Case Report

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Vertical diplopia after cataract surgery, overacting, and/or underacting extraocular muscle

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Abstract:

The purpose of this study was to demonstrate two cases of vertical diplopia after cataract surgery and to discuss the mechanism and types of strabismus caused by the local anesthesia with retrobulbar injection. Two cases of vertical diplopia after cataract surgeries were reported. They were operated by the same surgeon and both happened to the left eye and both presented with marked left hypotropia. The clinical findings consisted of overacting left inferior rectus (LIR) in case 1 and mixed overacting and restrictive LIR in case 2. The diplopia and left hypotropia were eliminated after muscle operation. Retrobulbar injection is a basic technique in ophthalmic practice. Although it is generally safe, complications do happen in certain cases including diplopia and strabismus. Ophthalmologists should know about the orbital anatomy and learn to prevent any accidental insult to extraocular muscles.

Keywords:

Diplopia, local anesthesia, retrobulbar injection, strabismus

Introduction

Retrobulbar injection of local anesthetics is a very popular method in cataract surgeries. In 1994, a survey by Schein *et al.*[1] reported that two-thirds of cataract procedures were done under retrobulbar injection. Lum *et al.*[2] also reported the initial 2 years of experience with the AAO National Eyecare Outcomes Network cataract surgery database, which collected data of 249 ophthalmologists from 1996 to 1997, and 41.4% of cataract surgeries were done under retrobulbar injection local anesthesia. Although there is a trend of less using retrobulbar injection for cataract surgeries,[3] it remains as a crucial technique in ophthalmic practices.

If well trained and performed cautiously, retrobulbar injection is a safe procedure. However, there are still many complications reported due to its nature of blind insertion of sharp needle into retrobulbar space. Retrobulbar hemorrhage, accidental penetrating into globe, and postoperative strabismus were reported before.

Retrobulbar injection-induced strabismus can be temporary or permanent. Moreover, it can be very frustrating to both patients and doctors because of postoperative diplopia. The diplopia may be due to overacting or underacting of the involved extraocular muscle (EOM).[4] The underaction of EOM can be paretic or restrictive. All the different types of strabismus should be cautiously differentially diagnosed for further proper management.

Here, we present two cases of vertical diplopia happened after cataract operation under local anesthesia with retrobulbar injection.

Case Reports

Case 1

A healthy 72-year-old male suffered from vertical diplopia more than one month after

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cataract surgery for his left eye. He had no diplopia before and came to seek for help 5 months after the cataract operation. From the history taking, the cataract surgery was performed under local anesthesia using retrobulbar injection. When examined, the vision was good and OD/OS was 6/6.7 and 6/6 without correction, respectively. For the eye position, there was significant left hypotropia at primary position which measured 40 prism diopters when the patient fixed at far target [Figure 1]. The duction test showed no limitations in all directions in both eyes, but the version test showed overacting left inferior rectus (LIR) muscle [Figure 2]. The other eye examinations were unremarkable except for the pseudophakic eyes. After observation for 2 more months, there was no change of the deviation. Under the impression of the left hypotropia due to overacting LIR muscle, we performed muscle operation for him. The surgical dose was 7.0 mm recession of LIR muscle with adjustable suture and 6.0 mm resection of the left superior rectus muscle. To prevent left lower lid retraction caused by inferior rectus muscle recession, we also performed left lower lid traction suture with adjustable suture for him. During the operation, there was no muscle restriction when we performed the forced duction test. After the muscle operation, the patient's diplopia disappeared and he was quite happy with the result. Three months after the muscle operation, the eyes were orthophoric at primary position [Figure 3] and the EOM was full and free in all directions [Figure 4] and there was no left lower lid retraction.

Figure 1: Preoperative primary position of case 1. Marked left hypotropia was noted

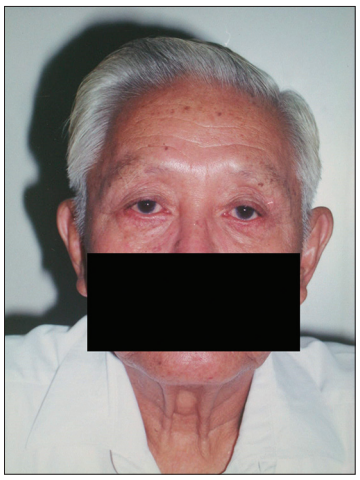

Figure 3: Primary position of case 1 after muscle operation for 3 months. The eyes were orthophoric and there was no left lower lid retraction

Case 2

A 74-year-old male patient suffered from vertical diplopia 10 days after cataract operation for his left eye and came to see us 10 months after the cataract operation. Interestingly, the second case was operated at the same clinic and by the same surgeon as case 1 and visited our hospital 5 months after case 1. For the eye examinations, the vision showed OD 6/10 and OS 6/6.7 with best correction. The primary position of eyes showed marked left hypotropia [Figure 5]. For the EOM examination, there existed −2 limitation of supraduction in his left eye and +2 overaction of the LIR [Figure 6]. We performed refixation movement to check the saccade and there was no gross lag of the left superior rectus by observation. The alternate prism cover test measured 30 prism diopters left hypotropia at primary position. The other eye examinations were unremarkable except for mild cataract of the right eye. Under the impression of the left hypotropia due to mixed overacting and restrictive LIR muscle, we performed muscle operation for him 1 month after his

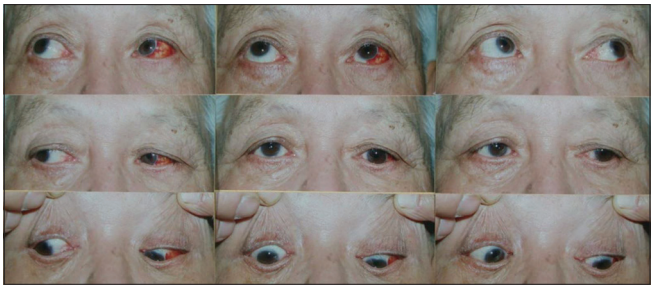

Figure 2: Preoperative extraocular muscle of case 1. There was overaction of the left inferior rectus and no underaction of the other muscles

Figure 4: Extraocular muscle of case 1 after muscle operation for 3 months. The eye movement was full and free in all directions

visit. During the operation, the forced duction test to LIR was +2 positive. The operation consisted of 6 mm recession of LIR muscle with adjustable suture and 4 mm resection of left superior rectus muscle and left lower lid traction suture to prevent postoperative lid retraction. There was no more diplopia after the muscle operation. Six months later, the eyes were orthophoric at primary position and there showed mild left lower lid retraction [Figure 7]; otherwise, the patient was satisfied with the result [Figure 8].

Discussion

Diplopia and strabismus can happen following almost all kinds of ocular surgeries. Cataract surgery, vitreoretinal surgery, glaucoma surgery, conjunctival surgery, and refractive surgery were reported to cause postoperative diplopia and strabismus.[5] Cataract surgery is the most popular in ophthalmic practice and it is usually done under local anesthesia, in which retrobulbar injection was the mostly used.[1,2] However, there is a trend of less using retrobulbar injection for cataract surgeries. Ianchulev *et al*.[3] and Tsontcho *et al*. reported office-based cataract surgery in 21,501 eyes and more and more topical or intracameral lidocaine (51.2%) replaced retrobulbar lidocaine (<0.03%) as the local anesthesia. Although retrobulbar injection is less used nowadays, it remains as a crucial technique in ophthalmic practice.

In a review of strabismus or binocular diplopia presenting after cataract surgery, Hamed[6] proposed four categories of the etiologies: (1) preexisting misalignment, (2) sensory deviation secondary to prolonged cataract, (3) optically induced deviations, and (4) surgical trauma. The surgical trauma can be bridle suture placement, subcunjunctival antibiotic toxicity, and local anesthesia.[5] Rainin and Carlson[7] first reported the possible mechanism of the myotoxicity of local anesthetics when direct injection into EOMs, which could be temporary or permanent. They attributed the strabismus to muscle paresis. de Faber and von Noorden[8] in 1991 reported a case of inferior rectus muscle palsy after retrobulbar anesthesia for cataract surgery. They proposed the mechanism of direct trauma from the injection needle to the nerve of inferior rectus or myotoxicity of anesthetic. Hamed and

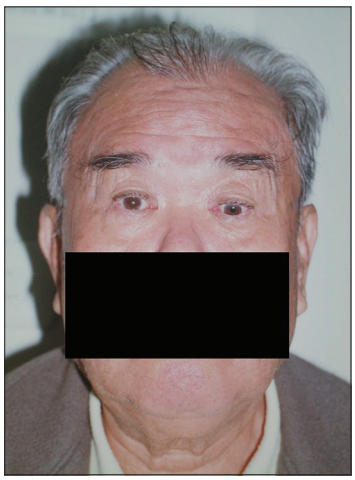

Figure 5: Preoperative primary position of case 2. Marked left hypotropia was noted

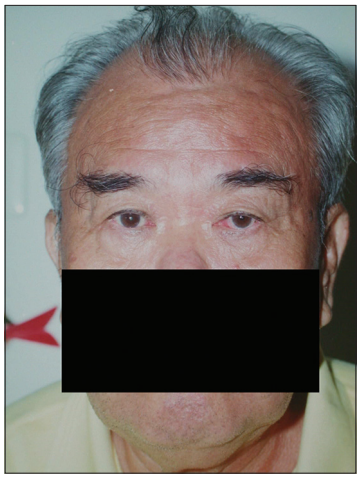

Figure 7: Primary position of case 2 after muscle operation for 6 months. The eyes were orthophoric and there was mild left lower lid retraction

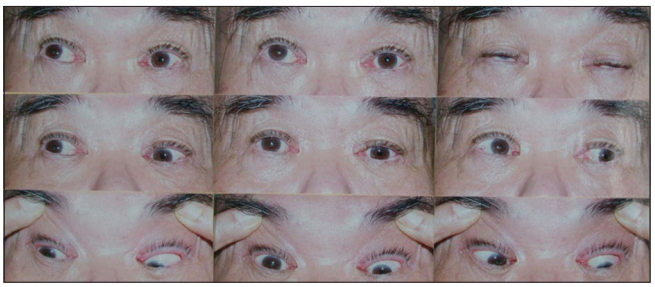

Figure 6: Preoperative extraocular muscle of case 2. There was overaction of the left inferior rectus and elevation deficit of the left eye

Figure 8: Extraocular muscle of case 2 after muscle operation for 6 months. The eye movement was full and free in all directions

Mancuso[9] observed eight cases of ipsilateral hypotropia after cataract operation under retrobulbar anesthesia. They found isolated enlargement of the inferior rectus from computed tomography and MRI and proposed the concept of "contracture syndrome" after retrobulbar anesthesia that is similar to "Volkmann's ischemic contracture" of the skeletal muscles. In another series of patients with strabismus after cataract surgery,[6] Hamed believed the contracture of the involved inferior rectus muscle happened by a cascade of needle penetration and with either subsequent intramuscular hematoma or injection of anesthetic and leading to increased tissue pressure and finally muscle ischemia and fibrosis.

Capó *et al*.[4] studied the vertical strabismus after cataract surgery and summarized the different patterns, in which the overaction type was the most common and the superior rectus was more affected than the inferior rectus. Restriction of the inferior rectus was the second most common type, and interestingly, there was no restriction type happened to superior rectus. The least common type of strabismus was paresis of the superior rectus. To prove that the superior and inferior recti are vulnerable to retrobulbar injection, Capó did the cadaveric dissection of the orbit to demonstrate how the needle tip would touch the two muscles. Capó's study showed us both overaction and underaction of the involved vertical muscle may cause vertical strabismus and diplopia which was clearly shown in our cases. Moreover, more interestingly is our second case which showed mixed overaction and restriction of the inferior rectus.

Capó and Guyton[10] also concluded that myotoxicity from direct injection of local anesthetics into an EOM probably causes transient paresis followed by segmental contracture of the involved muscle. Moreover, mild contracture results in a motility pattern of overactive muscle and a large amount of contracture leads to restrictive strabismus.

Clinically, the overaction of an involved rectus muscle can be easily identified from vertion test. Forced duction test and saccadic eye movement can be used to differentiate between paretic or restrictive type of strabismus. The outcome of surgical correction of the vertical strabismus caused by retrobulbar injection tends to be satisfactory. Our cases both had good outcome after traditional R & R muscle operation and adjustable suture technique can be helpful.

There are interesting points in this presentation. The two cases were operated at the same clinic and by the same surgeon, and both happened to the left eye. Hence, we postulated that the technique of retrobulbar injection was closely related. The posture when the surgeon inserted the needle, whether sitting at top of the patient's head or standing beside the right or left side of the patient, whether holding the syringe with the right or left hand, may be it was under an unnatural posture to perform the retrobulbar injection. In Capó *et al*.[4] study, there was a tendency that left eyes were twice more affected than the right eyes. He quoted Freeman[11] explanation that when the surgeon administering a block to the eye contralateral to the surgeon's dominant hand, a different motion is used and the tip of the needle is rotated toward the inferior rectus muscle rather than away from it.

Conclusion

We report two cases of vertical diplopia after cataract operation under local anesthesia with retrobulbar injection. Both cases were operated by the same surgeon, both happened to the left eye and can be explained by both mechanisms of overacting and underacting inferior rectus muscle. The shortage of this report is lacking of image study by computed tomography or magnetic resonance imaging. With the tendency of less using retrobulbar anesthesia and improved training by modern simulation surgical teaching,[12] we can expect there will be less and less, this kind of complication seen clinically and this is good news to both ophthalmologists and patients.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Nil.

Conflicts of interest

The author has no conflicts of interest to declare.

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