Long -Term Results of Surgical Management of Dislocated Crystalline Lenses

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Introduction

Traumatic cataracts and subluxated or dislocated crystalline lenses are frequently encountered in the settings of severe ocular trauma. Traumatic cataracts are thought to develop secondary to equatorial expansion with rupture of the lens capsule. This equatorial expansion may also cause a significant amount of zonular dehiscence with subsequent subluxation or dislocation1. Dislocation implies a complete displacement of the lens from the pupillary region either posteriorly into the vitreous cavity or anteriorly into the anterior chamber. Management of these commonly encountered entities first require a thorough evaluation for any other associated pathology such as herniation of vitreous into the anterior chamber, angle recession, vitreous haemorrhage, retinal breaks or retinal detachments2.

The evaluation of the crystalline lens after injury requires a thorough ophthalmic examination to look for an occult posterior scleral perforation, vitreous herniation into anterior chamber, gonioscopy for traumatic angle recession, dilated indirect ophthalmoscopy for retinal tears, retinal detachments or vitreous haemorrhage3.

In the presence of traumatic hyphema or vitreous haemorrhage, B. Scan Ultra sonography4 may be of a great value in delineating the dislocated lens as well as for evaluating for other associated posterior segment pathologies.

We present the results of a retrospective analysis of 25 cases of severe contusion injury with dislocated crystalline lenses, which was managed, at our centre with lens removal and ACIOL implantation.

Methods :- A retrospective case sheet analysis of all cases managed by us with a diagnosis of blunt injury severe enough to cause dislocation of crystalline lens into the vitreous cavity was performed. The data retrieved from the case sheets included the mechanism of injury, the best corrected visual acuity, biomicroscopic examination of the anterior segment, tension applanation, associated posterior segment findings, details of the surgical procedure performed including the technique used for lens removal and the type of IOL implanted, as well as the intraoperative difficulties and post operative complication both immediate and long term. The duration of follow up was 24 months to 60 months.

All patients had undergone a thorough preoperative evaluation, which included a detailed history to elicit the mechanism of trauma, the time of presentation for treatment and a thorough evaluation of both anterior and posterior segment of the eye. The surgical procedure depended on the results of the preoperative evaluation. Patients with associated retinal detachment, underwent a combined scleral buckling, pars plana vitrectomy, use of perflurocarbon liquid to achieve mechanical retinal flattering and also to elevate the lens to the pupillary area. Lens removal was performed using the outcome cutter in 8 eyes, by using the phacofragmatome hand piece in 9 eyes or though a limbal incision in 9 eyes. In 12 of the 25 eyes an anterior chamber Kelman multiflex AC IOL was implanted. In three patients who had an associated retinal detachment, underwent repair of the detachment along with lens removal and were left aphakic(Fig 1 a-f). 7 patients underwent 4 point sutured scleral fixation of a posterior chamber intraocular lens while in 3 patients a sutureless intrascleral haptic fixation of a posterior chamber IOL was performed. The presence or absence of intraoperative problems, short and long term postoperative complications were noted and analyzed.

Results:

A retrospective analysis of the case records of all patients managed at our centre (between March 2009-2014 March) for traumatic dislocation of crystalline lens were analyzed. 25 patients with a postopearative follow up varying from 24 months to 60 months formed the study group (Mean 42 m).

The patients were of the age group 30-70 years of age (Mean age = 50 years). The patients were predominantly males (19 patients) and there were 6 female patients in the study population. The mechanism of injury is listed in Table 1.

Table 1: Mechanism of Injury

1	Mango falling on face	4
2	Struck while cutting firewood	4
3	Soda bottle blast injury	1
4	Domestic Violence	3
5	Stone throw	8
6	Injury with Idiyappam makers spring (Rice hopper)	2
7	Assault (MLC)	3

Majority of patients were referred within a week of sustaining the blunt injury (20 eyes). 5 cases reported within 2 weeks of sustaining injury. Associated anterior segment findings included traumatic hyphema (3 eyes; 12%); Sphincter tears (2 eyes; 8%); angle recession (5 eyes; 20%); traumatic glaucoma (7 eyes; 28%); vitreous herniating into anterior chamber (3 eyes; 12%); uveitis (2 eyes; 8%); and traumatic mydriasis in 4 eyes (16%) (Table 2). Patients were taken up for surgery after controlling the intraocular inflammation and achieving medical control of IOP before surgical intervention.

Table: 2: Anterior Segment Findings

	Findings	**No of eyes**	**%**
1	Hyphema	3	12%
2	Sphincter Tear	2	8 %
3	Angle recession	5	20 %
4	Glaucoma	7	28 %
5	Vitreous in AC	3	12 %
6	Uveitis	2	8 %
7	Tr Mydriasis	3	12 %

A dilated posterior segment evaluation was performed and whenever Indirect Ophthalmoscopic view was poor, a B.Scan USG was performed. Associated posterior segment findings included vitreous haemorrhge (9 eyes; 36%). Berlins oedema (2 eyes ; 8%); Avulsed vitreous base (1 eye ; 4%), Retinal tear (3 eyes ; 12%); Retinal detachment (2 eyes; 8%), Choroidal rupture (1 eye ; 4 %). The preoperative best corrected visual acuity ranged from Hand Movements (HM) to 6/6 with aphakic correction. (Fig 1. a-d)

In all patients the surgery was performed under local anaesthesia. 2 patients with retinal detachment underwent retinal detachment repair along with lens removal and were left aphakic. In these 2 eyes Perflurocarbon liquid (PFO) was used to float the dislocated lens into the pupillary area for where it was removed through a limbal incision. The soft lens dislocations were managed by performing a parsplana lensectomy using an outcome cutter in 9 eyes. Phaco fragmentation was performed in 14 eyes after floating the lens on a small PFCL bubble.

In 12 patients a multiflex open loop ACIOL was implanted into the anterior chamber under adequate viscoelastic cover and the limbal section closed with 90 Nylon sutures. The residual PFO was aspirated and a fundus examination with scleral depression was performed before closure of sclerotomies.

In 7 eyes a 4 point sutured scleral fixation of a posterior chamber intraocular lens was performed while 3 patients underwent a sutureless intrascleral haptic fixation of a posterior chamber IOL implantation.

Intraoperative complications encountered were an iatrogenic retinotomy in one patient in whom an intraoperative endolaser barrage retinopexy was performed, residual retained PFO (1) and intraoperative hyphema (1). Post operative complications are listed in Table 2.

Table 2: Post operative Complications		
Macular Hole	1	4 %
Epiretinal Membrane	4	16 %
Macular Degeneration	4	16 %
CME	1	4 %
OD pallor	1	4 %
Residual PFCL	1	4 %
ILM folds	1	4 %
Retinal Detachment	1	4 %

15 patients achieved a final visual acuity of > 6/18. A final visual acuity between 6/24 - 6/60 was possible in 8 eyes and in 2 patients the final vision was less than 6/60. Traumatic glaucoma was seen in 1 patient who achieved adequate control with medical management. The commonest cause for subnormal vision was epimacular membrane and post traumatic macular degeneration. Other caused included cystoid macular oedema, optic disc pallor, choroidal rupture and macular ILM folds. One eye developed a total RD with advanced PVR, 5 years after the procedure. All 12 patients who underwent an ACIOL implant showed clear corneas and no evidence of corneal endothelial decompensation.

All patients were followed up and at each followup visit their best corrected visual acuity, intraocular pressure, degree of anterior segment inflammation, PAS formation and macular integrity for presence of CME were assessed.All eyes maintained good corneal clarity, no evident anterior segment inflammation or PAS formation.One patient each developed CME & Retinal detachment.

Discussion:

In general, the indications5 for removal of a dislocated crystalline lens includes impaired visual acuity, resulting from obstruction of the visual axis by the dislocated lens, development of complications such as phacolytic uveitis, or glaucoma, retinal detachment, and vitreous herniation into the anterior chamber resulting in a cystoid macular oedema. A relative indication for surgery is severe monocular diplopia.

Surgical techniques: Numerous surgical techniques6,7,8 have been described for the management of dislocated crystalline lenses, however, most have been abandoned because of their limitations, complications and complexities. The common techniques currently used to remove a crystalline lens dislocated into the vitreous cavity includes performing a three port pars plana vitrectomy9. With this technique a thorough pars plana vitrectomy with removal of as much of the basal vitreous gel is performed using vitrectomy cutter The lens is lifted into the midvitreous cavity and fragmented. Frequently it may be necessary to crush the lens between the endoilluminator and the fragmatome into smaller fragments which can be easily emulsified and aspirated. This procedure, though easy to perform can be hazardous in view of the mechanical retinal damage from falling lens fragments, or due to high energy of the ultrasonic probe. There is also an added danger of vitreous traction as the vitreous gets sucked into the probe, if the vitrectomy has not been completed Retinal damage is particularly likely to occur if these maneuvers are performed when the retina is detached and mobile

Therefore to remove the posteriorly dislocated crystalline lens safely and effectively, the use of prefluorocarbon liquids have been recommended. 10,11,12The advantage of using perfluoro carbon liquid in removing crystalline lenses dislocated into the vitreous cavity are as follows,

1. The perfluoro carbon liquid lifts the dislocated lens from the retinal surface into the mid vitreous.
2. In the presence of a retinal detachment, their high specific gravity mechanically flattens out the retina.
3. The PFCL bubble forms a cushion which supports the lens and prevents mechanical retinal damage from falling lens fragments.

Therefore with the use of PFCL, the potential for retinal damage is reduced. The surgical technique includes performing a pars plana vitrectomy with removal of as

NO	AGE/ SEX	PRE-OP DIAGNOSIS	BVCA PRE OP	ASSOCIATED PREOP FINDINGS	SURGICAL PROCEDURE	INTRA OP COMPLI CATION	POST OP COMPLI CATION	FINAL POST OP VA
1	30/M	Disloc lens, subtotal RD GRT 180^0 nasal	3/60	Vit in AC/ pigment in Vit	SB+ PPV+PPL+E/L+C3F8			Aphakic 6/6
2	65/M	Disloc lens, Inf RD Tr.disloc; 2^0 Glaucoma,	HM	Vit in AC	SB+PPV+ LR			6/9
3	45/M	VH, Tr Mydriasis, Tr.Ret tears	FCF	2^0 Glaucoma	PPV+LR + SF PCIOL		OD Pallor ERM	6/24 , N/P
4	48/M	Disloc VH	6/24	VH Tr. Mydriasis, 2^0	PPV+LR+ACIOL			6/12
5	55/F	Tr Dislocated lens	6/18	Glaucoma, Vitreous haemorrhage, RT inferiorly	SB+PPV+ LR SF PCIOL			6/9
6	48/M	Dislocated lens	6/12	Angle Recession	PPV+LE+ Sutureless SFIOL		Hyphema	6/36
7	34/M	Dislocated lens	6/36	Choroidal Rupture nasal to disc, VH	PPV+PPL+ ACIOL		Mac degn	6/18
8	48/F	Dislocated lens	6/60	Peri papillary subretinal hemorrhage	PPV+LR+ACIOL		ERM with hole	3/60
9	50/M	Dislocated lens	6/6	2 Glaucoma, 360^0 angle recession ,Tr Mydriasis	PPV+LR+Sutureless SFIOL		Residual PFCL	6/9
10	34/M	Tr. Dislocated lens	6/18	Tr.Mydriasis, Glaucoma, Berlins Oedema, Chor.rupture below disc	PPV+Frag LR+E/L		Macular / LM folds	6/60 Mac pucker
11	38/M	Dislocated lens RT	2/60	Vit in AC, RT	PPV+Frag + Laser +2^0 ACIOL		rpe mottling	6/12
12	48/F	Dislocated lens , 2^{0}Glau	HM	Angle Recession Hyphema	PPV- Frag SF PCIOL			6/9
13	52/F	Dislocated lens , VH	2/60	Hyphema, VH	PPV+ Frag ACIOL		Tr.Glaucoma	6/24
14	60/M	Dislocated lens	1/60	Sphincter Tear	PPV+ Frag ACIOL		ERM	6/9 6/60
15	49/M	Dislocated lens, Berlins oedema	HM	Berlins, Avulsed VB	PPV+ Frag ACIOL		Macular Degn	6/60
16	64/M	Dislocated Lens 2^0 Glau VH	3/60	Hyphema, VH	PPV+ Frag ACIOL			6/9
17	70/M	Dislocated lens	2/60	Vit in AC	PPV+ Frag ACIOL			6/9
18	38/M	Dislocated + VH	2/60	VH, RT	PPV + PPL+ ACIOL E/L			6/9
19	34/F	Dislocated + VH+ hyphem	CFCF	Angle recession	PPV+ PPL + SF PCIOL		ERM	6/12
20	39/M	2nd Glaucoma	5/60	Angle recession	PPV+ PPL + Sutureless SF IOL			6/18
21	42/M	Uveitis with Dislocated	CFCF	Uveitis	PPV+ PPL + SF PCIOL		RPE mottling	6/60
22	44/M	Uveitis with Dislocated	HM	Uveitis	PPV+ PPL + SF PCIOL			6/9
23	48/ M	Dislocated lens	6/ 24	RT, VH	PPV + PPL + ACIOL			6/9
24	52/ F	Dislocated lens	6/ 18		PPV + Frag + ACIOL			6/12
25	60 /M	Dislocated lens	6 /60	2^0 Glaucoma	PPV + Frag + SF PCIOL		RPE mottling	6 /24

much basal vitreous gel, prior to lens removal. After the completion of vitrectomy, PFCL is injected into the vitreous cavity over the optic disc floating up the dislocated lens into the anterior vitreous. If the dislocated lens is associated with a retinal detachment, the PFCL injection mechanically flattens the retina against the retinal pigment epithelium, displacing the subretinal fluid through a pre-existing retinal break into the vitreous cavity. The dislocated lens is then fragmented in the mid vitreous cavity while floating on the PFCL. Small fragments of lens matter that drop, float on the surface of the perfluorocarbon bubble and are easily aspirated. Lens particles can get entangled in the basal vitreous making its removal difficult. Damage to the peripheral retina can occur in an attempt to remove these entangled fragments.

If the dislocated crystalline lens is very hard it is preferable to remove it through the anterior (limbal route) using either a cryo or an irrigating vectis13.

If the eye with the dislocated crystalline lens also has an associated rhegmatogenous retinal detachment, the scleral buckle is placed prior to the lens removal. After removal of the lens, endolaser retinopexy is performed around the tear and a PFCL air exchange is carried to achieve pneumohydraulic retinal reattachment.

Three elements are key to a successful lens fragmentation techniques. (13)

1. Adequate vitrectomy avoids unintended vitreous traction during phaco fragmentation.
2. Reducing fragmentation power to only 5% to 10% facilitates nuclear extraction by continuous occlusion of the suction ports and avoids projectile fragments. This maneuver also minimizes the risk of fragments dropping on to retinal surface.
3. Fragments should be aspirated and brought to midvitreous cavity before ultra sonic fragmentation, if PFCL is not used.

There are several reports comparing various IOL fixation techniques in aphakic eyes14,15,16,17,18. Results of these studies have conclusively shown that there is no statistically significant difference between the various IOL types with respect to postoperative vision,central corneal thickness and intraocular pressure. Implanting a multiflex open loop design AC IOL into the anterior chamber is a viable option provided there is no corneal endothelial decompensation, compromised angles or loss of iris tissue.

In this study, all patients with ACIOL implants were followed up for atleast a minimum period of 24 months. Corneal capacity, endothelial cell counts, central corneal thickness, presence or absence of anterior chamber inflammation, peripheral anterior synchiea formation, intra ocular pressure, and presence of cystoid macular oedema were assessed as each follow up visit and found stable expect for CME in one patient.

Thus successful management of severe blunt injury involves a thorough preoperative work up, proper surgical planning and meticulously tailored postoperative management and follow up

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