Dynamic Ophthalmic Ultrasonography—A Video Atlas for Ophthalmologists and Imaging Technicians


Medical use of ultrasonography covers a wide variety of clinical settings ranging from therapeutic to diagnostic applications. The ultrasound frequencies and delivery systems used are necessarily different depending on the particular application. Therapeutic ultrasonography units used in treating patients with soft-tissue diseases, muscle spasms, or pain typically use frequencies in the range of 0.8 MHz to 3.0 MHz. Benefits of such treatments are derived from both thermal mechanisms (eg, absorption of ultrasound waves) and nonthermal mechanisms (eg, cavitation, microstreaming, acoustic streaming). Therapeutic ultrasonography applications also include fragmentation and cleansing.

Diagnostic ultrasonography, by contrast, typically uses frequencies in the range of 1 MHz to 18 MHz—and much higher for biomicroscopic ultrasonography (50-100 MHz). The primary benefits of diagnostic ultrasonography are derived from images produced by reflection of high-frequency sound waves by tissues. The 2 main types of diagnostic ultrasonography are A-mode (or A-scan) imaging and B-mode (or B-scan) imaging.

In A-mode imaging, the ultrasound “echoes” plotted on a screen reveal the depth of structures, allowing for measurement of various structures and providing a diagnostic advantage to the clinician in a variety of settings. In B-mode imaging, a linear array of piezoelectric transducers scans a sequence of planes through the body, and these scans are viewed on a screen as a “real-time” sequence of images resembling a video.

These images are best interpreted with the clinician or, in many cases, a trained technician observing the images as they are being generated. B-mode imaging is the most widely used type of diagnostic ultrasonography in clinical medicine. Much more clinical information can be obtained from a study observed in this dynamic, video-like manner (including information about the movement of tissues) than from a single still image.

It is with this dynamic between visually detected tissue movement and active interpretation by the observer in mind that Julian Pancho S. Garcia, Jr, MD, has produced a truly unique volume (at least for ophthalmologists) titled, Dynamic Ophthalmic Ultrasonography—A Video Atlas for Ophthalmologists and Imaging Technicians. Dr Garcia is an associate professor of ophthalmology at the New York Eye & Ear Infirmary in New York City and at New York Medical College in Valhalla.

The book is divided into 3 sections consisting of an introduction, a review of forms of ophthalmic ultrasound movement, and case presentations. The introductory chapter recounts basic techniques and physical principles of ophthalmic diagnostic ultrasonography and includes several useful explanatory diagrams. The 8 chapters of the book’s second section progress through interpretations of tissue interactions observed in a variety of clinical settings—convection, gravity-dependent movement, reflex motion, vasculature, aftermovement of the vitreous, aftermovement of the hyaloid, aftermovement of the retina, and aftermovement of the choroid. Each chapter features high-quality black-and-white ultrasonography images with relevant structures labeled.

A scratch-off sticker on the inner front cover of the book provides the reader with a code for immediate access to online videos of the concepts discussed in the book. These high-quality videos allow viewers to visually experience the concepts of each chapter as if they were performing ultrasonography studies on patients in real time. This experience demonstrates the accuracy of statements made in many other ultrasonography texts that observations made at the time of a study result in easier and more precise diagnostic interpretation. For example, a vitreous hemorrhage from diabetic retinopathy can be immediately recognized as caused by neovascularization elsewhere (as described in Chapter 6) by watching the vitreous move on video in relation to new vessels. Likewise, a vitreous hemorrhage can be seen to be caused by a hemorrhagic posterior vitreous detachment from a hyaloid stalk (as described in Chapter 7) by watching the vitreous move on video in relation to the stalk. In another example, the movement produced by a dislocated crystalline lens with and without retinal detachment (as described in Chapter 3 and Chapter 8) can be easily distinguished based on the relationships between the lens and retina observed in online videos.

The final section of the book includes several clinical cases—case presentations and appropriate associated diagnoses—to provide the reader with a means of testing his or her knowledge gained. The cases are well selected and worthwhile exercises for both student and teacher. One such case, for example, is described as follows:

This is a dynamic horizontal axial scan of a 49-year-old male, referred to this institution for evaluation of the eye. A month prior to consultation, he underwent surgery of a ruptured globe immediately following a shotgun injury to the face. Vision was hand motion at the time of ultrasound examination.

Watch Video 10-1, and then record your observations and/or impressions before proceeding.

After a detailed description of the movement shown in this video, including a labeled still picture from the
Low-lying temporal retinal detachment with incarcerated hyaloid secondary to metallic intraocular foreign body, vitreous hemorrhage, and serous partial posterior vitreous detachment status post anterior vitrectomy and ruptured globe repair.

The intent of Dr Garcia appears to have been to create a teaching atlas rather than an exhaustive and comprehensive catalogue of diseases of the retina and vitreous. He has succeeded in this goal. This is an especially outstanding text and atlas for those osteopathic physicians who are involved in training ophthalmology residents. It provides instruction in the basic ophthalmic ultrasonography examination, including details that range from simple directions on probe placement to more complex concepts, such as diagnoses of a variety of maladies in the vitreous and retinal subspecialty. The tissue interactions and anatomic relationships shown in the videos are discussed in the text in easily understood language, making images and diseases understandable from the perspective of the relationship between structure and function (a key tenet of osteopathic medicine). The online videos provide immediate visual feedback for concepts discussed in the text.

This book would also benefit those osteopathic ophthalmologists who use ultrasonography as part of their clinical practices—even if they delegate the actual performance of diagnostic ultrasonography to technical personnel. The book may aid the technician who observes patient studies dynamically to relay important diagnostic information to the osteopathic physician. Still-frame photographs of a study do not paint a complete picture of clinical findings and do not always cement the diagnosis. A well-educated technician who can communicate findings noted during the B-mode examination of a patient can prove invaluable to the clinician. Finally, the self-test in the book’s final section provides useful information for residents preparing for oral board examinations. Unfortunately, the audience for this text is relatively limited. The number of osteopathic ophthalmologists is relatively small, and those who have in-office access to B-mode ultrasonography are even fewer in number. Nevertheless, a wide range of healthcare providers working in osteopathic medicine would enjoy and benefit from having this text and atlas available to them, including osteopathic retina specialists, osteopathic medical school faculty members, osteopathic physicians involved in residency training programs, osteopathic ophthalmology residents, and any technical staff members working with osteopathic physicians.

Robert B. Chambers, DO, FAOCO-HNS
Associate Professor, The Ohio State University, Columbus