TRANSMAXILLARY REDUCTION AND URETHRAL CATHETER BALLOON FOR BLOWOUT FRACTURES

BLOWOUT KIRIKLARDA TRANSMAKSİLLER YAKLAŞIM VE ÜRETRAL KATATER BALONU

Gökhan YALÇINER, Ahmet KUTLUHAN, Hüseyin ÇETİN, Hasan Mervan DEĞER, Akif Sinan BİLGEN, Behçet TARLAK

ABSTRACT

Aim: To retrospectively evaluate the effectiveness and reliability of transmaxillary approach by using urethral balloon catheter or by grafting for repair of orbital blowout fractures.

Patients and Methods: Eighteen patients who were operated for isolated orbital blowout fracture by transmaxillary route in Ankara Ataturk Training and Research Hospital between June 2006-Jan 2009 were evaluated. Twelve of the patients were treated by urethral balloon catheter after fracture reduction and 6 were treated by grafting.

Results: Postoperatively the patients followed up for the persistence of diplopia and the presence of enophthalmus between 2 months and 2 years. Except one persistent diplopia case, the results of all patients were satisfactory and no serious complication was seen.

Conclusion: Transmaxillary approach by using urethral catheter balloon or by using a bone or cartilage graft is a safe and effective method for the repair or orbital blowout fractures

Key words: Orbital blowout fractures, transmaxillary approach, urethral balloon catheter

INTRODUCTION

Orbital blow out fractures occur frequently in patients who have facial trauma. High velocity periorbital impact forces may be transmitted to the floor and even to the medial wall, causing serious displacement of the bone in these areas (1). The physical mechanism of orbital blow-out fractures has been a subject of debate for years by maxillofacial surgeons (2). In general 3 mechanism of injury have been proposed to explain the mechanism of these type of fractures: hydraulic theory, globe-to-wall theory and bone conduction theory. Based on current evidences; blowout fractures could be due to a combination of 2 or more of these mechanisms (2). In blow out fractures the force of impact is transmitted to the delicate bones of the orbital floor causing fractures in these bones without disrupting the continuity of the stronger inferior, lateral and superior orbital rims (3). This type of fractures may frequently result prolapse of orbital contents into the paranasal sinuses.
This may result in extraocular muscle entrapment with diplopia and enophthalmus. Visual loss from optic neuropathy, retinal detachment or hyphema also may occur (4).

The indications for and timing of surgical treatment, the type of the surgical approach and the materials of reconstruction remain controversial (5,6).

Multiple surgical approaches have been described in the literature (transconjuctival, subciliary, transmaxillary) and different types of materials have been used for reconstruction (bone, cartilage, titanium, silicone, resorbable mesh, and nylon foil) (5-8). Nevertheless, these injuries continue to be some of the most complex and demanding reconstructive challenges in maxillofacial surgery (6).

In this article we presented 18 isolated orbital blow-out fracture cases treated by transmaxillary endoscopically assisted reduction and urethral catheter balloon or bone/cartilage graft emplacement. Indications, technique and results are discussed.

PATIENTS AND METHODS

Eighteen patients who were operated for isolated orbital blow-out fracture by transmaxillary route in Ankara Ataturk Training and Research Hospital between June 2006-Jan 2009 and whose required data were obtained from their files were evaluated in this article. The youngest of the patients was 16 years old and the eldest was 55. The age, gender distribution and etiology of the injuries are seen in Table 1.

<table>
<thead>
<tr>
<th>Description of the sample</th>
<th>Total</th>
<th>18 patients</th>
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<tbody>
<tr>
<td><strong>Age</strong></td>
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<td></td>
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<tr>
<td>Mean</td>
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<td>16-20</td>
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<tr>
<td>Male</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>4</td>
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<tr>
<td><strong>Mechanism of injury</strong></td>
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<td>Traffic accidents</td>
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<tr>
<td>Interpersonal violence</td>
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<tr>
<td>Industrial accidents</td>
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<td></td>
</tr>
<tr>
<td>Activities of daily life (falls etc.)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Sports injuries</td>
<td>1</td>
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</tbody>
</table>

All of the patients were evaluated by axial and coronal CT. The main indications for the operation were serious herniation of the bony orbital floor with or without entrapment and diplopia in 12 patients, diplopia only in 5 patients without serious displacement and exophthalmus in 1 patient. Most of the patients were operated in first week after injury. The time interval between the injury and operation and anesthesia type are seen in Table 2.

| The time interval between injury and operation | 1 WEEK | 14 patients |
|                                               | 2 WEEK | 3 patients |
|                                               | 4 WEEK | 1 patient  |
| Anesthesia                                   | Local  | 12 patients |
|                                               | General| 6 patients  |

All of the patients were operated by transmaxillary route. After the incision in gingivolabial sulcus the soft tissues over the maxillary anterior wall is elevated. The thin bone of the anterior face of the maxilla is cut with a saw in approximately 1 cm height and 2 cm width (just inferior of the infraorbital nerve). This bone fragment is protected to be used as a graft if necessary. Interior of the sinus was inspected and carefully aspirated by protecting the herniated orbital fat. Orbital flow is then examined by endoscope to decide if simple reduction or grafting necessary. The non-comminuted fractures, like trap door were reducted by an elevator in 12 cases. Then the reduction was reinforced by an urethral catheter balloon which was inserted by inferior maxillectomy way. The balloon was inflated with 10-15 cc saline solution and left in place for 10-15 days (Figure 1).

![Figure 1- The inflated balloon in maxillary sinus.](image-url)
If orbital floor is defective or comminuted, it is reconstructed by graft by the assistance of endoscope. The orbital soft tissues closed to defect had been elevated before the insertion of the graft. The maxillary anterior wall bone graft was used for this purpose in 3 patients and septal cartilage graft was used for 3 patients.

RESULTS

Post operatively the patients followed up for the persistence of diplopia and the presence of enophthalmus between two months and two years. Except one persistent diplopia who was admitted to us 1 month later after the injury and treated by balloon technique, there were no serious complications. Nearly all of the patients were complained from numbness over the check in early postoperative period but after eight weeks their complaints were reduced or recovered.

DISCUSSION

Management of the orbital blow-out fractures involves several issues such as the indications and timing of surgical treatment, how to access to the orbital floor and ideal reconstruction material.

The management of blow-out fractures like other facial fractures begins with the establishment of an accurate fracture diagnosis (3). Besides axial CT sections, coronal reformats are critical in the evaluation of the orbital floor (3) (Figure 2). The primary determination to make when assessing the CT scan is whether the orbital fracture is an isolated blow-out fracture or part of larger fracture pattern (3). If the orbital fracture consists only of the orbital floor then the treatment for orbital blow-out fracture applies.

The main indications to treat isolated orbital wall fractures are: 1. Entrapment of any of the extra ocular muscles (3). Entrapment of the muscle can cause ischemic damage and permanent dysfunction can occur if the fracture is not reduced and the muscle released expeditiously. Entrapment is diagnosed on clinical examination and cannot be directly assessed on CT. Even minimally displaced orbital floor fractures may result in trapdoor effect and can cause entrapment of the muscles. (Figure 3-4) 2. Diplopia observed by ophthalmologic examination. 3. Orbital injuries that are likely to produce enophthalmus are those, in which orbital floor disruption exceeds a total area of 2 cm², the bone volume changes exceed 1.5 cc (5% of orbital volume), or significant fat and soft-tissue displacement. In contrary to the last opinion Pautke et al. observed in their volume measurement by MRI and multislice CT that; in enophthalmic patients who had orbital floor reconstruction there were, significant bony orbital volume increase but hardly any fatty atrophy could be depicted by them (9). So orbital fat and soft tissue herniation may be a relative indication for operation. In our series the operation indications were serious bony orbital floor displacement in 12 patients, as previously mentioned serious bony orbital floor displacements are one of the main causes of enophthalmus and it's not acceptable a wait and see attitude.

Figure 2- Coronal CT showing a typical orbital blow-out fracture.

Figure 3- A minimally displaced bony fragment causing diplopia.
prevent irreversible muscular degeneration and for restoration of motion in the affected eye. Canto D at all claims that: delayed orbital floor fracture repair (15-29 days after trauma) is as effective as early repair in regard to postoperative motility, diplopia, and time to resolution but is needed more technically challenging. Therefore patients who were present early, and will predictably require surgery should be operated within 1 to 2 weeks to facilitate their repair (11). We also operated 17 of 18 patients in 1 to 2 weeks after trauma. Eyelid or periorbital swellings don’t constitute an impediment for early transmaxillary repair of the fractures.

In the presence of hyphema or poor light perception, the surgical repair should be postponed until these problems will recover or clarify. In these cases early surgical repair may worsen the state and carries potential risk of blindness.

Several surgical approaches have been described in the literature (transconjunctival, subciliary, transmaxillary and endonasal) for the repair of orbital floor fractures (6-13).

Traditional open approaches (i.e., transconjunctival and transcutaneous) can result in lid malposition such as entropion and ectropion (4). Reduction of the herniated tissues is also difficult or sometimes impossible by these approaches.

Several surgeons have described a transnasal endoscopic approach to orbital fractures (4-13). They describe endoscopic placement of balloon catheters, threaded through the nose to reduce the fracture and maintain reduction for up to 10 days (4). This method may be suitable for trapdoor fractures of orbital floor; however it’s not suitable when orbital floor is comminuted or defected and a graft is required.

On the other hand whether a true body cavity is associated with the past being threaded may have a significant impact on the ease of the various techniques (14). Maxillary sinus represents a real cavity that can be used to enhance visualization of the fracture and better facilitate to the placement of an implant (14). By transmaxillary approach assessment of the fracture site by endoscopes, reduction of the herniated tissues and hinged, trap door fractures is easy. To maintain the reduction, the urethral catheter balloon inserted by inferior meatal antrostomy is an effective and safe method.

If comminution or defect present on the orbital floor or the previously excised bone of the anterior wall can be used as graft. From each sides of the defect 1 mm greater sized graft is suitable for repair. A graft larger then this is difficult to insert. With this technique, we didn’t encountered any serious complication but only mild numbness on the cheek. Except one persistent diplopia, we haven’t seen any enophthalmus or eye movement disturbance.

The ideal material for orbital reconstruction remains controversial (6). Resorbable implants are prone to produce foreign body reactions, implant exposure may occur and only fibrous connective tissue remaining after resorption (6). Wang S et al. emphasized that: porous polyethylene and titanium mesh are ideal orbital floor repair materials (15). Talesh KT et al. claims that: nasoseptal cartilage is an easily accessible, abundant and autogenous source and gives minimal donor site morbidity (16). In our series we used nasoseptal cartilage for 3 cases and bone from anterior wall of the maxillary sinus for 3 cases. By transmaxillary approach the anterior wall of the maxillary sinus can be used as graft. We hadn’t seen any soft tissue herniation or facial depression in our cases as claimed by some authors. If this bone grafts size is small for repair of the defect we also used septal cartilage. According to us, autogenous bone and cartilage grafts are ideal materials for repairing orbital defects because; they can be easily accessed and don’t cause foreign body reaction.

Although CT can provide precious information about orbital blowout fractures, it can be sometimes
deceiving the most effective way to determine the right treatment method may be to see the fractures site directly through endoscope. In this research we wanted to emphasize that: significant portion of blowout fractures can be treated with simple reduction and balloon technique; and graft can be used if necessary.

In conclusion transmaxillary approach by using urethral catheter balloon or by grafting is a safe and effective method for repair of orbital floor fractures.

REFERENCES