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Case Report

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Intra-Operative Aqueous Misdirection During Cataract Surgery Following A Penetrating Injury

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Abstract

Purpose: *To describe a unique case of intra-operative aqueous misdirection occurring during cataract surgery in an eye with a prior self-sealing penetrating injury.*

Observations: *A 38-year-old Asian American male presented with rapid vision loss following a thumb tack injury to the left eye. Examination revealed a self-sealed limbal wound, localized iridodialysis, and a white cataract. During cataract surgery, hydrodissection triggered sudden anterior displacement of the iris–lens diaphragm with a rock-hard globe, consistent with acute intra-operative aqueous misdirection. The condition was successfully managed with lens aspiration and anterior vitrectomy, restoring normal anatomy and allowing intraocular lens implantation.*

Conclusions and Importance: *Penetrating ocular trauma may create occult pathways facilitating intraoperative fluid misdirection. Recognition and prompt surgical adaptation are critical to avoid catastrophic complications.*

Keywords: *malignant glaucoma, intraoperative aqueous, misdirection, cataract surgery, penetrating eye injury, hydrodissection complication.*

Introduction

Aqueous misdirection, also known as malignant glaucoma, is a rare but serious condition characterized by anterior displacement of the lens–iris diaphragm, resulting in a shallow or flat anterior chamber and elevated intraocular pressure despite a patent iridotomy. It is most commonly described postoperatively in angle-closure glaucoma but has been reported intraoperatively under certain conditions [1-3].

Traumatic cataracts following penetrating injuries may present unique anatomical disruptions, including occult capsular violations and vitreous communication [4]. These disruptions can predispose to atypical intraoperative fluid dynamics.

We report a rare case of acute intra-operative aqueous misdirection triggered during hydrodissection, likely facilitated by a prior penetrating injury tract.

Case Report

A 38-year-old Asian American male sustained blunt-penetrating trauma to the left eye from a thumb tack while removing a banner after an office event. The object struck the eye and rebounded. The patient experienced immediate pain, tearing, and redness, which subsided within minutes. He did not seek immediate medical care.

Over the subsequent weekend, his vision deteriorated progressively from normal to severely impaired. By presentation 4 days later, visual acuity was hand motions.

Examination

Slit lamp examination revealed:

- Self-sealed superonasal limbal wound
- Small underlying iridodialysis
- White cataract obscuring posterior view
- Intact anterior capsule
- Quiet anterior chamber (no cells or flare)
- White and quiet conjunctiva
- Intraocular pressure: 12 mmHg

B-scan ultrasonography confirmed an attached retina without significant vitritis.

The patient was diagnosed with a self-sealing penetrating injury with traumatic hydrated cataract and scheduled for cataract extraction with intraocular lens (IOL) implantation. Prophylactic topical antibiotics were initiated.

Surgical Course

Standard sterile preparation was performed under topical anesthesia with intravenous sedation.

Steps included:

- Paracentesis creation
- Intracameral 1% preservative-free lidocaine
- Viscoelastic injection
- Temporal clear corneal incision (2.6 mm keratome)
- Continuous curvilinear capsulorhexis

All steps proceeded uneventfully.

Intra-operative Complication

During hydrodissection using a bent 27-gauge cannula (initiated customarily superonasally for a left eye), there was immediate anterior vaulting of the iris–lens diaphragm, with:

- Complete anterior chamber collapse
- Iris–lens complex apposition to cornea
- Markedly increased intraocular pressure ("rock-hard" globe)

Attempts to deepen the anterior chamber with viscoelastic were unsuccessful.

Differential Diagnosis

The leading considerations included:

- Suprachoroidal hemorrhage or effusion
- Infusion misdirection syndrome
- Acute aqueous misdirection

Given:

- Lack of hypotony or wound leak
- Absence of precipitating event
- Early surgical stage
- Temporal association with hydrodissection

The most likely diagnosis was acute aqueous misdirection due to fluid diversion into the vitreous cavity.

Mechanism (Proposed)

It was hypothesized that:

- The prior penetrating injury created an occult tract through peripheral capsule into vitreous
- Hydrodissection fluid followed this path
- Rapid vitreous hydration caused forward displacement of the lens–iris diaphragm, consistent with aqueous misdirection physiology

Management

Retina consultation was requested but unavailable for approximately 40 minutes.

Given the presumed soft, acutely hydrated cataract, the surgeon proceeded with:

1. Irrigation/aspiration (I/A) removal of lens material without phacoemulsification
2. Creation of space in the anterior chamber
3. Posterior capsulotomy with anterior vitrector
4. Limited anterior vitrectomy

This resulted in:

- Immediate decompression of the globe
- Restoration of anterior chamber depth
- Normalization of anatomy

A posterior chamber IOL was implanted in standard fashion.

Notable intraoperative findings included significant iris chafing and trauma.

Postoperative Course

- Initial corneal edema resolved within several weeks
- Gradual visual recovery to 20/40
- No retinal complications observed

Discussion

Aqueous misdirection is classically associated with postoperative states, particularly in eyes with angle-closure glaucoma, but intraoperative cases have been described [1,2,6,7].

Most of these cases represent acute fluid misdirection syndrome involving short eyes with misdirection. This case is unique due to an association with occult penetrating trauma that likely directed fluid into vitreous via traumatic tract. If the possibility of misdirection had been entertained and hydrodissection was performed in a different quadrant, this could possibly have been avoided. However, as it was the case had begun smoothly and uneventfully, and the surgeon had assumed the rest of the case would too. Normally, hydrodissection is a very benign procedure.

The pathophysiology involved aqueous misdirection posteriorly diversion into the vitreous body, leading to vitreous expansion, forward displacement of the lens–iris diaphragm, and anterior chamber collapse. Hydrodissection may precipitate this if abnormal communication exists [3].

Management for standard malignant glaucoma involves medical therapy (limited intraoperatively)**,** pars plana vitrectomy (definitive)**,** aiming to disrupt the anterior hyaloid face. In this case, anterior vitrectomy combined with lens removal effectively relieved posterior pressure, consistent with prior reports emphasizing the importance of vitreous decompression [2,5].

Clinical Implications

- Penetrating injuries—even self-sealing—may create occult capsular or zonular defects
- Surgeons should exercise caution during hydrodissection in traumatic cataracts
- Early recognition of aqueous misdirection is critical to avoid:
  - Endothelial damage
  - Suprachoroidal complications
  - Surgical failure

Conclusion

This case highlights a rare but important intraoperative complication: aqueous misdirection triggered by hydrodissection in the setting of prior penetrating trauma. Prompt recognition and decisive surgical management with lens removal and anterior vitrectomy can successfully restore anatomy and visual function.

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