Medial Orbital Wall Blow-Out Fracture Producing an Acquired Retraction Syndrome

John W. Gittinger, Jr., M.D., James P. Hughes, M.D., and Eugenio L. Suran, M.D.

Blunt trauma to the orbit commonly produces an internal or blow-out fracture of the maxillary bone in the orbital floor, often with entrapment of the inferior rectus and surrounding tissues and consequent limitation of upward gaze (1). Medial wall blow-out fractures, which involve the ethmoid bone, are less frequently recognized. When the medial rectus and surrounding tissues are entrapped in the ethmoid fracture, this may result in a type of acquired Duane's retraction syndrome (2-15).

In the patient reported here, computed tomography allowed imaging of an isolated medial wall fracture and the entrapped tissues. Surgery was performed to relieve the resulting mechanical ophthalmoplegia.

CASE REPORT

An 8-year-old Black-Vietnamese boy was lying on a couch watching television when he was kicked in the face by his 13-year-old brother. His mother took him to an emergency room, where he was examined and sent home. The next day he was hospitalized for observation because of lethargy. For the first time, limitation of eye movements was noted. Computed tomography of his head and orbits was interpreted as normal, and he was referred to the University of Massachusetts Medical Center for neuro-ophthalmic consultation.

When examined as an outpatient 7 days after his injury, his visual acuity was 20/20 in each eye. There was injection over the insertion of the left medial rectus. Ductions of the right eye were full. The patient could not adduct his left eye past the midline, and abduction was limited to 50% of normal. The globe retracted on abduction. Forced ductions using a suction cup device were positive.
horizontally and negative vertically, although limited patient cooperation may have affected the findings. Review of the initial computed tomography revealed clouding in the right ethmoid sinus, suggesting the presence of a fracture. A medial wall blow-out fracture with entrapment was diagnosed, and the patient was asked to return in 1 week for re-examination and possible surgery.

He did not keep this appointment, but did return 18 days later. The previously noted injection had resolved, but the motility findings persisted (Fig. 1). The patient was admitted to the hospital, and computed tomography clearly demonstrated an ethmoidal fracture with tissue entrapment (Fig. 2).

Twenty-seven days after his injury he underwent an exploration of the medial orbit through a skin incision. The area of entrapment was visualized, and the surrounding bone removed with a rongeur. Intraoperatively, forced ductions improved, but there was some persistent mechanical limitation despite a large exposure and removal of bone. No orbital implant was placed.

Postoperatively the patient’s ocular motility improved, but 2 months after the surgery there was still some limitation of both adduction and abduction, with persistent retraction on abduction (Fig. 3). Exophthalmometry readings using a Hertel-Krahn instrument were 15 for the right eye and 16 for the left eye, with a base of 90.

**DISCUSSION**

The mechanism of orbital blow-out fractures is thought to be compression of the orbital soft tissues with increased intraorbital pressure being released by fracture of the orbit at its weakest points. This has been reproduced experimentally in cadavers (16–18). Fractures of the orbital floor associated with fractures of the orbital rim are not considered blow-out fractures, since these former are thought to result from direct trauma to the bony structures. Isolated internal orbital floor fractures, however, have been produced in dried skulls subjected to trauma of the infraorbital rim, demonstrating that the orbital contents do not necessarily have to be present in the experimental situation (19).

Despite the clinical preponderance of orbital floor fractures, the thinnest parts of the orbital walls are medial and not inferior (20). This disparity may be an effect of the bony partitions in ethmoidal air cells that buttress the medial wall and increase its bursting strength. Also, the incidence of medial wall fractures is relatively high in autopsy studies (18), and many medial wall fractures may go undetected both because they do not produce entrapment as often as orbital floor fractures and because the medial wall has been difficult to demonstrate radiologically (7).

In 1966 Miller and Glaser reported entrapment
of the medial rectus with retraction on abduction in a 16-year-old Black boy with fractures of both the medial wall and floor of the orbit (2). Subsequent case reports have documented medial wall fractures with entrapment, both with and without retraction (3–15). In all but one case (12), the retraction had been present on abduction rather than on adduction, as in the typical Duane's retraction syndrome. This diversity gave rise to an unfortunate proliferation of names for these findings: inverse, reverse, mirror image, and pseudo-Duane retraction syndrome.

In the past decade, Huber's clinical classification of congenital Duane's retraction syndrome into Type I (limitation of abduction with retraction on adduction), Type II (defective adduction with retraction on abduction), and Type III (defective abduction and adduction with retraction on adduction) has been confirmed and correlated with electromyography (21). Other congenital misinnervation syndromes, such as synergistic divergence (22), are also probably related to the retraction syndromes.

The motility pattern usually observed with medial wall entrapment and exemplified by the case reported here most closely resembles Duane's retraction syndrome Type II, but a more general and apt description would be acquired retraction syndrome. Acquired retraction syndrome has been recognized after surgery and trauma (23), in patients with rheumatoid arthritis (24) and Friedreich's ataxia (25), following sixth nerve palsy (26), and in patients with infiltrative orbital disease (27). Most instances of acquired retraction syndrome are mechanical in origin.

The patient described here had a Vietnamese mother and a Black American father. A disproportionately large number of cases of medial wall blow-out fractures seem to occur in young black males (Table 1). While this may be a discovery artifact or be due to this group's increased risk for trauma, an anatomic basis should be considered. Bony development may proceed differently in different ethnic populations, and a racial variation in the shape of the orbit or in the partitioning of ethmoidal air cells could underlie the racial predominance of this type of fracture.

The radiological detection of medial wall fractures has been improved by the advent of computed tomography, which has the unique ability to visualize both the bony and soft tissues simultaneously (28,29). Computed tomography has almost completely replaced previous techniques

### Table 1. Medial orbital wall blow-out fractures in young black males

<table>
<thead>
<tr>
<th>Case (reference)</th>
<th>Age (years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Miller and Glaser (2)</td>
<td>16</td>
</tr>
<tr>
<td>Maisel, Acomb, and Cantrell (11)</td>
<td>17</td>
</tr>
<tr>
<td>Duane, Schatz, and Caputo (13)</td>
<td>12</td>
</tr>
<tr>
<td>Duane, Schatz, and Caputo (13)</td>
<td>12</td>
</tr>
<tr>
<td>Mirsky and Saunders (14)</td>
<td>11</td>
</tr>
<tr>
<td>Present case</td>
<td>8</td>
</tr>
</tbody>
</table>
such as linear and hypocycloidal tomography and positive contrast orbitography.

The surgical treatment of blow-out fractures of the orbital floor is controversial (1). Most reported cases of medial wall blow-out fractures with entrapment have eventually come to surgery. Surgeons using a conjunctival approach have found the exposure difficult (3,9). The approach taken here was similar to that used in an external ethmoidectomy and allowed excellent exposure of the site of the fracture (30). A small keloid formed in the incision. We elected not to place an orbital implant, and despite removal of a large portion of the medial orbital wall, there is no enophthalmos. Orbital implants have both immediate and long-term risks (31) and may not be required when the bony defect is medial.

The persistence of the retraction despite freeing of the orbital tissues suggests scarring and contraction of the tissues around the medial rectus. In one previously reported case, this was a progressive process and led to significant motility disturbances (12). We do not know whether earlier surgery would have prevented this complication.

REFERENCES