

Strategies to Mitigate Movement in Children Undergoing MRI

- Pediatric patients often have difficulty with MR scans, due to requirements to remain motionless for long periods of time.
- Excessive movement during MRI can lead to motion artifacts on the image – blurring or streaking, for example – similar to the blurring seen with long exposure times in photography.
- Clinicians are increasingly relying on procedural sedation to facilitate imaging in children by minimizing body motion.
- Alternative, non-pharmacological techniques can also help to mitigate movement in children by addressing their anxiety about the procedure or teaching them strategies to remain motionless.

Magnetic resonance imaging (MRI) is an essential tool for the diagnosis and management of a broad range of diseases and disorders, particularly because it is noninvasive and does not use ionizing radiation. However, MR scans can be difficult for some patient populations, including young children, because quality images require them to lie motionless in a narrow bore for relatively long periods of time. Clinicians have adopted various strategies to facilitate MR imaging of these patients, including the use of sedation as well as other, non-pharmacological interventions to minimize motion artifacts that impact image quality.

Using Procedural Sedation in the MRI Environment

In the US, moderate sedation is frequently administered in nontraditional settings, including MR imaging suites. Because children are generally less likely to be able to tolerate MR scans, the use of sedation has become especially broadly accepted in pediatric imaging. The American Academy of Pediatrics has highlighted the role of sedation in managing discomfort, anxiety and stress while dedicated sedation/anesthesia programs in radiology have become prevalent in pediatric hospitals.

In using sedation for MRI, the challenge for the clinician is to select the drug and dosage that enable relatively motion-free imaging while maintaining both hemodynamic and respiratory stability. Studies have shown that inadequate sedation during MRI scans can lead to early termination in 3.7% of cases.

Historically, clinicians have used several types of agents for sedating patients during imaging: benzodiazepines, opioid analgesics, intravenous anesthetics (propofol, ketamine), inhalational anesthetics (e.g., sevoflurane), barbiturates (primarily pentobarbital) and hypnotics (e.g., chloral hydrate). More recently, dexmedetomidine, a selective alpha-two agonist, has shown promise for sedation in MRI settings. While the US Food and Drug Administration has approved it only for use in adults, clinicians are increasingly employing the drug for off-label applications in pediatric populations. A 2016 report from the Pediatric Sedation Research Consortium looked at the sedation of 13,072 children with dexmedetomidine and found a success rate of 99.7%.

There is still debate as to which drug is the most appropriate. For instance, a number of studies have looked at the respective advantages of dexmedetomidine and propofol, which is often viewed as the gold standard for sedation with MRI. The studies have considered factors including the duration of sedation, onset and recovery times, and possible adverse events. For example, a 2015 meta-analysis of five trials with a total of 337 patients compared the clinical efficacy of the two drugs in children undergoing MRI and found that, while they offer similar durations of sedation, dexmedetomidine was associated with longer recovery times.

Adverse events have been reported with several of the sedatives used with MRI. Bradycardia has occurred with the use of dexmedetomidine; hypotension and myocardial depression with the use of propofol; respiratory depression with the use of midazolam; and hypertension and hallucinations with the use of ketamine. However, the risk of acute adverse events with the sedatives is relatively small: as low as 0.4% during pediatric imaging.



Figure 1. Strategies to minimize movement in children undergoing MRI include the use of therapeutic play, which can reduce a child's anxiety about the procedure by helping him or her understand what to expect, as with this child's drawing of an MRI machine. Image courtesy of MassGeneral Hospital for Children.

Minimizing Body Motion with Alternative, Non-pharmacological Techniques

While the use of sedatives has proven effective in minimizing movement during MRI, researchers have also explored a number of nonpharmacological interventions. The interventions include a range of behavioral strategies to promote motion control in children undergoing MRI.

In many cases, these children and their caregivers are assigned a child life specialist, a pediatric healthcare professional who works with children to mitigate the stress of hospitalization and illness. With MRI, the child life specialist can help to minimize anxiety during imaging by explaining – during a phone call with the family, for example – what the child can expect from the procedure (i.e., the narrow bore of the scanner, loud noises, etc.). He or she will also ensure that all of the child's medical or developmental needs are met on the day of the scan.

Specific techniques to minimize a child's anxiety during MR imaging include the use of audiovisual tools such as MR-compatible goggles to focus the child's attention on something other than the scan; breathing exercises to help with relaxation; and therapeutic play, which can help to familiarize children with the MRI environment and thus to allay fears of the unknown. Use of these and other approaches can be part of a broader program to reduce the need for sedation with MRI. In a 2007 study, researchers found that implementation of such a program, with child life specialist consultations, use of MR-compatible goggles and more, resulted in a 34% decrease in the need for sedation in children younger than 7 years of age.

Scheduling

MRI with anesthesia is performed at Massachusetts General Hospital in Boston. Orders can be placed in Epic (inside the Partners network) or [Physician Gateway](#) (outside the Partners network) or by calling 617-724-9729. Child life specialist services are also available.

Further Information

For further information about strategies to minimize movement in children undergoing MRI, please contact [Michael Gee, MD, PhD](#), Chief of Pediatric Radiology, Massachusetts General Hospital, at 617-724-4207. We would like to thank Dr. Gee and Camilo Jaimes Cobos, MD, Department of Radiology, Massachusetts General Hospital, for their advice and assistance in preparing this article.

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