INTRODUCTION: Pediatric MRI is challenged by small anatomic structures and limited patient cooperation. This work investigates whether a phased array torso coil designed for highly accelerated parallel imaging of the pediatric torso enables submillimeter resolution.

METHODS: Coil: A 32 channel phased array was designed and constructed to fit the torso of an average 7 year old child (Fig 1), with 16 anterior 4x4 elements and 16 posterior 4x4 elements. Coil elements were slightly overlapped, and kept small (8 cm) for high SNR. Preamp filter oscillation was prevented with feedback compensation [1].

Subjects and MRI protocol: Phantom tests assessed SNR and coil element decoupling. 8 consecutive patients referred for pediatric abdominal imaging on a 3T GE MR750 with submillimeter resolution volumetric T1 and T2 acquisitions were retrospectively identified with IRB approval. Ages ranged from 2 to 5 years (mean 3.4 years). Patients had undergone a 3D FSE sequence with flip angle modulation (CUBE) and T2 weighting, with parameters: ETL 60, TE 70-90 ms, respiratory triggering, slice thickness 0.8 mm except one case at 0.6 mm and one case at 1 mm, 320x320 matrix, outer acceleration factor 8, FOV 22-30 cm, coronal plane. Post-gadolinium 3D SPGR with intermitter fat suppression and Poisson-disc [2] k-space variable density sampling had parameters of flip angle 15, slice thickness 0.8 mm (5 cases) or 1 mm (3 cases), acceleration 7.2 – 8 (mean of 7.8), matrix 288 x 288, FOV 24-30 cm, coronal plane. Routine clinical axial 2D FSE T2 imaging and axial volumetric navigated post contrast dual-echo SPGR were also obtained.

Image evaluation: The following were evaluated by consensus of two radiologists on a five point scale (Table 1): SNR of 3D acquisitions at source slice thickness (0.6 – 1 mm), SNR of 3D acquisitions at 3 mm slice thickness, aliasing artifacts of 3D sequences, sharpness of axial reformats from 3D T2 images versus conventional 2D axial T2, adequacy of spatial resolution of axial reformats of 3D T1, and sharpness of axial reformats of 3D T1 relative to navigated axial T1.

RESULTS: Phantoms: Improved SNR (Fig 2), coil decoupling, and g-factor (not shown) relative to adult sized coil was noted.

Volumetric T2: All cases had diagnostically acceptable SNR for thin source images as well as 3 mm slices (Figs. 3-5). Mild aliasing artifacts were noted in 7/8 cases and no aliasing artifact in 1/8. Sharpness of reformats was slightly inferior to 2D T2 in 2/8 cases, equivalent in 3/8, and superior in 3/8.

Volumetric T1: SNR of thin source images was slightly limited in 2 cases on thin images but of diagnostic quality on 3 mm thick slices for all cases. No coherent aliasing artifacts were noted. Axial reformats were of diagnostic quality in all cases. Mildly inferior sharpness of reformats compared with direct axial images was noted in 3/8 cases.

CONCLUSION: This preliminary work suggests true isotropic millimeter resolution volumetric T1 and T2 imaging with a dedicated pediatric abdominal phased array can be obtained with adequate SNR and with diagnosis quality reformats.