

MR Voiding Cystography for Vesicoureteral Reflux Evaluation

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Purpose:

X-ray voiding cystourethrogram (VCUG) is the standard of care for diagnosis of vesicoureteral reflux (VUR), with considerable radiation exposure. We have developed a novel MRI-compatible x-ray fluoroscopy system. With this system, we will develop an MRI VCUG protocol and validate it against the gold standard x-ray VCUG.

Methods and Materials:

Patients were recruited from the cohort of children with known VUR returning for annual followup x-ray VCUG. For 8 patients, a urinary bladder catheter was placed and the patient positioned in a unique hybrid x-ray/MR unit that can perform real-time x-ray fluoroscopy or real-time fluoroscopic MRI. Gadolinium was infused into the bladder under MR observation of the urinary tract. 3 slices were obtained every 3.5 seconds until voiding. If no VUR was found in infants under 1 year old, the study was repeated. Then, an x-ray VCUG was performed. Both imaging studies were read by 2 radiologists to grade VUR in each renal moiety by the International Classification System (ICS) of the International Reflux Study Committee in 1981.

Results:

Both x-ray and MRI studies were performed for all patients recruited into the study (Fig. 1). We have thus far found an encouraging 88% strict agreement of ICS VUR grading (95% confidence interval of 79 - 96%) between the two methods. Additionally, every case of reflux seen with x-ray was also identified by MRI. With agreement criteria relaxed to being within one ICS grade, a 94% concordance was noted between MRI and x-ray (95% confidence interval of 88 - 100%). Of note, one patient had VUR detected by MR, but not x-ray.

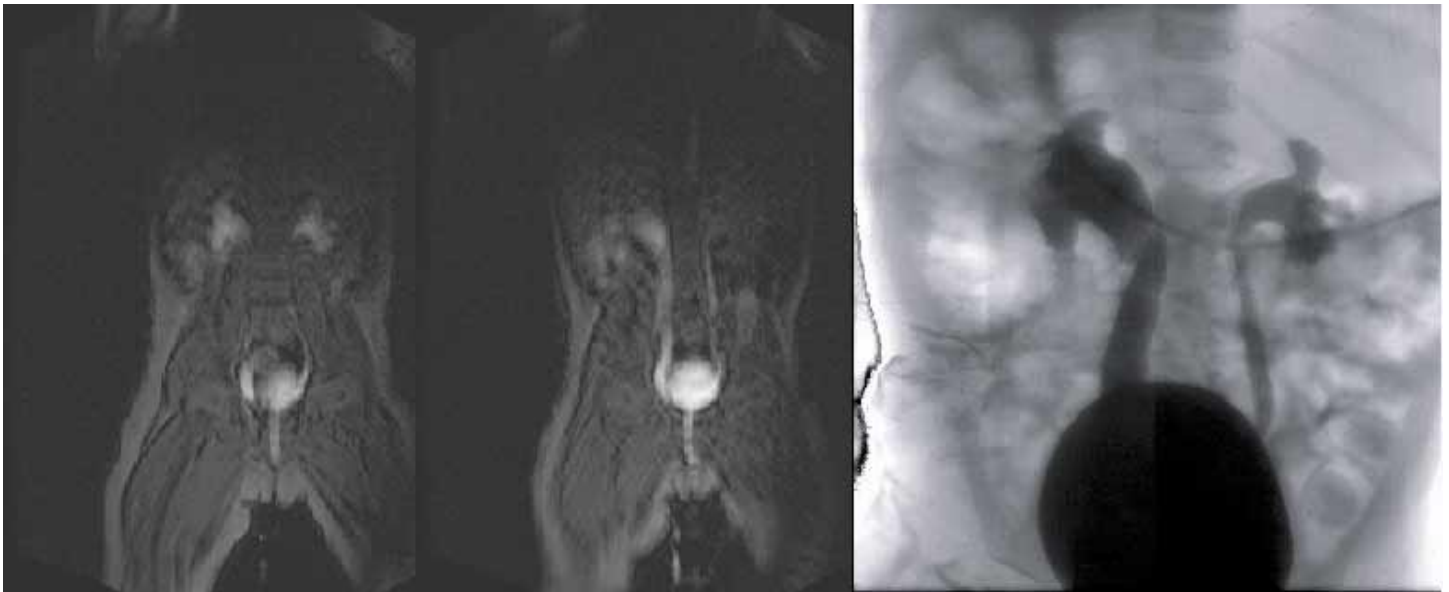


Figure 1. Left two images are from MR fluoroscopy, with the left image showing gadolinium in dilated renal pelvises and calyces bilaterally. Middle image reveals mild dilation of the ureter with no tortuosity, giving grade 4 on the right and grade 3 on the left. Right image shows similar findings by x-ray fluoroscopy.

Conclusions:

MR VCUG is a promising technique for evaluating VUR, with no ionizing radiation.