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Brief Report

Mobile vitreous opacities on ocular ultrasonography are not always pathologic: a cross-sectional survey in an asymptomatic population☆,☆☆,★

Gavin Budhram, MD *, Jennifer Cronsell, DO, Michele Schroeder, MD, Jeremy Sautner, MD, Elizabeth Schoenfeld, MD, Tala Elia, MD, Jennifer Friderici, MS

Department of Emergency Medicine, Tufts University School of Medicine, Baystate Medical Center, 759 Chestnut St, Springfield, MA, 01199

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ABSTRACT

Background: Ultrasonography is often used in the evaluation of patients with ocular concerns; however, several pathologic conditions and even some age-related changes can have similar sonographic appearances. One approach that clinicians use is to assume that unilateral findings visible at normal gain are acute, whereas bilateral findings requiring high gain are chronic, especially in the elderly population. To date, no studies have systematically evaluated this assumption.
Objectives: The objectives are to determine the prevalence of monocular and binocular mobile vitreous opacities (MVOs) in the vitreous chamber in an asymptomatic population at normal and high gain levels and to determine its prevalence with higher age stratifications.
Methods: We conducted a cross-sectional survey using 2-dimensional ultrasonography with a high-frequency transducer of 105 asymptomatic subjects aged 20-89 years and evaluated each subject's eyes for the presence of MVOs at both normal and high gain levels in progressive age stratifications.
Results: Ultrasonographic scans were obtained on 105 subjects. At normal gain levels, MVO was present in only 1 subject (0.95%; 95% confidence interval, 0.0%-5.0%). At high gain levels, MVO was present in 28.6% (30/105) of subjects. Of the subjects with MVO at high gain, 60% (18/30) had unilateral MVO. Mobile vitreous opacity was found more frequently with advancing age, being present in 23 subjects older than 59 years, compared with 7 subjects 59 years and younger (51.1% vs 11.7%, $P < .001$).
Conclusions: Mobile vitreous opacity in the vitreous chamber visualized at high gain levels is relatively common and may not be pathologic, even if unilateral and occurring at a relatively young age.

1. Introduction

Ocular trauma and vision changes are regular causes of emergency department (ED) visits, accounting for 2% of ED visits [1]. Eye injuries account for 3.5% of all occupational injuries in the United States, and about 2000 US workers injure their eyes each day [1]. In many acute ocular conditions, however, the physical examination can be difficult—especially because specialized equipment and ophthalmologic expertise are often unavailable in the ED. Eye injuries also pose risk to the provider because misdiagnosis of ocular pathology can lead to loss of vision, significant morbidity, and significant legal risk [2].

In this setting, bedside ultrasonography has quickly become an adjunct to standard examination techniques, allowing clinicians the ability to evaluate for retinal detachment (RD), posterior vitreous detachment (PVD), vitreous hemorrhages (VHs), lens dislocations, and other eye problems that have been traditionally difficult to diagnose using standard ED methods and tools [3]. The majority of ED ocular ultrasonographic studies have so far have focused on RD, so test characteristics for PVD, VH, and other entities are unfortunately not well described. Regarding RD, initial investigations by Blaivas et al [3] in 2002 were promising, showing a 100% sensitivity and 100% specificity in 61 patients with ocular trauma or other visual concerns. In subsequent investigations, however, test characteristics have been less robust. In 2011, Shinar et al [4] demonstrated a 92% specificity, and in 2010, Yoonessi et al [5] found only an 83% specificity of ultrasonography for RD. It is likely that these lower specificities are at least partly due to sonographic similarities between RD and other disease entities including PVD and VH. Certain types of VH, namely, acute mild VH, can also appear similar to chronic conditions including asteroid hyalosis. Although differentiating ultrasound characteristics have been described in the literature for more than 20 years [6], novice sonographers or clinicians with an understanding of only the basic ultrasonographic applications might easily confuse one clinical entity with another. In some instances, misdiagnosis could significantly impact treatment strategies and patient outcomes.

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* Corresponding author. Tel.: +1 413 794 2424; fax: +1 413 794 8070.
E-mail address: Gavin.BudhramMD@baystatehealth.org (G. Budhram).

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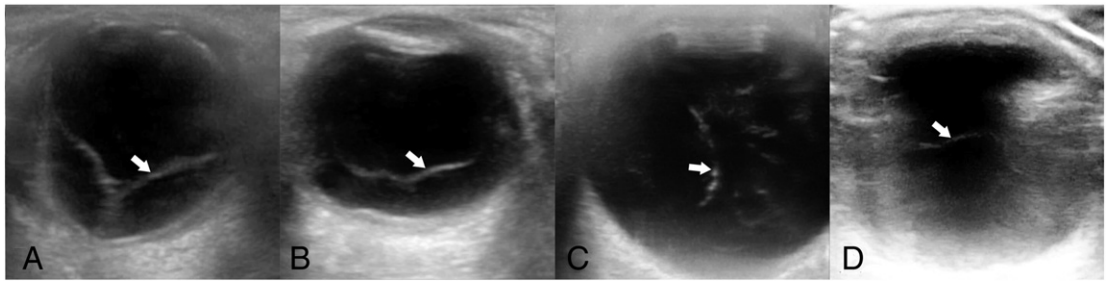

Fig. 1. Membranous MVO. A, Retinal detachment in an ED patient after a skiing injury at normal gain. B, Posterior vitreous detachment at high gain in an ED patient with acute, atraumatic vision loss. C, Subacute, organized VH at high gain in an ED patient after a fall 4 days prior and partial monocular visual loss. D, Membranous MVO from an asymptomatic study subject at high gain (arrows indicate membranes).

Retinal detachment is typically identified on ultrasonography as a unilateral, brightly echogenic line that "floats" in the vitreous, moves with eye movement, and is visible at normal gain levels (Fig. 1A). It should also be tethered anteriorly to the ora serrata and posteriorly at the optic disk, creating a V or funnel shape. Sonographers typically use this fact to differentiate it from a PVD, which is not tethered posteriorly.

Posterior vitreous detachment occurs when the gel-like vitreous substance contracts and pulls its posterior edge away from the retina and optic disk. Posterior vitreous detachment alone can be asymptomatic and does not necessitate emergent ophthalmologic referral and treatment, but as the vitreous retracts from the retina, it may cause tears, hemorrhage, and detachment of the retina—a condition which does require ophthalmologic referral. Sonographically, both chronic and acutely symptomatic vitreous detachments appear as a thin, mobile, C-shaped concave upward membrane that is seen at high gain levels (Fig. 1B). Unlike RD, it is not attached at the optic disk.

The sonographic appearance of VH depends on its age and severity. In fresh mild hemorrhages, small areas of particulate MVO are seen in the posterior chamber (Fig. 2A). As the hemorrhage ages, particularly with severe hemorrhages, the blood first organizes and then forms mobile membranes that are visible in the posterior chamber (Fig. 1C).

Asteroid hyalosis is typically an asymptomatic phenomenon, occurring in patients older than 60 years and requiring no specific treatment. The asteroid bodies represent calcium-laden lipids suspended within the vitreous. These may be progressive but never lead to severe vision loss [7]. Asteroid hyalosis is of concern to emergency physicians because it has a similar appearance on ultrasonography to acute mild VH: that of pinpoint "stars in the night sky" (Fig. 2B).

Although the sonographic descriptions above seem discrete, in practice, there can be some ambiguity in the ultrasound findings leading to confusion for emergency physicians evaluating patients with acute injury. Retinal detachment, subacute VH, acute PVD, and chronic PVD can all appear as mobile vitreous opacities (MVOs) that are membranous in nature and swirl with eye movement (Fig. 1). Acute mild VH maybe be confused with asteroid hyalosis because both appear as particulate MVOs that swirl with eye movement [8] (Fig. 2). Indeed, MVO in the vitreous chamber is now thought to be a relatively common and sometimes asymptomatic phenomenon, especially in the aging eye [9]. This fact has been recently highlighted by Schott et al [10] in a case report demonstrating PVD being confused for RD on ultrasonography in the ED.

To decide whether ultrasonographic findings are acute or chronic, clinical sonographers often use gain and lateralization: findings that are unilateral and visible at normal gains are considered acute, whereas findings that are bilateral and require high gain are more likely to be chronic, especially in the elderly population [9]. Although this approach seems intuitive, to date, no research has evaluated the accuracy of this assumption. The hypothesis of this study is that the sonographic finding of MVO in the vitreous chamber is a binocular phenomenon that is observed primarily at high gain levels and increases in prevalence with increasing age. We hope that results of this study will help clinicians differentiate acute, vision-threatening pathology from normal age-related changes.

2. Methods

2.1. Study design

This was a cross-sectional observational study that enrolled a convenience sample of patients aged 20-89 years presenting to an urban academic ED between March and June 2013. Patients were stratified into decades of age with 15 patients included in each stratum. Patients were eligible to participate in the study if they presented to the ED with a nonocular concern, were between the ages of 20 and 89 years, were able to provide informed consent, and were able to speak and/or read English. They were excluded from participation if they were currently experiencing ocular symptoms or if they had any condition which would make ultrasonography uncomfortable for them, a history of allergic reaction to the coupling gel or adhesive, any history of eye surgery, "flashers" or "floaters" in any visual fields, artificial eye, or history of significant eye pathology or trauma, excluding myopia (nearsighted) or hyperopia (farsighted) that is correctable to normal visual

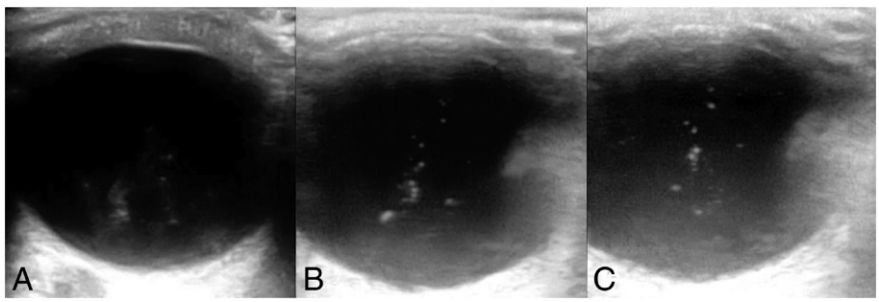

Fig. 2. Particulate MVO. A, Acute, mild VH at high gain in an ED patient with visual changes after motor vehicle collision. B, An ED patient with known asteroid hyalosis at high gain. C, Particulate MVO from an asymptomatic study subject at high gain.