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ORIGINAL ARTICLE

Frequency of posterior segment abnormalities detected by B-scan ultrasonography in patients with dense cataracts.

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ABSTRACT… Objective: To determine the frequency and types of posterior segment abnormalities detected by B-scan ultrasonography in patients with dense cataracts and to assess their association with demographic and clinical factors. **Study Design:** Descriptive Cross-sectional study. **Setting:** Department of Ophthalmology, L.R.B.T Eye Hospital, Multan Road. **Period:** over six months 22 June 2025 to 22 Dec 2025. **Methods:** The study was conducted on 194 patients aged 40–80 years with dense cataracts (LOCS III grade ≥4) B-scan ultrasonography was performed to detect posterior segment abnormalities. Data on age, gender, comorbidities, and cataract grade was collected. Statistical analysis was performed using SPSS version 26.0, with the Chi-square test applied to evaluate associations ($p < 0.05$ considered significant). **Results:** Among 194 patients, 35 eyes (18.0%) exhibited posterior segment abnormalities, while 159 eyes (82.0%) were normal. The most common abnormalities included vitreous hemorrhage (5.2%), retinal detachment (3.1%), and vitritis (2.1%). The prevalence of abnormalities significantly increased with age ($p = 0.022$), diabetes mellitus ($p = 0.042$), and higher cataract grade (LOCS III grade 5, $p = 0.020$). Gender ($p = 0.963$) and hypertension ($p = 0.582$) were not significantly associated with posterior segment abnormalities. **Conclusion:** For patients with dense cataracts, B-scan ultrasonography is an essential tool for identifying posterior segment abnormalities. These abnormalities are significantly predicted by older age, diabetes mellitus, and higher cataract grade, highlighting the significance of preoperative evaluation to maximize surgical planning and visual outcomes.

Key words: B-scan Ultrasonography, Dense Cataract, LOCS III, Posterior Segment Abnormalities, Retinal Detachment, Vitreous Hemorrhage.

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INTRODUCTION

Cataracts cause reversible blindness in the world, with prevalence increasing dramatically from 42.3 million cases in 1990 to 97 million in 2019 aand an annual increase in age-standardized rates by 0.41 % during this period.[1] Cataract blindness is a burden, especially in women, and the prevalence rate is 1.80% as opposed to 1.67% in men. In particular, cataract could be considered the cause of 51% of the blindness in the Southeast Asian region (which includes Pakistan) in 2018. The majority of these cases are caused by age-related cataracts, which build up over time and are not very noticeable until they severely impair vision. However, cataracts are the main cause of vision problems due to lens opacification and it is becoming recognized that there is a need to diagnose coexisting posterior segment eye diseases (PSEDs) in cataract patients.[2,3]

Co-occurrence: The presence of the abnormalities of the posterior segment with cataracts is an extremely important factor in the ophthalmic practice. Such pathologies can be vitreous hemorrhage, retinal detachment, posterior vitreous detachment, vitreomacular traction, and retinopathies of several types. They can complicate the surgery of the cataract, interfere with the final result of the visual outcomes, and require special surgical techniques or extra surgery in patients with dense cataracts when the posterior segment cannot be directly seen.[4,5] B-scan ultrasonography is important to identify these posterior segment pathologies, providing overall preoperative examination when direct visualization is compromised.[6]

Atiq et al. (2023) conducted a cross-sectional study of 165 patients, with the 51-60 years age group being most frequent (34.5%). Posterior segment pathologies were found in 92 patients (55.8%), with vitreous hemorrhage being most common (50 patients, 30.3%), followed by retinal detachment (10.9%), vitritis (6.7%), vitreous opacities (4.2%), posterior vitreous detachment (2.4%), and choroidal detachment (1.2%).[6]

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Pallarnreddy et al. (2023) studied 261 subjects (133 males, 51%; 128 females, 49%; age range 4-90 years). In eyes with hazy fundus view due to lenticular etiology, 56% had normal posterior segments. Common posterior segment lesions included degenerative vitreous opacities (18%), posterior vitreous detachment (10%), retinal detachment (7%), and vitreous hemorrhage (3%).[7] In another research of 150 cataract patients undergoing ultrasonography through the contact method, the presence of posterior segment eye diseases (PSEDs) was found in 17.3% of the patients. The result reported consisted of retinal detachment in 6%, vitreous hemorrhage in 5.3%, optic nerve head cupping in 2.6%, posterior staphyloma in 2%, and posterior vitreous detachment in 1.3%.[8]

The occurrence and the type of posterior segment abnormalities in patients with dense cataracts presents a critical knowledge gap in ophthalmology. These pathologies may cause severe consequences on surgical outcome and the prognosis of patients. These abnormalities are varied and need thorough knowledge of how often they occur and the type of abnormalities in relation to the best approach to surgical planning, counseling of the patient, and treatment. In this study, an attempt to fill this knowledge gap is to conduct a systematic assessment of the condition of the posterior segment in patients with dense cataracts, which could enhance the preoperative assessment, surgical decision-making, and postoperative care. The results might help result in more individualized care strategies and improved patient outcomes of cataract surgery. This study was therefore conducted to establish the rate and kind of abnormalities of the posterior segment as observed on B-scan ultrasonography among preoperative patients with dense cataracts.

METHODS

This descriptive cross-sectional study was conducted in the Department of Ophthalmology at LRBT Eye Hospital, Multan Road, over a period of six months from 22nd June 2025 to 22nd Dec 2025 after approval from ethical committee (Co/Admin/Doc-270). following approval of the research synopsis. Ethical approval was obtained from the Institutional Review Committee prior to the commencement of the study. A non-probability consecutive sampling technique was employed to recruit participants. The sample size was calculated as 194, based on an assumed proportion of 55.8% posterior segment abnormalities in the preoperative assessment of cataract patients, with a 95% confidence interval and a 7% margin of error.[7]

After obtaining written informed consent, participants meeting the inclusion criteria were enrolled. Individuals diagnosed with dense cataracts classified as LOCS III grade 4 or higher, aged between 40 and 80 years of either gender, were included in the study. Exclusion criteria included having a history of vitrectomy, retinal detachment surgery, or other interventions affecting the posterior segment; having ocular trauma that could independently cause posterior segment abnormalities; and those with systemic conditions that might predispose people to other unrelated posterior segment abnormalities such as advanced diabetic retinopathy, uncontrolled hypertension, or intraocular tumours, and patients having active ocular infections, including endophthalmitis, which could confound the accurate assessment.

The demographic and clinical data (age, gender, comorbidities, diabetes, and hypertension data) and the type and grade of cataract were obtained as baseline data of all the eligible participants. All participants were subjected to a thorough ophthalmic examination, including the evaluation of the baseline visual acuity, assessment of intraocular pressure, and a thorough examination at the slit-lamp. Then, the B-scan ultrasonography of the affected eye(s) was conducted by a trained ophthalmologist with standardized imaging guidelines. The results were interpreted by a consultant ophthalmologist and used to diagnose and categorize the results of the operation as per the operational definitions in the study protocol. All the observations were noted in a data collection form that was designed, and data collection was done until six months had passed or the necessary sample size was reached. Analysis of data was done through the use of SPSS software version 26.0. Categorical variables like the existence of the abnormalities of the posterior segment, gender, type of cataract, grade of the cataract opacities, and comorbidities were reported in terms of frequencies and percentages. Continuous

variables, including age, were given in terms of mean and standard deviation. To check the effect of potential confounders, such as age, gender, grade of the posterior segment opacities, and comorbidities, stratification was done to determine their impact on the occurrence of posterior segment abnormalities. Post-stratification of the Chi-square test was done to test the statistical significance of these associations, and a p-value of less than 0.05 was considered statistically significant.

RESULTS

TABLE-I

Demographic and clinical characteristics of patients with dense cataracts (n = 194)

Variable	Frequency (n)	Percentage (%)
Age Group (years)		
40 – 50	36	18.6
51 – 60	72	37.1
61 – 70	57	29.4
71 – 80	29	14.9
Mean Age ± SD (years)		58.7 ± 9.6
Gender		
Male	88	45.4
Female	106	54.6
Comorbidities		
Diabetes Mellitus	68	35.1
Hypertension	59	30.4
None	89	45.9
LOCS III Cataract Grade		
Grade 4	132	68.0
Grade 5	62	32.0

In this study, 194 patients who had dense cataracts were studied. The average age of the participants was 58.7 ± 9.6 years, with most participants (37.1%) in the age group of 51 to 60 years, then 61 to 70 years (29.4%), 40 to 50 years (18.6%), and 71 to 80 years (14.9%). The number of female participants was slightly higher than that of male participants (54.6% vs. 45.4%). In terms of comorbidities, 35.1% were found to have diabetes mellitus, 30.4% had hypertension, and 45.9% had no comorbidity of value. Regarding the severity of cataracts, the majority of the eyes belonged to category LOCS III grade 4 (68.0%), whereas the rest (32.0% of all eyes) fell in LOCS III grade 5.

TABLE-II

Frequency of posterior segment abnormalities detected by B-Scan ultrasonography (n = 194)

Posterior Segment Finding	Number of Eyes (n)	Percentage (%)
Vitreous Hemorrhage	10	5.2
Retinal Detachment	6	3.1
Vitritis	4	2.1
Vitreous Opacities	3	1.5
Posterior Vitreous Detachment	3	1.5
Choroidal Detachment	2	1.0
Optic Nerve Head Cupping	2	1.0
Posterior Staphyloma	1	0.5
Total with Abnormal Findings	35	18.0
No Detectable Abnormality	159	82.0

B-scan ultrasonography revealed that posterior segment abnormalities were present in 35 eyes, corresponding to 18.0% of the study population, while the remaining 82.0% had no detectable abnormality. Among the abnormalities detected, vitreous hemorrhage was the most frequent finding (5.2%), followed by retinal detachment (3.1%), vitritis (2.1%), vitreous opacities (1.5%), posterior vitreous detachment (1.5%), choroidal detachment (1.0%), optic nerve head cupping (1.0%), and posterior staphyloma (0.5%).

The age-specific prevalence of the posterior segment abnormalities was found to be higher among patients who were in the 71-80 years range (31.0%), compared to those who were aged between 40-50 years (5.6%), suggesting that older patients have a higher risk of experiencing the abnormalities. The rate of the presence of abnormalities in the posterior segment was much greater in patients with diabetes mellitus (29.4%) than among non-diabetic patients (11.9%) ($p = 0.042$). In terms of the severity of cataract, the eyes with grade 5 cataracts of LOCS III showed a higher percentage of abnormalities of the posterior segment (27.4%) compared to those with the grade 4 cataracts (13.6%) ($p = 0.020$), indicating that the more severe cataracts are, the higher the risk of the presence of other pathologies of the posterior segment. In contrast, gender ($p = 0.963$)

and hypertension (p = 0.582) were not significantly associated with the presence of posterior segment abnormalities, indicating that these factors do not substantially influence posterior segment status in patients with dense cataracts.

TABLE-III

Association of posterior segment abnormalities with demographic and clinical variables (n = 194)

Variable	With Abnormality (n = 35)	Without Abnormality (n = 159)	P-Value
Gender			0.963
Male (n = 88)	16 (18.2%)	72 (81.8%)	
Female (n = 106)	19 (17.9%)	87 (82.1%)	
Age Group (years)			0.022*
40 – 50 (n = 36)	2 (5.6%)	34 (94.4%)	
51 – 60 (n = 72)	10 (13.9%)	62 (86.1%)	
61 – 70 (n = 57)	14 (24.6%)	43 (75.4%)	
71 – 80 (n = 29)	9 (31.0%)	20 (69.0%)	
Diabetes Mellitus			0.042*
Present (n = 68)	20 (29.4%)	48 (70.6%)	
Absent (n = 126)	15 (11.9%)	111 (88.1%)	
Hypertension			0.582
Present (n = 59)	12 (20.3%)	47 (79.7%)	
Absent (n = 135)	23 (17.0%)	112 (83.0%)	
LOCS III Grade			0.020*
Grade 4 (n = 132)	18 (13.6%)	114 (86.4%)	
Grade 5 (n = 62)	17 (27.4%)	45 (72.6%)	

DISCUSSION

In 18% of eyes with dense cataracts, the current study found posterior segment abnormalities; the most common lesions were vitreous hemorrhage (5.2%) and retinal detachment (3.1%). According to previous B-scan studies of dense or mature cataracts, this prevalence falls between 8 and 48%, depending on the selection criteria and case mix.[9-15]

In Sudan, Shakour et al. reported that 47.6% of advanced cataracts had posterior segment eye diseases (PSEDs) like vitreous abnormalities 46.2% and retinal detachment 1.3%.[9] Their status of having a much higher overall abnormality rate than our 18% is likely due to the inclusion of more advanced cataracts and a greater percentage of vitreous degenerative changes. However, Chanchlani and Chanchlani, in an assessment of 400 hypermature cataracts, have detected discrete posterior segment pathology in approximately 9% of eyes- principally posterior staphyloma (3.5%), vitreous hemorrhage (1.6%), and retinal detachment (0.9%), nearer but still less than our value.[11]

Atiq et al. (2023) conducted a cross-sectional study of 165 patients, with the 51-60 years age group being most frequent (34.5%). Posterior segment pathologies were found in 92 patients (55.8%), with vitreous hemorrhage being most common (50 patients, 30.3%), followed by retinal detachment (10.9%), vitritis (6.7%), vitreous opacities (4.2%), posterior vitreous detachment (2.4%), and choroidal detachment (1.2%).[7] Pallarnreddy et al. (2023) studied 261 subjects (133 males, 51%; 128 females, 49%; age range 4-90 years). In eyes with hazy fundus view due to lenticular etiology, 56% had normal posterior segments. Common posterior segment lesions included degenerative vitreous opacities (18%), posterior vitreous detachment (10%), retinal detachment (7%), and vitreous hemorrhage (3%).[6,7] In a study of 150 cataract patients who underwent ultrasonography via the contact method, posterior segment eye diseases (PSEDs) were identified in 17.3% of cases. The findings included retinal detachment in 6%, vitreous hemorrhage in 5.3%, optic nerve head cupping in 2.6%, posterior staphyloma in 2%, and posterior vitreous detachment in 1.3%.[8]

Various dense /mature cataract series record rates nearer to ours. Meenakshi et al. reported posterior segment pathology in 11.0% of 490 mature cataract eyes with the primary detectable pathologies retinal detachment (2.85%), vitreous hemorrhage (2.09%), PVD (1.22%) and staphyloma (0.8%), which are very similar to the prevalence of the same as well as the pattern of that prevalence in our cohort.[13] According to Garg et al., abnormalities were reported in 16.4% of dense (comparable to our study) and the abnormalities were predominantly retinal detachment, vitreous hemorrhage, and PVD.[12] Abnormal scans in mature cataracts were noted by Kubrey et al. being 27% as compared to our 18% with retinal detachment in 9% and PVD in

5%.[14]

Pakistani and Indian cataract studies, which are more recent, also demonstrate similar or greater abnormality rates. In 260 dense cataract eyes, Karim et al. detected pathology in the posterior segment in 32.2% (most frequently, PVD (7.6%), retinal detachment (4.7%), and vitreous hemorrhage with lenticular media haze had lesions of the posterior segment, predominantly degenerative vitreous opacities (18%), PVD (10%) , retinal detachment (7%), and vitreous hemorrhage (3%). 15 This might be due to our lower prevalence rates, which can be attributed to either sorting out high-risk pathologies due to traumatic cataracts or also to a more strictly age-related, non-referral population.

Studies involving wider indications of opaque media (trauma, corneal opacity, endophthalmitis, etc.) tend to report higher rates of posterior pathology than our study. Another study revealed abnormalities in 45% of eyes with opaque media, which were mostly vitreous disorders (60%) and retinal detachment (14.2%).[16,17] Agrawal and Ahirwal also have found that 85.5 percent of the referred eyes were abnormal, vitreous hemorrhage and retinal detachment being the most dominant entities in a highly selected, non-cataract specific sample.[18] A similar series of high-resolution ultrasonography also records the presence of posterior lesions at about 30-33% in the presence of cataract, among many other indicators, which again outstrips our 18% due to referral bias and the presence of trauma and tumours.[19-21]

Concerning the lesion pattern, our PVD-vitreous hemorrhage-retinal detachment preeminence resembles that of most series, which uniformly observe the PVD, degenerative vitreous opacities, retinal detachment, and vitreous hemorrhage as the major B scan appearances in dense cataract and opaque media.[15,16] Vitreous changes are also reported as the most frequent defect in advanced cataracts in Sudanese data.[9] We had a fairly low incidence of PVD (1.5%) as compared to other series, which could be due to a more rigid classification of age-related vitreous changes as compared to clinically significant PVD.

We are also within the wider literature in terms of risk factor profile. Older age frequently associated with an increased prevalence of vitreous hemorrhage, PVD, and retinal detachment on eye ultrasonography, in both cataract cohorts and individuals with blurred vision.[22,23] In the same way, diabetes is a known risk factor of vitreous bleeding and tractional or combined retinal detachment in dense cataracts and diabetic patients.[23,24] Our data shows no gender effect, which is supported by a number of series that did not identify any significant sex difference in the posterior segment pathology after patients were thoroughly assessed.[24]

Lastly, B-scan ultrasonography is very sensitive and specific for major posterior segment lesions in dense cataract, with sensitivities between 64 and 95% and specificities between 80 and 100%, according to numerous diagnostic studies. While Pagore and Wagh showed 95.2% sensitivity and 98.9% specificity in a mixed cohort that included dense cataracts[22], Hegde et al. reported 64.2% sensitivity and 100% specificity in dense cataracts.[10] These results corroborate our conclusion that preoperative B-scan is a suitable and useful screening method in eyes with dense cataracts, especially in older, diabetic, and higher-grade cataracts, where our study reveals noticeably higher abnormality rates.

Some of the strengths of this study include a well-defined sample (194 patients with dense cataracts (LOCS III grade ≥4) and strict exclusion criteria to reduce possible confounding effects in the sample on the basis of the case, standardized B-scan ultrasonography performed by trained personnel, and the adoption of the right statistical analysis, including stratification of the confounders. Its shortcomings are its single-center, tertiary hospital-based study, which could limit generalizability, which prevents measuring long-term effects, and the comparatively low rate of identification of the presence of posterior vitreous detachment (1.5), which could be because of reluctance to diagnose this condition. Future directions will involve the use of multicenter studies involving different environments in Pakistan, longitudinal follow-up to determine the effects of identified abnormalities on surgical outcomes, and the cost-effectiveness of routine preoperative B-scan ultrasonography in

resource-scarce settings.

CONCLUSION

For patients with dense cataracts, B-scan ultrasonography is an essential tool for identifying posterior segment abnormalities. These abnormalities are significantly predicted by older age, diabetes mellitus, and higher cataract grade, highlighting the significance of preoperative evaluation to maximize surgical planning and visual outcomes.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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2	**Momina Malik:** Critical revision.
3	**Hammad Asghar:** Data collection.
4	**Muhammad Suhail Shehzad:** Proof reading.
5	**Zubair Saleem:** Data analysis.
6	**Fahd Kamal Akhtar:** Data entry.