

INFANTS WITH URINARY TRACT INFECTION – RENAL DAMAGE AND RISK FACTORS

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Background Identification of infants with urinary tract infection (UTI) who are at risk of renal scarring is an important clinical challenge with considerable economic consequences. Few issues in pediatric practice today have been so debated as the appropriate investigation of an infant with UTI. The widespread investigation model with ultrasonography (US), voiding cystourethrography (VCU) and renal scintigraphy is extensive and has lately been questioned. Minimising the work-up protocol is an important goal.

Aims The general purpose was to identify risk factors and to reduce the work-up protocol for infants with UTI with maintained clinical safety. Specifically, to assess replacement of VCU by renal scintigraphy and the value of standard US in the primary investigation of infants with UTI, to evaluate risk factors for permanent renal damage including the usefulness of urinary biomarkers in children with UTI.

Methods 290 consecutive infants with first time symptomatic community acquired UTI were included in this population-based 3-year study. US and dimercaptosuccinic acid (DMSA) scintigraphy were performed within a few days from diagnosis and VCU within 2 months. A late DMSA scan one year later was scheduled for patients with abnormal acute scan and for those having a febrile UTI recurrence during the follow-up. Investigations, treatment and management followed the guidelines of the hospital. In addition, analysis of urinary proteins was made in 52 children <2 years with UTI and in 23 controls with elevated serum CRP (s-CRP) >20 mg/L due to an acute non-UTI infection.

Results Vesicoureteral reflux (VUR) was found in 52 infants. DMSA scan was abnormal in 149 children (51%) and the rate of abnormality increased with VUR grade ($p < 0.001$). Only 1 of the 27 patients with dilating VUR (grade III-V) had normal DMSA scan. Abnormality on US was associated with presence and severity of abnormality on DMSA scan ($p = 0.006$). Renal length was associated with CRP and temperature ($p < 0.0001$).

Important structural abnormality including dilating VUR was found in 40 infants and permanent renal damage in 71. 25 children had febrile UTI recurrence. Renal damage was significantly associated with febrile UTI recurrence. S-CRP, serum creatinine, leukocyturia, and anterior-posterior diameter of the renal pelvis (APD) were identified as independent predictors of permanent renal damage.

S-CRP was positively correlated with temperature and all the other urinary proteins. Urinary retinol binding protein (u-RBP) and Clara cell protein (u-CC16) were significantly higher in children with UTI than in control children.

Conclusion Acute DMSA scintigraphy was abnormal in infants with UTI when there was dilating VUR. A normal DMSA scan makes VCU unnecessary in the primary examination of infants with UTI. US detected most infants with structural abnormality with the exception of reflux grade III. More children with structural abnormality were diagnosed after UTI than after antenatal diagnosis or because of other clinical symptoms. US is therefore essential in the work-up after UTI, especially when there is no systematic third trimester organ screening.

CRP is useful as predictor of permanent kidney damage in infants with UTI and may together with APD on US serve as basis for an imaging algorithm. The low molecular weight proteins u-CC16 and u-RBP showed an association with renal uptake defects visualized in acute DMSA scans. The levels of u-RBP and u-CRP were significantly higher in children with UTI compared to children with fever of non-UTI conditions. A combination of biomarkers may be useful in the clinical assessment of children with UTI.

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- I. **Preda I, Jodal U, Sixt R, Stokland E and Hansson S**
Normal dimercaptosuccinic acid scintigraphy makes voiding cystourethrography unnecessary after urinary tract infection.
J Pediatr. 2007; 151: 581-4.
- II. **Preda I, Jodal U, Sixt R, Stokland E and Hansson S**
Value of ultrasonography in work-up of infants with first-time urinary tract infection.
J Urol. 2010 (May), in press.
- III. **Preda I, Jodal U, Sixt R, Stokland E and Hansson S**
Imaging strategy in infants with urinary tract infection – a new algorithm.
Manuscript.
- IV. **Andersson L, Preda I, Mirjana Hahn-Zoric, Hanson L Å, Jodal U, Sixt R, Barregård L and Hansson S**
Urinary proteins in children with urinary tract infection.
Pediatr Nephrol. 2009; 24: 1533-8.

