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Case report

Repair of the orbital floor fractures: The endoscopic trans-maxillary approach as minimally invasive approach: A case-report

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ABSTRACT

Introduction: The endoscopy in orbital surgery provides, similar to other surgical fields, the option of combining an extended view of the surgical field with minimally invasive approaches; also allows an excellent functional and esthetic results. *Trans*-maxillary endoscopy of the orbital floor offers excellent visualization of the posterior bony shelf and confirms that the implant rests securely in place.

Presentation of case: The authors report a ten years-old male child, reported to the oral and maxillofacial surgery department, Ibn Rochd university hospital, Casablanca, Morocco. The child was diagnosed for left orbital floor fracture, complaining of orbital trauma due to road accident. The injury occurred at the left orbit level. There was no general story of any disease.

Discussion: In more than 40% of all the facial fractures parts of the orbital rim or/and the internal orbit are injured with a variety of fracture patterns. Accurate assessment is required in order to correct any bone defects or displacements. The surgical approaches have become more reduced offering better control of orbital pathological processes. Orbital lesions are precisely localized through imaging. Also, the approach decision depends on location, size and vascularization. No consensus exists regarding the timing of the repair, the repair technique and the optimal implant. In this case presentation, the defect on the orbital floor was extended by mobilization of the fragments. A combination of incisions was necessary due to the change in the dimensions of the defects intraoperatively and entrapment of orbital tissue by the placement of an implant.

Conclusion: The endoscopic approaches provide excellent visualization and safe from eyelid complications with no visible scar when secondary open fracture reduction is avoided. Also; the rate of postoperative complications are reduced: optic nerve injury, orbital apex injury.

1. Introduction

The endoscopy in orbital surgery provides, similar to other surgical fields, the option of combining an extended view of the surgical field with minimally invasive approaches [1]; also allows an excellent functional and esthetic results [2]. There are different surgical approaches (Extracranial, Neurosurgical and Combined approaches) to the orbit depending of its tumoral, traumatological or malformities nature [3]. Norris and Cleasby et al. performed the first attempts of endoscopic access to the orbit. This work was completed by Braunstein and his colleagues in 1990 [4].

The surgical treatment of orbital floor fractures is always a current topic of debate with much controversy. Several approaches have been described in the literature including lower eyelid incision, conjunctival incision and endoscopic approaches [5,6]. No consensus exists regarding the timing of the repair, the repair technique and the optimal implant.

This paper focuses on the treatment of orbital floor fractures, with special emphasis on endoscopic approaches, which allow for excellent functional and esthetic results while completely avoiding problems related to external approaches.

2. Case presentation

Our work is a single case report and has been reported in line with

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the SCARE criteria. [7]

A ten years-old male child, presenting at the department of oral and maxillofacial surgery, university hospital of 20 august, Casablanca, Morocco. Complaining of orbital trauma due to road accident. The injury occurred at the orbit level. There was no general story of any disease.

The ophthalmological examination of visual acuity, pupils, and intraocular pressures were normal. The enophthalmos and diplopia were present at moment of examination. Diplopia can be tested by moving a finger in all nine directions and to verify if patient has double vision.

A facial CT scan was performed, which reveal blow-out floor fracture (BOF); 2 cm × 3 cm. The defect of the orbital floor and/or of the medial wall >2 cm^2 with preservation of the bony ledge at the medial margin of the infraorbital fissure (Class III Jaquiéry classification) (Figs. 1–3).

The Hess Lancaster screen test was performed, showing an entrapment of the inferior rectus.

A preoperative CT scan was done, documenting the size of the defect 1 cm × 2 cm, and a slight enophthalmos.

A preoperative ophthalmologic consultation was done.

The patient was informed and consent obtained if the endoscopic approach unable to correct and release the entrapment the sub-ciliary approach will be indicated. The endoscopic approach was chosen as it provides excellent visualization and safe from eyelid complications with no visible scar when secondary open fracture reduction is avoided.

The surgical treatment is indicated in our case by the presence of the following signs:

- persistent vertical diplopia
- CT scan evidence of a hernia of the *endo*-orbital content
- positive forced duction test
- The maxillary sinus bone represented a suitable choice, but in this case, the authors opted to titanium mesh reconstruction.

The patient was undertaken under general anesthesia using the trans-maxillary endoscopic approach using a rigid video-endoscope with

Fig. 1. (A) Coronal view: left Blow out fracture with displacement of the orbital floor.

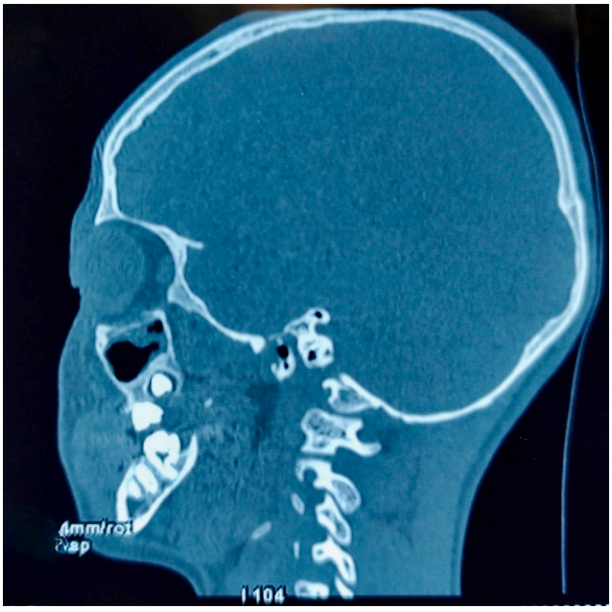

Fig. 2. (B) Sagittal view: Blow out fracture with displacement of the orbital floor.

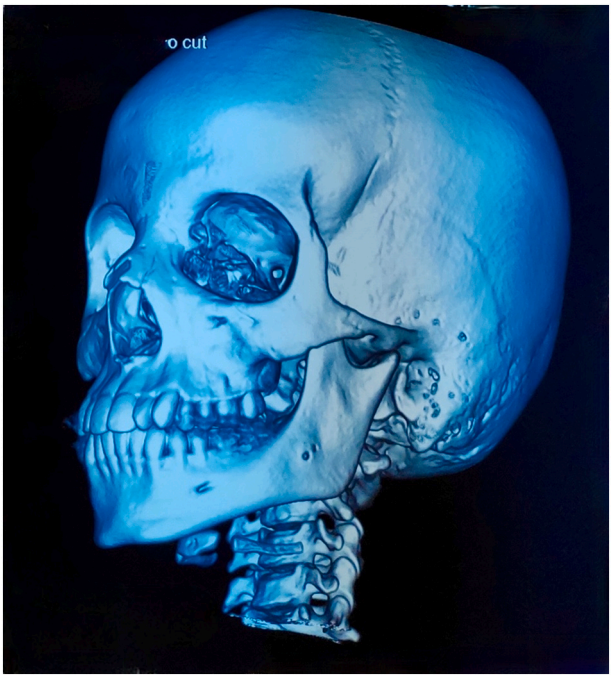

Fig. 3. 3D reconstruction showing left BOF.

a 30-degree tip, the steps followed are:

- A conservative mucosal dissection to clearly visualize the bony defect
- A complete removal and mobilization of all bone fragments that could be pushed into the orbital cavity
- reduction of the hernia
- A meticulous reconstruction of the orbital floor with a mesh.
- A verification of the location of the titanium mesh (video) (Figs. 4–8).

As a postoperative complication we noted: persistent diplopia with

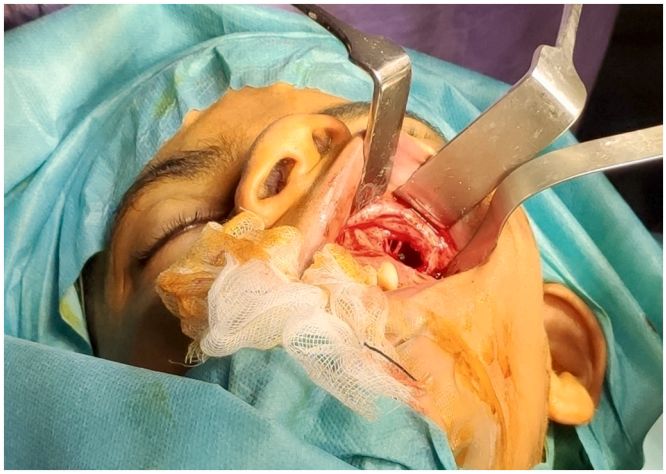

Fig. 4. The antral trans-maxillary approach toward orbital floor.

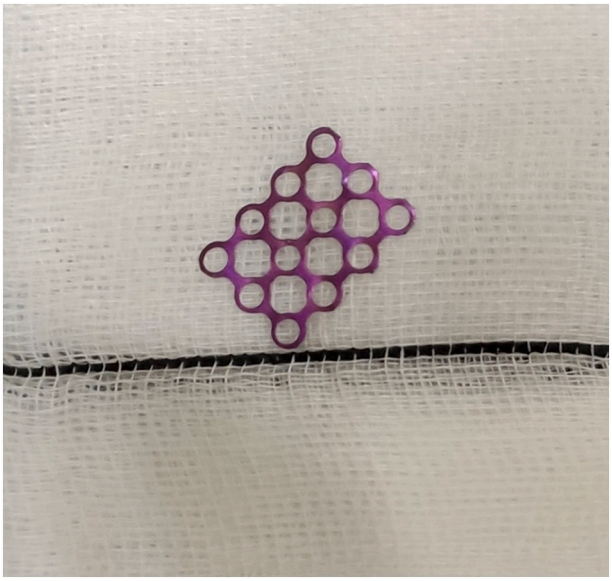

Fig. 5. Titanium mesh for floor orbital fracture reconstruction.

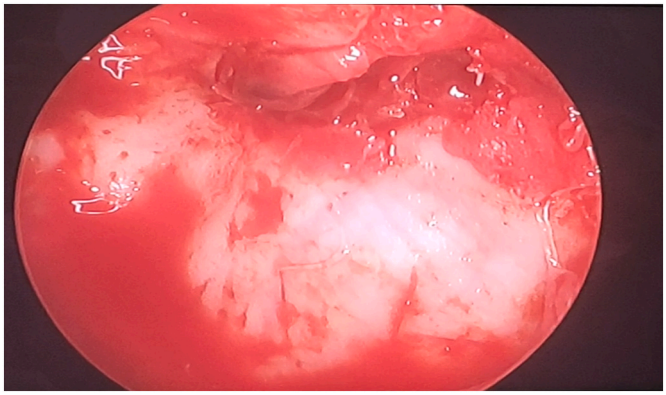

Fig. 6. Intra-sinusal musculo-fatty hernia.

correction of enophthalmos. The cheek numbness following the procedure was noted, released in the 7th day. Patients underwent a high-resolution CT scan 24 h after the operation.

A combination of incisions (sub-ciliary incision) was necessary due

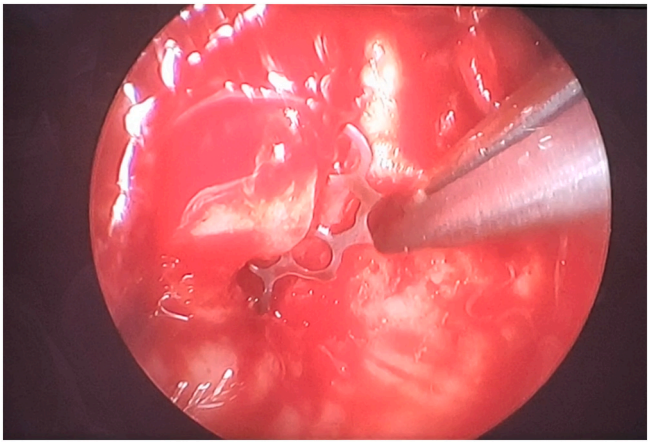

Fig. 7. Releasing of hernia and reconstruction of orbital floor by mesh titanium.

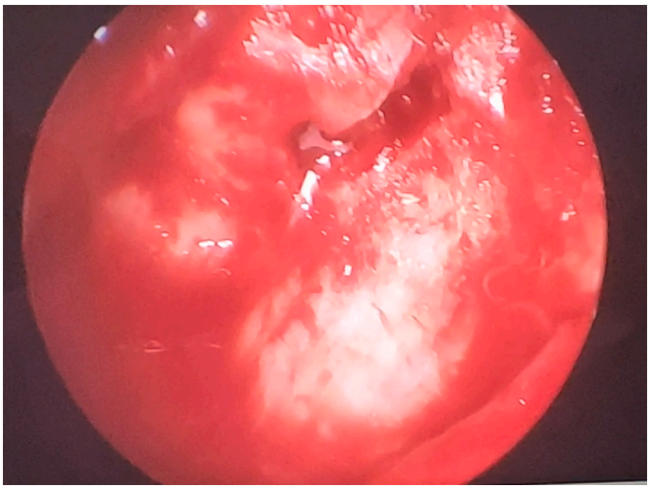

Fig. 8. Verification of the location of the titanium mesh.

to the change in the dimensions of the defects intraoperatively and entrapment of orbital tissue by the placement of an implant.

The postoperative follow-up was simple. Patient was reviewed at 1, 2, 4 weeks after surgery. The healing of the approach was good.

3. Discussion

In our context, the orbital fractures are common injuries. There may be an association with other fractures such as: orbito-zygomatic fracture, fracture of the naso-orbito-ethmoidal complex (NOE injuries).

The floor fracture is no more than a decompression of the increased intra-orbital pressure due to the anterior shock during orbital trauma. This hyper-pressure can lead to herniation of the orbital contents through the fracture with increased intra-orbital volume.

In more than 40% of all the facial fractures parts of the orbital rim or/and the internal orbit are injured with a variety of fracture patterns. The orbit is a bony cone-shaped 3D pyramid with 4 walls. Accurate assessment is required in order to correct any bone defects or displacements. The surgical approaches have become more reduced offering better control of orbital pathological processes. Orbital lesions are precisely localized through imaging. Also, the approach decision depends on location, size and vascularization.

The diplopia can be explained by soft tissue entrapment, neuromuscular injury, infraorbital or intramuscular hematoma or oedema or a change in orbital shape with displacement of the globe causing a

muscular imbalance [8].

The diagnosis of orbital floor fractures is based on clinical findings (diplopia, limitation of ocular motility, enophthalmos and disturbance of infraorbital nerve sensitivity … etc) and radiological exploration (Table 1) [9].

The choice of approach must allow: a good exposition, an acceptable scar, a low revision rate, an easiness [10].

The endoscopic trans-maxillary approach allows: reduction of surgical morbidity, Reduction in the size and visibility of the incisions, Postoperative comfort, Reducing the length of stay in hospital [11].

All patients with OBFs isolated to the orbital floor are candidates for endoscopic repair.

The trans-maxillary endoscopic approach offers an excellent solution to this dilemma. The orbital floor can be accessed endoscopically and the periorbital tissues released [5].

Trans-maxillary endoscopy of the orbital floor offers excellent visualization of the posterior bony shelf and confirms that the implant rests securely in place.

The authors recommend that surgeons interested in learning the endoscopic technique com- bine the endoscope on all OBF and zygomaticomaxillary complex fractures done with a traditional approach.

In this way surgeons can see what a given blowout fracture looks like endoscopically, and then perform a traditional open repair. This will validate the surgeon's endoscopic assessment and likely result in more accurate implant placement on the posterior orbital shelf.

The angulation of the shape of the orbital floor makes the visualization of the posterior borderline fractures impossible by open approach. [12] The trans-maxillary endoscopic approach for repair of OBFs offers improved visualization of the orbital floor (particularly the posterior shelf), accurate implant placement, and reduced postoperative periorbital edema, without the need for eyelid incisions [6].

Thus, in a trans-maxillary approach, bone can be harvested directly from the anterior wall of the maxillary sinus and then implanted into the floor of the orbit [13]. The bone harvest can be used as a bone graft to reconstruct the orbital floor. However, in our case, we used a titanium orbital mesh.

In this case presentation, the defect on the orbital floor was extended by mobilization of the fragments. A combination of incisions was necessary due to the change in the dimensions of the defects intraoperatively and entrapment of orbital tissue by the placement of an implant. The combination of the two techniques offers better visualization of the defect by endoscopy with perfect placement of the reconstruction mesh by the traditional approach (sub-ciliary incision) [14].

The trans-antral approach is a reliable approach for the treatment of orbital floor fractures. It is accomplished intraorally without visible scarring.

During the management of floor fractures, the clinician should keep in mind the following question [15]: What is the cause of diplopia after surgical repair of an orbital floor fracture?

1. incomplete removal of extraocular muscles and associated orbital tissues from the fracture site prior to implant placement
2. Entrapment of the orbital tissue by the placement of an implant.
3. Neuromuscular trauma.
4. Orbital adhesion syndrome.

4. Conclusion

An endoscopic trans-maxillary approach for the repair of orbital blow fractures has recently been described with a considered advantage. Besides, the traditional approaches for the repair of orbital fractures have several disadvantages (visibility of the approach, risk of ectropion).

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The following information is required for submission. Please note that failure to respond to these questions/statements will mean your submission will be returned. If you have nothing to declare in any of these categories, then this should be stated.

Table 1
Classification of orbital wall defects (Jaquiéry classification) [9].

Category	Description
- I	Isolated defect of the orbital floor or the medial wall, 1–2 cm^2, within zones 1 and 2
- II	Defect of the orbital floor and/or of the medial wall, >2 cm^2, within zones 1 and 2
- III	Defect of the orbital floor and/or of the medial wall, >2 cm^2, within zones 1 and 2
- IV	Defect of the entire orbital floor and the medial wall, extending into the posterior third (zone 3)
- V	Same as IV, defect extending into the orbital roof

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Ethical approval

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

Author contribution

Ouassime KERDOUD: writing the paper, studying the concept
Rachid ALOUA: writing the paper
Amine KAOUANI: acquisition of the pictures
belem OUSMANE: corresponding author and writing the paper
Faiçal SLIMANI: correction of the paper

Registration of research studies

Not applicable.

Guarantor

Belem OUSMANE.

Declaration of competing interest

Authors of this article have no conflict or competing interests. All of the authors approved the final version of the manuscript.

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