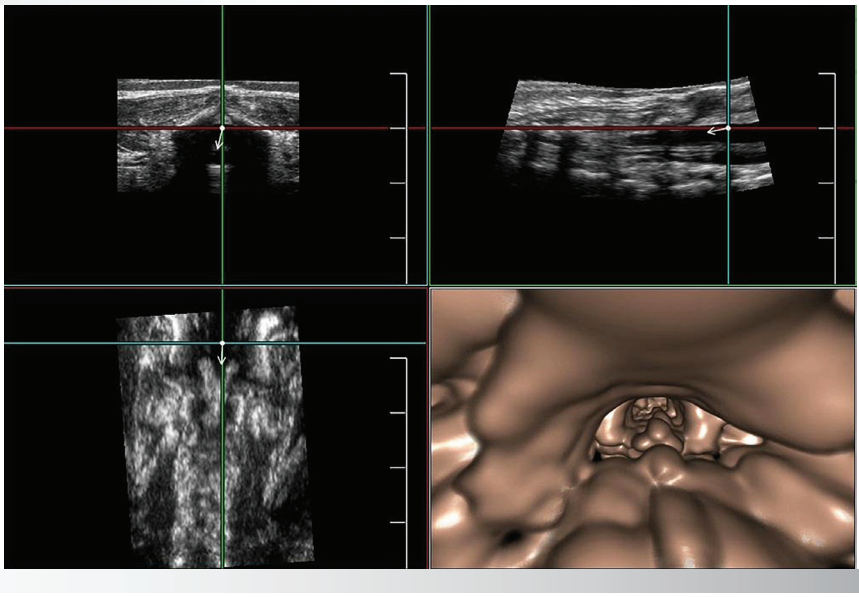
TOSHIBA
Leading Innovation

State-of-the-Art Ultrasound Technologies from Toshiba:

Enhancing Diagnoses for Better Patient Care



Sara M. O'Hara, M.D., FAAP

Professor of Radiology & Pediatrics
Chief, Ultrasound Division
Cincinnati Children's Hospital Medical Center

Internal visualization of fluid filled structures. Realistic imaging of the fetal face. Improved classification of tumors and lesions.

Ultrasound can now accomplish all of this.

State-of-the art ultrasound used to mean hybrid solutions, extended view, portability, cine loops and 3D and 4D enhancements. These technologies are now a given for ultrasound systems on the market today.

The latest technology breakthroughs are providing clinicians with a new perspective in ultrasound and expanding the use of non-invasive diagnostic tools.

Image Quality You Should Expect

Before you can use these high-end technologies, you need to ensure that your system provides high-resolution diagnostic images. A system that produces quality grayscale images will be able to handle these more advanced techniques.

For example, images of the kidney showcase the quality that you should expect from a premium system. They show significant detail of the internal structure of the kidney, and easily visualize the cortex and the medullary pyramids (**Figure 1**)

High-resolution images also expand the applications of ultrasound. For instance:

- Normal laminar flow in the jugular vein (**Figure 2**). There is no pathology here, but it demonstrates detail that was previously not resolvable.
- Pediatric testicle with tiny calcifications (**Figure 3**). This is also something that was previously beyond image resolution, especially with a small infant.
- Pediatric kidney with pyramids that has fine microcalcifications indicating renal disease (**Figure 4**).

Fly Thru

Introduced on Toshiba's most advanced ultrasound system, the Aplio™ 500, Fly Thru is an industry-first technology that images structures from the inside out. It is a 3D volume rendering technique that allows you to travel through fluid-filled structures like a virtual endoscope for better exploration of lesions and masses.

While it might seem like a complicated technique, it is actually quite easy to use. There are two modes: automatic interrogation and manual. The two options allow you to select the method

Figure 1: Significant detail of the internal structure of the kidney.

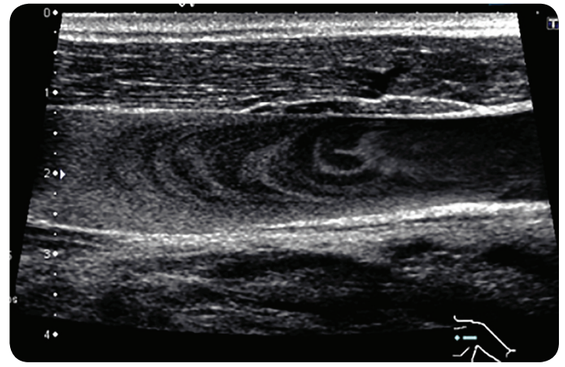


Figure 2: Normal laminar flow in the jugular vein.

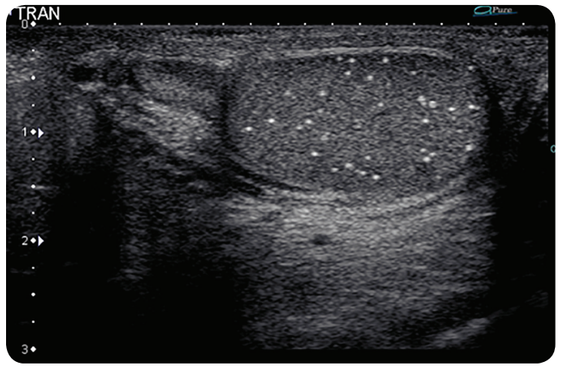


Figure 3: Pediatric testicle with tiny calcifications.

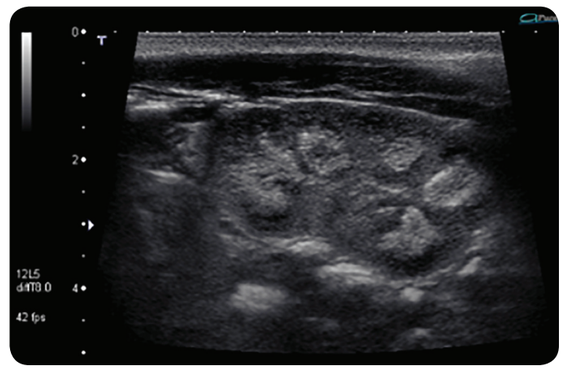


Figure 4: Pediatric kidney with pyramids that has fine microcalcifications.

that is most appropriate for the exam and fly-through through structures with ease.

The clinical possibilities for Fly Thru are vast. Examples of how we've leveraged the technology to image various structures include:

- Pediatric Spines: This image is flying through the CSF that surrounds the spinal cord between vertebral bodies to look for tethered cords. Conducted in "auto-pilot" mode, the system stays within the CSF space automatically (**Figure 5**).
- Dilated Superficial Vessels: Here, Fly Thru (**Figure 6**) produces alternative planes like the one on the bottom left with clear visualization of the twisty lumen. This is something you wouldn't be able to see without Fly Thru. For instance, if the patient had thrombophlebitis you could travel down the tube until you hit the clot. This patient doesn't have a clot, but the potential application is there.
- Newborn brains: Fly Thru can travel around the CSF spaces that surround a newborn's brain (**Figure 7**). The 3D rendering at the bottom shows the lining of the skull and brain surface connected by bridging veins. In this patient there was some debris because the patient had an intracranial hemorrhage.
- Bladder and ureter: In this image we are manually flying through the ureter upward into the bladder. In this patient, we can fly through the ureteral insertion and see that it is patent (**Figure 8**).
- Augmented bladders: This patient's bladder did not develop properly, so it was augmented with a piece of the bowel. We are using Fly Thru to image the undulating caves and outcroppings to identify anatomy and abnormalities (**Figure 9**).
- Ventricles of the brain: In this patient with dilated ventricles and hydrocephalus, Fly Thru is traveling from the third ventricle up into the lateral ventricle (**Figure 10**). One reason pediatric patients develop hydrocephalus is because the foramen of Monro is blocked with stenosis or a blood clot. In this case you can see that the foramen of Monro is open.

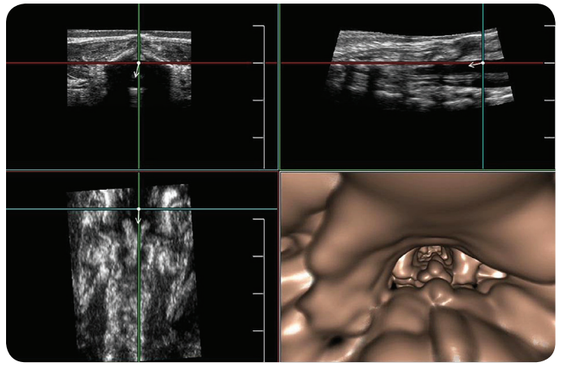
Fly Thru is beneficial in many different ways. It can visualize complex anatomy, and it aids in diagnosis, planning and treatment. It can show planes not accessible with 2D ultrasound and produces anatomical views in three orthogonal planes, offering a multidimensional landscape of anatomy and pathology. Fly Thru is opening up a new frontier in ultrasound as its applications continue to grow.

Luminance

Toshiba's Luminance adds depth and perspective to 4D imaging. It is a 4D rendering and lighting technique that allows the operator to change where the light source is coming from to accentuate the desired viewing area.

The primary Luminance application is in fetal and OB/GYN imaging. In this set of images (**Figures 11A-11C**) you can see how the changing light source highlights different areas on the fetal face. This is beneficial in evaluating the fetus and diagnosing birth defects like cleft palate.

Luminance can visualize different textures beyond fetal imaging. For Crohn's disease, an inflammatory bowel disease, you can see the



Figures 5: Pediatric spines.

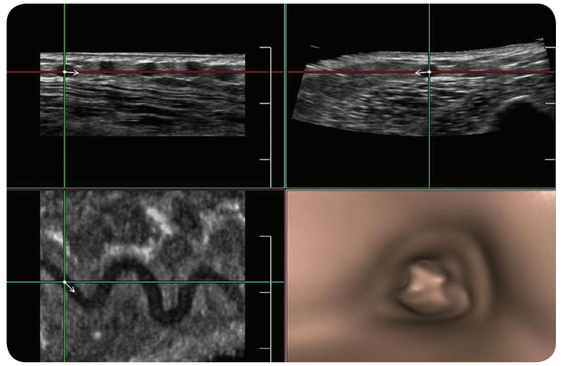


Figure 6: Dilated superficial vein.

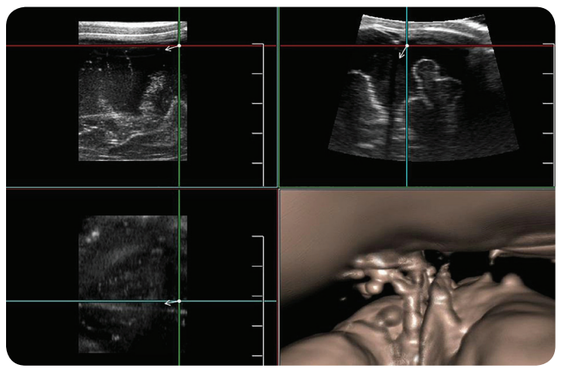


Figure 7: Newborn brains.

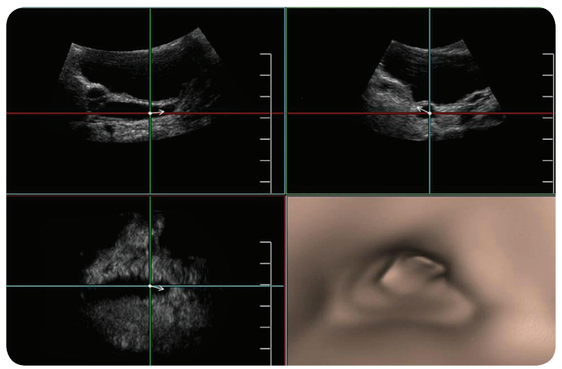
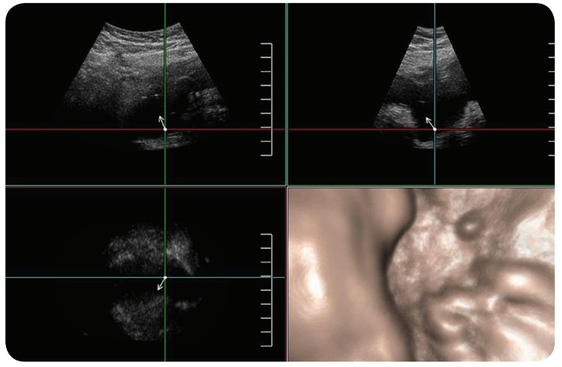


Figure 8: Bladder and ureter.



Figures 9: Augmented bladders.

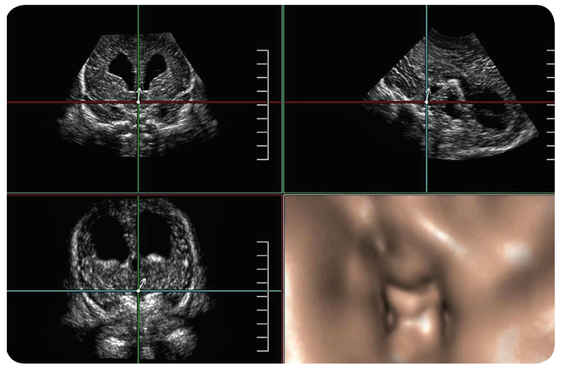


Figure 10: Ventricles of the brain.

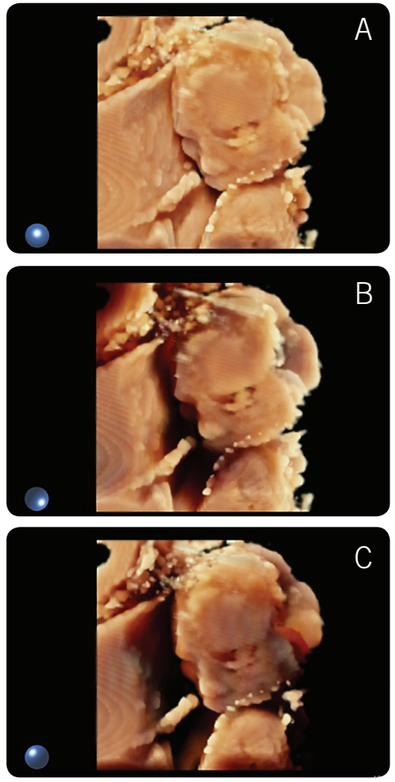


Figure 11A, 11B, 11C: Changing light source highlights different areas on the fetal face.

abnormal texture extending through the full thickness of the bowel caused by inflammation (**Figure 12**).

There is also potential for Luminance in imaging ureteral insertions. In **Figure 13**, you can see the comparison between the 2D and Luminance images. The yellow arrow points to the same orifice. Luminance allows you to get a 3D sense of where the ureter is coming in and where the cleft is.

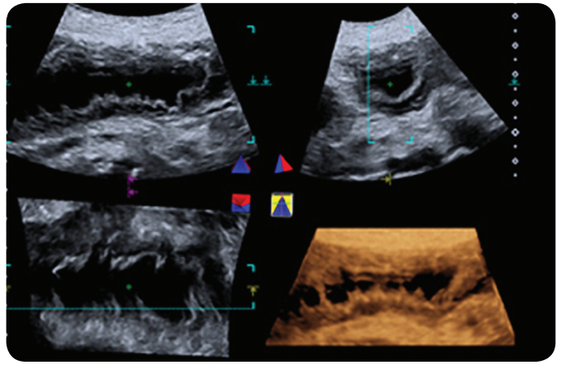
Elastography

Ultrasound is now able to accurately characterize tissue in real time with Elastography. Toshiba's Elastography is a manual compression method that evaluates tissue displacement and its firmness. Healthy tissue tends to be elastic, damaged or neoplastic tissue is rock hard and surgical scars are somewhere in between. Elastography determines the compression of the tissue and translates elasticity with color-coded images, as in this appendicitis example, **Figure 14B**.

Conclusion

The technology behind ultrasound continues to improve, expanding the use of this safe, non-invasive diagnostic tool. 3D and 4D volumetric imaging is changing the way clinicians work, but it is all founded on quality 2D imaging. Fly Thru provides a new perspective of ultrasound and allows the imaging of structures from the inside out. Luminance offers an enhanced perspective of fetal features. And Elastography increases tissue specificity and has the potential to decrease biopsies.

Together, these new technologies from Toshiba are paving the way for the future of ultrasound.



Figures 12: Abnormal texture extending through the full thickness of the bowel.

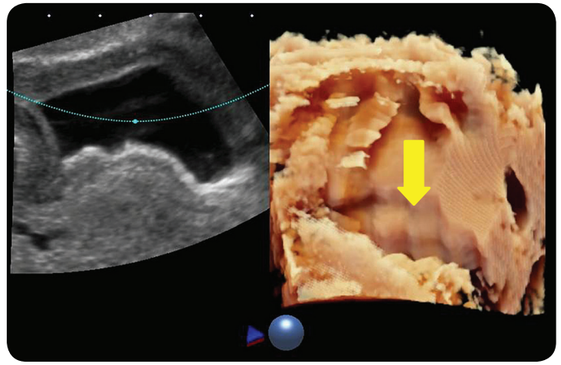


Figure 13: Ureteral insertions.

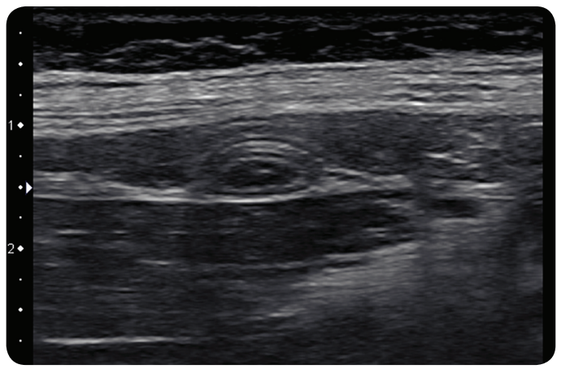


Figure 14A: Appendicitis example.

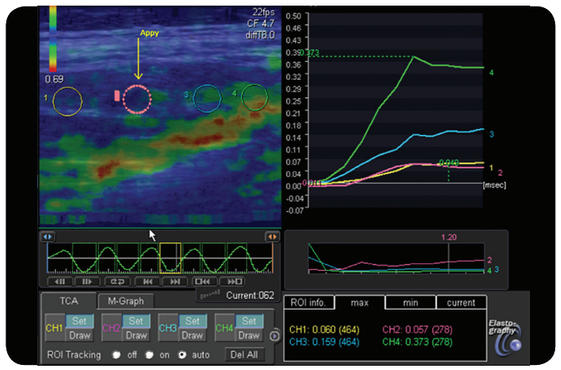


Figure 14B: Appendicitis example, color coding.

**Quantification not available in the United States*

www.medical.toshiba.com

TOSHIBA AMERICA MEDICAL SYSTEMS, INC.

2441 Michelle Drive, Tustin CA 92780 / 800.421.1968

ULWP12190US