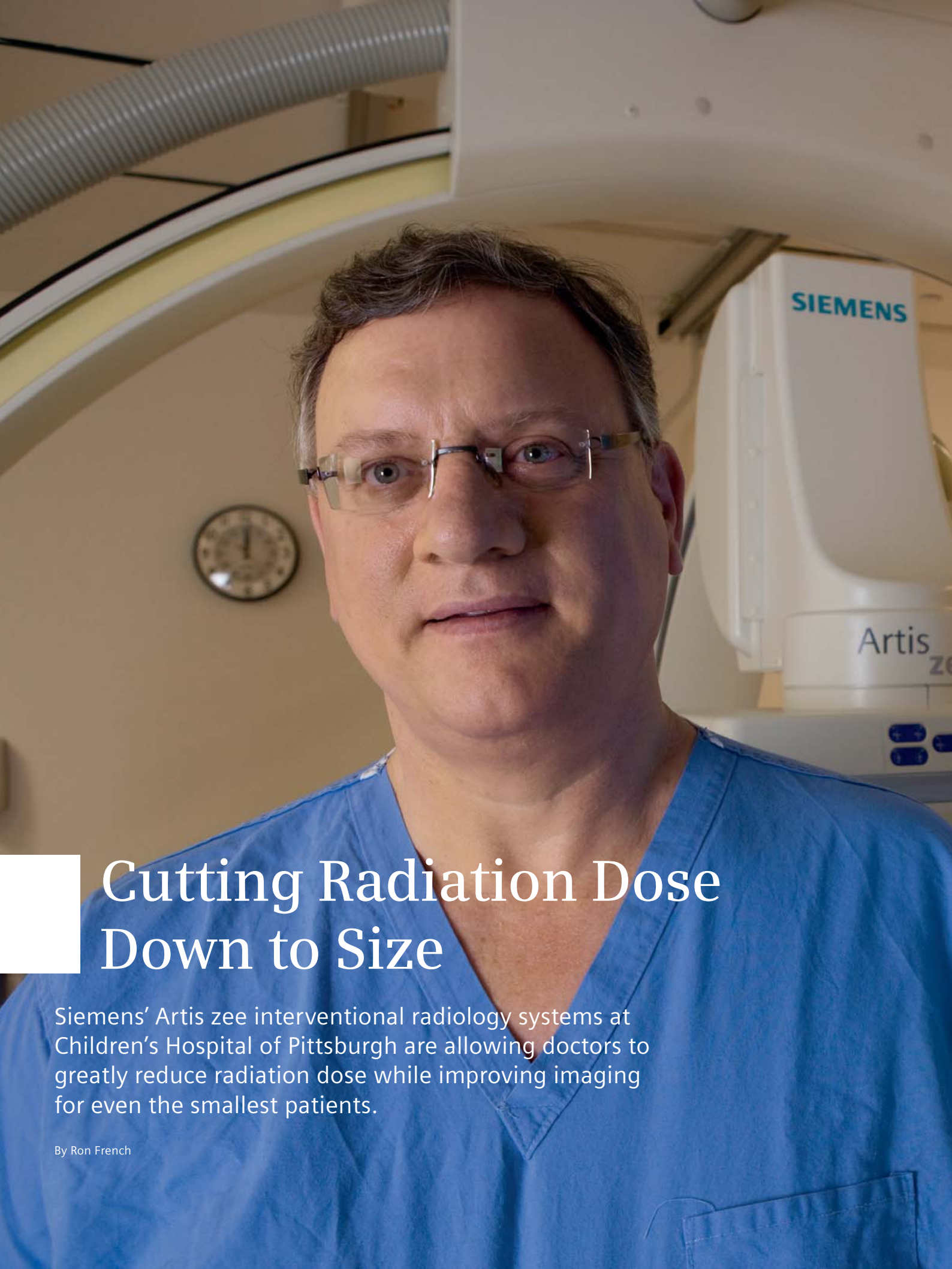

Cutting Radiation Dose Down to Size

Siemens' Artis zee interventional radiology systems at Children's Hospital of Pittsburgh are allowing doctors to greatly reduce radiation dose while improving imaging for even the smallest patients.

By Ron French


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For Kevin M. Baskin, MD, pediatric interventional radiology is all about partnerships and adaptation. At the world-renowned Children's Hospital of Pittsburgh, Baskin is often called to operating rooms to assist transplant surgeons, while those same surgeons are frequent guests at procedures in Baskin's state-of-the-art imaging suites. "One of the reasons we have such a high profile is the integration between interventional radiology and transplant surgery," says Baskin. "It's tight here."

For that partnership to be successful, Baskin must be part doctor and part engineer, contorting imaging equipment and tables designed for adults to fit the needs of the sickest and smallest of patients. "If we're not willing to let go of preconceived notions, we'll get nothing done," he explains. "Everything we do is a one-off procedure."

For years, that meant wrestling with imaging technology to lower the radiation dose received by his patients during often complex procedures. Today, a new partnership is helping solve that problem. The 50-year-old physician has worked closely with Siemens Healthcare to adapt the latest imaging technology to the needs of pediatrics. The result is greatly reduced dosage with improved imaging. "It's allowing us to do proce-

dures that we would never have attempted before," says Baskin.

Interventional Radiology in Transplants

Baskin's journey to Pittsburgh began on the opposite side of the United States. A native of California, he earned his medical degree at Creighton University. Since then, he has worked at some of the premiere pediatric hospitals in the world, including the Hospital for Sick Children in Toronto and Children's Hospital of Philadelphia. He joined the staff of Children's Hospital of Pittsburgh four years ago as Division Chief of Pediatric Interventional Radiology at the University of Pittsburgh School of Medicine. Children's Hospital Pittsburgh is internationally known for its expertise in transplants, particularly liver transplants. It's not uncommon for Baskin to "treat a patient from Colombia in the morning and a patient from Kuwait in the afternoon," he says. Those liver transplant patients often require years of follow-up procedures, so it's vital that the hospital have the cutting-edge imaging equipment to continue to provide the best care. When Children's Hospital moved to a new, 10-acre campus in 2009, Baskin lobbied to purchase Siemens imaging technology, even though the vast majority of the University of Pittsburgh medical centers used equipment from a different supplier.

Baskin knew that Siemens had been working to reduce dosage levels since the 1990s and continued to be the industry leader. "Dose was a huge challenge," says Baskin. "The earlier units had very limited capability for managing or measuring dose. In order to see small catheters and guidewires, we really had to ramp up the dose for the size of our patients.

We were pushing that older equipment to its limit and were probably using 20 times the dosage we do now. When you're doing hours of fluoroscopy, you can have burns or loss of hair. That's a horrible consequence."

Today, an old biplane system from another vendor has been replaced in Baskin's imaging suite with a Siemens Artis zee biplane system with two large 30 x 40 detectors that enable flexible positioning. The system provides better imaging with vastly lower dose levels for angiography and fluoroscopy. Intelligent noise reduction enhances not just the reference image, but the fluoroscopy image during live fluoro – without an increase in dose. Advanced temporal filtration uses an intelligent motion detection algorithm to separate moving from non-moving structures in real time.

The system cuts dose in two ways – first by lowering the dose of images, and second by allowing the interventional radiologists to switch off the ionized imaging and switch to ultrasound once an image is produced. "We leverage the limits of our ability to image by using *syngo* DynaCT with our Artis zee system to generate a cross-sectional image to design a pathway to the mass, and then use ultrasound to actually get us there," Baskin explains. "So instead of spending a lot of time scanning under CT for example, where you would be hammering the patient with a lot of radiation to non-target tissue, the *syngo* DynaCT gives us the ability to do some off-line planning. If we can use ultrasound to get there, then we've significantly limited the dose by not using an ionizing radiation modality."

Using a large spectrum of imaging capabilities allows physicians to find the quickest, most efficient solution possible. The 3D imaging capabilities of the Artis zee system have aided reconstruction procedures for liver transplants. "It's all a moving picture – it's such a dynamic environment, and there are a lot of vital structures nearby," says Baskin. "Often, the transplant graft is

upside down and backwards from its normal position. Even when we're literally holding everything in our hands, 3D imaging helps us understand relationships between the bile duct and the small bowel it ought to have been connected to – relationships that we can't see or feel. It's remarkable. You would think that interventional radiology is a way to avoid surgery, but even with a large incision, we still need the tools that imaging brings to the table to understand relationships with organs and structures."

The Children's Hospital of Pittsburgh has a five-year survival rate of 97 percent for liver grafts. "The best of the rest is around 93 percent, and the average internationally is 70 percent," notes Baskin. "To have a 97-percent graft survival rate means that not only are they doing a fine job in surgery, but also in procedure planning." And that planning is based in no small part on the images obtained from the Artis zee system. Baskin recalls the case of an 8-year-old girl who had undergone a heart and double-lung transplant. After the surgeries, she developed breath-

> "Due to its reduced dose our Artis zee is allowing us to do procedures that we would never have attempted before."
>
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ing problems. Imaging revealed that a pseudo-aneurysm was pushing against her airway, narrowing it dangerously. Surgery was too risky. Utilizing the Artis zee system, Baskin was able through fluoroscopy to design a pathway to the trouble spot. Baskin then switched to ultrasound to complete the procedure. It was a complicated case, but one Baskin was able to accomplish with only low dose levels to the patient.

"When you put really high-quality imaging equipment in the hands of people who have a vision," Baskin says, "it's a nice marriage."

Still, he adds, pediatric interventional radiologists must be creative and forceful to "bend the will of the machine to what we want to accomplish. We will always have to adapt equipment to our needs."

A Vision – and a Plan – for the Future

Siemens has been an enthusiastic partner in that adaptation. Baskin has traveled to Germany to meet with Siemens officials to discuss the needs of pediatric interventional radiologists, as part of a special advisory panel.

"We met with many Siemens employees, from engineers to salespeople to marketing to strategic planners," he recalls. "They listened in a very dynamic, interactive way to our vision for the future and what kind of help we need to get there. They questioned us closely and thoughtfully. This wasn't them telling us how great they are; they were all there because they were genuinely interested in figuring out how to adapt their equipment. We had these great give and take discussions where people didn't hold back. I've seldom been in so rich a setting."

The meeting was valuable to both Siemens officials and doctors. "They understand our special needs and have helped us modify our equipment," says Baskin. "And while they know we're never going to make them wealthy, they believe that children are a special population. You may not make your largest volume of sales, but the work that is done is important. At the end of the day, if the equipment just sits there, it's not very valuable. But if it helps us solve problems, we can all progress together."

Partnership and adaptation go hand in hand. Baskin is still working with Siemens on the next generation of adaptations. He'd like to see a ring of LED lights under the detector. For adult patients, lights in the room illuminate the work area. But, he points out, "Our patients live under the detector. They're smaller than the detector, making it difficult to get proper lighting."

"It's a world different than five years ago, but now we can see what can happen in 10 to 20 years," says Baskin. "What we do doesn't fit the preconceived notions of what is possible. It takes time and perseverance and a degree of understanding."

That understanding seems to have been reached between Children's Hospital and Siemens, in no small measure.

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