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ORIGINAL ARTICLE

Prevalence of Posterior Capsular Rent in Mature Cataract During Manual Small Incision Cataract Surgery

Devi Sindhuja S[1] and Usha B.R.[2,*]

[1]*Junior Resident, Department of Ophthalmology, Sri Devaraj Urs Medical College, Tamaka, Kolar, India*
[2]*Professor, Department of Ophthalmology, Sri Devaraj Urs Medical College, Tamaka, Kolar, India*

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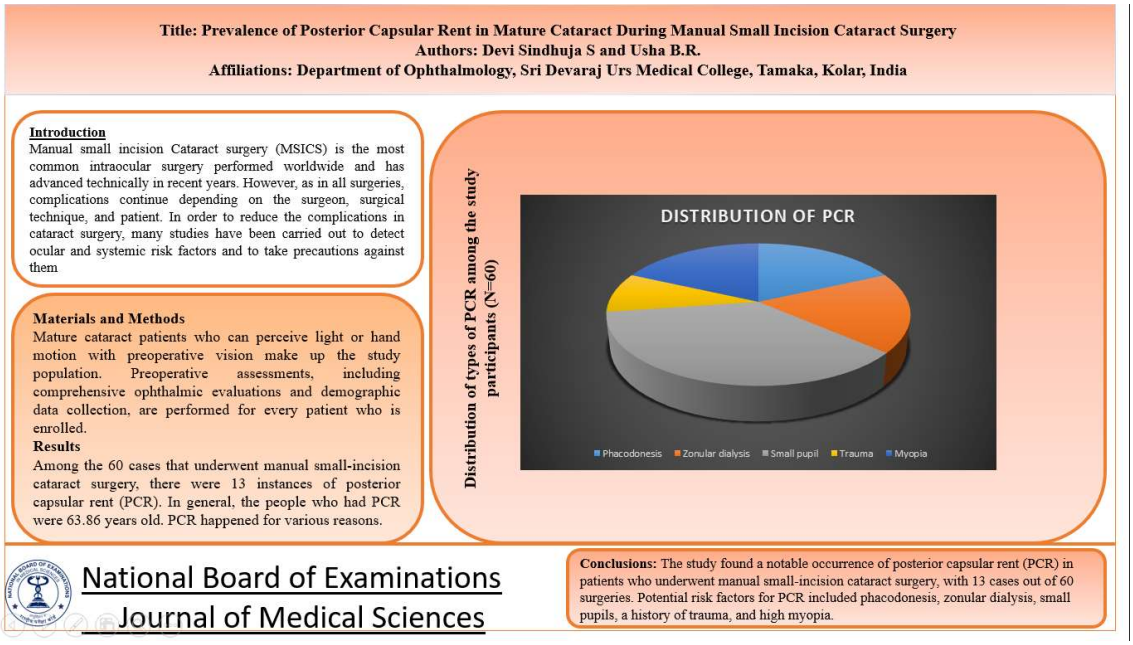
Abstract

Introduction: Manual small incision Cataract surgery (MSICS) is the most common intraocular surgery performed worldwide and has advanced technically in recent years. However, as in all surgeries, complications continue depending on the surgeon, surgical technique, and patient. In order to reduce the complications in cataract surgery, many studies have been carried out to detect ocular and systemic risk factors and to take precautions against them. **Materials and Methods:** Mature cataract patients who can perceive light or hand motion with preoperative vision make up the study population. Preoperative assessments, including comprehensive ophthalmic evaluations and demographic data collection, are performed for every patient who is enrolled. **Results:** Among the 60 cases that underwent manual small-incision cataract surgery, there were 13 instances of posterior capsular rent (PCR). In general, the people who had PCR were 63.86 years old. PCR happened for various reasons. **Conclusion:** The study found a notable occurrence of posterior capsular rent (PCR) in patients who underwent manual small-incision cataract surgery, with 13 cases out of 60 surgeries. Potential risk factors for PCR included phacodonesis, zonular dialysis, small pupils, a history of trauma, and high myopia. These findings demonstrate the significance of understanding and managing the risk factors for posterior capsular rent (PCR) in manual small incision cataract surgery to enhance patient safety and surgical outcomes.

Keywords: Manual small incision cataract surgery, Posterior capsular rupture, Mature cataract, Phacodonesis, Small pupil

*Corresponding Author: Usha B.R.
Email: drushamahesh@gmail.com

Graphical Abstract



Introduction

Manual small incision cataract surgery (MSICS) is one of the most frequently performed surgical procedures globally, significantly improving the quality of life for millions of patients each year. MSICS offers the benefit of a wound that seals itself without the need for sutures Given limited resources, MSICS has several advantages over phacoemulsification, including shorter surgery times, less reliance on high-tech equipment, and lower overall costs. A mature cataract, characterized by a completely opaque lens, poses additional challenges during surgery. The increased lens density and compromised zonular support in mature cataracts can make intraoperative management more difficult, raising the risk of posterior capsule rent (PCR) [1-3].

This complexity can result in a series of negative events, such as the loss of vitreous, the dropping of nuclei, and impaired visual outcomes, which in turn require additional surgical procedures and longer recovery periods. Surgery becomes more challenging when dealing with a mature cataract, which is identified by a lens that is completely opaque. A mature cataract can make intraoperative management harder because the lens is denser and the zonular support is weaker which can increase the risk of PCR. In addition, the risk of PCR increases in mature cataract surgery compared to normal cataract surgeries due to the absence of retroillumination, the fragile capsule, the obstruction of vision by liquefied cortical material, and the weak zonules [4] .With so many cases of PCR in older cataract patients, it is clear that careful planning and technique are needed during surgery to lower these risks [5].

Understanding the prevalence of PCR and identifying the risk factors

associated with it during mature Cataract surgery are crucial. As an example, it can help surgeons figure out which cases are high-risk and how to best treat them by changing their protocols and preoperative assessments Secondly, recognising the predictors of PCR can lead to the development of targeted interventions and training programmes aimed at reducing the incidence of this complication Lastly, having a thorough understanding of the prevalence of PCR can help healthcare professionals and patients set realistic goals, make better decisions, and provide better overall patient care. Our research aims to find out how common PCR occurs in mature cataracts during cataract surgery.

Material and Methods

This study employs a cross-sectional design to assess the occurrence rate of PCR during manual small incision cataract surgery (MSICS) in patients with fully mature cataracts. The institutional review board has granted ethical approval for the study. The purpose, methods, risks, and benefits of the study are explained to all participants before they provide their written consent.

The sample size is calculated based on the prevalence of PCR in mature cataracts, estimated at 10%. Using the formula for sample size calculation ($Z2aP(1-P)/L2Z^2$ α P (1-P)/ L2Z2aP(1-P)/L2), where ZZZ is the Z-value (1.96 for a 95% confidence level), a alpha is the significance level, PPP is the estimated prevalence, and LLL is the margin of error (5%). the sample size is determined to be 60 patients. The study is carried out for a duration of six months, providing ample time to enlist the necessary number of participants and gather extensive data on their surgical outcomes. The eligibility criteria for this study consist of adult patients who have mature cataracts and those who have preoperative vision at the level of hand motion or light perception.

The exclusion criteria encompass patients with immature cataracts and individuals with other notable ocular conditions such as glaucoma, diabetic retinopathy, or macular degeneration, as these factors could potentially complicate the study results. Once written informed consent is obtained from patients who meet the inclusion criteria, they are enrolled in the study.

Comprehensive preoperative assessments are conducted for all enrolled patients, including collecting demographic data and performing detailed ophthalmic evaluations. In the slit-lamp examination, pterygium, corneal scarring in the 6-mm central cornea, cornea guttata, leukoma adherence, posterior synechiae, presence of small pupil (pupil diameter ≤6 mm despite maximal pharmacologic dilation), presence of phacodonesis, degenerative disease of the vitreous (asteroid hyalosis, synchysis scintillans), and diabetic retinopathy in any eye were noted. Also, the risk factors were evaluated, including manifest sunken globe, strabismus (exotropia or esotropia >10 prism diopters misalignment), and history of trauma, glaucoma, and vitrectomy. Risk factors were determined according to whether PCR developed during the surgery or not.

Axial length (AL) of eyes assessed by using a 11-MHz probe of A-scan ultrasonography with applanation after instillation of proparacaine hydrochloride 0.5%. The mean values of these measurements will be retrieved from the patients medical records. All cases will be operated by same surgeon using manual small incision cataract surgery by making

superior 6mm sclerocorneal tunnel. Topical tropicamide 0.8% drops will be stilled preoperatively for pupil dilatation. There was either peribulbar or subtenon anaesthesia used in all of the surgeries. Patients undergo follow-up visits post-surgery to assess their final outcomes and address any potential post-operative complications. These follow-up visits are essential for assessing the short-term and long term success of the surgeries and managing any issues that arise postoperatively.

Results

Among the 60 cases that underwent manual small incision cataract surgery, there were 13 instances of PCR. The mean age of the patients who experienced PCR was 63.86 years. In general, the people who had PCR were 63.86 years old. PCR happened for various reasons. More precisely, PCR with phacodonesis was observed in two cases (15.38%), as did PCR with zonular dialysis in two cases (15.38%), and PCR with a tiny pupil was the most common, occurrence in six cases (46.15%). Furthermore, PCR with a history of trauma was found in one case (7.69%), while PCR wih extreme myopia was noted in 2 cases (15.38%) (Figure 1). Iris retractors were used in 6 cases (10%), capsular tension rings were used in 7 cases (11.6%). Two patients (15.3%) out of 13 PCR cases had sulcus IOL implantation, two (15.38%) underwent optic capture of IOL and one patient (7%) received iris claw IOL implantation.

These results highlight the diverse presentations and significant prevalence of PCR in mature cataract surgeries, emphasizing the need for careful intraoperative management and tailored surgical techniques to mitigate these risks. The age groups 45-75 years each accounted for 62% of the cases, showing a significant prevalence of PCR among middle-aged and early senior patients. About 51% of the patients had Type 2 Diabetes Mellitus (T2DM), while 49% had hypertension. This near-equal distribution suggests that both hypertension and T2DM are common comorbidities in patients undergoing cataract surgery and experiencing PCR.

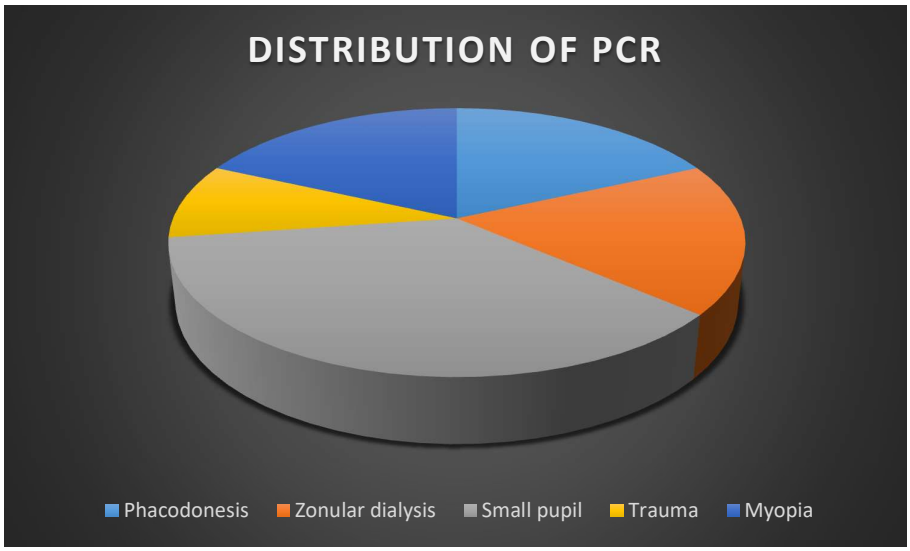


Figure 1. Distribution of types of PCR among the study participants (N=60)

Visual Outcome in Patients with and without PCR

Post operative day 1 vision in patients who underwent SICS without incidence of PCR was found to be good with 90% achieving >6/12 (Figure 2). Whereas in patients with PCR, Postoperative day 1 vision was low , with only 40% achieving >6/18 vision, and 54% of the individuals needed more than one topical drug and were started on oral steroids (Figures 3 and 4). During followup visits, vision improved to >6/12 in 90% of the patients with PCR.

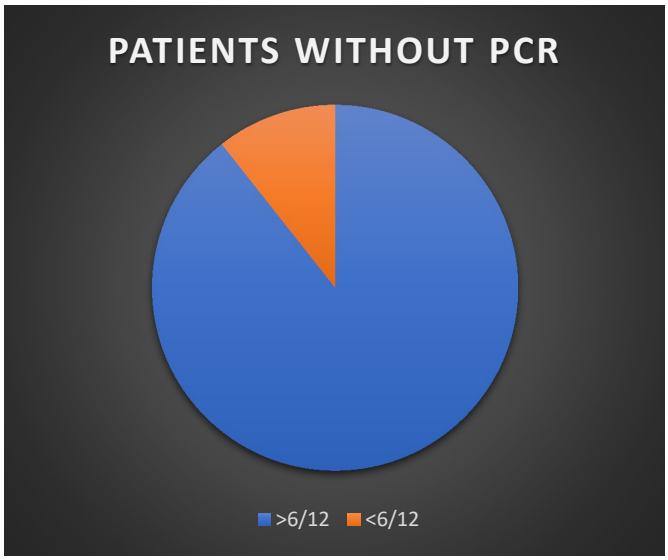


Figure 2. Visual Outcome in Patients without PCR

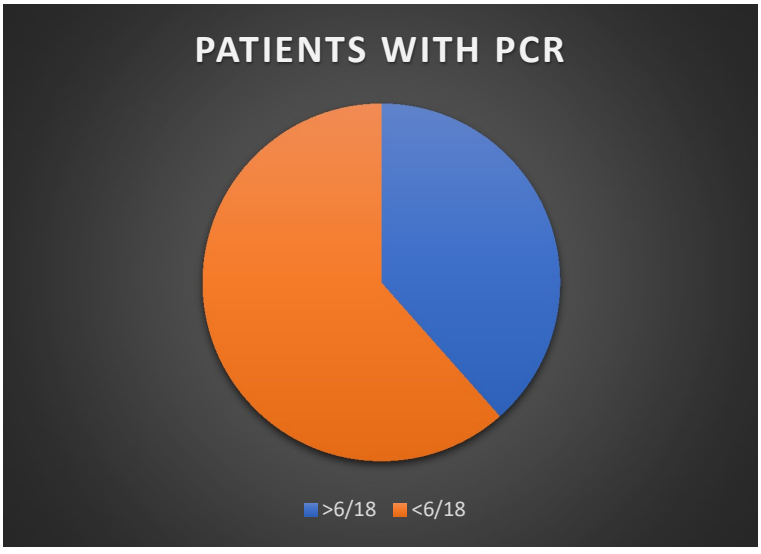


Figure 3. Visual outcome in patients with PCR

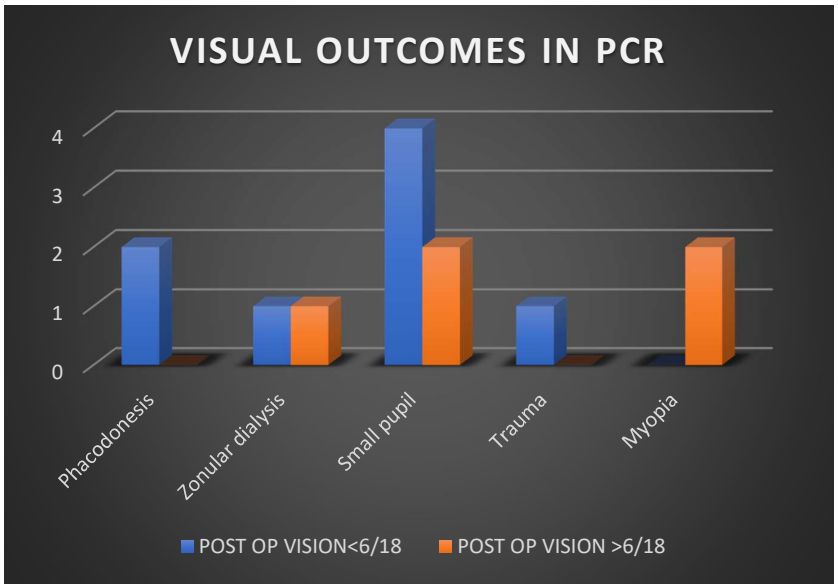


Figure 4. Visual outcome according to different causes of PCR

Discussion

The study found prevalence of posterior capsular rent (PCR) in patients undergo monial small in cataract surgery, with 13 cases observed out of a total of 60 surgeries This highlights the importance of understanding and managing this complication during cataract surgery. The mean age of patients experiencing PCR was 63.8 years. The finding suggests that age may be a factor influencing the risk of PCR, although further analysis would be needed to determine any significant correlation. The observed prevalence of PCR in this study is significant, as it underscores the inherent risks associated with cataract surgery particularly in patients with advanced cataracts. The fact that the mean age of patients with PCR was 63.8 years aligns with the typical age demographic for cataract surgery but also indicates that older patients may be at higher risk [7]. .Age-related changes in the lens and zonules, as well as comorbid conditions, might contribute to the increased susceptibility to PCR in this age group, PCR was observed in 2cases (15.38%) with phacodonesis, indicating a potential association between lens instability and PCR, Phacodonesis, which involves the trembling of wobbling of the lens, is a sign of zonular weakness or dehiscence. This condition complicate cataract surgery by making the lens more prone to movement during phacoemulsification, thereby increasing the risk of PCR. The significant occurrence of PCR cases with phacodonesis suggests that careful preoperative zonular fibers from their attachments, compromises the stability of the lens capsule. This can lead to an increased risk of PCR during cataract surgery as the mechanical forces exerted on the lens capsule can cause it to rupture more easily. Similarly PCR was observed in 2 cases wirh zonular dialysis (15.38%) Zonular dialysis has been linked to a number of negative outcomes, including early or late in-the-bag IOL dislocation and progressive asymmetrical capsular contraction, leading in IOL decentration. The strong correlation between zonular dialysis and PCR observed in this study

reinforces the need for surgeons to be vigilant in identifying and managing zonular weaknesses preoperatively. About 6 cases (46.15%) of PCR occurred in patients with a small pupil, suggesting that pupil size may contribute to the risk of PCR during surgery. A small pupil can limit the surgeon's view and access to the cataract, making it more challenging to perform manual small incision cataract surgery. Safety Techniques such as pupil expansion devices to dilate the pupil can help mitigate this risk. The high prevalence of PCR in patients with small pupils in this study highlights the necessity of addressing pupil size preoperatively to reduce the incidence of this complication [7].

PCR was noted in 1 case (7.69%) with a history of trauma, indicating that ocular trauma may predispose patients to PCR during cataract surgery. Previous ocular trauma can weaken the structural integrity of the lens capsule and zonules, making them more susceptible to rupture during surgery. The presence of a traumatic history as a risk factor for PCR suggests that thorough patient history and careful surgical planning are essential for these cases. Similarly, 2 cases (15.38%) of PCR were observed in patients with high myopia, which could be a potential risk factor for PCR High myopia is associated with elongation of the eyeball and thinning of the sclera and other ocular tissues, including the zonules. This anatomical alteration can increase the fragility of the lens capsule, making it more prone to rupture during cataract surgery. The association of high myopia with PCR in this study points to the need for special considerations and techniques when operating on myopic eyes.

Conclusion

The study found a notable occurrence of posterior capsular rent (PCR) in patients who underwent manual small-incision cataract surgery, with 13 cases out of 60 surgeries. Potential risk factors for PCR included phacodonesis, zonular dialysis, small pupils, a history of trauma, and high myopia. These findings demonstrate the significance of understanding and managing the risk factors for postoperative complications (PCR) in cataract surgery to enhance patient safety and surgical outcomes.

Statements and Declarations

Conflicts of interest

The authors declares that they do not have conflict of interest.

Funding

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