

## Case Study: Scanning Without Sedation

*A pediatric radiology department in Boston created a program that has reduced the use of anesthesia in MRI patients by 73%.*

### Key Takeaways:

- To reduce the number of children who are sedated for imaging exams, radiologists at Boston Children's Hospital began exploring alternatives to anesthesia.
- The team implemented several techniques to help patients get through their exams without anesthesia, including shortening image acquisition sequences, scheduling appointments to coincide with nap and bedtimes, recreating children's bedtime routines in the hospital, and helping families practice for exams.
- Through these efforts, the radiology team successfully reduced sedation rates from 55% to 15% for MRI procedures.

By Brooke Bilyj

When doctors scheduled a brain MRI for Angela Polizzotti's 10-month-old son, she was understandably concerned about the procedure. She couldn't imagine a baby like Blake lying still through the exam, which could take up to an hour. But she didn't like the idea of anesthetizing her child to keep him motionless. "He was so little, and he'd never had anesthesia before," Polizzotti says. "I was nervous about sedating him."

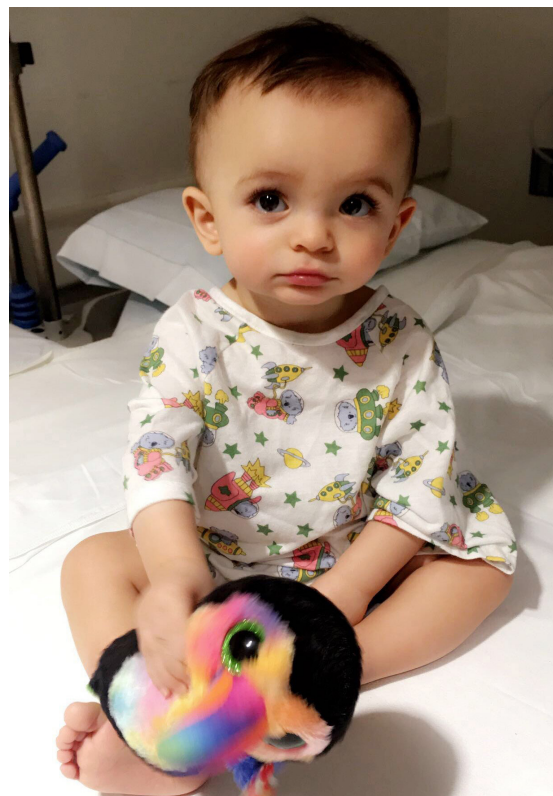
Luckily, Boston Children's Hospital's radiology department had been developing a program called Try Without Anesthesia to reduce the number of children who are sedated for their imaging exams. The team knew that limiting the use of anesthesia would have a twofold benefit: Patients could get their imaging sooner and avoid the potential risks associated with anesthesia.<sup>1</sup> When the Polizzotti family found out about the program, they decided to try the exam without sedating Blake.

"Obviously, MRI scans are not painful procedures. The only reason children need sedation is because they struggle to remain motionless long enough to capture clear images," says Richard L. Robertson, MD, radiologist-in-chief and chair of the department of radiology at Boston Children's Hospital. "By avoiding sedation, you reduce the overall risk, time, and cost of doing a diagnostic study."

Since radiologists at Boston Children's Hospital began exploring alternatives to anesthesia around 2007, they have formalized the Try Without Anesthesia program to get children through imaging exams without sedation. By helping children like Blake lie still during MRI procedures, the program has reduced sedation rates from 55% to 15% for these procedures. "This program provides a valuable service for patients and their families while also making our radiology practice safer and more efficient," says Robertson, who is also the John A. Kirkpatrick associate professor of radiology at Harvard Medical School.

### Getting Started

Prior to 2007, radiologists at Boston Children's Hospital generally assumed that most children younger than 7 required sedation to remain still during MRI procedures. But as the hospital's appointment volume



When doctors at Boston Children's Hospital scheduled a brain MRI for 10-month-old Blake Polizzotti, his mother was nervous about sedating him. She agreed to participate in the radiology department's Try Without Anesthesia program to explore options outside of sedation.

increased and the wait times for sedation swelled beyond 60 days, that assumption left many patients and their families waiting months for answers. To get children through imaging faster, the radiology team began exploring ways to reduce the need for sedation for imaging.

Around that time, Robertson learned about MRI-compatible video goggles that allowed children to watch movies during scans — a distraction that reduced the need for sedation by nearly 20% in early studies.<sup>2</sup> Impressed with the results, Robertson asked hospital administrators to invest in the goggles, and they quickly agreed. "The administration understood the importance of reducing the use of anesthesia," Robertson says. "They recognized that when you avoid

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## Case Study: Scanning Without Sedation



Continued from previous page



Richard L. Robertson, MD, radiologist-in-chief and chair of the department of radiology at Boston Children's Hospital, co-created the Try Without Anesthesia program to reduce the radiology department's reliance on anesthesia for imaging procedures.

sedation, you decrease the risk of the exam for the patient. It's also significantly less expensive."

According to a study published in the *Journal of the American College of Radiology*, the average cost of an outpatient MRI in 2011 was \$665 without anesthesia and \$902 with anesthesia.<sup>3</sup> Other research suggests that pediatric MRI costs for sedated and anesthetized patients are, respectively, 3.24 and 9.56 times higher than MRI costs for patients who stay awake.<sup>4</sup>

By monitoring the exams from the reading room through the picture archiving and communication system (PACS), Robertson and his fellow radiologists could instantly determine whether the goggles and other techniques were working for each child. "Our radiologists actively supervise MRI cases as they're being performed," Robertson says. "We set up our PACS with the ability to send images at the end of each series acquisition, so we can watch the study in action and instantly decide, 'We've captured the information we need; we can stop the exam now,' or, 'This child's moving; we need to repeat that scan to get a clear picture.'"

### Scanning Faster

After seeing early success with 5- to 7-year-old children, who seemed most engrossed in the movies, the radiology department began expanding the department's efforts to reduce MRI anesthesia in other age groups. "We decided that the children who are particularly vulnerable due to their small size and for whom we wanted to minimize sedation the most were babies up to age 1," Robertson says. "So, in 2010, we started focusing on reducing sedation in that population."

As part of this work, the radiology department adjusted the imaging protocols for faster acquisitions so that babies would be in the scanner for less time. "Shortening the image acquisition times is the single-most important thing that we can do as radiologists to reduce the need for anesthesia," Robertson says. "We found that many children can stay still for one minute but not for four minutes during a standard acquisition."

To convince radiologists that faster protocols were diagnostically equivalent to standard acquisitions, Robertson and his colleagues conducted a blind review of brain MR imaging comparing fast scans to standard scans. After collecting images from 60 cases and re-dacting the image acquisition details, Robertson asked radiologists in his department to compare each image set. "Half of the time, they said the conventional acquisition was better, and the other half of the time, they said the faster acquisition was better," says Robertson, who outlined his findings in a study that was published last year.<sup>5</sup> "Through the blind review, the radiologists saw that faster acquisitions were diagnostically equivalent, which secured their buy-in."

Although it wasn't a formal program yet, more nurses, technologists, and radiologists were convinced of the idea of trying exams without sedation. They allowed extra time for parents to swaddle and calm their babies before their exams and utilized faster acquisition times to shorten the length of each scan. Through these informal efforts, the radiology department reduced the sedation rate for babies under age 1 by more than half — cutting the use of anesthesia from about 55% to 20% in that population within a couple of years.

### Formalizing the Program

With positive results from their early efforts, the radiology department began to formalize and expand the Try Without Anesthesia program. In 2015, Robertson convened a group of schedulers, technologists, radiologists, nurses, MRI physicists, image analysts, and faculty members from radiology's research center to develop the program logistics. He also engaged the hospital's information strategy department and external MRI vendor to establish the program's technology workflow for faster imaging protocols and streamlined appointment-setting prompts.

"For this initiative to work, we needed to look at all of the factors around imaging," Robertson says. "The schedulers had to be able to identify candidates upfront. The radiologists needed to know what imaging protocols to use to minimize exam durations, and the techs and nurses had to be patient in working with the children. The physicists and image analysts also had a significant role in redesigning the imaging protocols, and the informatics team helped support the workflow."

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Continued on next page

## Case Study: Scanning Without Sedation



Continued from previous page



As the Try Without Anesthesia program coordinator, Kellyn Mahan helps families prepare for pediatric imaging by exploring alternatives to sedation.

Through monthly meetings, the committee developed the workflow for the Try Without Anesthesia program — starting with a digital dashboard that was developed in-house to aggregate information from the electronic medical record, scheduling system, PACS, and protocoling applications to help identify candidates for the program. Schedulers are prompted to share the benefits of the program whenever families call to schedule anesthesia appointments, and the radiologists and technologists can also flag patients who seem like good candidates for the program based on certain indications or conditions.

The committee officially launched the Try Without Anesthesia program in January of 2016. The team initially limited the sedation-free appointments to four 105-minute slots every Sunday afternoon, when the hospital's slower schedule permitted 30 minutes of one-on-one prep time with a child life specialist and 75 minutes of scanning time. These appointments initially focused on patients between 4 and 7, since patients in that age group had success using the video goggles to avoid sedation in prior years.

As more families learned about the anesthesia-free option, however, the program quickly expanded. By the time the Sunday-focused program concluded in July of 2019, 320 patients between the ages of 1 and 16 had participated in the Sunday Try Without Anesthesia appointments alone, with 91% of patients successfully completing the exams without anesthesia.

### Recruiting Patients

The program received additional incentive in December of 2016, when the Food and Drug Administration (FDA) issued an [advisory](#) about the potential neuro-cognitive effects of prolonged anesthesia exposure in young children. The warning urged pediatric health-care professionals to balance the risks and benefits of sedation. "The FDA advisory strengthened our resolve to advance the program," Robertson says. "But we needed a more structured approach if we were going to expand it further."

To that end, Robertson hired Kellyn Mahan, who worked as a scheduling coordinator in the radiology department for several years and who had recently finished training to become a child life specialist, to take ownership of Try Without Anesthesia as the program coordinator in January of 2017.

Mahan's main responsibility was to recruit patients for the program by calling families to discuss their options without sedation and informing families about the program when they called to schedule anesthesia appointments. Nurses and technologists also recommended the program when children seemed calm, unfazed, or even eager to interact with them in the prep room before an anesthesia appointment.

To reach more patients, Mahan created brochures to distribute throughout the radiology waiting rooms and local clinics and collaborated with the marketing department to develop materials to educate referring providers about the program. "We want to reach as many patients as possible," Mahan says, "so anything we can do to spread the word about these appointments is beneficial."

Additionally, to keep the program top-of-mind among referring providers, Robertson and other departmental leaders talked about the importance of reducing anesthesia rates in weekly operations meetings, multidisciplinary conferences, and the radiology group's annual quality management plan. "We constantly bring up the Try Without Anesthesia option," he says. "Now, a lot of referring clinicians specifically request this approach for their patients, which has been really nice to see."

### Imaging at Bedtime

As the program grew in popularity, Mahan worked with the committee to explore other alternatives to anesthesia. Recognizing that children were likely to remain still for an MRI if they were asleep, the committee decided to try later appointment times to coincide with patients' bedtimes. In October of 2017, the Try Without Anesthesia program began offering 9 p.m. appointments one day week. These appointments allow families to schedule exams when the hospital is quiet and their children are sleepy. Since the hospital already

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Continued on next page

## Case Study: Scanning Without Sedation



Continued from previous page



By offering late-night appointment times, MRI-compatible video goggles, child-friendly exam room décor, and plenty of patience, technologists and radiologists at Boston Children's Hospital help young patients get through imaging exams without anesthesia.

had MRI technologists and radiologists working overnight shifts, staffing wasn't a big issue.

"Our intention was to bring in children when they're as tired as possible," says Mahan, who initially advised patients' families to keep children from napping on the day of the scan — but that approach just made kids cranky, not sleepy. "We realized that our success depended not just on how tired the kids were but on how well we helped families prepare for these appointments."

Now, as soon as a family schedules a Try Without Anesthesia appointment, Mahan sends them a detailed email that explains the imaging process and encourages families to help children practice for their exam. The email includes a link to a [YouTube video](#) that plays the sounds of an MRI machine, and Mahan sends the earmuffs and noise-reducing ear putty that children can wear during their scan. "We suggest that they play the sounds as much as possible during the child's bedtime so that the child gets used to hearing the noises," Mahan explains. "We also ask them to use the ear protection leading up to the appointment because it's often a new sensation for the children."

Polizzotti played the MRI sounds for her son Blake during naps and bedtimes leading up to his appointment. "It definitely helped," she says. "By the time he went in for his exam, the noise didn't startle him at all!"

### Replicating Routines

For additional support, Mahan asks a lot of questions about each child's bedtime routine so that she can recreate that environment when families arrive for their nighttime appointments. She encourages

families to bring their children's blankets or stuffed animals to help them relax and asks families to arrive for their nighttime appointments around 7:15 p.m., giving the children plenty of time to get comfortable and fall asleep before their 9 p.m. exams, which the department now offers two days a week and hopes to eventually offer five days a week.

"They gave Blake a stuffed animal and provided a rocking chair for me to rock him to sleep and even allowed his favorite blanket to go in with him," Polizzotti says. "My son is obsessed with Michael Bublé, so they actually played Michael Bublé music in the background, which really helped soothe him. They gave him little headphones, and he slept through the whole thing."

Over time, the hospital added more MRI-compatible tools to keep kids comfortable inside the scanner, including a crib made of PVC pipes. They also began offering custom DockATots, oval-shaped pillows that cradle babies and prevent them from rolling around. "The DockATot company donated products to us," Mahan says. "They even changed the metal zipper to a plastic zipper so that we can use them to transfer sleeping children onto the MRI bed."

If all else fails, radiologists allow parents to join their children on the MRI bed during a scan. "Although it's not optimal, it can be one of our last resorts to keep a child still," Robertson says.

When Blake Polizzotti returned for a spinal MRI about six months after his first exam, he tossed and turned until his mother joined him on the bed. "I had to do a half-plank over his legs for the duration of the 30-minute exam, but he fell asleep as soon as I got on the bed," Polizzotti says. "Because the team was so patient and willing to try anything, my son made it through both MRIs without sedation."

### Reporting Results

Blake is just one of many sedation-free success stories at Boston Children's Hospital. Robertson estimates that prior to 2007, about 55% of the hospital's patients were sedated for MRI exams, but now thanks to the Try Without Anesthesia program, only about 15% of children require sedation for these studies.<sup>6</sup> For certain cases — like a high-resolution study for a pre-operation epilepsy evaluation, for example — sedation may still be the best option, but many children just need a little patience and preparation to get through an exam without anesthesia.

By working together with families to help children through imaging procedures without sedation, the radiology department is creating a more collaborative approach to care. "Through the Try Without Anesthesia program, families become more involved in the MRI

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Continued on next page

## Case Study: Scanning Without Sedation



Continued from previous page

scan," Mahan says. "Even if patients must ultimately be sedated, families appreciate having the opportunity to at least try it first without anesthesia."

For the Polizzotti family, the program positively impacted their overall healthcare experience. "It gave us a lot of peace of mind and relief," Polizzotti says. "My husband and I were thrilled that Blake didn't have to go through the sedation process. We're so thankful to the amazing team that runs this awesome program. You can tell that they want your baby to get through this as much as you do."

As the program moves forward, the team continues to explore new tools and creative techniques to prepare children for imaging. They're currently looking into augmented reality and even a therapy dog to keep kids at ease. It's all part of the group's ongoing commitment to minimize the use of anesthesia.

"As much as possible, we ought to avoid sedation of children for diagnostic imaging procedures," Robertson says, "but there's not one right way to go about this. It requires some experimentation and a real dedication to doing this because it's the right thing to do. You provide a valuable service to the patient, and in the end, it can actually be more efficient for your practice, as well."

### Now It's Your Turn

Follow these next steps to begin implementing a Try Without Anesthesia program at your practice, and tell us how you did on Twitter with the hashtag #Imaging3 or at [imaging3@acr.org](mailto:imaging3@acr.org):

- Engage a committee to explore alternatives to anesthesia, evaluating tools and techniques to distract and relax young patients during imaging exams.
- Adjust appointment times, imaging sequence protocols, and even the atmosphere of the prep room to make imaging exams more comfortable for young patients.
- Develop instructions to help families practice at home before an imaging appointment to prepare children for the sounds and other sensory experiences of an MRI exam.

### Endnotes

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