

## Management of antenatal detected hydronephrosis

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**Abstract:** Abnormalities of urinary tract in fetuses are being recognized with increased frequency due to high resolution of fetal ultrasonography and greater staff expertise. The incidence of antenatal hydronephrosis ranged from 0.6-4% with up to 90% can be detected antenatly. Most antenatal detected hydronephrosis are transient and resolve spontaneously however, severe urinary obstruction can lead to renal injury and end stage renal disease. Very few cases need antenatal management while most of fetuses with antenatal hydronephrosis are investigated and managed postnatally. The aim of this article is to review the literature on the management of this condition and to identify infants requiring further investigation and management.

**Keywords:** Antenatal hydronephrosis, urinary tract abnormalities, ultrasonography

### Introduction

Antenatal hydronephrosis (ANH) is defined as dilatation of the collecting system of the fetal kidney. It is a common finding of antenatal ultrasound examination. In nearly 1% of pregnancies, a significant fetal anomaly is detected by ultrasonography. 20-30% of these anomalies are genitourinary in origin. 50% of them manifest as hydronephrosis (1-3). 41-88% of infants with ANH resolves by birth or during infancy (4 - 6) and most pelvic dilation is a transient finding (7). However, urinary obstruction can lead to renal injury and end stage renal disease. If these anomalies are not

detected by antenatal US and subsequently managed, many of these abnormalities manifest later in life as pyelonephritis, hypertension and end stage renal disease. Several systems are used to grade antenatal hydronephrosis by ultrasonography (US). Two main classifications exist (8). The first is grading system developed by the Society of Fetal Urology (SFU). It is based on the long axis sonographic appearance of renal parenchyma and pelvicalyceal system (9, 10) as shown in Table 1.

**Table 1:** Society of Fetal Urology grading system of fetal hydronephrosis

Grade	Central renal complex	Renal parenchymal thickness
	Intact	Normal
1	Slight splitting of pelvis	Normal
2	Evident splitting of pelvis and calyces	Normal
3	Wide splitting of pelvis and calyces	Normal
4	Further splitting of pelvis and calyces	Reduced

Measurements based on the long axis of the kidney

The second and more widely used classification for antenatal hydronephrosis is based on the measurement of the maximum anteroposterior

diameter of renal pelvis or the renal pelvis diameter (RPD) and the gestational age (7) as shown in table 2.

**Table 2:** grading system of fetal hydronephrosis by renal pelvis diameter (RPD) measurement

Gestation (weeks)	RPD (mm)	Grading of hydronephrosis
15 to 20	4 to 7	Mild
	> 7	Moderate
> 30	5 to 8	Mild
	9 to 15	Moderate
	> 15	severe

RPD measurement based on the maximum anteroposterior diameter of the renal pelvis.

However mild renal pelvic dilation shows no clinical impact on normal renal development (4, 11), while moderate and severe renal pelvis dilation associated with increasing risk of significant congenital abnormalities of kidney and urinary tract (12 - 14). The controversy exists as to the threshold beyond which the fetal RPD is considered abnormal. Most recent studies suggest that antenatal hydronephrosis exist when RPD exceeds 5mm before 24weeks gestation or when over 7mm beyond 25 weeks of pregnancy (11, 15-17). It has been suggested that using both methods in combination is superior to using each method

#### **Causes of antenatal hydronephrosis:**

Antenatal hydronephrosis may due to non-obstructive or obstructive causes. Non obstructive lesions such as primary vesicoureteric reflux (VUR) and multicystic dysplastic kidney (MCDK). Obstructive lesions particularly bilateral lesions are more harmful to developing kidneys. These include pelviureteric junction obstruction (PUJO), vesicoureteric junction obstruction (VUJO) and posterior urethral valve (PUV). Transient

alone (18). The reported incidence of antenatal hydronephrosis is ranged from 0.6-4.5% in different studies (4, 11, 20, 21). In 20-40% are bilateral (20). Antenatal hydronephrosis is more common in boys than girls (2:1) (19). Five years cohort study (22) compare the incidence of renal abnormalities from 1999 to 2003 with those reported previously from 1989 to 1993. They concluded that there was increased incidence of renal abnormalities detected antenatal. The incidence was 7.6\1000 birth in recent cohort study versus 3\1000 live birth of previous one.

and physiological hydronephrosis is by far the most common form of antenatal hydronephrosis. It is accounted for 30-50% of cases (12). A study done at Tripoli Children's Hospital [36] which conducted 90 neonates (125 renal units) had presented with antenatal hydronephrosis from 1995 to 2007. Pelviureteric junction obstruction (PUJO) was found in 25.5% of cases, vesicoureteric reflux (VUR) was found in 14.4%, Posterior Urethral valve (PUV) was found in 17.7%, multicystic dysplastic kidney (MDK) was found in 20% of

cases, uretero-vesical junction obstruction (UVJO) was found in 6.6% and transient hydronephrosis found in 15.5% of cases.

**Management of antenatally detected hydronephrosis:** Management of infants with hydronephrosis detected antenatally is a challenge to pediatric nephrologists and urologists. The aim of post natal management of these infants is to identify those infants with severe congenital anomalies of kidneys and urinary tract while avoiding unnecessary testing in infants with transient dilation.

**Antenatal management:** Detailed family history is important to exclude any genetic predisposition. If other anomalies are present amniocentesis for karyotyping should be strongly considered (23). If RPD exceed 5mm in the second trimester, a repeat fetal US scan in the third trimester is required to assess its progression. If RPD exceed 7mm in the third trimester, a plan for postnatal management of newborn becomes mandatory (11). Antenatal intervention either by direct and repeated bladder drainage or placement of vesico-amniotic shunt of infant with antenatal detected hydronephrosis remain controversial and has failed to improve the natural course of congenital urinary tract obstruction. The main causes of failure of this type of management are renal dysplasia and pulmonary hypoplasia which are associated with urinary tract obstruction and are irreversible by the time the urinary dilation is first noticed by antenatal US. The main indication of invasive antenatal management is presence of markers of abnormal renal function. Which include presence of oligohydramnios and poor cortico-medullary differentiation in kidney with increased echogenicity (8). It is important to counsel the parent when fetal hydronephrosis is detected in sensitive way including

reassurance that the majority will turn out to be transient and benign. If fetal hydronephrosis persistent in the third trimester a multidisciplinary approach is needed which include neonatologist, pediatric nephrologists, pediatric urologist and geneticist as necessitated by the underlying condition.

**Post natal management:** Clinical examination will take place after birth to ensure that there are no other associated anomalies. If baby is well with no evidence of abdominal mass and passing urine with only unilateral lesion then discharge home should not be delayed. The role of prophylactic antibiotics is still controversial. Infants with minor postnatal dilation do not need prophylactic antibiotics, as the urinary tract infection is uncommon in infants with two normal postnatal US examinations (24). A prophylactic antibiotic is given for those neonates who had evidence of obstruction due to posterior urethral valve. Antibacterial prophylaxis is conventionally given to infants with VUR and for the first 6 months of life to infants demonstrating moderate to severe hydronephrosis (14).

Renal US should always be performed in neonates who had persistent hydronephrosis in the third trimester (17, 25). It should be done after 48 hrs after birth to ensure that the infant is well hydrated and urine flow is established. However, renal US can be done early when there is severe bilateral hydronephrosis or a palpable abdominal mass at birth. The optimal timing of US at around 7 to 10 days of life, applying the same standard grading system to antenatal scan (26). Most infants with postnatal hydronephrosis undergo voiding cystoureterogram (VCUG) to exclude VUR and bladder outlet obstruction. It should be performed, usually within 4 weeks in majority of cases (27). However, it must be done within

48 hours of birth in any infant suspected to have posterior urethral valve. Several studies have recently demonstrated that gross degree of VUR can be associated with minimal or no dilation on post natal US (28, 29). Some controversies still exist regarding the need of VCUG for cases of MCDK, PUJO and UVJO. The radionuclide imaging is usually delayed until 3 months after birth unless clinically indicated (palpable mass at birth or severe pelvic dilation). A technetium-99m dimarcaptosuccinic acid scan (DMSA) is performed to

confirm the non-function kidney and to define the differential function in infants with VUR and MCDK.  $^{99m}\text{Tc}$  mercaptoacetyltriethylglycine (MAG3) is radionuclide scan of choice because of its high initial renal uptake to demonstrate the differential function and excretion in infants with hydronephrosis and usually associated with diuretic injection. Alternatively,  $^{99m}\text{Tc}$  diethyl triamine pentaacetic acid (DTPA) may be used (11).

### Common specific etiology of antenatal hydronephrosis

- 1) **Transient hydronephrosis:** It is the commonest cause of antenatal hydronephrosis (12). The majority will resolve spontaneously either in third trimester or in early infancy (30). No need for prophylactic antibiotics and no further investigation apart from post natal US is needed.
- 2) **Uretero-pelvic junction obstruction (UPJO):** is the most common cause of non physiological obstruction. Its prevalence is approximately 1 in 2000 children with a male to female ratio in infancy of 3:1. 20-25% of cases had bilateral obstruction (12). Its management depends on the MAG3 renogram, if it is more than 40% a serial follow up by US is recommended while when the differential function is less than 40% with poor excretion surgical reconstruction is recommended (31).
- 3) **Posterior urethral valve:** It is one of most cause of antenatal hydronephrosis in male infants. It was accounted for 17.7% of cases presented with antenatal hydronephrosis in (36). A study done at Tripoli children's

hospital, 80 children with Chronic Kidney Disease (CKD) was conducted, from 2001 to 2010. Of the group 42(53%) of cases due to congenital nephropathy, PUV accounted for 52% of cases with late presentation to pediatric nephrologists (35). Antenatal intervention is required in severe cases with markers of impaired renal function and severe hydronephrosis by US, the bladder is generally decompressed using a percutaneously placed vesicoamniotic catheter or percutaneous endoscopic in utero ablation of the valve. These intrauterine procedures should be carried out in highly specialized centre. It carries many risks like fetal injury, intrauterine infection and premature labor. The risk of fetal mortality is 43% of cases (32). After diagnosis is established with postnatal VCUG, a small polyethylene tube is inserted. Foley catheter should not be used because the balloon may cause severe bladder spasm and may produce severe bladder obstruction. Early referral to pediatric urologist is recommended.



**Figure 1:** VCUG showing posterior urethral valve with bilateral VUR

4) **Multi cystic dysplastic kidney (MCDK):** It is usually unilateral. Bilateral MCDK is incompatible with life. It is easily recognized by cystic appearance on pre and postnatal US with no function at all on the DMSA

scan. Its management is usually conservative in (33) approach and they documented progressive involution with time 3% of cases disappear and 33% of cases reduced in size by 2 years of age (Figure 2).



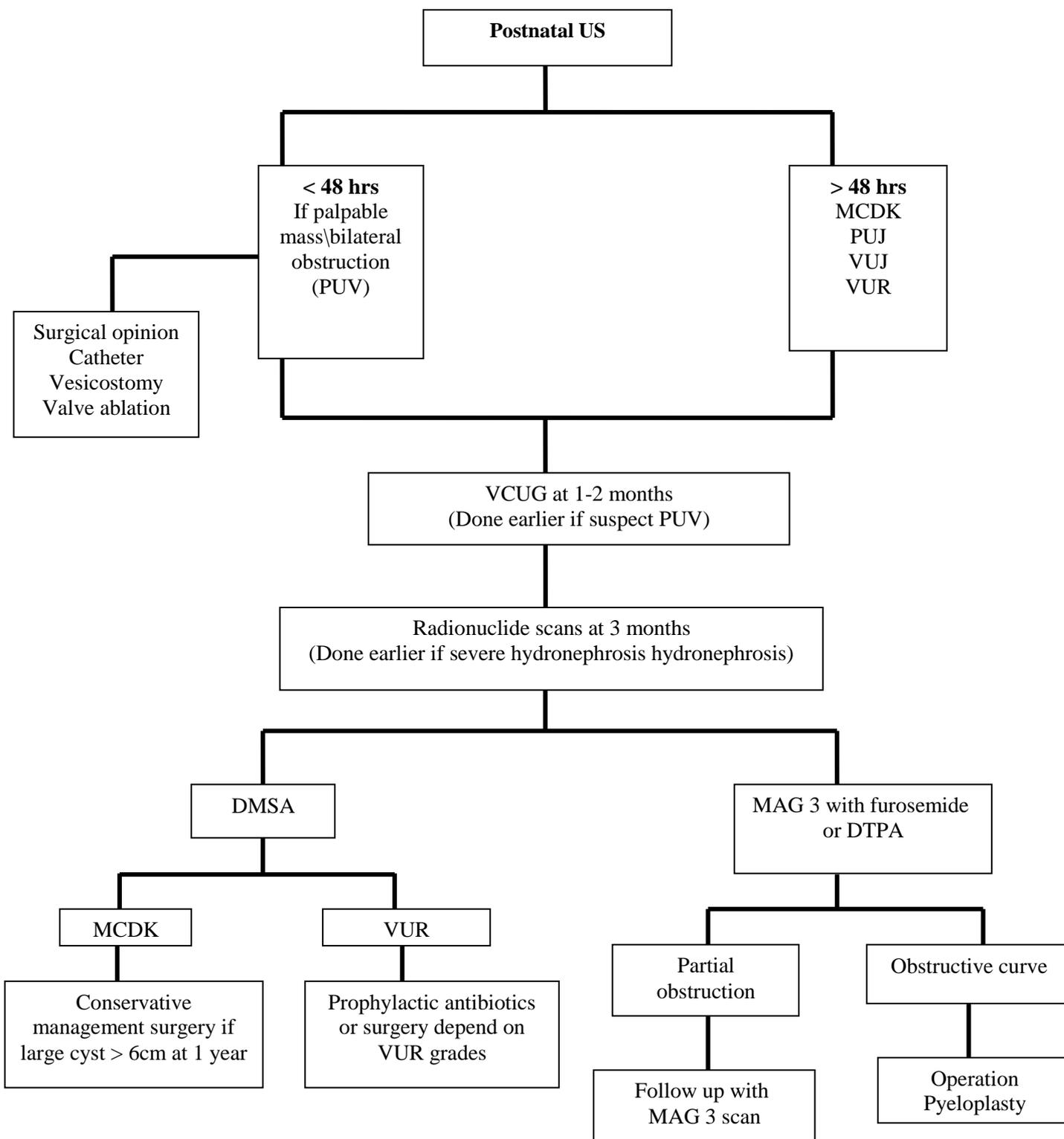
**Figure 2:** Multicystic dysplastic kidney (postmortem and US)

5) **Vesicoureteric reflux (VUR):** It constitutes between 10 to 38 % of cases of antenatal hydronephrosis (8). When diagnosis is made by postnatal VCUG then the infants require a DMSA scan to define differential renal function and presence of renal scarring. It predominates in males with high

resolution rate 65% within 2 years (34).

6) **Uretero-vesical junction obstruction (UVJO):** It is a rare condition and it is diagnosed when there is a dilated ureter as well as hydronephrosis without VUR on VCUG and it is confirmed by MAG3 renography.

Postnatal scheme of management of antenatal hydronephrosis as adopted from (33) is shown below:



*In conclusion,* antenatal detected hydronephrosis is commonly associated with significant morbidity in early life. It can lead to parental anxiety extending well beyond the current pregnancy. The indication for

choice to evaluate an infants with antenatal hydronephrosis should be based on evidence based protocols and guidelines. Multidisciplinary approach remains the best way to offer a good care for these children.

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