

Clinical Evaluation of Traumatic Ciliochoroidal Detachment with Surgical Treatment

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Abstract

Purpose: To determine the clinical features of traumatic ciliochoroidal detachment (CCD), and to evaluate the surgical outcomes.

Methods: We retrospectively reviewed the records of 37 consecutive patients with traumatic CCD who underwent surgical procedures, including ciliary body suturing, transscleral cyclophotocoagulation, and cyclocryopexy. A complete ocular examination was performed at pre-surgery and at periodical post-surgery follow-ups. We compared visual acuity (VA), intraocular pressure (IOP), and morphologic changes with UBM among the different surgical procedures at the pre-surgery and periodical follow-ups.

Results: The mean IOP was 6.62 mmHg, and the median VA was 20/200 at baseline. The mean final IOP was 11.03 mmHg, and the final median VA improved to 20/50. IOPs were significantly different in post-surgery compared with those at baseline ($P=0.000$) among the ciliary body suturing, cyclophotocoagulation, and cyclocryopexy groups. However, no significant differences were noted at each follow-up among the 3 groups ($P>0.05$). The post-surgical morphological figures consisted of complete reattachment, partial reattachment, and the complete detachment. Cyclocryopexy (71.4%), suturing (68.4%), and cyclophotocoagulation (63.6%) produced similar surgical outcomes of the complete reattachment based on UBM images.

Conclusion: Prompt treatment and periodic follow-ups are necessary after traumatic CCD, based on accurate dimensions and configuration by UBM. The appropriate choice of surgical

procedures is pivotal for an optimal outcome. (*Eye Science* 2013; 28:124–128)

Keywords: ciliochoroidal detachment; ultrasonic biomicroscopy; trauma; surgery

Traumatic ciliochoroidal detachment (CCD) frequently results in persistent ocular hypotony, a flat anterior chamber, narrow angle, transient myopia, and hypotonous maculopathy^{1,2}. Prompt and effective treatment is necessary for recovery of visual function. If the intraocular pressure (IOP) rises to a normal level by medication or/and surgery in a short timeframe, retinal abnormalities will be eliminated, and visual acuity will improve markedly. Otherwise visual function will undergo irreversible loss even though hypotony is restored^{3,4}.

Traumatic CCDs commonly require surgical treatment. Many strategies for CCD surgery are utilized, including cyclodiathermy, cyclocryopexy, vitrectomy, photocoagulation, ciliary body suturing, cyclohexy, drainage of suprachoroidal fluid, scleral buckling at the equator, oil or gas injection, and others⁵⁻⁷. However, no standard surgical treatment has been established for the disease. All procedures require an accurate diagnosis of the underlying cause, and therefore the sonographic high-resolution imaging with UBM is necessary for appropriate treatment⁸.

This study investigated patients with traumatic CCD in four quadrants. The aims were to investigate morphological changes occurring pre-surgery, to explore the surgical effectiveness of follow-up, and to assess the surgical outcomes and restoration of visual function.

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Patients and methods

Patients

In this retrospective study, we reviewed 37 consecutive patients (male 28, female 9) who had undergone surgical treatment for traumatic CCD between October 2009 and October 2012. All patients who had been diagnosed with the disease and had a follow-up at least 6 months were extracted from the records enrolled in our hospital. Baseline characteristics of the patients, including age, ocular history, gender, and ocular laterality were documented. All the patients underwent a complete ophthalmological examination composed of best corrected visual acuity (BCVA), slitlamp microscopy, tonometer (Topcon CT-80, Japan), binocular indirect ophthalmoscopy, OCT (Zeiss Cirrus-HD 4000, Germany) and UBM, at the baseline and each follow-up.

Patients with a history of previous intraocular surgery, such as glaucoma filtration surgery, cataract surgery and vitrectomy, were excluded. We also rejected those patients with a diagnosis of coexistent iridodialysis, retinal detachment, lens dislocation, hyphema, or vitreous hemorrhage.

Selection of surgical procedures

Patients had been treated originally with medication (topical or systemic corticosteroid therapy combined with topical atropine sulfate). However, the medication had a poor effect over 4 weeks. The patients were then treated surgically based on the findings from UBM. Surgery procedures included ciliary body suturing, transscleral cyclophotocoagulation with 810 nm diode laser (Iridis, Quantel, France), direct cyclocryopexy, or cyclocryopexy with scleral buckling at the equator.

IOP measurement

The IOP was measured with the Topcon CT80 tonometer by taking three readings and averaging them to get the IOP reading in mmHg. This procedure was adopted to suit the principle of IOP measurement used by the Topcon CT80 tonometer. All IOP measurements were made between 14:00 and 16:00 to ensure that the IOP was assessed at the same period of the day.

Ultrasound detection

The patients were examined with the Paradigm

UBM P40 system (Paradigm Medical Industries Inc., Salt Lake City, Utah, USA) for detailed morphologic changes in the anterior segment. The bilateral images were measured quantitatively at 3 and 9 o'clock, because the scanning probe could relatively easily scan the ora serrata at these two points, with eyeball rotating reversely.

Statistical analysis

Statistical analysis of IOP was performed by using software SPSS 13.0. The differences in traumatic eyes among the 3 surgical procedures (ciliary body suturing, cyclophotocoagulation and cyclocryopexy) were analyzed with one-way ANOVA. The morphological outcomes based on UBM images were analyzed with an independent-sample nonparametric test. $P < 0.05$ was considered as statistically significant.

Results

The duration of ocular trauma was 26.12 days (range, 4 to 78 days). The mean age was 25.36 years (range, 11 to 71 years). All the patients had a unilateral injury, 22 (59.46%) on the left, and 15 (40.54%) on the right. All patients had decreased BCVA in the traumatic eyes, with a median of 20/200. The final median BCVA improved to 20/50. The mean IOP at the baseline was 6.62 mmHg. The mean final IOP was 11.03 mmHg. The mean time of follow-up was 10.2 months, ranging from 6 to 21 months after surgery.

Twenty-three eyes (60.5%) developed signs of hypotonous maculopathy by ophthalmoscopy and OCT in pre-surgery, consisting of edema of the disk and macula (Figures 1E, 1G, 2E and 2G), peripheral choroidal detachment or chorioretinal folds. 2 eyes showed the choroidal rupture at the posterior pole. 12 patients (31.5%) remained retinal abnormalities at the final follow-up (Figures 2F and 2H).

Outcomes of different surgical procedures on IOPs

Surgical therapy must be based on the images with UBM. The procedures consisted of 4 subtypes: 19 patients with ciliary body suturing, 11 patients with transscleral cyclophotocoagulation, and 7 patients with drainage of supraciliary fluid, cyclocryopexy with buckling sclera at the equator. Table 1 shows the relevant data with baseline and follow-up among

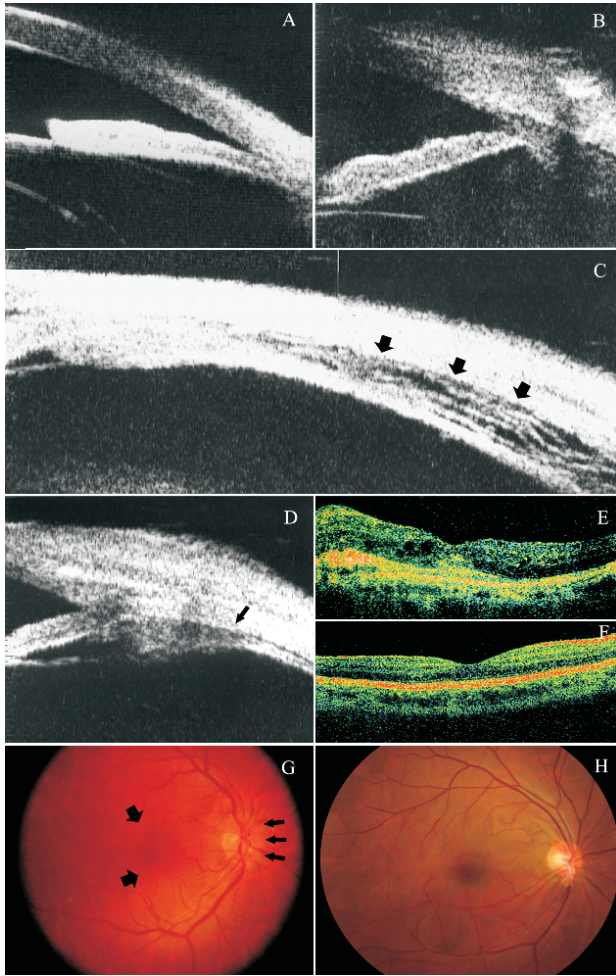


Figure 1 Pre- and post-operative photographs with complete reattachment of CCD.

Panel A shows the pre-surgical UBM image of anterior chamber. Some typical features are evident, including a shallow anterior chamber, narrow angle, and forward shift of lens-iris diaphragm. However, the shallow anterior chamber and narrow angle are eliminated after surgery, as shown in panel B. A composite UBM image of CCD is shown in panel C. The thick arrows refer to ciliochoroidal splits with effusion. The complete reattachment of the CCD after surgery is apparent in panel D. The thin arrow refers to the position of suturing. Panels E and F show the pre- and post-operative OCT images, respectively. Pre-operative macular edema shows complete recovery after surgery. Similarly, the pre- and post-operative fundus images are displayed in panel G and H, respectively. Pre-operative macular edema (thick arrows) and mild disc edema (thin arrows) completely recover after surgery.

the different surgical procedures. The IOPs of all 3 groups increased significantly post-surgery compared to the baseline ($P=0.000$). However, no differences in IOPs were noted at each follow-up am

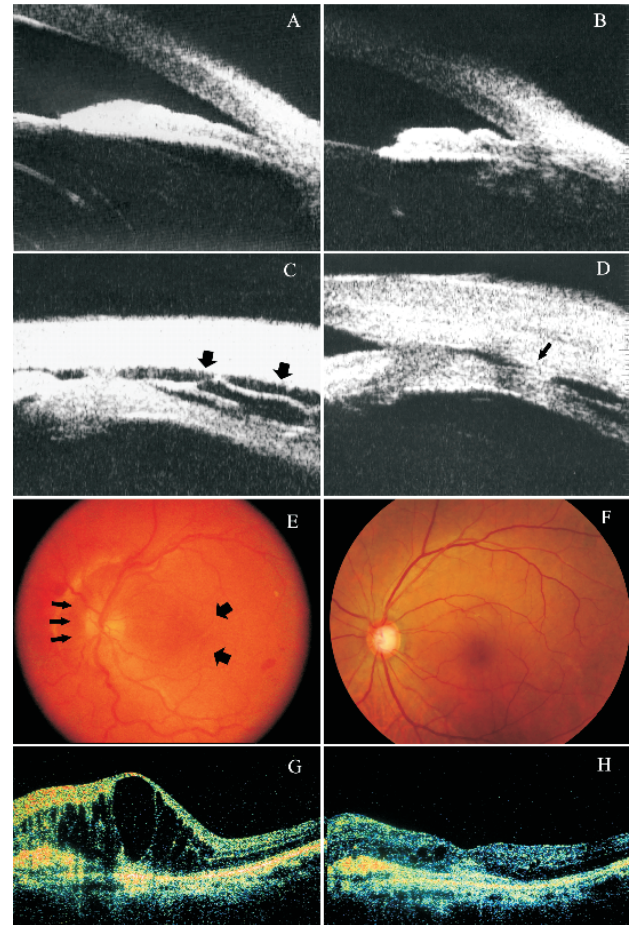


Figure 2 Pre- and post-operative photographs with post-surgical partial reattachment of CCD. Panel A shows the pre-surgical UBM image of anterior chamber. Panel B shows the relatively deep anterior chamber after surgery. Marked detachment (thick arrows) with splits is evident in the pre-operative UBM image (C). but only partial reattachment occurs after surgery of suturing (thin arrow) in panel D. Panel E and F show the pre- and post-operative fundus images, respectively. The edema of the disk (thin arrows) and the stellated folds around fovea (thick arrows) show in panel E, and the optical atrophy of long-term CCD is evident in panel F. Panel G and H show the pre- and post-operative OCT images, respectively: There is the marked macular edema (G), that remains after surgery (H).

ong the 3 groups. At the final follow-up, 65.8% (25) of the patients had IOP values greater than 10 mmHg. The IOPs of 7 patients were less than 8 mmHg. The IOP of one patient dropped to 5.2 mmHg. **UBM Outcomes with different surgical procedures**

The morphologic figures displayed by slitlamp were further identified by UBM. The typical characteristics of CCD consist of a shallow anterior cham-

Table 1 Clinical data with baseline and follow-ups among the 3 surgical procedures

patients	Age	Baseline VA	Final VA	Baseline IOP	IOP (0.5m)	IOP (1m)	IOP (2m)	IOP (4m)	Final IOP	
Ciliary body suturing	19	25.63±2.80	20/200	20/50	6.39±0.32	9.92±0.63	10.57±0.67	11.58±0.69	11.76±0.79	12.86±0.82
Cyclophotocoagulation	11	31.73±4.06	20/200	20/60	5.75±0.67	9.05±1.13	10.84±1.46	11.15±1.34	11.65±1.42	11.37±1.38
Cyclocryopexy	7	28.85±5.51	20/100	20/50	6.63±0.72	10.2±1.91	11.31±1.53	10.80±1.21	11.92±1.56	12.43±1.58

VA refers to median BCVA. IOPs and Age are expressed as mean±S.E. The IOPs in the 3 groups showed significant increases at each follow-up compared with baseline ($P=0.000$). However, the IOPs showed no difference at the each time point of follow-up among the 3 groups ($P>0.05$).

Table 2 Morphological outcomes of the 3 surgical procedures based on UBM images

	Complete reattachment	Partial reattachment	Complete detachment
Ciliary body suturing	13(68.4%)	5(26.3%)	1(5.2%)
Cyclophotocoagulation	7(63.6%)	2(18.2%)	2(18.2%)
Cyclocryopexy	5(71.4%)	2(28.6%)	0

There are no significant differences among the 3 groups ($P>0.05$).

ber, narrow angle, and iridocyclitis. In our study, the trauma eyes in all patients showed 360-degree detachment. The ciliary body and the anterior choroid displayed multifarious changes of traumatic CCD (Figure 1C). The marked edema of the pars plana was evident in the traumatic eyes (Figure 1C, 2C). The inflammatory cells and fibrin exudation were much more severe in the vitreous and posterior chamber than in the anterior chamber.

In the follow-up period, the morphological features consisted of the following subtypes: complete reattachment of the ciliary body and choroid (Figure 1D); reattachment of partial quadrants or partial area (Figure 1D); and remaining 360-degree detachment. Table 3 shows the surgical outcomes among different surgical procedures based on UBM images. No differences were noted among the procedures of ciliary body suturing, cyclophotocoagulation, and cyclocryopexy ($P>0.05$).

Discussion

UBM is regarded as a principal procedure for the diagnosis of CCD, because it provides direct visualization of the retroiridian structure, especially the ciliary body, anterior choroids, and supraciliary space. The typical morphological abnormality is a lacuna between the uvea internally and sclera externally, which also named ciliochoroidal effusion (CCE); CCE is terminologically interchanged with CCD in

the literature³. The pathogenesis of traumatic CCD is an increase in the permeability of the ciliary vessels after blunt injury, leading to extravascular leakage of the plasma components¹⁰.

The uveal tissues depart readily from the sclera following a global injury. The ciliary body is more susceptible to detachment than the choroid because no attachment is present between the longitudinal ciliary muscles and sclera from the scleral spur to the epichoroidal stars in the pars plana. The short posterior ciliary arteries, ciliary nerves, and vortex veins perforate the sclera, fusing it to choroid instead of the ciliary body. However, detachment in the anterior choroid tends to be more evident than in the ciliary body in patients with severe trauma, identified by UBM images^{11,12}. The structure of the anterior segment is readily changed, as the anterior uvea attaches loosely to the sclera. The forward rotation of the ciliary process consequently brings about an anterior shift of iris, lens, and lens-iris diaphragm, leading to a shallow anterior chamber and a narrowed or disappeared angle. The scleral spur is the unique site of attachment of the ciliary body in the pathological course of traumatic CCD. Therefore, it is an important anatomic structure for this disease, as it is the fulcrum upon which the uvea rotates forward.

Hypotony is an important feature in ciliochoroidal effusion as it causes transient myopia and hypotonous maculopathy. The long-term maculopathy leads to vision loss, even though ciliochoroidal detachment is reattached¹³. Blunt trauma causes edema of the ciliary body, especially the ciliary process epithelium, leading to a decrease in aqueous humor secretion. The ciliochoroidal effusion increases the uveoscleral outflow. The decreased secretion and the increased outflow produce hypotony¹⁴. In turn, hypotony aggravates the ciliochoroidal effusion. Thus,

the permanent hypotony results in phthisis bulbi. In this study, the mean IOPs were more than 11 mmHg for all surgical procedures at final follow-up, and no significant differences occurred among the three groups. However, significant differences were noted at fifteen days between group ciliary body suturing and cyclocryopexy, and at 2 and 4 months between group ciliary body suturing and cyclophotocoagulation.

Traumatic CCD is an intractable disease and only part of the patients achieved a complete morphological reattachment. Prompt treatment is necessary to reduce the risk of hypotonic maculopathy¹⁵. In this study, the 3 surgical procedures (cyclocryopexy, ciliary body suturing and cyclophotocoagulation) produced the similar outcomes, evaluated by either IOP or by complete post-surgical reattachment with UBM.

Based on our surgical outcomes, we considered that ciliary body suturing was a good choice for the disease, also supported by some previous studies^{8,10,16}, because supraciliary fluid drainage was performed from the scleral incisions as much as possible, and the ciliary body was fixed mechanically into sclera, thereby improving the possibility of reattachment of the ciliary body. In addition, secondary improved visual acuity and elevated IOP were achieved. Cyclocryopexy produced a similar result to that obtained with suturing. The proper buckle was important to eliminate CCE and maintain a normal post-operative IOP¹⁷. Photocoagulation was slightly less effective than the suturing. The potential reason was that exudative fluid remained within the supraciliochoroidal space during the surgery, which influenced the reattachment of ciliary body. In the present study, only one eye where vitrectomy was performed with a silicone oil tamponade showed a good outcome for a long-term CCD. In a few cases, the anterior chamber and angle recovered after surgery, but the structures of the ciliary body were only recovered with difficulty according to the UBM images. The persistent ciliochoroidal edema effusion was difficult to eliminate, even though epicyliary tissue reattached.

In conclusion, the choice of proper procedures is pivotal for an optimal outcome. Long-term follow-up

is important because a marked postsurgical increase in IOP was not sustained in some cases.

Disclosure statement

There is no conflict of interest to declare.

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