

OUTCOME OF ANTENATAL HYDRONEPHROSIS: A PROSPECTIVE COHORT STUDY.

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Abstract

Fetal hydronephrosis is one of the common anomalies seen during antenatal scans. In many of the cases this antenatally detected hydronephrosis is self-limiting and most of the times it resolves on its own without any intervention whatsoever. However in a small number of cases this obstruction may be significant and may even lead to serious complications including cystic renal dysplasia and renal failure. In some cases hydronephrosis is associated with pathologies such as Vesico-Ureteric reflux or posterior urethral wall and it is important to follow up these infants in postnatal life and intervention should be done if there is worsening of hydronephrosis.

Materials and Methods: This was a prospective cohort study in which 60 infants with antenatally detected hydronephrosis (Renal pelvic diameter more than 4mm before 33 weeks of gestation and more than 7 mm after 33 weeks) were included on the basis of a predefined inclusion and exclusion criteria. Post natal ultrasound of these infants was within 1st week of postnatal life and every monthly till hydronephrosis was resolved. At every follow up visits investigations such as complete blood count, C reactive protein levels, serum electrolytes, urine routine microscopy and culture was done. Micturating cystourethrography was done in selected cases. Prophylactic antibiotics were started in infants with VUR grade III and above. Final outcome was studied in these cases.

Results: Out of these 60 infants there were 49 (81.67%) males and 11 (18.33%) females with a M:F ratio of 1: 0.22. Vesico-Ureteric reflux was found in 12 (20%) infants. Out of these 12 infants with Vesico-Ureteric reflux 9 infants were found to have unilateral VUR whereas remaining 3 infants were found to have bilateral VUR. 21 (35.00%) and 16 (26.67%) infants with antenatally detected hydronephrosis completely resolved by 1st and last follow up visit respectively. In 8 (13.33%) patients hydronephrosis didn't resolve but reduced in severity and hence these infants were managed medically while in remaining 15 (25.00%) infants there was worsening of severity of hydronephrosis and surgical intervention was required in these cases.

Conclusion: A strict follow up protocol in post natal life is important, in cases of antenatally detected hydronephrosis, to detect worsening of hydronephrosis and to identify cases that will require surgical intervention.

Keywords: Antenatal Hydronephrosis, Ultrasound, Vesico-ureteric reflux, Outcome.

Introduction

Genitourinary abnormalities are approximately 25-30% of antenatally detected anomalies. There antenatal diagnosis is important because in postnatal life infants are less likely to undergo imaging because of non-specific symptomatology of these abnormalities and may result in delayed diagnosis. This delay in diagnosis can have catastrophic consequences in pediatric age group such as pyelonephritis, hypertension and even renal failure.¹ In recent past there is improved resolution of ultrasound machines and there is significant improvement in antenatal care leading to identification of genitourinary abnormalities at an earlier stage.²

One of the most common urogenital abnormalities which are detected during antenatal ultrasound include fetal hydronephrosis which is usually defined as Renal pelvic diameter more than 4 mm in second trimester and more than 7 mm in third trimester.¹ In many of the cases this antenatally detected hydronephrosis is self-limiting and most of the times it resolves on its own without any intervention whatsoever. In vast majority of the cases antenatally detected dilated renal pelvis do not have any distinct identifiable etiology and in these cases it's called isolated antenatal hydronephrosis.³ In these cases this dilatation represent physiological dilatation of developing ureter rather than any pathological process. With further development of urogenital system this physiological

dilatation gets resolved on its own without any intervention. However in a small number of cases this obstruction may be significant and may even lead to serious complications including cystic renal dysplasia and renal failure. It is important to identify these 2 set of cases one in which there is physiological dilatation and won't require any intervention except for follow up and another one in which there is significant pathological obstruction and if intervention is delayed these cases may land up into catastrophic complications including end stage renal disease.⁴

The various abnormalities associated with antenatally detected hydronephrosis include pelvi-ureteric junction obstruction, Vesico-Ureteric reflux, Vesico-Ureteric reflux junction obstruction, multicystic dysplastic kidney, duplex ureter and posterior urethral valves. Other less common pathologies associated with antenatal hydronephrosis include urethral atresia, urogenital sinus and prune belly syndrome. Mild Hydronephrosis is also commonly reported in fetuses having Downs syndrome.⁵ Generally severe hydronephrosis is associated with additional features on antenatal ultrasound such as oligohydramnios non-visualisation of bladder or characteristic key hole appearance of bladder and urethra in cases of posterior urethral valves. IN these cases there are

chances of significant obstruction leading to consequences such as development of lung hypoplasia.⁶

It is important to have a systematic follow up neonates who were found to have dilated renal pelvis on antenatal scans. Usually if asymptomatic these neonates can be discharged with a strict follow up protocol. These neonates are followed up with postnatal ultrasound on regular intervals.⁷ An initial postnatal ultrasound is recommended before 4 weeks and after that every month till hydronephrosis is resolved. In severe hydronephrosis (AP>10mm) further imaging may be required. In selected neonates antibiotics prophylaxis may be given to prevent urinary tract infection.⁸

We conducted this prospective observational study to find out the outcome in pediatric patients with antenatally detected hydronephrosis.

Materials and Methods:

This was a prospective cohort study conducted in the Department of Pediatrics of Vedantaa institute of medical sciences in which 60 infants with antenatally detected hydronephrosis (Renal pelvic diameter more than 4mm before 33 weeks of gestation and more than 7 mm after 33 weeks) were included on the basis of a predefined inclusion and exclusion criteria. All these patients were followed up for a period of 1 year. Post natal ultrasound of these infants was within 1st week of postnatal life and every monthly till hydronephrosis was resolved. Hydronephrosis was divided into Grade, Grade II and Grade III on the basis of society for fetal urology guidelines.⁹

Table 1: Grading of Hydronephrosis.

Renal Pelvic (AP) Diameter	Grade Of Hydronephrosis
Less than 7 mm	No Hydronephrosis
7-10 mm	Mild Hydronephrosis
>10mm	Moderate to severe Hydronephrosis

In selected cases further investigations such as micturating cystourethrography was done. Vesico-Ureteric reflux was divided into 5 grades on the basis of classification proposed by international reflux study committee¹⁰.

Table 2: Grading of Vesico-ureteric Reflux.

Renal Pelvic (AP) Diameter	
Grade I	Reflux involving only the ureter
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 pelvis, blunting of the sharp angles of the fornices and maintenance of papillary impressions in most of the calyces.
Grade V	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.

At every follow up visits investigations such as complete blood count, C reactive protein levels, serum electrolytes, urine routine microscopy and culture was done. Prophylactic antibiotics were started in infants with VUR

grade III and above. Pediatric urology consultation was sought in all the cases. In infants with proven urinary tract infection on the basis of urine culture appropriate antibiotics were started on the basis of antibiotic sensitivity pattern. In infants diagnosed to be having posterior urethral valve, worsening renal functions and having severe bilateral hydronephrosis early surgical intervention was planned and infants were referred to pediatric urology department.

For statistical purposes SSPS 21.0 software was used and p value less than 0.05 was taken as statistically significant.

Inclusion Criteria:-

1. All infants having history of antenatally detected hydronephrosis.
2. Informed Written consent obtained from parents/guardian.

Exclusion Criteria:-

1. Parents/Guardian refused consent.
2. Duplex or horseshow kidney.
3. Multicystic dysplastic or polycystic kidneys.
4. Infants with history of surgical intervention.
5. Infants found to have severe hydronephrosis requiring urgent surgical intervention.
6. Patients lost to follow up.

Results:

60 infants with antenatally detected hydronephrosis were included in this study on the basis of a predefined inclusion and exclusion criteria. Out of these 60 infants there were 49 (81.67%) males and 11 (18.33%) females with a M:F ratio of 1: 0.22.

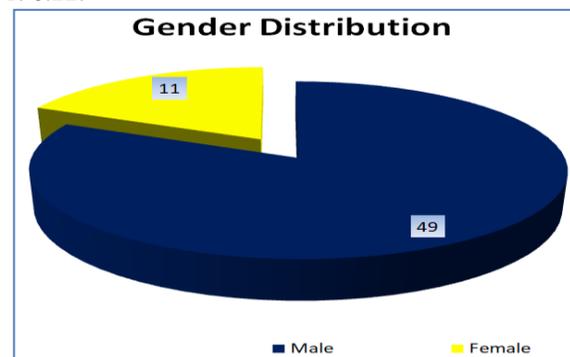


Figure 1: Gender Distribution of the studied cases.

Out of 60 studied cases antenatal USG showed bilateral hydronephrosis in 25 (41.67%) cases whereas in remaining 35 (58.33%) patients unilateral hydronephrosis was present. However on first post-natal ultrasound bilateral hydronephrosis was found only in 13 (21.67%) patients and in remaining 47 (78.33%) patients only unilateral hydronephrosis was seen on ultrasound. The difference was found to be statistically not significant (P=0.52)

Table 3: Unilateral Vs Bilateral Hydronephrosis.

	Unilateral Hydronephrosis	Bilateral Hydronephrosis
Antenatal Ultrasound	35 (58.33%)	25 (41.67%)
First Postnatal Ultrasound	26 (78.33%)	13 (21.67%)
P Value = 0.52 (Not-Significant)		

The analysis of cases of antenatal and postnatal ultrasound showed that mild hydronephrosis was seen in 41 (68.33%) and moderate to severe hydronephrosis was seen in 19 (31.67%) patients. On first postnatal ultrasound there was no hydronephrosis in 21 (35.00%) cases, mild to moderate hydronephrosis was seen in 24 (40.00%) cases and severe hydronephrosis was seen in remaining 15 (25.00%) cases.

Table 4: Comparison of Antenatal and first post natal ultrasound.

	Antenatal Ultrasound	First Post Natal Ultrasound
No Hydronephrosis	0 (0.00%)	21 (35.00%)
Mild Hydronephrosis	41 (68.33%)	24 (40.00%)
Moderate to severe Hydronephrosis	19 (31.67%)	15 (25.00%)
Total	60 (100%)	60 (100%)

Micturating cystourethrography was done in 15 infants who were found to have moderate to severe hydronephrosis on postnatal scan. Vesico-Ureteric reflux was found in 12 infants. Out of these 12 infants with Vesico-Ureteric reflux 9 infants were found to have unilateral VUR whereas remaining 3 infants were found to have bilateral VUR.

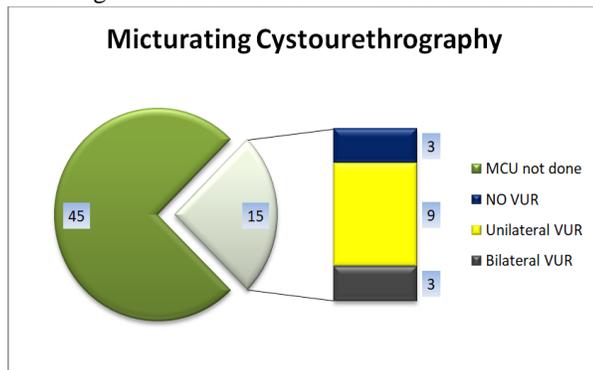


Figure 2: Micturating cystourethrography findings in studied cases.

In 9 patients who had Vesico-ureteric reflux the severity of VUR was analyzed as per SFU grading system. Out of 9 infants with VUR 3 infants were found to have grade I VUR whereas Grade II, Grade III and Grade IV VUR was found in 5, 1 and 3 infants respectively. There was no infant with grade V VUR in studied cases.

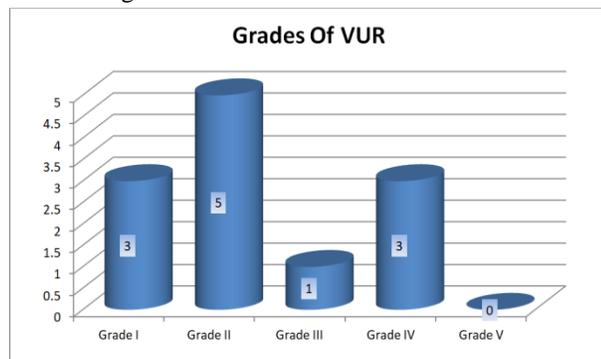


Figure 3: Grades of VUR on MCU.

The analysis of cases on the basis of etiological cause showed that out of 60 infants who have been included in

our study 32 (53.33%) infants had transitional hydronephrosis. Out of remaining 28 (46.67%) patients 12 (20.00%) infants were found to have Vesico-ureteric reflux whereas PUJ obstruction was found in 13 (21.67%) patients. In remaining 3 (5.00%) patients' posterior urethral was found to be the cause of hydronephrosis.

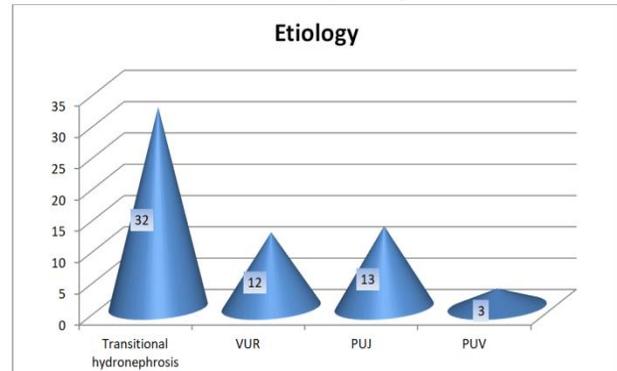


Figure 4: Etiological Classification of hydronephrosis.

Urinary tract infection was observed in 16 patients during post natal follow up. All these patients were given appropriate antibiotics on the basis of culture and sensitivity reports. The analysis of final outcome of the patients showed that out of total 60 antenatally detected hydronephrosis

Table 5: Outcome of cases with Antenatal Hydronephrosis.

Outcome	No of cases	Percentage
Completely Resolved on 1 st postnatal Ultrasound	21	35.00%
Completely resolved by last follow up visit	16	26.67%
Not Resolved till last follow up visit and medically treated	8	13.33%
Surgical Intervention required	15	25.00%
Total	60	100%

Discussion:

Fetal hydronephrosis is one of the common urogenital anomalies encountered during antenatal scans. Though in many cases this finding is temporary and resolves on its own with time it's important for pediatricians to follow up these cases regularly so that appropriate interventions can be done in selected cases in which there are chances of worsening of renal function leading to consequences such as chronic renal failure.

In our study out of the total 60 neonates who were included on the basis of a predefined inclusion and exclusion criteria there were 49 (81.67%) males and 11 (18.33%) females with a M:F ratio of 1: 0.22. Safdar O et al conducted a retrospective analysis of data collected from the medical records of 64 Antenatal hydronephrosis patients . The authors found that out of these 64 patients there were 45 males (70.30%) and 19 (29.70%) females with a M:F ratio of 1:0.42.¹¹ Similar male preponderance in cases of antenatally detected hydronephrosis was also reported by

the authors such as Orabi MM et al¹² and Sadeghi-Bojd S et al¹³.

Though alarming for parents antenatally detected hydronephrosis is usually transitory and gets resolved on its own in majority of the cases. In our study out of 60 antenatally detected hydronephrosis cases hydronephrosis persisted in postnatal life in only 39 (65%) neonates and in remaining 21 (35%) neonates hydronephrosis resolved before 1st postnatal ultrasound scan. Midhat Elmaci A et al conducted a Retrospective chart review of patients who were admitted to their pediatric nephrology clinic for the evaluation of antenatal hydronephrosis.¹⁴ The authors found that during a median follow up time of 16 months hydronephrosis completely resolved in 198 patients (71.7%). Surgery was not required in any of the patients; however, nine patients (3.3%) showed progression to higher grades of hydronephrosis or increase in AP diameter. Median time to complete resolution of hydronephrosis was 6 months (range 2–35 months) in our study. Similarly resolution rates are also reported by the authors such as Tombesi MM et al¹⁵ and Chou CY et al¹⁶.

In our study the analysis of etiology of hydronephrosis showed that 32 (53.33%) infants had transitional hydronephrosis. Out of remaining 28 (46.67%) patients 12 (20.00%) infants were found to have Vesico-ureteric reflux whereas PUJ obstruction was found in 13 (21.67%) patients. In remaining 3 (5.00%) patients posterior urethral was found to be the cause of hydronephrosis. Seçil Conkar conducted a study to report the outcome of infants with antenatal hydronephrosis.¹⁷ A total of 49 patients were included in the analysis; 32 were allocated to the group of non- significant findings (65.3%) and 17 to the group of significant uropathy (34.6%). It was detected that 8 (16.3%) of the group of significant uropathy had ureteropelvic junction obstruction (UPJO), 3 (6.1%) had vesicoureteral reflux (VUR), and 3 (6.1%) had posterior urethral valves (PUV). Similar etiology was also reported by Coplen DE et al¹⁸ Cheng AM and et al¹⁹.

Finally in our study the analysis of outcome of infants with antenatally detected hydronephrosis showed that in 21 (35.00%) and 16 (26.67%) infants with antenatally detected hydronephrosis completely resolved by 1st and last follow up visit respectively. In 8 (13.33%) patients hydronephrosis didn't resolve but reduced in severity and hence these infants were managed medically while in remaining 15 (25.00%) infants there was worsening of severity of hydronephrosis and surgical intervention was required in these cases. Similar findings were also reported by Pan P et al who reported that out of 57 antenatally detected hydronephrosis cases surgical intervention was required in 16 (28.07%) cases.²⁰

Conclusion:

Fetal Hydronephrosis is one of the common antenatally detected urogenital anomaly. Though in majority of the cases this hydronephrosis is transitional and may resolve on its own its important to pursue a strict postnatal follow up protocol to find out cases in whom there is worsening of

hydronephrosis thereby warranting further evaluation and surgical intervention.

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