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Trapdoor fracture of the medial orbital wall in an adult: A case report

Satoe Okuma[a,b], Takahiro Kanno[a,b,*], Rie Osako[a,b], Ichiro Kaneko[a,b], Takashi Koike[a,b], Masaaki Karino[a,b]

[a] Department of Oral and Maxillofacial Surgery, Shimane University Faculty of Medicine, Izumo, Shimane, Japan
[b] Maxillofacial Trauma Center, Shimane University Hospital, Izumo, Shimane, Japan

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ABSTRACT

Orbital blowout fractures frequently occur along the floor or medial aspect of the orbital wall, which are the two thinnest areas of the bony orbit. True trapdoor injuries of the orbit are less common and rarely involve an isolated medial wall injury. In addition, they usually occur in pediatric patients. An isolated medial wall trapdoor type blowout fracture in adults is extremely rare. Here, we report an isolated medial wall trapdoor type blowout fracture in a 44-year-old woman with restricted ocular mobility due to medial rectus muscle entrapment, the so-called 'missing rectus muscle'. A prompt diagnosis and early surgical intervention achieved a satisfactory clinical outcome.

1. Introduction

Orbital wall fractures are a relatively common consequence of maxillofacial trauma. Most occur as the result of falls, traffic accidents, sports accidents, and violence [1,2]. The orbit is formed from seven bones of the skull and facial skeleton [1,2]. The thickness of the bony orbital varies. As a result, there is a high possibility that the raceway wall will rupture with less trauma than is required to fracture the rim circumference.

A trapdoor type injury of the orbit is less common, and true trapdoor orbital fractures entrap the extraocular muscles or orbital contents in a nondisplaced fracture line [3]. Orbital trapdoor type fractures, such as the white-eyed blowout fracture [4,5], generally occur in pediatric patients and are very rare in adults [1–3]. This is because the elasticity and rigidity of the bone decrease with age, which results in open or crushed, punched-out orbital wall fractures following blunt ocular injury in adults [1].

Furthermore, trapdoor fractures are observed predominantly in the orbital floor and are much less common in the medial orbital wall [1,3], which is formed of more resilient cortical and cancellous bone. Therefore, the hinged fractured orbital bone readily returns to its original position in the orbital floor often entrapping an extra-ocular muscle. The oculocardiac reflex, defined as the triad of bradycardia, nausea, and syncope, can often be elicited in patients with entrapped muscle and intraorbital tissue [6]. Maxillofacial surgeons should be aware of this sign to ensure a prompt diagnosis [6].

Here, we report a rare isolated medial wall trapdoor type blowout fracture in a 44-year-old woman with restricted ocular mobility due to an entrapped medial rectus muscle, the so-called 'missing rectus muscle' [7]. Prompt diagnosis and immediate surgical intervention achieved a satisfactory clinical outcome.

2. Case report

A 44-year-old Japanese woman became inebriated and fell down, and her face struck the ground. The next morning, she was aware of pain in the face and orbits, and restricted eye movement; she thus visited the Emergency and Critical Care Center of Shimane University Hospital, where she was immediately referred to our Maxillofacial Trauma Center. She showed a clear sensorium, stable vital signs, and no abnormal neurological findings. External examination showed an upper eyelid abrasion, left periorbital edema, and limited lateral eye movement with extreme pain and diplopia.

Non-contrast orbital computed tomography (CT) showed an isolated left trapdoor-type medial orbital fracture, with an associated minimally displaced fracture of the left ethmoid wall. The shape of the inner rectus muscle was distorted and it appeared to be partially entrapped in the medial orbital wall fracture. On immediate consultation with an ophthalmologist, further ophthalmological examination revealed no retinal breaks or bleeding, and limited lateral movement of the left eye due to an isolated medial orbital wall fracture that had entrapped the medial rectus muscle.

Immediate surgical exploration and fracture repair with release of the entrapped medial rectus muscle were planned under general

* Corresponding author at: Department of Oral and Maxillofacial Surgery, Shimane University Faculty of Medicine, Izumo, Shimane, 693-8501, Japan.
E-mail address: tkanno@med.shimane-u.ac.jp (T. Kanno).

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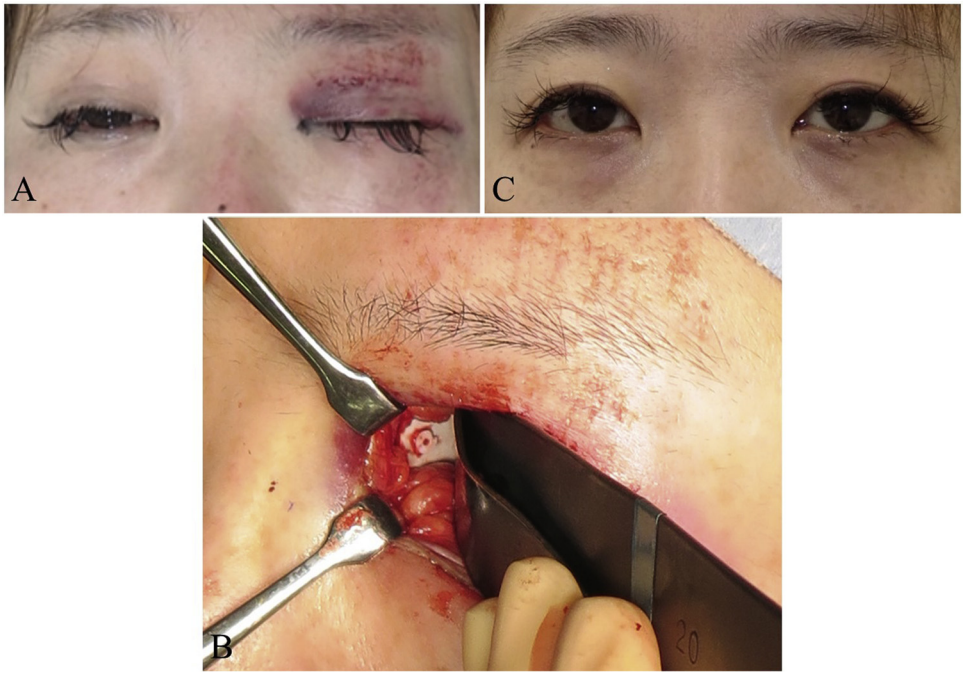

Fig. 1. The transcaruncular approach was used to reduce the orbital contents and medial rectus muscle. The medial orbital fracture was identified, and the entrapped medial rectus muscle tissue in the medial orbital fracture site was reduced. The fracture was reconstructed using a 0.3-mm-thick hydroxyapatite/poly-L-lactic acid (u-HA/PLLA) sheet with tack fixation.

anesthesia via intraoral intubation. The forced duction test was performed first and confirmed restrictive strabismus. The transcaruncular approach was used to reduce the orbital contents and medial rectus muscle. On exploration, the medial orbital fracture and entrapped medial rectus muscle tissue were identified and the muscle easily released. To reconstruct the fracture site, a 0.3-mm-thick bioactive osteoconductive, bioresorbable sheet (SuperFIXSORB®; Teijin Medical Technologies, Osaka, Japan) was applied with single-tack fixation, as reported previously [8] (Fig. 1). A repeat forced duction test showed unrestricted eye movement in all directions. The total operating time was 29 min.

Postoperative CT showed excellent reduction of the orbital contents with full release of the medial rectus muscle from the medial wall and an appropriately positioned sheet for reconstructing the fractured medial wall (Fig. 2). The patient had an uneventful recovery postoperatively and returned to social activities soon after the surgery, with no orbital or maxillofacial functional deficits.

3. Discussion

Orbital medial trapdoor fractures occur more often in males in childhood, adolescence, and early adulthood [1,3]. In previous clinical reports, few patients from early adulthood onward showed extraocular muscle incarceration [1,2]. Trap door fracture of the medial orbital wall was first reported in 2006 [7]. That report hypothesized that when a medial orbital wall with developed ethmoid air cells is struck, the wall cannot blowout fully into the ethmoid sinus because of the bony frame of the cells [3]. The orbital contents are then pushed through narrow cracks due to the high intraorbital pressure [3]. As a result, some cells may be broken, while others maintain their frames. Consequently, the orbital contents fill the cells under comparatively high pressure [3]. After the blow, some of the orbital contents tend to leak back into the orbit, pushing the fractured bone toward the orbit and trapping the orbital contents [4].

The suggested treatment of such trapdoor type fractures is immediate surgical intervention [6]. Patients with the oculocardiac reflex require rapid discontinuation of the presumptive stimulus. Surgical release of the entrapped muscle should be performed promptly in any such unstable patients. With true muscle entrapment in a nondisplaced fracture, long-term diplopia can result from the necrosis of muscle tissue and fibrosis of the muscle sheath within 8 h of the injury [6,9]. To prevent necrosis of the muscle and diplopia, the repairs should be performed soon after the injury. However, no clear treatment guidelines have been established [9]. Our patient had no sign of the oculocardiac reflex before surgery, although she had marked pain with limited lateral orbital motility and entrapment of the medial orbital muscle, as seen on CT. This justified our decision to perform immediate surgery, and may have led to the satisfactory clinical results obtained with minimal intervention.

We applied a bioactive, osteoconductive, bioresorbable unsintered hydroxyapatite/poly-L-lactic acid (u-HA/PLLA) sheet. It can take more than 5 years for the u-HA/PLLA to be fully replaced by bony tissue via resorption, and it is clinically stable with bioactive functional capacity [8,10]. In addition, u-HA/PLLA is radiopaque, which enables postoperative assessment. This helps to reduce the technical difficulty and risk of iatrogenic fracture, while ensuring the stability of the implant. The tack fixation technique yields stable, satisfactory ophthalmological functional results for any orbital trauma reconstruction, even for complex orbital wall fracture reconstruction, as we reported previously [8,10], although long-term follow-up studies are needed.

4. Conclusion

We reported a rare trapdoor type medial fracture with limited lateral eyeball movement in an adult, who also presented with a missing medial rectus muscle. In such cases, a prompt diagnosis and immediate surgical intervention should lead to a satisfactory clinical outcome.

Ethical approval

Not required.

Conflict of interest

The authors declare that there are no conflicts of interest in regard to this work.

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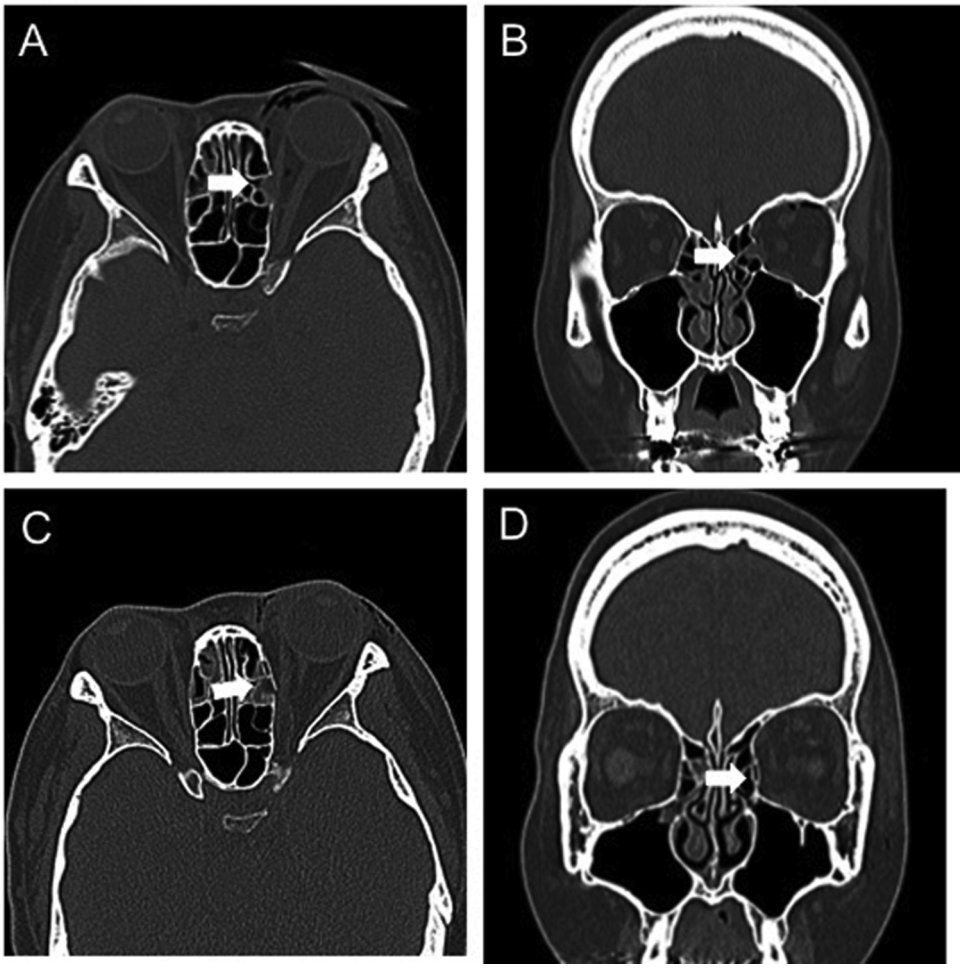

Fig. 2. Preoperative computed tomography (CT): (A) axial and (B) coronal views. CT showed a trapdoor fracture of the left medial orbital wall that entrapped the medial rectus muscle (arrow).
Postoperative CT: (C) axial and (D) coronal views. The entrapped medial rectus muscle was released and the fractured medial wall reconstructed with a bioresorbable osteoconductive sheet (arrow).

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