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Evidence Based Medicine

What is the Utility of Point-of-care Ultrasound for Diagnosing Retinal Detachment?

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□ **Abstract—Background: Retinal detachment is an important condition for emergency physicians to be aware of, as it can be challenging to diagnose on physical examination alone and, if it is missed, can lead to vision loss. Ultrasound has demonstrated utility in diagnosis. Clinical Question: What is the utility of point-of-care ultrasound (POCUS) for diagnosing retinal detachment? Evidence Review: Studies retrieved included three systematic reviews and meta-analyses evaluating the use of POCUS for diagnosing retinal detachment. These studies provide estimates of the potential utility of POCUS, with a sensitivity of 94-100% and specificity of 83-100%, positive likelihood ratios ranging from approximately 12-25, and negative likelihood ratios ranging from 0.06-0.25. Conclusion: Based upon the available literature, POCUS by emergency clinicians can reliably diagnose retinal detachment. © 2026 Elsevier Inc. All rights are reserved, including those for text and data mining, AI training, and similar technologies.**

□ **Keywords—Vision loss; Ophthalmology; Retinal detachment; Ultrasound; Point-of-care ultrasound; POCUS**

Case

A 55-year-old male presents with a history of myopia presents with sudden decrease in vision in the right eye. He denies eye pain or trauma to the eye. On physical examination, his vital signs are normal. Visual acuity with correction is 20/20 in the left eye but 20/400 in the right eye. He has normal eyelids, extraocular movements, pupil reactivity, and conjunctiva. There is no evidence of fluorescein uptake on slit lamp examination. You wonder if his signs and symptoms are due to retinal detachment and whether point-of-care ultrasound (POCUS) could assist in diagnosis.

Clinical Question

What is the utility of POCUS for diagnosing retinal detachment?

Context

Ophthalmologic complaints account for up to 3.4% of all emergency department (ED) visits, with 1.3 million ED encounters annually (1,2). A significant proportion of these visits is for acute vision changes, including decreased visual acuity and flashes and floaters (3,4). Several conditions may cause these symptoms, including posterior vitreous detachment, vitreous hemorrhage, retinal detachment, posterior uveitis, macular degeneration, occipital lobe disorders, migraine with aura, and several

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others (5). Though the majority of patients have a benign etiology for their symptoms, up to 26% are diagnosed with retinal detachment or tear (5,6).

Retinal detachment most commonly presents with sudden, painless, monocular vision changes often described as looking through a curtain, along with flashes and floaters (3). However, these symptoms are poorly predictive for the diagnosis of retinal detachment (5). There are several types of retinal detachment, including rhegmatogenous where the vitreous separate from the retina resulting in traction creating a hole in the retina, exudate where fluid accumulates beneath the retina, and tractional where acquired fibrocellular bands in the vitreous contract and detach the retina (7,8). It may also be categorized as macula on versus macula off (7). Risk factors include older age, prior or family history of retinal detachment, extreme myopia, and eye surgery (7,8).

Rapid diagnosis is important, as delays can lead to irreversible vision loss (8). Diagnosis entails evaluation of the posterior segment of the eye. Indirect ophthalmoscopy performed by ophthalmologists is highly accurate for the diagnosis (9). However, direct ophthalmoscopy is often limited in the ED setting due to limited fundoscopic training or comfort, lack of skill maintenance, and limited technique (9). POCUS has demonstrated utility in a variety of conditions, and a reliable, rapid, and portable means of diagnosis of retinal detachment can assist emergency clinicians (3,4,10).

Evidence Search

To address the clinical question, you search for systematic reviews and meta-analyses evaluating the use of POCUS for diagnosing retinal detachment. The patient population in whom you are interested are ED patients with concern for retinal detachment. You restrict your search results to systematic reviews and meta-analyses. Utilizing the search terms "retinal detachment" or "posterior chamber" and "meta-analysis" and "point-of-care ultrasound" or "POCUS" yields three relevant citations.

Evidence Review

Title: The diagnostic accuracy of bedside ocular ultrasonography for the diagnosis of retinal detachment: a systematic review and meta-analysis (10).

Population: Authors included studies of ED patients with concerns of retinal detachment who underwent a POCUS compared to a reference standard (computed tomography [CT] or masked ophthalmologic evaluation).

Exclusion criteria: Authors excluded case studies, retrospective reports, and non-human studies.

Study design: The authors conducted the systematic review according to the Meta-analysis of Observational Studies in Epidemiology statement (11). Ovid MEDLINE, PubMed, EMBASE, the Cochrane Library, Emergency Medical Abstracts, and Google Scholar were searched from inception to August 17, 2012. The Quality Assessment of Diagnostic Studies 2 tool (QUADAS-2 tool) was used to assess risk of bias (12). Two authors independently extracted data, including study setting, patient demographics, description of the criterion standard, and diagnostic test characteristics. Kappa was calculated to evaluate agreement between raters. Due to the small number of studies, variation in POCUS operator experience, and differences in definitions of what was a positive result, the authors did not pool the data. The authors reported sensitivity and specificity.

Outcomes: The authors identified 7771 citations, of which 78 were selected for full-text review, and four met inclusion criteria. Three trials with a total of 201 patients were deemed to have a low risk of bias and were included in the final systematic review. The prevalence of retinal detachment in the studies ranged from 15% to 38%. The sensitivity for POCUS ranged from 97 to 100%, and the specificity ranged from 83 to 100%. The study by Yoonessi et al. reported a positive likelihood ratio of 5.88, while the study by Shinar et al. reported a positive likelihood ratio of 12.1 for POCUS (13,14).

Title: Point-of-Care Ocular Ultrasound for the Diagnosis of Retinal Detachment: A Systematic Review and Meta-Analysis (3).

Population: Authors included studies with patients who had a POCUS performed for the evaluation of retinal detachment.

Exclusion criteria: Authors excluded case reports, case series, retrospective studies, cadaver studies, conference abstracts, and studies without a confirmatory test.

Study design: Authors conducted the meta-analysis according to the PRISMA guidelines and registered it with PROSPERO (15). They searched PubMed, CINAHL, LILACS, Scopus, the Cochrane Database of Systematic Reviews, and the Cochrane Central Register of Controlled Trials from inception until June 12, 2018. They included prospective or randomized controlled trials assessing POCUS for retinal detachment. Studies needed to have a confirmatory test which included ophthalmology examination, surgical findings, CT, magnetic resonance imaging (MRI), or clinical follow up. Authors planned to perform subgroup analysis of the primary outcome based on location (ED versus non-ED) as well as provider specialty (ED versus non-ED). Two investigators reviewed studies for eligibility and if both reviewers determined they met the criteria, they were included. They resolved discrepancies with a third reviewer. Studies were also assessed for quality using the

QUADAS-2 tool (12). Bivariate random effects model was used to calculate sensitivity, specificity, and likelihood ratios. Chi-square and I^2 were used to assess heterogeneity.

Outcomes: Authors identified 2,621 studies, reviewed 1,967 abstracts, and evaluated the full text of 39 studies. Authors included 11 studies with a total of 844 patients. Studies were conducted between 1995 and 2018 with populations ranging from 32 to 139. Three studies were conducted in the United States, while the remaining studies were conducted in other countries. Five studies were conducted in the ED, two were performed in the radiology department, and one was performed in the ophthalmology clinic. Emergency physicians performed the examination in six studies, and radiologists performed it in four studies. Studies were at low risk of bias except for patient selection and reference standard. Heterogeneity was moderate with an I^2 of 0.59. There was no evidence of publication bias. Retinal detachment was present in 21.4% of participants. POCUS for retinal detachment was 94.2% sensitive (95% CI 78.4% to 98.6%) and 96.3% specific (95% CI 89.2% to 98.8%). The positive likelihood ratio was 25.2 (95% CI 8.1 to 78.0), and the negative likelihood ratio was 0.06 (95% CI 0.01 to 0.25). There was no significant difference in sensitivities for ED providers versus non-ED providers. Among ED patients the sensitivity was 93.9% and sensitivity was 92.4%, compared to non-ED patients with a sensitivity of 74.1% and specificity of 85.3%. Studies were at low risk of bias except for patient selection and reference standard.

Title: Ocular Point-of-Care Ultrasonography to Diagnose Posterior Chamber Abnormalities: A Systematic Review and Meta-analysis (4).

Population: Authors included studies with adult patients who received a POCUS ultrasound by an emergency physician to assess the posterior chamber of the eye.

Exclusion criteria: Authors exclude studies that included patients under 18 years of age, if the POCUS operator was not an emergency physician, or if it was a case report or case series of less than 10 patients.

Study design: Authors conducted the meta-analysis according to the PRISMA guidelines and registered it on PROSPERO (15). They searched PubMed, MEDLINE, EMBASE, Cochrane, CINAHL, and SCOPUS from January 1, 1960, until June 1, 2019, for eligible studies. Two authors independently screened titles and abstracts and evaluated the full text. Disagreements were resolved by discussion or adjudication by a third author. The QUADAS-2 tool was used to evaluate the risk of bias (12). Authors used a random-effects model to meta-analyze the studies and generate summary estimates of sensitivity, specificity, and likelihood ratios, and they used I^2 to evaluate heterogeneity.

Outcomes: Authors found 1128 studies, reviewed the full text of 116, and found that 8 studies met full inclusion criteria. They identified one additional study through a bibliography search for a total of nine studies. Five studies were conducted in the United States, and eight were prospective. Studies included between 61 and 232 patients. Some studies included a data point for each eye resulting in more data points than actual patients enrolled. All the studies evaluated POCUS for the diagnosis of retinal detachment. POCUS was performed by emergency physicians and residents, with some physician assistants and one including medical students. Risk of bias was unclear in eight of the nine studies for patient selection due to convenience sampling. One study was at high risk of bias for index tests. Another was at high risk of bias for the reference standard, and two were at unclear risk due to the ophthalmologist not being blinded to the POCUS results. Four studies had an unclear risk of bias for flow and timing. The pooled sensitivity for POCUS for retinal detachment was 94.0% (95% CI 88.0%–97.0%), and specificity was 94% (95% CI 85.0% to 98.0%). The positive likelihood ratio was 11.7 (95% CI 3.1–44.3), and the negative likelihood ratio was 0.11 (95% CI 0.03–0.46). I^2 ranged between 92% to 96%.

Conclusions

Ocular complaints account for a significant proportion of ED visits. There are several potentially vision-threatening diagnoses in patients presenting with acute change in vision. Retinal detachment is one such diagnosis and may cause sudden, painless, monocular vision changes, as well as flashes and floaters (3). Ophthalmoscopy is often limited in the ED setting, and POCUS has demonstrated promise in assisting emergency clinicians in diagnosing this condition.

The systematic reviews and meta-analyses evaluated in this review found POCUS sensitivity ranged between 94% and 100%, with specificity 83–100%, negative likelihood ratio 0.06–0.11, and positive likelihood ratio 11.7–25.2 (3,4,10). Importantly, there are several considerations and limitations with these meta-analyses. Overall, there were a limited number of studies. There was significant heterogeneity regarding operator experience and specialties, POCUS training protocols, ultrasound machines, and different confirmatory tests. Unfortunately, studies did not assess patient oriented outcomes such as vision improvement with use of POCUS or cost-effectiveness (3,4,10).

Based on the presented evidence, we believe POCUS can assist in the diagnosis of retinal detachment, particularly when ophthalmology consultation is not imme-

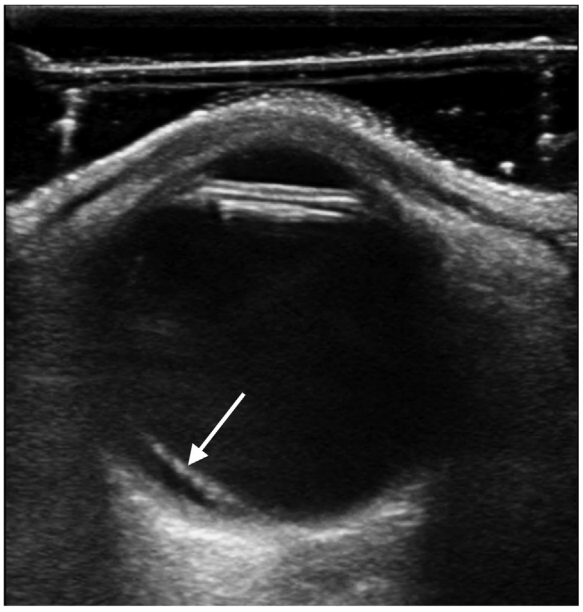

Figure 1. Point-of-care ultrasound (POCUS) demonstrating retinal detachment (white arrow). Courtesy of Dr. Michael Gottlieb.

diately available. Importantly, the American College of Emergency Physicians includes ocular POCUS as a core application in emergency medicine (16). Training is necessary for the appropriate performance of ocular POCUS, but evaluation for retinal detachment is straightforward. A linear, high-frequency 7.5–10 MHz transducer on ocular preset is recommended for the examination (17). The patient should be in the supine or partially upright position with the eye closed. A transparent adhesive dressing over the patient's closed eye can reduce the chance of US gel getting into the eye. The clinician should stabilize their hand on the patient's zygoma or nasal bridge, with the transducer placed gently on the closed eyelid and the marker facing the patient's right. The depth should be adjusted so that the posterior segment of the eye and optic nerve can be visualized. Following the identification of basic structures such as the lens and optic nerve, the gain should be reduced until the vitreous is black or anechoic. Then, have the patient move their eye left and right. Retinal detachment will appear as a thick line attached to the posterior aspect of the globe that moves as the eye moves. A large detachment is present with the flap attached firmly to the optic sheath, though with small detachments, the clinician should evaluate multiple axes of the eye, including at extremes of gaze to evaluate for a tethered flap adhering to the posterior part of the eye (Figure 1, Video 1). Following evaluation at normal gain, the gain should be slowly increased to visualize other vitreous abnormalities. Posterior vitreous detachment and vitreous hemorrhage will become more apparent with increased gain. Posterior vitreous detachment will appear as a thin, linear structure not tethered to the optic disc. As the patient moves their eye, the flap will float back and forth. Vitreous hemorrhage will appear as diffuse, mobile opacities at high gain that resemble a snow globe (13,14,18). While POCUS demonstrates high sensitivity and specificity for the diagnosis of retinal detachment and serves as an important adjunct to diagnosis in the ED setting, POCUS should only serve as an adjunct to the clinician's history and examination. Thus, a negative POCUS in the setting of visual changes still warrants further evaluation by an ophthalmologist.

Commentary by Dr. Srikar Adhikari

POCUS is a valuable tool in the evaluation of acute visual symptoms, especially when retinal detachment (RD) is suspected. It allows assessment of the posterior segment when conditions such as trauma, vitreous hemorrhage, corneal opacities, or dense cataracts obscure the view of the fundus. Its greatest value lies in rapidly distinguishing retinal detachment from other posterior segment pathologies given the significant overlap in clinical presentation.

Current evidence demonstrates high sensitivity and specificity of POCUS for the detection of RD. However, the current literature remains limited in addressing more nuanced diagnostic questions that influence time-sensitive management, such as macula-on versus macula-off status, subtle or focal detachments, and distinction from mimics such as posterior vitreous detachment (PVD) and choroidal detachment.

Macula-on versus macula-off status distinction is critical because not all retinal detachments carry the same degree of urgency with respect to management. The timing of repair depends on macular status, with traditional urgency being greatest for macula-on retinal detachments because progression to foveal involvement can significantly worsen visual outcome (19). Traditional guidelines recommend repair within 24 hours for macula-on retinal detachments to prevent foveal involvement, preserve photoreceptor integrity, and reduce subretinal fluid accumulation (20). A recent meta-analysis found that macula-on repairs within 24 hours of presentation were associated with significantly better final best-corrected visual acuity compared with repair after 24 hours (21). These findings are consistent across the literature and have become standard practice. For emergency physicians, this means that recognizing retinal detachment on POCUS is not enough; determining whether the detachment involves the macula can significantly influence the urgency of ophthalmology consultation and transfer decisions. However, this is precisely where the evidence base becomes considerably limited. Although emergency physicians can detect retinal

detachment reasonably well overall, their ability to determine macular status on POCUS is limited. A recent study demonstrated only modest accuracy by emergency physicians in differentiating macula-on from macula-off retinal detachment (22).

The distinction between retinal detachment and PVD is not always absolute. PVD can coexist with retinal detachment, and vitreous hemorrhage can confound or mimic echogenic membranes. Previous studies have reported only modest accuracy for distinguishing retinal detachment from PVD (23). Additionally, PVD is not as benign as it is often approached. Symptomatic PVD carries approximately a 10% risk of associated retinal tear or retinal detachment at presentation (24). Currently, there are no data demonstrating that POCUS can reliably detect retinal tears, which is generally identified via indirect ophthalmoscopy. Failure to detect retinal tears in a timely manner may allow rapid progression to retinal detachment, especially when vitreous hemorrhage is present (25). Thus, the combination of ultrasound findings of PVD and associated vitreous hemorrhage should heighten the suspicion for an occult retinal tear/detachment.

Differentiating retinal detachment from choroidal detachment is another clinically relevant pitfall because both are seen as detached posterior membranes on POCUS. Choroidal detachment usually appears as thicker, smoother, dome-shaped, convex peripheral membranes that are often bilateral or kissing in some cases (26,27). Accurate distinction between these two conditions is important because the management pathways differ. Additional pitfalls include focal retinal detachment, where it can be isolated to specific areas such as the superior, inferior, nasal, or temporal quadrants of the retina. The detachment also does not necessarily have to extend to the ora serrata or the optic nerve head. Small or shallow retinal detachments may not create classic membranes typically seen on POCUS and may lie outside the standard axial plane or appear as only a faint, thin echogenic line with minimal motion (14,18). These findings can be easily missed if the operator does not make appropriate adjustments during scanning.

POCUS users must recognize which ocular ultrasound findings are associated with a higher risk of progression to macula-off detachment. Superior/temporal detachments, bullous elevation, subretinal fluid near the fovea, and large retinal tears increase the risk of progression (28). POCUS should be used as a tool for identifying any retinal detachment and then stratifying by macular status, extent, and configuration, while acknowledging that subtle and peripheral disease may be underappreciated. Artificial intelligence (AI) models are being developed to recognize ocular anatomy on ultrasound, ensure adequate scanning technique, and identification of posterior segment pathology. The integration of AI technology could provide additional confidence to POCUS users and potentially identify subtle ultrasound features of retinal detachment that human operators might overlook. In the near future, AI-powered POCUS devices may combine automated detection of retinal detachment and assessment of risk, augmenting clinical decision-making at the bedside.

POCUS is a valuable, non-invasive tool for the detection and management of retinal detachment. The ability of POCUS to make a rapid bedside diagnosis and expedite management highlights its clinical utility. However, limitations in differentiating between associated or similarly appearing pathologies on POCUS underscore the need for continued research. Future studies should also focus on the questions that matter most to bedside medical decision-making, such as the reliability of macular status assessment, detection of shallow and peripheral detachments, the differentiation of retinal detachment from complex mimics, and performance across varying operator experience.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

CRediT authorship contribution statement

Kristine Jeffers: Investigation, Methodology, Writing – original draft. **Samuel M. Keim:** Conceptualization, Investigation, Methodology, Project administration, Supervision, Writing – original draft, Writing – review & editing. **Brit Long:** Conceptualization, Investigation, Methodology, Project administration, Supervision, Writing – original draft, Writing – review & editing. **Michael Gottlieb:** Investigation, Methodology, Supervision, Writing – original draft, Writing – review & editing. **Srikar R. Adhikari:** Conceptualization, Investigation, Supervision, Writing – original draft, Writing – review & editing.

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.jemermed.2026.04.023.

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Article Summary

1. Why is this topic important?

Diagnosing retinal detachment in the ED setting is important.

2. What is the Clinical Question?

What is the utility of point-of-care ultrasound for diagnosis of retinal detachment?

3. Search Strategy

PubMed search using combined keywords "retinal detachment" and "meta-analysis" and "point-of-care ultrasound" or "POCUS".

4. Citations Appraised

The diagnostic accuracy of bedside ocular ultrasonography for the diagnosis of retinal detachment: a systematic review and meta-analysis.

Point-of-Care Ocular Ultrasound for the Diagnosis of Retinal Detachment: A Systematic Review and Meta-Analysis.

Ocular Point-of-Care Ultrasonography to Diagnose Posterior Chamber Abnormalities: A Systematic Review and Meta-analysis.

5. Are the Results Valid?

Yes – for ED patients with suspected retinal detachment.

6. What are the Results?

Based upon the available literature, POCUS can reliably diagnose retinal detachment.

7. Can I Apply the Results to my Practice?

Yes.