A PRIMER ON DIAGNOSTIC OPHTHALMIC ULTRASOUND

Continued improvements to this imaging modality have made it an indispensable tool for the retina specialist.

BY LUIS J. HADDOCK, MD, AND YALE FISHER, MD

Annular array ultrasound permits phase focusing on a variety of depths, improving axial and lateral resolution that enhance diagnostic capabilities.

For advanced mapping of abnormalities, pay attention to the pathology’s proximity to known structures, such as recti muscles and the optic nerve, which are easily identified orbital landmarks during ultrasonography.

We can now store real-time ultrasounds as still images or movie segments for review, comparison, and transmission.
must be recognized each time the probe is moved during an examination and prior to pattern recognition evaluation. Cross sections of pathologic abnormalities are then mentally reconstructed and interpreted.

Movement and gray scale evaluations complete the examination process. Motion in real-time dynamic ultrasonography is extremely helpful in differentiating many ocular pathologies. For example, the mercurial movement of a formed vitreous separation is quite different from the more uniform and slower movement of a complete and newly formed rhegmatogenous retinal separation.

The next step is recognizing intraocular abnormalities in unfamiliar cross-sectional images. Pattern recognition is the key to diagnostic interpretation and requires experience, especially in complex, combined abnormalities. There are a variety of helpful techniques to aid interpretation. For example, practicing mental cross sections of known objects or reverse reconstruction by drawing what the screen might look like from a particular probe position can be useful.

Gray scale is more difficult to interpret because the probe must be perpendicular to the tissue of interest. Probe positioning becomes paramount in placing the area of interest at the center of the display. Simultaneous A-scan during B-scan capture often helps to ensure the strongest reflections for comparison with those of known strong reflectors, such as the retina or Tenon’s capsule/orbital fat.

**EXAMINING THE GLOBE AND ORBIT**

Various techniques for examining the globe and orbit exist, many of which involve direct scleral contact. We have always favored closed-lid examination rather than scleral contact. Here, we provide a step-by-step description of a posterior B-scan ultrasound examination via closed-lid techniques.

1. Briefly review and confirm the patient’s history and ocular examination reports. Take the appropriate precautions for any history of open-globe injury or surgery.
2. Carefully explain the steps to the patient and place the patient in a seated or slightly reclined position.
3. Apply ophthalmic lubricant gel to the clean ultrasound probe prior to scanning.
4. For **transverse imaging**, ask the patient to gaze inferiorly while you place the probe on the superior lid with the manufacturer’s mark in a nasal direction. With minimal pressure on the globe, tilt the probe to visualize the inferior portions of the eye from the most anterior areas behind the iris in a sweeping fashion back to the optic nerve insertion, fully scanning for any pathology inferiorly. Remember that the top of the screen display represents the nasal and inferior portions of the globe. The bottom of the display shows the temporal and inferior portion of the globe. The center of the display screen represents the 6 clock position. Once you complete the sweep and find no topographic abnormalities, scan the remaining quadrants in a similar fashion.

5. **Radial imaging** is easier to master, considering the probe mark is always directed toward the center of the cornea and pointing to the meridian of interest. The top of the
screen displays areas near the back of the iris and ciliary body and the bottom displays the posterior structures with the shadow of the optic nerve. Ask the patient to gaze upward and place the probe at the 6 clock position on the lower lid. Scan the superior globe from the 1 to the 11 clock position to evaluate the vitreous base and radially back to the posterior globe. Move the probe to the 3, 6, 9, and 12 clock positions to access the remainder of the globe (Figure 3). These sweeping real-time examinations are useful in detecting peripheral pathology, such as flap tears and minimal retinal separations.

ULTRASOUND TIPS
We do not examine the posterior globe through probe positions that involve the cornea or anterior segment because avoiding the natural lens or pseudophakic implant is important to prevent artifact reflections. For advanced mapping of abnormalities, pay close attention to the pathology’s proximity to known structures, such as recti muscles and the optic nerve, which are easily identified orbital landmarks. Often, gentle simultaneous scleral depression during the ultrasound evaluation of the anterior retina can help to localize clock hour positions.

Ultrasound equipment continues to improve, and we can now store real-time examinations as still images or movie segments for review, comparison, and transmission. This allows for remote analysis when probe positions are recorded. Newer devices also include automatic scan location detection technology.

Practice with clear media abnormalities, such as retinal and vitreous separation and traction retinal detachment, prior to routine visual examination; this will help you compare structures and improve your interpretation skills.

ULTRASOUND MASTERY
Ocular examination with ultrasound of the globe and orbit is a critical part of imaging for retina specialists. While the technique requires training and experience, the information it provides is well worth the time it takes to master the modality. Ultrasound remains a valuable tool to manage patients with complex vitreoretinal pathology. ■

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