

Outcome of Capsular Tension Ring (CTR) Implant in Complicated Cataracts

GARIMA RAI¹, ANSHU SAHAI², PUKHRAMBAM RATAN KUMAR³

ABSTRACT

Introduction: Surgery in the presence of zonular weakness or subluxated lens was a great surgical challenge and included intracapsular cataract extraction with anterior chamber IOL implantation or pars plana lensectomy and vitrectomy with a sutured (IOL). Modern surgical approach involves placement of endocapsular flexible PMMA ring that prevents iatrogenic loss of zonular support, minimizing vitreous loss and enables placement of in the bag IOL.

Aim: To evaluate frequency and indications of capsular tension ring (CTR) implant and analyse the visual and anatomical outcome in various complicated cataract surgeries.

Materials and Methods: Retrospective screening of database of 6000 consecutive cataract surgeries was done. BCVA, complete ocular examination with SLEx, intraocular pressure, direct ophthalmoscope, fundus examination with +78/+90D were noted. CTR was implanted in cases where Zonular dialysis of > 3 clock hours was present or capsular bag instability was detected during

capsulorhexis or subsequent intraoperative maneuvers. In cases with capsulorrhexis extension, CTR was not implanted. Records were analysed for indication of CTR implant and clinical outcome on Day 1, 1 month and 6 month follow up.

Results: In this series CTR implant was done in 45 cases. The indications were hypermature senile cataract in 9 cases, hypermature senile cataract with lens induced glaucoma in 9 cases, pseudoexfoliation syndrome in 9 cases, post blunt injury traumatic cataract in 6 cases, iridochoroidal coloboma in 6 cases, hypermature cataract with pseudoexfoliation and marfan syndrome in 3 cases respectively. Decision of CTR implant was intraoperative in 42 patients. At 6 month follow up, 39 patients had best corrected visual acuity $\geq 6/12$. IOL decentration was detected in only 3 cases, but without any subjective visual complaints.

Conclusion: As per the results CTR was used very infrequently (0.75%) but remains useful in cataract surgeries with difficult pre and intraoperative conditions. It gives good postoperative result and creates satisfied patients.

INTRODUCTION

Surgery in the presence of zonular weakness or subluxated lens was a great surgical challenge. In the past surgical interventions in these cases were difficult leading to complications [1]. Previous techniques for the management of zonular weakness included intracapsular cataract extraction with anterior chamber IOL implantation or pars plana lensectomy and vitrectomy with a sutured PCIOL [2]. Today surgical objectives aims to reduce surgical complications improve refractive results and shorten recovery time. Modern approaches in cataract surgery involves the use of small incisions, closed system techniques to prevent further iatrogenic loss of zonular support, minimize vitreous loss and enable the placement of in the bag PCIOL.

The use of endocapsular flexible PMMA ring has enabled surgeons to achieve these objectives and approaches in subluxated cataract. Implantation of CTR stabilizes the loose lens and allows the surgeon to place the IOL in the most beneficial position (capsular bag) when it might otherwise have to be positioned elsewhere [3]. The ring works by distributing centrifugal forces among the remaining zonules, while supporting areas of zonular weakness and allows redistribution of force to the existing zonules.

The capsular bag maintains its shape and does not collapse, preventing the proliferation and migration of epithelial cells and thus posterior capsular opacification [4-6]. Other possible applications include the prevention of postoperative shrinkage of the anterior capsular opening as a result of fibrosis (capsulorhexis phimosis, capsule contraction syndrome) and late IOL decentration [7,8].

Capsular tension rings (CTRs) are polymethyl methacrylate (PMMA) intraocular implantation devices introduced in 1993 by Withschel and Legler [9,10]. The original CTR was introduced into the market

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by Morcher [11]. Since then similar products have been introduced by different manufacturers. Commercially it is available in three models.

- CTR 11 with open diameter of 11mm, used for placement in hyperopic eyes.
- CTR 12 with open diameter of 12mm, used for placement in average size eyes.
- CTR 13 with open diameter of 13mm, used for placement in myopic eyes.

Cionni ring is a modified CTR (MCTR) which was originally designed by Dr Robert Cionni. It incorporates a unique fixation hook to provide scleral fixation in cases with severe zonulodialysis [12].

AIM

To evaluate frequency and indications of Capsular tension ring (CTR) implant and analyse the visual and anatomical outcome in various complicated cataract surgeries.

MATERIALS AND METHODS

A retrospective, nonrandomized, single center study was conducted on patients who underwent cataract surgery by phacoemulsification technique at Sahai Hospital and Research Center Jaipur, a tertiary care center. The database of 6000 consecutive cataract surgeries were screened, 45 cases were identified in which CTR implantation was done. All the records were screened for indication of CTR implantation, and subsequent clinical outcome on day 1, 1month and 6 month follow up was analysed. Preoperative evaluation in all cases included a detailed history, best corrected visual acuity measured using Snellen's visual acuity chart, intraocular pressure measured by applanation tonometer, detailed anterior segment

evaluation on slit lamp before and after pupillary dilatation, fundus evaluation using 78/90D lens and indirect ophthalmoscope.

CTR implantation was done in cases where pre-existing zonular dialysis of more than 3 clock hours was present or intraoperatively capsular bag instability was detected during capsulorhexis and subsequent surgical maneuvers. In cases with capsulorhexis extension, CTR implantation was not done. All cases were operated by the same surgeon under topical anaesthesia except 3 paediatric cases which were operated under general anaesthesia. CTR type 12 (12-10) and Cionni Ring-12 was used for implantation. Phacoemulsification was done by direct chop method in all cases except paediatric cases where irrigation and aspiration was used. CTR was inserted through main port by double McPherson forceps technique and then dialed in the bag to bring the open ends opposite to quadrant of zonular dialysis.

RESULTS

Out of 45 patients included in study, 30 were males (66.66%) and 15 were females (33.33%), ranging in age from 10 yrs to 70 yr, mean age being 50 yrs. The indications of CTR implantation were hypermature senile cataract in 9 cases, hypermature senile cataract with lens induced glaucoma in 9 cases, pseudoexfoliation syndrome in 9 cases, traumatic cataract (post blunt injury) in 6 cases, cataract with iridochoroidal coloboma in 6 cases, hypermature senile cataract with pseudoexfoliation in 3 cases and Marfan's syndrome in 3 cases.

Endocapsular ring implantation was done after hydrodissection in 39 cases, during phacoemulsification in 3 cases, after cortical clean up in 3 cases. Capsular bag implantation of PCIOL was done in all cases. Decision of CTR implant was made intraoperatively in 42 cases and in 3 cases it was a pre-planned surgery.

On analysing the postoperative results keratitis and iritis were seen in 40% and 30% of patients respectively which subsequently resolved over a period of one month [Table/Fig-1]. In all cases a posterior chamber, in the capsular bag IOL was placed which remained well centered in most of the patients. Mild decentration of IOL was seen in 3 patients (6.66%) at 6 months follow up but without any subjective visual complaints [Table/Fig-2]. Nearly all the patients had achieved visual acuity of $\geq 6/12$ by 4 weeks which was maintained in all the patients till 6 months follow up [Table/Fig-3].

Time	Cornea	Iritis (AC cells)
Day 1	Clear - 27 Oedema - 18	Occasional - 33 2 To 4 - 12
Month 1	Clear - 45 Oedema - Nil	Occasional - 5 Nil - 40
Month 6	Clear - 45 Oedema - Nil	Occasional - 2 Nil - 43

[Table/Fig-1]: Anterior Segment Changes in the form of corneal clarity, presence of oedema and anterior chamber cells indicative of iritis.

Time	Centered	Decentered
Day 1	Centered - 45	Decentered - Nil
Month 1	Centered - 45	Decentered - Nil
Month 6	Centered - 42	Decentered - 3

[Table/Fig-2]: IOL position changes: Properly centered and decentered IOL after CTR placement.

Time	$\geq 6/36$	$\leq 6/60$
Day 1	$\geq 6/36$ - 39	$\leq 6/60$ - 6
Month 1	$\geq 6/12$ - 39	$\leq 6/60$ - 6
Month 6	$\geq 6/12$ - 39	$\leq 6/60$ - 6

[Table/Fig-3]: Best corrected visual acuity on Snellen's Chart (acuity number of cases).

DISCUSSION

The present study was performed to address two subjects: First to investigate whether an anatomically and visually reasonable outcome could be reached by the insertion of a CTR in a variety

of complicated cataract surgeries and secondly to evaluate the frequency of CTR implantation in a large consecutive series of cataract surgeries.

On analysing the postoperative results keratitis and iritis were seen in 40% and 30% of patients respectively which subsequently resolved over a period of one month [Table/Fig-1]. However among 21 eyes investigated by Jacob S et al., showed iritis in 23.8% and keratitis in only 9.28% patients [13]. Higher incidence of immediate postoperative keratitis seen in our patients can be attributed to probable higher percentage of patients with hypermature cataract and pseudoexfoliation syndrome.

In all cases a posterior chamber, in the capsular bag IOL was placed which remained well centered in most of the patients. Mild decentration of IOL was seen in 3 patients (6.66%) at 6 months follow up but without any subjective visual complaints [Table/Fig-2]. The studies by Ma X et al., Gimbel et al., and Javier Moreno et al., who evaluated 36, 14 cases with CTR implant and 7 eyes with cionni ring implant respectively found no observable decentration of IOL in 1 year follow up and concluded that it provides excellent stability of capsular bag and IOL positioning in all cases [14-16]. However studies with longer follow up time as observed by Tribus C et al., (follow up 1 to 3 years) did showed decentration in 5% of cases which was not associated with any complaints of diplopia as in our study also [17]. Lui Y et al., in their study on 14 eyes identified decentration and tilting in 14.28% of cases that remained stable and did not progress further during follow up [18]. Vasavada AR et al., performed similar study in 41 eyes with cionni ring implant and found decentration in 3 eyes (7.3%) over a follow up period of 45.8 \pm 2.9 months [19]. So there is a possibility that studies with longer follow up time may show increased incidence of decentration.

Nearly all the patients had achieved visual acuity of $\geq 6/12$ by 4 weeks which was maintained in all the patients till 6 months follow up [Table/Fig-3]. This is similar to the finding of Jacob S et al., who studied 21 eyes and calculated best corrected visual acuity to be $\geq 6/12$ which was achieved in 71.42% patients [13]. Studies by Ma X et al., and Vasavada AR et al., have also reported improved BCVA in 91.7% and 85.4% patients respectively [14, 19]. Only 6 (13.33%) patients in our study had achieved visual acuity $\leq 6/60$ which was due of pre existing fundus pathology.

Frequency of CTR implant was calculated to be 0.75% and most common indication was hypermature senile cataract seen in 40% of cases followed by pseudoexfoliation syndrome (26.67%), blunt traumatic cataract (13.33%), Uveal coloboma (13.33%) and Marfan's syndrome in 6.67% patients. The indications for CTR implantation are in line with other authors like Tribus C et al, Moreno J et al, Deitlein TS et al, who had used the CTR in eyes with intraoperative signs for loose or broken zonules like decentration of the crystalline lens, movement of the lens during capsulorhexis, phacoemulsification or irrigation/aspiration [16,17,20].

In our study CTR implantation was done after hydrodissection in 86.6% of cases, during phacoemulsification in 6% of cases and after cortical clean up in 6% of cases, this was also concluded in the study done by Lanzetta P et al., that a CTR may be inserted at any stage of the cataract procedure: before phacoemulsification after capsulorhexis has been performed or after phacoemulsification, either before cortical aspiration or before IOL implantation [11].

CONCLUSION

Although CTR is used very infrequently (0.75%) but they are very effective adjunctive device that converts a potential catastrophic phacoemulsification procedure into a success story, provides good postoperative results and creates satisfied patients. The use of CTR facilitates safe surgery in cases with zonular dehiscence that is prone to intraoperative complication and provides fast recovery. However studies with longer follow up period are required to ascertain the changes of decentration and resulting visual disabilities. With the

fusion of innovative surgical devices and appropriate surgical techniques, difficult situations such as subluxated cataracts can be managed well.

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PARTICULARS OF CONTRIBUTORS:

1. Assistant Professor, Department of Ophthalmology, SGT Medical College, Gurgaon, Haryana, India.
2. Director, Department of Ophthalmology, Sahai Hospital and Research Center, Jaipur, India.
3. Senior Consultant, Department of Ophthalmology, Sahai Hospital and Research Center, Jaipur, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:

Dr. Garima Rai,
M-317, Vijay Ratan Vihar, Sector-15, Part 2, Gurgaon, Haryana, India.
E-mail: rai1garima@rediffmail.com

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