Antenatal Hydronephrosis: Trends and Management

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Is my baby going to be okay? Is my baby going to be hospitalized after I deliver? Is this something I did? What will this mean for my pregnancy? These are some of the questions that run through a mother’s mind once she is told that the fetus she is carrying has antenatally detected hydronephrosis (ANH).

Hydronephrosis is the dilatation of the collecting system of the kidney. The detection rate for ANH and other fetal abnormalities has dramatically increased over the last 20 years due to the routine use of prenatal ultrasound. Bowes (2002) reported that fetal urinary tract abnormalities occur in as many as 1 per 100 pregnancies, making it one of the most commonly diagnosed prenatal malformations. The wide range of management and treatment options for ANH often leave health care providers and families with questions about the appropriateness of referral to a pediatric urologist and the need for postnatal screening. Pre and postnatal management, radiologic findings, and treatment options are reviewed and three case scenarios presented.

Definition and Incidence

There are various ways to grade and measure the kidney to determine the amount of ANH. A collaborative effort from the Society of Fetal Urology (SFU) allowed pediatric urologists to address the controversies in the management and natural history of prenatal hydronephrosis (Fernbach, Maizels, & Conway 1993). They developed a system that would guide providers to appropriately grade the extent of hydronephrosis. The system starts with grade 0, representing no hydronephrosis, to a grade V, representing significant dilation of the renal pelvis and calyces along with parenchymal thinning (see Table 1 and Figure 1).

Most urinary tract abnormalities are detected during a routine prenatal ultrasound between 18 and 25 weeks gestation. Although most cases of ANH (approximately 80%) are considered to be mild cases and have favorable outcomes, not all cases resolve. The presence of prenatal calyceal dilatation is an important finding that may demonstrate a need for closer monitoring and intervention postnatally. Clinical resolution of mild cases without treatment often occurs. A study by the University of Connecticut reported that when mild hydronephrosis (grade II or less) was identified antenatally, resolution occurred in just over half of the instances, with just 10% worsening prior to delivery (Bowes, 2002). Another study by the Royal London School of Medicine found that 81% of patients diagnosed with mild hydronephrosis had clinical resolution without postnatal intervention (Sairam, Al-Habib, & Thilanganathan, 2001).

Clinical resolution of more severe cases is less common. When the University of Connecticut detected moderate hydronephrosis (grade IV or higher), the majority of patients did not improve prior to delivery (Bowes, 2002). Similarly, the Royal London School of Medicine discovered that when the diagnosis of moderate to severe hydronephrosis was made, up to one-third required postnatal surgical interventions (Sairam et al., 2001).

Note: CE Objectives and Evaluation Form appear on page 184.
Prenatal Findings

When parents present prenatally to the pediatric urology office their anxiety level is usually high. They look to the nurse practitioner or health care provider for not only comforting words, but also for information related to prenatal management. It is very important for the provider to review the prenatal ultrasound and reports with the family and explain what the findings mean. During the visit the family may express feelings of confusion and apprehension. It is essential for them to know that there is a high false-positive rate when determining ANH. The nurse practitioner needs to determine the anteroposterior renal pelvic diameter (APRPD) at different gestational ages to classify the amount of ANH. Based on these findings, recommendations for followup treatment will be developed. If the kidney(s) have mild hydronephrosis (SFU grade II or less), there is a high likelihood of resolution. However, if there is a moderate-to-severe hydronephrosis (SFU grade III or higher), there is a high likelihood that the lower incidences of primary VUR recorded in earlier series probably reflect the selective use of voiding cystourethrogram (VCUG) and the over diagnosis of UPJ obstruction. Routine use of VCUG in their series showed an incidence of 18.4% and 18.2%, respectively. Other potential diagnoses include posterior urethral valves (PUV), multi-cystic dysplastic kidney.

Inquiring about amniotic fluid levels is necessary since antenatal intervention is considered if the fluid levels are low. Normal fetal lung development is expected in the presence of normal amniotic fluid levels. However, when oligohydramnios (low levels of amniotic fluid) is observed, there is concern about pulmonary development and maturation. If lung immaturity is documented, early delivery should be considered. If significant bladder outlet obstruction is noted, fetal surgery may be indicated (Morin et al., 1996).

Etiology and Related Treatment

Determining a list of potential diagnoses and likely outcomes will enable the nurse practitioner or health care provider to give appropriate counseling. Although the debate continues over which cause is more prevalent, the two most common causes of ANH are vesicoureteric reflux (VUR) and ureteral-pelvic obstruction (UPJO). In a study where 298 (72%) fetuses were identified having dilatation to their kidneys, only 28% had postnatal dilatation. Of the patients with persistent hydronephrosis, VUR was seen in 14 infants (3%) and UPJO was seen in 23 infants (6%), making UPJO the most common cause of ANH (Gunn, Mora, & Pease, 1995).

In contrast, Tibballs and De Bruyn (1996), and Dudley and colleagues (1997) made the observation that VUR is the most common cause of ANH. They believe that the lower incidences of primary VUR recorded in earlier series probably reflect the selective use of voiding cystourethrogram (VCUG) and the over diagnosis of UPJ obstruction. Routine use of VCUG in their series showed an incidence of 18.4% and 18.2%, respectively. Other potential diagnoses include posterior urethral valves (PUV), multi-cystic dysplastic kidney.

Table 1.
The Society of Fetal Urology Grading System for Antenatally Detected Hydronephrosis

<table>
<thead>
<tr>
<th>Grade</th>
<th>Central Renal Complex (= Pelvis)</th>
<th>Renal Parenchyma Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Intact</td>
<td>Normal</td>
</tr>
<tr>
<td>I</td>
<td>Mild splitting = dilation</td>
<td>Normal</td>
</tr>
<tr>
<td>II</td>
<td>Moderate splitting but complex, confined within real border</td>
<td>Normal</td>
</tr>
<tr>
<td>III</td>
<td>Marked splitting, pelvis dilated outside renal border, and calyces dilated</td>
<td>Normal</td>
</tr>
<tr>
<td>IV</td>
<td>Further pelvicalyceal dilation</td>
<td>Thin</td>
</tr>
</tbody>
</table>

Source: Fernbach et al., 1993
MCDK), ureteroceles, megau-
reter, and extra renal pelvis.

Vesicoureteric reflux. VUR is one of the most common emerg-
ing diagnoses for the cause of ANH. VUR is the retrograde pas-
sage of urine into the ureter(s) and/or kidney(s) when the blad-
der fills and/or empties (see Figure 2). A VCUG is the only 
radiology study that can truly determine if VUR is present. It 
involves the catheterization and infusion of fluid into the bladder. 
If VUR is present, fluid will enter the ureters and/or the kidneys 
during filling and/or emptying. When reflux is identified, the 
amount of reflux is graded using the International Reflux Study 
Classification (Lebowitz, Olbing, Parkkulainen, Smellie, & Tamminen-
Mobius, 1985) grading tool (see Table 2). Based on the degree of 
reflux, a followup plan can be established. Most infants are 
monitored conservatively with antibiotic prophylaxis and obser-
vation.

Ureteral-pelvic junction ob-
struction. UPJO is an obstruction 
at the ureteral pelvic junction. 
More often an intrinsic stenosis 
associated with the ureter is 
found, but an insertion anomaly 
of the ureter, or a crossing vessel 
(usually an accessory renal 
artery) can also lead to this prob-
lem (see Figure 3). The diagnosis 
is usually suspected when there 
is hydronephrosis, the absence of 
ureteral dilatation, a normal 
appearing bladder, and normal 
amniotic fluid levels. Dudley and 
colleagues (1997) found that 
three-quarters of fetuses with an 
APRPD >15 mm seemed to be 
diagnosed with an UPJ obstruc-
tion, compared with none of the 
fetuses with an APRPD <15 mm. 

Diuretic renography (MAG III 
Renal Scan) is a functional study 
that can help determine whether 
urinary obstruction is present in 
persistent hydronephrosis. A MAG 
III Renal scan involves the infusion 
of a radioisotope and use of a 
gamma camera to determine the

![Figure 2. International System of Radiographic Grading of Vesicoureteric Reflux](image)

Source: Lebowitz et al., 1985

<table>
<thead>
<tr>
<th>Grade</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Reflux into ureter, no dilation</td>
</tr>
<tr>
<td>II</td>
<td>Level of kidney, no dilation</td>
</tr>
<tr>
<td>III</td>
<td>Mild to moderate dilation, minimal calyceal blunting</td>
</tr>
</tbody>
</table>
| IV    | Moderate dilation, loss of angles of fornices, papillary impres-

| Source: Lebowitz et al., 1985 |

![Figure 3. Ureteropelvic Junction Obstruction](image)

Source: Original work of the author.
total and individual renal function. Healthy kidneys should function symmetrically (for example, kidneys should each contribute 50% of the total function). If the function of the affected side drops below 40%, this may represent renal impairment. The renal scan also looks at the drainage time of the urine from the renal pelvis into the ureter(s) and or bladder. This gives an indication of the possibility and extent of obstruction. If the urine moves quickly through the system with or without the administration of a diuretic (usually furosemide [Lasix®]) patients are said to have a dilated nonobstructing system. If the washout of the urine is delayed, then the patient is studied for an obstruction.

The debate continues with the postnatal management of patients with UPJO. The initial thought was to surgically correct all infants with a suspected UPJO to preserve renal function. More recently, as long as the function remains stable, observation without surgery has taken precedence. The Society of Fetal Urology established a multi-center prospective, randomized study of unilateral high-grade hydronephrosis in asymptomatic infants less than 6 months of age. Thirty-two patients from ten centers met the criteria of presumed obstruction. The patients were divided into two groups: surgery and observation. The surgery group had improvement in hydronephrosis and stabilization of renal function at 6 months and 1 year. In the observation group, renal function deteriorated in 25% of the cases and crossed over to surgery, but the remaining 75% remained stable. The researchers concluded that the surgical patients’ grade of hydronephrosis and drainage pattern improved significantly when compared to the observation group (Palmer, Maizels, Cartwright, Fernbach, & Conway, 1998).

In contrast, the department of pediatrics in New Delhi, India, supports initial observation in all of their cases of moderate-to-severe bilateral ANH with a suspected UPJO. They followed 16 patients who met their criteria and found only 25% (4) required correction during a followup period of 3 years. They concluded that hydronephrosis will spontaneously resolve or improve in 78% of those observed by 2 years and only a few will require surgical management (Bajpai & Chandrasekharam, 2002). Unfortunately, there are no definitive guidelines for managing moderate-to-severe hydronephrosis in the face of a possible UPJO. This underscores the need for the long-term followup of these patients.

Posterior urethral valves. Progressive, moderate-to-severe hydronephrosis and the presence of a thickened bladder wall with poor emptying in a male fetus is usually indicative of posterior urethral valves. PUV are often described as leaflets or sail-like tissues that are found in the posterior urethra which obstructs urinary flow from the bladder into the kidneys and causes hydronephrosis, which may eventually lead to renal damage.

Once the diagnosis of PUV is suspected, these patients are carefully monitored both pre and postnatally. As long as the amniotic fluid level continues to stay within a normal range, these babies can be brought to full term. If there is evidence of oligohydramnios, the risk of pulmonary hypoplasia increases and antenatal intervention may be considered. A urethral catheter should be placed immediately after birth if PUV is suspected. The catheter will help facilitate urinary drainage and decrease pressure in the kidneys. A pediatric urologist should be consulted for appropriate management. Unfortunately, about one-third of these patients, despite antenatal diagnosis and close monitoring, will still develop renal insufficiency or end-stage renal disease.

Multi-cystic dysplastic kidney. MCDK is another urinary anomaly that can be detected on a prenatal ultrasound. MCDK is diagnosed when the renal parenchyma is completely replaced by multiple noncommunicating cysts of various sizes with no differentiated renal cortex (see Figure 4). The kidneys are nonfunctioning, there are no proximal ureters, and there is no communication from the perceived cysts into the renal pelvis. MCDK is not associated with inherited polycystic kidney disease.

Due to the significant dilatation seen on the ultrasound, MCKD may be difficult to differentiate from a UPJO on both pre and postnatal ultrasound, making postnatal management imperative. The diagnosis of MCDK should be confirmed with a renal scan (isotope scan), which will reveal that the kidney has little to no function. In addition, a VCUG is performed to look for evidence of VUR into the contralateral kidney. This occurs 18% to 20% of the time. Most infants and children with MCDK are followed by serial ultrasound evaluations of the kidney looking...
for it to shrink or involute. Involution of the kidney may take several years. If involution does not occur or if the patient suffers from pain and/or high blood pressure, a surgical nephrectomy may be considered.

**Ureteroceles.** Ureteroceles are a cystic dilatation of the terminal intravesical segment of the ureter. They are commonly associated with duplicated collecting systems. Ureteroceles may remain entirely within the bladder (intravesical) or extend through the bladder neck (extravesical). In a duplex system, the ectopic ureter drains the upper pole moiety, entering the bladder wall below the normal lower pole ureter. It may be obstructed by the ureterocele, resulting in upper-pole hydronephrosis.

The diagnosis of ureteroceles can be made by a postnatal ultrasound if it was not seen prenatally. But, a VCUG is necessary to show whether VUR is present into the ureterocele, resulting in upper-pole hydronephrosis.

The postnatal ultrasound reveals unilateral moderate-to-severe hydronephrosis (grade I) without bladder wall thickening. The child should be discharged on low-dose prophylactic antibiotics, and a VCUG should be set up in the next 4 to 6 weeks. The primary care provider can manage these patients. This is the treatment outcome for approximately 80% of neonates previously diagnosed with ANH. Although this has been the standard practice of care, currently, these guidelines for performing VCUG on each patient are being re-examined. Mild hydronephrosis is the most controversial of all the grades of ANH.

**Scenario 1**

The postnatal ultrasound reveals bilateral mild hydronephrosis (grade I) without bladder wall thickening. The child should be discharged on low-dose prophylactic antibiotics, and a VCUG should be set up in the next 6 weeks. The primary care provider can manage these patients. This is the treatment outcome for approximately 80% of neonates previously diagnosed with ANH. Although this has been the standard practice of care, currently, these guidelines for performing VCUG on each patient are being re-examined. Mild hydronephrosis is the most controversial of all the grades of ANH.

**Scenario 2**

The postnatal ultrasound reveals bilateral mild hydronephrosis (grade II or higher) without bladder wall thickening. The child should be discharged on low-dose prophylactic antibiotics, and a VCUG should be set up in the next 6 weeks. The primary care provider can manage these patients. This is the treatment outcome for approximately 80% of neonates previously diagnosed with ANH. Although this has been the standard practice of care, currently, these guidelines for performing VCUG on each patient are being re-examined. Mild hydronephrosis is the most controversial of all the grades of ANH.

**Scenario 3**

The postnatal ultrasound reveals moderate-to-severe bilateral hydronephrosis and a thickened bladder wall. It is appropriate at this time to immediately place a catheter. If the catheter cannot be placed transurethrally, a suprapubic catheter should be inserted. A voiding cystourethrogram is performed to rule out PUJ. If present, a pediatric urologist should be consulted. Depending on the health and size of the infant, transurethral endoscopic valve ablation versus a vesicostomy is considered. This is a possible outcome for less than 5% of neonates diagnosed previously with antenatal hydronephrosis.

### Case Study

**Three Scenarios for an Antenatal Hydronephrosis Diagnosis**

A 34-year-old female just ending her second trimester is waiting anxiously in examination room 3. Her 20-week prenatal ultrasound revealed that her fetus has bilateral hydronephrosis. The anterior-posterior renal pelvic diameter of the right kidney is 10 mm and the left kidney is 9 mm. There does not seem to be any type of bladder wall thickening. By report, her amniotic fluid levels have always been within normal limits. Thus far, it has been an uncomplicated pregnancy. The following scenarios describe three different possible outcomes for the full-term neonate later delivered.

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The postnatal ultrasound reveals bilateral mild hydronephrosis (grade I) without bladder wall thickening. The child should be discharged on low-dose prophylactic antibiotics, and a VCUG should be set up in the next 6 weeks. The primary care provider can manage these patients. This is the treatment outcome for approximately 80% of neonates previously diagnosed with ANH. Although this has been the standard practice of care, currently, these guidelines for performing VCUG on each patient are being re-examined. Mild hydronephrosis is the most controversial of all the grades of ANH.

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and go over time and has no significant morbidity. Extra renal pelvis is usually mild and may represent normal physiologic changes to the kidney prior to birth or an obstructed kidney that may have corrected itself prior to delivery. Until the process of ANH is understood, this diagnosis may never be fully explained. However, it is still benign in nature and resolves in 70% to 80% of most cases.

**Prenatal Counseling**

Despite prenatal ultrasound and improved technology for screening, the impact of early detection on the clinical outcomes remains unclear. Therefore, it is imperative to determine the functional significance of the dilatation of the upper tract(s) and provide appropriate counseling for affected families without engendering anxiety and unnecessary testing. Providing the initial contact between the expecting mother and the pediatric urology team is important in building a trusting rapport. One of the benefits to prenatal counseling is the positive correlation with postnatal followup visits. Jaswon and colleagues (1999) found that parents who attended prenatal counseling were more likely to attend postnatal evaluation. Of the 49% of parents who attended counseling, only 10% failed to attend postnatal followup appointments. This contrasts with a 20% failure rate from those parents who were not counseled.

Education is the primary goal of the pediatric urology specialist visit. It is important to review the various etiologies for the ANH and to determine an appropriate postnatal management plan. Information from this visit should be communicated to the primary health care provider.

**Postnatal Management**

At birth, the infant should be started on a low dose of antibiot-

ic prophylaxis. Amoxicillin (25 mg/kg) once per day is the antibi-
otic of choice of infants under 2 months of age. After 2 months, sulfamethoxazole (Bactrim®) (2 mg/kg) can be initiated. Bactrim is not started prior to 2 months because the sulfamethoxazole binds to the neonatal bilirubin and can cause an overall rise in the bilirubin leading to kernicterus.

For all patients with ANH, an ultrasound of the kidneys and bladder should be performed 48 hours after the birth unless the suspicion of PUUV is present. The ultrasound is delayed because of the low glomerular filtration rate and relative oliguria in the newborn. The lack of urine production may underestimate the degree of renal dilatation. Even in the face of obstruction, the kidney may look normal. The ideal time to study infants is at 1 week of life, but this may deny the neonate the advantage of in-hospital evaluation. The advantages include parental convenience and compliance, the immediacy of a diagnosis, and improved communication between the hospital and the primary health care provider for appropriate postnatal care and referrals.

If a VCUG reveals a VUR grade III-V, referral to a pediatric urologist is indicated. If the VCUG reveals a grade I-II, the primary care provider can continue to manage the infant. If while on prophylactic antibiotics the infant has a breakthrough UTI, referral to a pediatric urologist may be considered. The primary health care provider should follow VUR results until complete resolution is determined.

If the VCUG reveals no VUR, the primary care provider can continue to manage the infant and repeat the renal and bladder ultrasound at 3 months of age. If the hydronephrosis is stable or resolving, doubling the followup time between renal and bladder ultrasounds (for example, 3 months, 6 months, yearly) is indicated. Followup should be continued until the infant is through potty training or until resolution occurs. If the hydronephrosis resolves, followup can be discontinued. In contrast, if the hydronephrosis increases, referral to a pediatric urologist is appropriate.

**Nursing Implications**

Due to the increasing detection of ANH, proper pre and postnatal management guidelines for both families and primary care providers are essential. Appropriate parental counseling throughout the whole process from the nurse practitioner should alleviate fears and anxiety for the families. Although the natural history of ANH continues to be confusing, guidelines can assist the health care providers for this family to effectively manage all levels of ANH care. Pregnancy is a time in a family’s life where heightened emotions and anxiety are present. Although antenatal hydronephrosis is one of the more common diagnoses, it should be monitored throughout the pregnancy and after the birth of the infant. When families are seen prenatally, the nurse is able to teach and counsel the parents.

During postnatal management, it is important for the nurse to continue to monitor and to confirm that the families receive appropriate followup and care. The benefits to diagnosing antenatal hydronephrosis is a useful way to find the patients who usually would present with a urinary tract infection and/or a more serious diagnosis and can hopefully save some of the initial febrile urinary tract infection or any other serious morbidity to the genital urinary system.

**References**


Additional Reading

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