Emergency department point-of-care ultrasound diagnosis of submacular hemorrhage presenting as painless loss of vision

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ABSTRACT

Ocular complaints prompt a significant number of emergency department (ED) visits, and they can range from benign to sight-threatening. Detailed fundoscopic examination is difficult, even for experienced providers. Point-of-care ultrasound (POCUS) is increasingly utilized in the ED for numerous applications, including ocular evaluation. We present a case in which ocular POCUS was used to diagnose a submacular hemorrhage in a patient who presented with acute painless loss of vision. Ocular POCUS can be readily employed to assess for myriad clinically significant pathologies.

RÉSUMÉ

Les troubles oculaires motivent un grand nombre de consultations au service des urgences (SU) et peuvent être sans conséquence grave ou, au contraire, entraîner la perte de la vision. Or, l'examen approfondi du fond de l'œil n'est pas chose facile à réaliser, même pour les professionnels de la santé expérimentés. Par ailleurs, on trouve de plus en plus d'applications à l'échographie au chevet (EC), au SU, dont les évaluations oculaires. Ainsi sera exposé dans l'article un cas de perte de vision aiguë et indolore, dans lequel l'EC oculaire a permis de diagnostiquer une hémorragie sous-maculaire. L'examen peut donc se prêter facilement à l'évaluation d'un grand nombre d'affections importantes de l'œil sur le plan clinique.

Keywords: Ocular ultrasound, submacular hemorrhage, ultrasound, vision loss

INTRODUCTION

Primary ocular complaints prompted nearly two million emergency department (ED) visits in the United States in 2010, comprising approximately 1.5% of total ED visits.[1] Acute loss of vision is alarming for the patient and can represent an emergent condition requiring prompt subspecialty treatment. For many ocular conditions, accurate diagnosis depends on obtaining a detailed clinical history and performing a thorough physical examination, which can be challenging in a busy ED. Many physicians are uncomfortable or unskilled with ophthalmoscopy, and prompt ophthalmology evaluation may not be possible in some regions.[2] We present a case in which point-of-care ultrasound (POCUS) was used as an adjunct during initial evaluation to diagnose a submacular hemorrhage, an uncommon cause of acute painless vision loss.

CASE

A 43-year-old, left-handed man presented with approximately 24 hours of right eye vision loss. He noticed an acute onset of blurry vision, as well as a "red cloud," that appeared after waking up at 4:00 a.m. and brushing his teeth. There was no precipitating trauma, infection, or other event that he could recall. He had decreased vision in the right eye and was unable to make out any movement. He denied headache, dizziness, lightheadedness, loss of consciousness, extremity weakness, or extremity numbness. His exam was notable for symmetric and reactive pupils, without an afferent or efferent pupillary defect. Vision was 20/200 in the right eye and 20/30 in the left

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This article has been updated to include the French abstract; see https://doi.org/10.1017/cem.2019.400.

eye. He had no history of previous vision deficits or need for corrective lenses. Bedside ocular ultrasound was performed, and a still image from the clip is shown below (Figure 1) that revealed a non-mobile hyperechoic lesion along the posterior retina that did not follow the normal contour of the posterior chamber. There was a mixed echogenic signal posterior to the lesion concerning for hemorrhage. The identified lesion did not appear to involve the optic nerve. No mobile retinal flap or posterior chamber debris was identified. Ophthalmology was consulted, and a dilated fundoscopic exam was performed, confirming the diagnosis of a large submacular hemorrhage (SMH) in addition to scattered smaller retinal hemorrhages. A hypercoagulable workup was initiated given concern for a thromboembolic event such as a central retinal vein occlusion as the possible etiology of this localized hemorrhage. The patient was referred to the subspecialty retina clinic. The hypercoagulable workup was non-contributory. While conservative management was initially recommended, the central vision did not improve, and a vitrectomy with possible internal limiting membrane peeling was scheduled.

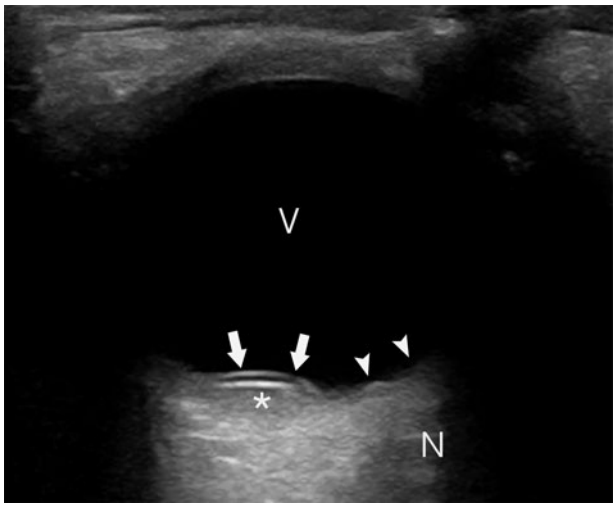

Figure 1. Ocular ultrasound showing the vitreous (V), optic nerve (N), retina (arrowheads), and non-mobile retinal contour abnormality (arrows). Also noted is a mixed echogenic material (asterisk) posterior to the retinal lesion indicating the presence of hemorrhage.

DISCUSSION

SMH is a vision-threatening condition that can occur spontaneously and result in significant morbidity even after treatment is initiated.[3] This condition is because of the accumulation of blood between the retinal layers and can arise from the choroid or retinal blood supply.[3] Non-traumatic SMH can be related to age-related macular degeneration, but it may also be related to arterial microaneurysms, trauma, or other primary ophthalmological pathologies.[3,4] Patients typically present with an acute onset of blurry vision, decreased visual acuity, or scotomas.[3] Currently, there is no gold standard for treatment of this condition, with options including tissue plasminogen activator, anti-vascular endothelial growth factor, and pneumatic decompression.[3,4]

The differential diagnosis for acute painless vision loss includes central retinal artery occlusion, central retinal vein occlusion, and retinal detachment. This case presentation is not entirely consistent with those diagnoses. A fundoscopic exam is a valuable component of the initial diagnostic workup for acute non-traumatic vision loss. However, this procedure is difficult to learn and even more difficult to employ when not consistently practised. One study of medical students, residents, and faculty physicians showed that confidence in performing an appropriate fundoscopic exam was poor across all levels including faculty.[5] Furthermore, performing a non-dilated exam can severely limit a physician's ability to identify and interpret ocular findings. In one study of 500 patients, 38% of conditions that required additional treatment or intervention were not evident on non-dilated exams.[6]

POCUS in the ED is a rapidly growing diagnostic modality in both adult and pediatric settings.[7,8] The normal anatomy of the eye is easily identifiable with ultrasound (Figure 2), and the pathology shown in this case can be easily identified (Figure 1). Ocular ultrasound is used in the point-of-care setting to assess the posterior chamber, and studies have shown that POCUS after minimal training has sensitivities and specificities for retinal detachment of 91–100% and 83–96%, respectively.[9–12] Traditional evaluation and diagnosis of SMH relies on a direct fundoscopic exam, but, as previously shown, this can be difficult to perform. This case is an example of the ability of POCUS to diagnose less common ocular pathologies and direct further workup.

Guidelines published by both the Canadian Association of Emergency Physicians (CAEP) and the

https://doi.org/10.1017/cem.2019.375 Published online by Cambridge University Press

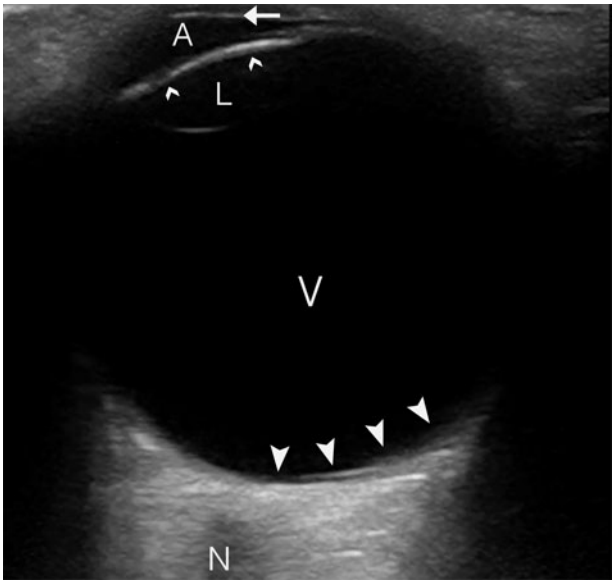

Figure 2. Normal ocular exam showing the vitreous (V), optic nerve (N), retina (arrowheads), lens (L), iris (chevrons), anterior chamber (A), and cornea (arrow).

American College of Emergency Physicians (ACEP) state that the scope of practice for POCUS by emergency physicians includes ocular imaging.[13,14] Furthermore, the American College of Graduate Medical Education (ACGME) mandates POCUS education for all emergency medicine residents. This case highlights the use of ocular POCUS to reveal a rare condition that requires urgent ophthalmology follow-up yet is traditionally difficult to diagnose by non-specialty trained physicians.

CONCLUSION

As the use of POCUS increases, emergency providers should seek to become comfortable with its various uses, including ocular evaluation. Ocular POCUS is a valuable diagnostic tool in the ED, and this case highlights the ability of this modality to identify a condition that requires urgent ophthalmological consultation and management, in addition to expanding the growing body of literature showing that POCUS can identify ophthalmologic conditions not commonly considered sonographic diagnoses.

Competing interests

This research received no specific grant from any funding agency, commercial, or not-for-profit sectors. None declared.

REFERENCES

1. Channa R, Zafar SN, Canner JK, et al. Epidemiology of eye-related emergency department visits. *JAMA Ophthalmol* 2016;134(3):312–9.
2. Mackay DD, Garza PS, Bruce BB, Newman NJ, Biousse V. The demise of direct ophthalmoscopy: a modern clinical challenge. *Neurol Clin Pract* 2015;5(2):150–7.
3. Hochman MA, Seery CM, Zarbin MA. Pathophysiology and management of subretinal hemorrhage. *Surv Ophthalmol* 1997;42(3):195–213.
4. Ozkaya A, Erdogan G, Tarakcioglu HN. Submacular hemorrhage secondary to age-related macular degeneration managed with vitrectomy, subretinal injection of tissue plasminogen activator, hemorrhage displacement with liquid perfluorocarbon, gas tamponade, and face-down positioning. *Saudi J Ophthalmol* 2018;32(4):269–74.
5. Wu EH, Fagan MJ, Reinert SE, Diaz JA. Self-confidence in and perceived utility of the physical examination: a comparison of medical students, residents, and faculty internists. *J Gen Intern Med* 2007;22(12):1725–30.
6. Siegel BS, Thompson AK, Yolton DP, Reinke AR, Yolton RL. A comparison of diagnostic outcomes with and without pupillary dilatation. *J Am Optom Assoc* 1990;61(1):25–34.
7. Marin JR, Abo AM, Arroyo AC, et al. Pediatric emergency medicine point-of-care ultrasound: summary of the evidence. *Crit Ultrasound J* 2016;8(1):16.
8. Blaivas M, Theodoro D, Sierzenski PR. A study of bedside ocular ultrasonography in the emergency department. *Acad Emerg Med* 2002;9(8):791–9.
9. Lahham S, Shniter I, Thompson M, et al. Point-of-care ultrasonography in the diagnosis of retinal detachment, vitreous hemorrhage, and vitreous detachment in the emergency department. *JAMA Netw Open* 2019;2(4):e192162.
10. Jacobsen B, Lahham S, Lahham S, et al. Retrospective review of ocular point-of-care ultrasound for detection of retinal detachment. *West J Emerg Med* 2016;17(2):196–200.
11. Yoonessi R, Hussain A, Jang TB. Bedside ocular ultrasound for the detection of retinal detachment in the emergency department. *Acad Emerg Med* 2010;17(9):913–7.
12. Shinar Z, Chan L, Orlinsky M. Use of ocular ultrasound for the evaluation of retinal detachment. *J Emerg Med* 2011;40(1):53–7.
13. Henneberry RJ, Hanson A, Healey A, et al. Use of point of care sonography by emergency physicians. *CJEM* 2012;14(2):106–12.
14. American College of Emergency Physicians. Emergency ultrasound guidelines. *Ann Emerg Med* 2009;53(4):550–70.

https://doi.org/10.1017/cem.2019.375 Published online by Cambridge University Press