EMERGENCY MEDICINE

Emergency Ultrasound: Bedside Ultrasound for Ocular Emergencies

By: Jehangir Meer, MD; Todd Taylor, MD; Sierra Beck, MD

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The authors illustrate how bedside ultrasound assists in the rapid diagnosis of time-sensitive conditions such as retinal detachment, vitreous hemorrhage, and lens dislocation.

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Ocular Ultrasound

Since the eye is predominantly composed of fluid, it is the perfect organ for ultrasound evaluation. As shown in a prospective observational study by Blaivas et al in 2002,[1] the use of bedside ultrasound in the ED can assist in the rapid diagnosis of time-sensitive conditions such as retinal detachment, vitreous hemorrhage, and lens dislocation.

Patient Preparation

Using a high-frequency transducer, the clinician should place a tegaderm barrier over the closed eyelid of the reclined patient before next applying copious amounts of sterile gel to the top of the barrier (ultrasound gel is not bacteriostatic). Then he or she should brace a hand on the patient's forehead or cheek to control the downward pressure exerted on the transducer (**Figure 1**). The transducer will sit on top of the gel and make indirect contact with the eyelid.

Figure 1. Photo demonstrating correct placement of the probe and fingers on patient's face prior to performing an ocular ultrasound.

It is important to note that while ocular ultrasound is an excellent imaging modality, it is contraindicated in patients in whom globe rupture is suspected or obvious due to the risk of pressing on the globe with resulting increase in intraocular pressure.

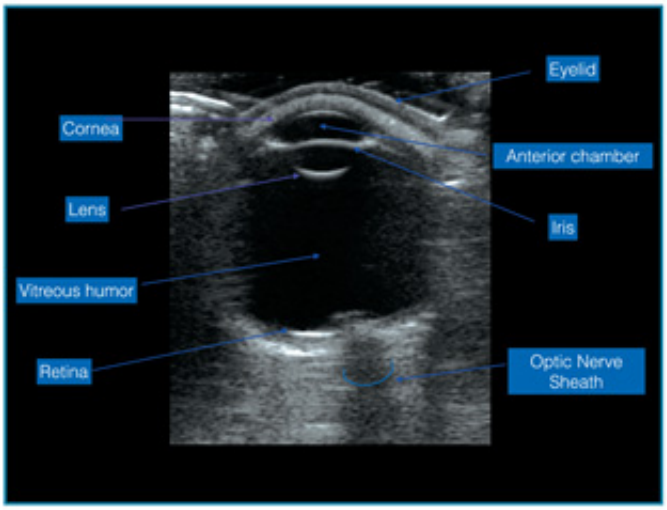

Figure 2. Ocular ultrasound showing normal superficial and deep structures of the eye.

Technique

When performing ocular ultrasound, it is recommended that the clinician should scan/sweep the normal eye first and then the abnormal eye. **Figure 2** demonstrates the ocular structures easily visualized by ultrasound.. Both eyes should be imaged in at least 2 planes. In addition, the patient should be instructed to look through all of the cardinal positions of gaze to maximize the ocular structures visualized.

Over-gaining the image is also helpful when looking at the posterior chamber for hemorrhage or retinal detachment. However, the time spent scanning the eye should be limited, since ultrasound could theoretically cause heating and cavitation over a prolonged period of time.

Retinal Detachment

When evaluating for retinal detachment, one should focus on the posterior chamber of the eye and turn-up the far-field gain. The retina is firmly attached at two sites: the optic nerve posteriorly and the ora serrata anteriorly. Even with a complete retinal detachment, the retina is tethered at these points. Therefore, during examination, look for a hyperechoic membrane floating and moving within the vitreous body, but tethered anteriorly and posteriorly when the patient moves his or her eyes. **Figures 3** and **4** are examples of ultrasound demonstrating partial and complete retinal detachment.

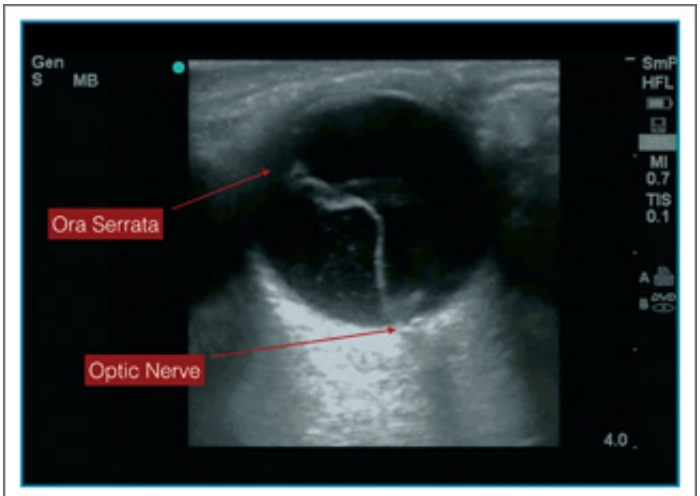

Figure 3. Ocular ultrasound showing a partial retinal detachment tethered at the ora serrata and optic disc.

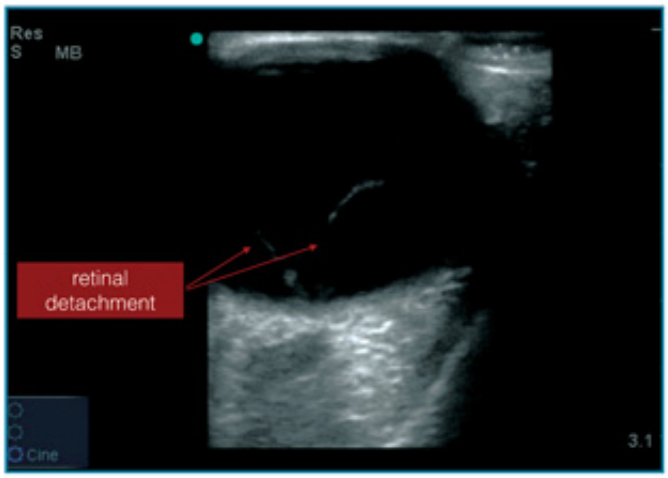

Figure 4. Ocular ultrasound showing a complete retinal detachment, with a V-shaped appearance of retinal membrane.

Vitreous Hemorrhage

Vitreous hemorrhages will appear as hyperechoic particles or opacities within the posterior chamber (**Figures 5 and 6**). The appearance of hemorrhage will vary depending on age and degree, and can have the appearance of swirling or rotating particles during eye movement, resembling the movement of clothes in a

washing machine.

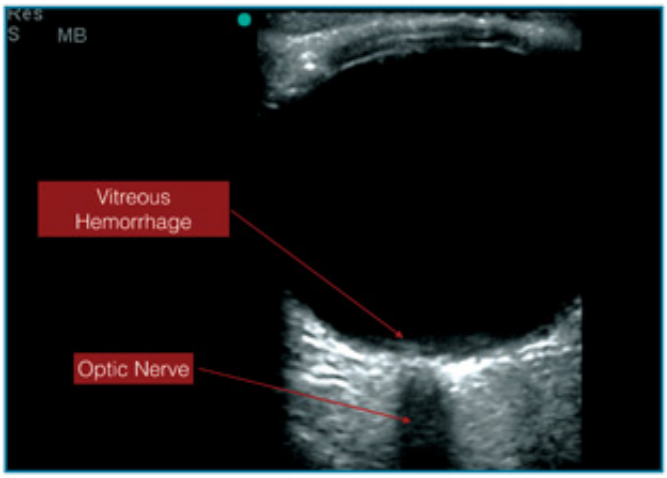

Figure 5. Ocular ultrasound showing small posterior vitreous hemorrhage, with increased gain.

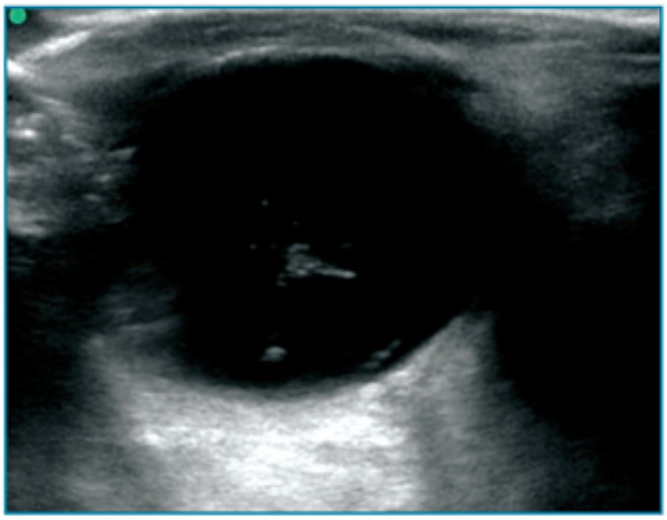

Figure 6. Ocular ultrasound showing a vitreous hemorrhage. In this image, the hemorrhage more clearly appears as a heterogeneous mass of free floating debris.

Lens Dislocation

Lens dislocations are quite easy to visualize on ultrasound and are divided into partial or full dislocations. Complete dislocations are diagnosed when the lens is out of the expected position, dislodged into the anterior chamber or vitreous (**Figure 7**). Partial dislocations are harder to diagnose and require careful attention during active range of movement of the eye—the lens will appear to move independent of the rest of the iris/ciliary body complex.[2]

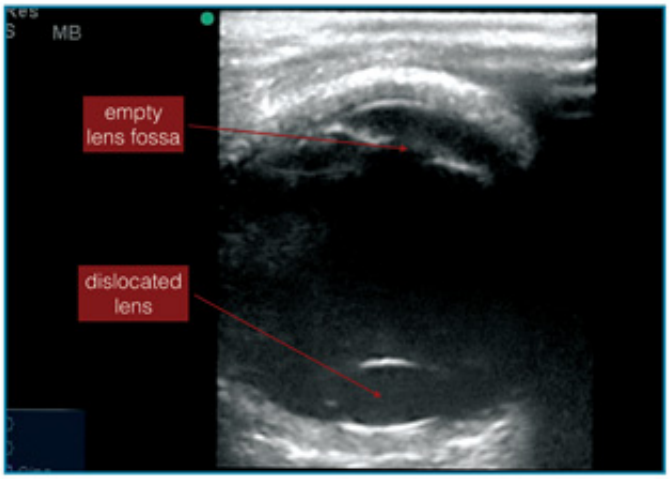

Figure 7. Ultrasound showing a complete dislocation of the ocular lens; note the lens is seen sitting on top of retina.

Conclusion

Bedside ultrasound performed in the ED can rapidly and accurately evaluate and diagnose ocular emergencies, facilitating prompt treatment.

Dr Taylor is an assistant professor and director of postgraduate medical education, department of emergency medicine, Emory University School of Medicine, Atlanta, Georgia. **Dr Meer** is an assistant professor and director of emergency ultrasound, department of emergency medicine, Emory University School of Medicine, Atlanta, Georgia. **Dr Beck** is an assistant professor, department of emergency medicine, Emory University School of Medicine, Atlanta, Georgia.
