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PREOPERATIVE POSTERIOR SEGMENT EVALUATION USING B-SCAN ULTRASONOGRAPHY IN ADVANCED CATARACT PATIENTS: A TERTIARY CARE OBSERVATIONAL STUDY

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ABSTRACT **Introduction:** Cataracts are the leading cause of reversible blindness worldwide, particularly prevalent in older adults. Advanced cataracts often obscure visualization of the posterior segment, hindering the detection of coexisting ocular pathologies. B-scan ultrasonography offers a reliable method for evaluating the posterior segment when conventional fundus examination is not feasible. **Aim & Objective:** This study aimed to assess the posterior segment preoperatively in patients with advanced cataracts using B-scan ultrasonography and to determine the incidence of posterior segment pathologies in such patients. **Methodology:** A hospital-based observational study was conducted over one and a half year at Rajshree Medical Research Institute, Bareilly. A total of 201 patients aged 0– 75 years with advanced cataracts were included after obtaining informed consent. A comprehensive ocular examination was performed. In cases where the fundus could not be visualized, B-scan ultrasonography was utilized to assess the posterior segment. The collected data were analyzed using SPSS version 26. **Result:** Out of 201 patients, Most commonly, no morphological pathology is observed in 153 patients, accounting for 76.12% of the total cases. The prevalence of posterior vitreous detachment (PVD), which was observed in 19 patients (9.45%), and retinal detachment, found in 8 patients (3.98%), are relatively rare but clinically significant. Vitreous hemorrhage, found in 16 patients (7.96%). The presence of posterior staphyloma which is a rare condition was found in 5 patients (2.49%). All these preexisting conditions suggest poor visual outcomes if not treated and sometimes may also cause medico legal harm to the treating doctor. **Conclusion:** B-scan ultrasonography is an effective, non-invasive diagnostic tool for evaluating posterior segment abnormalities in advanced cataract patients.

KEYWORDS : Cataract; Posterior Segment; B-Scan Ultrasonography; Retinal Detachment; Vitreous Degeneration; Visual Acuity; Preoperative Evaluation; Intraocular pressure.

INTRODUCTION

In India, cataract is the leading cause of bilateral blindness, accounting for 50-80% of cases. Initiatives such as Vision 2020. The number of cataract surgeries performed annually has risen from around 1.2 million in the 1980s to 3.9 million by 2003, with projections indicating that this number will reach 7.63 million annually by 2020. Despite a 32% decrease in cataract blindness prevalence among individuals aged 50–59 years between 1989 and 2001, the absolute number of cataract-blind individuals in India grew from 7.75 million in 2001 to 8.25 million in 2020, largely due to the expanding aging population. (1)

A cataract is defined by the clouding or opacification of the normally clear lens or its capsule, which obstructs the passage of light to the retina. This condition can affect individuals of various ages, including infants, adults, and the elderly, with a higher prevalence among the older population. Cataracts may develop bilaterally and can vary in severity. The condition typically progresses slowly, often not disrupting daily activities in its early stages. However, as the cataract advances, usually after the fourth or fifth decade of life, the lens becomes fully opaque, severely hindering normal activities. While initial treatment may include refractive correction, surgery is generally recommended when the cataract has progressed to the point where it significantly impairs daily functions, offering highly successful outcomes. (2)

In advanced cases of cataracts (mature and hypermature cataracts), fundus visualization becomes obstructed, making preoperative assessment essential for accurately predicting visual outcomes following cataract surgery. (3)

Traditional methods, such as direct and indirect ophthalmoscopy or optical coherence tomography (OCT), are often hindered by the refractive media opacities caused by cataracts. However, ocular B-scan ultrasonography remains a valuable imaging modality, as it is unaffected by these opacities and can effectively detect major retinal abnormalities. (4)

This imaging technique provides essential insights into the status of the vitreous, retina, choroid, and sclera, facilitating more informed clinical decision-making. B-scan ultrasonography plays a vital role as a supplementary diagnostic tool. When performed with appropriate technique and a clear understanding of its indications, it provides critical diagnostic insights that are not always achievable through clinical examination alone. This imaging modality is particularly advantageous in cases where direct visualization of intraocular structures is obstructed by conditions such as severe lid edema, partial or complete tarsorrhaphy, corneal opacities (including scarring or edema), keratoprosthesis, hyphema, hypopyon, miosis, pupillary membranes, dense cataracts, or vitreous opacities such as hemorrhage or inflammatory debris. It aids in differentiating iris and ciliary body lesions, distinguishing vitreous opacities from membrane formations, assessing intraocular tumor dimensions, and differentiating serous from hemorrhagic choroidal detachments. Additionally, it helps classify retinal detachments as rhegmatogenous, tractional, or exudative. Moreover, this 7 imaging technique is beneficial in ruling out scleritis and distinguishing optic disc drusen from papilledema. (5) B-scan ultrasonography which operates at frequencies ranging from 8 MHz to 10 MHz, provides high-resolution imaging by converting echoes into brightness dots proportional to echo amplitude. This technique is particularly useful in assessing lesion morphology, including its shape, size, and location, and in detecting conditions such as retinal and choroidal detachments, posterior vitreous detachment, vitreous hemorrhage, intraocular foreign bodies, and neoplasms. (6)

MATERIALS AND METHODS

Study Design: This hospital-based observational study was conducted over a one and a half year period at the Department of Ophthalmology, Rajshree Medical Research Institute, Bareilly in which total 201 patients presenting with advanced cataract were evaluated.

Inclusion Criteria: Patients aged 0–75 years presenting with advanced cataracts obscuring fundus view and consenting to participate were included.

Exclusion Criteria: Patients with ocular trauma, recent intraocular surgery, or unwilling to participate were excluded.

Methodology: Each subject underwent detailed history taking and visual examination. B-scan ultrasonography was performed where direct fundus examination was not possible. Findings were recorded, and data were statistically analyzed using SPSS v26.0. Proper informed consent was taken from the patients in the language they understood (preferably hindi).

RESULTS

Table 1 demonstrates the **demographic characteristics across age groups** in this study reveal a distribution where the **majority of patients were in the middle-aged to older age ranges**, with the highest representation in the **48–57 years (38.3%)** and **58–67 years (35.8%)** groups. These findings suggest that **patients in their late middle age** constitute the largest demographic, possibly due to age-related conditions that require medical attention.

The **38–47 years age group (6.5%)** and **28–37 years age group (2%)** had relatively fewer patients, which indicates that **younger populations** were less represented in the cohort, possibly due to **lower incidence or severity of the condition in this age range.** The **68–75 years group (17.4%)** represents a significant proportion of elderly patients, indicating that **age-related factors** such as **comorbidities, frailty, or age-associated organ dysfunction** contribute to the incidence of the studied condition in this demographic.

Table 1 Demographic Characteristics Of Patients Across Age Group

Age(in Yrs)	Counts	% of Total
28 - 37	4	2.00%
38 - 47	13	6.50%
48 - 57	77	38.30%
58 - 67	72	35.80%
68 - 75	35	17.40%

Table 2 Slit Lamp Findings In Cataract Patients

OD (SLX)	Counts	% of Total
Hyper mature Cataract(morgagnian)	27	13.40%
Hyper mature Cataract(sclerotic)	8	4.00%
Mature Cataract	61	30.30%
Pseudophakic	105	52.20%
OS (SLX)		
Clear	4	2.00%
Hyper mature Cataract(morgagnian)	28	13.90%
Hyper mature Cataract(sclerotic)	9	4.50%
Mature Cataract	68	33.80%
Pseudophakic	92	45.80%

Table 2 demonstrates the slit-lamp examination of cataract patients demonstrates various cataract types and postoperative conditions in both the right eye (OD) and left eye (OS).

Right Eye (OD) Findings:

- **27 patients (13.4%)** had **hyper mature cataracts (Morgagnian type)**, indicating **advanced cataracts with dense nuclear sclerosis and liquefaction of the cortex**.
- **8 patients (4%)** had **hyper mature cataracts (sclerotic type)**, which typically involve **hardening and opacity in the lens**.
- The largest group, **61 patients (30.3%)**, had **mature cataracts**, indicating **moderate progression with opacity affecting both the nucleus and cortex of the lens**.
- **105 patients (52.2%)** were **pseudophakic**, meaning they had **undergone cataract surgery** with intraocular lens implantation.
- Left Eye (OS) Findings:
- **4 patients (2%)** had **clear lenses,** indicating **no cataract formation.**
- **28 patients (13.9%)** had **hyper mature cataracts (Morgagnian type),** similar to the right eye**,** indicating **advanced stage cataracts.**
- **9 patients (4.5%)** had **hyper mature cataracts (sclerotic type),** showing a **similar distribution to the right eye.**
- **68 patients (33.8%)** had **mature cataracts,** reflecting **moderate to advanced cataract formation.**
- **92 patients (45.8%)** were **pseudophakic,** indicating a **post-surgery state.**

Table 3 Fundus Examination (Preoperative Status)

OD/OS (Fundus)	Counts	% of Total
Tessalated	49	24.40%
Peripapillary atrophy	9	4.50%
Within normal limit	143	71.10%

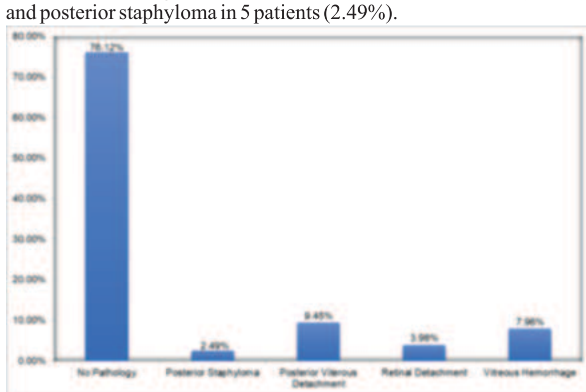
Table 3 demonstrates the preoperative fundus examination findings for both right normal eyes (OD) and left normal eyes (OS) show a variety of conditions related to the retinal health of the patients:

- 49 patients (24.4%) had tessellated fundi, which suggests a congenital retinal feature commonly associated with increased risk for macular degeneration, especially in aging individuals.
- 9 patients (4.5%) showed peripapillary atrophy, which can be a sign of optic nerve damage or early glaucomatous changes.
- The majority, 143 patients (71.1%), had a normal fundus (WNL), indicating healthy retinal and optic nerve findings with no visible signs of pathology.

Table 4. B-Scan Ultrasonography Findings In Posterior Segment

OD/OS (B scan Findings)	Counts	% of Total
No Pathology	153	76.12%
Posterior Staphyloma	5	2.49%
Posterior Viterous Detachment	19	9.45%
Retinal Detachment	8	3.98%
Vitreous Hemorrhage	16	7.96%

Table 4 provides insight about B-scan ultrasonography that successfully visualized the posterior segment in all patients with obscured fundus. The most common finding was a normal posterior segment in 153 patients (76.12%). Among the abnormal findings, posterior vitreous detachment (PVD) was seen in 19 patients (9.45%), vitreous hemorrhage in 16 (7.96%), retinal detachment in 8 (3.98%), and posterior staphyloma in 5 patients (2.49%).



DISCUSSION

The study, titled "To Evaluate the Posterior Segment Preoperatively in Patients Presenting with Advanced Cataract with B-Scan Ultrasonography in a Tertiary Care Hospital," was conducted at Rajshree Medical Research Institute, Bareilly, Uttar Pradesh. It aimed to assess the role of B-scan ultrasonography in evaluating the posterior segment of patients with advanced cataracts—a condition that significantly impairs vision.

The primary objective was to determine the incidence of posterior segment pathologies in these patients, offering valuable insights into potential complications that could impact surgical outcomes.

The demographic characteristics of the patients in this study reveal several key insights into the population most affected by the condition under investigation. The age distribution across different groups shows a clear predominance of middle-aged and older adults. The majority of patients were in the 48–57 years (38.3%) and 58–67 years (35.8%) groups, indicating that age-related factors, such as increased likelihood of cataracts and other eye conditions, significantly contribute to the incidence of advanced cataracts. Similarly, Hegde, R., et al(2022) identified a significant correlation between cataract formation and advancing age, with the highest incidence observed in individuals aged 50–60 years.

In contrast, the 38–47 years and 28–37 years age groups in this study were represented by a smaller proportion of patients, 6.5% and 2%, respectively. This observation aligns with the general understanding that cataracts, especially advanced cataracts, are less prevalent in younger populations, as corroborated by the findings of Mujeeb Ur Rehman Parrey et al. (2019))and Madhu Chanchlani et al. (2016).

The slit-lamp findings in this study provide valuable insight into the types of cataracts and postoperative states observed in the patients. The right eye (OD) findings show that the majority of patients had mature cataracts (30.3%), followed by pseudophakic patients (52.2%), those who had undergone cataract surgery with intraocular lens implantation. This distribution is consistent with the observations made by Hegde, R., et al(2022) who similarly reported a high prevalence of mature cataracts in their cohort. Their study also highlighted the significant number of pseudophakic patients post-surgery, echoing the importance of cataract surgery and the commonality of intraocular lens implantation in the treatment of advanced cataracts. However, the 13.4% of patients with hypermature cataracts (Morgagnian type) in the right eye is a more pronounced finding compared to studies like those by Pallamreddy et al. (2023) who did not highlight the Morgagnian type specifically. The Morgagnian cataracts observed in this study suggest advanced cataract progression, often associated with significant cortical liquefaction and dense nuclear sclerosis.

In contrast, the left eye (OS) findings also show a notable number of patients with mature cataracts (33.8%) and pseudophakic eyes (45.8%), with a smaller proportion exhibiting hypermature cataracts (Morgagnian type) at 13.9%. The relatively higher percentage of hypermature cataracts in this study could point to a more advanced cohort or a higher referral rate of cases with dense cataracts for evaluation via B-scan ultrasonography.

The preoperative fundus examination findings in this study reveal a high prevalence of normal retinal findings (71.1%), with a smaller percentage of patients exhibiting tessellated fundi (24.4%) and peripapillary atrophy (4.5%). Tessellated fundi, a congenital condition associated with an increased risk of macular degeneration, were observed in a significant proportion of patients, which is consistent with findings in studies like those by Chanchlani, M. et al(2016).

The B-scan ultrasonography findings in this study reveals a predominance of no pathology (76.12%), which is expected given the nature of the study population, composed predominantly of cataract patients. The relative rarity of posterior segment pathologies like retinal detachment (3.98%), vitreous hemorrhage (7.96%), and posterior vitreous detachment (PVD) (9.45%) in this study contrasts with findings from Hegde, R., et al(2022), who identified a higher incidence of posterior vitreous detachment in their cohort. This discrepancy may reflect the differences in the severity and types of cataracts in the patient populations, as Hegde's study included patients with a wider range of cataract severity. The low occurrence of posterior staphyloma (2.49%) in this study is consistent with the findings of studies such as those by Pallamreddy, et al (2023).

CONCLUSION

B-scan ultrasonography is an indispensable diagnostic modality in the preoperative evaluation of patients with advanced cataracts. It aids in the detection of hidden posterior segment pathologies, ensuring better prognostic outcomes and helping surgeons tailor management strategies. Its non-invasive, cost-effective, and widely available nature makes it an ideal tool, particularly in developing countries. Incorporating B-scan into routine preoperative workups is strongly recommended for all patients with mature cataracts.

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