



Orbital Wall Fracture with Displacement of the Right Eyeball into the Right Nasal Cavity: A Case Report

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Abstract

Here, we report the case of a man whose eyeball had been completely displaced into the nasal cavity due to a trauma. A 65-year-old man with a history of radical surgery to the bilateral maxillary and ethmoid sinuses received a severe blow to the right eye. He was subsequently unable to open this eye, and the eyeball was displaced into the nasal cavity. Visual acuity on initial examination was light perception only, and surgery was performed on Day 4 after the injury. Although visual acuity did not improve postoperatively, the patient was fully satisfied from the cosmetic view point. One factor in this case may have been the ossification that occurred as part of remodeling of the maxillary sinus after his previous Caldwell-Luc procedure for chronic rhinosinusitis. To our knowledge, this is the first report of the complete displacement of an eyeball into the nasal cavity due to a trauma.

Keywords: Orbital fracture; Blowout fracture; Eyeball displacement; Orbital medial wall; Nasal endoscopy

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Introduction

Orbital wall fractures usually occur in the inferior or medial wall of the orbit. Although cases of displacement of the eyeball into the ethmoid or maxillary sinus have been reported, to the best of our knowledge, there has been no previous report of complete displacement of the eyeball into the nasal cavity. The case of a patient with an orbital fracture in whom the right eyeball was traumatically displaced into the right nasal cavity (common nasal meatus) is reported, together with a brief discussion of the literature.

Case Presentation

A 65-year-old man was struck on the right side of his eye by a 90-cm-long piece of metal pipe that had been used to secure a wire, while he was engaged in felling trees.

At the initial physical examination, the right orbit was swollen and bruised (Figure 1). When the eyelids were opened manually, only the palpebral conjunctiva was visible. Although the eyeball was not identified in the right nasal cavity via a fiberscope, the patient was able to perceive light from the fiberscope inside the right nasal cavity during observation. Computed Tomography (CT) revealed a fracture of the medial wall of the right orbit with the right eyeball displaced into the nasal cavity (common nasal meatus), as well as a fracture of the frontal bone and pneumocephalus (Figure 2). Magnetic Resonance Imaging (MRI) did not show any rupture of the sclera, and it was inferred that the eyeball, optic nerve, and extraocular muscles were preserved (data not shown). Ossified remodeling of bilateral maxillary sinuses was seen due to his previous surgery, a Caldwell-Luc procedure combined with radical ethmoidectomy in his 20s due to chronic rhinosinusitis.

Members of the Departments of Otolaryngology, Ophthalmology, Plastic Surgery, and Neurosurgery discussed the treatment strategy, and after confirming the absence of complications, such as exacerbation of the pneumocephalus or cerebrospinal fluid rhinorrhea, surgery was scheduled for Day 4 with the objectives of restoring visual function and improving cosmetic appearance.

Surgery was performed by nasal endoscopy, and removal of nasal polyps from the common nasal



Figure 1: Facial photograph on initial examination: The right eye cannot be opened.



Figure 2: Preoperative CT. The right eyeball is displaced into the nasal cavity (arrow). Both sides of the maxillary sinuses are healed with ossification (asterisks).

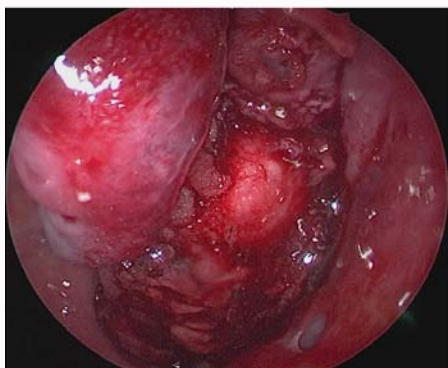


Figure 3: Intra operative findings of the right nasal cavity: The cornea of the eyeball (arrow) is visible in the nasal cavity (asterisk: nasal septum mucosa).

meatus showed tissue believed to be orbital fat in the middle meatus. This fat was gently detached, and, finally, the eyeball was identified (Figure 3). Attempts to return the eyeball from the nasal cavity to the orbit were unsuccessful, and then a transcutaneous sub palpebral approach was added. The defect in the medial orbital wall was slightly expanded, and the eyeball was gently pushed laterally from inside the nasal cavity, successfully restoring it to the orbit. It was then moved anteriorly, and the bulbar and palpebral conjunctivae were sutured. Finally, a silicone plate (0.5-mm-thick) bent into a reverse U shape was placed into the nasal cavity, and a balloon was inserted into the space made by the silicone plate and inflated to stabilize the shape of the medial orbital wall. At the final step of the surgery, antibiotic ointment gauzes were inserted in front of the balloon.

Postoperative course: The balloon and ointment gauzes were removed 2 weeks postoperatively, followed by the silicone plate 3 weeks postoperatively. At 2 weeks postoperatively, the patient was able to perceive light with the right eye, but at 3 weeks postoperatively, the



Figure 4: Postoperative facial photograph. The eyelids are closer together than normal, but the eyeball is visible.

eye was totally blind. There was also no recovery of ocular movement. At 5 weeks postoperatively, vitreous surgery was performed in the Department of Ophthalmology for vitreous hemorrhage, which had been evident preoperatively. At 6 months postoperatively, the right eye was still totally blind, but the swelling of the tissue around the eyeball had subsided to the point that slight enophthalmos was seen on facial photographs (Figure 4). CT also showed that the eyeball was still reduced within the orbit (data not shown); cosmetically, the patient was satisfied.

Discussion

As far as we have been able to ascertain, 8 cases of displacement of the eyeball into the ethmoid sinus have been reported in either English or Japanese between 1980 and 2015 (Table 1) [1-8], but we believe this is the first report of the complete displacement of an eyeball into the nasal cavity. Seven of these eight case reports concerned men, and the injury occurred on the right side in four cases and on the left in four. The present patient was also a man, and it may be inferred that men are more likely than women to undergo a strong blow to the face.

Several mechanisms of orbital fracture have been suggested, including the hydraulic mechanism, in which the fracture is caused by elevated intra orbital pressure, the buckling mechanism, in which the fracture occurs when the orbital wall is flexed, and the globe-to-wall contact mechanism, in which the fracture occurs when the eyeball makes direct contact with the orbital wall [9-11]. Sugamata et al. [9] reported on the basis of CT findings that, in 20 of 45 cases, fractures were caused by the globe-to-wall contact mechanism, with all of these fractures occurring in the inferomedial area of the orbital wall, and that pure medial wall fractures were not caused by this mechanism. In previous cases of the invagination of the eyeball into the ethmoid sinus, this was also reported to occur via fracture of the inferomedial orbital wall caused by a strong, direct, and blunt blow from an object smaller than the diameter of the orbit. In the present case, the patient had previously undergone radical surgery to the maxillary and ethmoid sinuses in which the maxillary sinuses had healed by ossification, and the honeycomb structure of the ethmoid sinuses had already disappeared, meaning that pressure from the trauma was concentrated on the inferomedial orbital wall, and the absence of the ethmoid air cells meant that the thin, lamina papyracea was further weakened [1], suggesting that the eyeball may have been displaced into the nasal cavity by the globe-to-wall contact mechanism via the ethmoid sinus.

Unfortunately, the patient's vision could not be preserved in this case. Given the transition from light perception to total blindness over the long term, the cause of the visual impairment may have been either compression or extension of the optic nerve or occlusion of the central retinal artery [7]. Excluding one of the previous 8 reported

Table 1: Present case and cases of displacement of the eye ball and ethmoid sinus.

Case	(Age y)/sex	Traumatic	Eyeball	Previous	V is va I
		event	displacement	surgery	outcome
Present case	55/M	Blow	Nasal cavity	C-L surgery	TB
Case 1 [2]	40/M	Blow	ES	Not recorded	LP
Case 2 [2]	24/M	Blow	ES	Not recorded	TB
Case 3 [3]	401M	Traurri figl(it)	ES	Not recorded	TB
Case 4 [4]	58/M	Blow	ES	Not recorded	20/100
Case 5 [5]	66/M	Traffic Injury	ES	Not recorded	LP
Case 6 [6]	37/M	Accident	ES	Not recorded	20/15
Case 7 [7]	57/F	Fall	ES	None	LP
Case 8 [8]	59/M	Traffic injury	ES	None	20f33.3

ES: Ethmoid sinus; C-L: Caldwell Luc; TB: Total blindness; LP: Light perception

cases of eyeball displacement into the ethmoid sinus for which the outcome was not recorded, 5 of the remaining 7 were either totally blind or could only perceive light postoperatively [1-8]. The magnitude of the traumatic force may have been one factor in the poor prognosis. However, improvement in visual impairment was achieved in 2 patients who underwent surgery on the day of injury [6-8]. Preoperative visual acuity is difficult to determine with any accuracy when the eyeball has been displaced into the ethmoid sinus or nasal cavity, and given the magnitude of the impact, there is a high probability of severe loss of visual acuity, meaning that surgery should be carried out as soon as possible [10]. In the present case, concerns about the possibility of intracranial complications and consideration for the patient's general condition led to surgery being scheduled for Day 4 after injury, but the possibility that earlier treatment might have resulted in a different prognosis for visual acuity cannot be excluded. The risk of sympathetic ophthalmia must also be considered in the event of trauma. In the present case, whether or not the eyeball should be removed was also discussed, but since MRI findings were not suggestive of damage to the eyeball itself, it was judged that there was still the possibility of recovery of sight. Since it also appeared from imaging findings that the extraocular muscles were preserved, the decision was made to preserve the eyeball. Ultimately, ocular movement was not restored, and this may have been due either to damage to the nerves governing the extraocular muscles, as identified by Kang et al. [5] or damage to the extraocular muscles themselves as a result of hyperextension.

Endoscopic treatment for fracture of the medial orbital wall has become common in recent years. In the present case, the field of view was obstructed by the eyeball within the nasal cavity, preventing restoration via a transnasal endoscopic approach alone, but the eyeball was restored to the orbit without resistance by adding a transcutaneous subpalpebral incision and slightly enlarging the bone defect in the anteroinferior medial orbital wall.

A silicone plate and balloon were used together to fix the comparatively large defect in the medial orbital wall. There is no firm consensus on the duration for which the silicone sheet should be left in place, with reports ranging from 2–3 weeks [12] to around 2 months [13]. For regular fractures of the medial wall, we insert a reverse U-shaped silicone plate to immobilize the medial wall for around 2 weeks, but given the large defect in the medial orbital wall in the present case, we used both a silicone plate and a balloon,

removing the balloon after 2 weeks and the silicone plate after 3 weeks. Enophthalmos was not visible immediately after removal, and, in fact, the area around the eyeball appeared swollen. Currently, over 1 year postoperatively, the patient is satisfied with his cosmetic appearance.

Conclusion

A patient with a fracture of the right medial orbital wall with displacement of the eyeball into the nasal cavity was described. The patient had a history of radical surgery to the bilateral maxillary and ethmoid sinuses (C-L surgery), and the mechanism of the fracture may have been related to the fact that the maxillary sinus had ossified. Although preoperative visual acuity is difficult to determine accurately in cases of displacement of the eyeball into the ethmoid sinus or the nasal cavity, it is important to evaluate the patient's general condition and the condition of the eyeball accurately and to perform surgery as rapidly as possible. Cases such as this are encountered extremely rarely, but carrying out simulations under normal circumstances may be helpful for their appropriate management. More than one year postoperatively, although the patient's sight has not recovered, from the cosmetic view point, a fully satisfactory result has been achieved.

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Conflict of Interest

We wish to confirm that there are no known conflicts of interest associated with this publication and there has been no significant support for this work that could have influenced its outcome.

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