Are Emergency Practitioners Able to Diagnose Posterior Chamber Abnormalities With Point-of-Care Ocular Ultrasonography?

TAKE-HOME MESSAGE

Emergency practitioners can accurately diagnose retinal detachment in adult patients by using ocular point-of-care ultrasonography. Further study is necessary to determine the accuracy of emergency practitioner–performed point-of-care ultrasonography for other posterior chamber abnormalities.

METHODS

DATA SOURCES

Meta-analysis authors identified studies from PubMed, MEDLINE, EMBASE, Cumulative Index of Nursing and Allied Health, Scopus, and the Cochrane databases from January 1, 1960, to June 1, 2019, without language restrictions. They performed a supplemental search including clinical trial registries and conference abstracts.

STUDY SELECTION

The authors included studies if they met 3 specific criteria: point-of-care ultrasonographic examinations were performed by emergency practitioners, sufficient information was reported on diagnostic test characteristics for at least one posterior ocular abnormality (defined as retinal detachment, vitreous hemorrhage, vitreous detachment, globe rupture, intraocular foreign body, and lens dislocation), and patients had a formal evaluation and diagnosis by an ophthalmologist as a reference standard. Two authors independently evaluated and selected articles, with disagreements resolved by

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Results

Diagnostic accuracy of emergency practitioner–performed point-of-care ultrasonography for posterior ocular abnormalities.

Diagnosis	No. of Studies (No. of Eyes)	Sensitivity (95% CI)	Specificity (95% CI)	Positive LR (95% CI)	Negative LR (95% CI)
Retinal detachment	9 (1,189)	0.94 (0.88–0.97)	0.94 (0.85–0.98)	16.6 (6.1–45.3)	0.064 (0.031–0.130)
Vitreous hemorrhage	5 (739)	0.90 (0.65–0.98)	0.92 (0.75–0.98)	11.7 (3.1–44.3)	0.112 (0.027–0.459)
Vitreous detachment	4 (388)	0.67 (0.51–0.81)	0.89 (0.53–0.98)	6.2 (1.2–31.3)	0.36 (0.25–0.53)
Lens dislocation	2 (400)	0.97 (0.83–0.99)	0.99 (0.97–1.00)	89.3 (33.0–237)	0.03 (0.00–0.22)
Intraocular foreign body	2 (400)	1.00 (0.81–1.00)	0.99 (0.99–1.00)	383 (54–2,712)	0
Globe rupture	2 (400)	1.00 (0.63–1.00)	0.99 (0.99–1.00)	392 (55–2,779)	0

LR, Likelihood ratio.

DATA EXTRACTION AND SYNTHESIS

The primary outcome included diagnostic test characteristics of point-of-care ultrasonography for the diagnosis of a posterior ocular abnormality. After study selection and inclusion, authors conducted meta-analyses using a random-effects model to provide summary estimates of sensitivity, specificity, and positive and negative likelihood ratios with 95% confidence intervals (CIs). Authors assessed using the Quality Appraisal of Diagnostic Accuracy Studies–2 instrument and heterogeneity with the I^2 statistic. Publication bias was not assessed.

Meta-analysis authors identified 1,128 unique citations, 9 of which they included in the meta-analysis.[1] All studies were observational, with 8 prospective studies and 1 retrospective study. All 9 studies evaluated point-of-care ultrasonography to diagnose retinal detachment, and 5 studies evaluated accuracy of point-of-care ultrasonography in the diagnosis of other ocular abnormalities. Numbers of included patients ranged from 16 to 232. All studies used a linear probe for point-of-care ultrasonographic evaluation. One study included medical students, and 2 studies included physician assistants working in emergency departments (EDs). Data from 1,083 patients (1,189 eyes) demonstrated high diagnostic accuracy for most posterior ocular abnormalities and exceptionally high diagnostic accuracy among emergency practitioners for retinal detachment (Table). Of the 9 included studies,

the authors deemed 6 at low risk of bias for retinal detachment, 3 at low risk of bias for vitreous hemorrhage, and 2 at low risk of bias for vitreous detachment. Combining the results of the 6 studies deemed low risk of bias for retinal detachment did not significantly affect the estimate of accuracy. Similarly, sensitivity analyses with studies at low risk of bias did not substantially change estimates of accuracy for either vitreous hemorrhage or vitreous detachment. Lens dislocation, globe rupture, and intraocular foreign body were evaluated by 2 studies, but only 1 was at low risk of bias, so a sensitivity analysis was not performed for these diagnoses.

Commentary

Eye-related chief complaints are common in the ED, and more than 40% of cases are urgent.[2] Retinal detachment is a time-sensitive diagnosis and may result in irreversible vision loss with delay of treatment. Evaluation of posterior ocular abnormalities remains a challenge in the ED setting because of limitations of equipment, suboptimal examination conditions, and variable practitioner experience and comfort in performing fundoscopy.[3,4] Ultrasonography is a valuable tool allowing assessment of posterior chamber abnormalities.

A previous systematic review and meta-analysis of 11 studies (844 patients) evaluated the accuracy of point-of-care ultrasonography in diagnosing retinal detachments, but included 5 studies of practitioners with training in radiology and ophthalmology.[5] Of the 6 studies limited to emergency medicine practitioners, there were 515 ED patients (517 eyes)

included. In the studies limited to emergency physicians, ocular point-of-care ultrasonography had a pooled sensitivity of 92% (95% CI 67% to 99%) and specificity of 91% (95% CI 85% to 95%).[5]

This new meta-analysis[1] includes the 6 earlier studies performed in the ED and 3 additional studies (Lahham et al[6] [225 patients], Ojaghihaghighi et al[7] [232 patients and 351 eyes], and Jacobsen et al[8] [109 patients]) that were not included in the original meta-analysis because of its retrospective design. The 5 previous studies performed by radiologists were not included in this analysis.

All 9 ED studies included in this updated meta-analysis evaluated accuracy of point-of-care ultrasonography for retinal detachment. The results of the updated meta-analysis support the previous findings, demonstrating high diagnostic accuracy of ED-performed point-of-care ultrasonography for retinal detachment. This is the first meta-analysis to evaluate the diagnostic accuracy of point-of-care ultrasonography in predicting other posterior chamber abnormalities. The authors found emergency practitioner diagnosis of other posterior chamber abnormalities, including lens dislocation, globe rupture, intraocular foreign body, and vitreous hemorrhage, using point-of-care ultrasonography to be accurate, but with wide CIs. Emergency practitioner–performed point-of-care ultrasonography appeared to be less accurate in assessing vitreous detachment, which is less urgent. The number of studies and eyes evaluated for each additional diagnosis is listed in the Table.

Although these findings suggest emergency practitioners may use point-of-care ultrasonography to reliably diagnose posterior ocular abnormalities, this meta-analysis has several limitations.[1] There were few studies evaluating test characteristics of point-of-care ultrasonography to diagnose ocular abnormalities other than retinal detachment. The 95% CIs around these estimates are wide because of the limited number of studies, small sample sizes, and small numbers of true-positive results. This small number of positive scan results increases the risk of selection bias. Additionally, many studies specifically, and reasonably, excluded patients who were at risk for globe rupture or penetrating injury. There is a potential risk of applying pressure to an open globe with point-of-care ultrasonography, but neither study evaluating for globe rupture reported adverse events. The safety of point-of-care ultrasonography for assessment of a ruptured globe or an intraocular foreign body through a penetrating injury has not been established, and using it is not recommended. Heterogeneity was significant among included studies and demonstrated moderate variability in evaluation of retinal detachment and high proportion of variability in evaluation of other posterior ocular abnormalities. The moderate to high statistical heterogeneity may be attributable to differences in experience and proficiency in the emergency practitioners performing point-of-care ultrasonography. Imaging protocols and ocular point-of-care ultrasonography–specific training differed significantly among included studies. One study included attending and resident physicians, as well as medical students.[9] The largest study included in the meta-analysis evaluated the diagnostic accuracy of only 2 practitioners, both of whom had extensive training and experience in point-of-care ultrasonography.[7] However, smaller studies demonstrated similar accuracy for retinal detachment in emergency practitioners with only 30 minutes to 2 hours of ocular point-of-care ultrasonographic education.[5] It is unclear whether emergency practitioners with less formal point-of-care ultrasonographic training would demonstrate similar test characteristics for other posterior ocular abnormalities.

To our knowledge, this is the first meta-analysis of the diagnostic accuracy of emergency practitioner–performed point-of-care ultrasonography for the evaluation of posterior chamber abnormalities. The authors concluded that emergency practitioner–performed point-of-care ultrasonography can accurately diagnose retinal detachments in adults. Further study is needed to determine the utility in using point-of-care ultrasonography to diagnose other posterior chamber abnormalities.

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