Original Article

Outcome of infants with antenatally detected hydronephrosis

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ABSTRACT

Background: It is estimated that genitourinary anomalies comprise 20% of all antenatally detected fetal anomalies, of which hydronephrosis is the most common anomaly affecting 1–5% of all pregnancies. Depending on diagnostic criteria and gestation, the prevalence of antenatal hydronephrosis (ANH) ranges from 0.6 to 5.4%. **Aim:** The aim of the study was to find the causes and outcome of antenatally detected hydronephrosis. **Methods:** Babies diagnosed with antenatally detected hydronephrosis from January 2016 to December 2016 were followed up for 6 months postnatally. Based on anteroposterior diameter of renal pelvis babies were classified as mild, moderate and severe according to Society for Fetal Urology consensus statement on evaluation and management of ANH and these babies were followed up. **Results:** Two percent of babies born during the study period had significant ANH (68/3251). Three were lost to follow-up. Among the remaining 65 babies, three (4.6%) had severe, 13 (20%) had moderate, and 49 (75.4%) had mild ANH. During follow-up 39 (60%) resolved spontaneously, ten (15.3%) showed resolving hydronephrosis and 16 (24.6%) required some form of intervention. All babies with severe ANH required intervention (100%). Nine (69.2%) babies with moderate and four (8.1%) babies with mild ANH required intervention. Among babies who required intervention, majority had vesicoureteric reflux (12.3%) and pelviureteric junction obstruction (9.2%). Sixteen babies (24.6%) developed urinary tract infection. **Conclusion:** Majority of the ANH are mild and resolve spontaneously. Size at detection decides the likelihood of need for intervention as all those with severe hydronephrosis required intervention. Majority of babies with ANH are asymptomatic at birth and postnatal abnormality could be detected only by follow-up scans. Hence, this study reinforces on the regular follow-up of babies with ANH.

Key words: Antenatal hydronephrosis, Pelviureteric junction obstruction, Renal pelvic anteroposterior diameter, Society for fetal urology, Ultrasonography, Urinary tract infection, Vesicouretric reflux

Antenatal hydronephrosis (ANH) is the dilatation of the fetal renal collecting system. Antenatal ultrasonography detects structural abnormalities in approximately one to three percent of all pregnancies [1]. At present, it is estimated that genitourinary anomalies comprise 20% of all antenatally detected fetal anomalies [2]. Hydronephrosis is the most common antenatally detected renal anomaly affecting 1–5% of all pregnancies [3]. The rates of vesicoureteric reflux (VUR) and urinary tract infections (UTI) are several-fold higher for these babies in later life.

Depending on diagnostic criteria and gestation, the prevalence of ANH ranges from 0.6 to 5.4% [1,4,5]. The condition is bilateral in 17–54% cases [6,7]. ANH resolves by birth or during infancy in 41–88% patients [6,7]. Urological abnormalities requiring intervention are identified in 4.1–15.4% [4,8]. Causes of ANH requiring intervention are pelviureteric junction (PUJ) obstruction, VUR, posterior urethral valve (PUV), dysplastic kidney, ureterocele, etc. With the advent of routine prenatal ultrasonography (USG), children with urinary tract obstruction or reflux are being detected prior to the development of complications which may be averted by early diagnosis. Complications include UTI, kidney stones, and kidney dysfunction or failure.

Any anomaly detected in the fetus is a great concern to the parents. Knowledge regarding the possible outcome and its determinants can help the physician in proper counseling of the parents. This can alleviate unnecessary anxiety in parents. Although the prevalence and outcome of ANH in a different group of population are studied by various investigators, clinical relevance of detecting ANH and its value in predicting postnatal outcome in Indian population is not well studied. Therefore, we planned this study to know the prevalence of ANH and its outcome in Indian population.

MATERIALS AND METHODS

This prospective observational study done at the postnatal ward, NICU, and outpatient of the pediatrics department of tertiary

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care center in South India from January 2016 to December 2016 included all newborns with ANH. The sample size has been calculated by considering 4% prevalence of hydronephrosis from the past published literature [1,4,5]. The minimum sample size has been calculated as 3190 cases using the formula, $n = \frac{Z^2_{\alpha/2}PQ}{D^2}$, to be screened with 0.0068 as a marginal error which is 17% of prevalence of hydronephrosis at 5% level of significance assuming two-tailed hypotheses. Hence, we have enrolled 68 cases after screening 3251 deliveries for hydronephrosis.

Infants with ANH, showing renal pelvic anteroposterior diameter (APD) of >4 mm in gestational age (GA) <33 weeks (2nd trimester) or >7 mm in GA >33 weeks (3rd trimester), were included in the study. Infants, whose follow-up could not be completed, were excluded from the study.

Neonates who fulfilled inclusion criteria were enrolled for the study after getting informed written consent from parents and institutional ethical clearance. Antenatal, natal, and postnatal history was noted. Detailed clinical examination (routine general physical examination, to look for other associated anomalies and external genitalia examination) of the newborns were done and associated anomalies noted. Antenatal USG showing hydronephrosis was analyzed and recorded. Based on APD of renal pelvis, babies were classified as mild, moderate, and severe. A second-trimester fetal renal pelvic APD of 4–7 mm was classified as mild, 7–10 mm as moderate, and >10 mm as severe. In the third trimester APD of 7–9 mm, 9–15 mm and >15 mm were classified as mild, moderate, and severe hydronephrosis, respectively [9].

Postnatally clinical examination and USG of babies were done at 1st week, 1st month, and 6th month. Micturating cystourethrogram (MCU) diuretic renography were done if needed (with ANH – Society for Fetal Urology grade 3 and 4 or APD >10 mm or dilated ureters on USG KUB, MCU was done at 4–6 weeks and in children with features of lower urinary tract obstruction, MCU was done within 48 h). Those babies who were lost for follow-up were excluded from the study.

Data were analyzed using descriptive and inferential statistics. The categorical data were expressed in terms of frequencies and percentages. To elucidate the associations between two attributes Freeman-Halton test was used which is an extension of the Fisher exact test for m rows and n columns. For all statistical evaluations, a two-tailed $p<0.05$ was considered as statistically significant. Qualitative data were also summarized using charts and diagrams. Data were analyzed using the statistical package SPSS-20.

RESULTS

Among 3251 babies delivered, 68 babies were found to have hydronephrosis on antenatal USG. Three babies were lost follow-up; hence, 65 babies with ANH formed the study group, of them, 39 were male (60%) and 26 were females (40%). Majority of the babies (n=49, 75.4%) had mild ANH followed by moderate ANH (n=13, 20.0%) and 4.6% (n=3) had severe ANH. Majority (n=37, 56.9%) had unilateral hydronephrosis and 43.1% (n=28) had bilateral hydronephrosis.

At 1 month follow-up, ten (1.5%) babies had shown spontaneous resolution. After 6 months of follow-up majority of ANH (n=39, 60%) resolved spontaneously and 24.6% (n=16) required some intervention. Whereas in 15.56% (n=10) babies ANH was resolving in follow-up scans. Majority (n=37, 75.5%) of mild ANH resolved completely on follow-up scans, 16.3% (n=8) showed resolving hydronephrosis whereas, 8.2% (n=4) required intervention. Among moderate ANH group, the majority (n=9, 69.2%) required intervention, 15.4% (n=2) showed complete resolution and 15.4% (n=2) showed resolving hydronephrosis. Among severe ANH group, all (n=3, 100%) required intervention (Table 1).

Among the 65 babies followed up, 16 babies (24.6%) developed UTI. UTI was more in babies with moderate to severe ANH. Two babies with severe ANH had altered renal function. Among them, one had PUV and other had unilateral dysplastic kidney. After cystoscopic ablation, renal function became normal in baby with PUV, and in baby with unilateral dysplastic kidney, renal function improved spontaneously (Table 2).

MCU was done in 26 (40%) babies, VUR was detected in eight (30.7%) of these babies. Diuretic renogram done in 18 (27.7%) babies, abnormal pattern (obstructive curve on scintigraphy) was detected in six (33.3%) babies. Among them, one (16.6%) baby had split renal function <40% and APD >20 mm, this baby underwent pyeloplasty. Remaining five (83.3%) babies had split function >55% and APD <20 mm, these babies were continued to be followed up. In 16 (24.6%) babies, who required intervention, eight (50%) had VUR, six (37.5%) had PUJ obstruction, one (6.25%) had PUV, and one (6.25%) had dysplastic kidney (Table 3).

DISCUSSION

Ultrasound fetal screening during pregnancy has resulted in increasing recognition of fetal hydronephrosis. Depending on diagnostic criteria and gestation, the prevalence of ANH varies. In majority of neonates with ANH, hydronephrosis resolves on postnatal evaluation and only a few requires intervention. Although hydronephrosis is present at birth, there are often no signs and most of these babies are asymptomatic.

Of the 3251 newborns delivered during the study period, 68 had ANH. The incidence of ANH is two percent in the present study. Similarly, in a study by Sairam *et al*. [4], ANH was identified in 2.3% of pregnancies (268/11465). Odibo *et al.* [10] found ANH in 2% (150/7416) of pregnancies. Among 68 babies with ANH, three were lost for follow-up. Hence, the study group consists of 65 babies, majority (60%) were males. Similarly, Tibballs *et al*. [11], Chertin *et al*. [12], and Orabi *et al*. [13] in their studies showed a male predominance of 74.5%, 75.8%, and 79%, respectively.

In the present study, majority (75.4%) had mild ANH followed by moderate and severe ANH (20.0% and 4.6%, respectively).

Table 1: Outcome based on size at detection

Follow-up	Mild (n=49)		Moderate (n=13)		Severe (n=3)		Freeman-Halton exact
	Cases	Percent	Case	Percent	Case	Percent	p-value
Resolved	37	75.5	2	15.4	0	0.0	
Resolving	8	16.3	2	15.4	0	0.0	0.000*
Intervention needed	4	8.2	9	69.2	3	100.0	

Table 2: Renal manifestations in the study group

Manifestation, number (%)	Mild (49)	Moderate (13)	Severe (3)
UTI (n=16)	8 (16.3%)	6 (46.1%)	2 (66.7%)
Altered renal function (n=2)	0	0	2 (66.7%)

UTI: Urinary tract infections

Table 3: Etiology and outcome of ANH among the study group

Final diagnosis	Number (n=65)	Percent
Transient hydronephrosis		
Spontaneous resolution	39	60.0
Resolving ANH	10	15.4
VUR	8	12.3
PUJ obstruction	6	9.2
PUV	1	1.5
Dysplastic kidney	1	1.5

ANH: Antenatal hydronephrosis, PUJ: Pelviureteric Junction, PUV: Posterior urethral valve, VUR: Vesicoureteric reflux

Similar results were found in studies by Sairam *et al.* [4], where mild and moderate/severe ANH was 80.6% (216/268) and 19.4% (52/268), respectively. Chaudhary [14], in his study, found that the distribution of mild, moderate, and severe ANH was at 58.51, 31.92, and 9.57%, respectively. ANH was unilateral in 56.9% and bilateral in 43.1% in our study. Similar results were found in studies by Tibballs *et al*. [11], where 58% were unilateral and 42% were bilateral.

In the present study, majority of ANH (60%, n=39) resolved spontaneously. Sairam *et al*. [4] and Broadley *et al*. [7] reported spontaneous resolution in 88% and 72.8% of cases, respectively. These studies were conducted for a longer period (4 years); hence, the spontaneous resolution rate was probably higher than our study. About 15.4% babies showed resolving hydronephrosis in our study, which may show resolution over long-term follow-up.

In the present study, 16 babies (24.6%) required some form of intervention, similar results were reported in studies by Sairam *et al*. [4] and Broadley *et al.* [7], where interventions were required in 12% and 27.2% babies, respectively.

All babies with severe ANH (100%), 69.2% babies with moderate ANH and 8.1% babies with mild ANH showed postnatal abnormality requiring intervention. Risk of postnatal abnormality increased progressively from 8.1% with mild, 69.2 with moderate, and 100% with severe ANH. Thus, from our study, we could assure parents about the possibility of resolution in mild ANH. Similarly, Lee *et al*. [6] showed that risk of any postnatal abnormality per degree of ANH was 11.9% for mild, 45.1% for moderate, and 88.3% for severe ANH. Sidhu *et al*. [15] showed that postnatal abnormality detected and intervention needed only in two percent of patients with APD <12 mm as compared with 49% with larger APD (>12 mm). Paserotti *et al*. [16] showed that the risk of postnatal abnormality increased progressively from 29.6% with mild hydronephrosis to 96.3% in severe hydronephrosis.

In present study, 24.6% babies developed UTI. Meta-analysis by Braga *et al*. [17] showed UTI prevalence of 2.8% to 28.6% in babies with ANH. In our study, 66% of the severe, 46.1% moderate, and 16.3% of mild ANH had UTI. Hence, as the severity of ANH increases the chances of UTI increases. This is in concordance with other studies [17,18]. Coelho *et al*. [18] reported that infants with postnatal renal pelvic APD of 10 mm or more have a significantly increased risk of infections compared with those with mild hydronephrosis. Braga *et al*. [18] reported that rates of UTI were low for neonates with low-grade hydronephrosis, regardless of the status of antibiotic prophylaxis.

Transient hydronephrosis was found in 75.4% of these babies (resolved in 60% and resolving in 15.4%). Similarly, studies by Sairam *et al.* [4] and Broadley *et al*. [7] showed transient hydronephrosis in 88% and 72.8% cases, respectively. In contrast, Pan [19] conducted a study that showed the causes of fetal hydronephrosis was transitional in 33.33%, PUJ obstruction in 33.33%, VUR in 29.82%, and 3.5% had PUV. In this study, hydronephrosis was divided into three groups based on APD, Group 1– APD <10 mm, Group 2– APD 10–15 mm, and Group 3 – APD >15 mm.

Among 16 babies (24.6%) who required intervention, majority 12.3% (n = 8) had VUR followed by PUJ obstruction (9.2%, n=6). One baby with PUV and one baby with dysplastic kidney also presented as ANH (1.4% each). Jaswon *et al*. [20] showed that VUR is the most common (22%) abnormality associated with ANH followed by PUJ obstruction (3.8%). Nguyen *et al*. [9] found similar results in his meta-analysis showing VUR in 10–30% and PUJ obstruction in 10–20% of cases.

There were certain limitations in this study. In this study, babies were followed up for only 6 months which is too inadequate to assess the complete resolution and the incidence of complications such as renal stones, hypertension, and renal dysfunction. Being a tertiary care center, more number of referred cases was included in the study. Hence, our calculated incidence of ANH may not be a true representation of the general population.

CONCLUSION

Majority of the babies with ANH are asymptomatic at birth and postnatal abnormality could be detected only by follow-up scans. Hence, in asymptomatic babies with ANH, clinical examination

is not of much help and imaging should be done in follow-up. Majority of ANH are mild and resolve spontaneously, while all severe ANH and 66.3% of moderate ANH require intervention. Thus, size at detection decides the likelihood of resolution or intervention. A significantly high incidence of UTI was seen in follow-up of babies with ANH and the risk increases with the severity of ANH.

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