

New Perspectives on Imaging of Urinary Tract Infections in Infants

Akademisk avhandling

som för avläggande av Medicine doktorsexamen vid Sahlgrenska akademien, Göteborgs universitet kommer att offentligens försvaras i hörsal G Sanders, Medicinaregatan 9B, den 13 november, klockan 09:00

av Yvonne Simrén

Fakultetsopponent:

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Avhandlingen baseras på följande delarbeten

- I. Simrén Y, Stokland E, Lagerstrand KM, Valdimarsson S, Hansson S. *Ultrasound is an effective and noninvasive method of evaluating renal swelling in infants with their first urinary tract infection.* Acta Paediatr. 2017;106(11):1868-74.
- II. Simrén Y, Valdimarsson S, Stokland E, Lagerstrand KM, Sixt R, Hansson S. *Renal swelling indicates renal damage in infants with their first urinary tract infection.* Acta Paediatr. 2018;107(11):2004-10.
- III. Simrén Y, Stokland E, Hansson S, Sixt R, Svensson PA, Lagerstrand KM. *Diffusion weighted imaging is a promising method to detect acute pyelonephritis in non-sedated free breathing infants.* J Pediatr Urol. 2020;16(3):320-5.
- IV. Simrén Y, Stokland E, Hansson S, Hebelka H, Svensson PA, Lagerstrand KM. *Diffusion tensor imaging based multiparametric characterization of renal lesions in infants with urinary tract infections: an explorative study.* Submitted

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Abstract

Background: Urinary tract infection (UTI) is a common disease in infants that may lead to renal damage with an increased risk of long term complications. The diagnostic imaging aims to identify risk factors as underlying urinary tract abnormalities and renal involvement of the infection for prevention of long term adverse outcome. There is a need for alternative methods to the ones presently used for investigation and follow-up of this patient group without the use of invasive procedures, contrast agents or ionizing radiation.

The aim of this thesis was to evaluate the potential of ultrasound (US), diffusion weighted imaging (DWI) and diffusion tensor imaging (DTI) in the initial evaluation of the urinary tract in infants with their first UTI.

Methods: Infants with their first symptomatic UTI were included in four prospective studies. The infants were examined with US, magnetic resonance imaging (MRI) including DWI and DTI, and ^{99m}Tc-dimercaptosuccinic acid (DMSA) scintigraphy during the acute phase of the infection. Inflammatory parameters, C-reactive protein and body temperature, were registered. Follow-up examinations included US after 1 month and scintigraphy after one year.

Results: Renal size measured at early US determined renal swelling in infants with a UTI. The renal swelling correlated with inflammatory parameters and was associated with renal damage at acute and follow-up DMSA scintigraphy. There was an agreement between DWI and DMSA scintigraphy in the detection of pyelonephritis. With the use of DTI, differences were found in quantitative and qualitative parameters in lesions compared to normal tissue and further lesion characterization patterns were recognised.

Conclusion: The results show that US, DWI and DTI are valuable non-invasive, non-radiating tools in the initial evaluation of infants with their first UTI. Renal length US measurements adds value to the early US examination by helping to identify patients at risk for renal damage even though it cannot replace DMSA scintigraphy. DWI and DTI have the potential to be advantageous alternatives to DMSA scintigraphy. However, studies of larger cohorts are needed to verify the results.

Keywords: Urinary tract infection, Ultrasound, Diffusion weighted imaging, Diffusion tensor imaging