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Primary Peripheral posterior capsular opacification in foldable intraocular lenses
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Original article

Incidence of primary peripheral posterior capsular opacification after cataract surgery and posterior capsular opacification in the patients implanted with foldable intraocular lenses

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Abstract

Introduction: Preexisting posterior capsular opacification is commonly seen in the developing world due to late presentation of patients for cataract surgery. Patients are implanted with either hydrophilic or hydrophobic IOL. Effect of these IOLs on pre-existing posterior capsular opacification has not yet been reported. **Aim:** To determine the incidence of peripheral preexisting posterior capsular opacity (PPPCO) in patients undergoing cataract surgery and the rate of posterior capsular opacification (PCO) following implantation of hydrophilic and hydrophobic intraocular lens (IOLs). **Study design:** Prospective, observational case study Setting: Tertiary eye care center in central India. **Methodology:** 1400 consecutive patients undergoing phacoemulsification of senile cataract between July 2009 and June 2010 discovered to have PPPCO were included in the analysis. Patients were either implanted with hydrophilic (n= 40) or hydrophobic IOL (n=40). Images of the posterior capsule immediately and 3-years postoperatively were compared. Patients were followed up for development of PCO, visual outcome at 3 years and neodymium: YAG laser posterior capsulotomy (NYLPC) rate. Results: Eighty patients were found to have PPPCO (incidence of 5.7%). 47.5% of PPPCOs were from mature senile cataracts (n = 38), 36.2% were from posterior subcapsular cataracts (n = 29) and 16.2% were from posterior polar cataracts (n = 13). NYLPC was performed in 9 patients receiving hydrophilic (22.5%) and 3 patients receiving hydrophobic IOLs (7.5%; p = 0.12). Average time to NYLPC was 18 months in the hydrophilic and 30 months in the hydrophobic group (p = 0.002). Visual outcome was satisfactory at 3-years of follow-up. Conclusion: PPPCO is a frequent occurrence in mature cataract and there is a higher incidence of PCO in PPPCO patients implanted with hydrophilic IOL than with hydrophobic IOL. Therefore, hydrophobic IOL should be considered for patients discovered to have PPPCO during cataract removal.

Keywords: Posterior capsular opacification, primary peripheral posterior capsular opacification, phacoemulsification.

Introduction

Preexisting posterior capsular opacification (PPCO) is commonly seen in the developing world due to late presentation of patients for cataract surgery (Peng, 1998). The discovery during cataract surgery of PPCO occurs

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frequently with mature and hypermature cataracts (Vasavada, 1997; Asraf, 2010). These opacities are an intrinsic part of the cataract and cannot be completely removed by polishing or vacuuming of the posterior capsule. Vasavada et al. first described PPCO in adult eyes undergoing extracapsular cataract surgery and labeled it a posterior capsular plaque (Vasavada, 1997). Similar plaque-like opacities are also seen in posterior subcapsular cataract and posterior polar cataract. The location of these opacities on the posterior capsule can be central or peripheral. Small, peripheral PPCOs may not affect postoperative visual improvement, while PPCOs that are central and medium-to-large will. PPCOs are capable of proliferation in their early stages, aggravating visual disturbance (Biro, 2007). The surgeon may therefore have to decide on primary posterior capsulorhexis (PCCC) or early neodymium:YAG laser posterior capsulotomy (NYLPC) (Joshi, 2013).

While NYLPC is the treatment of choice for posterior capsular opacification (PCO), it can be associated with retinal complications (Sakimoto , 2008). Intraocular inflammation and rise of intraocular pressure have also been reported after NYLPC (Ronbeck, 2009). PCCC could be of great use in occurrence of thick, fibrotic PCO in the central visual axis that develops after removal of cataract (Blumenthal, 1990). However, posterior segment complications are higher if the posterior capsule is breached (Van Cauwenberg.,1997).

The influence of intraocular lens (IOL) design, size, material (hydrophilic or hydrophobic) and edge of the optic on the development PCO has been previously studied (Ram, 2008; Brar,2008). However, the influence of IOL material on peripheral PPCO (PPPCO) has not yet been studied.

The present study examines whether hydrophilic or hydrophobic IOLs affect long-term visual outcome in patients with PPPCO.

Methodology

This prospective, observational case study evaluated 1400 consecutive patients with senile cataract who had routine phacoemulsification with implantation of either hydrophilic or hydrophobic IOL. Operations were performed between July 2009 and June 2010 at a government medical college and hospital situated in central India. Preoperative examination the day prior to surgery included slit lamp biomicroscopy of the anterior segment, applanation tonometry, keratometry and A-scan ultrasonography for IOL power calculation. B-scan ultrasonography was done to assess the status of the vitreous and retina in cases where mature or hypermature cataract precluded posterior segment examination. Patients having complicated cataract, pseudoexfoliation, glaucoma, previous vitrectomy, non-dilating pupil, and subluxated, developmental or traumatic cataract were excluded from the study.

The hospital ethics committee approved the study. Written informed consent was obtained from all patients. A routine phacoemulsification surgery was performed be a single experienced surgeon as described by us (Joshi,2013). After nucleus removal, cortical clean up was performed using irrigation and aspiration cannula and the capsular bag was inflated with viscoelastic. The presence or absence of a persistent opacity on the posterior lens capsule was noted. Location of opacity on the posterior lens capsule was determined as described by Vasavada et al. (Vasavada, 1997). In brief, a 5mm diameter circle was superimposed on the posterior capsule. A vertical and a horizontal line intersecting the center of the posterior capsule were drawn dividing the posterior capsular area into four quadrants. PPCOs presenting in the central 5mm central area were considered a central opacity and

were excluded from the study (Fig. 1). The location of peripheral PPCOs was recorded as superotemporal, superonasal, inferotemporal and inferonasal.

Patients with peripheral PPCO were considered for the study (Fig. 2). Eyes that contained both peripheral and central PPCO were excluded from the study group (Fig. 3). A hydrophobic (Supra Phob, 6mm optic, 13mm overall length, square edge, Gantec Corporation, USA) (n=40) or hydrophilic IOL (n=40) (Galaxy Fold, 6mm optic, 13mm overall length, square edge, Ellis Ophthalmic Technologies Inc., Jamaica, New York, USA) was then implanted in the capsular bag. Right eye was implanted with hydrophobic and left eye with hydrophilic IOL. The viscoelastic material was replaced by balanced salt solution and stromal hydration of the paracentesis and main incision was performed. The integrity of the self-sealing clear corneal incision was insured.

Routine follow up was done on postoperative day 1. Further follow-up was done on day 7, 30 days, 6months and then yearly till 3 years. At every postoperative visit, patients' complaints, visual status, posterior capsular appearance after dilatation of pupil and need for NYLPC was noted. Images of the posterior capsule immediately and 3-years postoperatively were compared.

Statistical analysis

Statistical analysis was performed with SPSS software, 13.0 (IBM Corp., Chicago, USA). Unpaired t-test was used for the comparison of age and sex in the two IOL groups. Fisher's exact test was used for comparison of patients undergoing and not undergoing NYLPC in the two IOL groups. Mann–Whitney U test was used for comparison of time to NYLPC between the two IOL groups. A $p < 0.05$ was taken as statistically significant.

Results

Of the 1400 eyes enrolled over the 12-month period, 80 were found to have PPPCO (incidence 5.7%). The distribution of PPPCO location is shown in Table 1.

The mean age of patients in the hydrophilic IOL group (n = 40) was 65.8 years (SD: 9.9 years) and in the hydrophobic IOL group (n = 40) was 69.0 years (SD: 9.7 years). The difference in the mean age between the two groups was not statistically significant (p = 0.15). The hydrophilic IOL group included a total of 17 males and 23 females while hydrophobic IOL included 18 males and 22 females (p = 1).

Eyes with mature senile cataract (n = 38, 47.5%) had the highest incidence of PPPCO, followed by posterior subcapsular (n = 29, 36.2%) and posterior polar cataract (n = 13, 16.2%). The distribution of PPPCO in different types of cataract is show in Table 2.

NYLPC was performed in 9 patients in the hydrophilic IOL group (22.5%) and 3 patients in the hydrophobic IOL group (7.5%; p = 0.12). Average time to NYLPC was 18 months (range16–20 months) in the hydrophilic IOL group and 30 months (range 28–32 months) in the hydrophobic IOL group postoperatively (p = 0.002). No complications were seen following NYLPC in either group. At 3-years follow up, visual acuity was 0.3–0.8 LogMAR in the 12 patients receiving NYLPC, compared to 0–0.2 LogMAR in the 68 patients not receiving NYLPC. Visual acuity of all patients (n = 80) at 3 years follow up was 0–0.2 LogMAR.

No extension of PPPCO to the central area of the posterior capsule was seen in any patient. All patients developed PCO independent of PPPCO. Four patients in the hydrophilic IOL group developed fibrotic PCO (Figs. 4 and 5). Patients with hydrophobic group had thin PCO.

Table 1 Distribution of primary peripheral posterior capsular opacity in different areas of posterior capsule

Areas of posterior capsule	Hydrophilic Group	Hydrophobic Group	Total
Superotemporal	10	10	20
Superonasal	11	10	21
Inferonasal	09	09	18
Inferotemporal	10	11	21
Total	40	40	80

Table 2 Distribution of primary peripheral posterior capsular opacity in different types of cataract

Type of cataract	Hydrophilic Group	Hydrophobic Group	Total (%)
Mature senile cataract	21	17	38 (47.5%%)
Posterior polar cataract	06	07	13 (16.25%)
Posterior subcapsular cataract	13	16	29 (36.25%)
Total	40	40	80

Legends for figures

Fig.1- Quadrant wise distribution of posterior capsular area.

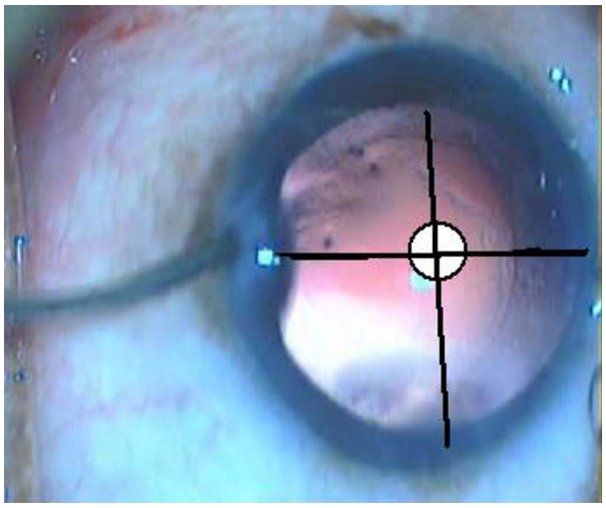


Fig.2- Primary peripheral posterior capsular opacity (arrow)

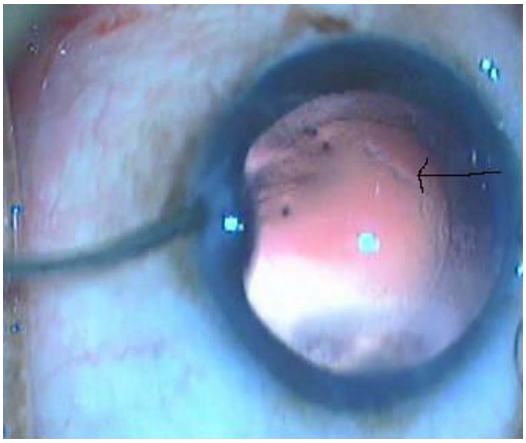


Fig.3- Presences of both peripheral and central opacity on the posterior lens capsule.

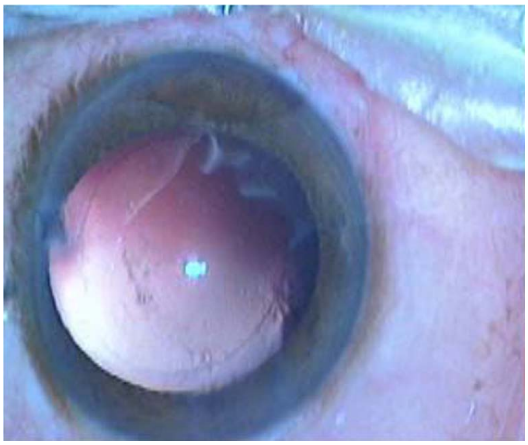


Fig.4- Fibrotic posterior capsular opacification.

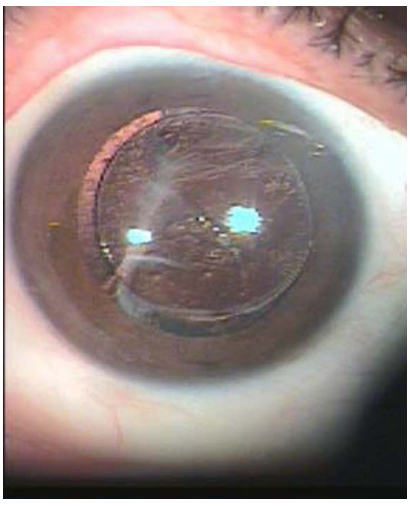
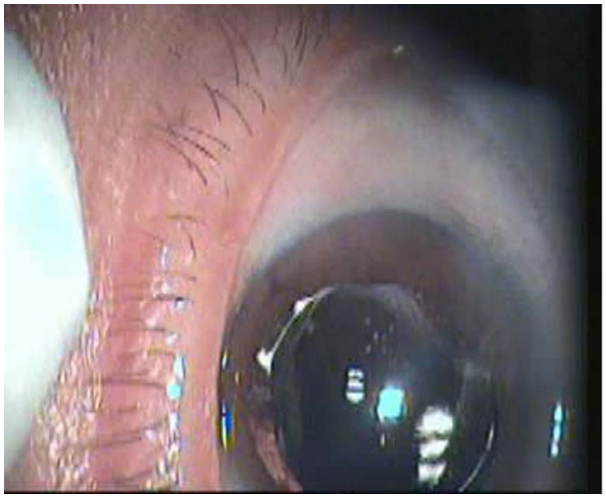


Fig.5- Fibrotic posterior capsular

opacification.



Discussion

The present study revealed an overall PPPCO incidence of 5.71%, with the highest occurrence in mature cataracts (47.5%). Vasavada et al. showed an incidence of 61.54% PPPCO and highest in the mature cataract (27.27%) (Vasavada, 1997). A study on Indian rural patients presenting with hypermature cataracts found a PPPCO incidence of 76.3% during cataract surgery (Joshi, 2013). In a study on hypermature senile cataracts, Ashraf reported a PPPCO incidence of 67.3%. Ashraf also found that the inferotemporal quadrant of the posterior capsule was involved in 51% of eyes (Asraf, 2010). The low incidence of PPPCO in our study could be due to our inclusion of all types of cataracts and inclusion of both urban and rural patients. The present study did not show predilection for any particular quadrant of posterior capsule involvement. Superonasal and inferotemporal quadrant of posterior capsule was equally involved(n=21). Inferonasal quadrant was involved in 18 eyes and superotemporal quadrant was involved in 20 eyes.

Patients with PCO affecting the central posterior capsular area (n = 12) had drop in visual acuity (0.3–0.8 LogMAR). However, visual outcome (0–0.2 LogMAR) was satisfactory in all patients at 3-year follow up including patients who underwent NYLPC.

All patients developed PCO involving the entire posterior capsule and independent of the PPPCO. In the hydrophobic IOL group, 3 patients required NYLPC. Fibrotic PCO was seen in 4 patients on the peripheral part of the posterior capsule in the hydrophilic IOL group. Fibrotic band prevention effect of migration of LECs from the equatorial area, as reported by Vasavada (Vasavada 1997), was not seen in our patients with hydrophilic IOLs. Proliferation of LECs in these patients occurred beyond the fibrotic band and approaching the central posterior capsular area. Early PCO was observed in patients implanted with hydrophilic IOLs. Patients implanted with hydrophobic IOLs had thin PCO. An adhesive effect of the hydrophobic IOL sealing against the posterior capsule has been suggested as a mechanism reducing PCO (Linnola 1997; Linnola, 2000).

On histological examination of PPCO, Biro et al. showed the presence of cuboidal cells with nuclei capable of proliferation leading to thickened posterior capsular area (Biro,2007). But the present clinical study did not observe a progression of PPPCO. The area on the posterior capsule having PPPCO became thick and fibrotic likely due to proliferation of LECs.

NYLPC was required in 9 patients (22.5%) in the hydrophilic IOL group and 3 patients (7.5%) in the hydrophobic IOL group (p = 0.12). Apple has shown that IOL material affects development of PCO and that implantation of hydrophobic IOL is associated with reduced incidence of PCO (Apple,2000).The time to NYLPC in the hydrophilic IOL group was 16–20 months, versus 28–32 months in the hydrophobic IOL group (p = 0.002). Early appearance of PCO in the hydrophilic IOL group was associated with early NYLPC. A study done by Joshi et. al on PPCO in hypermature cataracts in patients from a rural Indian population showed a NYLPC rate

of 14.5% (11/76 eyes) at 1 year, 6 (7.9%) of whom required NYLPC at 6-month follow up (Joshi,2013). However, in that study cataract surgery was performed by small incision method with polymethyl methacrylate lens implanted, both of which could have affected the rate of PCO formation (Joshi, 2013).

Conclusion

The incidence of PPPCO in this study was 5.71%. No progression of PPPCO into the central visual axis was seen. Thick, fibrous opacity was seen on PPPCO in patients implanted with hydrophilic IOL. No barrier effect of peripheral fibrous opacity on proliferation of LEC was seen in any group. Development of PCO was independent of the PPPCO. Patients implanted with hydrophilic IOLs had a higher chance of developing PCO. Therefore, hydrophobic IOL should be considered for patients discovered to have PPPCO during cataract removal.

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