Faster pediatric MRI

Samantha J Holdsworth[1], Stefan Skare[2], Kristen Yeom[3], and Michael E Moseley[1]

[1]*Lucas Center for Imaging, Department of Radiology, Stanford University, Palo Alto, CA, United States,* [2]*Clinical Neuroscience, Karolinksa Institute, Stockholm, Sweden,* [3]*Lucile Packard Children's Hospital, Department of Radiology, Stanford University, Palo Alto, CA, United States*

Target Audience: Researchers and clinicians who are interested faster pediatric MRI.

Introduction: MRI provides excellent contrast between the different soft tissues of the body, which makes it especially useful in imaging brain pathology. The main disadvantage of MRI is that is lengthy, taking up to one hour at our institution. Particularly in a pediatric setting, long protocols increases the risk of motion artifacts in the acquired images, thus GA is often used – at the expense of patient throughput, comfort, and cost. With the goal of shortening the overall scan time of pediatric MRI, here we present preliminary data acquired with the use of four MR methods that have been built in-house and that can be retrospectively corrected for patient motion: a T1-weighted 3D Short-Axis Propeller Echo Planar Imaging (SAP-EPI) sequence[1]; a T2-weighted 3D SAP-EPI sequence[2], a novel Fluid Attenuated Inversion Recovery (FLAIR) sequence using the Readout-Segmented (RS)-EPI trajectory[3]; and a dual-echo Diffusion-Weighted-Imaging (DWI) sequence[4]. The first three of these methods are faster than their conventional counterparts; and the latter can also deliver R2 maps for free.

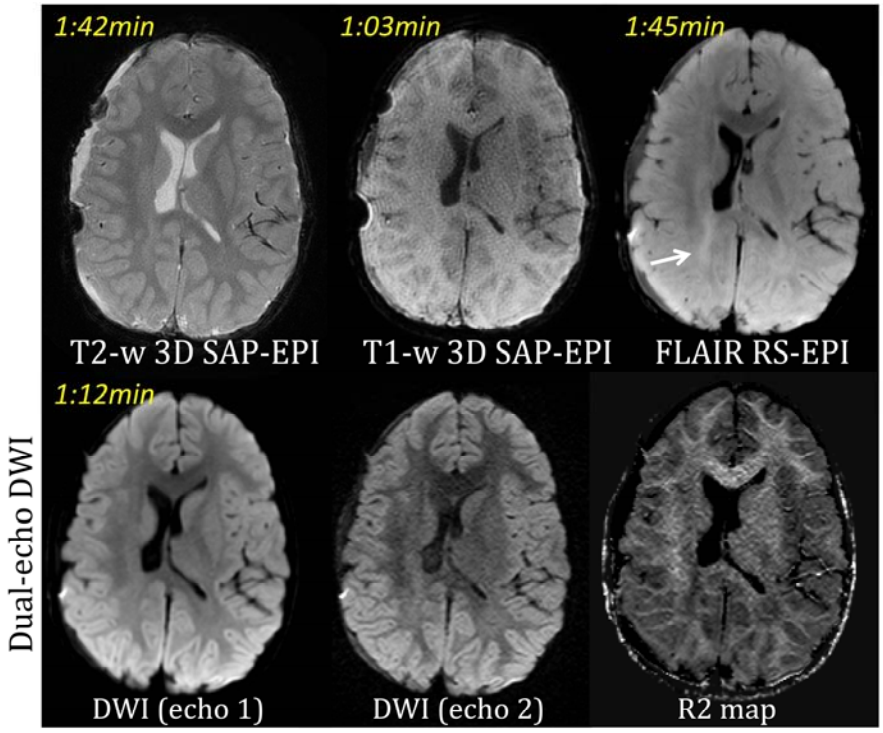

Fig. 1 – Proposed sequences acquired on a 4 year old male patient.

Materials & Methods: 10 pediatric patients ranging from 1mo to 18 years old were scanned with the above sequences on a 3T GE system (Waukesha, WI) and an 8-channel head coil after informed parental consent and assent were obtained. The scan parameters were: dual-echo DWI: FOV = 22cm, TR/TE_1/TE_2 = 4000/48/115ms, acquisition matrix = 192^2, in-plane acceleration factor (R) = 3, signal averages (NEX) = 3, slthck/gap = 4/0mm, 29 slices, 1 *b*=0, tetrahedral encoding with *b*=800 s/mm^2, scan time = 1:12min. T1-w 3D SAP-EPI: matrix size = 192^2, R = NEX = 3, TR/TE/FA = 46ms/9ms/50º, 64 *z*-partitions, slthk = 2mm, 7 blades of width 64, scan time = 1:03min. T2-w 3D SAP-EPI: matrix size = 252^2, R = NEX = 3, TR/TE/FA = 62ms/22ms/20º, 64 *z*-partitions, slthk = 2 mm, 9 blades of width 48, scan time = 1:42min. FLAIR RS-EPI: matrix size = 192^2, R=NEX=2, TR/TE/TI = 10000/40/2250ms, slthk/gap = 4/0mm, 5 blades of width 64, scan time = 1:45min. R2 maps were also calculated using the dual-echo *b*=0 and *b*=800 s/mm^2 images.

Results: Figure 1 shows images acquired with the proposed research sequences on a pediatric patient. The patient had prior resection of a right temporal lobe glioblastoma. Aside from reactive white matter signal abnormality from tumor treatment (arrow), no soft tissue or diffusion abnormality was seen to suggest residual/recurrent tumor.

Discussion & Conclusion: We have demonstrated preliminary data showing the promise of the use of four sequences that generate some of the leading contrast mechanisms required for pediatric brain imaging. Together, the four sequences take 5:42min – faster than the sum of their conventional alternatives scanned at our institution (totaling ~14min). Future work will assess the inherent motion-correction capability of these sequences. We will then investigate whether these sequences have the diagnostic potential to replace the need for the longer scan protocol acquired at our institution in the pediatric setting.

References: [1] Holdsworth, SJ *et al*. 17th ISMRM, Hawaii, U.S.A 1239 (2009). [2] Holdsworth SJ, *et al*. 17th ISMRM, Hawaii, U.S.A 756 (2009). [3] Porter D. 16th ISMRM, Toronto, Ontario, Canada 3262 (2008). [4] Holdsworth, SJ et al. 20th ISMRM, Melbourne, Australia, 649 (2012).