GOBrain 5-Minute MRI in Children:

Shown to Reduce the Need for Sedation

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Abstract

Shorter MR imaging protocols can be very valuable in pediatrics*, specifically when they reduce the need for sedation. In a pilot assessment of children under the age 8 years undergoing a 5-minute** brain MR for primary headache, we found that the need for sedation was reduced by 70%. A current barrier to wide adoption of this imaging protocol is the lack of data directly comparing diagnostic quality between a 5-minute brain MRI protocol and a conventional MRI brain protocol.

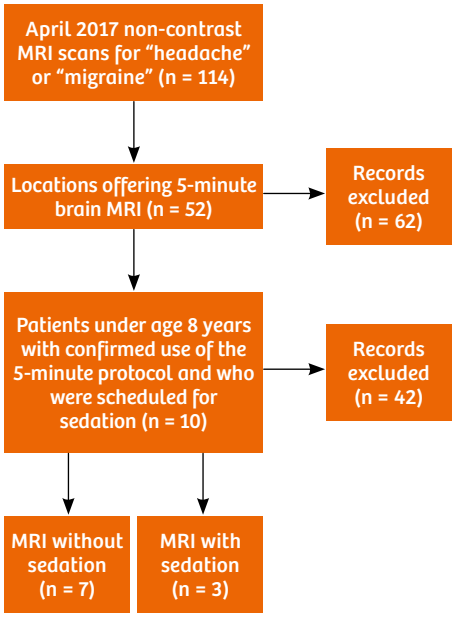

Figure 1: Study setup.

Background

The number of MRI studies requiring sedation in children increases at a rate of 8.5% annually, slightly exceeding the growth rate of CT and MRI imaging studies (8.1%)[1]. While sedation of children for imaging studies has been shown to be extremely safe, there has been some concern regarding potential neurotoxicity of certain anesthetics[2]. Sedation also adds cost to an MRI study, driving up health care expenses for individuals and for society[2]. From the patient and family perspective, use of sedation significantly increases the amount of time spent at the imaging facility and children may experience side effects post-sedation, such as motor imbalance, gastrointestinal symptoms, agitation, and restlessness[3].

Several strategies have been proposed to decrease the use of sedation in children. Child-life specialists can coach patients through MRI exams without sedation, but this may require training on 'mock' scanners, which are expensive and not widely available. Child-life coaching may lead to frequent interruptions during the scan, which could disrupt the MRI schedule. Video and audio technologies have been successful in serving this purpose and resulted in up to 45% decrease in sedation utilization[4]. In infants, feeding and bundling can be used to reduce motion artifacts, although this could result in overheating and respiratory compromise[5].

Here, we collected pilot data on using a 5-minute brain MRI protocol and its effect on the need for sedation in children with presumed primary headaches under the age of 8 years.

MR scanning has not been established as safe for imaging fetuses and infants less than two years of age. The responsible physician must evaluate the benefits of the MR examination compared to those of other imaging procedures.

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Material and methods

The pilot assessment was performed at a freestanding pediatric hospital that serves as a level I trauma center. We used a software application (Montage Health Solutions Inc, Philadelphia, PA, USA) to search radiology reports for any patients with an imaging indication containing the words “headache” or “migraine” and who underwent a non-contrast brain MRI. The study period was April 1–30, 2017. We excluded any patients 9 years or older assuming that they would be able to undergo MRI brain imaging without sedation. We also excluded two locations within our health care system that do not offer the 5-minute brain MRI protocol. We included only patients in whom we could confirm that the 5-minute brain MRI protocol had been used. For patients meeting inclusion criteria, we checked the medical records to determine whether they were scheduled as a sedated MRI and whether they were completed as a sedated or a non-sedated MRI.

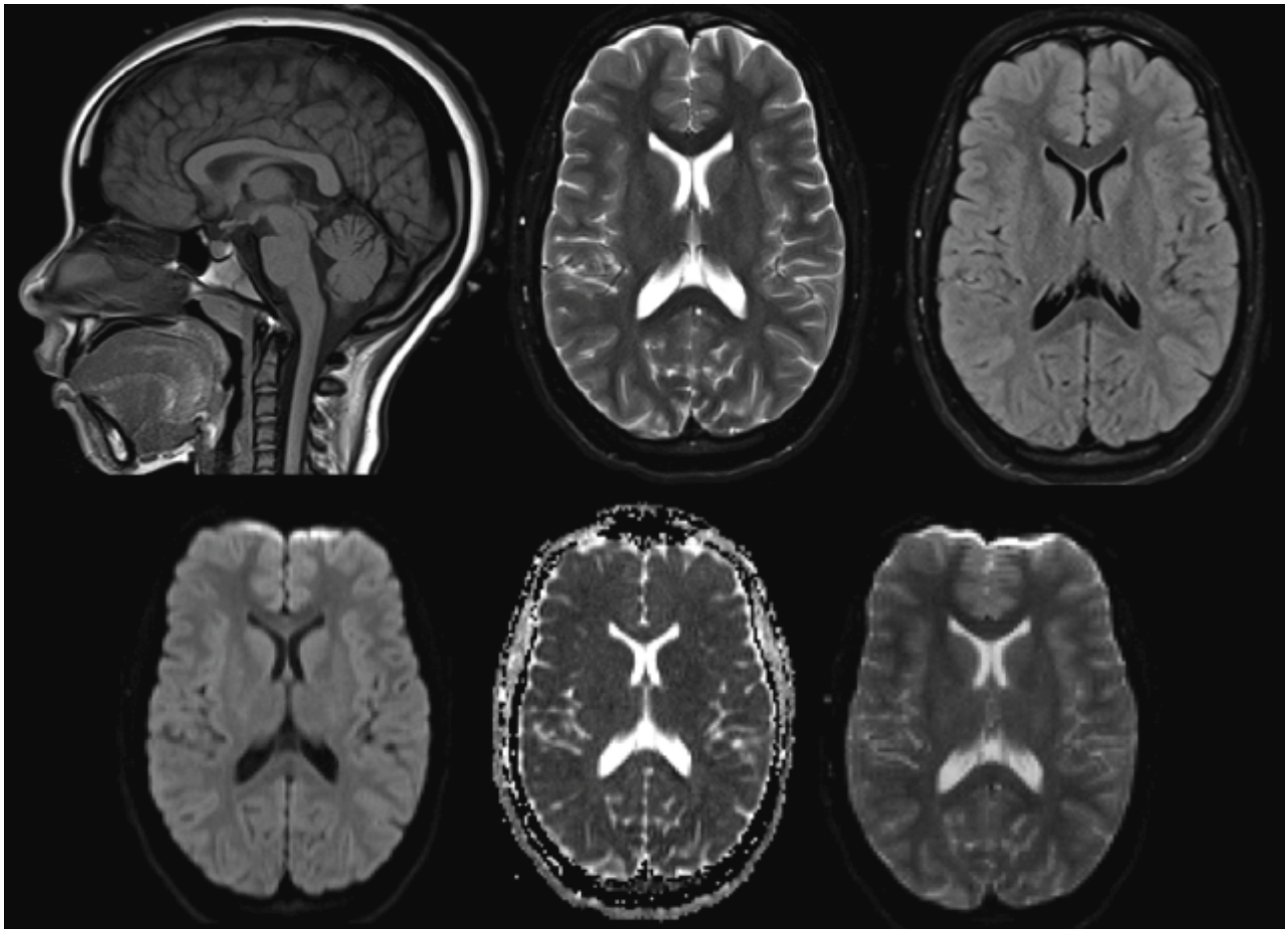

Figure 2: GOBrain 5-minute protocol.

Results

In the study period April 1–30, 2017, we found 114 non-contrast brain MRI studies done for indications containing the words "headache" or "migraine", 52 were done at locations that offer the 5-minute brain MRI protocol, and, of these, there were 10 patients under the age of 8 years in whom we confirmed that the 5-min brain protocol was used and who were scheduled to undergo the MRI with sedation. Of these, 7 were able to complete the MRI without sedation and 3 patients were imaged with sedation (Fig. 1). The percentage of patients converted to a non-sedated exam was 70% (7/10), which equals 6% of the entire cohort (7/114).

Discussion

By using the GOBrain 5-minute protocol we were able to reduce the number of sedated MRI's in the target cohort by 70%. This effect is stronger than the 45% reduction that can be achieved through use of audio-visual distraction. There is potential for increasing the cohort that can benefit from the GOBrain 5-minute protocol by >50% if this protocol was offered at other locations within our network. While the focus of this pilot data assessment was to observe the impact of a 5-minute brain MRI protocol on sedation requirements, we observed other benefits: given that the MRI slots are still 30 minutes long, the conversion of a full brain MRI to a 5-minute protocol opened up time on the MRI schedule that could be used for inpatient imaging or catching up on schedule delays.

The image quality of the 5-minute protocol was good (Fig. 2), but may not meet diagnostic quality standards for certain imaging findings. For example, small parenchymal lesions or small blood products may not be as readily visible given the constraints of the image acquisition in order to achieve short scan times. For this reason, we are limiting the use of this MRI protocol to a patient cohort with "headache" or "migraine" as the sole indication, where most patients are presumed to be screened in the setting of a primary headache with low probability of underlying structural pathology of the brain. Future studies will be needed to compare the diagnostic performance of short MRI protocols in direct comparison to MRI protocols with conventional exam length.

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