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Postnatal evaluation and outcome of infants with antenatally detected hydronephrosis

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Abstract

Introduction: *Fetal hydronephrosis is a common abnormality encountered on antenatal ultrasound. Though in majority of cases diagnosed with fetal hydronephrosis there is no underlying cause of such hydronephrosis and it is an isolated abnormality seen on routine ultrasound scan. In majority of these cases hydronephrosis resolves on its own without any intervention. However, in some instances there can be a significant underlying pathology leading to hydronephrosis and in these cases surgical intervention may be required to minimize renal damage. Therefore a strict follow up protocol is essential in infancy for all cases with antenatally detected hydronephrosis.*

Aims and Objectives

1. *To find out pathologies causing fetal hydronephrosis.*
2. *To analyse the outcome of infants who had been diagnosed with hydronephrosis on antenatal scans.*

Materials and Methods: *A prospective cohort study conducted in the department of obstetrics and gynaecology in collaboration with department of paediatrics, NMC Royal Hospital Abu Dhabi. 80 infants with antenatally detected hydronephrosis were included in this study on the basis of a predefined inclusion and exclusion criteria. Duration of study was 2 years. All infants with antenatally detected hydronephrosis. Infants were followed up by abdominal ultrasound every month till resolution of hydronephrosis. In selected cases Micturating cystourethrography was done. Pathologies associated with hydronephrosis and outcome was analysed. For statistical purposes p value less than 0.05 was taken as statistically significant.*

Results: *Infants of 80 women who had been diagnosed with fetal hydronephrosis in second and third trimester were included in this study. The mean gestational age at the diagnosis was found to be 26.34 +/- 8.24 weeks.55 (68.75%) infants had transitional hydronephrosis. Out of remaining 25 (31.25 %) infants 12 (15.00%) infants were found to have PUJ obstruction whereas VUR was seen in 8 (10.00%) patients. In 3 (3.75 %) patients' posterior urethral was found to be the cause of hydronephrosis. In 25 (31.25%) hydronephrosis completely resolved by 1st follow up scan whereas in 55 (68.75%) infants hydronephrosis completely resolved by last follow up visit. 8 (10%) infants were medically treated by close follow up and prophylactic antibiotics whereas 17(21.25%) infants underwent surgical management in view of significant and progressive hydronephrosis.*

Keywords: *Fetal Hydronephrosis, Vesicouereteric reflux, posterior urethral valve, outcome.*

Introduction

With increasing resolution of ultrasound machines there has been a significant increase in diagnosis of fetal anomalies. Diagnosis of genitourinary abnormalities is one of the important aspects of fetal imaging. The common fetal genitourinary abnormalities include bladder outlet obstruction, polycystic kidney disease, multicystic dysplastic kidneys, ectopic kidneys, renal agenesis and hydronephrosis.[1] While some of these anomalies, such as bilateral renal agenesis, may cause significant fetal morbidity and even mortality others, such as fetal hydronephrosis, are benign in nature and usually resolve during infancy. Antenatal ultrasound is the most important investigation in diagnosis of these abnormalities in-utero. It is all the more important because in neonatal period the infant is less likely to undergo imaging because of non-specific symptoms arising out of these abnormalities. In many conditions, such as in significant vesicouereteric reflux, delayed diagnosis may cause irreversible renal damage resulting into abnormal renal function or even end stage renal disease.[2]

The cut-off values for the diagnosis of fetal hydronephrosis include an AP diameter of renal pelvis above 4 mm and 7 mm in second and third trimester respectively. In majority of cases diagnosed with fetal hydronephrosis there is no underlying cause and hydronephrosis is an isolated abnormality seen on routine ultrasound scan. These cases are called idiopathic hydronephrosis. Infants with idiopathic hydronephrosis are reported to be having an excellent outcome as in majority of these cases hydronephrosis resolve on its own without any treatment or intervention. It is important to differentiate cases having hydronephrosis secondary to some significant etiology from idiopathic hydronephrosis as the management strategy significantly differ in these 2 types of cases.[3] While in idiopathic hydronephrosis generally nothing more than regular follow up scans is all that is required, in cases in whom there is a significant underlying pathology leading to hydronephrosis surgical intervention may be urgently required to minimize renal damage. In second instance delay in diagnosis may have catastrophic consequences such as renal failure.[4]

The underlying causes which may cause fetal hydronephrosis may include pelviureteric junction obstruction, Vesico-ureteric reflux, posterior urethral valves, duplex ureter and vesicouereteric junction obstruction, Urethral atresia, urogenital sinus, Prune belly and Down's syndrome.[5] While mild hydronephrosis is likely to be an isolated abnormality seen incidentally on routine obstetric ultrasound examination moderate to severe hydronephrosis is more likely to be associated with other problems such as oligohydramnios.[6]

Follow up of cases with fetal hydronephrosis is an essential part of management. A multi-speciality approach comprising of gynaecologist, paediatrician and urologist is needed in managing these infants. Infants with antenatally detected hydronephrosis can be safely discharged if there are no symptoms and if the baby is breastfeeding well with a strict advice for regular follow up.[7] A postnatal ultrasound is recommended within 4 weeks of birth followed by monthly ultrasound scan till hydronephrosis is completely resolved. In cases where AP diameter of renal pelvis is more than 10 mm or if there is progressive increase in AP diameter of renal pelvis further imaging such as micturating cystography or radionucleotide scanning is indicated.[8] Along with imaging prophylactic antibiotics or surgical intervention may also be indicated depending upon the etiology as well as severity of hydronephrosis. Many studies have reported that in absence of any significant etiology hydronephrosis is likely to be resolved in infancy without requiring any intervention[9].

We conducted this prospective study to analyse the outcome of infants who had been diagnosed with hydronephrosis on antenatal scans.

Materials and Methods

This was a prospective observational study conducted in the department of obstetrics and

gynaecology in collaboration with department of paediatrics, NMC Royal Hospital Abu Dhabi. 80 infants with antenatally detected hydronephrosis were included in this study on the basis of a predefined inclusion and exclusion criteria. Written informed consent was obtained from the parents of the infants. Infants were followed up for 1 year to see progression or resolution of hydronephrosis. The cut-off values for diagnosis of antenatal hydronephrosis was renal pelvis diameter more than 4 mm before 33 weeks and more than 7 mm after 33 weeks of gestation. Hydronephrosis was divided into mild, moderate or severe on the basis of consensus statement by society for fetal urology guidelines[10].

Table 1: Severity of hydronephrosis in studied cases.

Severity	< 33 weeks of gestation	> 33 weeks of gestation
Mild	4-6 mm	7-9 mm
Moderate	7-10 mm	10-15 mm
Severe	> 10 mm	> 15 mm

After delivery a senior paediatrician examined all the infants. Infants were discharged with a strict follow up protocol the necessity of which was explained to parents. All infants were followed up with serial ultrasound examination. 1st ultrasound examination was done within 2 weeks of postnatal life. Infants with mild to moderate hydronephrosis were advised monthly follow up ultrasound scans till there was resolution of hydronephrosis. In cases of severe hydronephrosis further evaluation was done by MCU. During each follow up visit the weight and length was recorded. Developmental milestones were assessed and routine blood investigations (HB, CBC, CRP and KFT) were done. Routine urine examination and culture sensitivity was done.

Vesicouereteric reflux seen on MCU was classified as grade I (reflux into ureter with no dilatation,), grade II (Reflux involving the ureter, pelvis and calyces with no dilatation and normal calyceal fornices.), grade III (Reflux causing moderate dilatation and/or tortuosity of the ureter, moderate dilatation of the pelvis and no or slight blunting of the fornices), grade IV (Reflux causing moderate dilation and/or tortuosity of the ureter, moderate dilatation of the renal pelvis, blunting of the sharp angles of the fornices and maintenance of papillary impressions in most of the calyces.) and grade 5 (Reflux causing gross dilatation and tortuosity of the ureter, pelvis and calyces. The papillary impressions are no longer visible in the majority of the calyces) depending upon the severity of reflux.

Paediatric surgery and urology consultation was done in all cases having severe hydronephrosis. Prophylactic antibiotics were started in patients having Grade III or above hydronephrosis. If hydronephrosis was secondary to pathologies such as posterior urethral valve or if there is significant and rapid worsening of renal function an early surgery was planned.

Sample size was calculated in accordance with previous reference studies which comprised of follow up of antenatally detected hydronephrosisby Open Epi-Version 3 online software, a 10% difference could be determined at 80% power and 5% significance (α=0.05, β=0.80). Minimum sample size calculated was found to be 55 patients therefore we enrolled 80 cases. For statistical purposes, SSPS 21.0 software was used. Microsoft Excel was used for preparation of charts and graphs. P value less than 0.05 was taken as statistically significant.

Inclusion Criteria

1. Infants with antenatally diagnosed Hydronephrosis.
2. Parents gave consent to be part of study.

Exclusion Criteria

1. Parents refused consent.
2. Infants in whom there were multiple anomalies in addition to hydronephrosis.
3. Polycystic kidney disease.
4. Patients lost to follow up.

Results

Infants of 80 women who had been diagnosed with fetal hydronephrosisin second and third trimester were included in this study. The most common gestational age group when diagnosis of antenatal hydronephrosis was made was between 21-28 weeks (55%) followed by 29-33 weeks (25%) and 12-20 weeks (15%). Only 4 (5%) patients were above 33 weeks of gestational age. The mean gestational age at the diagnosis was found to be 26.34 +/- 8.24 weeks.

Table 2: Gestational age at which fetal hydronephrosis was detected

Gestational Age	No of patients	Percentage
12-20 weeks	12	15.00%
21-28 weeks	44	55.00%
29-33 weeks	20	25.00%
Above 33 weeks	4	5.00%
Mean Gestational Age= 26.34 +/- 8.24 weeks		

The analysis of findings of antenatal ultrasound showed that the most common abnormality was unilateral hydronephrosis (51.25%) followed by bilateral hydronephrosis (27.50%) and unilateral hydronephrosis with hydroureter (13.75 %). In 6 (7.50%) cases there was bilateral hydronephrosis and hydroureter.

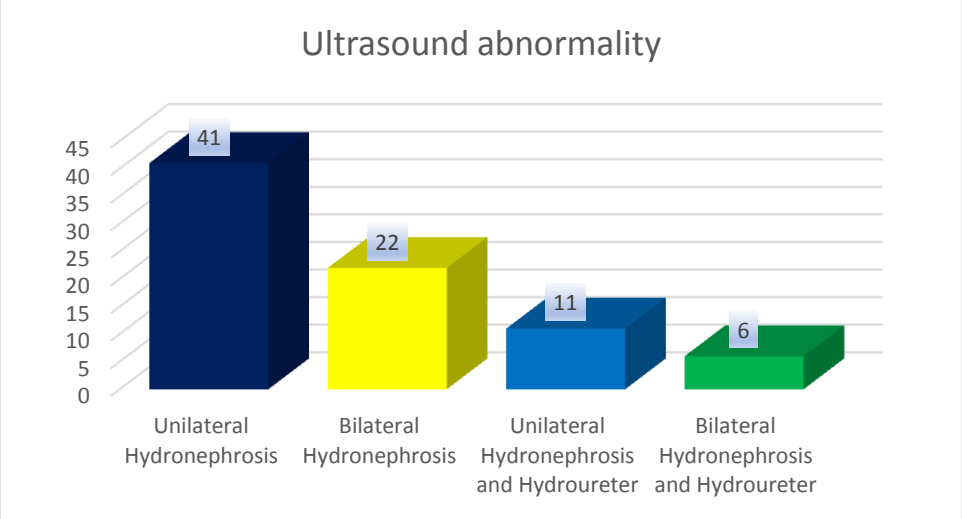

Figure 1: Ultrasound abnormalities on antenatal ultrasound.

Analysis of hydronephrosis on the basis of antenatal ultrasound (as per society of fetal urology criteria) showed that out of 80 patients 54 (67.50%) patients had mild hydronephrosis where as moderate and severe hydronephrosis was seen in 17 (21.25%) and 9 (11.25%) patients respectively.

Table 3: Severity of hydronephrosis on antenatal ultrasound

Severity	**No of patients**	**Percentage**
Mild Hydronephrosis	54	67.50%
Moderate Hydronephrosis	17	21.25%
Severe Hydronephrosis	09	11.25%
Total	80	100.00%

All these 80 cases with antenatally diagnosed hydronephrosis cases were followed up in postnatal period. Out of these 80 infants there were 67 (83.75%) males and 13 (16.25%) females with a M:F ratio of 1: 0.19.

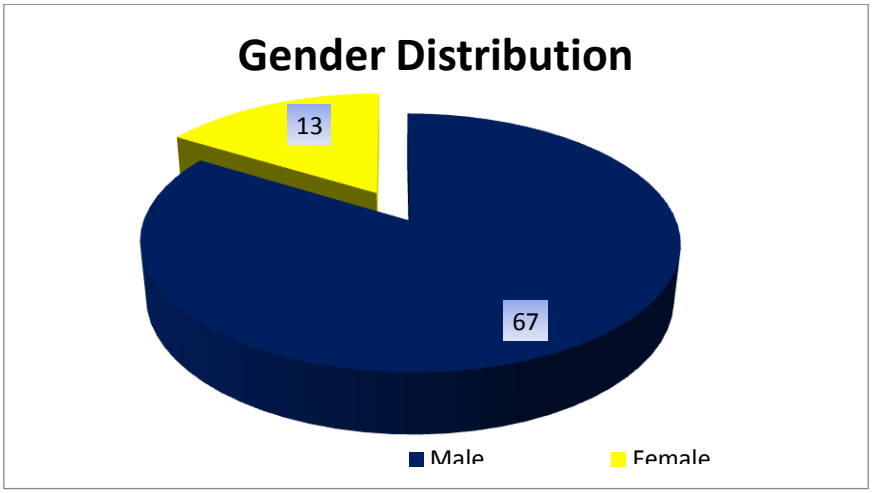

Figure 2: Gender Distribution in studied cases

First postnatal ultrasound was done within 2 weeks of delivery. Comparison of ultrasound findings in antenatal and first postnatal ultrasound showed that 25 (31.25%) infants didn't show any hydronephrosis in first post-natal ultrasound. Severe hydronephrosis was seen in 9 (11.25%) on antenatal ultrasound whereas only 5 (6.25%) infants were found to have severe hydronephrosis on first postnatal ultrasound. There was significant reduction in no of cases with hydronephrosis from antenatal period to first postnatal ultrasound (P<0.0001).

Table 4: Comparison of severity of hydronephrosis on antenatal and first postnatal ultrasound

	Antenatal Ultrasound		First Post Natal Ultrasound	
Gestational Age	**No of patients**	**Percentage**	**No of patients**	**Percentage**
No Hydronephrosis	0	0.00 %	25	31.25%
Mild Hydronephrosis	54	67.50%	42	52.50%
Moderate Hydronephrosis	17	21.25%	8	10.00%
Severe Hydronephrosis	09	11.25%	5	6.25%
Total	80	100.00%	80	100.00%
P < 0.0001 (Significant)				

Micturating cystourethrography was done in 13 (16.25%) infants who were found to have moderate to severe hydronephrosis on first postnatal ultrasound. Vesico-Ureteric reflux was found in 8 (10%) infants. Posterior urethral valves were seen in 3 (3.75%). Out of these 8 (10%) infants with Vesico-Ureteric reflux 6 (7.50%) infants were found to have unilateral VUR whereas remaining 2 (2.5%) infants were found to have bilateral VUR.

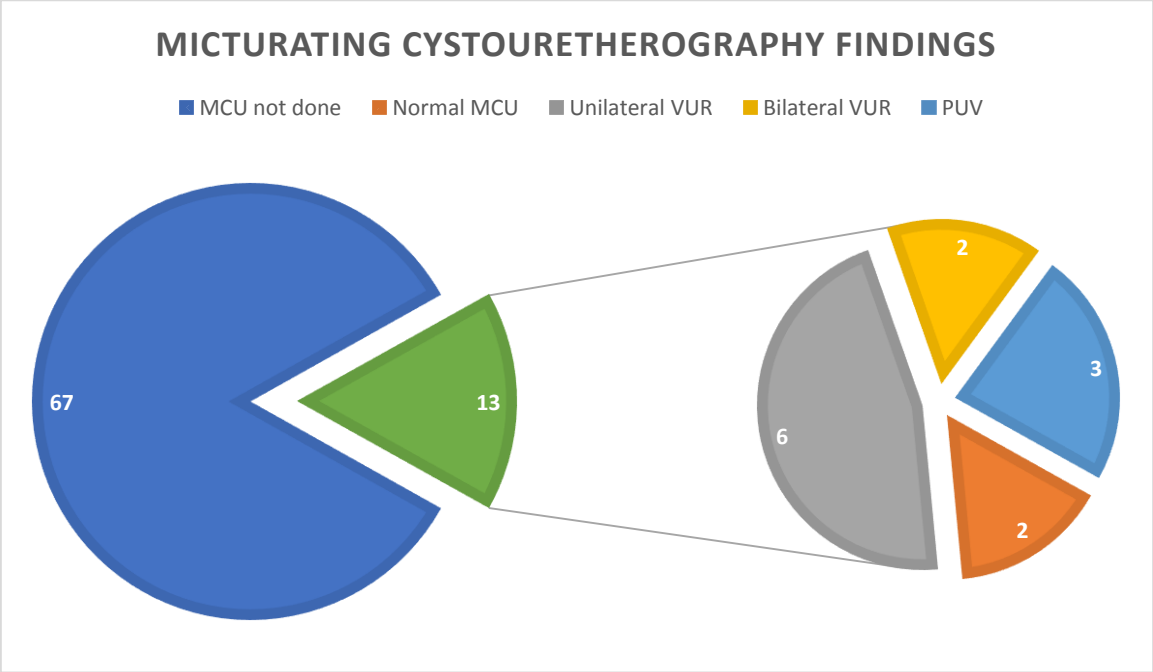

Figure 3: Micturating cystourethrography findings in studied infants

The analysis of infants who were found to have VUR were assessed for severity of VUR using international reflux study committee grades showed that out of 8 (10%) infants with VUR, Grade I VUR was seen in 2 (2.5%) infants whereas Grade II VUR was seen in 4 (5%) infants. Grade III and Grade IV VUR was seen in 1 (1.75%) infant each. No infant was seen to be having Grade V VUR.

Table 5: Severity of Vesicouereteric reflux on Micturating cystourethrography

Severity Of VUR	No of patients	Percentage
Grade I	2	25.00%
Grade II	4	50.00%
Grade III	1	12.50%
Grade IV	1	12.50%
Grade V	0	0.00%
Total	8	100.00%

The analysis of cases on the basis of etiology showed that out of 80 infants who have been included in this study 55 (68.75%) infants had transitional hydronephrosis. Out of remaining 25 (31.25 %) patients 12 (15.00%) infants were found to have PUJ obstruction whereas VUR reflux was seen in8 (10.00%) patients. In 3 (3.75 %) patients' posterior urethral was found to be the cause of hydronephrosis. In 2 infants no abnormality was detected on MCU.

Table 6: Etiology of hydronephrosis in studied cases

Gestational Age	No of patients	Percentage
Transitional Hydronephrosis	55	68.75%
PUJ Obstruction	12	15.00%
Vesico ureteric Reflux	8	10.00%
Posterior Urethral Valve	3	3.75%
Etiology not certain	2	2.50%
Total	80	100.00%

The final analysis of outcome of infants on antenatally detected hydronephrosis showed that hydronephrosis was seen to have completely resolved by 1st follow up scan in 25 (31.25%) infants. In 55 (68.75%) infants hydronephrosis completely resolved by last follow up visit. 8 infants were medically treated by close follow up and prophylactic antibiotics whereas 17 (21.25%) infants underwent surgical management in view of significant and progressive hydronephrosis.

Table 7: Outcome of infants with antenatally diagnosed hydronephrosis

Outcome	No of cases	Percentage
Completely Resolved on 1st postnatal Ultrasound	25	31.25%
Completely resolved by last follow up visit without any intervention	55	68.75%
Not Resolved till last follow up visit and medically treated	8	10.00 %
Surgical Intervention required	17	21.25%

Discussion

Prominent lateral ventricles, intracardiac echogenic focus and hydronephrosis are some of the common abnormalities seen on antenatal ultrasound. While in many cases these abnormalities resolve on their own its important on the part of an obstetrician to have a close follow up of these cases since in a small number of cases these abnormalities may progress and may demand therapeutic interventions. Fetal hydronephrosis is usually diagnosed on antenatal ultrasound and in majority of the cases it resolves completely without any intervention.[12] However, in small number of cases in whom hydronephrosis is secondary to pathologies such as Vesico ureteric reflux (VUR), posterior urethral valve (PUV) and pelviureteric junction obstruction (PUJ) there is progression of hydronephrosis and if appropriate intervention is not done then it may lead to significant renal scarring and eventually renal failure may ensue[13].

In our study out of 80 cases the most common gestational age group when diagnosis of antenatal hydronephrosis was made was between 21-28 weeks (55%) followed by 29-33 weeks (25%) and 12-20 weeks (15%). Only 4 (5%) patients were above 33 weeks of gestational age. The mean gestational age at the diagnosis was found to be 26.34 +/- 8.24 weeks. Cherian AG et al undertook a retrospective study to analyse 148 antenatally detected cases of fetal hydronephrosis.[14] The author reported the mean age of diagnosis for antenatal hydronephrosis to be 25.48 weeks of gestation. These findings were similar to our study. Follow-up ultrasounds during the prenatal period, 65% showed progression of the renal pelvis dilatation, 25.8% showed stable disease and 9.1% showed resolution on their subsequent scan. Similar findings were also reported by the authors such as Sidhu G et al[15] and Signorelli M etal[16].

Assessment of severity of hydronephrosis (as per society of fetal urology criteria) showed that out of 80 cases 54 (67.50%)infants had mild hydronephrosis where as moderate and severe hydronephrosis was seen in 17 (21.25%) and 9 (11.25%) patients respectively. Sairam S et al conducted a prospective study of 11465 pregnant who have undergone antenatal scans.[17] Fetal hydronephrosis was identified in 2.3% (268/11 465) of women. Mild hydronephrosis was present in 80.6% (216/268) and moderate/severe hydronephrosis in 19.4% (52/268). The hydronephrosis resolved in the antenatal or early neonatal period in 88% of foetuses. The resolution rate in our study was similar to this study. Similar findings were also reported by the authors such as Gökaslan F et al[18].

Amongst the studied cases 55 (68.75%) infants had transitional hydronephrosis. Out of remaining 25 (31.25 %) patients 12 (15.00%) infants were found to have PUJ obstruction whereas VUR reflux was seen in 8 (10.00%) patients. In 3 (3.75%) patients' posterior urethral was found to be the cause of hydronephrosis. In 2 (2.5 %) infants no abnormality was detected on MCU. Overall PUJ obstruction and VUR were the

common causes of hydronephrosis in our study after transitional hydronephrosis.Asl AS et al conducted a study to determine the cause and outcome of prenatal hydronephrosis.[19] The authors found that hydronephrosis was caused by ureteropelvic junction obstruction (UPJO) in 20 (44.5%), VUR in 10 (22.2%), ureterovesical junction obstruction in four (8.9 %), posterior urethral valves in four (8.9 %), UPJO with VUR in two (4.4%) and non-VUR non-obstructive in one (2.2%). Similar to our study this study also found PUJ obstruction to be the most common pathological cause of hydronephrosis in infants. Similar etiological profile of fetal hydronephrosis was also reported by the authors such as Lee RS et al[20.]

Limitation of the Study

Relatively small number of cases was the limitation of our study. Similar study on a larger cohort will further substantiate the finding of this study.

Conclusion

Fetal hydronephrosis is one of the common findings obstetricians come across. While majority of these cases are usually transitional in whom the hydronephrosis resolve without any intervention, in a small number of cases the hydronephrosis may be a consequence of significant pathology. A close postnatal follow up is essential to diagnose pathological cause of hydronephrosis which may need medical management or surgical intervention or both.

Conflict of Interest: None

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