Case Report

Anterior Chamber Shallowing from the Early Stage of Surgery and Suprachoroidal Effusion during Clear Corneal Small-Incision Cataract Surgery: A Case Report

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Keywords
Suprachoroidal effusion · Anterior chamber shallowing · Clear corneal small-incision cataract surgery · Infusion misdirection syndrome

Abstract
Suprachoroidal effusion (SCE) is a rarely observed complication due to the recent generalization of clear corneal small-incision cataract surgery. We report a case of anterior chamber shallowing (ACS) from the early stage of surgery and SCE during clear corneal small-incision cataract surgery. A 69-year-old man was referred to our department for primary open-angle glaucoma and grade 2 nuclear cataract. The intraocular pressure (IOP) was 18 and 12 mm Hg in the right and left eyes with the instillation of three antiglaucoma eye drops in both eyes, respectively, and deep anterior chamber and normal axial length were observed. At the age of 70 years, which was 4 months after the initial visit to our department, the IOP of the right eye increased to 30 mm Hg. Hence, cataract surgery and microhook ab interno trabeculotomy (μLOT) of the right eye were scheduled. Mild ACS was observed during continuous curvilinear capsulorhexis (CCC), and ACS worsened as the surgery progressed, making the surgery progressively challenging. SCE was observed by fundus examination after phacoemulsification and cortex removal, and the wound was immediately closed with a suture. The IOP was 28 mm Hg on postoperative day (POD) 1 and decreased to 14 mm Hg on POD 5. SCE disappeared on POD 12. On POD 18, intraocular lens implantation into the bag and μLOT were performed under general anesthesia. Subsequently, the IOP decreased to 15 mm Hg 3 months after the surgery. Mild ACS was already present at the time of CCC, so it is possible that SCE occurred in the early stage of surgery. If ACS is observed intraoperatively, especially if there are SCE risk factors, such as hypertension, glaucoma, and lung cancer, as in this case, and even if the eye...
has deep anterior chamber and normal axial length preoperatively, fundoscopic examination should be performed even at an early stage of clear corneal small-incision cataract surgery to rule out SCE.

Introduction

Suprachoroidal effusion (SCE) is a condition in which fluid rapidly accumulates in the suprachoroidal space due to an abnormal increase in choroidal vascular permeability and is considered a precursor of suprachoroidal hemorrhage (SCH) [1]. SCE, which develops during cataract surgery, is rarely observed recently when clear corneal small-incision cataract surgery has become commonplace [2]. This report presents a case of anterior chamber shallowing (ACS) immediately after the start of clear corneal small-incision cataract surgery and SCE on intraoperative fundus examination after phacoemulsification and cortex removal.

Case Report

The patient was a 70-year-old man. At 66 years of age, the intraocular pressure (IOP) was 40 mm Hg/28 mm Hg (right eye/left eye) at the first visit to a nearby physician, diagnosed as primary open-angle glaucoma. The IOP was controlled at 15 mm Hg with the instillation of three antiglaucoma eye drops in both eyes. The IOP sometimes increased to 40 mm Hg with the interruptions of clinic visit and treatment, and progression of visual field loss was observed. Therefore, at 69 years of age, he was referred to our department. His best-corrected visual acuities were 20/30 in the right eye and 20/25 in the left eye, IOP was 18 mm Hg/12 mm Hg, and slit-lamp examination revealed grade 2 nuclear cataract and Shaffer 4° open angle at the first visit to our department. The anterior chamber depth to the corneal endothelium was 2.98 mm/3.00 mm (right eye/left eye), and the white-to-white distance was 10.98 mm/11.10 mm as per anterior segment optical coherence tomography (CASIA2, Tomey, Tokyo, Japan) (Fig. 1). Axial length measured using an optical biometer (OA-2000; Tomey, Tokyo, Japan) was 22.89 mm/22.93 mm. At the age of 70 years, which was 4 months after the initial visit to our department, the IOP was 30 mm Hg/18 mm Hg

Fig. 1. Preoperative anterior segment optical coherence tomography. The depth of the anterior chamber was 2.98 mm/3.00 mm (right eye/left eye), and there was no difference between the right and left eyes, and no shallow anterior chamber was observed.
even after treatment with three types of eye drops (0.004% travoprost, 0.5% timolol, and 0.4% ripasudil) in both eyes. Hence, combined cataract surgery and microhook ab interno trabeculotomy of the right eye were planned 9 days after the last visit to our department, which was 4 months after the initial visit. He has had systemic hypertension, primary lung cancer, and brain metastasis. Radiation therapy for brain metastasis (left frontal lobe) was performed 1 month before the last visit, and chemotherapy (osimertinib 80 mg) was initiated after that at our hospital’s department of respiratory medicine. Moreover, 500 mg oral acetazolamide was administered from the last visit until 1 day before surgery. On the day before surgery, the IOP was 12 mm Hg/7 mm Hg, and the anterior chamber was deep in both eyes, and there was no difference in the depth of the anterior chamber between both eyes. The preoperative blood pressure from the day prior until the day of surgery was stable, with a systolic blood pressure of 120–130 mm Hg and diastolic pressure of 80–90 mm Hg during treatment with oral irbesartan 100 mg and amiodipine OD 5 mg.

Surgery was performed in the right eye under local anesthesia with topically applied 0.4% oxybuprocaine and 1% lidocaine injected in the anterior chamber. During the surgery, corneal side ports with a width of 1 mm were made at the 7:30 limbus and 10:30 limbus, and after anesthesia in the anterior chamber with 0.5 mL of preservative-free lidocaine 1%, the anterior chamber was filled with viscoelastic material (purified sodium hyaluronate 1%, OPEGAN0.6; Santen Pharmaceutical Co. Ltd., Osaka, Japan), but the anterior chamber formation was suboptimal. Continuous curvilinear capsulorhexis (CCC) was initiated using a cystotome, but we noted a consistent rhexis extending peripherally, especially in the second half of the CCC, and managed to complete CCC without tearing (Fig. 2a). A 2.4-mm temporal clear corneal incision was made with a disposable steel keratome. Although anterior shallowing was observed despite the addition of a viscoelastic material (purified sodium hyaluronate 1%, OPEGAN Hi 0.85; Santen Pharmaceutical Co. Ltd.) into the anterior chamber, hydrodissection was performed carefully (Fig. 2b). ACS remained during phacoemulsification of the lens nucleus, although we tried to form an anterior chamber by increasing the height of the irrigation bottle to 80 cm (Fig. 2c). The posterior capsule was elevated, and an attempt to push down and expand the elevated posterior capsule by injecting a viscoelastic material into the bag was unsuccessful because most viscoelastic material was extruded from the anterior chamber, and it is difficult to remove the cortex using irrigation and aspiration (Fig. 2d). Although anterior vitrectomy via the pars plana was performed using a 25-G vitrectomy cutter to decrease the pressure of the vitreous cavity because we suspected infusion misdirection syndrome, the IOP remained high and the posterior capsule was elevated again (Fig. 2e). When the fundus was observed, SCE was noted in the inferior temporal part and nasal inferior part of the fundus (Fig. 2f). Hence, the 2.4-mm corneal incision was sutured with 10-0 nylon and closed. No cortex was remaining in the capsule. The blood pressure did not increase during the surgery and was stable, and the blood pressure immediately after the surgery was low (112 mm Hg/94 mm Hg). Moreover, he was calm without urinary urgency, pain, or cough during the surgery.

On postoperative day (POD) 1, the IOP was 28 mm Hg in the right eye, and SCE was observed in the inferior temporal, nasal inferior, and superior parts (Fig. 3), although the height of SCE observed in the inferior part was shorter (Fig. 3). He was treated with 2% carteolol, 0.005% latanoprost, 0.4% ripasudil, 0.1% brimonidine, and 500 mg oral acetazolamide. On POD 5, the IOP decreased to 14 mm Hg, and the inferior and superior parts with SCEs improved considerably, leaving only the inferior temporal side. The disappearance of SCE was confirmed on POD 12. On POD 18, intraocular lens implantation into the bag and microhook ab interno trabeculotomy that incised approximately 120° of the nasal trabecular meshwork were performed under general anesthesia. Subsequently, the IOP
subsided, and 3 months after surgery, the IOP was 15 mm Hg and the best-corrected visual acuity was 20/25 in the right eye instilled with 0.004% travoprost, 0.5% timolol, and 0.4% ripasudil.

**Discussion/Conclusion**

The incidence of SCE in cataract surgery has been significantly reduced by modern cataract surgery techniques involving small incisions [2]. To date, the occurrence of acute SCE during clear cornea small-incision phacoemulsification and aspiration has rarely been observed. Recently, only one case of SCE identified during cataract surgery in the patient with central serous chorioretinopathy has been reported [3]. SCE is considered a precursor to choroidal...
and expulsive hemorrhage and is important because choroidal and expulsive hemorrhage can result in severe impairment of visual acuity [4].

If sudden ACS is encountered during cataract surgery, it is important to distinguish SCE from infusion misdirection syndrome. In this case, because we observed ACS with increased IOP, we suspected that it occurred due to infusion misdirection syndrome; thus, vitrectomy was performed using a 25-G vitreous cutter. The fundus should have been examined before vitrectomy to confirm the choroidal ridge to rule out SCE and SCH. Vitreous resection is recommended for misdirection syndromes with ACS and no choroidal ridges [5]. However, when SCE is present, this procedure is risky because removing fluid from the posterior segment may allow the effusion to propagate, causing SCH. Fortunately, this adverse event did not occur in our patient. If ACS occurs, the surgeon must ascertain whether fluid misdirection or SCE is the causal mechanism. Closing the incision and simply observing for a few minutes is often diagnostic. The chamber gradually deepens in misdirection but not in SCE. During this time, indirect ophthalmoscopy may be performed to observe for SCE or SCH.

SCE is reported to be caused by a rapid decrease and prominent change in IOP in phacoemulsification of lens nucleus and cortex removal [6]. Such large fluctuations can occur, especially when the wound does not self-seal and the phacoemulsification or irrigation/aspiration probe is withdrawn from the eye. If it does, it may increase the risk of SCH. However, in this case, mild ACS was present at CCC. Therefore, SCE could have occurred in the early stage of the surgery. Hydrodissection, lens phacoemulsification, and cortex removal exacerbated the condition. However, because fundoscopy (ophthalmoscopy) was not performed in the early stage of surgery and SCE was not confirmed during ACS, it is possible that ACS may have been caused by misdirection in the early stage of the surgery.

Risk factors for SCE include systemic factors, such as aging, hypertension, coughing, and arteriosclerosis; local ocular factors, such as glaucoma, long axial length, and short axial length (microphthalmia and nanophthalmia) [7]; and intraoperative factors, such as rapid decrease in IOP and coughing [6, 8, 9]. Our patient had glaucoma; however, the IOP on the day before the surgery was controlled to 12 mm Hg with the instillation of three eye drops and oral acetazolamide, with normal axial length and deep anterior chamber. Because trabeculotomy can be expected to have a more intraocular pressure-lowering effect when performed simultaneously with cataract surgery and the patient had grade 2 nuclear cataract at the age of 70 years, it seemed to be appropriate to plan combined cataract surgery and microhook ab interno trabeculotomy in this case [10]. Moreover, SCE is generally painless, and choroidal and expulsive hemorrhages are often accompanied by pain. In this case, no pain was observed, blood pressure before and during surgery was stable with antihypertensive drugs, and no notable increase in blood pressure was observed during the surgery. In addition, despite undergoing chemotherapy for lung cancer, patient’s respiratory function was within the normal range, and he remained calm without coughing during the surgery. However, considering the factors of hypertension, glaucoma, and primary lung cancer, the patient had a high risk for the SCE-SCH spectrum. We might have considered SCE when ACS was noticed in the early stage of the surgery.
We presented a surgical case of a patient with cataract and primary open-angle glaucoma who had mild ACS from the early stage of clear corneal small-incision cataract surgery. This condition has been rarely reported and its incidence remains unknown. In our case, ACS worsened as the surgery progressed, making the surgery progressively challenging. The patient also experienced SCE after phacoemulsification and cortex removal. If ACS is observed during surgery, especially if there is a risk factor for SCE, such as hypertension, glaucoma, and lung cancer as in this case, and even if the eye has deep anterior chamber and normal axial length preoperatively, fundoscopic examination should be performed even at an early stage of clear corneal small-incision cataract surgery to rule out SCE.

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Statement of Ethics

The Ethics Committee in Saitama Red Cross Hospital waived the approval of this retrospective case report. All procedures conducted in this study adhered to the tenets of the Declaration of Helsinki. Written informed consent was obtained from the patient for publication of this case report and any accompanying images.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

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Author Contributions

Atsushi Okubo, Suguru Nakagawa, and Shun Ogawa collected, analyzed, and interpreted the clinical data. Suguru Nakagawa wrote the first draft of the manuscript. Suguru Nakagawa, Shun Ogawa, and Kiyoshi Ishii contributed to the design and concept of this report. All the authors reviewed and approved the final version of the manuscript.

Data Availability Statement

All the data supporting the findings are contained within the manuscript. Further inquiries can be directed to the corresponding author.
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