



PAEDIATRIC URINARY TRACT INFECTION

- Urinary tract infections (UTI) are relatively common in children, affecting 3.6% of boys and 11.3% of girls. [14](#)
- However, the estimated prevalence of renal scarring in this population is approximately 5% (occurring more frequently in those with vesicoureteric reflux) and the risk that this will affect future renal function, blood pressure and quality of life is even lower. [15](#)
- The current evidence suggests that routine imaging of all children with a first episode of UTI is neither clinically or cost effective. Instead, investigations should be targeted at the very young (<6months) in whom there is a higher risk of a structural abnormality and those with recurrent or atypical infections where there is an association with structural abnormalities and renal scarring. [16](#)
- However, paediatric UTI is still very much a controversial area and consensus is lacking on the selection and sequence of tests. Therefore, the suggested pathway are general guidelines only.

- Simple UTI is defined as one which responds well to antibiotics within 48hrs and without any features of recurrent or atypical UTI. [15](#)
- Recurrent urinary tract infection (UTI) is defined as either: [15](#)
 - ≥ 2 episodes of acute pyelonephritis
 - One episode of acute pyelonephritis AND one episode of cystitis
 - ≥ 3 episodes of cystitis
- Atypical urinary tract infection (UTI) is defined as: [15](#)
 - Systemically unwell
 - Poor urine flow
 - Abdominal or bladder mass
 - Raised creatinine
 - Septicaemia
 - Failure to respond to antibiotics within 48hrs
 - Infection with non *E .coli* organisms

ULTRASOUND

- Considered the most appropriate initial investigation of urinary tract infections (UTI) in children.
- Safe and non-invasive method to assess the structure of the urinary tract including renal size and morphology, pelvicalyceal and ureteric dilatation, ureteroceles, bladder wall hypertrophy and residual bladder volume.
- Ultrasound cannot reliably exclude vesicoureteric reflux (VUR). Based on a systematic review of 11 studies, the sensitivity for detecting an abnormality in the setting of VUR ranged from 10.5 to 90.9% and the specificity from 14.6 to 93.8%. [17](#) Therefore, a micturating cystourethrogram (MCU) should also be considered in children less than 6 months of age where there is a higher risk of structural abnormalities. [3,15](#)
- Ultrasound may also detect severe parenchymal scarring but not as effectively as DMSA scanning. [1](#) The sensitivity ranges from 47.0 to 69.0% and the specificity from 80.4 to 100% depending on the timing of the ultrasound. [17](#)
- Ultrasound should be performed at the earliest convenience unless there are atypical features in which case an obstruction or abscess may need to be excluded with an acute ultrasound. [2](#)

TECHNETIUM-99m DIMERCAPTOSUCCINIC ACID (DMSA) SCAN

- Currently considered the reference standard for the detection of renal scarring in children with a history of urinary tract infection (UTI). [15](#)
- The study involves the intravenous injection of DMSA and scanning the kidneys with a gamma camera approximately 2-6 hours later.
- The role of a DMSA scan varies between institutions but in general, it is used to detect renal scarring in patients who have evidence of vesicoureteric reflux (VUR). [6](#) This study can also detect acute pyelonephritis, however, there is a 10% false negative rate and the findings often do not alter clinical management. [11](#) In view of this, the scan is not commonly used for this purpose in Australia.

- For the detection of renal scarring, it is recommended that the scan be delayed by at least 6 weeks (preferably 3-6 months) following resolution of infection to reduce false positive results.
- Currently, the long term implications of finding renal parenchymal defects on DMSA remains unquantified, however, the risk for future renal impairment, hypertension and poor quality of life is thought to be low. [2](#)

MICTURATING CYSTOURETHROGRAM

- Considered the reference standard for detection and grading of vesicoureteric reflux (VUR). It is also the most reliable method of evaluating associated urethral abnormalities such as posterior urethral valves. [5](#)
- Involves catheterisation of the bladder and infusion of contrast media to fill the bladder. Images are taken both during filling and during micturition to check for anatomical abnormalities and VUR.
- Grading of reflux is most widely based on the International Reflux System. [9](#)
 - Grade 1: Reflux into normal calibre ureter only.
 - Grade 2: Reflux into normal calibre ureter, renal pelvis, and calyces.
 - Grade 3: Mild ureteral and pelvicalyceal dilatation but no or mild blunting of the calyceal fornices.
 - Grade 4: Moderate ureteral and pelvicalyceal dilatation, with blunting of the calyceal fornices.
 - Grade 5: Marked ureteral and pelvic dilatation and tortuosity, marked blunting of the calyceal fornices, and lack of papillary impressions in most calyces.
- The optimal timing of the MCU in relation to the diagnosis of UTI is uncertain with some advocating the documentation of sterile urine to avoid false negative and false positive results. [5](#) Generally it is considered appropriate to wait until after completion of treatment for UTI and symptomatic improvement.
- The precise relationship between VUR and renal scarring is still uncertain. Although acute pyelonephritis on a background of VUR can be damaging to the kidneys, renal scarring can also be found in the absence of VUR. It is also clear that not all small kidneys in the setting of VUR occur as a result of scarring from repeated UTIs. [15](#)
- Disadvantages of MCU include:
 - Risk of infection and urethral trauma
 - Exposure to ionising radiation
 - May be distressing to patients and parents

Alternatives to Micturating Cystourethrogram (MCU)

- Contrast-enhanced voiding urosonography may be an alternative to MCU in girls depending on the local expertise. The sensitivity for the detection of VUR ranges from 86 to 93% with a specificity of 44 to 95%. [15](#)
- Although direct and indirect radionuclide cystograms are occasionally considered in the evaluation of VUR, there is little evidence to support its routine use in the investigation of children with a UTI. [15](#) However, some consider that they should be used to follow-up VUR as they involve a lower radiation dose and are less traumatic than an MCU.

MERCAPTOACETYLTRIGLYCERINE (MAG3) RENOGRAPHY

- Mercaptoacetyltriglycerine (MAG3) is the preferred agent in paediatric practice. [13](#)
- Useful to quantify an obstructive uropathy and can also provide information on renal vascularity and renal function.
- The scan involves the intravenous administration of Tc-99m, MAG3, and diuretic, followed by serial imaging over approximately 30 minutes to 1 hour.
- MAG3 renogram can be used to distinguish between a true obstruction and other causes of pelvicalyceal dilatation. [13](#)

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Website

For more information go to www.imagingpathways.health.wa.gov.au

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