

Comparison of encirclage and cryotherapy with argon laser in the management of traumatic cyclodialysis cleft

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Abstract

• The study compared anatomical and functional outcome of a novel technique of encirclage and cryotherapy with the conventional argon laser in the management of traumatic cyclodialysis cleft in 19 patients (10: encirclage and 9: argon laser). The postoperative anatomical success was taken as rise in intraocular pressure (IOP) more than 6 mm Hg or the closure of cleft on gonioscopy or ultrasound biomicroscopy (UBM). Visual outcome was measured as change in logMAR visual acuity. Traumatic cataract and hypotony were present in majority. IOP>6 mm Hg was noted in 90% of encirclage group and in 77.70% of argon laser group. Two cases had non-closure of cleft. Encirclage is comparable to argon laser in terms of anatomical and functional success with possible advantage of single procedure and use in cases with failed laser.

• **KEYWORDS:** traumatic cyclodialysis; encirclage; cryotherapy; laser; hypotony

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INTRODUCTION

Post-traumatic cyclodialysis cleft is the separation of ciliary body from the sclera spur after a blunt trauma which results in an unrestricted flow of aqueous into the suprachoroidal space and decreased aqueous production by detached ciliary body; resulting in hypotony and its deleterious sequelae^[1-3]. Spontaneous closure of the cleft is a rare occurrence and seems to occur only with smaller clefts^[4].

Treatment options which have been tried in traumatic cyclodialysis cleft include mydriatics^[5], ciliochoroidal diathermy^[6], direct cyclopexy^[7-8], indirect cyclopexy^[9], anterior scleral buckling^[10], cryoablation^[11], argon laser photocoagulation^[3,12], combined vitrectomy, cryotherapy and gas tamponade^[13], trans-scleral YAG^[14] or diode laser^[15], microendoscopic endophotocoagulation, or transcleral diode photocoagulation under microendoscopic view^[16]. However, all these techniques have been described as case reports or case series. The techniques have also not been compared in terms of anatomical and functional success rates.

Portney and Puncell^[17] proposed the idea of anterior buckling to treat hypotony in cyclodialysis cleft. They had placed a segmental silicone rod under the partial thickness scleral flap over the entire extent of the cleft. Mandava *et al*^[10] modified the technique by using a sponge which was removed after 3wk. The aim of the present study is to report a novel technique of using a 360 degree encirclage in combination with cryopexy to the extent of cleft for patients with hypotony due to traumatic cyclodialysis cleft and compare this technique with conventional laser photocoagulation.

SUBJECTS AND METHODS

Ethical Approval Institutional review board approval was obtained to analyze the hospital-based data and Declaration of Helsinki was followed. Patients had given written informed consent to be part of study or any clinical trial prior to intervention, and they received no stipend for that.

Study Design and Patient Eligibility Between March 1998 to March 2016, a retrospective chart review was done to identify cases with traumatic cyclodialysis cleft who had undergone either encirclage with trans-scleral cryopexy or argon laser treatment for the cleft; and fulfilled the eligibility criteria. Patients with history of blunt trauma who presented with hypotony and had been diagnosed with cyclodialysis cleft on gonioscopy +/- ultrasound biomicroscopy (UBM) were included in the study. Exclusion criterion was concomitant vitreoretinal surgery, spontaneous closure or closure by direct suturing of cleft.

Collected data included detailed history of nature of trauma, demographic features, duration of trauma; best corrected visual acuity, intraocular pressure (IOP), and associated anterior and posterior segment abnormalities. During final follow-up, after the intervention, the end points that were considered for

anatomical success included: a rise of IOP to ≥ 6 mm Hg, cleft closure on gonioscopy and cleft closure on UBM. Additionally, best corrected visual acuity and any additional procedures, which were done after the primary procedure, were noted.

Surgical Methodology Group I (belt buckle+trans scleral cryopexy): Under local anaesthesia, the conjunctival periotomy was done and all four recti were tagged using 4-0 silk. Sclera tunnels were made anteriorly, within 1 mm of muscle insertion and encircling band (#240, MIRA, USA) was placed. The region of cyclodialysis cleft was either localized using transillumination at the pupil or based on gonioscopy clock hours. Transscleral cryotherapy was performed about 1 mm from the limbus to cleft site (Frigitonic Cryoprobe). The encirclage was tightened to have a mild buckle indentation to mechanically appose the cleft and the conjunctiva was closed. One patient required an additional sclera patch graft for managing the staphyloma. In 2 patients at the end of the procedure, intraocular gas (0.3 mL) was injected (air and pure Arceole C3F8 one each).

Group II (argon laser): Under topical 0.05% proparacaine goniolens was placed on eye. No viscoelastic was injected to form the anterior chamber. Laser treatment was applied to both the edges and the depth of the cleft, blanching the tissue. Spot size used was 150-300 μm , duration 0.1-0.5s and power 300-1000 mW. After procedure topical atropine was prescribed to all patients to achieve a mechanical apposition for 2wk. If there was no significant apposition, the procedure was repeated after 1mo.

Outcome Measures We analyzed the anatomical and functional outcome of the patients. Anatomical outcome was build up in the IOP more than 6 mm Hg or the closure of cleft on gonioscopy or on UBM. Visual outcome was the change in visual acuity and analyzing the causes of decreased vision.

Statistical Analysis Categorical variables within groups were compared using Fisher's exact test or the Chi-square test. Quantitative variables were summarized by means and other descriptive statistics. Groups were compared using Mann-Whitney test.

RESULTS

Of the 19 eyes, in 16 eyes gonioscopy could be done and cleft identifies, however, in 3 eyes gonioscopy was difficult due to hypotony and the diagnosis and extent of was ascertained on UBM. Of the 19 eyes, 10 were in Group I and 9 were in the Group II (Table 1).

The two groups had no statistically significant difference between baseline characteristics like age, mean duration after injury, mean visual acuity at presentation, mean IOP at presentation and extent of cleft in clock-hours ($P>0.05$). Figure 1 shows the flowchart showing closure pattern of cleft of patients in Group I and Group II.

Table 1 The comparison of baseline characteristics between two groups

Characteristics	n (%)	
	Group I (n=10)	Group II (n=9)
Age (y)	35.4±14.2	30.3±7.8
Mean duration after injury	321±455.06	74.4±71.1
Mean VA at presentation	1.04±0.7	0.85±0.6
Mean IOP at presentation	4.33±2.5	2.5±1.9
Extent of cyclodialysis cleft (clock hours)	2.6±0.5	2.7±1.5
Confirmed on UBM	7 (70)	7 (77.8)
Associated anterior segment findings		
Traumatic cataract	4 (40)	4 (44.4)
Lens subluxation	1 (10)	3 (33.3)
Traumatic mydriasis	3 (30)	4 (44.4)
Hyphema	1 (10)	
Equatorial staphyloma	1 (10)	
Associated posterior segment findings		
Hypotonic maculopathy	6 (60)	8 (88.9)
Serous choroidal effusion	4 (40)	2 (22.2)
Viterous hemorrhage	3 (30)	1 (11.1)
Choroidal rupture	3 (30)	2 (22.2)
Berlin edema	1 (10)	
Macular scar	1 (10)	1 (11.1)
Subretinal macular hemorrhage	1 (10)	
Optic neuropathy	1 (10)	
Retinal dialysis		1 (11.1)

UBM: Ultrasound biomicroscopy; VA: Visual acuity; IOP: Intraocular Pressure; n: number. $P>0.05$ between baseline parameters in the two groups.

There was a statistically significant improvement in both groups, from 1.04 to 0.42 logMAR ($P=0.01$) in Group I and from 0.85 to 0.40 logMAR ($P=0.03$) in Group II. However, the visual results were comparable in between the groups ($P=0.92$). The diverse causes of reduced vision included macular scar, choroidal rupture, cataract and optic neuropathy. In Table 2 we mention the anatomical results in two groups along with any other intervention being contemplated.

DISCUSSION

This article describes a novel technique of encirclage with transscleral cryotherapy for the management of traumatic cyclodialysis cleft which was compared with the conventional Argon laser. The technique of encirclage with transscleral cryotherapy was found to result in anatomical closure in 90% of cases. There was a statistically significant improvement from 1.04 logMAR to 0.42 logMAR in this group of patients. The anatomical and visual success was comparable with the laser group.

In our study, the diagnosis of cleft was based on gonioscopy and in majority of cases was confirmed on UBM. However, Ioannidis *et al*^[18] in their series used intracameral injection of 0.1-0.2 mL of viscoelastic, and then repeating the gonio in cases where the gonioscopy was difficult. Hwang *et al*^[19]

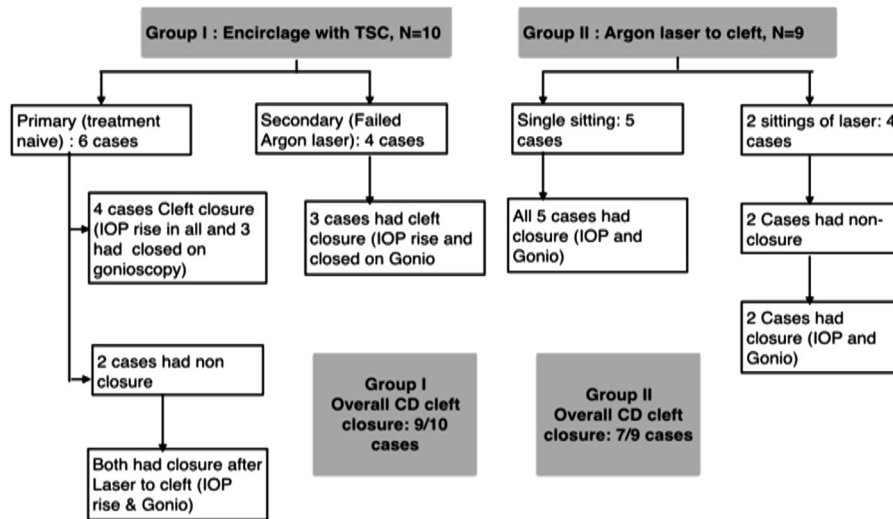


Figure 1 Flowchart showing closure pattern in Group I and II.

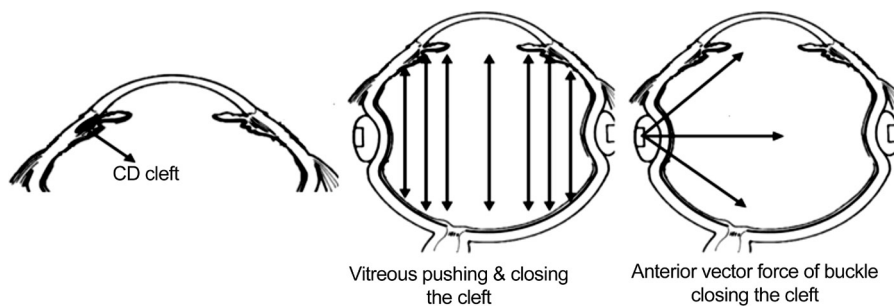


Figure 2 Possible mechanism of action of encirclage to close cyclodialysis cleft.

Table 2 The anatomical results of Group I and II and also shows the additional procedures done for cataract and subluxation of lens in both the groups

Characteristics	Group I	Group II	n (%)	P
Rise in IOP				
≥6 mm Hg	9 (90)	7 (77.7)		0.475
≥10 mm Hg	9 (90)	6 (66.6)		0.224
Closure of cleft on gonioscopy				
Closed	8 (80)	7 (77.7)		0.146
Not closed		1 (11.1)		
Gonio not performed	2 (20)	1 (11.1)		0.605
Closure also confirmed on UBM	2	1		
Mean follow-up duration (y)	4.96±5.6	3.48±3.4		0.501
Additional surgical interventions done				
Phacoemulsification +IOL	4 (40)	1 (10)		0.146
Phacoemulsification +IOL+ECR	1 (10)			
Repeat argon laser to cleft	2 (20)	4 (44.4)		0.320

IOP: Intraocular pressure; UBM: Ultrasound biomicroscopy; IOL: Intraocular lens; ECR: Endocapsular ring.

successfully identified all clefts in 32 cases in their series using UBM as the primary diagnostic modality. UBM and ASOCT are both non invasive procedures that can diagnose the cleft with certainty.

Though various methods have been tried till date for management of cyclodialysis cleft, the success of these methods have been evaluated and presented as case reports to case series.

However, there are no studies comparing these methods. Portney and Puncell^[17] have described use of segmental anterior buckling implant to treat hypotony in cyclodialysis cleft in a case report. A slight modification was proposed by Mandava *et al*^[10], who used a temporary sponge explant, which was removed after 3wk.

Argon laser, a conventional treatment modality in management of small clefts (<4 clock hours), has been evaluated in many case series^[5,18]. Ioannidis *et al*^[18] have postulated the laser is unsuccessful unless apposition of the ciliary body band to sclera can be achieved. We found that the laser group had a functional success rate of 66.6% (rise in IOP) to 77.7% (closure of cleft). But in terms of visual outcome, there was no statistical difference in two groups.

Scleral buckle is being used in the retinal detachment surgery for achieving an anatomic approximation between the detached neurosensory retina and the retinal pigment epithelium choroid complex. There can be multiple factors responsible for approximation of the cleft. The indentation of the encirclage pushes the vitreous in the anteroposterior direction; the anterior force can thereby approximate the cleft. Likewise, the tangential vector force due to the encirclage could act in a way to approximate the cleft. Hammer^[20] have described the forces which help in retinal reattachment after scleral buckling and suggested that the scleral buckle reverses the direction

of the radial inward force on the retina to an outward force, thereby promoting retinal reattachment of a detached retina. Likewise, the outward force of the vitreous could have closed the cleft (Figure 2). Further adhesion between the two layers was augmented by using transcleral cryotherapy causing inflammatory reaction and in long term scarring at the site^[13,21]. In our series, in cases where encirclage was used as a primary procedure, 2 of the 6 had non-closure, which subsequently closed after laser. The extent of cleft was similar in the ones which closed and the ones which didn't close; however, they were younger (mean age: 19y) as compared to others (mean age: 42.5y). It could probably be the inelastic vitreous in the younger age group, which could not exert the anterior force to allow approximation. Similarly in the patients who had failed laser, 3 of the 4 cases closed by encirclage. The one which didn't close was similar to others in respect to age, duration of cleft, and extent of cleft.

Thus, this novel technique seems to have a role in the management of traumatic cyclodialysis cleft and is comparable in terms of anatomical and functional success with the conventional argon laser. However, encirclage seems to have a possible advantage of a single procedure (in the laser group, 44% needed additional laser to close the cleft). Also encirclage can be used as second procedure, in patients where laser had failed.

The study has several strengths. It describes a novel and effective technique which is comparable to laser treatment. The comparison of techniques has not been previously done. However, the study has few limitations. The retrospective design and smaller sample in each group are important limitations. The two groups though comparable in baseline characteristics but all cases in Group I were not treatment naive cases and two received additional laser after encirclage thus the overall success in this group would have been lower if encirclage was used as isolated procedure. Also, it is difficult to ascertain whether cryopexy alone could have been equally effective. A larger randomized trial could probably give the answer to it and may help the treating ophthalmologists to make the best choice in cyclodialysis cleft.

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