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The Surgical Repair of a Cyclodialysis Cleft Caused by a BB Pellet

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We report our surgical technique to repair a cyclodialysis cleft in a young patient with hypotony maculopathy and decreasing visual acuity in his left eye for approximately seven weeks following ocular trauma caused by a BB pellet.
The technique was introduced for suturing a cyclodialysis cleft in which sutures are placed on the corneal limbus to restore the cleft using a long curved needle with 10-0 polypropylene thread, in order to apply tension to the ciliary body which has been relaxed by dialysis.
One year after surgery, the patient's visual acuity had improved, the hypotony showed recovery, and optic disc swelling had also improved. However, choroidal rupture persisted.
This surgical technique is suitable for restoration of the traumatic cyclodialysis cleft associated with hypotony maculopathy. The technique in this report also makes it possible to spare the lens.

Key words: BB pellet, cyclodialysis cleft, hypotony maculopathy, surgical repair

INTRODUCTION

We treated a patient who had been directly hit in his left eye by a BB pellet, causing decreasing visual acuity, hyphema, iridodialysis, choroidal detachment, and choroidal rupture. As the patient's decreased visual acuity associated with hypotony maculopathy persisted even after the absorption of blood from the hyphema, we selected to perform surgical repair of the cyclodialysis cleft. Surgical approaches reported in the past for treating ocular trauma associated with hypotony maculopathy include direct or indirect cryopexy [1], diathermy coagulation [2, 3], transscleral diode-laser treatment [4], argon laser coagulation [5, 6], anterior scleral buckling [7], and pars plana vitrectomy [8, 9]. In the present case, we conducted surgical repair of iridodialysis while lens-sparing, placing two sutures in the iris using a long curved needle with 10-0 polypropylene thread, perforated the sclera 2 mm from the limbus while hanging the two sutures from the other side of cornea, on which a semi-thickness incision had been made, and carried out temporary suturing. The cyclodialysis cleft was extended closer to the scleral side, and the ciliary body in the area of the cleft was subjected to diathermy coagulation and directly sutured, thereby alleviating the hypotony maculopathy.

CASE AND METHODS

The patient was a 19-year-old man. On June 19, 2002, the patient was directly hit in his left eye by a BB pellet from a friend's air-powered gun. Due to sudden decreased visual acuity of his left eye, he visited Hiratsuka City Hospital for treatment. The patient's visual acuity (VA) was 0.7 (1.2xS −0.5D Cyl −0.5D Ax160) in the right eye and 0.01 (0.02xP −0.5D) in the left eye. Intraocular pressure (IOP) in the right eye was normal at 12 mmHg, but it was 5 mmHg in the left eye with the trauma. On slit-lamp examination, findings in the right eye were normal, but the left eye showed hyphema, a papillary sphincter tear at 5 o'clock position and phacodonesis. On gonioscopy, the angle was invisible due to hyphema. The ocular fundus of the left eye was also invisible due to hyphema. Choroidal detachment was seen on B-scan ultrasonography in his left eye. The patient was observed for 6 weeks following trauma. VA of the left eye was not improved, and IOP also failed to improve, dropping from 5 to 2 mmHg. On slit-lamp examination, a papillary sphincter tear was observed at 5 o'clock position. Phacodonesis was observed, possibly due to the papillary sphincter tear (Fig. 1). Papillary sphincter tear was seen from 4 to 6 o'clock position with gonioscopy. On fundoscopic examination, optic disc papilledema, venous tortuosity, chorioretinal folds extending to the macula, and choroidal rupture were observed. Fluorescein angiography was performed. These findings were consistent with hypotony maculopathy (Fig. 2). As the patient showed no improvement in IOP and fundoscopy findings, invasive surgery was performed in the 7th week after trauma. As the lens was still transparent, it was decided not to extract it. The patient was scheduled for reattachment of the ciliary body to the sclera.

Surgical technique

Temporary suturing of the cyclodialysis cleft

1) The corneal limbus was incised with a 20 gauge micro-vitreoretinal (MVR) blade at the 11 o'clock position of the limbus on the side opposite the cyclodialysis cleft. The anterior chamber was filled with a viscoelastic material to increase the IOP in order to facilitate the following procedures.
2) The conjunctiva was peeled back at a position corre-

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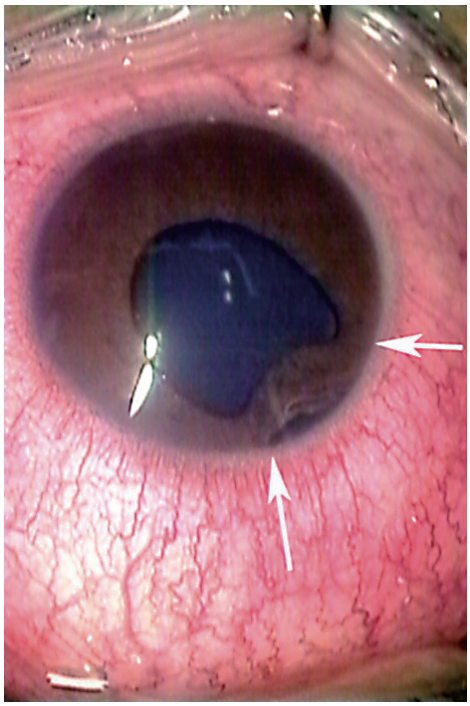


Fig. 1 Preoperative clinical video photograph taken from the temporal side

Fig. 2 Preoperative clinical photograph of ocular fundus

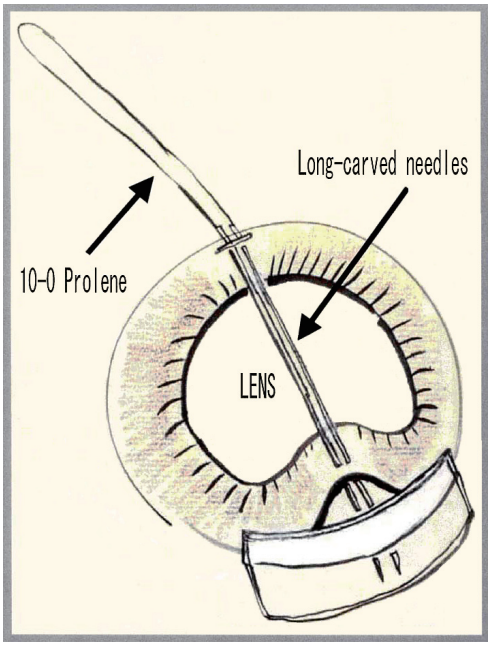


Fig. 3 Illustration of the technique

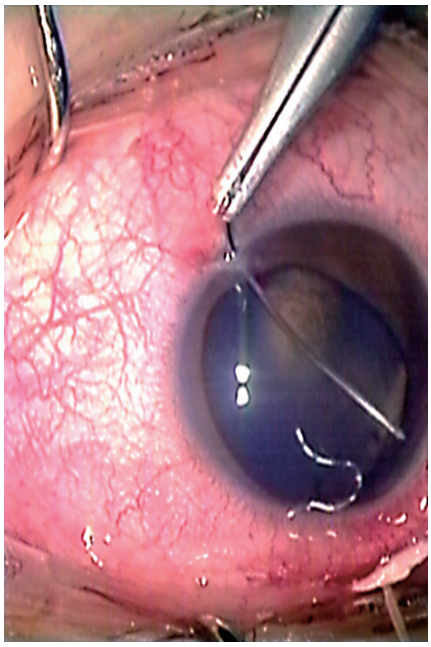


Fig. 4 Temporally suturing of the cleft

sponding to the cyclodialysis cleft from 4 to 6 o'clock position, and a half-thickness incision was made in the sclera approximately 4 mm from the limbus to fashion a scleral flap.

3) Two opposite sutures were placed using a long curved needle with 10-0 double polypropylene thread (PC-9, Alcon) through 11 o'clock position on the corneal limbus (Fig. 3). In the opposite suturing method, two sutures are placed at a position 1.5 mm from the sclera in which a half-thickness incision is made from the limbus on the opposite side, and this thread is then sutured to the half-thickness incision site on the sclera (Fig. 4). Tension is then reapplied to the cyclodialysis cleft, which had been relaxed due to dialysis. Caution must be exercised at this stage so that the tip of the needle does not touch the lens.

Direct suturing

1) The site of the half-thickness incision on the sclera from the 4 to 6 o'clock position was subjected to 14 diathermy coagulations for periods of one second each.
2) At a position 2 mm from the limbus at the half-thickness excision site, the layers of the sclera were

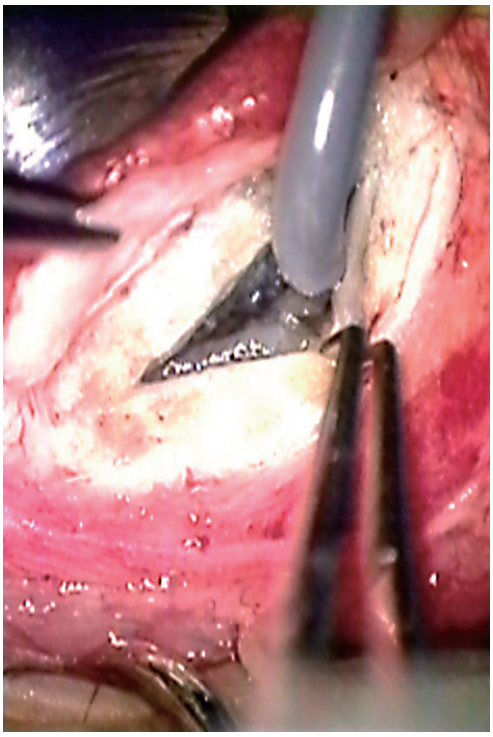
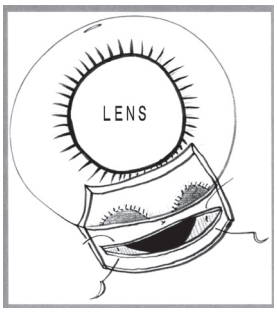


Fig. 5 Diathermy coagulation to the ciliary body



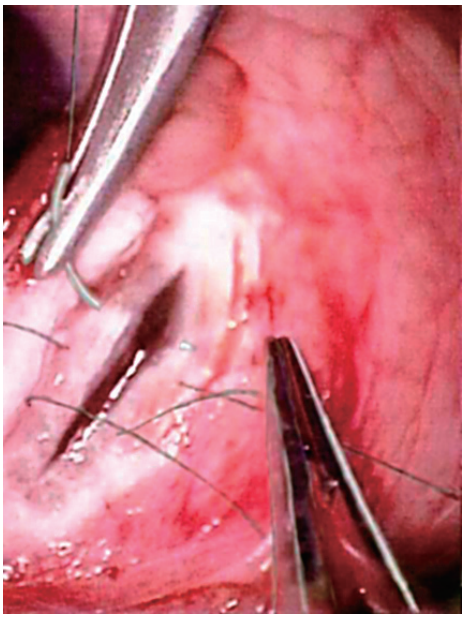


Fig. 6 Direct suturing of the cleft

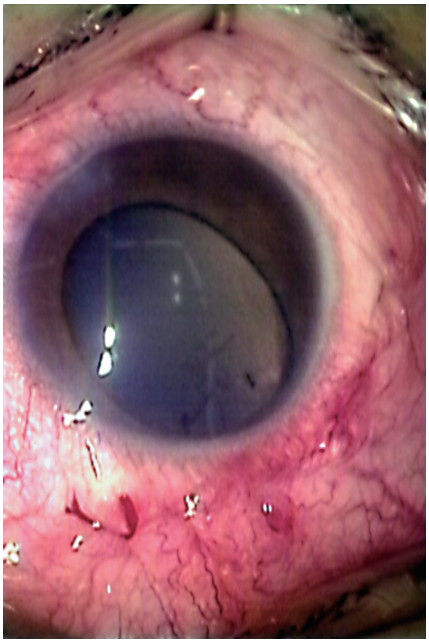


Fig. 7 Postoperative clinical video photograph

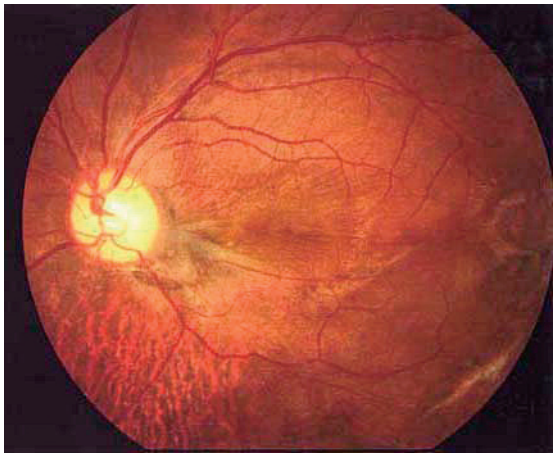


Fig. 8 Postoperative clinical photograph of ocular fundus, five months postoperation

excised (the ciliary body was lifted up on the scleral side using a temporary suture), and dialysis of the ciliary body was confirmed by direct observation.

3) The ciliary body elevated using a temporary suture was subjected to 6 direct diathermy coagulations for one second each at the 4 to 6 o'clock position (Fig. 5).
4) While checking the ciliary body, the sclera and the ciliary body were directly sutured with a total of 5 stitches using 8-0 nylon sutures at the 4 to 6 o'clock position (Fig. 6).
5) After the opposite 10-0 temporary polypropylene sutures were removed, the scleral flap is sutured using 8-0 nylon, the conjunctival flap was sutured using 8-0 Vicryl thread, and the surgery was completed leaving the viscoelastic material in the anterior chamber (Fig. 7).

RESULTS

At five months post-operation, VA in the left eye improved to 0.2 (0.3xS +1.75D Cyl −4.5D Ax115), and IOP was elevated to 14 mmHg. On slit-lamp and gonioscopic examinations, the papillary sphincter tear in the left eye showed improvement. No traumatic cataract, lens subluxation nor phacodonesis were observed. On

fundoscopic examination, no swelling of the optic disc was observed. The folds on the macula associated with hypotony showed an improving trend. Choroidal rupture was observed (Fig. 8). In the early stage after surgery, IOP was elevated at 30 mmHg. It decreased to 10 mmHg by applying Diamox and timolol maleate (β-blocker); however, as IOP again increased to 28 mmHg, latanoprost eyedrops were applied and it decreased again to 10 mmHg. It remained stable at 16 mmHg one year after surgery. The hypotony showed recovery, and papilledema also improved, with VA recovering from 0.01 prior to surgery, to 0.3 after surgery.

DISCUSSION

If the cyclodialysis is detached, the coagulation treatment would not be effective. Also it becomes quite difficult, if for a larger detachment case, to conduct direct suturing to restore the ciliary body under direct visual observation. By temporarily suturing the iridodialysis while inserting viscoelastic material to widen the anterior lens capsule and to avoid any damage from the needle, coagulation treatment would then become effective before direct suturing of cyclodialysis cleft. This procedure would result in better healing process. While diathermy coagulation and direct suturing procedure has already been known, there have been no previous reports on this lens-sparing technique, in which the iridodialysis is temporarily sutured [10], the cyclodialysis is moved closer to the sclera and tension is maintained, making it possible to carry out direct visual observation of the ciliary body via an incision wound in the sclera, and the cyclodialysis cleft is subjected to diathermy coagulation and directly sutured. For young patients as this case who suffer traumatic cyclodialysis cleft associated with hypotony maculopathy without complications such as lens luxation or cataract, the surgeons have to think twice about the way of treatment. The important point among the various surgical techniques [1-9] is how to restore the ciliary body to where it was and bring back the IOP to its normal position.

In the report by Sternberg *et al.*, young patients predominated, with subjects 7, 9, 10, 12 and 18 years of age [11]. The subject of this study was also young as 19 years of age; and he suffered ocular trauma due to a BB pellet sustained while playing with a friend. As they reported, this is a dangerous toy in which a BB pellet fired from the air-powered gun can hit the eye and damage the eyeball. The various pathological findings in the eye include corneal laceration, hyphema, iridodialysis, lens damage, vitreous hemorrhage, choroidal rupture, tearing of the ciliary body, and retinal damage [11]. Luckily, our patient was able to avoid eyeball enucleation, but he suffered blunt trauma with the complications of hypotony maculopathy and choroidal rupture, thus constituting a serious case. Moreover, in cases where the pathology of hypotony maculopathy is a significant factor in the prognosis of visual acuity, the treating physician is faced with the problem of whether to allow the injury to heal spontaneously with medical treatment or elect to carry out surgery [1-9]. If the physician selects to perform surgery, he is faced with a variety of problems, such as selecting the surgical approach, the operating time, and whether to extract the lens. This holds all the more true in young patients. Why is it that when IOP increases, optic disc swelling, venous tortuosity, and extensive choroidal folds are eliminated, also accompanied by an improvement in visual acuity? Masaoka *et al.* reported on the use of indocyanine green angiography in cases of dilation and tortuosity of the choroidal vessels in the posterior pole due to disturbed choroidal circulation resulting from ocular trauma or ocular surgery. Moreover, choroidal circulation is also disturbed in traumatic hypotony maculopathy, but when surgical therapy is conducted, it has been reported that choroidal circulation returns to normal by five months after surgery accompanying elevation of IOP [12]. If hypotony persists, backflow of cerebrospinal fluid may result in optic disc swelling, venous tortuosity, and extensive choroidal folds extending through the fovea, and in the long term, this pathology may affect the macula, with focal retinal detachment affecting the macular retinal pigment epithelium and possibly resulting in irreversible changes [8, 13]. Ormerod *et al.* have reported that medical management of small cleft should be attempted for six weeks following trauma with cyclodialysis cleft [5].

Based on the above considerations, in the present case, as IOP had decreased to 2 mmHg after 7 weeks of observation and fundoscopic findings had not improved, we selected to perform surgery in view of the patient's visual acuity prognosis. We initially considered laser treatment, but because the moderate cyclodialysis cleft was present in the area from 4 to 6 o'clock, we thought that, based on the report by Ormerod *et al.*, the therapeutic effect would be poor [5], so we selected from the outset to perform surgery. Postoperative IOP increased to within the normal range, visual acuity improved to 0.3, and fundoscopic findings also showed gradual improvement. We even attempted to achieve greater visual acuity, however we then observed a choroidal rupture, and visual acuity remained at the level of 0.3 after one year. Choroidal rupture, which was originally induced by ocular trauma and occurred in the area of macula, would cause a damage in nutrient circulation. In such a case, greater visual acuity than 0.3 in this patient could not be expected.

CONCLUSION

The patient suffered from hypotony maculopathy resulting from decreased intraocular pressure, with decreased visual acuity persisting for approximately seven weeks, so it was decided to suture the ciliary body under direct visualization. In order to preserve the lens, the anterior chamber was filled with a viscoelastic substance, and the iridodialysis site was temporally sutured to the sclera at a position corresponding to the cyclodialysis site from the opposite side of the corneal limbus using a long curved needle with 10-0 double polypropylene suture. As a result, it was possible to reattach the cyclodialysis cleft to the sclera, and it was also possible, under direct observation via the scleral wound, to carry out diathermy coagulation and direct suturing of the cyclodialysis cleft. The patient showed improving IOP, visual acuity, and retinal lesions. We feel that this surgical technique is suitable for restoration of the traumatic cyclodialysis cleft associated with hypotony maculopathy.

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