

Review Article

Outcome and safety of secondary pars plana capsulotomy in patients with posterior capsular opacity following extracapsular cataract extraction

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ABSTRACT

Objectives: Posterior capsular opacity is a major delayed complication seen in patients following cataract extraction. Neodymium-doped Yttrium Aluminium Garnet laser capsulotomy is the standard procedure for capsulotomy; however, its high cost and unavailability in the developing countries makes it important for us to find an alternative, effective and safe method that will help reduce the burden of severe visual impairment and blindness in individuals who have had cataract extraction. The aim of the study was to showcase the effectiveness, outcome and safety of pars plana capsulotomy in reducing the burden of visual impairment and blindness occurring after cataract extraction due to posterior capsular opacity amongst patients.

Materials and Methods: This is a hospital-based retrospective study, where the clinic, ward and theatre registers of patients who had secondary pars plana capsulotomy in the past 3 years (2019–2022) due to posterior capsular opacity were reviewed. Patient's folders who had pars plana capsulotomy with incomplete records were excluded as well as patients who had diabetes, glaucoma, corneal opacity and age-related macular degenerations. The frequency, age distribution, duration from cataract extraction to presentation with posterior capsule opacification (PCO), the grading and morphology of PCO were all noted. The pre- and post-operative visual acuity (VA) was also recorded alongside the pre- and post-operative intraocular pressure (IOP). We also documented intra- and post-operative complications that were seen in these patients. Data were analysed using SPSS package version 23 (SPSS Inc. Illinois, Chicago), and values were expressed as simple frequencies and proportions. Paired *t*-test was used to test the statistical significance with $P < 0.05$.

Results: A total of 36 patients records were reviewed; capsulotomy was performed in all age groups with the majority done in individuals 60–69 years – 11 eyes (26.8%). A total of 41 eyes of 36 patients had undergone secondary pars plana capsulotomy. Five (13.9%) patients had bilateral pars plana capsulotomy on different occasions. The mean age was 45.3 ± 26.9 years. There were 22 (53.7%) females and 19 (46.3%) males. Female-to-male ratio was 1.2:1. About 75.6% presented between 1 and 5 years after cataract surgery; mean duration for presentation with posterior capsular opacity after cataract extraction was $2.0 \text{ years} \pm 1.6 \text{ months}$. The majority 31 (75.6%) had their pars plana capsulotomy done under topical anaesthesia. VA at presentation was found to be below 3/60 in 17 (41.5%) eyes. After pars plana capsulotomy, VA improvement was seen – 6/6–6/12 in 23 (56.1%) eyes. Grade of PCO revealed that 15 (36.6%) eyes had Grade 2 PCO and the Elschnig pearls were the most common morphological form seen in 30 (73.2%) eyes. Most eyes had normal IOP post-operatively 38 (92.7%); there was a transient increase in IOP in 3 (7.3%) eyes. There were no complications recorded in most eyes 27 (66%). The most common of the few complications seen was subconjunctival haemorrhages in 6 (14.6%) eyes which resolved within a week of follow-up.

Conclusion: Pars plana capsulotomy is a safe, easy and effective alternative for posterior capsulotomy and will be useful in resource-poor settings.

Keywords: Outcome, Safety, Secondary pars plana, Capsulotomy, Posterior capsular opacity

INTRODUCTION

Cataract is a leading cause of global blindness.^[1] It is also the leading cause of blindness in Nigeria (43%).^[2] At the moment, the only means of treating cataract is by surgical intervention.^[3] After cataract surgery with posterior intraocular lens (IOL) implantation, nearly half of the people

surfer from visual impairment due to posterior capsular opacification.^[4] Posterior capsule opacification (PCO) is the most common complication of cataract surgery.^[5-7] PCO is the major cause of significant visual deterioration following cataract surgery; it is often referred to as secondary cataract or after cataract.^[5] The posterior capsule tends to undergo

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secondary opacification due to migration, proliferation and differentiation of lens epithelial cells.^[7] Posterior capsular opacity occurs in 20–50% of patients within 2–5 years following cataract extraction, children and infants have a significantly higher incidence and earlier onset with an increasing risk of developing amblyopia.^[8,9] Other risk factors for the development of PCO include the presence of diabetes mellitus, uveitis, myotonic dystrophy, retinitis pigmentosa and traumatic cataract. PCO has two forms or growth patterns, the fibrous and pearl (also referred to as proliferative). The fibrous form is a product of lens epithelial cells proliferation and tends to present as wrinkles and folds on the posterior capsule.^[10] The pearl is composed of normally differentiated lens epithelial cells that line the equatorial region, manifesting as clusters of swollen, opacified and differentiated lens epithelial cells called bladder or wedl cells; this form of PCO is responsible for the majority of the PCO-related visual loss.^[11] The diagnosis of PCO is clinical, based on the history and slit-lamp examination of the eye.^[5] Most patients present months or years following an uneventful cataract extraction.^[6] Mostly, patients with PCO complain of decreased vision, blurry vision, glare, light sensitivity, impaired contrast sensitivity, halos around light or difficulty reading.^[5] PCO has been graded by Aslam and Patton, as:

Grade 0: None visible at all.

Grade 1: Visible but none reaching to IOL edge.

Grade 2: At IOL edge.

Grade 3: Well Inside IOL edge but visual axis is clear.

Grade 4: Across visual axis.^[12]

The solution for this problem is common with the use of neodymium-doped yttrium aluminium garnet (Nd:YAG) laser capsulotomy which is non-invasive, quick and effective; however, it is not devoid of significant complications, expensive and may not be available in remote areas and large parts of developing countries.^[4,11,12] Complications may include retinal detachment, IOL damage, IOL subluxation, cystoid macular oedema, increased intraocular pressure (IOP), iris haemorrhage, cornea oedema, iritis, macular hole, corneal endothelial cell loss and exacerbation of localised endophthalmitis.^[8] Considering the above limitation of the laser, the complications of the laser capsulotomy and the recent increase in comfort to access the pars plana by the anterior segment surgeons to administer antivascular endothelial growth factors, secondary par plana capsulotomy can be a good alternative to laser capsulotomy.^[13] Surgical pars plana capsulotomy may be considered a safe, efficient and appropriate technique in experienced hands for use in developing countries and areas where lasers are not available to meet the need of the patient.^[4]

In settings with no Nd:YAG laser for capsulotomy, there is a need to provide patients with PCO, a safe and effective alternative in restoring their vision. This study was aimed at

assessing the safety and effectiveness of pars plana posterior surgical capsulotomy in pseudophakic patients using only a 29 Gauge needle through the pars plana. Opacified posterior capsule is under tension that is why a small puncture results in a large central opening. To the best of the author's knowledge, data on the safety and effectiveness of pars plana capsulotomy do not exist in the country Nigeria, also only scanty data could be found globally.

MATERIALS AND METHODS

Approval to carry out the study was obtained from the ethical review committee of the hospital. This was a retrospective hospital-based study where the clinic, ward and theatre registers of patients who had undergone pars plana capsulotomy on account of PCO in the past 3 years (November 2019–November 2022) were reviewed.

Patient's folders who had secondary pars plana capsulotomy of all ages and sexes were included in the study, while folders with incomplete information, those of patients with glaucoma, age-related macular degeneration and corneal opacity were excluded from the study. Demographic data were recorded; duration since after cataract surgery, type of surgery, and IOL implanted were noted. Examination findings recorded included: the grade/degree of PCO, pre- and post-operative visual acuity (VA), post-operative IOP and posterior segment findings. Data were analysed using SPSS package version 23 (SPSS Inc. Illinois, and Chicago). Values were expressed as simple frequencies distribution tables, mean and standard deviation were used for continuous variables. Categorical variables were presented as proportions and percentages. Paired *t*-test was used to test the statistical significance of the mean and standard deviation with $P < 0.05$. The patients were then followed up for a period of 6 weeks evaluating for the VA, IOP and possible complications.

Procedure for pars plana capsulotomy

This procedure was performed by the general ophthalmologist who is the principal author. For children under 18 years who could not cooperate under topical anaesthesia, it was done under general anaesthesia after taking consent from the parents; however, the majority of the patients were adults who had it done under topical anaesthesia (amethocaine 0.5%). Topical anaesthesia was applied to the eye and 10% povidone was used to clean the lids, while a 5% povidone-iodine was used to clean the conjunctiva and rinsed after 5 min with normal saline. Eyelid speculum was inserted and with the use of a caliper to measure 3.0 mm from either the nasal or temporal limbus for ease of access into the globe. With counter fixation on the opposite side using a colibri fixation forceps, a 29 G 1.2" sterile needle was bent at about 45° with the bevel tip upwards from the base of the needle, the needle was then passed perpendicularly into

the globe. Optimum care was taken to have single entry to avoid softening the globe, the needle was then advanced forward until it touches the optical edge and the posterior capsule while viewing through the operating microscope. The tip of the needle is then allowed to engage the posterior capsule and cutting through the posterior capsule with and upwards and downwards movement using the scleral entry point as the support for the movement. This opening is the enlarged vertically and horizontally in a cruciate manner. Upon removal of the needle, a cotton bud is used to apply pressure at the site to prevent vitreous leaking out for about a minute or two and antibiotics and 5% povidone-iodine are instilled into the eye. Eyes were padded for 2 hours(h) to avoid photophobia from the dilating drops and also damage from undue rubbing of the eye (due to surface anaesthesia). Patients were advised to remove the patch themselves and were given topical broad-spectrum antibiotic moxifloxacin and dexamethasone steroid combination eye drop to commence the same day after removal of the eye patch. Patients were followed up the next day, 1 week and 6 weeks after to record the IOP and best-corrected VA as well as check for possible early and delayed complications.^[4]

RESULTS

A total of 41 eyes of 36 patients underwent surgical posterior capsulotomy. Five (13.9%) patients were operated on both eyes, whereas 16 (44.4%) on the right eye and 15 (41.7%) on the left eye. The mean age was 45.3 ± 26.9 years.

There were 22 (53.7%) females and 19 (46.3%) males. Female-to-male ratio was 1.2:1. There was no statistical difference between age and sex of participants ($\chi^2 [f] = 3.958$, $P = 0.775$), $t = 1.662$, $P = 0.104$ [Table 1].

Duration from cataract surgery to the capsulotomy revealed that the majority (75.6%) presented between 1 and 5 years after cataract surgery, whereas 24.4% presented within a year following their cataract extraction. The mean duration for presentation was 2.0 years ± 1.6 months.

About 10 (24.4%) were operated under general anaesthesia, whereas 31 (75.6%) had their pars plana capsulotomy done under topical anaesthesia.

VA assessment

VA at presentation was found to be below 3/60 in 17 (41.5%) eyes. After surgical capsulotomy, VA improved to 6/6–6/12 in 23 (56.1%) eyes seen in [Figure 1].

Grade of PCO

Grade of PCO revealed that 15 (36.6%) eyes had Grade 2 PCO, 14 eyes (34.1%) had Grade 3 PCO and 12 (29.3%) had Grade 4 PCO.

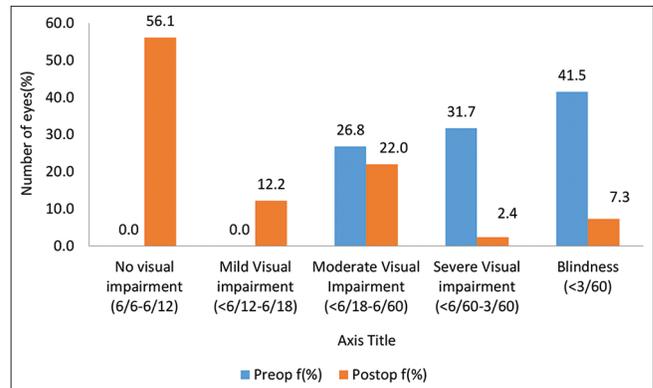


Figure 1: Pre- and post-operative World Health Organization categories of visual acuity ($n = 41$ eyes).

Morphological types of PCO

Elschnig pearls were the most common morphological form seen in 30 (73.2%) eyes [Figure 2].

IOP

Pre-operative IOP was within normal range (10–21 mmHg) for all eyes. Mean IOP was 14.9 ± 4.1 mmHg. Post-operatively, majority 38 (92.7%) eyes had normal IOP, whereas 3 (7.3%) had IOP >21 mmHg.

Post-operative complications

The majority of the eyes 27 (66%) had no complications, subconjunctival haemorrhage was the most common immediate post-operative complication seen 6 (14.6%) eyes. However, all these complications were resolved within a week of follow-up. Details are as shown in [Table 2].

DISCUSSION

Developing countries have an enormous burden of cataract and a high volume of cataract surgery.^[13] A large number of surgeries are performed within the hospitals and in eye camps, with this high volume and numbers to operate at time, there's a high tendency to leave some cortical matters behind which can favour the development of PCO.^[14] Within the period of this study, the majority of the patients who had PCO were elderly signifying cataract to be mostly senile in our population, this collaborates with findings from Wahab *et al.*^[4] who also noted PCO to be common in individual in their 5th and 6th decades of life. The majority of the patients developed PCO within 1–5 years following their cataract extraction and presented for the pars plana capsulotomy; similar finding was reported from another study.^[4] PCO is the most common long-term complication of cataract extraction;^[13] this was also said to occur within the first 5 years following cataract extraction in 25% of cases.^[8,9,13] Nd:YAG laser capsulotomy is not

Table 1: Age–sex distribution of participants.

Age of participants (years)	Sex		Total
	Female	Male	
<10	2 (9.1)	5 (26.3)	7 (17.1)
10–19	3 (13.6)	3 (15.8)	6 (14.6)
40–49	1 (4.5)	1 (5.3)	2 (4.9)
50–59	4 (18.2)	3 (15.8)	7 (17.1)
60–69	6 (27.3)	5 (26.3)	11 (26.8)
70–79	4 (18.2)	2 (10.5)	6 (14.6)
80–89	2 (9.1)	0 (0.0)	2 (4.9)
Total	22 (100.0)	19 (100.0)	41 (100.0)
Mean±SD	51.6±24.9	37.9±28.1	45.3±26.9

χ^2 (f)=3.958, P=0.775; t=1.662, P=0.104. SD: Standard deviation

Table 2: Post-operative complications.

Post-operative complication	Frequency	percentage
Nil	27	66.0
Pin-point haemorrhage	5	12.1
Subconjunctival haemorrhage	6	14.6
Pseudophakic cystoid macular oedema	2	4.9
Vitreous haemorrhage	1	2.4
Total	41	100.0

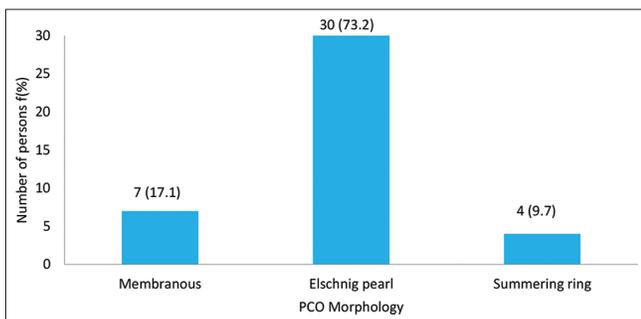


Figure 2: Morphological type of posterior capsule opacification. n = 41 eyes

available in most developing countries and also in our centre to address the problem of visual impairment and blindness from secondary posterior capsular opacity;^[4,14] we no longer have to refer our patients for long distances to access YAG. Apart from the issue of distance, such patients might require booking an appointment before having the procedure and might have to pay for hotel accommodation while away from home. An alternative method had to be adopted to overcome this problem which is time and money saving and easy to perform under aseptic condition. Majority of the patients had their pars plana capsulotomy done under local anaesthesia not needing admission (Topical application of amethociane 0.5%). This was possible because they were cooperative, as they were mostly adults and could tolerate the accompanied minimal pains. Those who had their capsulotomy under general

anaesthesia were mostly children who would not cooperate with the procedure. Again with the lack of YAG laser in our centre, they have to be subjected to general anaesthesia.

About a quarter of the patients seen had a significant opacification involving the visual axis, hence more than half of the patients seen presented with severe visual impairment and blindness. The most common morphology seen was the Elschnig pearls. This is similar to findings by Wahab *et al.*^[4] who also noted a high frequency of higher grades of PCO in their patients at presentation. This could be as a result of the delayed onset of PCO and gradual progression of the opacity to involve the visual centre, and also the time at which the patients are presenting. There was a significant improvement in vision after the procedure with decline in symptoms. There was a significant improvement in VA following the pars plana capsulotomy; this was seen in more than two-thirds of the patients, only about four patients still had severe visual impairment/blindness even after the procedure. This level of improvement in vision shows the effectiveness of this procedure in a patient with PCO.

This procedure was a safe, closed chamber technique without retrobulbar anaesthesia and no viscoelastic was used. This was similar to the procedure carried out by Wahab *et al.*^[4] Almost all the patients had normal IOPs post-operatively, only three patients had elevated IOPs above 21 mmHg that resolved within 1 week post-operative period with observation. The pressure rise noticed in these three patients might be as a result of a mild inflammatory process that might have occurred. This collaborates with the study done by Ari *et al.*,^[15] who also did not notice any persistent rise in IOP after YAG laser; however, Shetty and Sridhar reported elevation in IOPs as the most common complication of YAG laser capsulotomy. Although not all rises in IOPs needed the use of topical antiglaucoma medications, for those that had more than 30 shots of the lasers had persistent elevation in IOP that needed topical pressure-lowering medications.^[16] Some factors have been postulated to be the possible cause of elevated IOP following Nd:YAG laser including larger size capsulotomy, effect on the ciliary body caused by the laser shock waves, neurohumoral increase in the IOP, structural damage by the effect of the laser energy on sodium hyaluronate of the vitreous and blockage of the trabeculum with various debris such as fragments from the disrupted posterior capsule or vitreous.^[17]

The majority of the patients from this study had no complication associated with the procedure. Few of the complications which were most common were subconjunctival haemorrhages around the site of entry that were seen in six patients, and mild vitreous haemorrhage was seen in only one patient. This is most likely because there was no excessive manipulation during the procedure. There was no retinal detachment or displacement/splitting of IOL. This

collaborates with reports from Wahab *et al.* who also reported a few complications that were mild to subconjunctival haemorrhage, pinhead hematoma at entry site and vitreous haemorrhage amongst others.^[4] However, complications such as retinal tear, retinal detachment, splitting of lens and macular oedema amongst others have been reported from the use of Nd:YAG laser capsulotomy, this is so because of the high energy used to disrupt the posterior capsule.^[4,18]

CONCLUSION

Pars plana capsulotomy is a safe, straightforward forward and effective alternative to posterior capsulotomy; it is a procedure that will be of benefit to patients with posterior capsular opacity. Visual improvement in patients with posterior capsular opacity was significant; this procedure can be carried out either under topical anaesthesia or general anaesthesia and will be a useful alternative in resource-poor settings.

Limitation

We do not have enough number of patients to make a conclusive statement about our findings; however, this will create room for further research into this cost-effective and efficient technique for secondary pars plana capsulotomy.

Declaration of patient consent

Institutional Review Board (IRB) permission obtained for the study.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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