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To Study the Demographics and Surgical Outcomes of Patients with Posterior Polar Cataract

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ABSTRACT

Background: Posterior polar cataracts (PPC) are a unique type of congenital cataract that pose an increased risk of intraoperative complications due to posterior capsule weakness. Understanding the demographics and surgical outcomes of patients with PPC is crucial for improving surgical strategies and patient care. This study aimed to investigate the demographics and surgical outcomes of PPC patients undergoing cataract surgery.

Method: A total of 45 patients diagnosed with PPC were recruited from outpatient clinic of Department of Ophthalmology between February 2022 and January 2024. Data on demographics, laterality, refractive error, and systemic comorbidities were recorded. Preoperative evaluations included visual acuity, slit-lamp examinations, and intraocular pressure measurement. Intraoperative details, including surgical techniques and complications, were documented. Postoperative follow-up visits at 1-day, 1-week, 1-month, 3-months, 6-months, and 1-year assessed visual acuity and recorded complications.

Results: The mean age of patients was 68.4 years with slight male predominance (53.33%). Common comorbidities included diabetes (32%) and hypertension (45%). Phacoemulsification was used in 92% of cases. Intraoperative complications included posterior capsule rupture (12%), vitreous loss (5%), and zonular dehiscence (1%). Visual acuity improved significantly in 78% of patients at one week, 85% at one month, and 88% at three months. Postoperative complications included posterior capsule opacification (20%) and cystoid macular edema (7%).

Conclusion: PPC surgery poses significant challenges, but proper surgical techniques and careful management of comorbidities can lead to improved visual outcomes. Younger age and the absence of comorbidities are associated with better outcomes, while surgeon experience and patient counseling are essential to optimizing surgical success.

Keywords: Posterior polar cataracts; Phacoemulsification; Visual acuity; Posterior capsule rupture; Comorbidities

Introduction

Posterior polar cataract (PPC) is a rare congenital cataract characterized by central, posteriorly located opacities in the lens of the eye. It is often bilateral and poses significant challenges for surgical management due to the fragility of the posterior lens capsule, increasing the risk of complications during cataract extraction surgery.[1] PPC's prevalence, demographic distribution, and surgical management are subjects of interest in ophthalmological research. PPC affects individuals across various age groups, often detected in early childhood or young adulthood. Genetic factors, including familial predisposition, play a key role in its development. Although congenital, PPC may not manifest with visually significant symptoms until later in life, making the timing of treatment complex.[2,3]

Surgical management of PPC requires meticulous technique due to the increased risk of complications, particularly posterior capsule rupture (PCR). Understanding patient demographics helps tailor surgical approaches to minimize risk and optimize visual rehabilitation.[4] PPC affects individuals globally, though its prevalence varies by region. Populations with higher rates of consanguineous marriages, such as in parts of South Asia and the Middle East, report a higher incidence of PPC, suggesting a strong genetic component. Conversely, in populations with lower consanguinity rates, PPC is less common.[5,6] The age at which PPC becomes clinically significant varies. Some patients experience visual impairment in early childhood, while others may remain asymptomatic until later in life. Gender distribution shows no significant bias, with both males and females equally affected. However, slight variations may be observed in specific populations due to genetic or environmental factors.[7]

The posterior location of the cataract in PPC demands a refined surgical approach, with the primary concern being the heightened risk of PCR. Advancements in techniques, such as femtosecond laser-assisted cataract surgery (FLACS) and improved phacoemulsification methods, have enhanced outcomes for PPC patients. The use of viscoelastic devices and capsular tension rings has also contributed to safer procedures.[8,9] Despite these advances, the risk of complications remains high, with studies showing a greater incidence of PCR in PPC surgeries compared to other types. Anterior vitrectomy and strategic intraocular lens (IOL) placement are essential in managing these cases effectively. Postoperative outcomes for PPC patients are generally positive, with significant improvements in visual acuity when complications are managed well. Long-term success, however, depends on addressing postoperative inflammation and preventing secondary complications, such as posterior capsule opacification (PCO). Regular follow up and monitoring are essential to ensure optimal visual outcomes and address any issues promptly.[6,10] The present study was undertaken to study demographics and surgical outcomes of patients diagnosed with posterior polar cataract (PPC)

Methodology

After obtaining Institutional Ethical Committee approval and written informed consent from all the patients, this interventional and prospective study was conducted on 45 patients diagnosed with posterior polar cataract, recruited from the Department of Ophthalmology's outpatient clinic between February 2022 and January 2025. Patients were selected based on specific inclusion criteria, which required a confirmed diagnosis of PPC through clinical examination and relevant ophthalmic investigations. Individuals with comorbidities such as diabetes, glaucomatous eyes, shallow anterior chambers, or coexisting retinal pathologies and those patients not willing to participate in the study were excluded.

At the initial visit, demographic data such as age, gender, laterality (unilateral or bilateral cataract), occupation, residence, refractive error, and systemic comorbidities were recorded. Each patient then underwent a comprehensive preoperative evaluation, including visual acuity assessment, slit-lamp examination, and intraocular pressure measurement. Additional investigations, such as optical coherence tomography (OCT) or ultrasound biomicroscopy (UBM), were performed when necessary. During surgery, the specific technique employed for each patient was documented, along with any intraoperative complications, such as posterior capsule rupture or zonular dehiscence. Postoperatively, patients were scheduled for follow-up visits at 1 day, 1 week, 1 month, 3 months, 6 months, and 1 year after surgery. Visual acuity was reassessed at each visit, and any complications or adverse events were carefully monitored and recorded.

The primary outcome variables included visual acuity improvement and surgical complications. Visual acuity was measured using standard charts preoperatively and during each postoperative follow-up at 1 day, 1 week, 1 month, 3 months, 6 months, and 1 year. Improvement was evaluated by comparing pre- and postoperative visual acuity levels. Surgical complications, such as posterior capsule rupture, zonular dehiscence, and other challenges, were carefully documented.

Secondary outcome variables included intraocular pressure changes, which were measured preoperatively and at each follow-up to monitor for any significant changes or the development of secondary glaucoma. Postoperative complications such as infection, inflammation, posterior capsule opacification (PCO), and cystoid macular edema (CME) were recorded at each visit. Patient satisfaction was assessed through self-reported outcomes on visual improvement, quality of life, and overall satisfaction with the surgery. Refractive outcomes were also measured postoperatively to assess changes and the need for corrective lenses. Additionally, the study examined the correlation between demographic factors (age, gender) and visual and

surgical outcomes to identify any significant associations or trends.

Statistical analysis:

The statistical analysis was performed using IBM SPSS software, version 24 and Microsoft Excel 2017. Descriptive statistics summarized demographic characteristics such as age, gender, and laterality using frequencies, percentages, means, and standard deviations. Preoperative and postoperative visual acuity, slit lamp examinations, and intraocular pressure measurements were compared using paired t tests or Wilcoxon signed rank tests, depending on data distribution. Chi square and Fisher's exact tests analyzed the association between demographic factors and complications. Subgroup analyses identified differences in outcomes based on age and gender. A significance level set at $p<0.05$.

Observations and Results

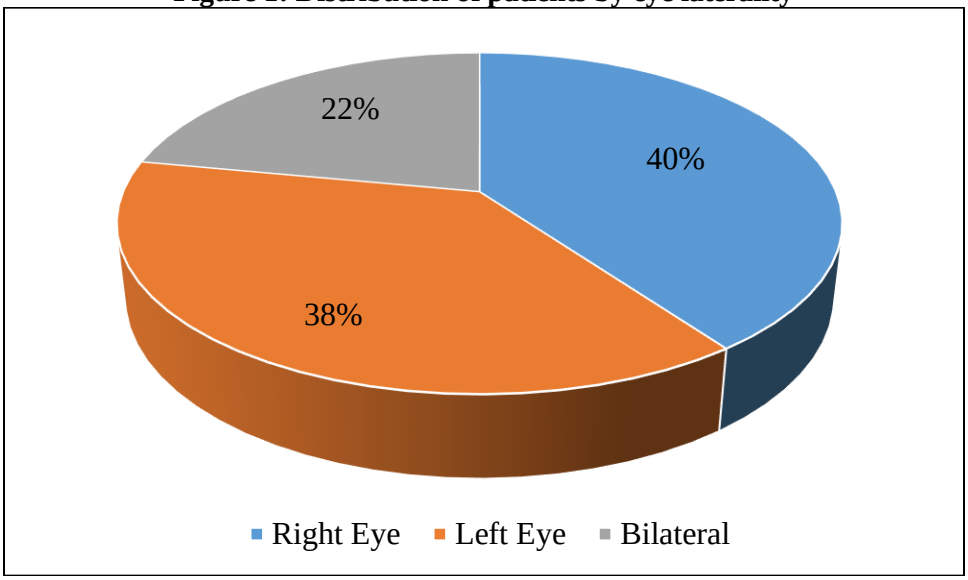
A total of 45 patients diagnosed with PPC were enrolled in the study. The majority of patients were over 60 years old (44.44%), followed by those aged 40 to 59 years (35.55%), with a slight male predominance (53.33%). Regarding occupation, nearly half of the patients were professionals (46.66%), while 24.44% were laborers, 17.77% were retired, and 11.11% fell into other categories. Most of the patients resided in urban areas (73.33%), with a smaller proportion from rural regions (26.66%), (Table 1).

Table 1: Socio-demographic profile of the patients

Socio-demographic data		Frequency	Percentage
Age group (years)	<40	09	20.0
	40 to 59	16	35.55
	>60	20	44.44
Gender	Male	24	53.33
	Female	21	46.66
Occupation	Professional	21	46.66
	Labor	11	24.44
	Retired	08	17.77
	Others	05	11.11
Residence	Urban	33	73.33
	Rural	12	26.66

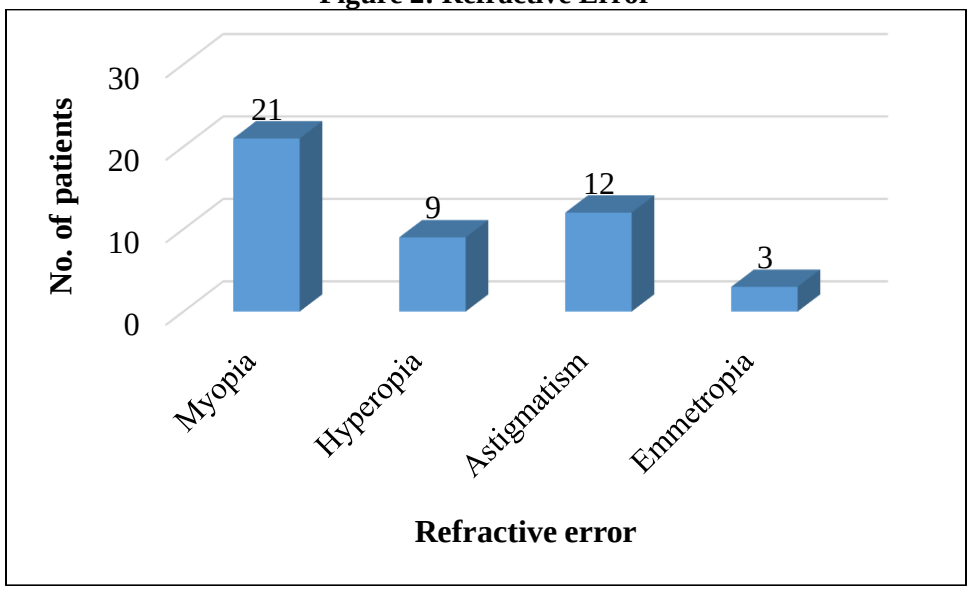
Out of 45, 18 patients with issues in the right eye, 17 in the left eye, and 10 with bilateral involvement as depicted in figure 1.

Figure 1: Distribution of patients by eye laterality



Among patients with refractive errors, 21 have myopia, 9 have hyperopia, 12 have astigmatism, and 3 have emmetropia as shown in figure 2.

Figure 2: Refractive Error



In terms of comorbidities, 14 patients have hypertension, 11 have cardiovascular issues, 5 have respiratory conditions, and 15 have other comorbidities.

The most common intraoperative complication was posterior capsule rupture, occurring in 24.44% of cases. Zonular dehiscence was observed in 8.88% of patients, while anterior capsule tear occurred in 6.66%. Iris prolapse was noted in 4.44% of cases. Additionally, 11.11% of patients experienced other intraoperative complications, (Table 2).

Table 2: Intraoperative Complications

Complications	Frequency	Percentage
Posterior Capsule Rupture	11	24.44
Zonular Dehiscence	04	8.88
Anterior Capsule Tear	03	6.66
Iris Prolapse	02	4.44
Other	05	11.11

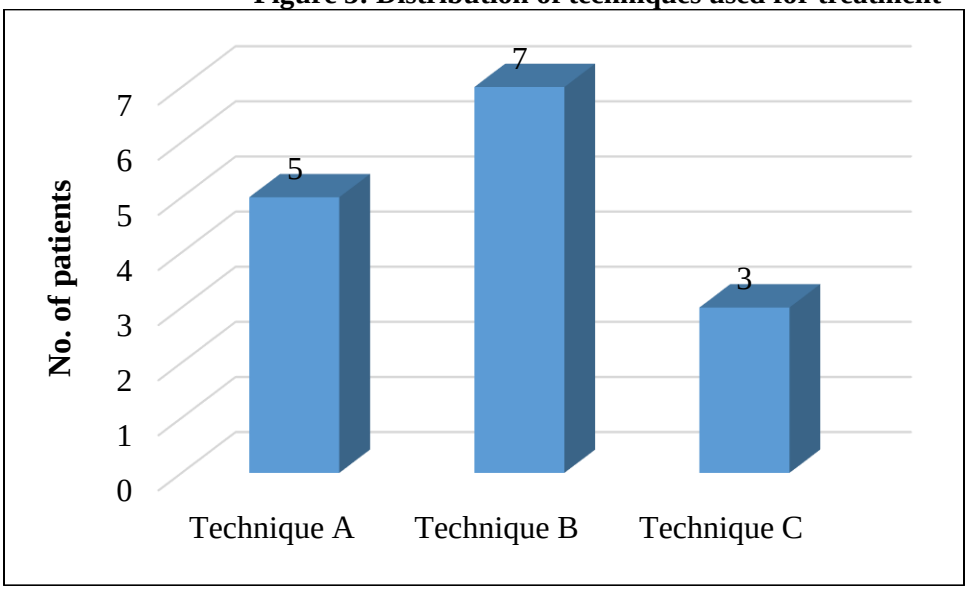
Visual outcomes indicate 20 patients achieving 6/6 or better vision, while 15 fall within the 6/9 to 6/12 range. Additionally, 5 patients each have visual acuity ranging from 6/18 to 6/24, and worse than 6/24, (Table 3).

Table 3: Postoperative Visual Outcomes

Visual Outcome	Frequency	Percentage
6/6 or better	20	44.44
6/9 6/12	15	33.33
6/18 6/24	05	11.11
Worse Than 6/24	05	11.11

The distribution of techniques used for treatment reveals 5 cases employing Technique A, 7 cases utilizing Technique B, and 3 cases employing Technique C, (Figure 3).

Figure 3: Distribution of techniques used for treatment



Among patients under 40, 7 achieved 6/6 or better vision, while for the 40 59 age group, 10 attained this level. However, notable differences emerge in the older age brackets, with significance levels (p values) suggesting that visual outcomes varied significantly, particularly for those aged 60 79 and those 80 years and older, (Table 4).

Among males, 15 achieved 6/6 or better vision, while 12 females attained this level. However, the p values suggest a significant difference in visual outcomes between genders, (Table 4).

Table 4: Visual Outcome by Age Group and Gender

Age Group (years)	6/6 or better	6/9 6/12	6/18 6/24	Worse Than 6/24	p value
<40	07	03	00	00	0.183
40 to 59	10	04	01	00	0.543
60 to 79	06	02	01	03	0.019
≥80	04	01	00	03	0.001
Total	27	10	02	06	-

Gender	6/6 or better	6/9 6/12	6/18 6/24	Worse Than 6/24	p value
Male	15	08	02	00	0.296
Female	12	06	01	06	0.015
Total	27	14	03	06	-

Discussion

Posterior polar cataract (PPC) presents unique surgical challenges due to its anatomical location and the associated risk of posterior capsular rupture during cataract surgery. Various studies[11-13] have explored the surgical outcomes of patients with PPC, emphasizing the importance of preoperative assessment, surgical technique, and intraoperative management to optimize visual outcomes and minimize complications. The demographic data from our study revealed a higher prevalence of patients aged 60 and older, followed by those aged 40 to 59 years, with only a small percentage of patients under 40. This aligns with existing literature, which shows that age-related ocular conditions, such as cataracts, become more common with advancing age. The relatively low number of younger patients may reflect the lower incidence of age-related conditions, although refractive errors are still frequent in this group.

In terms of gender distribution, while there was a slight male predominance (24 patients), the difference was not substantial. Gender differences in visual outcomes, however, suggest some variation in disease severity or treatment response between male and female patients. These findings are comparable with the studies by Dhanaseelan et al[11], Aswin et al[12], Pathak et al[13]. All these studies and our study reveals variations in age and gender distributions among patients with PPC. Occupationally, professionals constituted the largest group (21 patients), followed by laborers and retired individuals, which may reflect occupational hazards or lifestyle factors contributing to ocular conditions, such as prolonged screen time, exposure to environmental pollutants, or physical strain associated with certain professions. The urban-rural distribution showed a greater number of patients from urban areas, possibly due to better access to healthcare facilities and increased awareness of ocular health.

Present study also analyzed the laterality of eye involvement, showing a relatively balanced distribution between right (18) and left eye (17) involvement, with 10 cases of bilateral involvement. This highlights the need for comprehensive assessments of both eyes, especially in cases where bilateral involvement is present. Regarding refractive errors, myopia was the most prevalent, followed by astigmatism, in line with global trends.[14] The presence of systemic comorbidities, particularly hypertension and cardiovascular issues, highlights the importance of comprehensive health assessments, as these conditions can impact ocular health and treatment outcomes.

Posterior capsule rupture (PCR) was the most common complication, occurring in 11 cases, followed by zonular dehiscence (4 cases) and anterior capsule tear (3 cases). Other complications included iris prolapse (2 cases) and miscellaneous complications (5 cases). The high incidence of PCR reflects the known challenges of PPC surgery, where the integrity of the posterior capsule is often compromised. Pathak et al[13] also noted similar trends in intraoperative complications, emphasizing the need for meticulous surgical technique.

In terms of visual outcomes, 20 patients achieved 6/6 or better vision, 15 achieved visions in the 6/9 to 6/12 range, and 5 patients each had visual acuity between 6/18 to 6/24 and worse than 6/24. These results indicate favorable visual outcomes for a majority of PPC patients, although older age groups experienced more challenges in achieving optimal vision. The age-related decline in visual outcomes could be attributed to age-related changes in ocular structures and the presence of systemic comorbidities. A closer look at age-specific outcomes shows that patients under 40 years had the best outcomes, with 7 achieving 6/6 or better vision. In contrast, older patients (≥60 years) had more difficulty achieving optimal visual acuity, with 3 patients in the ≥80 age group having vision worse than 6/24. This suggests that age is a significant factor influencing treatment outcomes. Our findings are consistent with studies by Dhanaseelan et al[11], Aswin et al[12], and Pathak et al[13], which also reported differences in intraoperative complications and postoperative visual outcomes. While our study recorded 11 cases of PCR and notable visual outcomes across age and gender groups, it highlights the variability in surgical outcomes based on patient demographics and the importance of tailored preoperative and intraoperative strategies to optimize visual outcomes in PPC patients. Age, in particular, was found to significantly influence visual outcomes, with older patients experiencing more difficulty in achieving favorable results compared to younger individuals.

Gender differences were also observed in visual outcomes, with males generally achieving better results than females. Among males, 15 patients achieved 6/6 or better vision, while only 12 females reached this level. Additionally, females had a higher incidence of worse than 6/24 vision, indicating possible gender disparities in treatment response. Further investigation is warranted to explore underlying biological or socioeconomic factors contributing to these differences.

A comparison of our study with those by Dhanaseelan et al[11], Aswin et al[12], and Pathak et al[13] reveals notable differences in the management and outcomes of PPC. While all studies identified PCR as a major complication, the use of preoperative anterior segment optical coherence tomography (AS-OCT) was not uniformly reported, which could affect preoperative planning and outcomes. In addition, gender-based differences in outcomes were more pronounced in our study compared to others, underscoring the need for further research into individualized treatment approaches for PPC patients.

Conclusions

In conclusion, our study highlights that surgical outcomes in patients with posterior polar cataract are shaped by preoperative evaluations, surgical techniques, and demographic factors. Male patients generally achieved better visual outcomes, and

phacoemulsification combined with advanced imaging like AS-OCT showed superior results. The strong correlation between PPC morphology and the risk of posterior capsular rupture underscores the importance of tailored surgical planning. Addressing disparities in outcomes based on age, gender, and access to care is crucial for optimizing patient management and ensuring equitable ophthalmic services, especially in underserved regions.

By analysing patient demographics, including age, gender, and comorbidities, and correlating these with surgical outcomes, our research provides critical insights into factors influencing surgical success and complications. Also, our results provide valuable insights into the demographic characteristics, clinical profiles, and treatment outcomes of patients undergoing ophthalmic treatment. The findings underscore the multifactorial nature of ocular health and highlight the importance of comprehensive assessments, tailored interventions, and equitable healthcare delivery in optimizing patient outcomes.

Study Limitations

This single-center study, conducted at one institution, may limit the generalizability of the findings to other settings or populations with different demographics and healthcare practices. Additionally, the sample size, though adequate for preliminary observations, may not be large enough to identify rare complications or subtle variations in outcomes.

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