Case series and reports

Surgical approach to isolated bilateral orbital floor fractures

Approccio chirurgico alle fratture isolate bilaterali del pavimento orbitario

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SUMMARY

Isolated bilateral orbital floor fractures are uncommon and are rarely described in the scientific literature. They are usually seen in association with naso-ethmoidal fractures, zygomatic fractures, or fractures of the middle third. We report our experience in the management of a patient presenting bilateral isolated orbital floor fracture. The difficulties in management of these fractures are due to the lack of an uninjured contralateral side for intraoperative comparison.

KEY WORDS: Maxillofacial fracture • Orbital floor fracture • Bilateral isolated fracture

RIASSUNTO

Fratture isolate bilaterali del pavimento orbitario sono rare e raramente sono descritte nella letteratura scientifica. Sono osservate solitamente in associazione con fratture naso-etmoidali, fratture zigomatiche o fratture del terzo medio. Riportiamo la nostra esperienza nella gestione di un paziente che presenta frattura isolata bilaterale del pavimento orbitario. La difficoltà nella gestione di queste fratture è dovuta alla mancanza di un lato controlaterale non lesionato per il confronto intraoperatorio.

PAROLE CHIAVE: *Frattura maxillofacciale • Frattura pavimento orbitario • Frattura isolata bilaterale*

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Introduction

Bilateral orbital floor fractures are in most cases associated with other facial skeletal fractures. They are usually seen in association with naso-ethmoidal fractures, zygomatic fractures or fractures of the middle third. Isolated bilateral orbital floor are uncommon and are not easy to surgical management. We report our experience in the treatment of a patient presenting bilateral isolated orbital floor fracture.

Case report

On May 2011, a 54-year-old man was referred to the Maxillofacial Department of the Novara Major Hospital after an assault; he sustained several injuries to the face. Clinical examination showed bilateral periorbital swelling and ecchymosis, bilateral subconjunctival haemorrhages and hypoesthesia in the distribution of the infraorbital nerve. The patient did not report subjective diplopia. There was no clinical evidence of other concomitant facial fractures. The patient underwent immediate radiographic examination. The axial, coronal and sagittal computed tomography (CT) scans showed displaced bilateral orbital floor fractures. There was the absence of any other fractures to the middle third of the face. A Hess Chart revealed moderate restriction in both eyes, and abduction, restriction of elevation and depression of the left eye. Diplopia was demonstrated in all fields. At 2 days after trauma the patient underwent surgery. Under general anaesthesia both orbital floors were explored by a transconjunctival approach. Extensive fractures of the orbital floors with herniation of periorbital contents was observed bilaterally. The floor defects were reconstructed bilaterally with titanium mesh secured to the infraorbital rim with three 5-mm titanium screws. Forced abduction tests showed no restriction of eye movements. One month after the surgical procedure, CT scan demonstrated adequate osteosynthesis of the titanium mesh. The implants were placed bilaterally in a proper position, restoring the geometric anatomy of the orbital floor. Hess chart examination at 6 months showed complete restoration of ocular movements and total resolution of diplopia. There was no evidence of enophthalmos. At 3 months after surgery, we observed left scleral show that was improved by active palpebral physiotherapy and did not require surgical revision.

Discussion

Isolated bilateral orbital floor fractures have rarely been reported in scientific literature; there are a limited number of clinical cases of bilateral orbital floor fractures not associated with other facial fractures.

Polli reported a case of isolated bilateral orbital floor fractures [1]; Swinson reported three cases [2] and another case has been described by Agir [3]. The analysis of 19 patients with bilateral orbital floor fractures reported by Nielsen showed that these were present with other facial fractures [4]. Orbital floor fractures are divided into pure, limited to the floor, and into impure, associated with fracture of the infraorbital margin. The pathogenesis of orbital fractures over the years has been discussed and explained by two theories. The first is the buckling mechanism, first postulated by Le Fort in the 1901, which implies a force to the infraorbital rim causing a ripple effect with buckling of the bone of the orbital floor [5]. The second is the hydraulic theory, explained by Pfeiffer in 1943, which refers to a direct force to the globe causing an increase in intraorbital pressure and fracture at the weakest point [6]. It is still not entirely clear which mechanism is actually responsible for these fractures, but it is likely that both mechanisms can contribute to fracture with different patterns of injury [7]. The majority of bilateral orbital floor fractures are result of fights, and only Agir identifies a bomb blast as the cause [3]. In this case, the patient was victim of an aggression in which he sustained several blows to the face. The patient could not describe exactly where he was struck. Probably, both described mechanisms played a role in the origin of these fractures. The clinical picture is similar to other midface fractures such as periorbital swelling and ecchymosis, conjunctival chemosis, ptosis, hypoesthesia in the territory of the infraorbital nerve and diplopia. During clinical examination, we found it technically difficult to assess the enophthalmos and ocular movements due to the lack of an unaffected side for comparison. Next, ophthalmologist assessment supported by Hess Chart becomes necessary. Fine-section spiral CT scans of the orbits are essential to assess the type, location and extent of fracture; three-dimensional reconstruction also allows more accurate pre-operative planning [8]. However, despite the accuracy of modern imaging techniques, the size of the bone defect observed on CT appears smaller than the bone gap found intraoperatively [9]. Management of these fractures is technically difficult because of the lack of comparison with the contralateral globe. The failure or inadequacy of proper orbital reconstruction is frequently due to the incomplete exposure of the bone defect, especially the inferomedial orbital floor [10]; it is essential to get wide surgical expo-

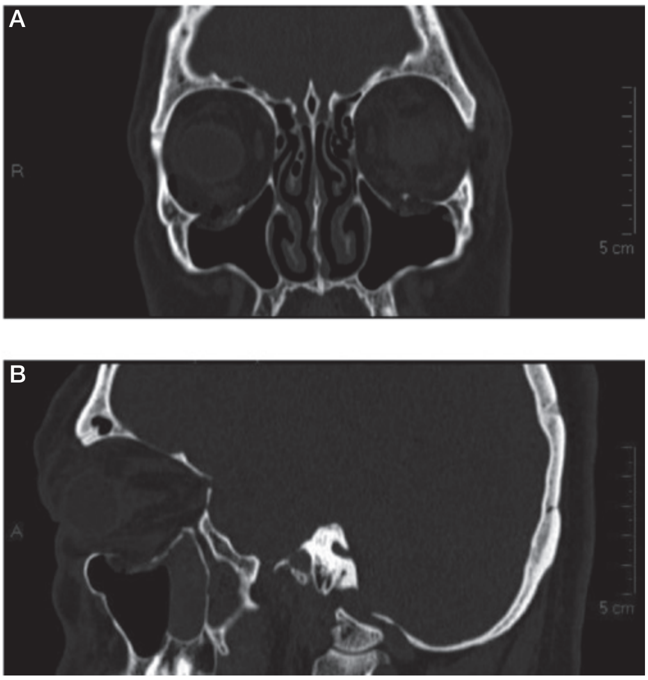

Fig. 1A-B. CT scans showing the displaced bilateral orbital floor fractures in the absence of other midface fractures.

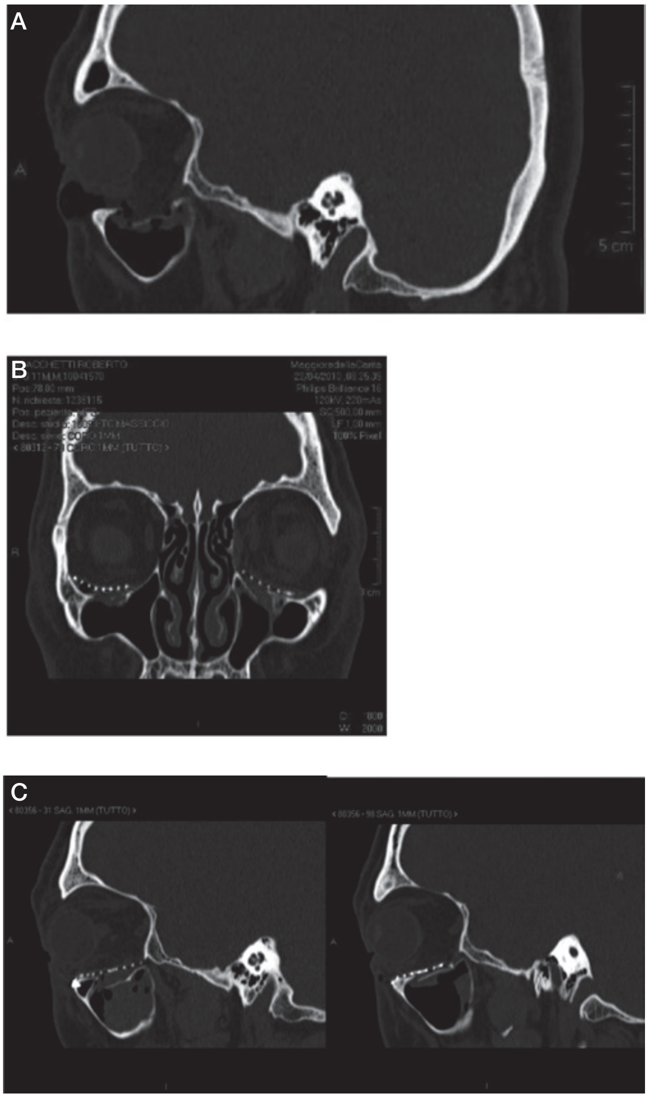

Fig. 2A-C. CT scans showing reduction and osteosynthesis of bilateral orbital floor fracture.

sure. The most frequent postoperative complications are diplopia, enophthalmos and infraorbital nerve dysaesthesia. The incidence of these complications depends on the type, extent and location of fracture. The purpose of surgical treatment is to restore orbital volume and to reposition herniated structures to avoid re-operation which is often unsatisfactory. According to the majority of authors, the operating time must not exceed two weeks of injury to minimise the risk of scarring events in the herniated soft tissue [11]. Surgical techniques are varied and include: 1) Reduction of the fracture by endosinusal hydro-pneumatic supports (endosinusal balloon) [12]; 2) Autologous grafts (calvarian bone, antral wall, cartilage, rib and ilium); 3) heterologous and/or alloplastic resorbable materials (polydioxanone, polyglycolic acid or to the poly L-lactide acid); 4) No resorbable materials (polyethylene or titanium) [13]. Titanium mesh permits accurate reconstruction of the orbital anatomy. In our case, we used titanium mesh on both sides. Titanium mesh has the advantage of being fully compatible and easily modelled [14], and is also indicated in the presence of major bone defects that are difficult to reconstruct [15]. Recently, computer aided design/modelling (CAD/CAM) software allows preoperative "mirroring" planning and can be associated with an intraoperative navigation system. The non-fractured contralateral side is "mirrored" by pre-operative CT imaging. A titanium mesh is prefabricated on this virtual template; it is sterilzed and is placed to reconstruct the orbital floor. The position is controlled intraoperatively with the aid of the of the pointer device of the navigation system. However, to the best of our knowledge, this approach is limited to unilateral cases and the cost is very high [16]. In conclusion, isolated bilateral orbital floor fractures should be approached and studied as unilateral orbital fractures, putting more attention to the precise exposure and surgical bone reconstruction. The difficulties in management of these fractures are due to the lack of an uninjured contralateral side for comparison.

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