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Portable Low Field Strength MRI: Preliminary Experience in Neonates and Children

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Background
• High field strength MRI is a pediatric imaging staple and access is limited by strong (1.5 – 3.0T) magnetic fields with associated safety concerns, space requirements, and cost.
• To address these limitations, Hyperfine® developed a low field magnetic field (0.064T) portable MRI device.
• The purpose of this study was to assess image quality in pediatric patients.

Methods
• Prospective cohort study including patients ages 0-4 years from the Neonatal and Pediatric Intensive Care Units that had standard of care brain imaging (SOC) were considered.
• SOC imaging included MRI brains, CT heads, and US heads.
• Axial FLAIR T2, T2, T1 and DWI/ADC sequences were performed within +/- 24 hours of SOC imaging.
• 10 consecutive scans were independently evaluated for image quality each was graded on a five-point Likert scale by 5 attending pediatric radiologists who were blinded to clinical picture and SOC findings.

Results
• Individual quality scores (average +/- SD) for each sequence were FLAIR: 3.6 +/- 0.8, T2: 3.6 +/-0.7, T1: 4.6+/-.06, and DWI/ADC 4.2/-.06.
• 48% of scans were of diagnostic quality (Figure 2).
• Written feedback stated that the sequences were adequate for diagnosis of large or global processes but lacking detail for smaller or subtle abnormalities.

Figure 2: Low Field vs High Field MRI in Same Patient

Figure 2: 39 & 6 gestational age (GA) 3-day old female with seizure-like activity. Top row is low field T2, Flair, T1, and Diffusion sequences. Bottom row are Axial, Coronal, and Sagittal CT images of the same patient. Hypodensity with loss of cortex in the left posterior parietal and temporal lobes.

Conclusion
• Adult sequence parameters were suboptimal in pediatrics.
• T2 and T2 FLAIR performed better than T1 and DWI sequences.
• This initial data demonstrates the need for development of pediatric specific sequences for the low field MRI.
• Overall, low field MRI is a promising technology with further research efforts warranted by its potential to provide quick, safe, accessible, and cost-effective MRI.

Next Steps?
• The plan is to continue developing and optimizing sequence protocols for neonates and pediatrics.