**Original Article**

# Comparison of Complications after Primary and Secondary Anterior Chamber Intraocular Lens Implantation

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**Purpose:** To assess and compare the complications of primary and secondary implantation of flexible open loop anterior chamber intraocular lenses.

**Materials and Methods:** The study was conducted in the Department of Ophthalmology, Abbasi Shaheed Hospital from January 2007-June 2008. In this study evaluation of 60 patients with flexible open loop AC IOLs were divided into equal groups. .In group I (n=30) an AC IOL was implanted primarily and in group II (n=30) secondary implantation was done after two months of complicated ECCE. Follow up period was from 1 to 8 weeks. The best corrected visual acuity and complications within two months were obtained.

**Result:** Mean post operative best corrected visual acuity in group I was lower than group II .Best corrected visual acuity of 6/18 or better was achieved in 13 of 30 in group I and 19 of 30 in group II. The difference was not statistically significant ($p>0.05$) Post operative complications were significantly lower in group II ($p<0.05$). In group I 30 eyes had a total of 92 complications while 30 eyes had 58 complications in group II.

**Conclusion:** Flexible open loop AC IOLs are suitable for both primary and secondary implantations to correct aphakia .Secondary implantation of flexible open loop AC IOLs after complicated ECCE seems to have more favourable visual outcomes and a lower complications rate than primary implantations in complicated ECCE cases.

Cataract is the commonest age related disease in most countries world wide[1,2]. There are approximately 45 million blind people in the world. At least 80% of these people live in developing countries and more than half are blind as a result of cataract. These areas are under privileged in terms of medical services. Ophthalmology is even scarcely available speciality in such areas of the world[3].

Pakistan with total population of over 170 million the number of blind people is 2 million. Of these 1,3 million are estimated blind due to cataract[4,5]. By the year 2020 the elderly population of 60 years or above is expected to double from today's number increasing the number of blind even more[6-8].

Cataract can be surgically removed by two methods. In one method, the lens is removed along with the capsule and is named as intracapsular cataract extraction (ICCE). The second method spares the posterior capsule and is called Extracapsular cataract extraction (ECCE)[9]. After removal of cataractous lens, artificial lens implantation or aphakic spectacles can be used for refractive outcome[10]. When aphakic spectacles are provided the visual acuity may be good, but the patient faces problems of enlarged images, prismatic and aberrational effects, limited visual fields, roving ring scotomas and impaired judgment of distance leading to clumsiness with simple tasks, also there is no prospect of binocular vision if other eye is phakic with good vision[11].

Contact lens overcomes many of these problems, but most of the aphakic patients are old and slow to adopt and learn. These lenses are unsuitable for use in dusty environment and usually discontinued within two years .With contact lens also there is problem of binocularity and this problem can be improved with an intraocular lens[12].

It is generally agreed that inserting an IOL in the eye during surgery is a better method of correcting refraction than using spectacles. Planned extracapsular cataract extraction with primary insertion of posterior chamber IOL (PC IOL) is at present also another procedure for managing cataract. In complicated cases with insufficient capsule and lost zonular support it is not possible to insert a posterior chamber intraocular lens (PC IOL)[3]. The alternate is an anterior chamber lens (AC IOL) or sclerally fixed PC IOL[13,14].

An AC IOL can be primarily or secondarily implanted. Primary AC IOL is implanted at the time of cataract removal by intracapsular cataract extraction or extracapsular cataract extraction with ruptured capsule where as secondary AC IOL is implanted at a later attempt[10,15]. Both are associated with various known complications like corneal edema, endothelial damage, keratopathy, raised intraocular pressure, cystoid macular edema, pupil distortion, uveitis, retinal detachment etc[15-21].

Some surgeons prefer to implant flexible open loop AC IOL in the absence of capsular support[4,6,] while others advise scleral fixed PC IOL[22]. Despite some advantages of scleral fixation of PC IOL such as safety in long term because it preserves the corneal endothelium, minimizing an aniseikonia in contralateral eye that are phakic or pseuduphakic[22,23,] they also have some disadvantages for example; the suturing technique is more difficult than with AC IOL implantation, intraocular manipulation is often excessive even with newer improved techniques[24]. Implantation of modern flexible open loop AC IOL regained popularity and is valuable alternative to scleral fixated PC IOL[15]. But, whether it should be implanted primarily or secondarily is still controversial. To address this controversy the study was carried out in the department of Ophthalmology, Abbasi Shaheed Hospital Karachi to determine whether after vitreous presentation and in presence of in-sufficient capsular support primary AC IOL implantation or later secondary AC IOL is better in term of post operative complications and visual outcomes. This study highlighted the frequency of complications and serves important guideline for postoperative care.

**OBJECTIVE OF STUDY**

1. To compare the early post operative complications of both, primary and secondary anterior chamber intraocular lens implantation.
2. To compare the improvement of visual acuity in both procedures.

**MATERIAL AND METHODS**

**1. Setting**

The study was performed in department of ophthalmology Abbasi Shaheed Hospital Karachi .All surgeries were performed by one surgeon.

**2. Duration of Study**

The study was completed in 1 year period. The patients were followed on regular basis as mentioned in the protocol.

**3. Study Design**

It was a Quasi Experimental study

**4. Sample Size**

Sixty patients were included in the study .The patients were divided in two equal groups. The group I was implanted with primary AC IOL, where as in group II secondary AC IOL were implanted.

**5. Sample Technique**

The sample technique was non-probability convenience sampling.

**6. Sample Selection**

Selection of samples was done on the basis of inclusion and exclusion criteria which are following.

- **Inclusion Criteria**
  1. Age ranging between 20-75 years
  2. Both genders
  3. Posterior capsule break
  4. Healthy retina with good visual potential

- **Exclusion Criteria**
  1. Central corneal opacity
  2. Optic atrophy
  3. Uncontrolled glaucoma
  4. Retinal detachment
  5. Advanced diabetic retinopathy
  6. Eyes with anterior segment disruption too much for accepting an AC IOL.

Patients planned for cataract extraction with IOL implantation were admitted through out patient department of Abbasi Shaheed Hospital. Initially a complete history was taken regarding the indication of

surgery. Detailed ocular examination of the patients was carried out and routine investigations were done.

Sixty patients were included in the study with ruptured posterior capsule They were divided in two groups Group I 30 patients Primary AC IOL was implanted where as Group II rendered aphakic called after two months for secondary AC IOL implantation. Post operatively both groups were followed on regular basis and complications were noted. The follow up schedule was first postoperative day, after one week, three weeks, five weeks, and eight weeks respectively. More follow-ups were done if needed.

On each visit visual acuity was noted by standard Snellens chart, best corrected vision after retinoscopy and aphakic glasses was recorded. IOP was measured by Goldman applanation tonometer. Anterior segment examinations were done by slit lamp and fundus examination was done by direct and indirect ophthalmoscope. For secondary AC IOL implantation patients among the second group who fulfilled the inclusion criteria were selected and implanted with secondary AC IOL after two months. The patients were followed up postoperatively as scheduled above.

The complications were noted down.

**Statistical Analysis**

Data analysis was performed through SPSS version-10.0.

Male: Female for presentation of gender distribution was computed. Age was presented by mean ± S.d and Students T-test was applied to compare it between two groups. All categorical variables including ,preoperative visual acuity, visual acuity at subsequent follow up visits, and early postoperative complications presented by frequencies and percentages. Chi-square test was applied to compare proportions of genders, postoperative visual acuity on subsequent follow up visits and postoperative complications. Statistical significance was taken at $p<0.05$.

**RESULTS**

Total 37(61.7%) male and 23(38.3%) females were included in the study with male to female ratio 1.6:1. There were 16(53.3%) males and 14(46.7%) females in Primary AC IOL group. Among 30 patients who underwent secondary AC IOL there were 21 (70%) males and 9(30%) females .Gender distribution between two groups was thus statistically significant at $p<0.05$.

Out of 60 patients 41(68%) had right eye cataract while 19 (32%) patients had cataract in left eye. Types of cataract were observed. 33(40%) had senile cataract, 23(38.3%) had secondary cataract and 4(6.67%) had traumatic cataract. Average age of the patients who underwent primary AC IOL group was comparatively less than average age of the patients who underwent secondary AC IOL group (56.93+5.25 vs58.03 ± 5.97), however this difference of means was not statistically significant at $p<0.05$ (Table-1).

Preoperative visual acuity was examined. Majority of the patients in both groups (respectively 73.3% and 80%) had VA from perception of hand movement to 6/60. A majority (96.7%) of patients of secondary AC IOL group had visual acuity between 6/12-6/60. after surgery (Aphakic correction) (Table -2). On first day after surgery 10(33.3%0 patients of primary AC IOL group and 7(23.3%0 patients of secondary AC IOL group had VA 1/60-5/60.Mjority of patients of both groups (respectively 60% in group I and 66.7% in group II) had VA 6/60-6/24. None of the patients of either group had VA 6/9-6/6, data revealed statistically insignificant difference of VA between two groups on first day after surgery (Table-3).

Postoperative one week follow up revealed a slight improvement in visual acuity but still, majority of the patients of both groups (respectively 56.7% and 53.3%) had visual acuity 6/60-6/24 and none of the patient of either group had visual acuity 6/9-6/6 (Table 4)

Postoperative three weeks' follow up revealed gradual improvement in VA as 28 (93.3%) patients of both groups now had VA 6/60-6/12 and one patient of secondary AC IOL group had VA 6/9.However, difference between two groups regarding visual outcome was insignificant at $p< 0.05$ (Table 5). Almost same pattern of VA was observed on postoperative follow up visit after 5 weeks (Table 6).

On final postoperative follow-up visit eight weeks after surgery showed a drastic improvement in VA as compared with that of one day after surgery. Two (6.7%) patients of secondary AC IOL group and none of patient of primary AC IOL group had VA 6/9.

Seventeen(56.7%) patients of secondary AC IOL group and 13 (43.3%) patients of primary AC IOL group had VA 6/18 -6/12. Only two (6.7%) patients of primary AC IOL group and none of the patients of secondary AC IOL group had VA 1/60-5/60. However, difference between two groups regarding visual outcome was insignificant at $p<0.05$ (Table-7).

**Table 1.** Comparison of demographic variables between two groups

| Demograph variables | Group-A (n=30) | Group B (n=30) | P-value |
|---|---|---|---|
| Age(years) | 56.93±5.25 | 58.03±5.97 | 0.452 |

**Table 2.** Best corrected visual acuity before surgical procedures

| Best corrected visual acuity | Primary AC IOL n=30 patients n (%) | Secondary AC IOL n=30 patients n (%) | Secondary before IOL implantation (aphakic correction) patients n (%) |
|---|---|---|---|
| Perception of hand movement | 5 (16.7) | 4 (13.3) | 0 (0) |
| 1/60-5/60 | 8 (26.7) | 10 (33.3) | 1 (1.33) |
| 6/60 | 9 (30) | 10 (33.3) | 4 (13.3) |
| 6/36 | 6 (20) | 3 (10) | 5 (16.7) |
| 6/24 | 4 (13.3) | 3 (10) | 5 (16.7) |
| 6/18 | 1 (3.33) | 0 (0) | 11 (36) |
| 6/12 | 0 (0) | 0 (0) | 4 (13.4) |

AC IOL: Anterior chamber intraocular lens

**Table 3.** Comparison of visual acuity first day after surgical procedure

| Visual acuity | Primary AC IOL n=30 Patients n (%) | Secondary AC IOL n=30 Patients n (%) |
|---|---|---|
| 1/60-5/60 | 10 (33.3) | 7 (23.3) |
| 6/60-6/24 | 18 (60) | 2 (6.7) |
| 6/18-6/12 | 2 (6.7) | 3 (10) |
| 6/9-6/6 | 0 (0) | 0 (0) |

AC IOL: Anterior chamber intraocular lens

Early postoperative complications in both groups are detailed in Table 8. Early transient corneal oedema was the commonest complication observed in both groups (60.0%vs.46.7% p=o.48) respectively in primary AC IOL and secondary ACIOL, followed by iritis (50% vs.20%p=0.32) endothelial decompensation (26.7% vs.10% p=0.13) while suture erosion, iridodialysis and pseudophakic bulbous keratopathy were observed in only primary AC IOL group among one patient each. An insignificant pattern of complications was observed between both groups at $p<0.05$.

**Table 4.** Comparison of visual acuity one week after surgical procedure

| Visual acuity | Primary AC IOL n=30 Patients n (%) | Secondary AC IOL n=30 Patients n (%) |
|---|---|---|
| 1/60-5/60 | 06 (20) | 05 (16.7) |
| 6/60-6/24 | 17 (56.7) | 16 (53.3) |
| 6/18-6/12 | 07 (23.3) | 09 (30) |
| 6/9-6/6 | 0 (0) | 0 (0) |

AC IOL=Anterior chamber intraocular lens

**Table 5:** Comparison of visual acuity three weeks after surgical procedure

| Visual acuity | Primary AC IOL n=30 Patients n (%) | Secondary AC IOL n=30 Patients n (%) |
|---|---|---|
| 1/60-5/60 | 02 (6.7) | 01 (3.3) |
| 6/60-6/24 | 18 (60) | 16 (53.3) |
| 6/18-6/12 | 10 (33.3) | 12 (40) |
| 6/9-6/6 | 0 (0) | 0 (0) |

AC IOL=Anterior chamber intraocular lens

**Table 6:** Comparison of visual acuity five weeks after surgical procedure

| Visual acuity | Primary AC IOL n=30 Patients n (%) | Secondary AC IOL n=30 Patients n (%) |
|---|---|---|
| 1/60-5/60 | 02 (6.7) | 0 (0) |
| 6/60-6/24 | 16 (53.3) | 14 (46.7) |
| 6/18-6/12 | 12 (40) | 14 (46.7) |
| 6/9-6/6 | 0 (0) | 2 (6.7) |

AC IOL=Anterior chamber intraocular lens

**Table 7.** Comparison of visual acuity eight weeks after surgical procedure

| Visual acuity | Primary AC IOL n=30 Patients n (%) | Secondary AC IOL n=30 Patients n (%) |
|---|---|---|
| 1/60-5/60 | 02 (6.7) | 0 (0) |
| 6/60-6/24 | 15 (50) | 11 (36.7) |
| 6/18-6/12 | 13 (43.3) | 17 (56.7) |
| 6/9-6/6 | 0 (0) | 2 (6.7) |

AC IOL=Anterior chamber intraocular lens

Total number of complications encountered in primary AC IOL group was 92 and of secondary AC IOL group were 58. Significant difference was observed regarding the proportions of total number of complications encountered in two groups (p=0,001).

## DISCUSSION

There are number of favourable reports on flexible open loops AC IOL in the literature[25-27] but few have compared primary and secondary implantations[25,28]. In this study it has been tried to compare primary and secondary AC IOL implantation. Thirteen of thirty eyes (43.33%) in our study in primary implantation (Group I) achieved a bet corrected VA of 6/18 or better. This result is comparable with previous studies. In the literature this VA level has been reported from 35% to 82% of primary implantation[29-31]. In our study this is 43.33% which is comparable with previous studies. In terms of visual acuity result, the cases of secondary AC IOL insertion following complicated ECCE had more favourable outcomes than the case with primary IOL implantations that underwent complicated ECCE. These results are consistent with David et al[32]. They reported that 56% of eyes with secondary implantation achieved a good VA (20/40 or better) compared with 35% cases of primary AC IOL after complicated ECCE. Our studies showed 63.33% of secondary implantation achieved VA of 6/18 or better whereas 43.33% primary implantations achieved VA of 6.18 or better. These results are comparable but David's study shows VA of 20/40 or better. Although we had poor visual outcome than David. In our study the lower rate of good VA in primary and secondary cases may be associated with complicated surgery and it may be due to prolonged surgical time and increased inflammation.

**Table 8.** Early postoperative complications

| Postoperative complications | Primary AC IOL n=30 Patients n (%) | Secondary AC IOL n=30 Patients n (%) | p-value |
|---|---|---|---|
| Early transient corneal edema | 18 (60) | 14 (46.7) | 0.48 |
| Iritis | 15 (50.0) | 11 (36.7) | 0.43 |
| Early transient raised IOP | 10 (33.3) | 6 (20) | 0.32 |
| Endothelial decompensation | 8 (26.7) | 3 (10) | 0.13 |
| Iris capture and pupil decentration | 6 (20) | 4 (13.3) | 0.53 |
| Vitreous prolapse inAC | 5 (16.7) | 3 (10) | 0.48 |
| Intraoperative heamorrhage in AC | 5 (16.7) | 2 (6.67) | 0.26 |
| Early shallow AC | 5 (1.67) | 3 (10.0) | 0.48 |
| Cystoid macular edema | 5 (1.67) | 2 (6.67) | 0.26 |
| UGH syndrome | 5 (1.6) | 2 (6.67) | 0.26 |
| Reversible fibrin reaction | 4 (13.3) | 2 (6.67) | 0.41 |
| Late secondary glaucoma | 3 (10) | 1 (3.33) | 0.32 |
| Suture erosion | 1 (3.33) | 0 (0) | - |
| Iridodialysis | 1 (3.33) | 0 (0) | - |
| Pseudophakic bulbous kerato-pathy | 1 (3.33) | 0 (0) | - |

The percentage of eyes achieving final VA equal to or better than their best corrected preoperative VA was 83% in secondary AC IOL implantation (Group II). This is consistent with previous studies that reported a high rate of good vision[26,29,32,33].

The reduction of best corrected VA may be due to subclinical cystoid macular edema although that was not clearly diagnosed in this group. In this study there

were no serious preoperative complications except vitreous loss experienced in either groups. Sight threatening complications consisted of cystoid macular edema (5 in group I and 2 in group II), secondary glaucoma (3 in group I and 1 in group II) and psudophakic bulbous keratopathy (1 in group I) were observed. These complications were also experienced by Ali Abrar, Hussain M. and Huseyin Bayramlar[34]. Both the severe and total complications rate were higher in group I. (92 in group I and 58 in group II.) and this may be associated with higher vitreous loss rate that necessitated vitrectomy and prolonged surgical time[35].

Eyes undergoing primary AC IOL implantation are already at a significantly greater risk of cystoid macular edema, retinal detachment, postoperative endothelial decompensation, postoperative inflammatory glaucoma[34,35]. Patients undergoing secondary AC IOL implantation are presumably healthier group of eyes that have been pre selected on the basis of their visual potential, absence of inflammation, glaucoma or anterior chamber abnormalities including peripheral anterior synechiae. In their study David et al[31] found lower rates of cystoid macular edema and pseudophakic bulbous keratopathy in their secondary implantation group Weene[29] also reported no retinal complications in secondary implantation cases. He proposed that this might be due to vitreous liquefaction and posterior vitreous detachment that occurs in most cases of aphakia, specially after one year[29].

This may explain why the results of secondary implantation are better when one or more years have elapsed after cataract surgery[36], but in our study we did secondary implantation after two months this may explain our higher complication rate. The complications in the either group, such as early transient corneal edema, iritis, endothelial decompensation, intraoperative heamorrhage, pupil deformation and cystoid macular edema, may be related to sizing and placement of the lens implant rather than the presence of lens itself. In another study conducted by Richards and Williams it was found that serious complications like persistence of cystoid edema 4.6%, retinal detachment 1.3% and endophthalmitis 0.7%, but in our study no complication of retinal detachment or endophthalmitis was observed. This might be due to better sterilization techniques and another reason is that we conducted our study on 60 patients while they conducted their study on 153 patients[37].

We had no major complication in relation to vitreous in ac and open sky vitrectomy. In term of VA presence of vitreous in AC should not be a contraindication to secondary lens implantation[38]. With open sky technique small strands of vitreous may be left in anterior chamber, it is recommended that vitrectomy should be done with microsurgical technique. A high incidence of retinal detachment was reported by Wong in cases requiring anterior vitrectomy[39]. Harward showed that neither vitreous manipulation nor a previous history of trauma had significant effect on change between pre and post operative vision[32].

We did not use specular microscope for counting endothelial cells preoperatively and postoperatively. Leatherbrow demonstrated a mean endothelial cell loss of 15.6%after secondary implantation[40]. It was recommended that intraocular lens implantation should be avoided in patients having endothelial count of less than 1000 cells per sq.mm[41].

Because of high complication rate of AC IOL[42] some surgeons advocate implanting scleral fixated PC IOLs and not using AC IOLs in the absence of posterior capsular support[25,43-46]. In their prospective comparative study however Melluci, Tayyab A, Hussain M[47,48] found a higher complication rate in scleral fixated lenses than in open loop AC IOLs. The surgical technique of scleral fixated lenses need elaborate skills and aggressive intraocular manipulation, not always mastered by average cataract surgeons. However flexible open loop AC IOL are easier and faster to implant in the anterior chamber and vitreous manipulation not always necessary[47].

When vitreous is lost during cataract surgery, sufficient vitreous cleaning is necessary to obtain more favourable results in secondary and specially in primary AC IOL implantation.

## CONCLUSION

In conclusion using an open loop flexible AC IOL for both primary and secondary implantation is a suitable way to treat aphakia. Although AC IOL either primary or secondary implantation caries some hazards but it is preferable to perform the procedure to restore patient binocular single vision .On the basis of our study secondary implantation of flexible open loop AC IOL seems to have more favourable outcomes and lower complication rates overall than primary implantation. Further studies including larger follow up may help us to draw this conclusion more clearly.

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