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Video

Delayed orbital floor implant complications: Case report and review of the literature

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ABSTRACT

Purpose: Foreign body reaction to non-absorbable alloplastic orbital implants utilized for bony reconstruction are infrequently documented in the literature. We present the workup and surgical management of a giant cystic mass encapsulating a patient's alloplastic orbital implant, which was ultimately deemed to be a result of foreign body reaction.

Observations: A 41-year-old male patient with distant history of a right orbital floor fracture had undergone repair with the placement of a nylon foil implant. The patient presented twenty years later with progressive ipsilateral globe proptosis and was found to have a giant inferior orbital cyst. Surgical exploration and removal of the implant and capsule were performed. Histopathology confirmed a delayed foreign body reaction around the patient's alloplastic implant.

Conclusions: Alloplastic implants may result foreign body reaction and cyst encapsulation as a delayed complication.

1. Introduction

Nonabsorbable alloplastic implants are routinely used for orbital bony reconstruction and are generally regarded as inert. However, rare cases of foreign body reaction to alloplastic orbital implants have been reported.[1,2] Herein we report an unusual presentation of progressive, ipsilateral globe proptosis 20 years after orbital floor fracture repair. Evaluation revealed a giant cystic mass encapsulating his orbital floor implant, which was ultimately determined to be a delayed, foreign body reaction around the patient's alloplastic implant.

2. Case report

A 41-year-old man had a history of right orbital trauma at 20 years of age, for which he underwent orbital floor fracture repair with nylon foil implant placement. He reported chronic, stable diplopia in far lateral and vertical gaze, and progressive right globe proptosis for the preceding seven years. His examination was notable for right ipsilateral supraduction and abduction deficits, hyperglobus (Fig. 1A), moderate resistance to retropulsion, and 5 mm of relative globe proptosis (Fig. 1B). The remainder of the examination, including visual acuity, intraocular pressure, and anterior segment was normal. Nasal endoscopy was unremarkable. Orbital CT revealed a well-circumscribed cystic mass of the right orbital floor abutting the inferior and medial rectus muscles, with superior displacement of the right optic nerve (Fig. 2A). MRI confirmed a non-enhancing 2.5 x 1.7 × 2.6 cm, well-circumscribed cystic inferior and posterior orbital mass (Fig. 2B). A curvilinear hypodensity was noted within the cystic cavity (Fig. 2A and 2C, red arrows), consistent with a non-metallic alloplastic implant.

A transconjunctival orbitotomy was performed (Supplementary Video 1). A fibrous cystic capsule was encountered along the orbital floor (Fig. 3A, green arrow). The capsule was bluntly entered, and a moderate amount of mucoid fluid was expelled and swabbed for culture (Fig. 3B). A single fixation screw (yellow arrow) with bony overgrowth (blue arrow) was also encountered and removed. A nonporous nylon foil orbital implant was visualized within the cystic cavity and retrieved (Figs. 3C and 4A). The cavity was copiously irrigated with saline and bacitracin solution. Endoscopic visualization confirmed no neoplastic tissue or additional foreign material within the cavity (Fig. 3D). The inferior wall of the cystic cavity was excised, and the superior cyst wall

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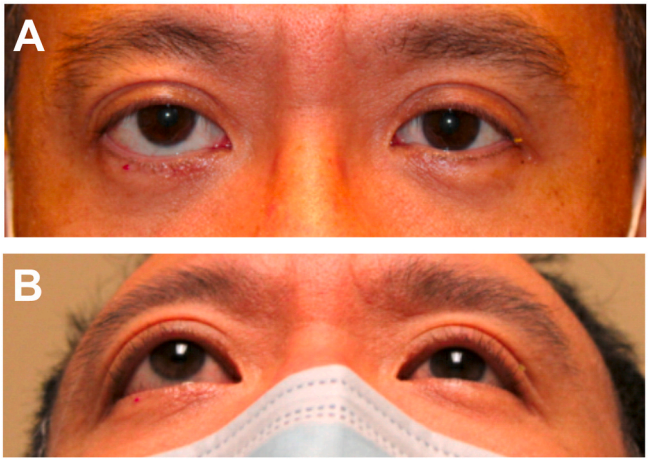

Fig. 1. Clinical images demonstrating right hyperglobus and proptosis on frontal (A) and worms-eye views (B).

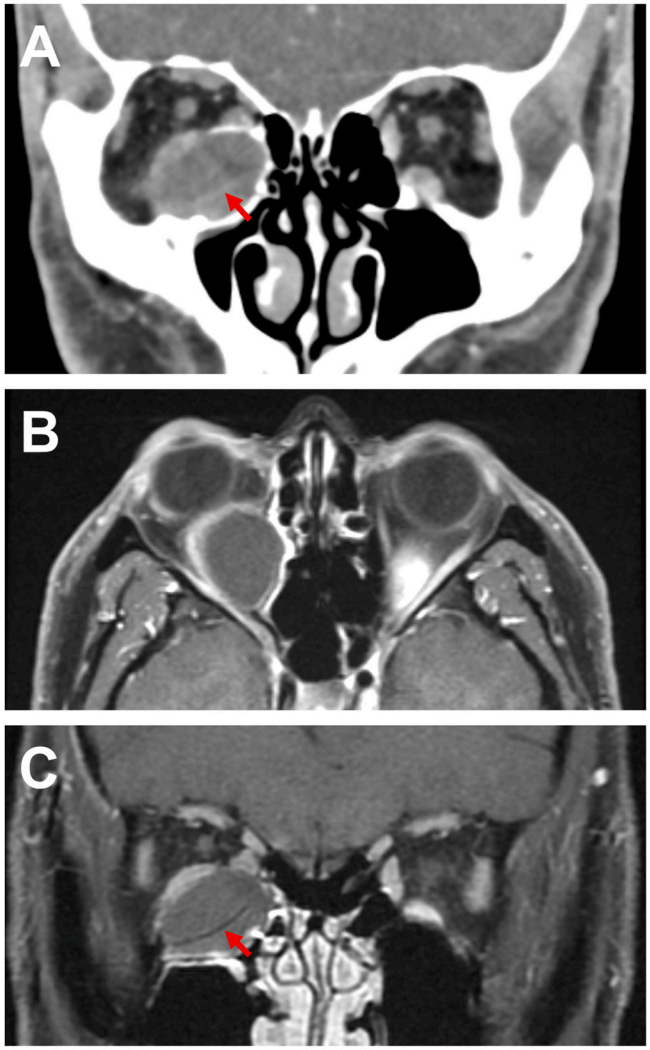

Fig. 2. (A) Orbital CT image demonstrating a giant, well-circumscribed cystic mass in the inferior right orbit abutting and displacing the inferior and medial rectus muscles. (B, C) Orbital MRI demonstrating a non-enhancing well-circumscribed mass abutting the globe and inducing proptosis, with linear heterogeneity seen within the mass (red arrow). A curvilinear hypodensity within the cystic mass (red arrows).

was left in situ to provide inferior orbital soft tissue support without an implant. Culture of the cystic contents confirmed a sterile inflammatory infiltrate. Histopathologic examination of the excised cyst wall showed a fibrotic cyst wall with fibroblast proliferation and without respiratory epithelium (Fig. 4B).

Supplementary video related to this article can be found at https://doi.org/10.1016/j.ajoc.2024.102047

Upon post-operative follow-up, the patient had improved diplopia and resolved hyperglobus and proptosis, with full resolution at six months (Supplementary Fig. 1).

3. Discussion

Historically, orbital fractures were repaired with autogenous bone grafts or maxillary sinus packing. Browning and Walker first described successful outcomes using nylon foil implants in orbital fracture repair in 1965.[3] Nylon foil is a non-porous alloplastic implant, composed of polyamide and available in various thicknesses from 0.05 to 2.0 mm (Supramid SupraFOIL, S. Jackson Inc., Alexandria, VA). Other nonporous implants, including silicone (Silastic) and polytetrafluoroethylene (Teflon), as well as titanium mesh, were contemporaneously introduced for this indication. However, in recent years, there has been a shift towards the use of porous implants, such as porous polyethylene (MedPor, Stryker, Kalamazoo, MI), for orbital bony reconstruction to enable biocompatible integration via fibrovascular ingrowth.

Acute complications of orbital wall fracture repair using nylon foil implants have been previously reported to include visual loss, graft migration, persistent diplopia, fistula formation, infection, and acute retrobulbar hemorrhage.[4] In a study by Park et al.,[5] smooth nylon foil implants were used in 181 cases of orbital fracture repair, with only three complications observed. Two cases were attributed to infection, necessitating implant removal. An acute retrobulbar hemorrhage occurred in one case, requiring surgical evacuation. Notably, no additional complications were reported in the four-year period following the study. Jensen et al. reported an unusual acute inflammatory mass reaction after SupraFOIL implantation, which ultimately required implant removal and a steroid taper.[6]

Causes of late proptosis following alloplastic implant placement may include peri-implant inflammation and fibrosis, gelatin film cyst formation, abscess formation, sino-orbital fistula, carotid-cavernous fistula, and traumatic optic neuroma.[2] A delayed orbital implant cyst may result from retained blood products, mucocele formation and foreign body reaction (Table 1).

Hemorrhage within the capsule surrounding the implant, also known as a chocolate or hematic cyst, has been reported for both porous and non-porous implants.[7,8] In some reports, these have been referred to as hematic "pseudocysts" due to their lack of epithelial lining.[19] Custer et al. reported four patients with hemorrhage within the nylon foil orbital implant capsule.[4] All cases presented nearly one decade after implantation. Fine vessel angiogenesis within the capsule and chronic inflammation were hypothesized to increase susceptibility to hemorrhage. Prendes et al. specifically studied the rate of intracapsular hemorrhage in a retrospective study of 227 patients at a single institution.[9] During four years of follow up, no patients were found to have intracapsular hemorrhage. The authors suggested that implants with increased rigidity and thickness may have a higher risk of forming fragile bridging vessels, which may lead to intracapsular hemorrhage.

Mucocele formation may also occur following alloplastic implant placement. These iatrogenic respiratory cysts are believed to arise from mucus-producing, maxillary sinus epithelium entrapped within the orbital floor at the time of fracture repair.[2] Mucocele formation after orbital fracture repair has been rarely reported.[2,10–14] Stewart et al. reported one case where a large cystic lesion presented on the orbit floor five years after floor fracture repair.[2] Needle aspiration yielded mucus and mucous membrane lining. Kwun et al. reported two cases of histologically-proven mucocele with respiratory epithelium after orbital

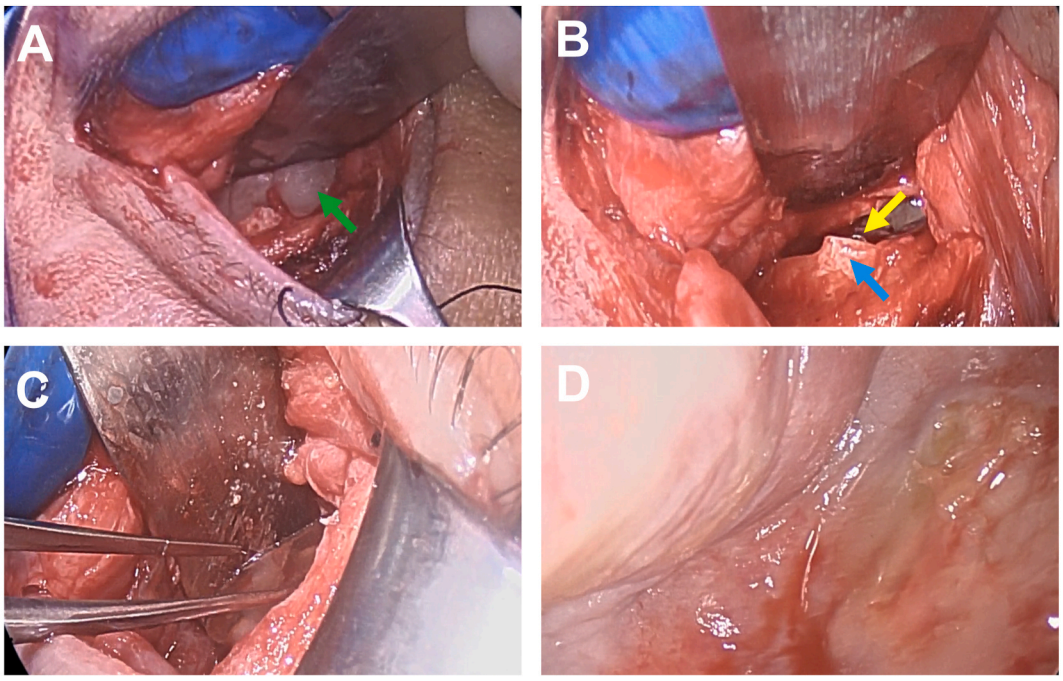

Fig. 3. Intraoperative endoscopic images demonstrating (A) the white cystic mass along the orbital floor (green arrow), (B) bony overgrowth (blue arrow) in area of retained screw (yellow arrow), (C) removal of the alloplastic implant from within the cavity, and (D) internal cystic cavity following content decompression.

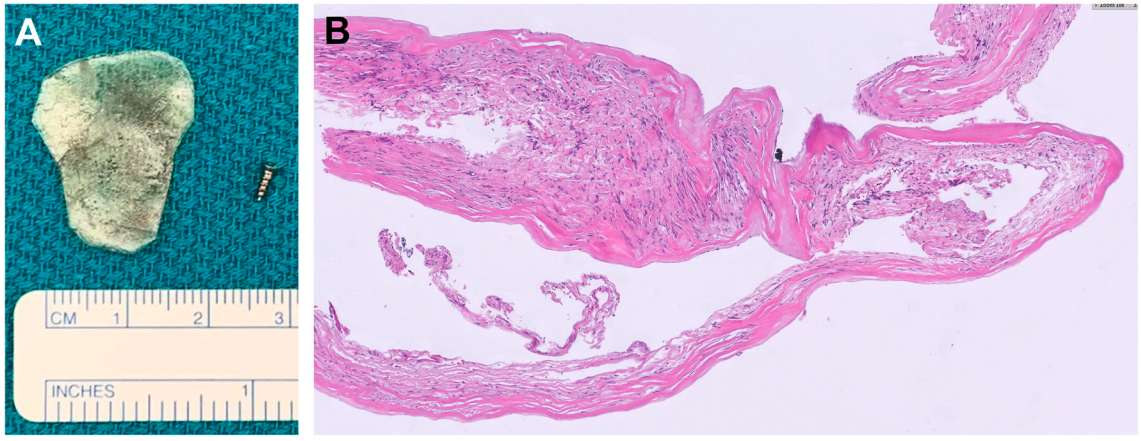

Fig. 4. (A) Gross examination of the explanted nylon foil implant and titanium screw (A). (B) Hematoxylin and eosin staining of the surgical specimen showing a fibrous cyst wall (microscope objective: 10x).

Table 1
Differential diagnosis of a chronic orbital implant cyst.

Diagnosis	Unique Features
Hemorrhagic cyst	Lack of epithelial lining Dark hemorrhage within the capsule[4,7–9]
Mucocele	Trapped respiratory epithelium May have fistula between sinus and cyst[2,10–17]
Foreign body reaction	Fibrous capsule without epithelial lining[18]

wall fracture repair, with both cases involving the medial orbital wall.[11] Park et al. reported a case of mucocele after medial wall orbital fracture repair masquerading as optic neuritis.[15] Ha'luf and Hillier et al. both presented cases with similar clinical and radiographic presentations to the case presented herein but were both ultimately found to have epithelial-lined cysts consistent with mucocele.[16,17]

Foreign body reaction to orbital implants have been rarely reported. The immune system detection of alloplastic material within the body may lead to an inflammatory and fibrotic cascade.[20] In the acute phase, M1 macrophages secrete factors to break down the biomaterial, which may lead to degradation and cracking of an implant's surface. In the chronic phase, M2 macrophages drive the formation of a fibroblastic capsule that surrounds the implant. The fibrous capsule results in a potential space where blood or mucoid fluid can accumulate.[8] Continued mobility of the implant or repeat trauma may lead to a prolonged tissue reaction.[18]

Our case presents a rare and delayed presentation of a giant pseudocyst, surrounding an alloplastic implant used for an orbital floor fracture repair. The diagnosis of orbital and sino-orbital mucocele was excluded due to the absence of communication between the orbit and sinus cavity and lack of respiratory epithelium on histopathology of the excised cyst wall. The intraoperative yellow-white mucoid contents demonstrated sterile inflammation consistent with delayed foreign body reaction rather than hemorrhage or infection. Foreign body reaction was

also inferred by the degradation of the surface of the implant on gross examination. The reaction was possibly prolonged due to the loss of implant fixation, resulting in increased mobility of the implant within the capsule. Sewall et al. reported a similar chronic inflammatory response in a silicone implant for orbital floor reconstruction, where a dense fibrous cyst-like lesion was encountered around the implant with non-infectious mucoid contents.[18]

4. Conclusions

Alloplastic implants may result in delayed complications including foreign body reaction and cyst encapsulation. Management should include cystic capsule and implant removal, with conservative reconstruction to limit future adverse events.

Patient consent

Consent to publish this case report was obtained from the patient. This report, however, does not contain any personal information that could lead to the identification of the patient.

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Authorship

All authors attest that they meet the current ICMJE criteria for Authorship.

CRediT authorship contribution statement

Brian Soetikno: Methodology, Investigation, Data curation, Writing – original draft, Writing – review & editing. **Steven Losorelli:** Methodology, Writing – review & editing. **Chaow Charoenkijkajorn:** Methodology, Writing – review & editing. **Jayakar V. Nayak:** Methodology, Supervision, Writing – review & editing. **Natalie A. Homer:** Conceptualization, Methodology, Supervision, Writing – original draft, Writing – review & editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ajoc.2024.102047.

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