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Serial OCT Imaging of Spontaneous Closure of a Pediatric Traumatic Macular Hole

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Abstract

Purpose: To describe a case of spontaneous closure of a pediatric traumatic macular hole (MH) using serial optical coherence tomography (OCT) imaging. **Methods:** A single case was evaluated. **Results:** An 8-year-old girl developed a full-thickness MH in the right eye after sustaining blunt trauma from a bungee cord. She was observed monthly. By 3 months, the MH spontaneously closed, at which time an epiretinal membrane (ERM) developed. Spontaneous release of the posterior hyaloid and ERM at 5 months resulted in a relatively normal foveal contour. At the patient's last follow-up, the visual acuity in the right eye had improved from 20/80 to 20/30. **Conclusions:** Observation of a pediatric traumatic MH is a viable initial treatment option. Serial OCT imaging was useful in observing the natural history and mechanism behind spontaneous closure of a traumatic MH.

Keywords

pediatric macular hole, traumatic macular hole, optical coherence tomography

Introduction

Macular holes (MHs) in the pediatric population differ from those in adults in that they are rarer and frequently occur secondary to trauma (vs an idiopathic etiology, which is most common in adults).[1] Other reported etiologies for pediatric MH include X-linked retinoschisis, high myopia, incontinentia pigmenti, optic pit, ocular toxocariasis, and retinopathy of prematurity.[1] Traumatic MHs can occur in both younger children and adolescents. The mechanism behind the formation of a traumatic MH has been suggested to result from blunt trauma, causing axial compression of the globe and leading to subsequent compensatory equatorial expansion with centrifugal shearing forces on the macula.[2]

Spontaneous closure of pediatric traumatic MHs has been previously reported; however, the underlying mechanism is uncertain[1,3,4] and the literature describing the process of hole closure is scarce. Here, we report a case of a pediatric traumatic MH that closed without surgical intervention. Serial optical coherence tomography (OCT) imaging was used to show the natural history of pediatric traumatic MH closure.

Case Report

An 8-year-old otherwise healthy girl was referred for evaluation 10 days after sustaining blunt trauma to the right eye while playing tug-of-war with a bungee cord. Initial symptoms of intermittent floaters without flashes had resolved. Application of topical bromfenac to the right eye was started by the referring ophthalmologist. The visual acuity (VA) was 20/80 OD and 20/20 OS. The intraocular pressure was 20 mm Hg bilaterally. Both pupils were normal with no relative afferent pupillary defect. The examination of the anterior segment was unremarkable. A dilated fundus examination showed a full-thickness MH (FTMH) in the right eye and an area of commotio retinae approximately 2 disc diameters in size in the region of the superotemporal vascular arcade (Figure 1, A and B). The FTMH in the right eye was confirmed on OCT (Figure 2A).

The patient's initial management plan comprised a trial of monthly observation with monitoring, serial OCT imaging, and ongoing reconsideration of future surgical intervention (Figure 2). Two months after presentation, an epiretinal membrane (ERM) developed over the right macula with a reduction in the MH diameter (Figure 2C). The MH closed spontaneously by 3 months, albeit with an ERM and retinal thickening (Figure 2D). By 5 months, OCT showed that the ERM had resolved, with a reduction in foveal thickening and possible release of the posterior hyaloid (Figure 2E). At the 9-month visit, the foveal contour was restored, with a small residual

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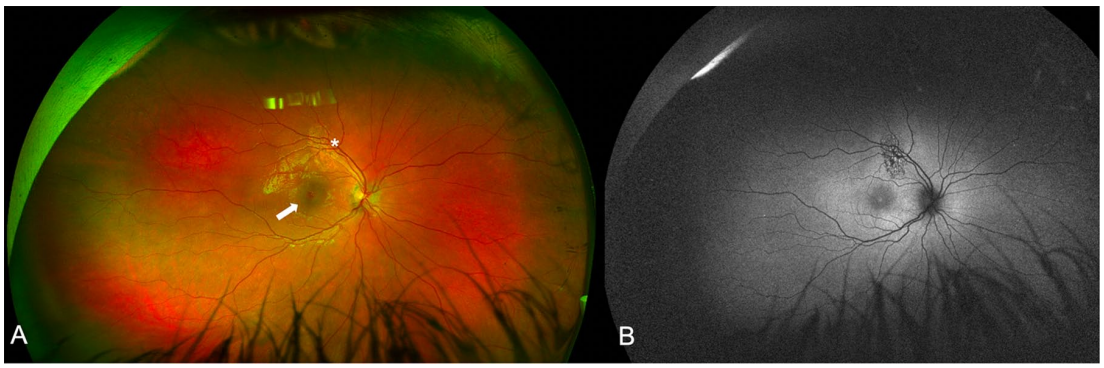

Figure 1. (A) Widefield imaging shows a macular hole (arrow) and commotio retinae (asterisk). (B) Fundus autofluorescence shows hypoautofluorescence in the area of commotio retinae.

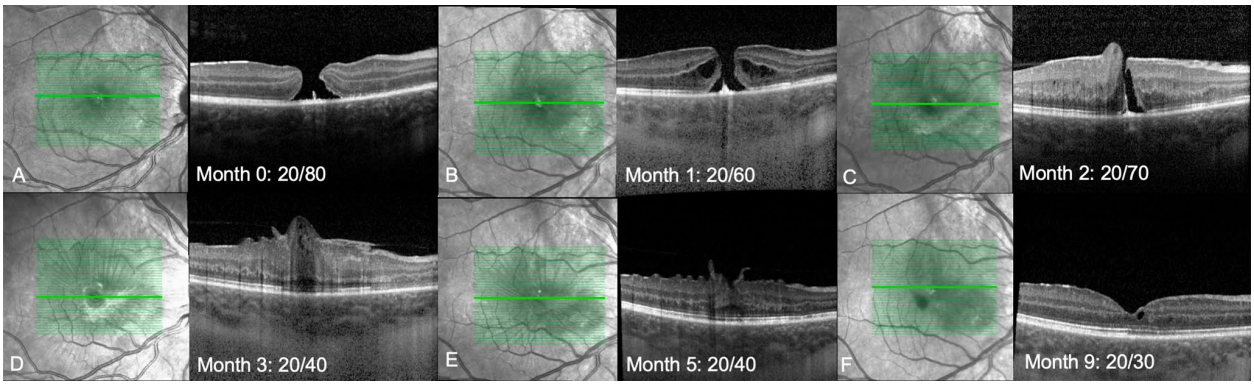

Figure 2. Serial spectral-domain optical coherence tomography imaging shows the process of spontaneous closure of a traumatic macular hole (MH) and the corresponding improvement in visual acuity. (A) A full-thickness MH. (B) Intraretinal cystic changes and hyperreflective material within the cavity. (C) Development of an epiretinal membrane. (D) Closure of the MH. (E) Reduction in retinal thickness. (F) Restoration of foveal contour.

cystic change (Figure 2F). Accordingly, the VA in the right eye had improved to 20/30. The right fundus examination also showed an area of chorioretinal scarring in the area where the commotio used to be and a whitish fibrotic material anterior to the right fovea that was presumed to be the released ERM.

Conclusions

In this report, we describe a case of spontaneous closure of a pediatric traumatic MH that was observed with serial OCT imaging and corresponded with good visual improvement. Pediatric traumatic MHs are more likely to close spontaneously[1,2] than idiopathic MHs in adults (2.7% to 6.2%).[5] In several small case series,[6] the rate of spontaneous MH closure was reported to range from 10% to 67%. Favorable prognostic factors for traumatic MH closure include younger age, smaller holes, and the absence of a fluid cuff.[1,7] Severe vision loss associated with traumatic MH may also stem from other sequelae, such as choroidal rupture, commotio retinae, and retinal detachment (RD).[1]

Although the mechanism behind hole closure in pediatric traumatic MH is unclear, theories include cell proliferation at the base of the hole, formation of a contractile ERM causing hole shrinkage, and detachment of the posterior hyaloid, which releases anteroposterior traction.[4] In our patient, we observed that centripetal tangential traction caused by the formation of an ERM may have contributed to a reduction in hole diameter and subsequent hole closure. We also documented a subsequent release of the posterior hyaloid and ERM, with restoration of a relatively normal foveal contour and corresponding improvement in VA.

The clinical approach to pediatric traumatic MHs requires considering the possible risks and benefits of observation vs surgical intervention. Most authors recommend a 4-month observation period before surgery if the MH fails to close.[6,8] However, in younger patients, the risk for developing amblyopia with reduced VA has to be weighed against the risk of surgery.[9] Pars plana vitrectomy (PPV); gas injection, with or without internal limiting membrane (ILM) peeling; and prone positioning have been associated with high rates of surgical success in traumatic MH.[1,8,10]

In a retrospective study by Liu et al of 40 pediatric traumatic MHs,[1] all patients had an initial period of observation. Spontaneous closure occurred in 10 patients (25%), with an average time from trauma to MH closure of 63.2 days. Twenty-nine patients had surgical intervention, with a mean time from trauma to surgery of 12.5 months. All 29 patients who were surgically managed achieved anatomic closure, with 22 (75.9%) of 29 experiencing closure after initial PPV and the remaining eyes requiring additional surgery. The VA improved with closure of the traumatic MH, regardless of whether surgery was performed. However, the final VA was better in the spontaneous closure group (20/80) than in the surgical group (20/160). Similar to the patients in the spontaneous closure group in the Liu et al study, our patient had a favorable visual outcome.

Induction of a posterior vitreous detachment is a crucial step in relieving anteroposterior traction. In pediatric patients, lifting an adherent posterior hyaloid during vitrectomy increases the risk for iatrogenic retinal tears.[8] Wu et al[8] reported the use of autologous plasmin enzyme–assisted vitrectomy to reduce the potential for surgical trauma in pediatric MH closure. Twelve of 13 patients with ages ranging from 1 to 15 years had successful hole closure, with 1 patient having complications of cataract surgery and another patient developing an RD. The mean time from trauma to surgery was 2.9 ± 2.0 months. Brennan et al[10] also reported a greater than 90% success rate in 13 patients with pediatric traumatic MHs who had PPV with ILM peeling. The patients' ages ranged from 11 to 17 years, and no surgical complications were reported. The mean time from trauma to surgery was 21 weeks.

To date, because the cases of pediatric traumatic MH are limited, there has been no randomized controlled trial to evaluate observation vs vitrectomy as initial management. A multicenter effort will be required to obtain meaningful results.

In conclusion, we present a case of spontaneous closure of a pediatric traumatic MH associated with 4 lines of improvement in VA. Serial OCT imaging allowed us to observe and describe the mechanism behind hole closure. An initial period of observation is a viable management option to achieve good visual and anatomic outcomes in cases of pediatric traumatic MH.

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Ethical Approval

Ethical approval was not required for this case report.

Statement of Informed Consent

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

Declaration of Conflicting Interests

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