

THE EFFECTIVE RADIATION DOSE IN THE DIAGNOSIS OF VESICOURETAL REFLUX BY FLUOROSCOPY OR NUCLEAR MEDICINE

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Voiding cystourethrography (VCU) and direct radioisotope cystography (DRC) are studies to detect and follow-up vesicoureteral reflux. Vesicoureteral reflux is abnormal movement of urine from bladder to ureter or kidneys. In VCU patient's bladder is filled with contrast agent and imaged by fluoroscopy and by single radiographic images. Because of the anatomical differences the procedure is somewhat different depending on the gender. In DRC a radionuclide tracer is introduced into the patient's bladder and tracked by a gamma camera. VCU studies are done most often to children and the majority of patients are 0-1 years old [1]. The determination of the radiological risk of children is particularly important due to their increased radiosensitivity when compared with adults.

Direct measurement of the effective radiation dose during VCU is not possible. The fluoroscopic system keeps track of the patient dose by measuring dose-area-product (DAP). The recorded DAP data and information about radiation fields can be used for a Monte Carlo simulation to determine the effective radiation dose of the patient.

We assessed the effective radiation dose associated VCU's of two 2-year-old patients, one female and one male. The patient size (height 90 cm, weight 13 kg) was estimated based on their age. The Monte Carlo code PCXMC [2] was used to calculate the effective dose.

10 DCR studies were performed during the year 2012 at our institution for 2-year-old patients. The radiation dose associated with DRC was calculated based on the recorded (8 patients) the average activity of the Tc-99m tracer (36 MBq, standard deviation 6 MBq) and a conversion factor (0.0024 mSv/MBq) [3] for effective dose.

For VCU the calculated effective dose for the female patient was 0.02 mSv and for the male patient 0.03 mSv. For DCR average effective dose was 0.09 mSv.

[1] T. Helasvuo, Radiologisten tutkimusten ja toimenpiteiden määrät vuonna 2001, Finnish Centre for Radiation and Nuclear Safety, Helsinki 2013. STUK-B161.

[2] M. Tapiovaara, T. Siiskonen, PCXMC A Monte Carlo Program for Calculating Patient Doses in Medical X-ray Examinations, Finnish Centre for Radiation and Nuclear Safety, Helsinki 2008. STUK-A231.

[3] J. Fettich et al., Guidelines for direct radionuclide cystography in children, Eur J Nucl Med Mol Imaging 30, B39 (2003).