

PEDIATRIC IMAGING

Challenges and Solutions in Imaging Children



In 2008, an alliance of radiology organizations was formed to launch the Image Gently campaign, emphasizing the importance of child sizing radiation dose to image pediatric patients more safely. The renewed focus on improving the safety of imaging for children has prompted hospital radiology departments and imaging centers to reexamine every aspect of their pediatric care. By reducing exam times, eliminating the need for follow-up exams and providing automated dose protocols for a range of weights and sizes, the right imaging technology can help facilitate safer imaging for the youngest patients.

Robb Young, senior manager of the CT business unit at Toshiba America Medical Systems, Inc., asks, “What are the greatest challenges in imaging small children? Children, especially young children, have a hard time taking instructions, and they tend to be a little squirmy. That’s the main challenge in pediatric imaging versus adult imaging: How do you get the diagnostic image you need so you don’t have to re-image?”

Young says that Toshiba’s Aquilion® ONE 320-detector row, dynamic volume CT scanner is optimal for pediatric imaging in terms of both speed

and dose. “With this technology, we can image children so quickly that we need less – sometimes even no – sedation, and often without them having to hold their breath,” he says. “You can image 16 cm in 0.35 seconds, whereas on a conventional CT it could take four or five seconds.”

The Aquilion ONE’s automated dose protocols take the guesswork out of imaging children by automatically child sizing dose, so the technologist can focus on the patient, not the control board. “This is a real issue,” Young says. “Should the technologists be focused on the scanner or the patient? Our design philosophy has always been to automate everything so they can focus on the child.”

Sometimes pediatric imaging goes beyond the diagnosis, and physicians are faced with performing interventional procedures where imaging plays a key role in the care delivered. Allan Berthe, product manager for Toshiba’s X-ray vascular business unit, notes that in some pediatric hospitals, cardiac imaging is performed alongside surgery to repair congenital heart defects. While this can help minimize disturbance to patients, it also creates unique challenges in the cardiac-catheterization suite. Toshiba’s Infinix-i™ C-arm addresses this issue with a unique five-axis positioner, enabling multiple clinicians to work around the patient while gathering high-quality images.

“There’s always a challenge with maneuverability around the room because the patient doesn’t give you any cooperation,” Berthe says. “It was paramount that the entire system design philosophy was changed to accommodate greater patient access and coverage. The five-axis positioner enables us to park the C-arm in a position that, when combined with the ceiling C-arm, gives 180° open head-end access while maintaining the C-arm coverage you want, the motion in various directions, the speed and the

right angles.”

The Gentler Approaches

Ultrasound is often used as the frontline modality in imaging children because it is noninvasive and emits no radiation. Erin Owen, senior manager for Toshiba's ultrasound business unit, says, “If they can diagnose it with ultrasound, they're going to do that first.” Toshiba's ultrasound technology facilitates rapid, high-quality pediatric imaging through a multitude of proprietary features. One such feature is differential tissue harmonic imaging (D-THI), which offers superior penetration at the high frequency needed to maintain image quality. “The higher the frequency, the better the image quality,” she says. “D-THI gives us image quality throughout without losing the penetration and while maintaining the resolution.”

Toshiba also offers two transducers that are ideal for pediatric imaging. One condition often experienced by infants in the neonatal ICU is bleeding in the brain; Toshiba's neonatal head transducer offers high-frequency imaging in a nickel-sized package designed to fit the smallest patients. Another transducer, the 745 BTV, is “a very small convex transducer that is good for neonatal heads and also for looking at the livers or kidneys of very tiny babies,” Owen says. “For some of these babies, a regular transducer would be too powerful, and that would negatively affect image quality.” Precision Imaging, a feature available on most TAMS transducers, also enhances image quality by providing superior definition of lesions. “It helps us get a clearer understanding of what's going on, and might help eliminate a more costly or frightening exam,” Owen says.

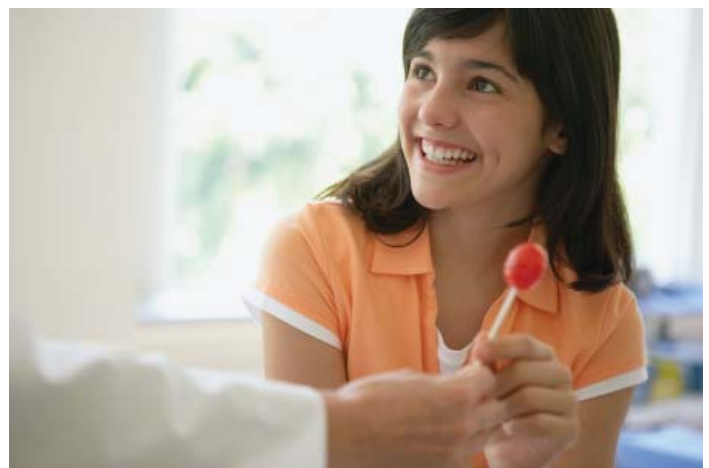
Pediatric MRI represents a multitude of challenges. Most MRI exams are lengthy and children might require sedation to keep still. Additionally, anyone who has experienced an MRI exam can testify to the loud noise, which can frighten young patients. Joel Urick, product manager in Toshiba's MRI business unit, explains how the company's MRI technology addresses these issues by shortening exam length and improving image quality. “Our coils are integrated into the table. Therefore, instead of having to go into the MRI room to reposition the child, you can continue the scan without stopping.

This not only makes the exam faster when performing multiple exams, but also makes the exam more comfortable for the patient,” he says. “You landmark the patient ahead of time and the table moves from location to location.”

Toshiba's non-contrast MRI techniques can eliminate the need for an IV for a child prior to a scan, enabling users to perform contrast-free imaging for full runoffs down the legs, renal exams, pulmonary embolism and more. The manufacturer's proprietary JET™ sequence offers motion correction, a valuable benefit with imaging patients who have a hard time holding still. “Even if a patient turns his or her head to the side, JET can extrapolate the data where the patient wasn't moving and produce a detailed image,” Urick says. “Even if a child moves during a scan, it might not be necessary to repeat it.”

Improving the safety of pediatric imaging yields benefits across the board, Young notes. “If you are able to image children at the lowest possible dose, you can image everyone that way,” he says. “If it's safe for kids, it's safe for everyone.”

Keeping Kids Comfortable During Exams



Imaging can be intimidating for patients of all ages, but for children in particular, the technology poses a unique challenge. To image young patients safely, it is crucial to minimize the number of scans needed for fast and accurate diagnosis. To minimize the number of scans performed, it is equally crucial that patients be as comfortable as possible during their exams. “The whole objective

is to achieve a gentle experience,” Robb Young, senior product manager, CT business unit, Toshiba America Medical Systems, Inc., explains. To that end, Toshiba has developed a series of innovations to boost the comfort of pediatric imaging. These include a miniature CT scanner designed to help educate children about the procedure and help them exert a degree of control over the process. Prior to undergoing their own scans, children can watch a favorite toy go into the miniature CT. The mini-CT will be introduced at this year’s RSNA meeting, alongside a dedicated version of the Aquilion® ONE unit designed for pediatric imaging and decorated with a playful jungle theme. “If a child is more comfortable, it’s going to be a better patient experience and ultimately a higher quality scan,” Young says.

With MRI, noise reduction is a key element to helping children relax and feel more comfortable during the scan process. Toshiba’s groundbreaking noise-reduction technology, Pianissimo™, and the short, open-bore design of all MRI units raise the pediatric comfort level. Joel Urick, product manager, MRI business unit, says, “Our Pianissimo technology makes our scanners much quieter than standard MR scans – up to 90 percent quieter with many sequences. Reducing the noise makes it much less scary. It allows us to make working with kids a little easier, and if they do need to be sedated, the odds of them waking up are reduced.” Bore design reduces the level of intimidation children feel; in many cases, kids can be imaged feet first. “That way, their parents can be at the front part of the scanner, holding their hands and doing whatever else is needed to make them more comfortable,” Urick notes.

In the case of ultrasound, often considered the frontline technology in pediatric imaging, room design can go a long way toward reducing the intimidation factor. Erin Owen, product manager in Toshiba’s ultrasound business unit, says, “Children will fuss with ultrasound, like anything else, but the transducers are designed to be comfortable, they have warm gel, and there’s usually a television where children can choose what they want to watch during exams.” Toshiba will also showcase a decorated pediatric ultrasound unit at this year’s RSNA meeting. The unit will be decorated in a manner similar to that of the pediatric Aquilion

ONE.

“Lowering dose is of utmost importance, but it’s also important to make imaging comfortable, fast, and the best experience it can be,” Young says. “These children deserve it.”

Cultivating the Leaders of Tomorrow

What do an organic vegetable garden, a Great Lakes water-quality analysis, and the DNA mapping of fruit have in common? They’re all science projects funded by the Toshiba America Foundation (TAF), which offers science and math teachers across the United States grants to underwrite hands-on education. Founded in 1990 through an endowment created by Toshiba, TAF provides around 150 educational grants every year, in amounts ranging from \$1,000 to \$25,000.

“The method we use is unique in that TAF gives grants directly to individual classroom teachers to help them with their wish lists for instructional equipment and to support projects to make the classroom more exciting for students,” Laura Cronin, director of TAF, explains. “Once the students start doing real science and get a sense of how it’s connected to their everyday lives, it becomes fun and exciting.”

Cronin explains that the foundation’s goals are aligned with Toshiba’s desire to contribute in a meaningful way to the community. “Education is always at the top of the list in terms of U.S. charitable concerns,” she notes. “Science and technology are disciplines in which Toshiba has expertise, and so through these grants we can help prepare the next generation.”

A partnership between TAF and Toshiba also led to a second educational endeavor called ExploraVision, which is a nationwide science contest co-sponsored by the National Science Teachers Association (NSTA). “ExploraVision invites students from throughout the United States and Canada to explore solutions for contemporary problems by imagining future technologies,” Cronin explains. “The students think about something that’s happening today that’s important to them,

and then they imagine the technology 20 years into the future and invent a solution.”

ExploraVision entries are judged by the NSTA, and finalists are judged by experts from NASA, the National Institutes of Health and other prestigious institutions. “The ideas are extraordinary,” Cronin says. “The children are amazingly imaginative, and their wonderful teachers coach participating students to help bring their ideas to life.”



Cronin emphasizes the importance of working directly with teachers to create innovative new educational opportunities for students. “The teachers are the experts,” she says. “Toshiba America Foundation has a direct impact based on their expertise, and on their passions and interests, and that’s why the foundation supports projects designed by teachers in individual classrooms all over the country.”

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