyeball changes its position, its mobility is disturbed, and with the functional usefulness of the eye, the patient complains of doubling - diplopia. There are several options for changing the position of the eyeball. Hypophthalmos - downward displacement of the eyeball. It depends on the degree of bone dislocation, is a consequence of rupture and violation of the integrity of the suspension and fixation ligamentous apparatus of the eye, is considered as a manifestation of traumatic contusion syndrome in the orbit. Enophthalmos, or retraction of the eyeball, occurs as a result of an increase in the volume of the deformed orbit, prolapse of its contents through the area of a fracture or defect in the orbital tissue and extraocular muscles. In addition, scarring of the orbital tissue in the retrobulbar regions, pathological fixation of the Tenon's capsule or its derivatives with bone fragments at the site of a defect in the lower wall of the orbit, shortening of the extraocular muscles in the posterior parts of the orbit due to the scarring process leads to the retention of the eyeball in a deep position [2,4,10].

Improving diagnostic methods in maxillofacial surgery requires the introduction of more informative and ergonomic methods into practice, which has become possible thanks to computer technology.

Computed tomography (CT) occupies a dominant place in the diagnosis of orbital damage. With the help of CT, simultaneous visualization of the soft tissue and bone structures of the orbit is possible. It is possible to conduct a biometric study in the plane of interest, for example, strictly along the muscle diameter [7].

One of the perfect methods for diagnosing and planning treatment is 3D reconstruction, which accurately determines the nature and location of the injury [1,12]. The construction of three-dimensional graphical models was based on obtaining x-ray computed tomograms at minimum time intervals, which make it possible to create texture segmentation and three-dimensional reconstruction of organs.

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Surgical treatment of fractures and elimination of defects in the lower wall of the orbit is still an urgent problem of reconstructive surgery, occupying the minds of physicians of various specialties for a number of years.

Despite numerous studies, the surgical treatment of isolated fractures of the lower wall of the orbit, especially its defects and deformities, remains one of the significant problems of maxillofacial surgery, and its study continues.

The aim of our study was to improve the planning and surgical treatment of post-traumatic defects in the lower wall of the orbit.

Materials and research methods. In the department of plastic surgery of the multidisciplinary clinic of the Tashkent Medical Academy, 38 patients with post-traumatic defects in the lower wall of the orbit were operated on in the period from 2022 to 2023. Of these, men accounted for 82% and women 18%. The age of the patients varied from 20 to 45 years. In 28 cases, the causes of trauma to the middle zone of the face were road accidents, and in 10 cases, domestic trauma. All patients underwent a classic comprehensive examination upon admission, including diagnostics by related specialists (neurosurgeon, ophthalmologist, otorhinolaryngologist) and multislice computed tomography with 3D reconstruction in three projections. Scanning was carried out in automatic mode according to a special program embedded in the computer software of the tomograph. To determine the state of the lower wall of the orbit, sections were obtained in the frontal (coronal) plane. For a detailed assessment of the state of the infraorbital canal and extraocular muscles, images were obtained in the axial plane, layer collimation 0.6 mm, reconstruction interval 0.6 mm with multispiral reconstruction of the obtained images in sagittal and coronary projections. The planning of surgical elimination of a post-traumatic defect of the bones of the lower wall of the orbit is a virtual computer simulation with a special computer program that can accurately determine the nature and localization of the defect.

RESEARCH RESULTS

Posttraumatic deformity of the zygomatic-orbital complex with a defect in the inferior wall of the orbit was diagnosed most frequently in 22 (58%) cases. Isolated post-traumatic defects of the inferior wall of the orbit were diagnosed in 16 (42%) cases. The duration of the fracture ranged from 14 days to 6 months. All patients in the preoperative period had all the symptoms of post-traumatic deformity of the zygomatic-orbital complex, including orbital deformity and varying degrees of enophthalmos and hypophthalmos, as well as diplopia of a different nature. We observed limitation of eyeball mobility in the preoperative period in 75% of patients. When performing a standard radiography, there were no

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signs of a violation of the integrity of the infraorbital margin of the maxillary bone and the adjacent part of the zygomatic bone. CT scan in the frontal plane revealed an isolated linear fracture of the lower wall of the orbit in the middle third with a displacement of more than 2 mm and infringement of the lower rectus muscle in the fracture zone - in 30% with prolapse of retrobulbar tissue into the maxillary sinus - 48%, blood in the maxillary sinus - 59% . However, it was not possible to assess the state of the inferior rectus muscle, which was restrained in the fracture zone. The clinical and radiological (multispiral computed tomography with 3D reconstruction) examination made it possible to: clarify the location and nature of the damage, assess the state of the oculomotor muscles, the position of the eyeball, detect prolapse of the orbital tissue and clarify the size of the defect in the orbital walls, which is especially important for choosing an orbital implant and surgery planning. All patients in the preoperative period were made a computer 3D model of the orbit with a stereolithographic intraoperative template printed on a 3D printer. All patients underwent surgery under general anesthesia and included the steps to eliminate the deformity of the lower edge of the orbit using miniplates (75%), endoprosthesis of the orbital walls (80%), and the use of balloon endothesis (20%). The terms of surgical treatment of patients were as follows: on the 5th–14th day - 28 (73%) patients and after 1–2 months. after injury - 10 (27%). Surgical treatment of injuries of the zygomatic-orbital complex, isolated injuries of the inferior wall of the orbit was performed according to the technique developed by us, observing a number of features depending on the severity and localization of injuries, as well as the timing of the surgical intervention. The most important stage of the operation was the careful revision of orbital fractures, the release of the restrained oculomotor muscles, the elimination of prolapse of the orbital fat, and the most important is the plasty of the bone defect of the lower wall of the orbit, based on a stereolithographic intraoperative template, with which we determine the exact size, give the shape of the implant and the place of its fixation, and the implant itself is a porous titanium membrane. In the postoperative period, all patients were prescribed standard anti-inflammatory therapy, and rehabilitation was carried out together with an ophthalmologist to restore eye function. 14 days after the operation, diplopia persisted in 4 (16.6%) patients. Restoration of binocular vision in these patients lasted up to 2–3 months, which was associated with the nature of the eyeball injury and the late terms of surgical treatment.

CONCLUSIONS

Thus, the planning of reconstructive surgery using virtual computer simulation allows the use of stereolithographic intraoperative templates on a 3D printer. This technique helps to reduce the time of surgical intervention and increases the accuracy of

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planning and implementation of surgical treatment. Virtual computer simulation allowed us to accurately determine the scope of the operation, the selection and manufacture of an individual implant, as well as its fixation. Thanks to the stereolithographic model of the orbit, it is possible to determine the indications and contraindications for surgery, the technique of surgical intervention, low-traumatic access to the damaged area, in addition, it also helps to avoid postoperative complications.

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