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POST NATAL FOLLOW UP OF ANTENATAL HYDRONEPHROSIS

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Abstract

Background: To determine the outcome of antenatally detected hydronephrosis in the post natal period. **Objectives:** To follow up all cases of antenatally diagnosed hydronephrosis postnatally to determine the time course until spontaneous resolution of antenatal hydronephrosis and to identify the causes of hydronephrosis persisting in the postnatal period which requires early intervention. **Materials and Methods:** A total of 109 children with antenatal hydronephrosis were followed up with timely ultrasonography and other investigations(wherever necessary and also making a note on the various grades of hydronephrosis and their outcomes in postnatal life.) **Results:** A total of 109 children with antenatal hydronephrosis were followed up in the current study. It was observed that most of the cases in our study were males with a M:F ratio of 2.4:1. The most common cause of antenatal HUN were transient HUN(81%) followed by PUJ(10%) and VUR(3.7%).There was an increase in the number of children who resolved in the postnatal period as noted as 13.8%(15/109) children by day 7,57.8%(63/109) children by 1st month, 79.84%(87/109) children by 6th month and 87.2%(95/109)cases by 1st year. The risk of postnatal pathology increases with the severity of HN. Out of 109 babies with antenatal hydronephrosis 16 babies had persistent hydronephrosis at 1 year follow up. **Conclusion:** In fetuses with hydronephrosis detected in late second trimester, a thorough work up is required to rule out other anomalies and a follow up USS in third trimester can identify the progress of the same so that treatment and postnatal follow up can be planned accordingly.There is an increased risk of postnatal pathology as the grade of hydronephrosis increases. Most of the cases are managed conservatively as majority of them resolve in the infancy with watchful waiting.

Key Words: Antenatal hydronephrosis, Ultrasonography, Postnatal hydronephrosis

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Introduction

Among the anomalies detected antenatally, those of the kidney and urinary tract are the most common. With the advent of ultrasonography, the urinary tract can be visualised from 16 weeks of age.[1,2,3] Of the foetuses undergoing routine ultrasound scanning at 18 to 20 weeks of gestational age,4.5% have urinary tract anomalies. The overall prevalence of renal tract anomalies are estimated to be 5/1000 live birth.[1,2,3] Prenatal hydronephrosis is diagnosed at an incidence of 1:100 to 1:500 by ultrasonography.[1,2,4] Hydronephrosis is usually detected without difficulty in foetal ultrasonography. The simplest and most widely used classification is by measuring the diameter of renal pelvis(Anteroposterior pelvic diameter in mm) on a transverse scan of fetal abdomen.[5]However maternal hydration, hormonal influence and intermittent renal pelvic dilatation can be associated with difficulty in image interpretation.[1] So these days diuretic renogram and schintigraphy are used to confirm an obstructive pattern and assess the differential function. [6] With the advent of routine prenatal ultrasound children with urinary tract obstruction or reflux are being detected prior to the development of complications such as urinary tract infections, Kidney stones and renal dysfunction or renal failure. These complications might be averted by early diagnosis.[7,8] Hence it is important to know the natural progression and course of antenatally detected hydronephrosis not only for timely intervention but also for prognostication.

Material And Method

This was a hospital based observational study conducted in 109 children over a period of 4 years which includes 2 years retrospective and 2 years prospective. The study was carried out from April 2020 to April 2022 in the department of Paediatrics with input from the departments of Radiodiagnosis and Obstetrics and Gynaecology. Informed consent was obtained for all patients enrolled in the study. In the retrospective part of the study, infants with antenatally detected hydronephrosis born between April 2020 and April 2022 were recruited and followed up until April 2023(1 year follow up for all infants). In the prospective part of the study, cases of antenatally detected hydronephrosis born between April 2022 and April 2023 were recruited and followed up till April 2024.

Technique and tools

Machine: GE VINGMED ultrasound machine.

Transducers: 5 MHz curvilinear transducer(for antenatal sonography) 5-8.5 MHz pediatric sector transducer

Antenatal hydronephrosis was defined based on antenatal sonography performed after 20th week of gestation. With transabdominal sonography using a 5MHz transducer, transverse slice images of foetal abdomen were obtained. An hypoechoic image identified on each side of the spine corresponds to the kidneys. The renal pelvis appeared as an anechoic image on the medial edge of the kidneys. The image obtained was then frozen and the greatest antero posterior distance parallel to the spine was measured. The degree of hydronephrosis was classified as mild, moderate or severe when the anteroposterior pelvic diameter was 5- 9 mm,10 -14 mm and ≥15 mm respectively according to the sonographic measurements. Complete physical examination was done after birth to exclude any other congenital anomalies. Postnatal ultrasound was performed for all inborn cases of antenatal

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hydronephrosis on or after day 7 with 5-8.5 MHz pediatric sector transducer in GE VINGMED ultrasound machine to confirm the presence of hydronephrosis.

Postnatal follow up of infants

Infants with gross hydronephrosis with or without a palpable kidney were started on uroprophylaxis and followed up with a repeat ultrasound scan at 4 weeks of age. If hydronephrosis was persisting early DTPA was done before surgical intervention and subsequent follow up. Infants without gross hydronephrosis on day 7 ultrasound were subjected to DTPA scan at 8 weeks of age to rule out any obstruction and those with obstruction were taken up for surgery. Those without obstruction were followed up with repeat ultrasound at 1 month,6months and 1 year of age with DTPA done in case of any indeterminate findings on ultrasound. Infants referred to paediatric OPD with antenatally detected hydronephrosis had their ultrasound scans done as early as possible. Their records were analysed retrospectively and followed up until 1 year of age with the same protocol as above. In bilateral hydronephrosis cases VCUG is performed as soon as possible to rule out posterior urethral valves and other abnormalities. The flow chart below summarises the protocol followed in this study.

For statistical calculation data was spread in excel sheet and analysis is done with the help of R software v.2.15.1(a freely downloadable software). Descriptive statistics were used to calculate the mean and median values and to find out the percentages. Chi square test was used to find out the association between the antenatal grades of hydronephrosis and the risk of postnatal pathology. The risk was defined as those cases in which there was an etiology. Those cases associated with transient hydronephrosis in the postnatal period were not associated with any risk of renal pathology, Chi square test was also used to find out the association between the gender, sidedness with the risk of postnatal pathology. The association between the antenatal grades and the final underlying etiology in postnatal period was also calculated using Chi square test. p value ≤ 0.05 was considered statistically significant.

Results

In the study period, among 123 children who were registered,14 were excluded(due to lack of follow up and incomplete data),leaving a total of 109 children for the study. Out of these 109 children,97 were diagnosed and followed up in our hospital and 12 cases came referred as hydronephrosis from various other centers. These children were followed up to see the outcome in their postnatal period. Among them,73/109 babies detected during second trimester were studied prospectively and 36/109 infants were analysed retrospectively for their records. Other associated anomalies detected in our study population include ambiguous genitalia, Pierre Robin syndrome and sacral agenesis.104/109(95.4%) children were born at term gestation and 5/109(4.6%) were born preterm. The mean birth weight of babies were 3.00 kgs. The male:female ratio were 2.3:1(76:33).The mean gestational age for detection of antenatal hydronephrosis among the prospective study group was found to be 22 weeks. The lowest age of detection was 20 weeks and the maximum age of initial detection was 25 weeks of intrauterine life. 72% presented with mild HUN.23% cases presented with moderate to severe HUN. There was a complete resolution of HUN by 3rd trimester in 4.6% cases. Ancillary sonological findings were noted in 12.8%(14/109) children.

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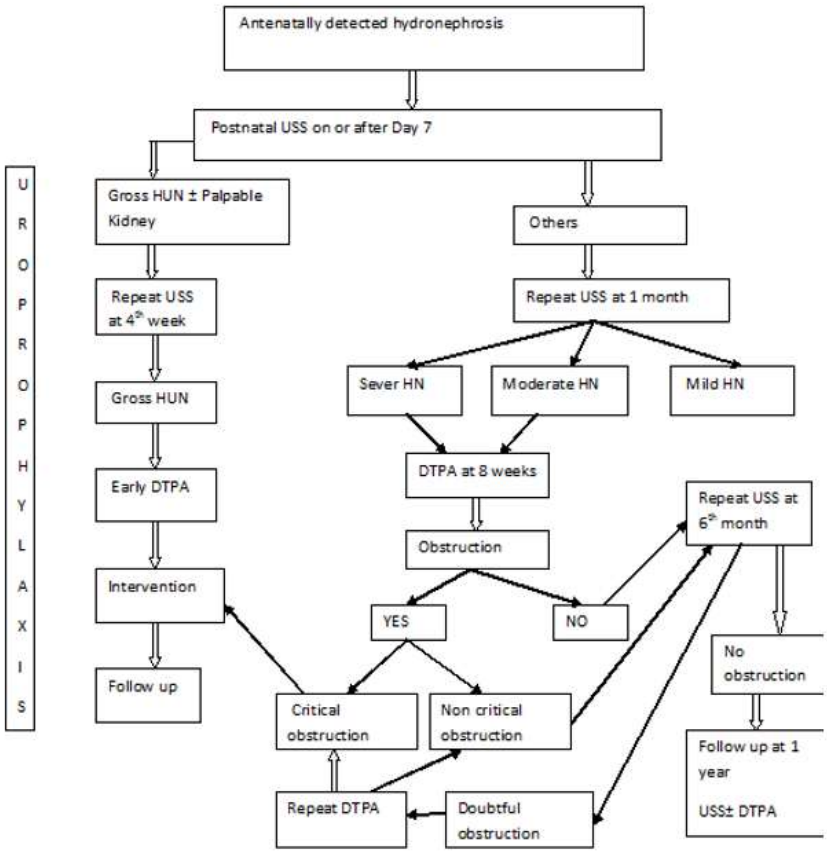
Study Flow chart



hey were thickening of bladder(1.8%), Over distension of bladder(1.8%),Oligohydramnios(7.3%), fetal ascites and perinephric urinoma(0.9%),cleft lip and talipes foot(0.9%). Mild hydronephrosis was present in 64.9%,26.6%,5.5%,1.8% children on day 7,1st month,6th month and 1 year of postnatal age respectively(Table 1,2,3). Moderate hydronephrosis was present in 11.9%,6.4%,6.4%,2.8% children on day 7,1st month,6th month and 1 year of postnatal age respectively(Table 1,2,3). Severe hydronephrosis was present in 10.1%,9.2%,8.3%,8.3% children on day 7,1st month,6th month and 1 year of postnatal age respectively(Table 1,2,3). A diagnosis of transient hydronephrosis was made when there was complete resolution on follow up. 4.6% foetuses showed resolution in the 3rd trimester USS. Based on the sidedness, it was found that 26.6% cases had bilateral involvement, whereas 74.7% had unilateral involvement out of which left side predominance in 42.2% cases. The risk of postnatal pathology was more in boys(with an odds ratio of 4.62 and 95%CI) as compared to girls(Table 4). There was an increase in the risk of postnatal pathology when the grade of HN was more in antenatal diagnosis. Only 3/79 cases of mild antenatal HN had postnatal pathology, as against 17/25 cases of moderate to severe antenatal HN who were found to have urological pathology in postnatal period(Table 5).The risk of postnatal pathology was more with unilateral kidney involvement. There was no significant association between laterality and the risk of post natal pathology in cases of bilateral antenatal HUN. The most common causes of HUN were transient HUN(81%),followed by PUJO(10%), and then VUR(3.7%).UTI episodes were present in 6.4% children(7/109) and uroprophylaxis were required in 17.4%(19/109) children. Among 19/109 children who were

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on uroprophylaxis,2 developed UTI. Out of 109 cases,90.8% were managed conservatively and 9.2% underwent surgical management.

Table 1: APPD grading at 7th postnatal day

Side	APPD	Number of Children	Percentage of Children
Right	Mild	22	20.12
	Moderate	4	3.7
	Severe	2	1.83
Left	Mild	35	32.1
	Moderate	4	3.7
	Severe	6	5.5
Bilateral	Mild	13	11.9
	Moderate	5	4.6
	Severe	3	2.75
Resolved/Normal		15	13.8
Total		**109**	**100**

Table 2: APPD grading at 1 month

Side	APPD	Number of Children	Percentage of Children
Right	Mild	22	20.12
	Moderate	4	3.7
	Severe	2	1.83
Left	Mild	35	32.1
	Moderate	4	3.7
	Severe	6	5.5
Bilateral	Mild	13	11.9
	Moderate	5	4.6
	Severe	3	2.75
Resolved/Normal		15	13.8

Table 3: APPD grading at 1st year

Side	APPD	Number Of Children	Percentage of Children
Right			
Left	Mild	0	32.1

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	Moderate	1	3.7
	Severe	7	5.5
Bilateral	Mild	0	11.9
	Moderate	0	4.6
	Severe	2	2.75
Resolved/Normal		95	13.8

Table 4: Association between gender and risk of postnatal pathology

Gender	**Risk of postnatal pathology**				**Odds (95% CI)**
	No risk		**Risk**		
	Number	**Percentage**	Number	Percentagez	
Male	59	77.6	18	22.4	4.62(0.94-19.94)
Female	30	93.8	2	6.3	1

Table 5: Association between the risk of postnatal pathology and antenatal grade of HUN

Antenatal diagnosis	**Risk of postnatal pathology**			
	No		**Yes**	
	Number	**Percent**	**Number**	**Percent**
Transient	5	100.0	0	0.0
Mild	76	96.2	3	3.8
Moderate	8	61.5	5	38.5
Severe	0	0.0	12	100.0

Discussion

Antenatal Hydronephrosis is the most common urological abnormality detected on prenatal USS, and has been reported in 1 to 5% of all pregnancies. With the help of ultrasonography antenatal hydronephrosis is detected more frequently. In the current study, 109 patients with hydronephrosis detected antenatally were followed up to see the outcome in their postnatal period. Of these 73 children were studied prospectively and 36 were studied retrospectively.104/109(95.4%) of children were born at term gestation and 5/109(4.6%) were born as preterm. Among prospectively followed up cases, mean age of detection of hydronephrosis was 22 weeks of gestation. This is comparable with study of Miranda *et al* and Dulley *et al* where the mean gestational age was found to be 24 weeks.[9,10] Most of the patients were males with a male:female ratio of 77:32(2.4:1). This is comparable with the other studies done by Vandervoot *et al* and Samsirshaz *et al*[11,12].72% of the patients presented with mild grade of HUN. Moderate to severe HN was seen in 23% cases. There was a complete resolution of HUN in 4.6% of cases. The result was almost comparable with study done by Asl *et al* where there was spontaneous resolution in 23% children antenatally, however not in agreement with study done by Sairam *et al* and Deborah *et al* where most of the cases resolved during antental period.[13,14,15] This could be because of differences in the sample chosen and also due to radiological interobserver variations. The percentage of mild

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hydronephrosis decreased from 64.9% on day 7 to1.8% by first year, whereas most of severe hydronephrosis remained persistent at the 1 year follow up(i.e10.1% at day 7 and 8.3% at 1 year).This is in comparison with Deborah *et al* who reported that 51% of mild and 15% of moderate showed reduction in postnatal life.[15]A diagnosis of transient hydronephrosis was made when there was complete resolution on follow up.4.6% foetuses showed resolution in the 3rd trimester ultrasound scan. Most of the cases were diagnosed postnatally as transient HN and 87.2% cases resolved by 1st year. This is on par with studies of Sairam *et al* and Deborah *et al* where transient hydronephrosis was the most common cause of antenatally detected hydronephrosis.[13,14] But the age at resolution differed from our study; they found the maximum cases resolving in the antenatal period, where as in this study the same was more in the postnatal period. Other ancillary findings detected on antenatal ultrasonography were thickening of urinary bladder(1.8% cases),over distension of bladder(0.8% cases),oligohydramnios(7.3% cases),fetal ascites(0.9% cases) and cleft lip with talipes foot(0.9%cases).[8] Bilateral antenatal hydronephrosis was present in 26.6% cases(29/109) and unilateral in 74.4% cases with left side predominance of 42.2%(46/109).This is comparable with studies done by Dudley *et al*, Shamshirsaz *et al*, Sairam *et al*, Sharifian *et al* [10,12,14,16].Irrespective of the cause there was a noticeable male preponderance in those babies with a significant post natal pathology. Our study was aimed at detecting the clinical outcome of Antenatal HUN in infants. The most common cause of Antenatal HUN as per the study were transient HUN(81%) followed by PUJO(10%) and VUR(3.7%). This is almost comparable with the studies done by Nguyen *et al*, Cheng *et al* and Woodward *et al* [5,17,18] who found similar etiologies. Out of 109 babies with antenatal hydronephrosis,[16] babies had persistent hydronephrosis at 1 year follow up. This is in comparison with the study done by Sairam *et al*.[14] Uroprophylaxis had to be started in 19/109(17.4%) infants with gross hydronephrosis with or without a palpable kidney. UTI episodes were reported in 7/109(6.4%) children. Among the 19/109 children who were on uroprophylaxis 2 developed UTI. The same is pointed out in the study by Conkar *et al*.[19] There is always a controversy regarding the protocol of postnatal management of Antental HUN. In this study we performed first postnatal USS on day 7 to avoid false positive diagnosis, and later followed them up with USS at 1 month,6 months and 1 year unless there were any associated complications like gross hydronephrosis, bilateral HUN or break through UTI where DTPA, MCU or DMSA was required. In our study,93/109 cases required only follow up with USS and other investigations were done only in 16/109 cases. Even though routine USS is not recommended we followed all patients up to 1 year even if USS was normal beyond 6 months of age.

Conclusion

In foetuses with hydronephrosis detected in late second trimester, a thorough work up is required to rule out other anomalies. A follow up repeat USS in third trimester can identify the progress of foetal hydronephrosis so that treatment and postnatal follow up can be planned accordingly. The antenatal grading of HUN can predict the postnatal outcome in most cases.There is an increased risk of postnatal pathology as the grade of hydronephrosis increases. Most of the cases are managed conservatively as most of them resolve in the infancy with watchful waiting.

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