Investigations for Antenatally Detected Renal Uropathies

This guideline is currently under review.

Please note that as of 2nd July the cut off for investigating ANH is a renal pelvis diameter of 10mm or more at 34 weeks. Less than 10mm at 34 weeks is NORMAL and does not require any further management.

Background and Introduction

Since the 1970s antenatal renal uropathies have been increasingly detected with ultrasonography. The commonest finding is hydronephrosis, but other abnormalities include dysplastic kidneys and bladder outlet obstruction. Some uropathies resolve spontaneously, but others require early intervention, or long term monitoring. It is therefore essential that a thorough review of maternal notes forms part of the newborn baby check. If in doubt consult a senior colleague.

Antenatal hydronephrosis (ANH)

This is also called antenatal renal pelvis dilatation or pyelectasis. The reported incidence is between 0.65 and 5% of all pregnancies (Dudley, Elder, Livera, Sairam). This varies because there is no agreed international classification of ANH. It can be graded according to the appearances of the renal parenchyma and pelvicalyceal system. This includes measurement of the maximum anteroposterior diameter of the renal pelvis (RPD) and observations of renal calyces and parenchyma. The threshold above which the RPD is considered to be abnormal and requires investigation is debated (Dudley, Grignon).

RPD

Anomaly scan at 22 weeks

RPD of > 5mm is considered to be abnormal. Mild cases will have a repeat scan at 34 weeks at St. Peter’s Hospital. More severe cases may be scanned more frequently, or referred to St.George’s Hospital for further management.

At 34 weeks

AP diameter < 6mm is normal and no further intervention is required.
AP diameter >10 mm is abnormal and should be further investigated.
AP diameter 6 – 9 mm is a grey area, and management is highly controversial. Currently our ultrasonographers may report this group as “normal”, or report the actual diameter.

Postnatal

Our radiologists consider RPD > 7mm to be abnormal (if USS performed after 48 hours and before 6 weeks). After 6 weeks postnatal age >10mm is considered to be abnormal.

Management of ANH

The initial assessment of a baby with ANH includes a physical examination to detect the presence of an abdominal mass (possible PUJ or MCDK) or palpable bladder (PUV). Subsequent investigations are organised according to the protocol, and are based on the
RPD at 34 weeks. If the mother has been seen at a tertiary centre, a clear plan should be outlined in her notes and should be followed accordingly.
RPD 6 to 9mm at 34 week scan

The most likely underlying diagnosis is transient or physiological hydronephrosis, but there may be other pathologies including VUR. Management does not differ between unilateral and bilateral mild ANH

At Birth
Start prophylactic antibiotics – Trimethoprim 2mg/kg once daily. Please fill out a hospital TTO form, or if an FP10 is used out of hours, please clearly document in the baby’s notes the dose of Trimethoprim prescribed.
Ultrasound scan (USS) of kidneys at 4 - 6 weeks
Arrange outpatient appointment for 6 – 8 weeks; ideally indicate on USS request form when the date of the OPA is, as the radiology department will then ensure the USS is carried out prior to the clinic appointment.

6 week scan
If < 7mm stop antibiotics. No further follow up is required.
If 7 -9 mm, continue antibiotics. Repeat USS at 4 - 6 months
If ≥10mm or any calyceal or ureteric dilatation, continue antibiotics and investigate further as indicated by scans to exclude reflux/obstruction

4 - 6 month scan
If <10mm, stop antibiotics and discharge from clinic. There is a slightly increased risk of UTI - advise parents how to minimise risks (good hygiene, avoid constipation). This is likely physiological and transient, and potential risks of MCUG do not justify investigating this group for underlying VUR (Dremesk).
If ≥10mm or any calyceal or ureteric dilatation, continue antibiotics and investigate further as indicated by scans to exclude reflux/obstruction

To exclude reflux
Any diameter between 10 and 15mm or with calyceal or ureteric dilatation consider MCUG to exclude VUR.

To exclude obstruction
Any diameter >15mm should consider a MAG 3 renogram
RPD 10 – 15 mm at 34 week scan

The most likely pathology (excluding transient or physiological hydronephrosis) is VUR.

At Birth
Start prophylactic antibiotics – Trimethoprim 2mg/kg once daily. Please fill out a hospital TTO form, or if an FP10 is used out of hours, please clearly document in the baby’s notes the dose of Trimethoprim prescribed.
Arrange USS for 4 - 6 weeks
Arrange outpatient appointment with the attending Neonatal Consultant for 6 weeks – ideally indicate on USS request form when the date of the appointment is, as the radiology department will then ensure the USS is carried out prior to the clinic appointment.

4 – 6 week scan
If still 10 – 15mm continue antibiotics and consider MCUG to exclude reflux.

VUR present on MCUG
Continue antibiotics, and re-emphasise good hygiene and UTI prevention measures, signs and symptoms of UTI and the need for samples for M,C&S prior to commencing antibiotics for presumed UTI.

VUR not present
Consider discontinuing antibiotics. Repeat USS at 6 months and then annually to ensure dilatation not increasing. If stable at age 5 can discharge. If dilatation is increasing above 15mm, consider a MAG 3 renogram to exclude obstruction.
**RPD >15mm at 34 weeks**

There is more likely to be a significant underlying pathology, especially pelviureteric junction obstruction (PUJ). The mother may have been seen antenatally at St. George’s Hospital, and there may be a plan documented in her notes.

**At Birth**  
Start prophylactic antibiotics – Trimethoprim 2mg/kg once daily. Please fill out a hospital TTO form, or if an FP10 is used out of hours, please clearly document in the baby’s notes the dose of Trimethoprim prescribed.  
Request early USS (ideally at 72 hours).

Suspect bladder outlet obstruction if bilateral in a male. This requires urgent investigation with USS and MCUG to exclude posterior urethral valves - see management of bladder outlet obstruction.

**Early USS**  
If bilateral >15mm or unilateral >30mm, discuss with Paediatric Urologists. May require urgent MAG 3.  
If unilateral >15mm <30mm arrange routine MAG 3.

**MAG 3**  
If MAG 3 confirms PUJ obstruction, discuss with Paediatric Urologists. If differential function of affected side is <40% baby will likely require surgery. If differential function is >40% a conservative approach is usually taken, with a repeat USS at 3, 6 and 12 months, and a repeat MAG 3 at 12 months.

If there is increasing dilatation on USS or drop in differential function on MAG 3, refer to Paediatric Urologists.  
If the condition remains stable but dilated, continue yearly USS until age 5 years, to look for increasing dilatation and consider need for a further MAG 3 renogram.

If MAG 3 shows there is no PUJ but persisting dilatation, continue antibiotics and consider an MCUG to exclude VUR.
Postnatal Investigations

Ultrasound scan (USS)
Mild (6 – 9mm) and moderate (10 – 15mm) hydronephrosis and can have an ultrasound at 4 - 6 weeks.
If an early postnatal USS is necessary e.g. with >15mm hydronephrosis, it is usually delayed for 72 hours to avoid false negative results when the baby is relatively oliguric. Exceptions include unilateral hydronephrosis in a solitary kidney, or where bladder outlet obstruction (bilateral hydroureteronephrosis, thick walled bladder) or a ureterocele is suspected, and an urgent USS should be requested in these babies. This should be performed within 24 hours. Discuss with the on call Radiology Consultant if necessary.

Micturating cysto-urethrography (MCUG)
MCUG is carried out on selected babies with persistent hydronephrosis on postnatal USS, or dilatation of the ureter. It is performed mostly to look for PUV and VUR. It involves placing a catheter in the baby’s bladder, injecting some dye and then taking some X-Rays. Some parents wish not to proceed with this invasive investigation and an alternative management approach may be necessary.
To minimise the risk of infection the baby should receive a treatment dose of Trimethoprim (4mg/kg twice daily) for 24 hours prior and 2 days following the procedure. This is clearly indicated on the appointment form sent to the parents.

MAG 3 renogram
This is a radioisotope diuretic renogram which determines whether urinary obstruction is present. It also gives an indication of differential renal function. It is performed on babies with persisting hydronephrosis >15mm, to rule out PUJ or other forms of obstruction. It involves inserting a cannula to allow intravenous injection of the radioisotope.
Background Evidence

General aims of management of antenatal hydronephrosis:
1. Detection of underlying abnormalities
2. Prevention of infection and scarring

1. Detection of Underlying Abnormalities

The prenatal diagnosis of ANH may confer a significant risk for postnatal pathology (Lee). There are a wide number of underlying abnormalities that may cause ANH. These include:

<table>
<thead>
<tr>
<th>Cause</th>
<th>Frequency (% of total)</th>
</tr>
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<tbody>
<tr>
<td>Transient or physiological hydronephrosis</td>
<td>65</td>
</tr>
<tr>
<td>PUJ obstruction</td>
<td>11</td>
</tr>
<tr>
<td>VUR</td>
<td>9</td>
</tr>
<tr>
<td>Megaureter (+/- obstruction)</td>
<td>4</td>
</tr>
<tr>
<td>MCDK</td>
<td>2</td>
</tr>
<tr>
<td>PUV</td>
<td>1</td>
</tr>
<tr>
<td>Other</td>
<td>8</td>
</tr>
</tbody>
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The likelihood of a baby having a significant underlying postnatal renal abnormality appears to be proportional to the severity of the ANH. (Lee)
Hydronephrosis can be divided into mild (6 – 9mm), moderate (10 – 15mm) and severe (>15mm). Most significant abnormalities (requiring surgery or long term monitoring) are detected in babies whose AP diameter is >10mm (moderate or severe hydronephrosis) and most babies (97%) with AP diameter <10mm (mild hydronephrosis) do not have any long term problems. (1/29 baby in one study had mild PUJ only – stable on follow up with no intervention required over 3 years) (Grignon).

The most common postnatal diagnoses are transient or physiological hydronephrosis (“baggy systems”) constituting up to 65% of all cases (Woodward). These kidneys are unobstructed and the hydronephrosis often resolves within the neonatal period. Many others improve with complete resolution by 12 months, whilst in some it persists.

The role of VUR

VUR is detected postnatally in ≈ 9% of all neonates with ANH (Lee), compared to ≈1% in asymptomatic healthy children (Bailey). The degree of ANH is not a good indicator of the presence or absence of VUR, as VUR can be present even with just mild ANH (Jawson). There did appear to be some association however, as VUR was present in 4.4% of mild ANH, but 14% of moderate ANH. (p 0.10).

VUR can also be present even if the ANH has resolved on the postnatal scan (Pal) and if more babies with resolved ANH or mild ANH (6 – 9mm), are investigated with an MCUG, the detection of VUR will increase (Marra, Anderson). Conversely if mild ANH is not investigated some cases of VUR will be undetected. However, an MCUG is an invasive test with associated morbidity for the baby, and therefore many Urologists do not advocate it for babies with mild and possibly moderate ANH.
2. Prevention of infection and scarring

Many neonates diagnosed with VUR are managed conservatively with simple antibiotic prophylaxis, although the use of postnatal antibiotic prophylaxis in ANH has not been examined in the context of a trial.

Early detection of VUR enables initiation of treatment before the development of UTI and/or reflux nephropathy (Dudley). However, children with ANH and VUR have a seemingly more benign course with a higher rate of resolution than children discovered to have VUR after a febrile infection. (Penido, Ylinen). It is considered by some to be physiological / insignificant (Marra, Dremesk), with no evidence of scarring seen on DMSA scans (Jawson). This is increasingly likely if the postnatal scan is normal (Godley).

The evidence to show that antibiotic prophylaxis has any impact on morbidity in a child with demonstrated VUR is also controversial (Garin).
Other renal uropathies

2 vessel umbilical cord
There is a reported incidence of renal abnormalities in 5% of babies with a 2 vessel cord (Thummala). If the antenatal anomaly scan (22 weeks) reports a normal renal system, a postnatal scan is not required. If an anomaly scan has not been performed, the baby does not require prophylactic antibiotics, but should have a routine USS at 6 weeks, and an outpatient appointment with the attending Consultant to discuss the result.

Isolated minor ear abnormalities
There is no increased risk of renal abnormalities with isolated minor ear abnormalities (preauricular skin tags and pits, misshapen pinnae) and these babies do not require any renal imaging. If there are any other congenital malformations to suggest a syndrome (e.g. CHARGE) a renal USS should be performed. (Deshpande)

PUJ obstruction
PUJ obstruction occurs in ≈1:2000 children, with M: F ratio 3:1, and is bilateral in 20 – 25%. The diagnosis is generally suspected in a fetus with hydronephrosis but no ureteric dilatation, and with a normal bladder and amniotic fluid volume. It may account for up to 11% of ANH. The degree of ANH gives some indication of the likelihood of PUJ obstruction. 75% of fetuses with an RPD of >15mm were shown postnatally to have PUJ obstruction (Dudley). The diagnosis is confirmed with a MAG3 study which will show obstruction, and if significant, the differential renal function is usually reduced <35%. In unilateral PUJ, if the differential function is not <40%, a conservative approach is usually adopted, with prophylactic antibiotics and serial USS (3, 6 and 12 months) and MAG3 (12 months). If the function is <40%, a referral should be made to the urologists. The risk of needing pyeloplasty increases with an increasing RPD, therefore all cases of RPD >30mm should be discussed with the urologists.

Bladder Outlet Obstruction
This should be suspected antenatally if there is progressive bilateral hydronephrosis with a large thick walled bladder with diverticulae and poor emptying. Posterior urethral valves (PUV) are the most common cause of severe obstructive uropathy, occurring in ≈1:8000 live births (males). The baby should be commenced on antibiotics and an urgent USS (on the first day of life) and MCUG organised. Urgent referral to the urologists will be necessary.

Ureterocele and duplex systems
A ureterocele is a cystic dilatation of the intravesical ureter and occurs in 1:5000 babies, M: F ratio 1:3-5. It is usually associated with duplicated collecting systems (duplex kidneys) and may be associated with multicystic dysplastic kidneys (MCDK). In a duplex system the ectopic ureter drains the upper pole moiety, and enters the bladder inferiorly to the normal lower pole ureter. The ureterocele may obstruct this ectopic ureter, leading to upper pole hydronephrosis. It may also obstruct the contralateral ureter or the bladder neck, resulting in bilateral obstruction which merits urgent investigation. The ureter draining the lower pole moiety may have VUR. The duplex system may show up on USS. Ureteroceles and dilated duplex systems should be discussed with the urologists. Investigations may include MCUG to look for reflux into the lower pole, and a MAG 3 to assess for obstruction and function.

Multicystic Dysplastic Kidney (MCDK)
MCDK is a developmental anomaly in which the renal parenchyma is replaced by multiple cysts of varying sizes, with no discernable cortex. The ureter is usually atretic and not communicating with the bladder. The incidence is ≈1:3000 babies with M: F ratio of 2:1 and can be divided into simple (normal contralateral side) or complicated (abnormality of the contralateral side).
Simple MCDK
If the contralateral kidney looks normal antenatally no further scans are required until after
birth. The baby does not need antibiotics, but should have its blood pressure measured, and
an early scan (72 hours) to confirm the diagnosis and look at the contralateral kidney. (If
there is any abnormality in the contralateral kidney, see below – complicated MCDK.) The
baby should have a routine DMSA to look for function. There should be no function – if there
is, the diagnosis is not MCDK and the baby should be referred to a nephrologist. The baby
should have annual BP and USS monitoring until the age of 5, and then if stable can be
discharged. The parents should be given advice on prevention of UTIs, and the slight
increase risk of hypertension in later life. Indications for nephrectomy include increasing size
or persistence of lesion >6cm at 2 years, hypertension and symptomatic masses. You may
wish to discuss individual cases with a urologist.

Complicated MCDK
If there is hydronephrosis of the contralateral renal pelvis, consider performing an MCUG as
there is a risk of VUR in the contralateral kidney (20 – 25%).

VUR
If VUR is identified, prophylactic antibiotics may be continued. Some parents wish to
discontinue antibiotics, and seek early investigation and antibiotic treatment if UTI is
suspected. Consider performing a DMSA scan depending on degree of VUR (i.e. for more
severe grades) or presence of any UTIs. Consider performing a MAG 3 renogram with
indirect cystogram at age 2 – 3 years (when toilet trained) to see if reflux has resolved. An
alternative approach would be to continue antibiotics until 3 years but not perform any
imaging. The degree of reflux, history of UTI and parents wishes will influence the
management decisions.

Family History of Uropathy
If there is a family history of VUR the fetus should have a third trimester scan (≈ 34 weeks)
as there is a reported incidence of 30% risk for siblings (Jawson). If this is normal, no further
action is necessary. If there is no late scan, offer a postnatal USS at 6/52.
If there is a family history of scarring, commence trimethoprim and arrange an USS, and an
outpatient appointment with the attending consultant. Further imaging may include a DMSA
to look for scarring, and if this is positive an MCUG and urology opinion.
**Glossary**

ANH  Antenatal Hydronephrosis  
MCDK  Multicystic Dysplastic Kidney  
MCUG  Micturating Cysto Urethrogram  
PUJ  Pelvi Ureteric Junction  
PUV  Posterior Urethral Valves  
RPD  Renal Pelvis Diameter  
USS  Ultrasound scan  
UTI  Urinary Tract Infection  
VUR  Vesico Ureteric Reflux  

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Reviewed, amended and approved by Neonatal Clinical Management Group April 2008

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Review Date April 2011