

Assessment of the Role of B Scan Ultrasound in Diagnosis of Posterior Segment Ocular PathologiesRam Shankar Kumar¹, Haroon Rashid²¹Associate Professor, Department of Radiology, Narayan Medical College & Hospital (NMCH), Jamuhar, Rohtas, Bihar, India²Associate Professor, Department of Ophthalmology, Narayan Medical College & Hospital (NMCH), Jamuhar, Rohtas, Bihar, India

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Abstract

Background: Posterior segment pathologies of the eye are important causes of visual morbidity and may remain undetected when routine ophthalmoscopic examination is hindered by opaque ocular media. Conditions such as vitreous hemorrhage, retinal detachment, posterior vitreous detachment, choroidal detachment, intraocular foreign body, endophthalmitis, and intraocular masses require early diagnosis for timely management. In such situations, B-scan ultrasonography serves as a rapid, non-invasive, and reliable imaging modality for evaluation of the posterior segment.

Aim: To study the role of B-scan ultrasonography in the diagnosis of posterior segment pathologies of the eye in patients attending a tertiary care hospital.

Material and Methods: This hospital-based observational study was conducted in the Department of Ophthalmology at a tertiary care hospital and included 110 patients with suspected posterior segment pathology or cases in which posterior segment evaluation was not possible due to media opacity. After obtaining informed consent, all patients underwent detailed clinical history taking and comprehensive ophthalmic examination. B-scan ultrasonography was performed using a high-frequency ophthalmic probe in axial, transverse, and longitudinal planes. The findings were documented and correlated with clinical diagnoses wherever possible. Data were entered into Microsoft Excel and analyzed using SPSS version 27.0. Quantitative variables were expressed as mean \pm standard deviation, while qualitative variables were expressed as frequency and percentage. Appropriate statistical tests were applied, and a p-value of less than 0.05 was considered statistically significant.

Results: The mean age of the patients was 46.82 ± 17.34 years, with the maximum number of patients in the 41–60 years age group (40.00%). Males constituted 61.82% of the study population. Diminution of vision was the most common presenting complaint (83.64%). The most common indication for B-scan was dense cataract or opaque lens (30.91%). Vitreous hemorrhage was the most frequently detected posterior segment pathology on B-scan (24.55%), followed by retinal detachment (20.00%) and posterior vitreous detachment (14.55%). Abnormal B-scan findings were present in 90.91% of cases. A statistically significant association was observed between media opacity and abnormal B-scan findings ($p = 0.003$). Ocular trauma showed a significant association with vitreous hemorrhage ($p = 0.002$) and intraocular foreign body ($p < 0.001$).

Conclusion: B-scan ultrasonography is a valuable, non-invasive, and cost-effective tool for diagnosing posterior segment pathologies, especially in eyes with opaque media and traumatic injuries. It has high diagnostic utility and plays an essential role in the evaluation and management of posterior segment ocular disorders in tertiary care settings.

Keywords: B-scan Ultrasonography; Posterior Segment; Retinal Detachment; Vitreous Hemorrhage; Ocular Trauma.

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Introduction

Posterior segment pathologies of the eye constitute an important group of disorders that may lead to significant visual impairment or even irreversible blindness if diagnosis is delayed. These conditions include retinal detachment, vitreous hemorrhage,

posterior vitreous detachment, choroidal detachment, endophthalmitis, intraocular foreign body, posteriorly dislocated lens, and intraocular masses. Many of these disorders present with nonspecific symptoms such as diminution of

vision, floaters, flashes of light, pain, or redness, and clinical differentiation on the basis of symptoms alone is often difficult. Early recognition of posterior segment disease is therefore essential for timely referral, appropriate treatment planning, and prevention of permanent visual loss. In daily ophthalmic practice, this need becomes even more critical in emergency settings and tertiary care hospitals, where patients often present with advanced disease, trauma, or media opacity that limits routine posterior segment examination [1]. The diagnosis of posterior segment pathology traditionally relies on detailed ophthalmic examination, including slit-lamp biomicroscopy, indirect ophthalmoscopy, and fundus evaluation after pupillary dilatation. However, these methods are not always feasible. Visualization of the posterior segment may be severely hindered by dense cataract, corneal opacity, hyphema, vitreous hemorrhage, inflammatory exudates, or severe ocular trauma. In such situations, the clinician may be unable to directly inspect the retina, vitreous cavity, choroid, or posterior coat of the globe. This creates a major diagnostic challenge, especially when urgent decisions regarding surgery or medical management are required. Under these circumstances, an imaging modality that is rapid, noninvasive, repeatable, and effective even in opaque media becomes indispensable in ophthalmology [2]. B-scan ultrasonography has long occupied an important place in ophthalmic imaging because it provides a two-dimensional cross-sectional representation of the eye and orbit in real time. Unlike optical imaging techniques, which depend on relatively clear ocular media, B-scan ultrasound can evaluate internal ocular structures despite marked media opacity. It is especially useful in assessing the vitreous, retina, choroid, sclera, and posterior globe contour, and it can also help identify associated orbital abnormalities. Characteristic sonographic patterns allow differentiation between retinal detachment, posterior vitreous detachment, vitreous hemorrhage, choroidal detachment, and intraocular foreign body. Because it is bedside-applicable, relatively inexpensive, and widely available, B-scan continues to be highly relevant in both routine and emergency ophthalmic care [3].

Posterior segment ocular disorders encompass a wide spectrum of sight-threatening conditions affecting the vitreous, retina, choroid, and optic nerve. Accurate evaluation of these structures is essential for timely diagnosis and management. However, direct ophthalmoscopic visualization of the posterior segment may be impeded by opaque ocular media such as dense cataracts, corneal scars, and vitreous hemorrhage. In such clinical scenarios, B-scan ultrasonography has emerged as an indispensable diagnostic modality due to its non-invasive nature, real-time imaging capability, and

high resolution cross-sectional display of intraocular structures (Agrawal & Ahirwal 2015) [4]. Subsequent studies have reinforced the diagnostic utility of B-scan, demonstrating its effectiveness in identifying conditions such as vitreous hemorrhage, retinal detachment, posterior vitreous detachment, and intraocular foreign bodies, particularly in patients with opaque media (Nanda et al. 2017) [5]. Another important feature of B-scan ultrasonography is its adaptability to different levels of healthcare delivery. In tertiary care centers, it supports decision-making in complex referrals, trauma, inflammatory disease, and preoperative work-up. In resource-limited environments, it may be one of the few available imaging tools capable of revealing vision-threatening posterior segment abnormalities. New developments in portable ophthalmic ultrasound devices have further increased the potential reach of this modality, making it more accessible outside conventional imaging rooms and closer to point-of-care practice. This portability, combined with its noninvasive nature and rapid execution, strengthens the role of B-scan as a highly practical diagnostic investigation in modern ophthalmology. Despite its many advantages, B-scan ultrasonography is operator dependent and requires familiarity with ocular anatomy, scanning techniques, probe orientation, gain adjustment, and interpretation of reflectivity patterns. Accurate differentiation between retinal detachment, posterior vitreous detachment, and dense vitreous echoes may at times be challenging, particularly for less experienced examiners. Even so, continuous improvements in training, image optimization, and technological refinement have enhanced its reliability and diagnostic confidence. As the burden of posterior segment disease remains substantial, especially in patients with opaque ocular media, B-scan ultrasonography continues to be an invaluable imaging modality for early diagnosis and clinical management [6].

Aim & Objectives

Aim: To evaluate the role of B-scan ultrasonography in the diagnosis of posterior segment pathologies of the eye in patients with suspected ocular diseases and media opacity preventing fundus visualization.

Objectives

1. To determine the demographic profile (age, sex distribution, and laterality) of patients undergoing B-scan ultrasonography.
2. To analyze the presenting clinical symptoms associated with posterior segment ocular pathology.
3. To identify the major indications for performing B-scan ultrasonography.

4. To evaluate the spectrum of posterior segment pathologies detected on B-scan imaging.
5. To assess the diagnostic yield of B-scan ultrasonography in detecting ocular abnormalities.
6. To study the association between media opacity and abnormal B-scan findings.
7. To analyze the relationship between ocular trauma and specific posterior segment pathologies detected on B-scan.

Materials & Methods

Study Design: This was a hospital-based observational cross-sectional study conducted to evaluate the diagnostic role of B-scan ultrasonography in posterior segment pathologies of the eye.

Study Population: The study included 110 patients of either sex and all age groups presenting with suspected posterior segment pathology or cases in which posterior segment evaluation was not possible due to media opacity.

Study Place: The study was conducted in the Department of Ophthalmology, in collaboration with the Departments of Radiology, at Narayan Medical College & Hospital (NMCH), Jamuhar, Rohtas, Bihar, India

Study Period: The study was carried out over a period of 17 months, from June 2023 to October 2024.

Ethical Considerations: Ethical clearance was obtained from the Institutional Ethics Committee (IEC) prior to commencement of the study. Written informed consent was obtained from all participants or guardians (in minors). Confidentiality of patient data was strictly maintained. The study adhered to the Declaration of Helsinki guidelines.

Inclusion Criteria

- Patients with clinical suspicion of posterior segment pathology.
- Patients with opaque ocular media preventing fundus visualization (e.g., dense cataract, vitreous hemorrhage, corneal opacity, hyphema).
- Patients with suspected posterior segment conditions such as retinal detachment, vitreous hemorrhage, posterior vitreous detachment, choroidal detachment, intraocular foreign body, intraocular tumors, endophthalmitis, lens dislocation, or other posterior segment abnormalities were included in the study.
- Patients willing to participate and provide consent.

Exclusion Criteria

- Patients unwilling to participate.

- Patients with open globe injury where ultrasound was contraindicated.
- Patients with severe ocular trauma not suitable for examination.
- Patients with incomplete clinical or imaging records.

Methodology

All enrolled patients underwent a structured evaluation:

Clinical Evaluation

- Detailed history including age, sex, symptoms, trauma history, and duration.
- Symptoms recorded: diminution of vision, floaters, flashes, pain, redness.
- Comprehensive ocular examination:
 - Visual acuity (Snellen/age-appropriate methods)
 - Slit lamp examination
 - Intraocular pressure (where feasible)
 - Fundus examination (direct/indirect ophthalmoscopy when possible)

B-Scan Ultrasonography Technique

- Performed using a high-frequency (10 MHz) ophthalmic ultrasound probe.
- Conducted with closed eyelid using sterile coupling gel.
- Patient positioned supine or seated.
- Scanning performed in:
 - Axial plane
 - Longitudinal plane
 - Transverse plane
- Dynamic real-time scanning with ocular movements was used to assess mobility of lesions.
- Machine settings (gain, depth) were optimized for image clarity.

Investigations Assessed on B-Scan

The following findings were systematically evaluated:

- Vitreous hemorrhage / vitreous opacities
- Posterior vitreous detachment
- Retinal detachment
- Choroidal detachment
- Intraocular foreign body
- Intraocular masses
- Endophthalmitis-related echoes
- Dislocated lens
- Membrane characteristics (thickness, reflectivity, mobility, attachment site)
- After-movements and dynamic changes
- Associated orbital abnormalities (if present)

Correlation of Findings

- B-scan findings were correlated with clinical diagnosis, intraoperative findings whenever available, fundus examination after the clearing of media opacity, and other relevant diagnostic evaluations.
- Final diagnosis was based on composite clinical–radiological correlation.

Outcome Measures

Primary Outcome: Diagnostic utility and role of B-scan ultrasonography in detecting posterior segment pathologies.

Secondary Outcomes

- Frequency and distribution of posterior segment lesions
- Demographic profile of patients
- Laterality of involvement
- Common presenting symptoms
- Association between clinical features and ultrasound findings
- Diagnostic yield in cases with opaque ocular media

- Spectrum of pathologies (RD, VH, PVD, IOFB, tumors, etc.)

Statistical Analysis

- Data were entered into Microsoft Excel 365 and analyzed using IBM SPSS Statistics version 27.0.
- Quantitative variables (e.g., age) were expressed as:
 - Mean ± Standard Deviation (SD)
- Qualitative variables (e.g., gender, diagnosis, symptoms) were expressed as:
 - Frequency (n) and Percentage (%)
- Associations between categorical variables were analyzed using:
 - Chi-square test (χ^2 test)
 - Fisher’s exact test (when expected cell count <5)
- A p-value < 0.05 was considered statistically significant.

Results

Table 1: Distribution of patients according to demographic characteristics and laterality

Variable	Category	Frequency (n)	Percentage (%)
Age group (years)	≤20	12	10.91
	21–40	28	25.45
	41–60	44	40.00
	>60	26	23.64
Sex	Male	68	61.82
	Female	42	38.18
Laterality	Right eye	49	44.55
	Left eye	45	40.91
	Bilateral	16	14.55
Mean age (years)	46.82 ± 17.34 years		

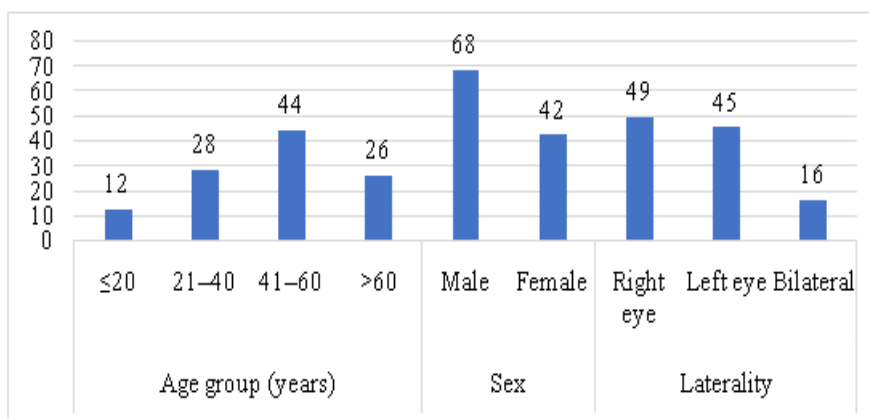


Figure 1: Distribution of patients according to demographic characteristics and laterality

Table 1 and figure I, shows the distribution of study participants according to age, sex, and laterality of eye involvement. The mean age of the patients was 46.82 ± 17.34 years, indicating that middle-aged and elderly individuals formed a major proportion of the study population. The largest number of

patients belonged to the 41–60 years age group, accounting for 44 cases (40.00%), followed by the 21–40 years age group with 28 patients (25.45%). Patients aged more than 60 years constituted 26 cases (23.64%), while the least represented group was patients aged 20 years or less, comprising 12

cases (10.91%). This age distribution suggests that posterior segment pathologies evaluated by B-scan ultrasonography were more commonly encountered in middle-aged and older patients, possibly due to the increasing prevalence of degenerative, vascular, traumatic, and media opacity-related conditions in these age groups.

With regard to sex distribution, males constituted 68 patients (61.82%), whereas females accounted for 42 patients (38.18%). This male predominance

indicates that posterior segment pathologies requiring B-scan evaluation were more frequent among males in the present study.

This may be attributable to greater occupational exposure to trauma, outdoor activities, and healthcare-seeking patterns among male patients. In terms of laterality, right eye involvement was noted in 49 patients (44.55%), left eye involvement in 45 patients (40.91%), and bilateral involvement in 16 patients (14.55%).

Table 2: Distribution of patients according to presenting complaints

Presenting complaint*	Frequency (n = 110)	Percentage (%)
Diminution of vision	92	83.64
Ocular trauma	31	28.18
Floater	24	21.82
Pain	19	17.27
Redness	17	15.45
Flashes of light	11	10.00

Table 2 depicts the presenting complaints of the study participants. Diminution of vision was the most common presenting symptom, reported by 92 patients (83.64%), making it the predominant clinical feature in this series. This finding highlights that reduced visual acuity is the principal symptom prompting evaluation for posterior segment pathology, especially when direct fundus visualization is difficult or impossible. Ocular trauma was the second most frequent complaint, present in 31 patients (28.18%), emphasizing the important role of B-scan ultrasonography in the assessment of traumatic ocular conditions. Floaters were reported by 24 patients (21.82%), which may

correlate clinically with conditions such as vitreous hemorrhage or posterior vitreous detachment. Pain was observed in 19 patients (17.27%), and redness in 17 patients (15.45%), suggesting that inflammatory, infectious, or traumatic causes were present in a considerable number of cases. Flashes of light were the least common presenting complaint, seen in 11 patients (10.00%), but remain clinically important as they may indicate vitreoretinal traction or early retinal detachment. Since multiple complaints were present in some patients, the total percentage exceeds 100%, reflecting overlapping symptomatology of posterior segment disorders.

Table 3: Distribution of patients according to indication for B-scan ultrasonography

Indication	Frequency (n=110)	Percentage (%)
Dense cataract / opaque lens	34	30.91
Vitreous hemorrhage obscuring fundus view	23	20.91
Ocular trauma	21	19.09
Corneal opacity / edema	12	10.91
Suspected retinal detachment	10	9.09
Endophthalmitis / severe media haze	6	5.45
Suspected intraocular foreign body / mass lesion	4	3.64

Table 3 shows the indications for performing B-scan ultrasonography in the study subjects. The most common indication was dense cataract or opaque lens, observed in 34 patients (30.91%).

This demonstrates that media opacity due to lenticular causes was the leading reason for inability to visualize the posterior segment clinically, thereby necessitating B-scan examination. Vitreous hemorrhage obscuring the fundus view was the second most common indication, noted in 23 patients (20.91%), followed closely by ocular trauma in 21 patients (19.09%). These findings underline the usefulness of B-scan

in cases where blood in the vitreous cavity or traumatic ocular injury prevents adequate posterior segment examination.

Corneal opacity or edema accounted for 12 cases (10.91%), again reflecting the value of ultrasound in situations of anterior segment media disturbance. Suspected retinal detachment was the indication in 10 patients (9.09%), showing that B-scan was also used as a confirmatory diagnostic tool when retinal pathology was clinically suspected. Endophthalmitis or severe media haze was seen in 6 patients (5.45%), while suspected intraocular foreign body or mass lesion constituted the least

common indication, occurring in 4 patients (3.64%).

Table 4: Distribution of posterior segment pathologies detected on B-scan ultrasonography

B-scan finding	Frequency (n=110)	Percentage (%)
Vitreous hemorrhage	27	24.55
Retinal detachment	22	20.00
Posterior vitreous detachment	16	14.55
Chorioretinal thickening / endophthalmitis	10	9.09
Intraocular foreign body	8	7.27
Choroidal detachment	7	6.36
Dislocated lens / posteriorly dislocated lens	6	5.45
Intraocular mass	4	3.64
Normal posterior segment study	10	9.09

Table 4 presents the spectrum of posterior segment pathologies detected on B-scan ultrasonography. Vitreous hemorrhage was the most common abnormality identified, seen in 27 patients (24.55%). This indicates that hemorrhage within the vitreous cavity was a major posterior segment finding in the study population and supports the value of B-scan in differentiating vitreous echoes from other membranous lesions. Retinal detachment was the second most common pathology, detected in 22 patients (20.00%). This is clinically significant, as retinal detachment is a vision-threatening condition in which early and accurate diagnosis is essential, especially when direct fundus examination is not feasible. Posterior vitreous detachment was observed in 16 patients (14.55%), showing that B-scan was useful in identifying mobile membranous lesions within the vitreous cavity and in distinguishing them from retinal detachment. Chorioretinal thickening or endophthalmitis was found in 10 patients (9.09%), indicating that B-scan also contributed to the evaluation of inflammatory and infective

intraocular conditions. Intraocular foreign body was detected in 8 patients (7.27%), which is particularly important in the context of ocular trauma, as prompt localization can guide surgical management and prevent complications.

Choroidal detachment was identified in 7 patients (6.36%), and dislocated lens or posteriorly dislocated lens was seen in 6 patients (5.45%), both representing conditions where B-scan provides critical anatomical information not always evident clinically. Intraocular mass lesions were detected in 4 patients (3.64%), demonstrating the role of B-scan in the preliminary evaluation of intraocular tumors or space-occupying lesions. A normal posterior segment was noted in 10 patients (9.09%), indicating that no detectable posterior segment pathology was identified despite clinical suspicion or inability to visualize the fundus. Overall, abnormal posterior segment findings were present in 100 out of 110 patients (90.91%), demonstrating a high diagnostic yield of B-scan ultrasonography in this clinical setting.

Table 5: Association of media opacity with B-scan abnormality

Media opacity	Abnormal B-scan finding present	Normal B-scan finding	Total	p value
Present (n=75)	72 (96.00%)	3 (4.00%)	75 (100.00%)	0.003
Absent (n=35)	28 (80.00%)	7 (20.00%)	35 (100.00%)	
Total	100 (90.91%)	10 (9.09%)	110 (100.00%)	

Table 5 shows the association between media opacity and the presence of B-scan abnormalities. Among the 75 patients with media opacity, abnormal B-scan findings were present in 72 cases (96.00%), while only 3 patients (4.00%) had a normal B-scan study. In contrast, among the 35 patients without media opacity, abnormal B-scan findings were present in 28 cases (80.00%), whereas 7 patients (20.00%) had normal findings.

Overall, abnormal B-scan findings were observed in 100 patients (90.91%), and normal findings in 10 patients (9.09%). The difference between the two groups was statistically significant, with a p-value of 0.003. This indicates a strong association between media opacity and the likelihood of detecting posterior segment pathology on B-scan ultrasonography.

Table 6: Association of ocular trauma with selected B-scan findings

B-scan finding	Trauma present (n=31)	Trauma absent (n=79)	Total	p value
Vitreous hemorrhage	14 (45.16%)	13 (16.46%)	27 (24.55%)	0.002
Retinal detachment	8 (25.81%)	14 (17.72%)	22 (20.00%)	0.341
Intraocular foreign body	7 (22.58%)	1 (1.27%)	8 (7.27%)	<0.001
Posterior vitreous detachment	2 (6.45%)	14 (17.72%)	16 (14.55%)	0.135

Table 6 demonstrates the association of ocular trauma with selected B-scan findings. Vitreous hemorrhage was identified in 14 of 31 trauma cases (45.16%) compared with 13 of 79 non-trauma cases (16.46%), and this association was statistically significant ($p = 0.002$). This suggests that vitreous hemorrhage was significantly more common among patients with a history of ocular trauma. Retinal detachment was present in 8 trauma cases (25.81%) and 14 non-trauma cases (17.72%); however, this difference was not statistically significant ($p = 0.341$).

Intraocular foreign body was detected in 7 trauma cases (22.58%) but in only 1 non-trauma case (1.27%), and this association was highly statistically significant ($p < 0.001$). This clearly shows that intraocular foreign body was strongly associated with ocular trauma and highlights the important role of B-scan in traumatic eye injuries. Posterior vitreous detachment was seen in 2 trauma cases (6.45%) and 14 non-trauma cases (17.72%); however, this association was not statistically significant ($p = 0.135$). This suggests that posterior vitreous detachment was more commonly related to non-traumatic causes, such as age-related vitreous degeneration, rather than trauma in the present study.

Discussion

In the present study, the mean age of the patients was 46.82 ± 17.34 years, and the largest proportion belonged to the 41–60 years age group (40.00%), followed by 21–40 years (25.45%), >60 years (23.64%), and ≤ 20 years (10.91%). This shows that posterior segment pathologies evaluated by B-scan were more frequent in middle-aged and older individuals. A comparable age trend was reported by Nanda et al. (2017), who studied 200 patients with opaque ocular media and found a mean age of 47.85 ± 22.95 years, with the maximum number of patients in the ≥ 61 years group (34%). The slight difference from the present study, where the peak shifted to 41–60 years, may be due to the inclusion of both traumatic and non-traumatic posterior segment disorders in the current series, rather than a predominantly opaque-media screening population alone [7].

Male predominance was observed in the present study, with 68 males (61.82%) and 42 females (38.18%), while laterality showed right eye

involvement in 44.55%, left eye involvement in 40.91%, and bilateral disease in 14.55%. This male excess is in agreement with Shaikh et al. (2009), who evaluated 227 eyes of 200 patients with dense cataract and reported 116 males (58.00%) and 84 females (42.00%). They also documented bilateral cataract in 27 of 200 patients (13.50%), which is very close to the bilateral involvement of 14.55% in the present study. The near-equal distribution of right and left eye disease in our series indicates no marked side predilection, while the lower bilateral frequency suggests that most posterior segment lesions requiring B-scan remain largely unilateral at presentation [8].

Regarding presenting complaints, diminution of vision was by far the commonest symptom in the present study, reported by 92 patients (83.64%), followed by ocular trauma in 31 (28.18%), floaters in 24 (21.82%), pain in 19 (17.27%), redness in 17 (15.45%), and flashes of light in 11 (10.00%). This pattern supports the clinical reality that reduced vision is the usual trigger for posterior segment evaluation, especially when media opacity limits fundus examination. A similar symptom profile was noted by Maheswar Chaudhury et al. (2021), in whom low vision was the leading presenting complaint in 42 of 84 patients (50.00%), followed by black spots in the visual field in 10.71% and flashes of light in 8.33%. Although the proportion of visual loss was higher in the present study, both studies consistently identify decreased vision as the dominant symptom that prompts B-scan referral [9].

The most common indication for B-scan in the present study was dense cataract or opaque lens in 34 patients (30.91%), followed by vitreous hemorrhage obscuring fundus view in 23 (20.91%), ocular trauma in 21 (19.09%), corneal opacity/edema in 12 (10.91%), suspected retinal detachment in 10 (9.09%), endophthalmitis/severe media haze in 6 (5.45%), and suspected intraocular foreign body or mass lesion in 4 (3.64%). This pattern again emphasizes that opaque media remains the chief reason for ultrasonographic assessment. Bhavani et al. (2023) similarly reported that cataract was the leading cause of opaque media in 92 of 250 eyes, while retinal detachment was seen in 55 eyes, vitreous hemorrhage in 47 eyes, and posterior vitreous detachment in 44 eyes. Thus, both studies support the use of B-scan primarily as an indispensable investigation in eyes where

lenticular opacity prevents direct visualization of the posterior segment [10]. With respect to the spectrum of B-scan findings, vitreous hemorrhage was the commonest pathology in the present study, detected in 27 patients (24.55%), followed by retinal detachment in 22 (20.00%) and posterior vitreous detachment in 16 (14.55%). These findings are comparable to those of Dawood et al. (2008), who performed 320 B-scans and found vitreous disorders in 98 cases (44.95%) and retinal detachment in 58 cases (26.60%); within the vitreous disorders, vitreous hemorrhage alone accounted for 35 cases (35.82%) and posterior vitreous detachment for 9 cases (9.08%). Although the proportion of vitreous pathology was somewhat lower in the present study, both studies show that vitreous hemorrhage is the dominant posterior segment abnormality detected by B-scan, underscoring the value of ultrasound in differentiating vitreous echoes from retinal or choroidal membranes [11].

The present study also demonstrated a substantial burden of retinal detachment and posterior vitreous detachment, with retinal detachment seen in 20.00% and posterior vitreous detachment in 14.55% of patients. In comparison, Qureshi et al. (2010), in a large preoperative cataract series of 750 patients, reported posterior segment lesions in 90 cases, of which retinal detachment was seen in 25 eyes, posterior vitreous detachment in 14 eyes, vitreous hemorrhage in 24 eyes, and intraocular foreign body in 6 eyes. The lower frequencies in that study likely reflect its restriction to cataract patients undergoing screening rather than a broader cohort of clinically suspected posterior segment disease. Nevertheless, both studies consistently demonstrate that retinal detachment and posterior vitreous detachment are among the most important lesions recognized by B-scan because of their direct impact on visual prognosis and surgical planning [12].

Less frequent abnormalities in the present series included chorioretinal thickening/endophthalmitis in 9.09%, intraocular foreign body in 7.27%, choroidal detachment in 6.36%, dislocated lens/posteriorly dislocated lens in 5.45%, and intraocular mass in 3.64%, while only 9.09% had a normal posterior segment study. Javed et al. (2007), in 463 eyes with opaque media, reported 60 cases of vitreous hemorrhage, 68 retinal detachments, 51 tractional retinal detachments, 4 retinoblastomas, 2 choroidal pathologies, 2 persistent hyperplastic primary vitreous, and multiple pathologies in 163 patients (31.20%).

Compared with that wider diagnostic spectrum, the present study showed relatively higher proportions of inflammatory and traumatic lesions such as choroidal detachment and lens dislocation, which may be explained by the tertiary-care referral

nature of the present sample. Even so, both studies confirm that B-scan is capable of identifying not only common vitreoretinal lesions but also rarer masses, choroidal disorders, and lens-related posterior segment abnormalities that may not be clinically visible [13]. A notable finding in the present study was the strong association between media opacity and abnormal B-scan findings. Among 75 patients with media opacity, 72 (96.00%) showed abnormal findings, whereas only 3 (4.00%) had a normal scan; in contrast, among 35 patients without media opacity, abnormal findings were present in 28 (80.00%). This association was statistically significant ($p=0.003$), highlighting the particularly high diagnostic yield of B-scan in eyes with obscured media. This observation is in line with the classic study by Anteby et al. (1998), who retrospectively evaluated 509 dense cataract patients and found posterior segment pathology in 19.60% on preoperative ultrasonography. Although the absolute proportion of abnormalities was much higher in the present study, the difference is understandable because our sample was enriched with clinically suspected posterior segment disease and traumatic cases, whereas Anteby et al. studied routine dense cataract referrals. Even so, both studies support the same conclusion: when ocular media are opaque, B-scan becomes a crucial method for uncovering occult posterior segment pathology [14]. The association of trauma with specific B-scan abnormalities in the present study was also clinically meaningful. Vitreous hemorrhage was present in 14 of 31 trauma cases (45.16%) versus 13 of 79 non-trauma cases (16.46%), showing a significant association ($p=0.002$). Intraocular foreign body was found in 7 trauma cases (22.58%) but only 1 non-trauma case (1.27%), which was highly significant ($p<0.001$), whereas retinal detachment and posterior vitreous detachment did not show statistically significant differences. These findings compare well with Ali et al. (2018), who studied 126 ocular trauma patients and found vitreous hemorrhage in 42 cases (33.30%), intraocular foreign body in 31 (24.60%), and retinal detachment in 14 (11.10%). Thus, both studies identify vitreous hemorrhage and intraocular foreign body as the principal trauma-related posterior segment lesions detectable by B-scan, reaffirming its major role in rapid assessment and treatment planning in ocular trauma [15].

Limitations of the Study

- The study was conducted on a relatively small sample size ($n = 110$), which may limit generalizability.
- Being a single-center study, findings may not represent the broader population.
- B-scan findings were not universally confirmed with gold standard investigations

such as MRI or intraoperative correlation in all cases.

- Operator-dependent variability in ultrasound interpretation may have influenced diagnostic accuracy.
- The cross-sectional design limits assessment of disease progression and long-term outcomes.
- Some posterior segment pathologies with early or subtle changes may have been missed due to resolution limitations of ultrasound.
- Patients with normal B-scan findings were not followed longitudinally for delayed manifestations.

Conclusion

B-scan ultrasonography is a highly effective, non-invasive, and reliable imaging modality for the evaluation of posterior segment ocular pathologies, particularly in cases where direct visualization of the fundus is not possible due to media opacity. In the present study, a high diagnostic yield was observed, with vitreous hemorrhage and retinal detachment being the most frequently detected abnormalities. The study demonstrates a strong association between media opacity and detection of posterior segment pathology, confirming the crucial role of B-scan in diagnostic evaluation. Ocular trauma showed a significant correlation with vitreous hemorrhage and intraocular foreign bodies, highlighting its importance in emergency ocular assessment. Overall, B-scan ultrasonography serves as an essential diagnostic tool in ophthalmic practice, aiding in early detection, clinical decision-making, and surgical planning for posterior segment diseases, especially in resource-limited settings where advanced imaging modalities may not be readily available.

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