

Systemic Allergic Response in the Setting of a Metallic Intraorbital Foreign Body With Intraoperative Magnet-Assisted Retrieval

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Abstract: A 12-year-old boy with a past medical history of nickel allergy was referred to our service after sustaining an air rifle injury with a retained BB in his left inferior orbit. On examination, he had a palpable orbital mass and systemic urticaria. Plain films demonstrated a spherical metallic foreign body adjacent to the left inferior orbital rim. Given his worsening systemic reaction despite oral antihistamine therapy, decision was made to remove the foreign body. In the operating room, the Allergan Magna Finder—a prepackaged, sterile device normally used for retrieval of a port used in tissue expansion surgery—was placed over the inferior conjunctiva of the lower eyelid. With the magnet holding gentle anterior traction on the foreign body, it was easily dissected and removed. The patient tolerated the procedure well, and had rapid resolution of his systemic allergic response following removal of the BB.

Intraorbital foreign bodies generally occur in the setting of ballistic trauma such as accidents involving industrial machinery or gunshots. Although rare, they are a significant contributor to ocular morbidity, and depending on the mechanism of injury and composition of the material, they can produce serious sequelae.¹⁻³ Organic intraorbital foreign bodies can present with a multitude of complicating factors, most notably infection; thus, removal is generally recommended. However, inorganic materials without known contamination can often be safely treated conservatively.¹⁻⁴ Retained metallic intraorbital foreign bodies are particularly well-tolerated with the documented exception of iron, copper, and lead.^{1,2,4} Potential complications of these metals include siderosis bulbi, suppurative inflammation with retained copper and systemic lead toxicity, respectively. Herein, the authors present the case of a systemic allergic reaction associated with a retained BB in a child presenting 2 weeks after being shot with an air rifle, and the novel use of a cost-effective, readily available sterile magnet to assist with its removal.

CASE

The authors adhered to Health Insurance Portability and Accountability Act of 1996 guidelines for protected health information in presenting this report, and patient consent was obtained regarding use of clinical photographs. Two weeks prior to presentation, a 12-year-old boy was shot with a BB from an air rifle that lodged in his left inferior orbit. He suffered what his parents believed was a superficial injury. Two days after the incident, he noted flashes and floaters in his left eye, and was found to have an inferior retinal tear with overlying hemorrhage,

which was treated with laser retinopexy. Approximately 10 days after the initial injury, he developed an urticarial reaction on his neck, thighs, and flanks (Fig. 1). The child's parents were concerned that this may be related to his BB injury as prior skin patch testing was positive for an allergy to nickel, and initiated oral diphenhydramine therapy; he has no known seasonal or drug allergies, and no other provocative metal encounters had occurred.

After the onset of the urticarial reaction, the patient placed a household magnet over his left lower eyelid, and noted that it stuck. This interesting observation led his parents to seek a consultation in the authors' oculoplastic surgery clinic for concern of a possible retained foreign body.

At presentation, a scar was visible on the left lower eyelid. Just lateral to this entrance wound, there was a palpable firm mass over the orbital rim. The patient was sent for plain films, which revealed a round, metallic foreign body adjacent to the inferior orbital rim (Fig. 2). In light of his underlying metal allergy and worsening systemic reaction despite oral antihistamine treatment, the decision was made to proceed with removal of the presumed BB.

Preoperatively, the oculoplastic surgeon requested a sterile magnet used for intraocular surgery. This was unavailable at the time, but the operating room assistant provided a sterile, prepackaged magnet typically used to locate injection ports on tissue expanders in breast surgery (Magna Finder, Allergan, Irvine, CA, U.S.A.). The Magna Finder was placed over the lower eyelid preoperatively and magnetized to the foreign body in the superficial orbit. A second, sterile Magna Finder was then placed on the palpebral conjunctiva intraoperatively, which had a higher magnetization to the foreign body and assisted guidance during the transconjunctival surgical approach. After reaching the appropriate surgical plane, the magnet was placed over the



FIG. 1. Gross intraoperative photograph demonstrating hives about the patient's upper chest and neck.

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FIG. 2. Coronal radiograph demonstrating a round, metallic foreign body in the left inferior orbit.

fibrous tissue enveloping the BB, exerting gentle traction that stabilized the foreign body. This allowed easy dissection of the BB with cotton swabs and Westcott scissors (Fig. 3A,B). By the second postoperative day, the patient's urticaria resolved completely. At 12 months follow up, he was stable without any recurrence of symptoms or complications of surgery.

DISCUSSION

The potential morbidity of retained inorganic intraorbital foreign bodies is largely related to their location and composition. Ho et al. recently completed a review of 43 patients with retained metallic intraorbital foreign bodies. Of the 38 of these who did not require enucleation, only 2 patients suffered secondary complications that mandated surgical removal. One patient developed an inflamed, sterile cyst 25 years after suffering a retained shotgun pellet to his orbit. The second patient developed diplopia from retained bullet fragments causing mechanical

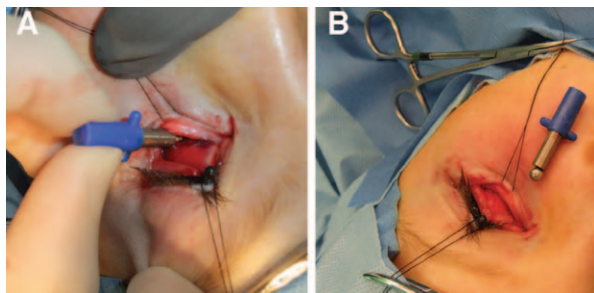


FIG. 3. **A**, Gross intraoperative photograph demonstrating conjunctival approach with Magna Finder in place, magnetized over the metallic foreign body. **B**, Gross intraoperative photograph demonstrating successful dissection and removal of the BB, magnetized to the Magna Finder.

restriction of his medial rectus.² Another case series looked at 40 patients with intraorbital foreign bodies; of these, 27 were inorganic, and only 3 cases developed secondary complications, all of which were infections in the setting of low-velocity trauma and delayed presentation, ranging from 1 week to 2 months.¹

Other authors have noted that inorganic intraorbital foreign bodies are generally well-tolerated with the exception of 3 specific metals: iron, copper, and lead.¹⁻³ The exact risk of siderosis with retained iron cannot be determined, but studies suggest that it is likely related to the amount of iron present and its area of contact with the sclera.¹⁻³ Retained copper can produce severe local, suppurative inflammation.^{1,2} Lastly, a theoretical risk for systemic lead toxicity exists with retained lead fragments, and has been seen with shotgun pellets lodged in joint spaces. However, there have been no reported cases of systemic toxicity associated with retained intraorbital lead particles.² The systemic urticarial response in the setting of a retained intraorbital foreign body noted in our case is likely extremely uncommon, having not been previously reported in larger reviews.

In the United States, commercially available BBs are predominantly composed of steel, with either a copper or zinc plating; however, other options are available including nonplated, steel- and lead-based BBs with copper or zinc plating. Prior studies demonstrated that retained BBs are generally well-tolerated, though the specific types were not stated.^{2,3} It is proposed that metallic intraorbital foreign bodies lodged into soft tissue incite a fibrotic reaction, producing a capsule around the material, and preventing systemic sequelae.² This patient's injury resulted from what appears to be either a zinc-plated or nonplated steel BB, and despite having such fibrous tissue around the foreign body at the time of surgery, developed systemic urticaria. Zinc plating commonly has additional components such as silver or nickel. Additionally, the plating may contain superficial defects allowing exposure to the underlying steel, of which nickel is a common component. The exact composition of the BB in this case could not be determined, and is a limitation to this report; however, given his documented allergy to nickel, and the resolution of his rash following removal of the BB, the authors propose this as the most likely source of his urticaria. Type IV delayed-type hypersensitivity to metals affects 10% to 15% of the human population, and nickel has the highest sensitization rate.⁵ Common etiologies of nickel-induced urticarial reactions include dental hardware and excessive ingestion of certain foods such as whole wheat, rye, tea, cocoa, almonds, legumes, and strong licorice, none of which the patient reported.^{5,6}

Metallic intraorbital foreign bodies can present a unique set of challenges when attempting removal; locating the intraorbital foreign body and preventing posterior migration are particular concerns. For very anteriorly located intraorbital foreign bodies, prior studies have reported using chalazion clamps or scalpel blade handles to stabilize the eyelid and prevent posterior migration. Additionally, a rare earth magnet was used for localization in cases where the intraorbital foreign body was not readily visible after dissection.³ A recent case report by Yoo et al.⁴ described utilization of an oscillating magnet in concert with high-resolution ultrasonography to assist with localization and removal of a superficial metallic intraorbital foreign body involving the canalicular system that could not be localized on clinical exam. In this case, the intraorbital foreign body was readily palpable, but not in a location amenable to stabilization with a chalazion clamp or scalpel handle.

As the patient had previously magnetized the intraorbital foreign body before presentation, we elected to use the Allergan Magna Finder, a sterile, prepackaged magnet to assist with guiding our surgical approach and stabilizing the intraorbital

foreign body. Other authors have recommended using a standard surgical approach as opposed to dissecting directly over the intraorbital foreign bodies.³ We elected to perform a trans-conjunctival approach once the magnet revealed stronger magnetization when placed on the conjunctiva as compared with the skin. After establishing the tissue plane, the magnet was reintroduced into the surgical field, and used to hold gentle traction on the intraorbital foreign body, allowing easy dissection and preventing posterior migration of the BB.

The authors propose the Magna Finder as a cost-effective (\$14 per unit, Allergan, Irvine, CA, U.S.A.), readily available, sterile device that can assist with determination of surgical approach and removal of anteriorly located intraorbital foreign bodies. Lastly, they highlight that, though metallic intraorbital foreign bodies are generally well-tolerated, localized or systemic complications can occur, as evidenced by the urticarial reaction in this case.

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