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CLINICAL

Retrospective study of visual outcome of secondary in the sulcus implantation of single piece polymethylmethacrylate (PMMA) intraocular lens (IOL)in adults.

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A B S T R A C T

Background: Cataract is the most common cause of reversible blindness in India. Preexisting or intraoperative complications during surgery can lead to aphakia. Implantation of Intraocular lens in a secondary sitting is needed for visual rehabilitation of these aphakic patients. Aim:to evaluate the efficacy in form of visual outcome, stability and complications of secondary in sulcus implantation of single piece polymethylmethacrylate (PMMA) intraocular lens in adults Settings and design:53 eyes of 53 patients visiting tertiary eye care between Jaunuary 2018 and March 2020 and who developed intraoperative complications were included in the study Material and method: 53 eyes of 53 patients underwent secondary in suclus implantation of single piece PMMA. Assesment of vision, slit lamp examination and fundus examination was done at each followup. Any postoperative complication was noted. Statistical analysis: It was a retrospective study and Wilcoxon signed-rank test was used to determine the visual outcome.($p<0.0001$- statistically significant) Result and conclusion: Best corrected visual acuity between 6/12 to 6/6was observed in 18(33.96%) patients ,6/60-6/18 in 33 (62.26%) patients and <6/60 in 2(3.77%) patients. In our study we noticed corneal oedema in 17 eyes(32.07%)and anterior segment inflammation in 15 eyes(28.30%) on 1st postopday and macular oedema on post op 14th day .. Among the complcations which needed surgical management and were sight threatening were IOLdrop seen on 1st postop day in 1 eye(01.88%) and retinal detachment observed in 1 eye on 14th post op day in 1 eye(01.88%).Conclusion: This method is a very good and economical procedure for the visual rehabilitation in surgicaly induced aphakic poor patients visiting tertiary care and teaching institute

K E Y W O R D S

secondary,sulcus,PMMA LENS

ABSTRACT:

Retrospective study of visual outcome of secondary in the sulcus

implantation of single piece polymethylmethacrylate (PMMA) intraocular lens (IOL) in adults.

Background: Cataract is the most common cause of reversible blindness in India. Preexisting or intraoperative complications during surgery can lead to aphakia. Implantation of Intraocular lens in a secondary sitting is needed for visual rehabilitation of these aphakic patients.

Aim:to evaluate the efficacy in form of visual outcome, stability and complications of secondary in sulcus implantation of single piece polymethylmethacrylate (PMMA) intraocular lens in adults

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Statistical analysis: It was a retrospective study and Wilcoxon signed-rank test was used to determine the visual outcome.(p<0.0001-statistically significant)

Result and conclusion: Best corrected visual acuity between 6/12 to 6/6was observed in 18(33.96%) patients ,6/60-6/18 in 33 (62.26%) patients and <6/60 in 2(3.77%) patients. In our study we noticed corneal oedema in 17 eyes(32.07%)and anterior segment inflammation in 15 eyes(28.30%) on 1st postopday and macular oedema on post op 14th day .These complications were very mild and taken care of with medical management. Among the complcations which

needed surgical management and were sight threatening were IOLdrop seen on 1st postop day in 1 eye(01.88%) and retinal detachment observed in 1 eye on 14th post op day in 1 eye(01.88%)

However the statistical analysis using Wilcoxon-signed ranktest (p>0.0001).showed that the major sight threatening complication rate was not statistically significant .

Conclusion: This method is a very good and economical procedure for the visual rehabilitation in surgicaly induced aphakic poor patients visiting tertiary care and teaching institute . The present study assessed the effectiveness of this method with the aim of improving the treatment of aphakic patients within low and middleincome countries.

Original paper:

Introduction: In India cataract is the leading cause of reversible blindness .Ideally, after uneventful cataract

surgery, a posterior chamber Intra Ocular Lens (PC-IOL) is implanted in the capsular bag. This provides the greatest IOL stability and places the IOL closer to the nodal point of the original crystalline lens, resulting in better image resolution.(1) This position also keeps the foreign lens material away from the anterior chamber, thus preventing complications involving the corneal endothelium and anterior chamber angle. (2).

However, it may not be possible in cases such as capsular bag-associated complications which may already exist preoperatively (loose zonules, lens subluxation) or occur intraoperative (large anterior or posterior capsular tear, zonular dialysis). In these cases, either no IOL will be implanted (aphakia) or the IOL has to be fixated in other positions such as anterior chamber (AC), iris, sulcus or the sclera.

In case of intraoperative

complications the IOL can be implanted in the same sitting or secondarily depending on the amount of capsular rupture and vitreous loss.

Our study aimed to evaluate the visual outcome, IOL stability and complications in secondary implantation of PMMA IOL in the ciliary sulcus.

Material and method:

A retrospective study was conducted on 53 eyes of 53 patients operated between January 2018 to March 2020. Ethical committee approval for the study was taken.

The patients had undergone either SICS or Phacoemulsification surgery as primary treatment for cataract. The surgeries were complicated by a large posterior capsular rupture (>5mm) with vitreous prolapse. Meticulous anterior vitrectomy was performed and cortex aspiration done. The patients were kept aphakic and the incisions

sutured with 10-0 ethilon. Patients were informed about the complication and counseled regarding lens implantation in secondary sitting.

Postoperatively patients were prescribed antibiotic steroid drops QID for a period of 15 days. The patients were followed up on post-operative day 1,3,7 and 14.Vision ,slitlamp evaluation and funduscopy was done at each followup. Slit lamp assessment was done to evaluate mainly status of anterior capsular rim, inflammation and intraocular pressure. OCT was done to assess macular oedema.

Inclusion criteria: 1. All Patients having best corrected visual acuity more than 6/60 on snellens vision chart were posted for secondary IOL implantation surgery .2.Adequate stable capsular rim seen on slit lamp examination.3.No signs of inflammation.4.Intra ocular pressure maintained.(<20mm Hg on applanation tonometer).5.No posterior segment

pathology.

Exclusion criteria: 1.Paediatric patients. 2. Inadequate anterior capsular support 3.Active inflammation. 4. Raised intraocular pressure 5.Any posterior segment pathologies.

Surgical procedure: Informed consent was taken from the patient for secondary IOL implantation. Dilatation of pupils was achieved with tropicamide0.8% and phenylephrine5%. After anesthetic fitness peribulbar block with lignocaine (2%) and adrenaline (1:100,000), bupivacaine (0.5%) and hyaluronidase (50units/ml)was achieved . Betadine (5%)eye drops were installed in the conjunctival sac for 5 minutes. Painting and draping was done under all aseptic precautions. Superior rectus bridle suture was taken and conjunctival peritomy from 11 0 clock to 1 o clock was done superiorly. Previous incision sutures were removed and sclerocorneal tunnel was opened using

crescent blade. Viscoleastics injected and examination of anterior segment for any vitreous strands was done. Anterior vitrectomy was done if needed. Following the injection of viscoelastic solution between the iris and potential remaining anterior capsule, the first haptic of IOL (single piece PMMA lens of optic size 6 mm and overall size 12 mm) was inserted through the 6 mm scleral tunnel incision into the ciliary sulcus.The second haptic of IOL was then inserted into ciliary sulcus, using a MC phersen forcep and lens hook by pulling the haptic in centre and releasing it back in the sulcus and the adjusting its position in order to ensure that the two haptics were well positioned in the ciliary sulcus and anterior capsular rim. Viscoelastic materials were cleaned up using an aspirating cannula and a small air bubble was injected via paracentesis into the anterior chamber in order to maintain normal intraocular pressure. The scleral

incision was sutured and conjunctival flap was closed. The eye was patched after subconjunctival injection of antibiotic and steroid (gentamycin and dexamethasone).

Postoperative treatment: Postoperatively, all patients received antibiotic steroid(moxifloxacin 0.5% and dexamethasone1%)eye drop QID for two weeks and then tapered over period of 4 weeks. Followup was done on 1 day, 1 week, 2 weeks and 1 month following surgery, and monthly thereafter. The median followup time was 4 months (range: 26 months). At each followup visit, visual acuity was monitored and a complete ocular examination was performed using a slit lamp microscope and ophthalmoscopy. Intraocular pressure was measured using applanation tonometer, if required. Each examination evaluated visual acuity, corneal edema, anterior chamber depth and

inflammation, posterior synechia of iris, intraocular pressure, lens decentration and tilt, intraocular hemorrhage, cystoid macular edema(using OCT) and retinal detachment.

Result:

The demographic data of the patients included in the study is as per shown in table I.

The study included 23 right eyes and 30 left eyes of the patients. Small incision cataract surgery was performed as the initial procedure in 37 eyes and phacoemulsification was performed in 16 eyes.

Visual outcome: In our study snellens chart was used to evaluate the visual acuity of patients at each follow up. The mean best corrected visual acuity of the patients on each follow up has been shown in the table (II).

Refractive Correction was given to the patients 4 weeks after the surgery.

As observed in table

(II) the visual acuity improved gradually as the corneal edema and inflammation subsided. Using the Wilcoxon signed –rank test, p<0.0001was statistically significant and indicated the improvement of visual acuity.

Slit lamp evaluation:

Corneal edema: 17 eyes(32.07%) showed severe corneal edema on postop day 1.These patients were additionally prescribed sodium chloride (6%) ophthalmic ointment TDS for 1 week along with antibiotic steroid ointment. The edema subsided on 1 week follow up in all cases.

IOL centration: 52(98.11%) eyes showed well centered in sulcus IOL without any tilt or subluxation. There was 1 IOL drop in posterior vitreous seen on 1st 1postop day follow up. The patient was referred to vitreoretinal surgeon for further management

Anterior segment inflammation: It was observed in

15(28.30%) eyes on the 1st postop follow up which subsided after 1 week of steroid eyedrop instillation.

Intra ocular pressure: Mean IOP of all the eyes was 13.8 mmHg as measured on applanation tonometry. Thus none of the patient suffered any rise of neither intraocular pressure nor hypotony.

Fundus: Indirect Ophthalmoscopy was done in all patients to look for vitrtis and retinal detachment. On the 2 nd week follow up retinal detachment was seen in 1 patient (01.88%).The patient was referred to Vitreoretinal surgeon for further management.

90D slit lamp bio microscopy and OCT was used to assess macular edema.1 eye showed macular edema on 2nd week follow up. The patient was prescribed nepafenac(0.1%) eye drop and observed every week for another 2 months. The edema subsided consequently.

Complications: On post-operative day

1corneal edema was seen in 17 eyes (32.07%) and anterior segment reaction in 15 eyes (28.30%).These complications were managed with appropriate medical treatment. Intraocular lens drop was observed in 1 eye (1.88%).

1eye showed retinal detachment (1.88%) which was referred for vitreoretinal management.1eye showed macular edema (1.88%) which subsequently reduced with appropriate medical management.

Discussion:

Modern cataract surgery is safe and effective in >95% of patients, but in a small number of cases, intraoperative and postoperative complications may occur especially in a teaching institute. These may lead to failure of the IOL implant and potentially vision loss. PCR is a complication that may occur during cataract surgery, despite various technological advances that have improved the safety

of such procedures. Day *et al* (13) demonstrated that PCR and/or vitreous loss occurred in 1.95% of patients that underwent cataract surgery. However, this varies slightly depending on the cataract surgery performed; the incidence was 0.27% in femtosecond laser cataract surgery , 0.68% in phaco , 2.0% in MSICS and 2.9% in ECCE.

Following PCR, it is important to establish whether the implantation of a posterior chamber IOL would be suitable. Previous studies have determined that posterior chamber IOL may be implanted successfully in the bag in cases involving small PCR (2,3),, however, the risks associated with implantation are higher in patients with large PCR (4,7).Implantation of IOL regardless of the size of PCR, may cause IOL tilt, dislocation and the misplacement of haptics into the vitreous cavity (9).. Although the spectrum for surgery

indication is quite wide, IOL dislocation and aphakia after complicated cataract surgery or other complicated intraocular surgery still remain the major reasons for secondary IOL implantation in most other studies as well (1,8) . In the absence adequate capsular support, there are other options for the implantation of IOL, including primary anterior chamber lens implantation, Iris fixated IOL, and scleral fixated IOLS. (1,11)

Each of these lenses are associated with own complications.

1. Anterior chamber IOL are in close proximity of corneal endothelium and hence more likely to cause corneal endothelial damage. This can lead to pseudphakic bullous keratopathy and corneal scaring. These lenses are also associated with other complications like anterior chamber inflammation, Glaucoma and hyphaema.

2 .Iris supported lenses can cause uveitis, glaucoma, iris chaffing, iris tear,

IOL tilt, IOL subluxation and dislocation, pupillary block and pupillary abnormilities

3. Scleral fixation of IOL is a long tedious procedure and associated with complications like scleritis ,suture slippage, haptic break, IOL tilt ,subluxation and dislocation.

Secondary in sulcus IOL implantation: The timing of intraocular lens implantation following a posterior capsular tear should be considered for a good visual outcome. It should be emphasized that delaying IOL implantation until a later secondary procedure may be an appropriate option. This decision may be influenced by factors such as pupil size; compromised surgical visibility from corneal edema or hyphema; excessive softening of the globe; patient discomfort and medical stability; surgeon experience and fatigue; and availability of the necessary instrumentation, sutures, and IOL(4)

When adequate

anterior capsular support is available, in sulcus placement of IOL offers a safe and effective way to treat aphakia. (2)

We found that secondary IOL implantation in the sulcus 2 to 3 weeks after primary surgery allows the anterior capsule fibrosis and capsule to become taut. This offers better stabilization to the lens haptic. This resting period also allows the anterior vitreous phase to stabilize and reduce any inflammation of ocular tissues. The anterior chamber reaction and intraocular pressures can also be taken care of in this resting period.

LENS:

Adjustment of Lens Power

When placed entirely within the ciliary sulcus, the IOL sits 0.5 mm more anterior than if it were placed within the capsular bag.

The power of the sulcus based IOL usually needs to be decreased by 0.50–1.00D to provide the same refractive outcome for an average eye.

For larger, myopic eyes the IOL needs to be reduced by less than 0.50D, while for small, hyperopic eyes it may need to be reduced by 1.50D. The exact adjustment of IOL power can be calculated if the sulcus position is known but the “rule of 9s” method is a reasonable approximation. (4, 5) as shown in table III

Material of lens:

Complications associated with single piece acrylic lenses:

Chang et al(4) conducted a large retrospective survey of patients referred to six members of the American Society of Cataract and Refractive Surgery(ASCRS) Cataract Clinical Committee for chronic complications associated with Single piece acrylic IOLs implanted in the ciliary sulcus. Thirty patients (30 eyes) were evaluated, 29 of 30 IOLs were single piece acrylic IOLs which showed complications like pigment dispersion, IOL decentration,

hyphaema and glaucoma .

According to study conducted by Dr Rajvi(2)Single piece foldable acrylic lenses are a poor choice for ciliary sulcus placement because the square-edged optic design, thick haptics, and unpolished side walls cause friction at the edges of the lens. The overall diameter of these lenses, while ideal for capsular fixation, is undersized for the ciliary sulcus. They have minimal to no posterior angulation and the optic may be more likely to prolapse anteriorly, increasing the risk of pupillary capture. The adherent surface of the acrylic IOL and the bulkier single-piece haptics promote iris chafing, increasing the risk for pigment dispersion syndrome, uveitis-glaucoma-hyphema (UGH) syndrome, iridocyclitis, and increased intraocular pressure (IOP).

PMMA: In our study PMMA Lenses were used which were available in our setup and hence free of cost to the poor

patients taking treatment in our setup who work on daily wages and cannot afford the other lenses. The thin haptic design of PMMA lenses makes these IOLs compatible with both capsular and sulcus placement. When placed in the sulcus, these rigid non foldable lenses with their thin haptic design allow the optic to be displaced away from the iris(10).This reduces chances of iris chaffing, pigment dispersion and subsequent glaucoma.

We also found that PMMA lenses had better stability in sulcus. The design of PMMA lenses fits perfectly in sulcus and thus complications of decentration and tilt of lens are reduced.(2)

Complications: Renieri *et al* (12) assessed the eyes of 13 patients with implanted IOL in the sulcus due to complications following phaco, including extensive posterior capsule rupture with or

without vitreous loss. Postoperative complications included corneal edema (2 patients), Descemet folds (1 patient), intraocular pressure elevations (3 patients) and pronounced anterior segment inflammation (1 patient).

In our study we noticed corneal oedema in 17 eyes(32.07%)and anterior segment inflammation in 15 eyes(28.30%) on 1st postopday and macular oedema on post op 14th day .These complications were very mild and taken care of with medical management. Among the complications which needed surgical management and were sight threatening were IOL drop seen on 1st postop day in 1 eye(01.88%) and retinal detachment observed in 1 eye on 14th post op day in 1 eye(01.88%)

However the statistical analysis using Wilcoxon-signed ranktest ($p>0.0001$)showed that the major sight threatening

complication rate was not statistically significant.

Taking into consideration the excellent visual outcome and complication rate which was minimal this method is a very good option for visual rehabilitation of aphakic patients.

Conclusion: This method should be considered a very good and economical procedure for the visual rehabilitation in surgicaly induced aphakic poor patients visiting tertiary care and teaching institute.

The present study assessed the effectiveness of this method with the aim of improving the treatment of aphakic patients within low and middleincome countries.

Conflict of Interest: The authors declare that they have no conflicts of interest

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