Intraoperative OCT in Pediatric Posttraumatic Intraocular Bleeding

The following case report demonstrates the utility of this promising imaging technique in surgical decision-making.

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Spectral-domain optical coherence tomography (OCT) is a noninvasive, high-resolution imaging technique that provides in vivo cross-sectional views of the retina and choroid with good reproducibility. This technology has revolutionized diagnosis, therapeutic decision-making, surgical planning, and follow-up for patients affected by vitreoretinal diseases.

Vitreoretinal surgery has also made outstanding advances over the past few years, with the development of small-gauge instruments, vital dyes, new illumination systems, and widefield viewing systems. OCT has clearly already transformed medical retina, but the application of this imaging modality in the OR could be the next breakthrough in ophthalmic surgery.

CASE REPORT

A 5-year-old girl was referred to our department with a history of recent domestic trauma in her right eye (OD). Anterior segment examination showed periorbital hematoma with no extraocular foreign bodies visible and no extraocular muscle deficits detectable. Massive bleeding in the anterior chamber was evident, and no visualization of the posterior segment was possible at the slit-lamp examination.

BCVA OD was light perception with forced opening of the eyelids. Digital intraocular pressure (IOP) seemed to be higher OD than in the fellow eye. B-scan ultrasonography showed no pathologic echoes from the vitreous cavity, macula, or peripheral retina. The patient was hospitalized, and topical therapy of 2% atropine and 0.5% timolol twice a day was established.

The day after the trauma, periorbital edema had diminished and digital IOP seemed to be better, but massive hyphema persisted. With the informed consent of the patient’s parents, surgery was planned for the next day under general anesthesia (Video).

To ensure thorough disinfection, instillation of 5% povidone-iodine solution into the conjunctival fornix was performed, and the solution was left on for

At a Glance

- Ideally, intraoperative OCT should be performed with a hands-free technique.
- Fully integrated intraoperative OCT delivers high-resolution, cross-sectional images with immediate feedback to surgeons during surgery.
- In the case study, a real-time integrated high-definition OCT system confirmed that macular integrity was achieved through surgery.

Video: Addressing Hyphema

bit.ly/1S0YuHK
3 minutes. Then a 25-gauge irrigation cannula was inserted at the limbus into the anterior chamber at 7 o’clock. The main port was created at 11 o’clock with a microvitreoretinal blade, and removal of the anterior chamber blood clot was accomplished with 25-gauge vitrectomy while paying attention to the integrity of the lens and endothelium.

By means of a widefield imaging system integrated into the microscope (Resight 700, Carl Zeiss Meditec), a careful inspection of the posterior pole and retinal periphery was performed with no pathologic findings. Further confirmation of macular integrity was obtained using a real-time integrated high-definition OCT system (Rescan 700, Carl Zeiss Meditec).

The incisions were closed with hydro-sutures, and a subconjunctival injection of cefazolin and dexamethasone was administered. The postoperative course presented no complications.

Five days after surgery, BVCA had improved to 20/20, IOP was 16 mm Hg by applanation tonometry, and anterior and posterior segment examination showed no inflammation or bleeding recurrence. This status was maintained throughout the 2-month follow-up.

**DISCUSSION**

Several authors have reported the advantages of perioperative OCT in the surgical theater, including interesting findings in many vitreoretinal diseases: epiretinal membrane,8-13 macular hole,8-12,14 retinal detachment,15-17 vitreomacular traction,10,18 optic pit–associated maculopathy,19 and retinopathy of prematurity.20

Most of these studies were conducted using hand-held or non-parfocal microscope-coupled OCT devices. Although these machines provide prompt and useful details about the morphologic consequences of surgical procedures, they still do not allow real-time surgical visualization. In addition, without the steadiness of a fixed platform, even minimal operator movements can result in unsatisfactory image quality.

Identifying the target tissue on OCT is difficult without surgical microscope integration; in fact, patients undergoing vitreoretinal surgery are usually unable to collaborate by fixating due to sedation and/or local or general anesthesia. Thus, it is crucial to perform OCT with a hands-free technique, allowing the surgeon to move and keep focus on the OCT image without interrupting the surgery.

An additional issue with OCT that is not integrated into the surgical microscope is the potential risk of contamination of the surgical field. From a practical point of view, an OCT device incorporated into the surgical microscope optics could minimize this risk.

We believe that fully integrated intraoperative OCT (Figure) could have a huge impact on daily surgical practice for several reasons:

- It provides high-resolution, cross-sectional images with simultaneous feedback to the surgeon during intraoperative maneuvers.
- It allows real-time imaging, facilitating surgical decision-making and improving the understanding of the pathophysiology of underlying diseases.
- It saves time and offers ergonomic benefits with respect to perioperative imaging with minimal disturbance of the surgical procedure.
- It gives the surgeon control of the OCT from the microscope footpedal; the surgeon can simultaneously look at the surgical field in a planar and cross-sectional view.

In addition, published studies have already addressed the utility of parfocal OCT integrated with the surgical microscope, both with commercial systems9,21 and laboratory prototypes.22

The incidence of patients with ocular emergencies presenting at emergency departments in the United States has been estimated to be three per 1000 persons per year,23 and ocular trauma is the major cause of unilateral blindness in the United States,24 with associated relevant social and economic implications. As seen in our case report, intraoperative imaging can be particularly useful during pediatric evaluations and surgery. This observation has also been reported by other authors.25,26

In our case, intraoperative OCT helped us to minimize the length of surgery and the potential for iatrogenic damage (ie, cataract development), which improved our surgical management and outcome. The intraoperative objective confirmation of macular integrity had great value, including from a medicolegal point of view.

Fully integrated intraoperative OCT can greatly influence surgical decision-making; however, further studies are needed to establish the real cost-to-benefit ratio of this novel and promising imaging technique.
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