

THE “WHIRLPOOL” SIGN - A TURNING POINT IN THE DIAGNOSIS OF PELVI-URETERIC JUNCTION OBSTRUCTION

K. C. Tan^{1,2} and H. S. Teh³

¹Singapore Health Services, Singapore, Singapore, Singapore, ²National Neuroscience Institute, Singapore, ³Changi General Hospital, Singapore, Singapore

Introduction

Magnetic resonance urography (MRU) is a useful technique that is readily reproducible, providing anatomic and structural information superior to that shown on sonography and renal scintigraphy. It is highly sensitive and also allows easy categorization of the degree of hydronephrosis as well as the volume of functioning renal parenchyma (1, 2). Vascular anatomy is readily depicted for surgical planning. Congenital anomalies, for example, ectopically inserted ureters, and urethrovesical narrowing (3) may also be shown. MRU easily distinguishes cortical scarring from medullary atrophy which can occur in pelvi-ureteric junction obstruction (PUJO). We describe two distinct patterns of contrast material movement within the renal collecting system, the “whirlpool sign” and the “swirl sign”. The presence of these signs may reflect different degrees of obstruction at the pelvi-ureteric junction, and permit qualitative grading of the severity of PUJO, potentially aiding management decision.

Purpose or Aim of the exhibit

The purpose of the exhibit is:

1. To demonstrate the imaging features of PUJO using multimedia videos giving specific emphasis to two signs recently described: “The whirlpool sign” (1) and “The swirl sign” (1, 2). Thus, emphasizing the usefulness of MRU in grading the severity of the disease as well as its efficacy in diagnosis and assessment of the disease.
2. To discuss the special role of MRU in today’s environment of radiation safety and concern.

Abstract text

Circular movement of contrast in a spiral configuration during the excretory process has been observed in patients with PUJO – what the authors would like to term the “whirlpool” sign. It is unsure why this sign occurs. One theory postulates that this occurs in patients with severe PUJO where there is likely to be complete obstruction. In these patients, the urine will encounter a focus of high resistance at the junction of the renal pelvis and the ureter. Its forward flow is blocked as the “gate” into the ureter is closed. The high intra renal pelvis pressure causes the excreted urine to whirl in a circular motion as it is forced to return via the path of least resistance back into the renal pelvis (*movie1*). For patients in whom the whirlpool phenomenon is noted, a more aggressive treatment may be advised. This whirlpool sign is contrasted with the “swirl” sign, in which contrast is observed to swirl in the renal pelvis in a haphazard or random fashion (*movie2*). This arises when the degree of pelvi-ureteric obstruction is less, allowing some amount of excreted urine to flow antegradely down the ureter. The relative decrease in the intra-renal pelvic pressure together with the bottleneck at the pelvi-ureteric junction, turns some of the contrast back into the renal collecting system, causing swirling of contrast in the renal pelvis.

MRU provides accurate morphological and functional evaluation of the urinary system which has several advantages over other modalities such as sonography, conventional intravenous urography and CT urography in the diagnosis of urological diseases. MRU, due to its non-use of ionizing radiation, is the most important tool in the diagnostic work-up of genitourinary pathologies in infants, small children and in women during pregnancy (3). The major drawback of MRU is its low sensitivity in detecting calcifications and subtle urothelial lesions, the latter due to the reduced spatial resolution compared with conventional intravenous urography (4). However, MRU can be offered as an alternative to conventional intravenous urography and CT urography to avoid repetitive radiation exposure in patients with conditions such as chronic urolithiasis, which may require serial follow-up imaging. In future, when cost considerations are managed, this technique holds potential as a single technique approach to pelvi-ureteric obstruction that offers both anatomic and functional insights (1).

Conclusion with major points to be emphasized

The major teaching points of this exhibit are:

1. MRU is useful in evaluating PUJO, being able to delineate the dynamic pathology of the urinary tract.
2. MRU permits diagnosis and grading of severity of PUJO so that early and appropriate intervention can be instituted.

References:

1. Teh HS, Ang ES, Wong WC et al. MR Renography Using a Dynamic Gradient-Echo Sequence and Low-Dose Gadopentetate Dimeglumine as an Alternative to Radionuclide Renography AJR 2003; 181:441-450.
2. McDaniel BB, Jones RA, Scherz H, Kirsch AJ, Little SB, Grattan-Smith JD. Dynamic contrast-enhanced MR urography in the evaluation of pediatric hydronephrosis: Part 2, anatomic and functional assessment of uteropelvic junction obstruction. AJR 2005; 185(6): 1608-1614.
3. Kocaoglu M, Ilica AT, Bulakbasi N, Ergin A, Ustunsoz B, Sanal T, et al. MR urography in pediatric uropathies with dilated urinary tracts. Diagn Interv Radiol. 2005; 11: 225-232.
4. Girish G, Chooi WK, Morcos SK. Filling defect artefacts in magnetic resonance urography. Eur Radiol 2004;14: 145–50.