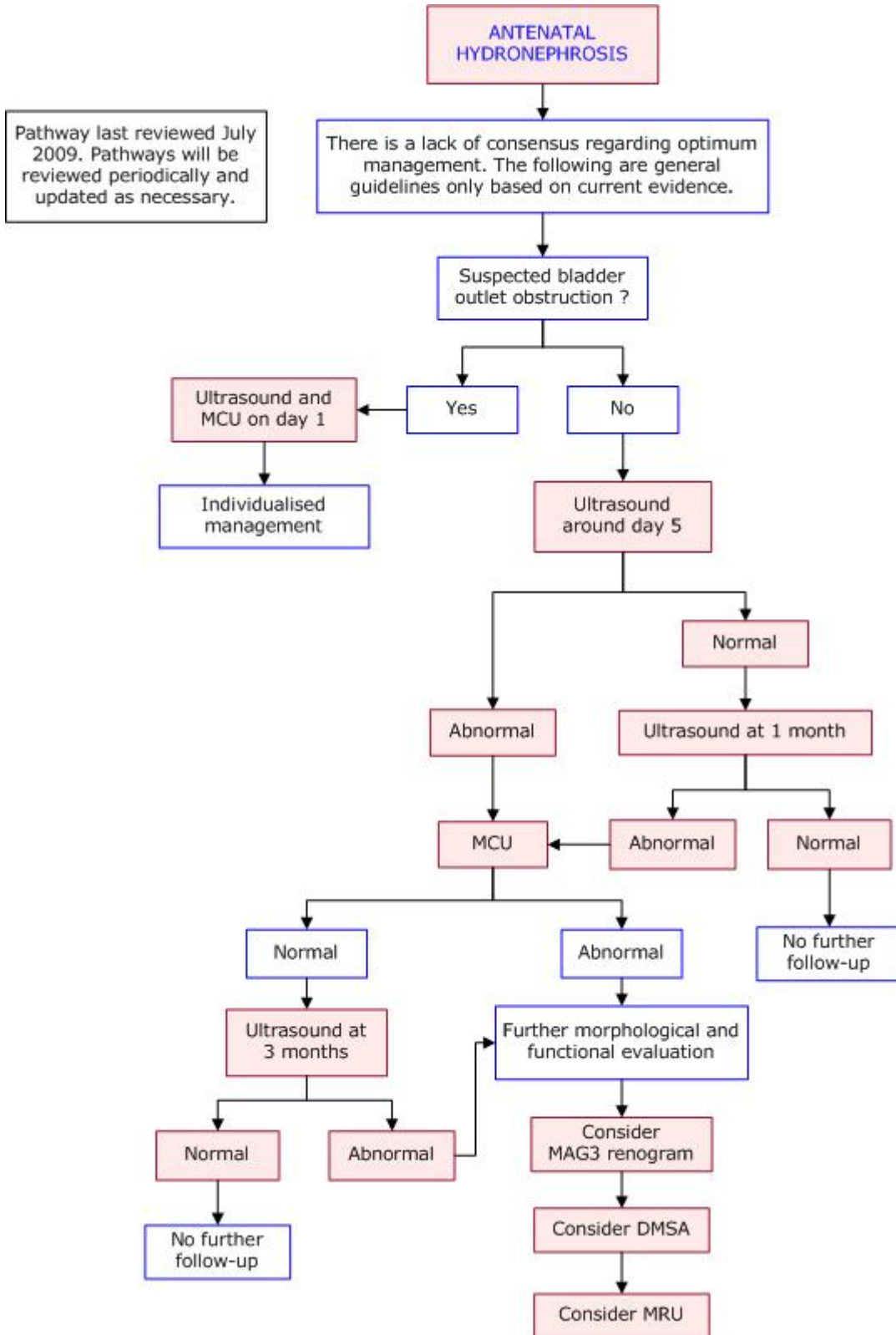




# DIAGNOSTIC IMAGING PATHWAYS

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## Introduction

- With the introduction of routine ultrasound in pregnancy, antenatal hydronephrosis is being increasingly detected and is currently found in 1-5% of pregnancies. [1](#) However, this finding does not necessarily imply obstruction or impaired renal function and many cases improve spontaneously. Therefore, this is a controversial area in paediatrics and there is a lack of consensus on optimum management. The following are general guidelines only based on best available evidence.
- Antenatal hydronephrosis is defined as a renal pelvis anteroposterior diameter of >4mm less than 33 weeks gestation and >7mm less than 40 weeks on ultrasound. [2](#)
- The most widely accepted grading system for hydronephrosis is the Society of Fetal Urology hydronephrosis system: [3,4](#)

Grade 0	No or minimal collecting system visible - considered normal
Grade I	Just the renal pelvis visible with an axial diameter <5-7 mm - usually considered normal
Grade II	Axial renal pelvis diameter 5/7-10 mm; some calices with normal forniceal shape visible
Grade III	Marked dilatation of the renal calices and pelvis >10 mm with reduced forniceal and papillary differentiation without parenchymal narrowing
Grade IV	Gross dilatation of the collecting system with narrowing of the parenchyma

- The risk of postnatal pathology is 12% for mild, 45% for moderate and 88% for severe antenatal hydronephrosis. [1](#) Overall, only a minority of neonates will require surgical intervention. [5](#) Mild hydronephrosis is more likely to stabilise or improve compared to higher grades. [6](#)
- Common causes of antenatal hydronephrosis include pelviureteric junction (PUJ) obstruction, vesicoureteric reflux (VUR), posterior urethral valves, duplication anomalies (ureterocoele/ectopic ureter), megaureter and multicystic dysplastic kidney.

## Ultrasound

- Ultrasound is a safe and non-invasive method to monitor the structure of the urinary tract including renal size and morphology, pelvicalyceal and ureteric dilatation, ureterocoeles and bladder wall thickness.
- In addition to hydronephrosis, associated findings which should also be documented include the volume of amniotic fluid, cycling of the bladder, visualisation of the ureter, presence of the contralateral kidney and abnormal organ findings.

- All neonates with documented antenatal hydronephrosis should have ultrasound scans at 5-10 days after birth and a repeat scan at 4 weeks if normal as false negatives are not uncommon at birth. [2](#) If both scans are normal, the vast majority will not have any renal tract abnormalities and therefore do not require any further imaging. [4,7](#)
- All abnormal ultrasounds should be followed-up with a micturating cystourethrogram to exclude vesicoureteric reflux (VUR). [4](#)
- Mild hydronephrosis should still be investigated according to the suggested pathway. Although studies are conflicting with some showing a benign clinical course [8-10](#) and others showing deterioration over time, [11](#) significant uropathies have been noted up to 39% of patients with mild hydronephrosis. [5](#)

## Micturating Cystourethrogram

- The role of a micturating cystourethrogram (MCU) is in the detection of vesicoureteric reflux (VUR) and urethral abnormalities such as posterior urethral valves.
- MCU should be performed on all neonates with abnormal ultrasound scans. [4](#)
- The incidence of VUR in antenatal hydronephrosis ranges from 8 - 38% [2,12](#) and up to 60% of patients with VUR will have a normal initial postnatal ultrasound. [13,14](#)
- In cases of suspected bladder outlet obstruction, an MCU should be performed as early as possible. For the evaluation of possible VUR, an MCU can be delayed for up to one month after birth. [2](#)
- Disadvantages of MCU include:
  - Risk of infection and urethral trauma
  - Exposure to ionising radiation
  - May be distressing to patients and parents

## Mercaptoacetyltriglycine (MAG-3) Renogram

- Radionuclide scans performed with a diuretic are dynamic studies which allow for assessment of obstruction which, in this setting, is mostly due to pelviureteric junction (PUJ) obstruction.
- Mercaptoacetyltriglycine (MAG-3) or a diethylene triamine pentaacetic acid (DTPA) can both be used, however, MAG-3 is preferred due to its favourable renal excretion properties which allow for more accurate assessment of renal drainage. [15](#)
- Renograms require careful interpretation as they can be affected by the level of hydration, the region of interest selected for analysis and failure of the immature kidney to respond to the diuretic. [15](#) Some institutions perform a “well-tempered renogram” with intravenous hydration and a urethral catheter in-situ to minimise the effect of these variables. However, this increases the invasiveness of the procedure.

- Disadvantages of radionuclide scans include:
  - Exposure to ionising radiation
  - Can be difficult to interpret
  - "Well-tempered renograms" are invasive
  - Variable accuracy reported in the literature [2,15](#)

## Tchnetium-99m Dimercaptosuccinic Acid (DMSA) Scan

- Currently considered the reference standard for the detection of renal scarring and differential renal function in children, particularly those with evidence of vesicoureteric reflux. [15](#)
- The study involves the intravenous injection of DMSA and scanning the kidneys with a gamma camera approximately 2-6 hours later.
- 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](#)

## Magnetic Resonance Urography (MRU)

- Magnetic Resonance Urography offers excellent anatomical visualisation and multiplanar 3D reconstruction as well as an assessment of differential renal function and drainage. [16,17](#) It provides detailed information on renal pathology within a single study which correlates well with surgical findings. [18,19](#)
- MRU can accurately demonstrate all the common causes of antenatally detected hydronephrosis and guide subsequent management. [18,20](#)
- Gadolinium-DTPA dimeglumine is used to assess the excretion and drainage of the kidneys.
- Advantages include:
  - Assessment of anatomical structure and function in a single study
  - Avoids ionising radiation
- Disadvantages include:
  - May require sedation and anaesthesia in young children
  - Relatively expensive with limited availability and requiring local expertise

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