

# Role of B-scan Ultrasonography in Diagnosing Posterior Segment Orbital Pathologies: A Hospital-based Cross-sectional Study of Clinicoradiological Concordance

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## ABSTRACT

**Background:** Posterior segment pathologies, including retinal detachment, vitreous hemorrhage and posterior vitreous detachment, are clinically important causes of visual morbidity. Direct ophthalmoscopic assessment may be limited by opaque ocular media, dense cataract, corneal opacity or vitreous hemorrhage. B-scan ultrasonography provides rapid, non-invasive, dynamic evaluation of the posterior segment and can support timely triage and management.

**Objective:** To evaluate the clinical role of B-scan ultrasonography in patients with suspected posterior segment orbital pathology and to assess clinicoradiological concordance between ophthalmoscopic impressions and B-scan findings.

**Methods:** This hospital-based cross-sectional study included 42 patients referred from the Ophthalmology outpatient department to the Department of Radiodiagnosis, Adichunchanagiri Institute of Medical Sciences, B. G. Nagara, between May 2024 to October 2025. Patients with clinical suspicion of posterior segment pathology or opaque media limiting fundus assessment underwent structured clinical evaluation and B-scan ultrasonography using a 5-14 MHz linear transducer. Images were taken in transverse and sagittal planes, and the eye was also scanned during guided movements. The analysis used descriptive summaries, cross-classification tables and comparator-based diagnostic indices. As no single independent reference test was available for every participant, these values were treated as measures of agreement, not as final estimates of diagnostic accuracy.

**Results:** Among the 42 patients, the age band seen most often was 50-59 years (14/42, 33.3%); 54.8% were male. Disease was unilateral in 88.1%. Floaters (33.3%), vision loss (28.6%) and photopsia (19.0%) were the main complaints. On B-scan, 28 patients (66.7%) had posterior segment abnormalities. The commonest B-scan diagnosis was retinal detachment (11/42, 26.2%), followed by vitreous hemorrhage (10/42, 23.8%), posterior vitreous detachment (6/42, 14.3%) and macular edema (1/42, 2.4%). Agreement was highest for vitreous hemorrhage, confirmed in 10 of 11 clinically suspected cases (90.9%), and for retinal detachment, confirmed in 11 of 13 cases (84.6%). In the assessed categories, specificity and positive predictive value were 100%. For posterior vitreous detachment, the corrected sensitivity was 66.7%, not 76.7%.

**Conclusion:** B-scan ultrasonography remains a useful first-line adjunct when posterior segment disease is suspected, especially when the fundus cannot be seen clearly. In this series, it was particularly helpful in confirming retinal detachment and vitreous hemorrhage. Future multicentre studies with blinded readers and independent reference standards are needed to validate diagnostic accuracy across a broader spectrum of posterior segment disease.

**Keywords:** B-scan ultrasonography; posterior segment; retinal detachment; vitreous hemorrhage; posterior vitreous detachment; opaque media; clinicoradiological concordance; ocular ultrasound.

**Abbreviations:** BCVA, best corrected visual acuity; CI, confidence interval; OCT, optical coherence tomography; PPV, positive predictive value; PVD, posterior vitreous detachment; RD, retinal detachment; USG, ultrasonography; VH, vitreous hemorrhage.

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## Introduction

Posterior segment ocular pathologies are clinically consequential because delayed recognition of retinal detachment, vitreous hemorrhage, posterior vitreous detachment and related vitreoretinal disorders may result in

avoidable visual loss. The diagnostic challenge is greatest when direct ophthalmoscopy is compromised by opaque media, including dense cataract, corneal opacity, vitreous hemorrhage or post-traumatic changes. In this setting, B-scan ultrasonography has long been used as a rapid, non-

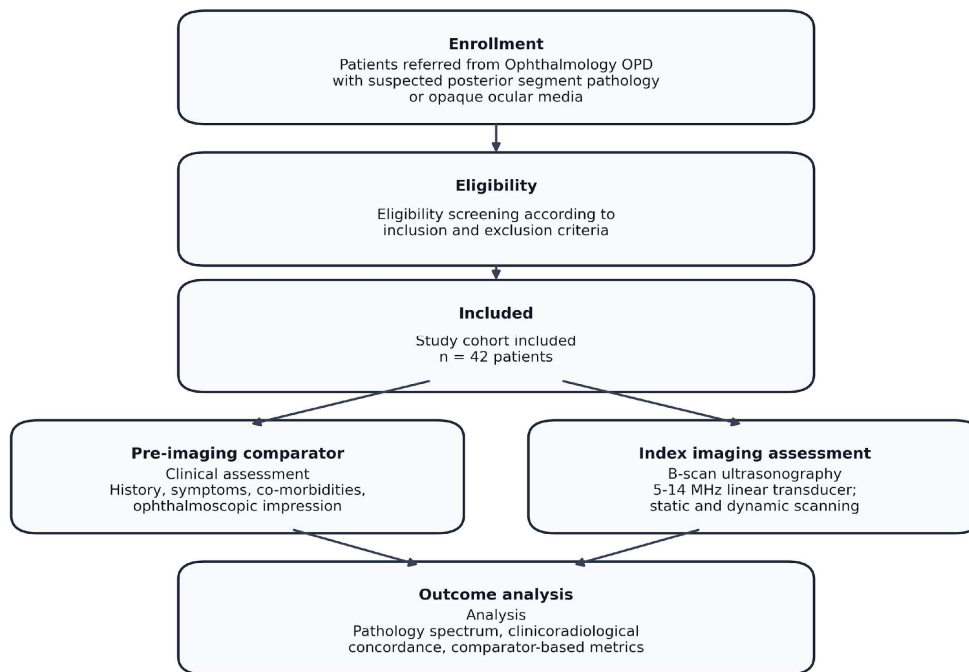
invasive and widely available technique for anatomical assessment of the globe and posterior segment [1,2]. The value of ocular ultrasonography is based on the superficial location and cystic structure of the eye, which permit high-resolution imaging with high-frequency probes. B-scan imaging allows real-time assessment of the vitreous cavity, retina-choroid-sclera complex, optic nerve head region and intraocular membranes. Dynamic scanning during ocular movement further helps differentiate mobile vitreous opacities from fixed retinal or choroidal detachments [3-7]. In radiology and ophthalmology practice, these advantages matter because cross-sectional imaging may be avoidable, hard to access, or less able to show fine intraocular membrane changes. Earlier studies have used B-mode ocular ultrasound to assess retinal and vitreous disease, particularly when media opacity limits fundus examination or when eyes are being assessed before surgery [8-12]. The evidence, however, is not uniform. Studies differ in the way patients are selected, the reference tests used, the diagnostic indices reported and the way concordance is defined. In some smaller series, ultrasound results were matched only with the clinical

impression, rather than with an independent standard applied to all patients, such as surgery, optical coherence tomography, fundus photography or follow-up. Under those circumstances, the findings are better read as clinikoradiological agreement, not as firm proof of diagnostic accuracy.

This study was therefore planned around a practical question seen in tertiary care: what spectrum of B-scan findings is encountered in patients referred with suspected posterior segment pathology? The main aim was to describe the ultrasonographic pattern of posterior segment disorders. A second aim was to compare the ophthalmoscopic impression with the B-scan result, while making clear that no universal independent reference standard was available.

**Materials and Methods**

To improve reporting, the manuscript was organized with reference to STARD for diagnostic studies and STROBE for observational studies [13,14]. At the same time, the dataset is acknowledged as not being a fully blinded diagnostic-accuracy study with an independent reference standard. Figure 1 shows the study workflow.



**Figure 1. Study workflow from clinical referral to B-scan ultrasonography and outcome analysis.**

**Design and study setting**

The study was conducted as a hospital-based cross-sectional descriptive study in the Department of Radiodiagnosis, Adichunchanagiri Institute of Medical Sciences, B. G. Nagara, Mandya District, Karnataka, India. The study period extended for 18 months, from May 2024 and October 2025.

**Participants and eligibility**

Patients were drawn from the Ophthalmology outpatient department and were sent for radiology assessment when posterior segment orbital pathology was clinically suspected. Patients were eligible if they had suspected posterior segment disease or opaque ocular media that precluded or limited ophthalmoscopic visualization. Patients with active painful ocular surface infection, high risk of extrusion of intraocular contents, or recent ocular surgery were excluded.

**Sample size**

Sample size was estimated with the formula  $n = Z^2PQ/d^2$ . The expected proportion was 46.73%, taken from an earlier B-scan study of posterior segment pathology; Z was set at 1.96 and the allowable absolute error at 15%. The calculation gave a minimum of 42 patients, and all 42 were included in the analysis [9].

**Clinical evaluation**

For every participant, demographic and clinical variables were entered in the study form, including laterality, symptom duration, presenting complaints and relevant co-morbid illness. Presenting complaints were grouped as vision loss, floaters, blurring of vision, eye pain and photopsia. Co-morbidity was recorded as diabetes mellitus, hypertension, both diseases, or none. Before B-scan, the ophthalmoscopic impression was noted and classified as normal, macular edema, posterior vitreous detachment, retinal detachment or vitreous hemorrhage.

**B-scan ultrasonography protocol**

Ultrasound examinations were performed using Voluson E6 and Samsung HS70/V8 ultrasound systems. A linear array transducer with a frequency range of 5-14 MHz was used. Patients were examined in the supine position through closed eyelids using sterile coupling gel. The probe was placed gently to avoid undue ocular pressure. Static scans were obtained in transverse and sagittal planes; dynamic scans were obtained during guided eye movements to assess mobility and attachment of intraocular membranes and echoes. Gain, focus and depth were optimized individually to visualize the posterior segment and to differentiate vitreous, retinal, choroidal and mass-related abnormalities.

**Outcome definitions**

The primary outcome was the distribution of final B-scan findings. B-scan categories were normal, retinal detachment, vitreous hemorrhage, posterior vitreous detachment and macular edema. Retinal status, vitreous status and choroid/mass assessment were recorded. The

secondary outcome was concordance between pre-imaging ophthalmoscopic impression and final B-scan categorization.

**Statistical analysis**

Data were entered in Microsoft Excel and analyzed using SPSS version 26.0. Categorical variables were summarized as frequencies and percentages. Cross-classification of ophthalmoscopic impression against B-scan diagnosis was performed. Comparator-based sensitivity, specificity, positive predictive value, negative predictive value and overall accuracy were calculated for clinically suspected macular edema, posterior vitreous detachment, retinal detachment and vitreous hemorrhage. Wilson 95% confidence intervals were added for transparency. Because no independent reference standard was applied uniformly, these estimates should be interpreted as agreement metrics against the clinical comparator rather than definitive diagnostic accuracy of B-scan ultrasonography.

**Ethical considerations**

Institutional Ethics Committee approval was obtained before the start of the study. Written informed consent was obtained from all participants after explaining the purpose, nature and safety of the procedure. No patient-identifying information is included in this manuscript.

**Results**

A total of 42 patients were included in the analysis. The baseline demographic and clinical characteristics of the study population are presented in Table 1. The largest age group was 50-59 years (33.3%), followed by 18-29 years (23.8%) and 60-69 years (19.0%). Males accounted for 54.8% of the cohort. Unilateral involvement predominated (88.1%), with left and right eyes affected at similar frequencies. Floaters were the most common symptom (33.3%), followed by vision loss (28.6%) and photopsia (19.0%). Diabetes mellitus, hypertension or both were present in 59.5% of patients.

**Table 1. Baseline demographic and clinical characteristics of the study population (n = 42).**

Characteristic	Category	n (%)
Age group, years	18-29	10 (23.8)
	30-39	5 (11.9)
	40-49	4 (9.5)
	50-59	14 (33.3)
	60-69	8 (19.0)
	>=70	1 (2.4)
Sex	Male	23 (54.8)
	Female	19 (45.2)
Eye involved	Left eye	19 (45.2)
	Right eye	18 (42.9)
	Bilateral	5 (11.9)
Presenting symptoms*	Floaters	14 (33.3)
	Vision loss	12 (28.6)
	Photopsia	8 (19.0)
	Blurring of vision	1 (2.4)
	Eye pain	0 (0.0)
Duration of symptoms	2 days	8 (19.0)

Characteristic	Category	n (%)
	1 week	13 (31.0)
	10 days	6 (14.3)
	3 weeks	11 (26.2)
	1 month	4 (9.5)
Co-morbidity	None	17 (40.5)
	Diabetes mellitus	13 (31.0)
	Hypertension	8 (19.0)
	Diabetes mellitus + hypertension	4 (9.5)

\*Symptoms were not mutually exclusive; percentages are calculated using the total sample size of 42 patients as the denominator.

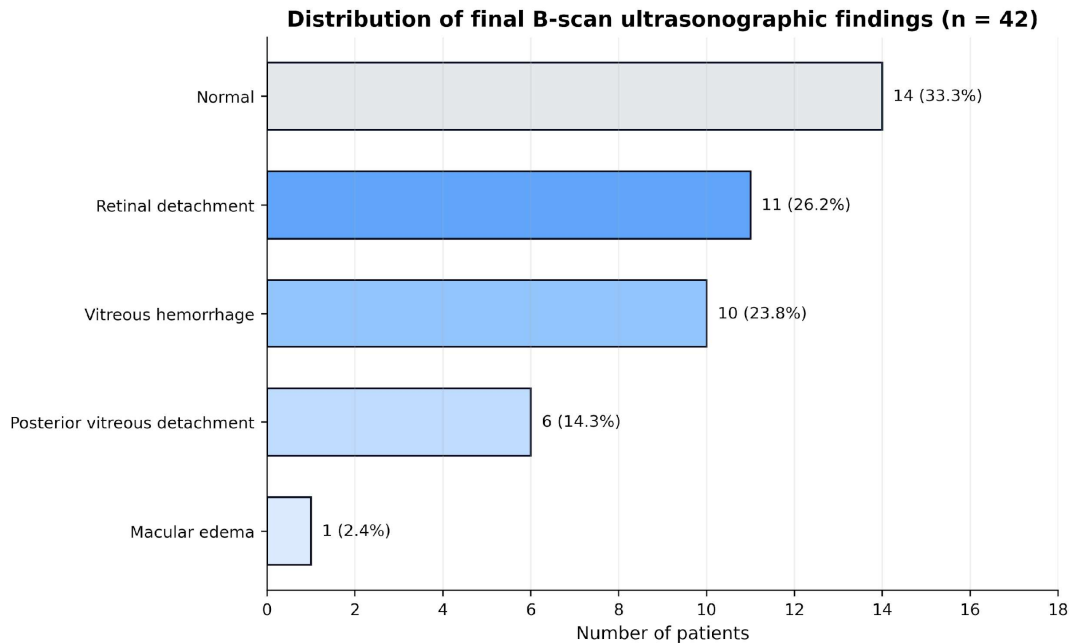
The distribution of ophthalmoscopic impressions and B-scan findings is summarized in Table 2. On ophthalmoscopy, retinal detachment was suspected most frequently (31.0%), followed by vitreous hemorrhage

(26.2%) and posterior vitreous detachment (21.4%). On B-scan, 14 patients (33.3%) had no abnormal posterior segment finding. Among abnormal B-scan findings, retinal detachment was the most common (26.2%), followed by vitreous hemorrhage (23.8%), posterior vitreous detachment (14.3%) and macular edema (2.4%). The overall B-scan diagnostic spectrum is displayed in Figure 2.

**Table 2. Comparison of ophthalmoscopic impressions and final B-scan ultrasonographic findings (n = 42).**

Diagnostic category	Ophthalmoscopic impression, n (%)	B-scan finding, n (%)
Normal	7 (16.6)	14 (33.3)
Macular edema	2 (4.8)	1 (2.4)
Posterior vitreous detachment	9 (21.4)	6 (14.3)
Retinal detachment	13 (31.0)	11 (26.2)
Vitreous hemorrhage	11 (26.2)	10 (23.8)

PVD, posterior vitreous detachment.



**Figure 2. Distribution of final B-scan ultrasonographic diagnoses in the study cohort.**

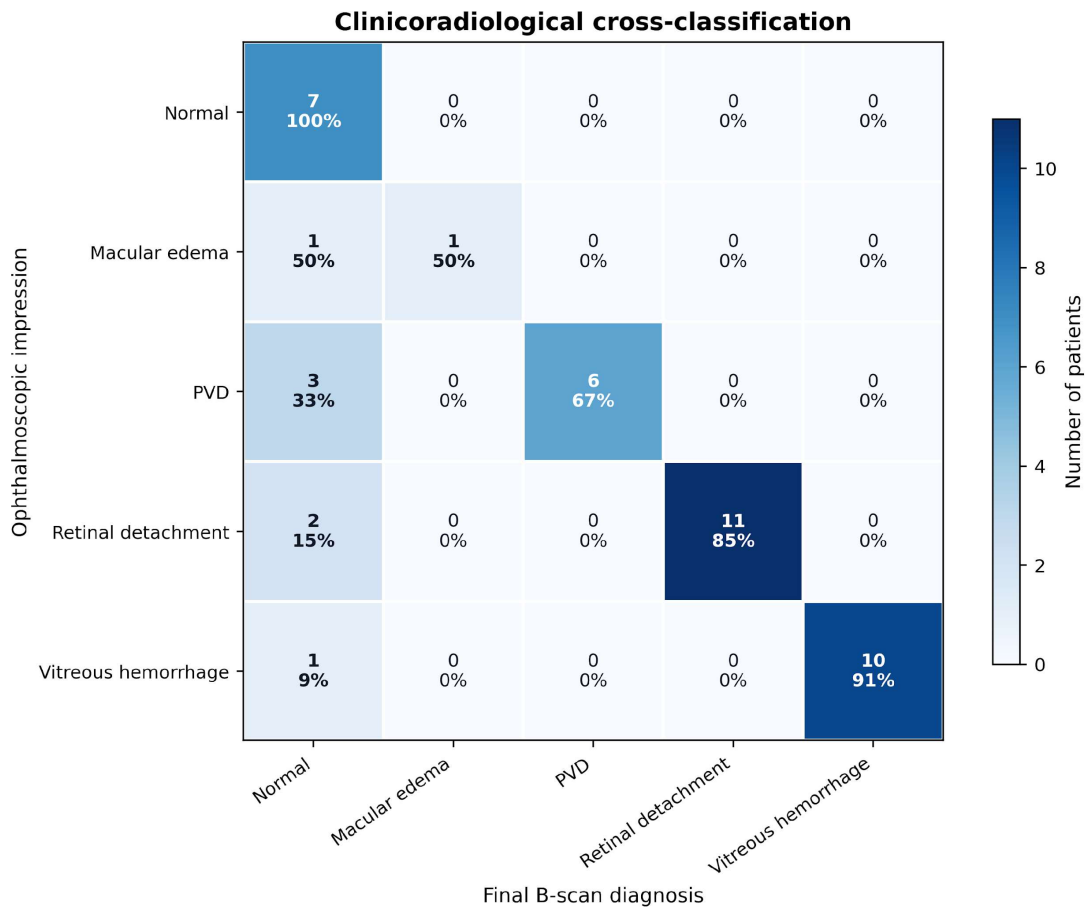
Detailed cross-classification of ophthalmoscopic impression against B-scan diagnosis is presented in Table 3 and visualized in Figure 3. All seven cases labelled as normal on ophthalmoscopy were also normal on B-scan. Retinal detachment showed high concordance, with 11 of

13 clinically suspected cases confirmed on B-scan. Vitreous hemorrhage had the strongest concordance, with 10 of 11 clinically suspected cases confirmed. Posterior vitreous detachment showed moderate concordance: six of nine suspected cases were confirmed, while three were reclassified as normal on B-scan. Of two clinically suspected cases of macular edema, one was confirmed and one was reclassified as normal.

**Table 3. Clinoradiological cross-classification between ophthalmoscopic impression and B-scan diagnosis.**

Ophthalmoscopic impression	Normal	Macular edema	PVD	Retinal detachment	Vitreous hemorrhage
Normal	7 (100.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Macular edema	1 (50.0)	1 (50.0)	0 (0.0)	0 (0.0)	0 (0.0)
Posterior vitreous detachment	3 (33.3)	0 (0.0)	6 (66.7)	0 (0.0)	0 (0.0)
Retinal detachment	2 (15.4)	0 (0.0)	0 (0.0)	11 (84.6)	0 (0.0)
Vitreous hemorrhage	1 (9.1)	0 (0.0)	0 (0.0)	0 (0.0)	10 (90.9)
Total	14 (33.3)	1 (2.4)	6 (14.3)	11 (26.2)	10 (23.8)

Values are n (row percentage), except the total row where percentages use the full sample denominator. PVD, posterior vitreous detachment.



**Figure 3. Heatmap of clinicoradiological cross-classification. Cell values show the number of patients and row percentage.**

Comparator-based performance metrics are summarized in Table 4 and Figure 4. Using ophthalmoscopic impression as the clinical comparator, B-scan confirmation was highest for vitreous hemorrhage (sensitivity 90.9%; 95% CI, 62.3-98.4) and retinal detachment (84.6%; 95% CI, 57.8-95.7).

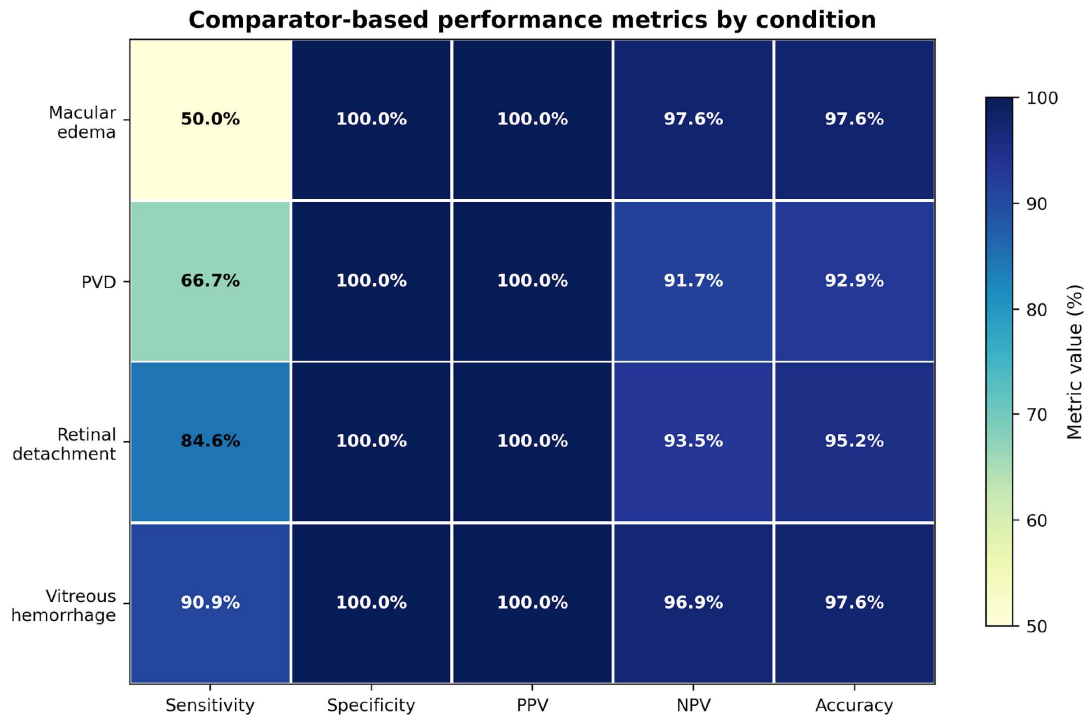
Posterior vitreous detachment showed a corrected sensitivity of 66.7% (95% CI, 35.4-87.9), and macular edema showed a sensitivity of 50.0% (95% CI, 9.5-90.5), reflecting very small case numbers. Specificity and positive predictive value were 100% across all evaluated conditions in this dataset because B-scan did not identify any positive cases among clinically negative comparator groups. Accuracy ranged from 92.9% to 97.6%.

**Table 4. Comparator-based performance metrics of B-scan ultrasonography by condition.**

Condition	Sensitivity % (95% CI)	Specificity % (95% CI)	PPV % (95% CI)	NPV % (95% CI)	Accuracy % (95% CI)
Macular edema	50.0 (9.5-90.5)	100.0 (91.2-100.0)	100.0 (20.7-100.0)	97.6 (87.4-99.6)	97.6 (87.7-99.6)
Posterior vitreous detachment	66.7 (35.4-87.9)	100.0 (89.6-100.0)	100.0 (61.0-100.0)	91.7 (78.2-97.1)	92.9 (81.0-97.5)
Retinal detachment	84.6 (57.8-95.7)	100.0 (88.3-100.0)	100.0 (74.1-100.0)	93.5 (79.3-98.2)	95.2 (84.2-98.7)
Vitreous hemorrhage	90.9 (62.3-98.4)	100.0 (89.0-100.0)	100.0 (72.2-100.0)	96.9 (84.3-99.4)	97.6 (87.7-99.6)

Metrics were calculated using the ophthalmoscopic classification as the clinical comparator. Because there was no uniform independent reference standard, these estimates should be interpreted as concordance metrics rather than definitive diagnostic accuracy. The PVD sensitivity was

corrected to 66.7% based on 6 confirmed cases among 9 clinically suspected cases. CI, confidence interval; NPV, negative predictive value; PPV, positive predictive value; PVD, posterior vitreous detachment.



**Figure 4. Heatmap of comparator-based diagnostic performance metrics by condition.**

**Discussion**

This study demonstrates that B-scan ultrasonography provides clinically useful information in patients referred with suspected posterior segment orbital pathology. Two findings are particularly important. First, a substantial proportion of the cohort had abnormal B-scan findings, with retinal detachment and vitreous hemorrhage comprising the largest diagnostic categories. Second, B-scan had high confirmatory concordance for clinically suspected vitreous hemorrhage and retinal detachment, while posterior vitreous detachment and macular edema showed lower concordance. Together, these observations place B-scan as a useful

adjunct in day-to-day imaging practice, but they also caution against treating clinical-imaging agreement as the same as diagnostic accuracy.

In this series, the age distribution fit the usual pattern seen with vitreoretinal disease. Patients aged 50-59 years formed the largest group, and just over half of the study population was 50 years or older. This pattern is close to the age clustering described by Rajimwale et al., Boruah et al. and Bhat et al. [9-11]. A slight male excess was also seen here. Similar male predominance has been noted in some cohorts, although the balance between men and women may change with the proportion of trauma cases, cataract referrals and local health-care seeking behaviour.

Floaters, vision loss and photopsia were the symptoms recorded most often. Clinically, this fits with vitreoretinal

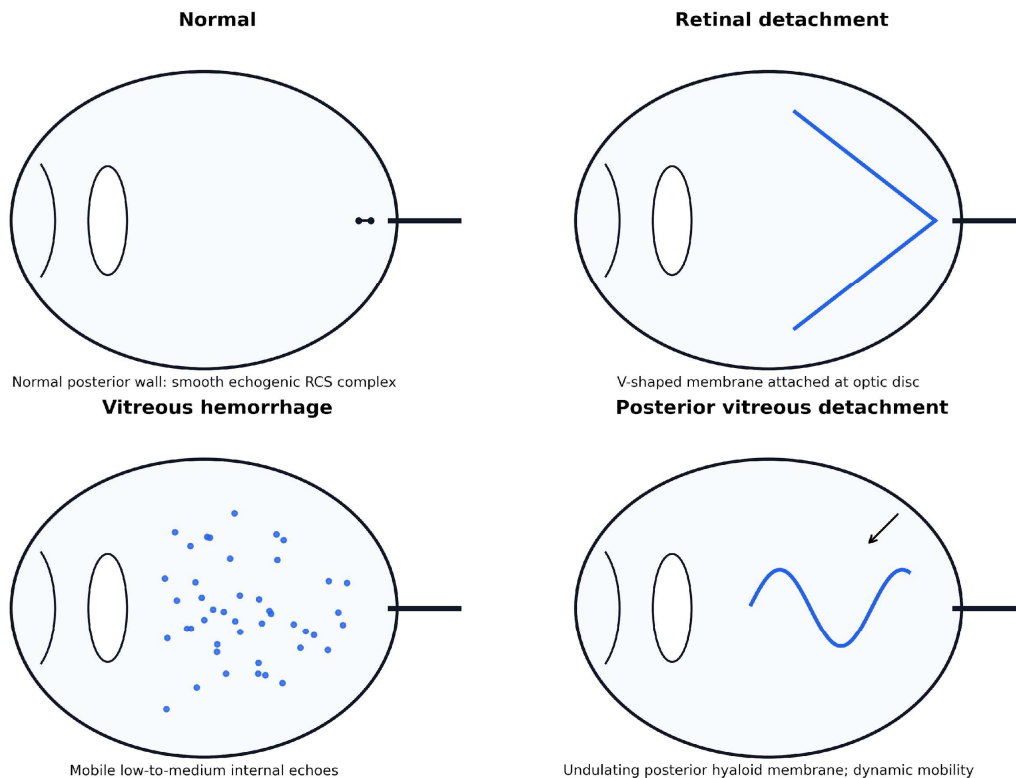
interface disease, vitreous hemorrhage and retinal detachment. No patient presented with eye pain, which suggests that inflammatory, infectious, anterior-segment and panophthalmitis-type presentations were not the main pattern in this sample. Diabetes mellitus and hypertension were frequent co-morbidities, a relevant point because diabetic retinopathy and vascular fragility can contribute to vitreous hemorrhage and tractional vitreoretinal disease. Musa and Sedeq also noted links between systemic illness and posterior segment abnormalities detected on ultrasonography [12].

In this cohort, retinal detachment and vitreous hemorrhage were the leading B-scan diagnoses. Other studies have found a similar broad pattern, although the share of each condition has differed from one setting to another. Rajimwale et al. identified retinal detachment and vitreous hemorrhage as major findings, while Bhat et al. listed retinal detachment, vitreous hemorrhage and vitreous detachment among the common diagnoses on B-scan [9,11]. In the study

by Boruah et al., posterior vitreous detachment and retinal detachment were frequent in patients with cataract or blunt ocular trauma [10]. Taken together, these comparisons show that B-scan remains useful in many clinical environments, but the case mix is shaped by referral criteria, trauma load, cataract burden, and inclusion or exclusion of pediatric tumors and orbital lesions.

High agreement for retinal detachment and vitreous hemorrhage is understandable because both usually have recognizable B-scan appearances. In retinal detachment, the scan typically shows an echogenic membrane fixed at the optic disc and extending forward, sometimes with a V-shaped or funnel-like contour. Vitreous hemorrhage appears as low-to-medium reflective internal echoes that may be mobile during dynamic scanning. Posterior vitreous detachment is more subtle because the posterior hyaloid membrane may be thin, mobile and variably detached. The schematic B-scan patterns shown in Figure 5 illustrate the pattern-recognition principles used during interpretation.

**Schematic B-scan pattern recognition for common posterior segment findings**



**Figure 5. Schematic B-scan pattern recognition for normal posterior segment, retinal detachment, vitreous hemorrhage and posterior vitreous detachment. This figure is an original educational schematic and not a patient image.**

Macular edema had low sensitivity in this dataset, but this finding must be interpreted cautiously because only two cases were clinically suspected and only one was confirmed by B-scan. More importantly, B-scan is not the optimal

modality for subtle macular microstructural change; optical coherence tomography remains superior for macular thickness, intraretinal fluid and subretinal fluid characterization when optical media are sufficiently clear. Therefore, B-scan should be positioned as an adjunct for gross posterior segment pathology, vitreoretinal membranes, detachment, hemorrhage and intraocular mass screening rather than as a substitute for tests that examine the macula in detail.

The performance statistics need careful reading. In the original thesis framework, the calculations were described as sensitivity, specificity and diagnostic accuracy. In the available dataset, however, B-scan was compared with the ophthalmoscopic impression, and an independent reference standard was not applied to every patient. For that reason, the values reported here are presented as comparator-based concordance measures. This is an important distinction, not merely a wording choice. When B-scan and the clinical impression differ, the ultrasound result may have corrected a false-positive clinical impression; it is not automatically a missed diagnosis. At the same time, without surgical findings, OCT, fundus photographs or follow-up confirmation, the true diagnostic accuracy of either approach cannot be established. This point was kept explicit because Q1-level reporting requires accuracy claims to be appropriately restrained. Clinically, these results support the use of B-scan when posterior segment pathology is suspected and the posterior pole is not adequately visible. The method is bedside-friendly, relatively low cost, free of ionizing radiation,

dynamic, and suitable for resource-limited settings. When retinal detachment or vitreous hemorrhage is suspected, B-scan may help speed triage, set referral urgency and assist preoperative planning. If the B-scan is normal or equivocal, follow-up and other condition-specific imaging are still required, particularly when symptoms persist or macular disease remains a concern.

The comparison with selected earlier ocular ultrasonography studies is shown in Table 5. Overall, the present findings fit with the published evidence that B-scan is useful for opaque media and posterior chamber pathology [15-20]. Future work should go beyond descriptive single-centre series. Prospective multicentre studies, preferably with masked independent readers, common imaging protocols, interobserver-agreement testing and independent reference standards, are required before robust condition-specific accuracy estimates can be made. Such work would also allow subgroup analyses by diabetic status, traumatic versus non-traumatic presentations, cataract density and symptom duration.

**Table 5. Comparison of the current study with selected prior ocular ultrasonography studies.**

Study	Design/sample	Main findings	Relevance to current study
Current study	Cross-sectional; 42 patients	RD 26.2%, VH 23.8%, PVD 14.3%	High concordance for VH and RD; no independent reference standard
Sen et al. [8]	164 patients/328 eyes	Retinal disorders in opaque media	B-mode described as rapid, safe and useful in opaque media
Rajimwale et al. [9]	Prospective; 92 patients	RD 48.9%, VH 46.7%	Reported sensitivity 97.7% and specificity 80%
Boruah et al. [10]	81 patients; high-resolution USG	PVD and RD common in cataract/blunt trauma subgroups	Reported sensitivity 87.3%, specificity 80% and accuracy 86.4%
Bhat et al. [11]	Cross-sectional; ocular USG referrals	RD 26.7%, VH 22.9%, vitreous detachment 17.1%	Similar pathology distribution to current cohort
Musa and Sedeq [12]	Prospective cross-sectional; 50 patients	Old VH 72%, PVD 36%, RD 34%	Diabetes and hypertension associated with posterior segment changes
Netam et al. [16]	145 eyes; high-frequency real-time USG	RD common in non-traumatic eyes; VH common in trauma	High performance for intraocular and extraocular categorization

*RD, retinal detachment; VH, vitreous hemorrhage; PVD, posterior vitreous detachment; USG, ultrasonography.*

**Limitations**

This study has several limitations. The sample size was small and drawn from a single tertiary care centre, limiting generalizability. The cohort was referral-based; therefore, the observed pathology distribution cannot be interpreted as population prevalence. The number of patients with macular edema, choroidal disease and intraocular mass lesions was very small or absent, preventing meaningful conclusions about these conditions. A uniform independent reference standard, such as OCT, fundus photography, surgical

confirmation, histopathology, or standardized longitudinal follow-up, was not used for all patients. Therefore, the statistical metrics are clinicoradiological concordance measures rather than definitive diagnostic accuracy estimates. Interobserver agreement was not assessed. Although dynamic scanning was performed, cine-loop documentation and quantitative echogenicity grading were not included in the analysis.

**Future Directions**

Future research should use larger multicentre cohorts and define, in advance, the reference standard for each pathology group. Diagnostic validity would be stronger with

two blinded readers, kappa-based interobserver analysis, correlation with OCT and fundus photography, and follow-up-based adjudication. Studies should also test whether structured B-scan reporting templates improve communication between radiologists and ophthalmologists. In resource-limited settings, future work should examine cost-effectiveness, referral impact, and patient outcomes after integrating B-scan into routine triage pathways for opaque media and suspected vitreoretinal disease.

### Conclusion

B-scan ultrasonography is a clinically valuable, non-invasive and accessible imaging adjunct for evaluating suspected posterior segment orbital pathologies, particularly when direct fundus visualization is limited. In this cohort, B-scan most frequently identified retinal detachment and vitreous hemorrhage and showed strong concordance for these conditions against clinical ophthalmoscopic impressions. The modality is best interpreted as a confirmatory and triage-supporting tool rather than a standalone replacement for comprehensive ophthalmic evaluation. Robust multicentre studies using independent reference standards are required to establish definitive diagnostic accuracy across the full spectrum of posterior segment disease.

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No external funding was received for this study.

### Conflict of Interest Statement

The authors declare no conflicts of interest.

### Ethics Statement

The study was approved by the Institutional Ethics Committee of Adichunchanagiri Institute of Medical Sciences. Written informed consent was obtained from all participants. The manuscript contains no patient-identifying information.

### Data Availability Statement

De-identified aggregate data are included in the manuscript. Additional de-identified data may be made available by the corresponding author upon reasonable request and subject to institutional ethics requirements.

### Author Contributions

M.K.G. contributed to study execution, data collection, analysis and manuscript drafting. M.R.S.K. contributed to study supervision, methodological guidance, interpretation and manuscript revision. Both authors approved the final manuscript.

### References

1. Byrne SF, Green RL. *Ultrasound of the Eye and Orbit*. 2nd ed. St Louis: Mosby; 2002.

2. Aironi VD, Gandage SG. Pictorial essay: B-scan ultrasonography in ocular abnormalities. *Indian J Radiol Imaging*. 2009;19(2):109-115. doi:10.4103/0971-3026.50827.
3. Bedi DG, Gombos DS, Ng CS, Singh S. Sonography of the eye. *AJR Am J Roentgenol*. 2006;187(4):1061-1072. doi:10.2214/AJR.04.1842.
4. De La Hoz Polo M, Torramilans Lluís A, Pozuelo Segura O, Anguera Bosque A, Esmerado Appiani C, Caminal Mitjana JM. Ocular ultrasonography focused on the posterior eye segment: what radiologists should know. *Insights Imaging*. 2016;7(3):351-364. doi:10.1007/s13244-016-0471-z.
5. Lorente-Ramos RM, Arman JA, Munoz-Hernandez A, Gomez JM, de la Torre SB. US of the eye made easy: a comprehensive how-to review with ophthalmoscopic correlation. *Radiographics*. 2012;32(5):E175-E200. doi:10.1148/rg.325115105.
6. Silverman RH. High-resolution ultrasound imaging of the eye - a review. *Clin Exp Ophthalmol*. 2009;37(1):54-67. doi:10.1111/j.1442-9071.2008.01892.x.
7. Fielding JA. Ocular ultrasound. *Clin Radiol*. 1996;51(8):533-544. doi:10.1016/S0009-9260(96)80131-0.
8. Sen K, Parihar JKS, Saini M, Moorthy RS. Conventional B-mode ultrasonography for evaluation of retinal disorders. *Med J Armed Forces India*. 2003;59(4):310-312. doi:10.1016/S0377-1237(03)80142-9.
9. Rajimwale G, Parihar PS, Rajimwale S, Phatak S. Role of ultrasonography in evaluation of pathologies of posterior segment of the orbit. *Int J Anat Radiol Surg*. 2018;7(4):RO46-RO51.
10. Boruah DK, Vishwakarma D, Gogoi P, Lal NR, Deuri A. Utility of high-resolution ultrasonography in the evaluation of posterior segment ocular lesions using sensitivity and specificity. *Acta Med Litu*. 2023;30(2):171-180.
11. Bhat TA, Mir MF, Gojwari TA, Sajad S. The pattern of pathologies in B-scan ocular ultrasound. *J Med Sci*. 2021;24(Suppl 1).
12. Musa S, Sedeq M. Ocular ultrasonography for detection of posterior segment pathology in adult patients presenting with blurred vision. *Zanco J Med Sci*. 2021;25(3):610-618.
13. Bossuyt PM, Reitsma JB, Bruns DE, Gatsonis CA, Glasziou PP, Irwig L, et al. STARD 2015: an updated list of essential items for reporting diagnostic accuracy studies. *BMJ*. 2015;351:h5527. doi:10.1136/bmj.h5527.
14. von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP, et al. The Strengthening of Reporting of Observational Studies in Epidemiology (STROBE) Statement: guidelines for reporting observational studies. *PLoS Med*. 2007;4(10):e296. doi:10.1371/journal.pmed.0040296.
15. Agrawal R, Ahirwal S. A study of role of B scan ultrasound in posterior segment pathology of eye. *Int J Med Res Rev*. 2015;3(9):969-974.
16. Netam SBS, Jain V, Singh R, Kumar S, Dutt V. Real time B-scan evaluation of posterior chamber and extraocular pathologies of eye and orbit. *Int J Med Res Rev*. 2015;3(9):925-933.
17. Sujatha G, Krishna N, Vasantha G, Sindhu V. Evaluation of posterior segment ocular disorders using B-scan ultrasonography in patients attending a tertiary care teaching hospital Telangana India. *Int J Health Sci*. 2022;6(S6):3764-3774.
18. Chaudhury M, Parida B, Panigrahi SK. Diagnostic accuracy of B-scan ultrasonography for posterior segment eye disorders: a cross-sectional study. *J Clin Diagn Res*. 2021;15(10):TC07-TC11.
19. Bangal S, Bhandari A, Siddhiqui F. Pattern of ocular pathologies diagnosed with B-scan ultrasonography in a hospital in rural India. *Niger J Ophthalmol*. 2016;24(2):71-75.
20. Narra RK, Edara S, Ramya PB, Putcha A. Role of B-scan in evaluation of ocular and extraocular pathologies. *J Evid Based Med Healthc*. 2018;5(48):3307-3312.