

EVALUATION OF POSTERIOR SEGMENT WITH B-SCAN FOR MATURE CATARACT

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ABSTRACT

Introduction: Mature and hypermature cataract can obscure the fundus and conceal posterior segment lesions that directly influence counselling, operative planning and expected visual recovery. In such eyes, B-scan ultrasonography remains the most practical preoperative imaging tool.

Aim: To evaluate posterior segment abnormalities detected on B-scan ultrasonography in eyes with mature cataract and to examine their association with age, cataract type and systemic comorbidity.

Materials and Methods: This hospital-based cross-sectional descriptive study was conducted over 12 months in 120 subjects with dense cataract preventing adequate fundus evaluation. After routine ophthalmic examination, posterior segment assessment was performed with contact B-scan ultrasonography using a standard ophthalmic 12 MHz probe. Scans were obtained through closed eyelids in multiple meridians. Age, gender, cataract type, visual acuity, intraocular pressure, diabetes mellitus, hypertension and B-scan findings were recorded. Categorical variables were summarised as frequencies and percentages, and associations were tested using the chi-square test.

Results: The mean age of the study population was 60.5±13.0 years, and 56 subjects belonged to the 61–80 year age group. Abnormal posterior segment findings were identified in 41 of 120 eyes (34.2%). Posterior vitreous detachment was the commonest lesion (13 eyes, 10.8%), followed by retinal detachment (10 eyes, 8.3%) and vitreous haemorrhage (8 eyes, 6.7%). Age showed a significant association with posterior pathology ($p<0.001$): no abnormal scan was detected below 40 years, whereas 34 of 56 subjects aged 61–80 years and 5 of 7 older than 80 years had abnormal findings. All 23 hypermature cataracts demonstrated posterior segment abnormalities. Diabetes mellitus and hypertension were also significantly associated with abnormal scans.

Conclusion: Preoperative B-scan ultrasonography is highly useful in dense mature cataract. Occult posterior segment pathology was seen in 41 of 120 eyes, with abnormalities clustering in older subjects, hypermature cataract and systemic comorbidity.

Keywords: mature cataract, B-scan ultrasonography, posterior segment, retinal detachment, vitreous haemorrhage

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INTRODUCTION

Cataract remains one of the leading causes of avoidable visual loss worldwide [1]. The burden is especially substantial in India, where delayed presentation, rural access gaps and dependence on late referral pathways still shape the way dense cataract reaches tertiary centres [2].

Once lens opacity becomes dense enough to block the fundus, the surgeon faces a practical dilemma. The cataract may be obvious, yet the retina and vitreous remain uncertain. That uncertainty matters because hidden retinal detachment, vitreous haemorrhage, posterior vitreous detachment or posterior staphyloma may alter counselling, expected prognosis and, at times, operative strategy [3].

B-scan ultrasonography is well suited for this situation because it is non-invasive, repeatable and feasible even in opaque media [4]. It also remains a dependable method for identifying structural posterior segment changes when ophthalmoscopy is not possible [5]. Radiology-based reviews have similarly underlined its value in detecting detachments, vitreous pathology and posterior globe abnormalities in eyes with obscured media [6].

Indian studies on mature and hypermature cataract have repeatedly shown that occult posterior segment lesions are not uncommon on preoperative B-scan [7]. Similar observations have been reported from tertiary centres where retinal detachment and vitreous pathology formed a clinically important share of abnormal scans [8]. Other hospital series have confirmed the same broad pattern, although the exact proportion varies with age profile, referral mix and cataract type [9,10]. The present study was undertaken to evaluate the posterior segment with B-scan in eyes with mature cataract over a 12-month period and to examine how these findings varied across age group, cataract type and systemic comorbidity.

MATERIALS AND METHODS

Study Design and Setting: This hospital-based cross-sectional descriptive study was conducted over 12 months in the Department of Ophthalmology, Adichunchanagiri Hospital and Research Centre, Adichunchanagiri Institute of Medical Sciences, B.G. Nagara. Institutional Ethics Committee approval was obtained before analysis (EC/NEW/INST/2023/KA/0382).

Study Population: Adult patients presenting with mature, hypermature or traumatic cataract severe enough to obscure fundus details on clinical examination were included. Sampling and sample size: Consecutive eligible patients presenting during the 12-month study period were enrolled. A formal a priori sample size calculation was not performed because the primary objective was descriptive and feasibility-driven, aimed at estimating the prevalence and spectrum of posterior segment abnormalities in dense cataract in this tertiary-care setting.

B-scan Technique: Posterior segment evaluation was performed with contact B-scan ultrasonography using a standard ophthalmic 12 MHz probe. Coupling gel was applied over the closed eyelid, and scans were obtained in multiple meridians. B-scan formed part of the routine preoperative work-up and was performed by a trained examiner using a predefined departmental protocol. Dynamic scanning was used whenever required to distinguish mobile vitreous echoes from fixed retinal pathology. For standardisation, each eye was scanned in transverse and longitudinal sections across the four quadrants. When an abnormality was suspected, scans were repeated in orthogonal meridians and in dynamic mode to confirm reproducibility. For analysis, a posterior segment lesion was labelled only when the abnormal echo pattern was consistently demonstrable on repeat sweeps; isolated or non-reproducible echoes were not classified as pathology.

Data Collection and Variables: The recorded variables included age, gender, eye involved, cataract type, diabetes mellitus,

hypertension, preoperative visual acuity, intraocular pressure and B-scan finding. Intraocular pressure was grouped as <10 mmHg, 10–21 mmHg, 22–30 mmHg and >30 mmHg. Posterior segment status was classified as normal or abnormal depending on whether any lesion was detected on B-scan. Abnormal findings were further categorised as posterior vitreous detachment, retinal detachment, vitreous haemorrhage, asteroid hyalosis and posterior staphyloma.

Statistical Analysis: Categorical variables were expressed as frequency and percentage. Associations between posterior segment status and age group, cataract type, diabetes mellitus and hypertension were examined using the chi-square test. A p-value <0.05 was considered statistically significant.

Reporting: The manuscript was prepared with reference to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement for cross-sectional studies. The completed checklist can be provided if requested by the journal.

RESULTS

The study included 120 eyes of 120 subjects. The mean age was 60.5±13.0 years, with near-equal gender distribution (61 males and 59 females). The 61–80 year bracket formed the largest age cluster, accounting for 56 of 120 subjects. The baseline demographic and clinical profile is summarised in Table 1 and shown graphically in Figure 1 and Figure 5.

Table 1. Demographic and clinical profile of the study population

Variable	Category	n	%
Age group (years)	<40	8	6.7
Age group (years)	40–60	49	40.8
Age group (years)	61–80	56	46.7
Age group (years)	>80	7	5.8
Gender	Male	61	50.8
Gender	Female	59	49.2
Eye involved	Right	59	49.2
Eye involved	Left	56	46.7
Eye involved	Both	5	4.2
Cataract type	Mature	92	76.7
Cataract type	Hypermature	23	19.2
Cataract type	Traumatic	5	4.2
Comorbidity	Diabetes mellitus	42	35.0
Comorbidity	Hypertension	30	25.0
Comorbidity	DM + HTN	18	15.0
Visual acuity	CF	46	38.3
Visual acuity	HM	47	39.2
Visual acuity	PL	22	18.3
Visual acuity	No PL	5	4.2
IOP group (mmHg)	<10	2	1.7
IOP group (mmHg)	10–21	94	78.3
IOP group (mmHg)	22–30	21	17.5
IOP group (mmHg)	>30	3	2.5

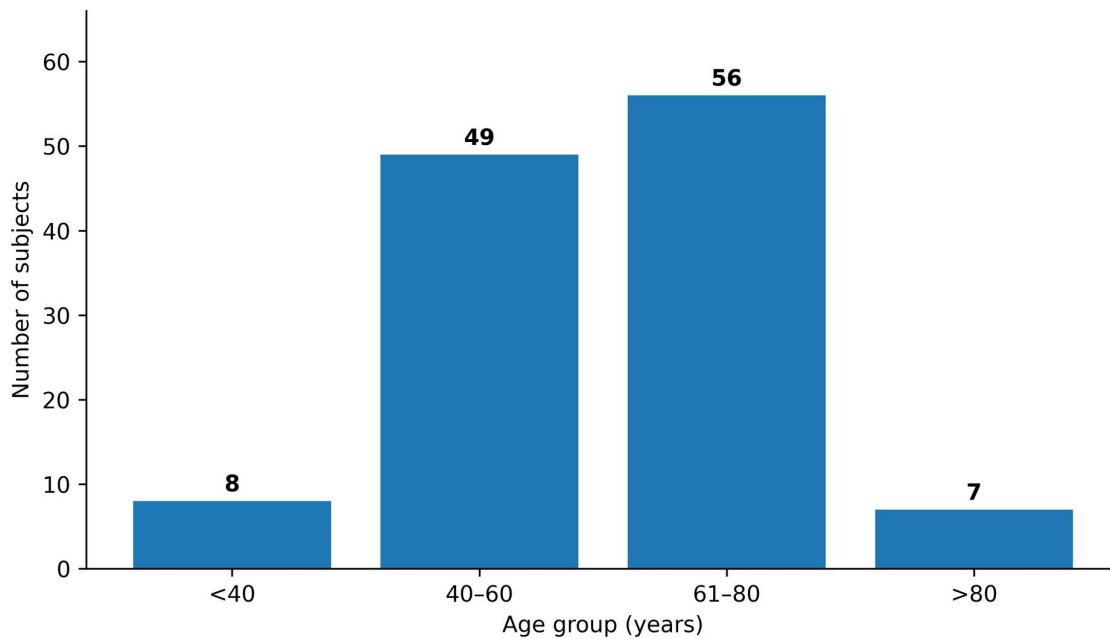


Figure 1: Age-group distribution of the study population

Mature cataract constituted the majority of presentations (92/120, 76.7%), followed by hypermature cataract (23/120, 19.2%) and traumatic cataract (5/120, 4.2%). Diabetes mellitus was present in 42 subjects, hypertension in 30, and both conditions coexisted in 18.

The overall distribution of B-scan findings is presented in Table 2 and Figure 2. B-scan was normal in 79 eyes (65.8%). Abnormal

posterior segment findings were identified in 41 eyes (34.2%). Posterior vitreous detachment was the commonest lesion, observed in 13 eyes (10.8%), followed by retinal detachment in 10 eyes (8.3%), vitreous haemorrhage in eight eyes (6.7%), asteroid hyalosis in six eyes (5.0%) and posterior staphyloma in four eyes (3.3%).

Table 2. Overall distribution of B-scan findings

Finding	n	%	Interpretation
Normal	79	65.8	No posterior segment lesion detected
PVD	13	10.8	Most frequent abnormality
Retinal Detachment	10	8.3	Vision-threatening retinal pathology
Vitreous Hemorrhage	8	6.7	Suggests occult posterior segment bleed
Asteroid Hyalosis	6	5.0	Degenerative vitreous change
Posterior Staphyloma	4	3.3	Posterior ectatic change

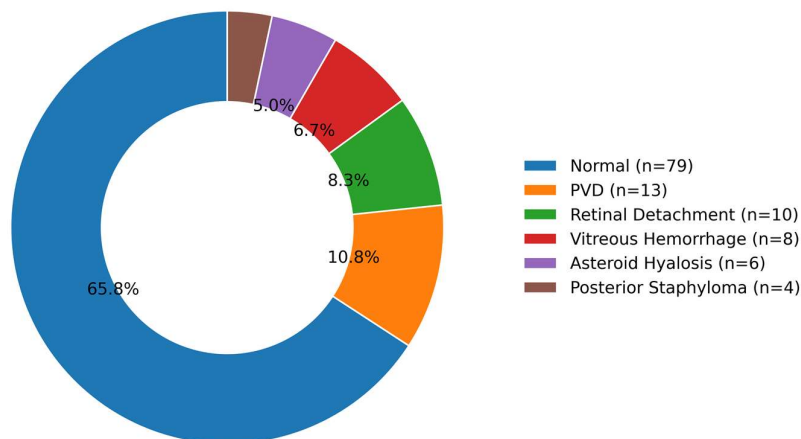


Figure 2: Overall distribution of B-scan findings

Age-wise and cataract-wise associations with posterior segment status are shown in Table 3, and the cataract-type pattern is illustrated in Figure 3. No abnormality was detected below 40 years. In the 40–60 year group, only 2 of 49 eyes had an

abnormal scan. The abnormal burden rose sharply thereafter, with 34 of 56 eyes in the 61–80 year group and 5 of 7 eyes older than 80 years demonstrating posterior segment pathology ($p<0.001$).

Table 3. Association of posterior segment status with age, cataract type and systemic disease

Factor	Category	Normal	Abnormal	Total	p-value
Age group	<40	8	0	8	<0.001
Age group	40–60	47	2	49	
Age group	61–80	22	34	56	
Age group	>80	2	5	7	
Cataract type	Mature	74	18	92	<0.001
Cataract type	Hyperature	0	23	23	
Cataract type	Traumatic	5	0	5	
Diabetes mellitus	Yes	18	24	42	<0.001
Diabetes mellitus	No	61	17	78	
Hypertension	Yes	13	17	30	0.005
Hypertension	No	66	24	90	

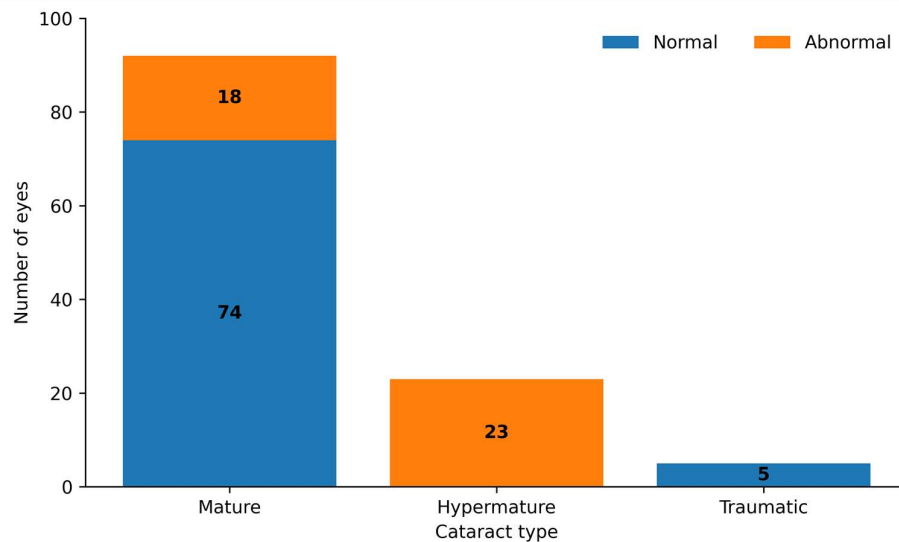


Figure 3: Posterior segment status by cataract type

Cataract morphology also showed a strong association. All 23 hyperature cataracts had abnormal B-scan findings, whereas 74 of 92 mature cataracts had a normal posterior segment. None of the five traumatic cataracts in this series demonstrated posterior pathology on B-scan ($p<0.001$).

Systemic disease showed the same direction of effect. Among subjects with diabetes mellitus, 24 of 42 had an abnormal scan

compared with 17 of 78 subjects without diabetes ($p<0.001$). Hypertension was also associated with a higher share of abnormal findings (17/30 versus 24/90; $p=0.005$). The lesion profile according to diabetes status is detailed in Table 4 and depicted in Figure 4.

Table 4. Pattern of abnormal findings according to diabetes status

Abnormal finding	Diabetes present (n=42)	No diabetes (n=78)	Total
PVD	12	1	13
Retinal Detachment	7	3	10
Vitreous Hemorrhage	5	3	8
Asteroid Hyalosis	0	6	6
Posterior Staphyloma	0	4	4

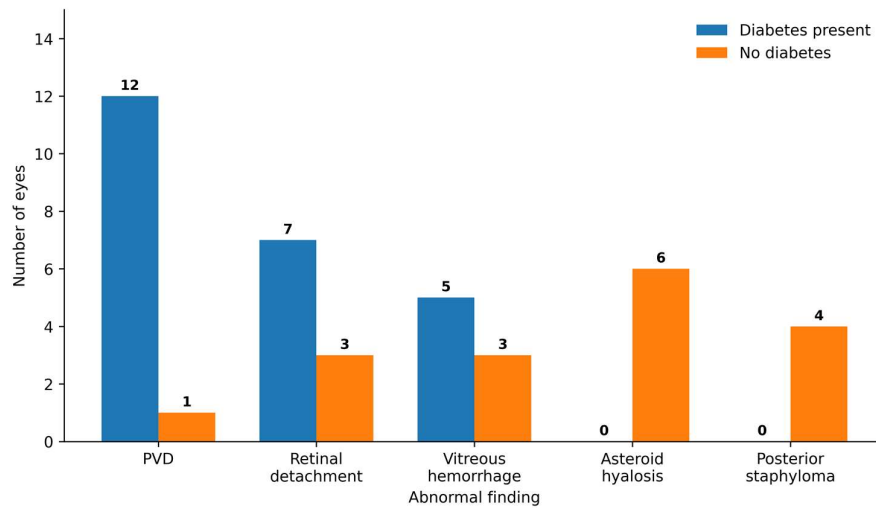


Figure 4: Pattern of abnormal findings by diabetes status

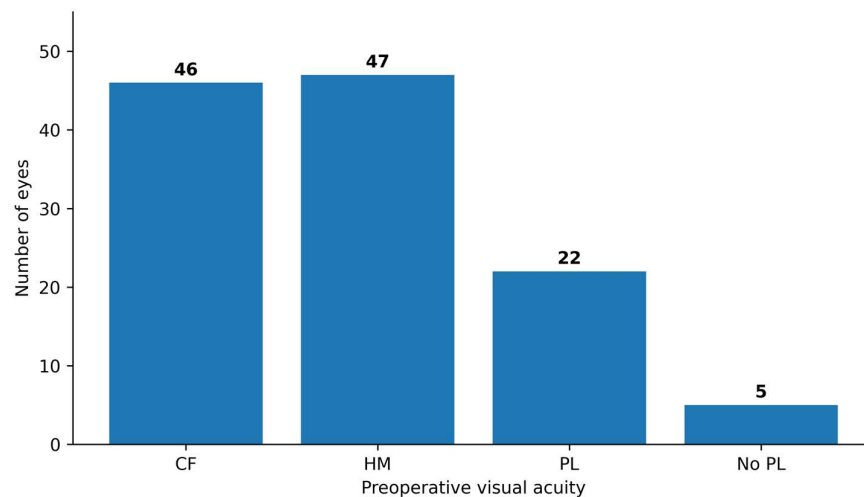


Figure 5: Preoperative visual acuity distribution

DISCUSSION

A sizeable proportion of dense cataract eyes in this study carried occult posterior segment disease on preoperative B-scan. The abnormality rate of 34.2% is clinically relevant because it reminds the cataract surgeon that a white or densely opaque lens is not always the only pathology present [11].

Posterior vitreous detachment emerged as the commonest abnormality in this series, followed by retinal detachment and vitreous haemorrhage. Earlier ultrasonographic work has shown a comparable pattern, with posterior vitreous and retinal lesions accounting for much of the clinically meaningful pathology found behind opaque media [5]. Similar hospital-based studies in mature cataract have also reported retinal detachment and vitreous pathology as recurrent findings that alter counselling before surgery [8].

The age effect was pronounced. No abnormality was recorded below 40 years, whereas pathology became much more frequent after 60 years. That trend is clinically plausible. Degenerative vitreoretinal changes, posterior vitreous separation and age-linked retinal disease become more common as age advances, and this increases the chance of detecting an occult lesion when the lens is already opaque [12].

The association with cataract type was even stronger. Every hypermature cataract in the present series demonstrated abnormality on B-scan, while the majority of mature cataracts did

not. Hypermature cataract often reflects delayed presentation, long-standing lens opacity and neglect of concurrent posterior disease. Other observational studies have similarly noted a heavier posterior segment burden among dense and hypermature cataracts [13].

The 100% abnormality rate among hypermature cataracts is a noteworthy signal. Clinically, it may reflect longer-standing lens opacity and the tendency for older age and systemic comorbidity to cluster in this subgroup. At the same time, the study context could amplify this proportion: hypermature cataracts reaching a tertiary centre may represent a selected referral group, and enrolment was restricted to eyes where fundus visualisation was inadequate. Therefore, this finding should be interpreted as characteristic of this clinical cohort rather than a population prevalence estimate.

Diabetes and hypertension also moved in the expected direction. Subjects with diabetes showed a higher proportion of abnormal scans, and diabetic eyes contributed disproportionately to retinal detachment and vitreous haemorrhage. This is clinically plausible because retinal ischaemia, tractional change and vitreous bleeding are more likely to coexist when dense cataract is superimposed on systemic disease. Recent cross-sectional work from tertiary settings has supported the continued role of B-scan in precisely these eyes, where direct posterior segment assessment is limited [14].

LIMITATIONS

The study was single-centre and descriptive, so the findings should not be overgeneralised to every cataract population. The observed spectrum reflects eyes that specifically required B-scan because fundus visualisation was inadequate. Because recruitment was hospital-based and limited to eyes requiring B-scan due to an obscured fundus, referral and selection effects are possible, particularly for hypermature cataract.

Posterior diagnoses were limited to the categories recorded on ultrasonography, and postoperative visual outcome could not be correlated in this analysis. Even so, the study offers a practical preoperative profile of eyes in which B-scan genuinely influences counselling and operative expectation. Interobserver agreement was not formally assessed; however, repeat scanning across meridians and dynamic sweeps were used to improve internal consistency when classifying lesions.

CONCLUSION

B-scan ultrasonography remains a dependable preoperative screening tool in mature cataract. In this series, 41 of 120 eyes (34.2%) showed an occult posterior segment lesion, with abnormal scans concentrated in older subjects, hypermature cataract and systemic comorbidity. Routine preoperative B-scan in such settings can refine prognosis, guide counselling and reduce avoidable surprises after cataract surgery.

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