# High Resolution Contrast Enhanced MR Angiography (CEMRA) at 3.0T in Pediatric Abdominal Organ Transplantation: Initial Results.

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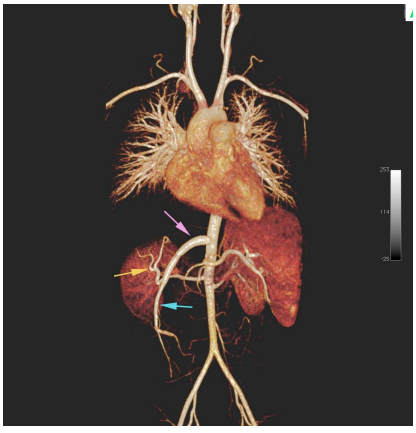
**Background:** Organ transplantation requires confident preoperative definition of vascular anatomy. Conventional angiography and CT angiography (CTA) have serious drawbacks in children, so a safe non-ionizing alternative is desirable. We report what we believe to be the first results of high resolution contrast enhanced MRA (CEMRA) at 3.0T in pediatric patients prior to and /or following liver, small bowel and pancreas transplantation.

**Methods:** 29 consecutive pediatric patients (19 males/10 females, age 3.0 ± 3.17 years, weight 18.12 ± 12.86 kg) underwent high resolution CEMRA for: exclusion of thrombosis (12), vascular mapping for surgery (11), venous mapping for line placement (6), and others (3) for evaluation of upper extremity lymphatic venous malformation, renal artery stenosis and portal caval shunt. 21 patients had studies prior to surgery and 8 patients following surgery. All patients were evaluated at 3.0T on a 32 channel system (Siemens Magnetom TIM Trio) under general anesthesia with controlled ventilation. Gadolinium (Gd) contrast delivery was calculated based on a total dose of 0.2 mmol /kg (0.4 ml /kg), infused over approximately 66% of the image acquisition time. A parallel imaging (GRAPPA) acceleration factor of 4 was used, generating 0.7 x 0.5 x 0.6 mm voxels in an acquisition time of 17-22 seconds (depending on patient size). Multi-phase, CEMRA volumes included the neck, thorax, abdomen and pelvis for visualization of arterial, early venous and late venous phases of enhancement. Variable receiver coil combinations were employed, depending on patient size.
Two radiologists independently graded image quality (1=poor, 2=moderate, 3=good, 4=excellent), artifacts (0=none, 1=mild, 2= moderate, 3=severe), and level of confidence (1=not confident, 2=moderate, 3=structure with high confidence, 4=fine detail with high confidence) in defining normal, variant and abnormal anatomy. Quantitative measurements of SNR (signal-to-noise ratio) and CNR (contrast-to-noise ratio) were performed on partition images in the abdominal aorta, IVC, portal vein and SVC. CEMRA findings were correlated with surgery (5 patients) and other imaging findings (29 patients).

**Results:** SNR: abdominal aorta = 93.0 ± 33.4; mid aortic arch = 91.9 ± 39.2. CNR: abdominal aorta = 65.3 ± 28.7; mid aortic arch = 79.2 ± 34.9. SNR: portal vein = 56.9 ± 21.6; infrahepatic IVC = 47.1 ± 17.2; IVC = 49.2 ± 18.5; SVC = 61.4 ± 29.1. CNR: portal vein = 34.3 ± 13.9; infrahepatic IVC = 21.1 ± 9.6; IVC = 39.1 ± 17.3; SVC = 50.4 ± 27.8. Inter-reader agreement was high (Kappa = 0.81) and abdominal aorta and visceral branches, portal tributaries, and central veins were rated good or excellent in all patients. In smaller patients, the inferior mesenteric artery was less well rated, but never lower than "good". Associated findings were common: organomegaly, venous occlusions, and in one child, heterotaxy. 5 patients have received transplantation to date, with concordant surgical findings.

**Conclusion:** High-resolution CEMRA at 3.0T provides consistent, high quality evaluation of vascular anatomy in pediatric transplant patients and can provide comprehensive vascular information prior to and following abdominal organ transplantation, obviating the need for angiography and repeated radiation exposure.



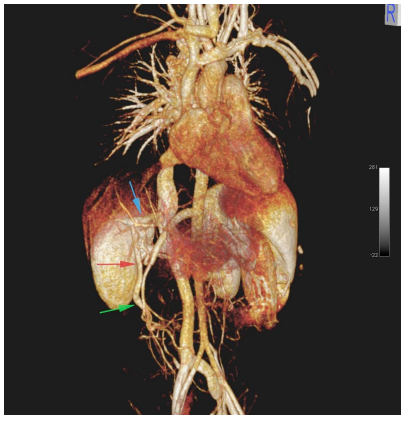


**Figure 1a & 1b: Volume rendered CEMRA in one of a series of 6 follow up studies in a child post successful liver and small bowel transplantation.** (1) arterial phase shows widely patent donor graft artery (arrows) (2) venous phase shows widely patent donor superior mesenteric vein and portal vein (arrows), as well as the entire systemic venous anatomy