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Grand Rounds

A 15-year-old-boy with an optic neuropathy

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History

A 15-year-old boy with no past medical or ophthalmic history presented at the Ochsner Hospital and Medical Center, New Orleans, 3 days after having been accidentally shot in his left temple with an air gun from distance of approximately 1 foot. The pellet lodged in his posterior left orbit. On examination in the emergency department, his visual acuity was 20/20 in the right eye and 20/25 in the left eye.

Examination

On clinical examination, the patient had mild edema and ecchymosis of the left upper eyelid, mild proptosis of the left eye, a small subconjunctival hemorrhage in the temporal conjunctiva, and commotio retinae in his left macula. Ishihara color plates were full in both eyes. There was no resistance to retropulsion and no relative afferent pupillary defect. He was given oral antibiotics and a three-day course of oral steroids. He was followed closely and 1 week later referred to the oculoplastic surgery service for evaluation of the orbital foreign body. At the time of this evaluation (Figure 1), his visual acuity in the left eye had decreased to 20/40, and he had developed a mild left afferent pupillary defect. In addition, there was restriction of gaze to the extreme right secondary to pain.

Figure 1. External photographs taken 7 days following the incident showing the temporal subconjunctival hemorrhage, eyelid ecchymosis, and mild proptosis in the left eye (A) and the entry site of the pellet in the left temple (B).

Ancillary Testing

A computed tomography (CT) scan showed a 4.5 mm metallic foreign body within the posterior and superior aspect of the left orbital apex in close proximity to the optic nerve. A second 1–2 mm foreign body fragment was located adjacent to the superficial aspect of the lateral orbital wall along the inner aspect of the left temporalis muscle (Figure 2A). Visualization of the lateral rectus muscle was limited secondary to imaging artifact of the adjacent foreign body. A defect was noted in the left lateral orbital wall with a comminuted fracture and osteoid formation, indicating that the foreign body had entered through the lateral wall (Figure 2B). The globe, calvarium, calvarial soft tissues, and brain were noted to be unremarkable.

Treatment

Oral steroids were restarted to decrease the orbital edema and treat his compressive optic neuropathy. A transcranial orbitotomy with a cranio-orbital approach was performed for exploration and removal of the foreign body. Removal of the orbital roof allowed for total

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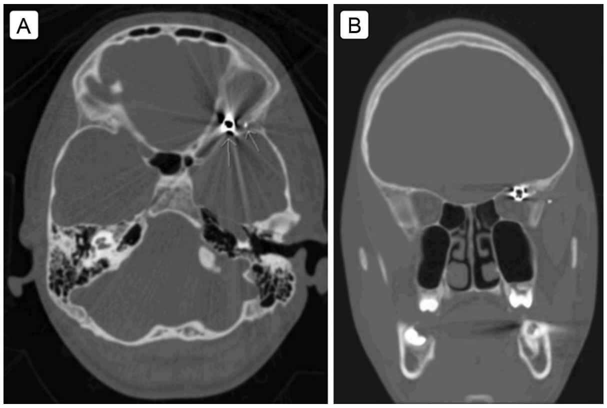

Figure 2. Computed tomography of the head. A, Axial scan showing the 4.5 mm metallic foreign body located in the apex of the left orbit; also visualized is a smaller shrapnel fragment lodged in the inner aspect of the left temporalis muscle. B, Coronal scan showing the path of the pellet through the left temporalis muscle and fractured lateral orbital wall, stopping short of and immediately adjacent to the optic nerve within the apex.

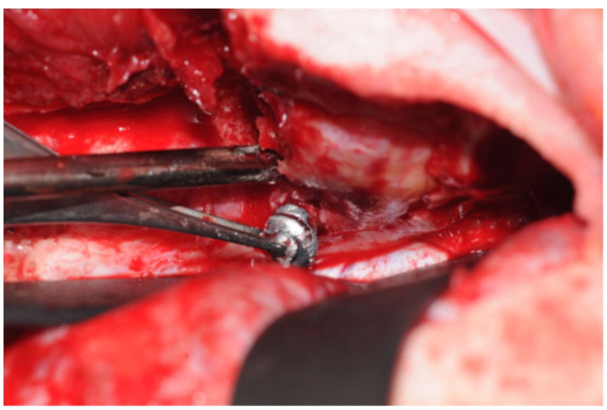

Figure 3. Intraoperative photograph showing the reflected left frontal lobe of the brain and demonstrating the extraction of the pellet lodged in the posterior apex of the left orbit, through the removed orbital roof and incised periorbita.

exposure of the posterior aspect of the superior orbit, including the apex on the left side. An intraoperative navigation system was used to confirm the exact location of the pellet within the orbital apex. An incision through the periorbita was performed and extended to expose the entire pellet (Figure 3). A 5 mm foreign body was removed and further exploration revealed residual small foreign body pieces, which were removed and followed by copious irrigation of the field. Exploration of the inner aspect of the temporalis muscle revealed the site of entry and damaged tissue. Neurosurgery completed the procedure by closing the craniotomy. All metallic pieces and removed tissue were sent to pathology for documentation.

Postoperatively, the patient was admitted to the pediatric neuro-critical care unit. Repeat CT scan showed no evidence of acute intracranial hemorrhage or sulcal effacement. On postoperative day 1, there was complete resolution of the left afferent pupillary defect, and the patient's visual acuity returned to 20/20 in the left eye. The patient was discharged on postoperative day 4 with resolution of eye pain and no restriction in his extraocular movements. He was followed closely for 3 months, with no further complications.

Discussion

The treatment of retained metallic intraorbital foreign bodies has been debated in the Literature.[1–3] The main factors that determine whether surgical intervention is warranted are composition of the foreign body, resting location within the orbit, and the presence of ocular complications, such as decreased vision, restricted motility, or intractable pain.[1–3]

Most metallic foreign bodies are inert and should be managed conservatively if there are no other indications for surgery.[4] Copper, iron, and pure lead (that is, lead not mixed with antimony) are three metals that are not inert and require a more vigorous investigation, because they have been documented to cause both local and systemic complications.[4] On our patient's presentation, we contacted the pellet manufacturer, who confirmed that the pellet used was 99.9% lead, which by itself might warrant removal if the foreign body is readily accessible. In many instances the composition of the metallic foreign body can never be determined, which often complicates the decision for surgical removal.

In our patient, several presenting factors determined the necessity for surgical removal. The decreased visual acuity in the left eye along with an afferent pupillary defect indicated a compressive optic neuropathy resulting from the location of the pellet in the apex in proximity to the optic nerve and resultant compressing edema in a tight compartment. Fortunately, the projectile did not directly injure the optic nerve. In the absence of any brain injury, there was no contraindication for steroids. The patient was started on oral prednisone 40 mg (1 mg/kg/day) in attempt to improve the orbital edema and decrease the optic nerve compression while awaiting surgical decompression and removal of the retained foreign body material.

A decision was made for a left transcranial orbitotomy with a cranio-orbital approach for removal of the foreign

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body. The posterior location of the pellet in the orbital apex eliminated an anterior orbitotomy approach. A lateral approach could have been used yet it would have required an osteotomy extending along the lateral orbital wall that was posteriorly fragmented. This would have required enlarging the bony incision of a classic lateral orbitotomy and removing the sphenoid wing to the superior orbital fissure, as described by Goldberg et al.[5] This approach would have eliminated the need for a craniotomy; however, it was possible that this might not have provided enough access and exposure to safely extract the pellet. A multidisciplinary team included our neurosurgery service who performed a left transcranial orbitotomy with a cranio-orbital approach and provided access for our oculoplastic surgery team. A cranio-orbital approach allowed for direct visualization of the superior orbital space, including the apex, and the pellet was easily removed without injuring vital structures. This approach also allowed for adequate exploration of the surrounding tissue for removal of smaller fragments within the orbit. In addition, the shrapnel lodged within the surgically reflected left temporalis muscle was removed.

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