

Performance of Contrast-enhanced Voiding Urosonography (ceVUS) compared to Micturating Cystourethrography (MCU) in diagnosing Vesicoureteral Reflux (VUR)

Introduction and Aim:

MCU has been the gold standard for the diagnosis of VUR.¹⁻² ceVUS is a radiation-free alternative for the evaluation of VUR. The aim of our study is to determine the performance of ceVUS in diagnosing VUR with MCU as reference standard.

Methods:

This is a retrospective study in a single center.

All paediatric patients who underwent both ceVUS and MCU performed in same session in Kwong Wah Hospital from October 2018 to August 2019 were included.

Patients' demographics and any complications were reviewed on electronic patient records. Cine of ceVUS and images of MCU were reviewed by 2 independent radiologists (5 and 7 years of experience), who were blinded to each other and the reports, for the presence and grading of any VUR according to International Classification of VUR³. For any discrepancy, consensus was reached between the 2 reviewing radiologists for analysis.

Sensitivity and specificity of ceVUS in detecting VUR were calculated with MCU as reference standard. Subgroup analysis for high grade VUR (grade III to V) was performed. Cohen's kappa coefficient was used to assess inter-observer agreement.

Results:

A total of 24 patients were included: M:F = 20:4, age range = 2 - 44 months. 1 patient showed unilateral renal agenesis, hence a total of 47 pelvoureteric units (PUUs) were included.

VUR was detected in 12 PUUs (25.5%) by both modalities. ceVUS showed sensitivity of 100% and specificity of 100% in detecting VUR with MCU as reference standard.

For high grade VUR, ceVUS showed sensitivity of 87.5% (7/8) and specificity of 50.0% (2/4).

There were discrepancy in grading between ceVUS and MCU in 6 PUUs with VUR. 3 of them showed disagreement regarding high and low grade VUR:

- 1 PUU showed low grade in ceVUS (grade II) but high grade in MCU (grade III). (Fig 2)
- 2 PUUs showed high grades in ceVUS (grade V and III) but low grades in MCU (both grade II). (Fig 3)

There was no discrepancy between the 2 readers regarding the presence or absence of VUR in all PUUs in both modalities. Cohen's kappa coefficient = 1. There was good agreement on VUR grading between the two readers, with Cohen's kappa coefficients of 0.68 and 0.76 for ceVUS and MCU respectively.

No urethral abnormality was detected in all patients by both modalities. There was no documented complication in all patients.

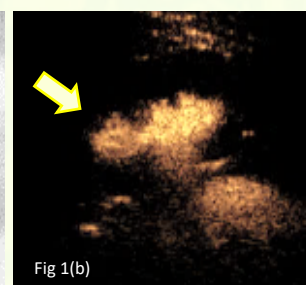
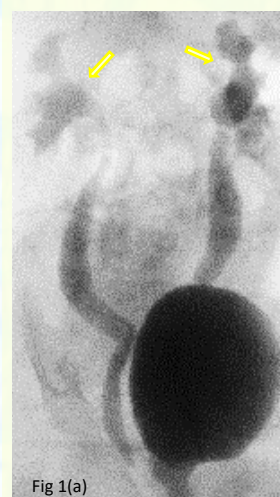


Fig 1(b)

Fig 1. Example of concordant results. (a) MCU showing bilateral grade V VUR (thin arrows). (b) ceVUS showing grade V VUR (thick arrows) on the right and similar finding on the left (not shown).

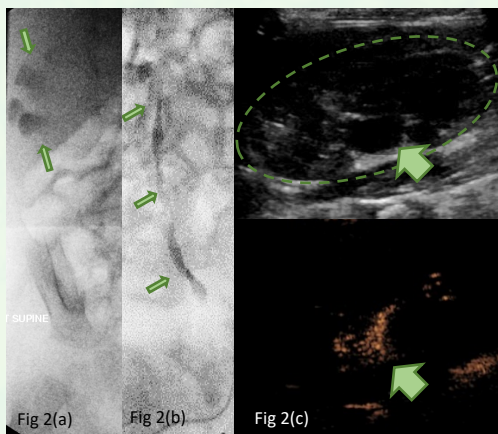


Fig 2. Case of low grade VUR in ceVUS but high grade in MCU. (a) & (b) MCU showing right grade III VUR and no VUR on the left side. (c) ceVUS showing right side grade II VUR. Dashed ellipse indicates confines of right kidney. Thick arrows indicate the position of right renal pelvis. ceVUS also showed no VUR on the left side (not shown).

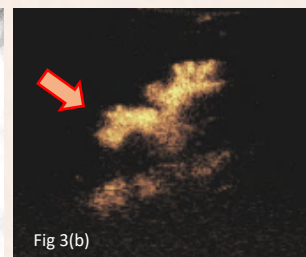
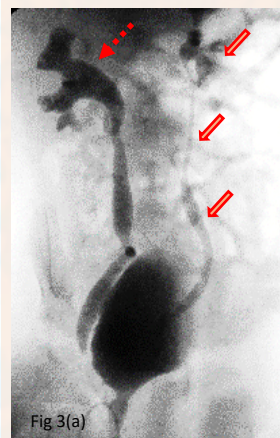


Fig 3(b)

Fig 3. Example of high grade VUR in ceVUS but low grade in MCU. (a) MCU showing left grade II VUR (thin arrows) and right grade V VUR (dashed arrow). (b) ceVUS showing left grade V VUR (thick arrow) and also right grade V VUR (not shown).

Conclusion:

ceVUS showed 100% sensitivity and specificity in detecting VUR, and 87.5% sensitivity and 50.0% specificity in detecting high grade VUR, with MCU as reference standard.

References:

1. JAWK Tang, JCH Tse, AYT Lai, et al. Contrast-enhanced Voiding Urosonography with Second-generation Ultrasound Contrast Agent versus Micturating Cystourethrogram for Diagnosis of Vesicoureteric Reflux. Hong Kong J Radiol. 2019;22:16-25.
2. Mane N, Sharma A, Patil A, et al. Comparison of contrast-enhanced voiding urosonography with voiding cystourethrography in pediatric vesicoureteral reflux. Turk J Urol 2018; 44(3): 261-7.
3. Lebowitz RL, Olbing H, Parkkialainen KV, et al. International system of radiographic grading of vesicoureteral reflux. International Reflux Study in Children. Pediatr Radiol. 1985;15:105-9.