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Retrobulbar hemorrhage during strabismus surgery

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ABSTRACT

Purpose: This case report presents an event of retrobulbar hemorrhage (RH) occurring during the initial stage of strabismus surgery after incision of the conjunctiva and Tenon's capsule.

Observation: Significant bleeding with subsequent proptosis was observed intraoperatively after the incision of conjunctiva and Tenon's capsule during routine strabismus surgery on the medial rectus muscle in a 5-year-old boy. Intravenous mannitol was administered intraoperatively and surgery was completed as planned. The RH receded within 24 hours without the necessity of orbital decompression. Tenon's capsule prolapse was noted on the first postoperative day and managed with surgical excision under shallow intravenous anesthesia. No damage to the optic nerve or ganglion cells was detected a week after and three months post-surgery.

Conclusions and importance: Strabismus surgery bears a risk of RH at every stage of the operation. Careful hemostasis should be provided at each step of the procedure to decrease the risk of such an event. Patients after events of serious intraoperative bleeding should undergo careful post-operative investigation towards coagulation insufficiencies, though no such deficits were identified in the present case.

1. Introduction

Strabismus surgery, as with every surgical procedure, is burdened with potential complications.[1] Retrobulbar hemorrhage (RH) in strabismus surgery is reported very seldomly and typically occurs as a complication of retrobulbar anesthesia[2,3] or inferior oblique (IO) muscle surgery.[4,5] Apart from such reports, we experienced a significant RH after a typical and routine incision of the conjunctiva and Tenon's capsule during strabismus surgery.

2. Case presentation

A 5-year old boy with a history of prematurity presented to the Specialist Hospital of Chojnice, Poland for strabismus surgery. He was otherwise healthy. Pre-operative laboratory evaluation, which included blood count with platelet count and INR (International Normalized Ratio) for blood clotting time, was normal. The surgical plan was bilateral medial rectus (MR) muscle recession of 5.5 mm performed under general anesthesia.

The surgery began on the left eye from limbal incision of the conjunctiva with blunt Wescott scissors. The first cut was made along the limbus and included conjunctiva only. After that, incision of both conjunctiva and Tenon's capsule were made perpendicularly to the limbus in the inferonasal quadrant. At that point, intense bleeding occurred rapidly within a limited area thus we believe its source was a larger conjunctival vessel or the vessel of the intermuscular septum. This was well controlled with electrocoagulation within 20–30 seconds, however some amount of blood penetrated under the Tenon capsule and behind the globe. Protrusion of the eyeball and significant resistance to retropulsion with elevated intraocular pressure by tactile means was noted. Intravenously 100 ml of 15% mannitol was administered immediately and after the drop of intraocular pressure assessed by tactile means, the surgery was carried on. The MR muscle was prepared and hooked and presented intact. Additionally, the inferior rectus muscle was also examined (prepared and hooked) and showed no damage to the muscular tissue. Hence, the bleeding could not be attributed to accidental muscle damage. Sclera within the whole surgical area was carefully examined before and after muscle disinsertion and presented intact. Muscle recession and reattachment to the globe was performed directly with 6.0 Vicryl sutures without complications, including bleeding. At the end of the surgery on that eye, the surgeon experienced some difficulties with conjunctival closure due to moderate protrusion of the eye. The tension of the eye globe was moderately increased, as evaluated tactilely. Surgery on the right eye was carried out according to the plan without complications. Intravenous dexamethasone (Dexaven) at a dose of 1 mg was administered postoperatively to diminish the tissue

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Fig. 1. (A–C) Clinical photographs of patient after strabismus surgery following retrobulbar hemorrhage of the left eye.
A. A few hours after surgery, a large palpebral hematoma is observed on the left eye.
B. A week after surgery, there is prolapse of Tenon's capsule at the medial limbus in the left eye. The eyes are orthotropic in primary position.
C. Three weeks after surgery, there is persisting redness of the medial conjunctiva of the left eye. The eyes are orthotropic in primary position.

edema.

The patient was evaluated a few hours after surgery when he woke up after general anesthesia. Examination revealed a large palpebral hematoma and moderate exophthalmos of the left eye, nevertheless the eyeball did not present with increased tension as evaluated tactilely (Fig. 1A).

The pupil reaction was normal and the eye was not excessively reddened. The right eye seemed completely normal. The next post-operative visit was scheduled in a week and revealed normal ocular alignment but also Tenon's capsule prolapse visible at the limbus (Fig. 1B).

Due to poor cosmesis, the redundant Tenon's capsule was cut off under short intravenous general anesthesia. At the following visit 3 weeks postoperatively, the patient presented without detectable ocular deviation on the cover test but persisting redness in the spot of conjunctival sutures in the left eye (Fig. 1C).

Titmus test for stereoscopic vision for near showed stereopsis of 100 seconds of arc. Additionally, optical coherence tomography (Zeiss Cirrus OCT with AngioPlex; Carl Zeiss Meditec AG, Jena, Germany) measurements of retinal nerve fiber layer (RNFL) were performed two months post-surgery to exclude any potential optic nerve damage during the episode of RH. Evaluation did not reveal any asymmetry in RNFL values between the eyes (there is no normative database for RNFL values in Zeiss OCT for children under 18 years of age). The results of RNFL examination are presented in Fig. 2.

The boy remains under control of our clinic with regular follow-up visits. Due to this incident further diagnostics towards coagulation deficiencies was conducted. Blood clotting tests were repeated and investigation of deficiencies in clotting factors was conducted, however significant abnormalities were not found. Platelet count was 365 G/l (normal range 180–415), INR 1.08 (normal range 0.8–1.2), prothrombin time 11.8 sec. (normal range 25.1–37.7), and activated partial thromboplastin time - APTT 31.2 sec. (normal range 25.1–37.7). Fibrinogen was slightly decreased with 177 mg/dl (normal range 200–400), but repeated test showed values within the normal range. The levels of clotting factors fell within normal range; Factor VIII: 104% (normal range 70–150), XI: 85% (normal range 70–120) and XIII: 76% (64–133). Further monitoring of the patients' systemic results is conducted by the local pediatrician.

3. Discussion

The presented case report stands out among other papers on the subject as it shows relatively serious complication after just an incision of the conjunctiva and Tenon's capsule. To our knowledge, this is the only case of RH reported after routine and simple incision during initial stage of strabismus surgery. Penetration of blood from the conjunctival, Tenon's or possibly intermuscular septum vessels behind the eyeball caused a distinct proptosis, which, however, did not affect ocular motility or pupil reflexes. Intraoperative assessment and intravenous mannitol administration enabled completion of the surgical procedure without the need for orbital decompression.

Medical literature search reveals reports on cases of RH occurring after retrobulbar[2] or rarely, after sub-Tenon's injection of anesthetic used for such surgical procedures.[3] These reports obviously indicate accidental damage from the needle penetrating through the vessels in the orbit and subsequent massive bleeding. Hence, these complications do not refer to the surgical technique itself.

IO muscle surgery theoretically should increase the risk of RH due to the IO muscle location being close to the vortex veins and possible injury to that large vessel. Al Thiabi reports a serious unilateral RH after bilateral strabismus surgery on MR and IO muscles.[4] After surgery, the author observed severe ocular proptosis, limited ocular motility and anisocoria. The case required urgent canthotomy and cantholysis for evacuation of the blood due to risk of the pressure elicited on the optic nerve and other orbital structures. As the hemorrhage had a sudden onset, the author assumed that the vortex vein was damaged during the lateral rectus muscle hooking in order to expose IO and advised not to hook the muscle far from its insertion. Serious RH was also reported after rectus muscle surgery by Todd et al.[6] The authors observed a delayed hemorrhage, 36 hours after surgery that had a dramatic course and required surgical orbital decompression. Late intraorbital bleeding after uncomplicated strabismus surgery was also reported by Arès et al.[5] Symptoms appeared 2 days after a routine procedure of bilateral MR muscle recession and bilateral IO myotomy in a young boy with congenital esotropia. The authors hypothesized that the bleeding could have occurred due to insufficient cauterization of the dissected IO muscles. It must be emphasized, that all the abovementioned episodes were noted in patients without any hematological disorders, which could explain the occurrence of RH.[6,7] Coagulation deficiencies are well-recognized risk factors for intraorbital hemorrhage[8–10]; however, there are cases of RH that are hard to explain, or at least astonishing. A serious event of bilateral retrobulbar bleeding was reported in the course of strabismus surgery and was believed to be associated with concentrated garlic intake in the form of a tablet.[11]

Evaluation of the causes of RH in strabismus surgery cannot be based on statistical analysis as only singular episodes of such complications are reported. Thus, analysis must include available case reports and knowledge of surgical anatomy and practice. Sudden onset of RH is usually associated with direct damage to the vascular system, whereas

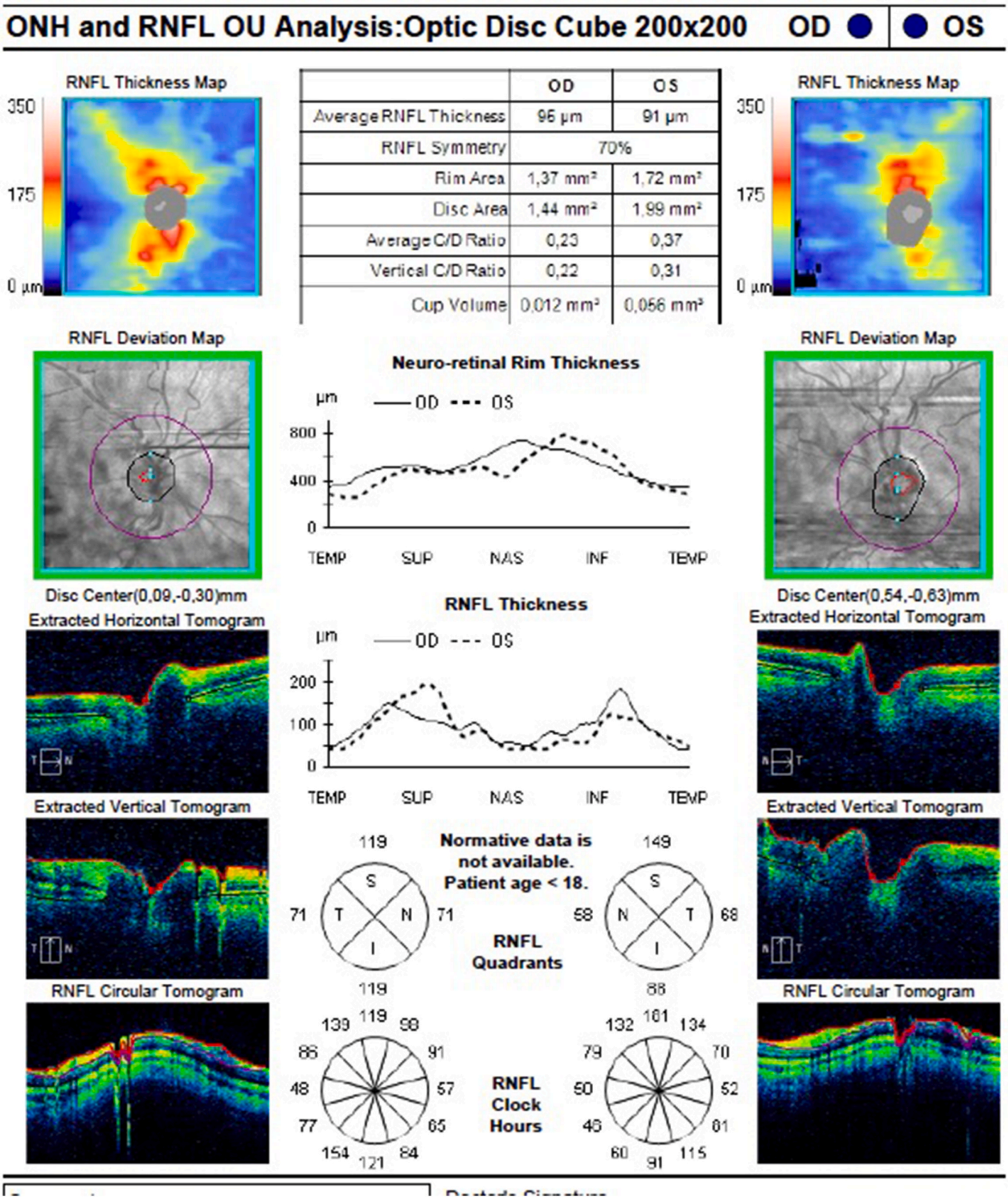

Fig. 2. Optical coherence tomography (OCT) (Zeiss Cirrus OCT with AngioPlex; Carl Zeiss 129 Meditec AG, Jena, Germany) measurements of retinal nerve fiber layer (RNFL) in both eyes 2 months after occurrence of the retrobulbar hemorrhage in the left eye. Results show lack of significant asymmetry between the eyes in RNFL. There is no normative database for RNFL values for patients below 18 years of age for that device.

delayed bleeding probably has muscular origin. While RH after even careful anesthetic injection is difficult to avoid, surgical practice may reduce its risk by cautious incision and cauterization of incised vessels and muscles during the operation. Patients with episodes of intense bleeding during the surgery should be subject to hematological investigation towards clotting insufficiencies.

4. Conclusions

RH in strabismus surgery is a rare but possible complication that can occur at every stage of the operation, despite careful and prompt hemostasis. According to analyzed reports, it can be caused by direct damage to the vessels or have a muscular origin, and in such cases have delayed onset. Patients after such surgical events should undergo careful post-operative investigation towards clotting insufficiencies, though none may be identified.

Patient consent

Written consent to publish case details has been obtained from the patient's mother.

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Data availability statement

All data generated or analyzed during this study are included in this article. Further enquiries can be directed to the corresponding author.

CRediT authorship contribution statement

Maciej Gawęcki: Writing – review & editing, Writing – original draft, Methodology, Conceptualization. **Krzysztof Kiciński:** Validation, Resources, Investigation, Data curation.

Declaration of competing interest

Authors declare no conflict of interest in publishing of this paper.

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