

## Original Article

# Clinical Outcomes of Children With Prenatal Hydronephrosis



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## ABSTRACT

**Background:** Fetal hydronephrosis (HY) is a frequent congenital condition that may be detected by prenatal ultrasound studies. The main underlying abnormalities found in these cases after birth are ureteropelvic junction stenosis, primary vesicoureteral reflux, megaureter, duplex kidneys, and posterior urethral valves, with uretero-pelvic junction stenosis and primary vesicoureteral reflux accounting for most cases.

**Method:** Neonates with a prenatal diagnosis of congenital HY born between 2017 and 2020 were referred to our center for the appropriate management and follow-up and were included in this cross-sectional study. Ultrasonographic studies were performed in all these neonates in the first week of birth. Prenatal HY was categorized as mild, moderate, severe, and highly severe when the antero-posterior diameter of the renal pelvis was less than 5 mm, between 5 mm and 10 mm, between 10 mm and 15 mm, and more than 15 mm, respectively.

**Results:** A total of 164 children with prenatal HY were included in this study. 84 patients (51.2%) had unilateral HY and 80 patients (48.8%) had bilateral HY. Twelve patients had posterior ureteral valves and 64 patients (39%) had vesical-urethral reflux (VUR). no significant relationship was observed between unilateral or bilateral reflux and outcome (P value 0.645).

**Conclusion:** Prenatal screening of HY is vital. Some antenatal HY, especially in women resolves without any intervention over time.

**Keywords:** Neonate, Hydronephrosis (HY), Diagnostic ultrasound, Vesicoureteral reflux (VUR), Ureteropelvic junction stenosis

## Introduction

**F**etal renal pelvic dilation is a common and transient finding in newborns observed in 1–4.5% of all pregnancies [1]. It may be detected as an incidental finding in routine prenatal ultrasound studies and is charac-

terized by abnormal dilatation of the renal pelvis and calyces, as well as atrophy in renal parenchyma. This dilation can involve either the renal pelvis alone (also called pyelectasis) or the dilation of the pelvis and the calyces (also called pelvicaliectasis or hydronephrosis [HY]). In practice, these terms are often used interchangeably to refer to a dilated renal collecting system regardless of its

etiology or severity [2, 3]. HY may be divided into physiological and pathological types based on the post-partum conditions of the newborn. HY may spontaneously resolve after birth, classified as physiological HY, while in deteriorating types, it may lead to impaired renal function and is referred to as pathological HY [4]. A post-natal antero-posterior renal pelvis diameter of 10 mm is the most commonly accepted upper limit threshold value of its normal range. While a pelvis diameter of more than 15mm is mostly associated with significant uronephropathies [5]. According to the society for fetal urology (SFU), HY grading and anterior-posterior diameter (APD) of calyces are the two major ultrasonography-based systems to evaluate HY. The classification of the SFU system consists of five grades (0, I, II, III, and IV) according to the appearance of calices, pelvis and thinning of the parenchyma. According to the APD system, three grades (mild, moderate, and severe) exist based on the anterior posterior diameter of the pelvis [6, 7]. Postnatal ultrasonography should not be performed in the early neonatal period and it has been recommended that if ultrasound is negative within 48 hours after birth, the second study should be repeated at least one week afterlife. These recommendations address the concern that significant HY may be missed due to the common neonatal oliguria resulting in delayed initiation of treatments and irreversible renal damage [8]. HY may result from anatomic or functional impairments and also decreased urinary flow due to obstructions. These derangements may occur in any part of the urinary tract from the kidney to the meatus. Increased fluid pressure in the ureter causes a severe reduction in glomerular filtration rate (GFR), tubular function, and renal blood flow within hours which may continue for a long time even after the abnormal pressure is reduced. In addition, impaired tubular function results in decreased transport of sodium, potassium, and protons; therefore urine concentration is greatly decreased [9]. This study aims to determine the incidence and outcome of kidney problems in infants born with a history of prenatal HY.

## Materials and Methods

This is a cross-sectional study conducted on neonates born with prenatal HY from 2017 to 2020. Prenatal HY was detected by ultrasonographic study in the second or third trimester of pregnancy during routine examinations. An ultrasonographic study was also performed on all of these neonates at the end of the first week after birth. An expert radiologist with at least 5 years of work experience in the field of pediatric radiology and sonography performed sonographic studies. Canadian QSonix devices made by the Ultrasonix factory and ultrasound machine G50 made in Germany by Siemens factory were used. Sonography was done using a linear and convex probe with a frequency of 3.5–5 and 7–10 MHz with a gradual compression technique (Graded compression). HY was categorized as mild, moderate, severe, and very high according to APD of the renal pelvis (APDRP) (less than 5 mm,  $5 \text{ mm} \leq \text{APDRP} \leq 10 \text{ mm}$ ,  $10 \text{ mm} \leq \text{APDRP} \leq 15 \text{ mm}$ , and greater than 15 mm, respectively). If bilateral sever HY or unilateral sever HY was observed and all male neonates who couldn't urinate normally, the newborn was hospitalized for further evaluation. Also, a voiding cystourethrogram (VCUG) study was performed at 6–8 weeks postnatal in all subjects with unilateral HY or mild to moderate bilateral HY. If the posterior urethral valve (PUV) was suspected, VCUG was immediately performed after birth. The outcome of these neonates was classified as improvement with conservative management, increase in severity of HY over time, and improvement of HY with surgical intervention. All these neonates were screened for any associated anomalies in the urinary tract and other organ systems.

## Results

A total of 164 children with prenatal HY were included in this study. Tables 1 and 2 present sex, gender, and outcome. In this study, 84 patients (51.2%) had unilateral HY and 80 patients (48.8%) had bilateral HY. Twelve patients had posterior ureteral valves and 64 patients (39%) had vesical-urethral reflux (VUR). VUR was more common in women with spontaneous improvement over time. Tables 3 and 4 present the frequency of severity of HY that which

**Table 1.** Gender of neonates

Variables	No. (%)	Valid
Male	40(24.4)	24.4
Female	124(75.6)	75.6
Total	164(100)	100

**Table 2.** Overall outcome of patients

Variables	No. (%)	No.	
		Valid	Cumulative
Improvement	76(46.3)	46.3	46.3
Surgery	22(25.6)	25.6	72
Increased HY	46(28)	28	100
Total	164(100)	100	-

HY: Hydronephrosis.

**Table 3.** Frequency of severity of hydronephrosis (HY) and vesical-urethral reflux (VUR)

HY	No. (%)	VUR	No.	
			Valid	Cumulative
Mild	74(45.1)	40	45.1	45.1
Moderate	56(34.1)	18	34.1	79.3
Sever	34(20.7)	6	20.7	100
Total	164(100)	64	100	

VUR: vesical-urethral reflux; HY: Hydronephrosis.

shows the relationship between outcome and severity of HY. According to the Chi-square test, no significant relationship was observed between unilateral or bilateral reflux and outcome ( $P=0.645$ ). All patients with PUV had surgical intervention. No significant relationship was observed between the severity of HY and outcome ( $P=0.881$ ). According to the Chi-square test, no significant relationship was observed between existing reflux and the outcome of

patients ( $P=0.347$ ). In this study, the mean age of studied patients was  $35\pm 5$  months. Table 5 presents the relationship between the mean age of patients and their outcomes. According to the analysis of variance (ANOVA) test, no significant relationship was observed between age and outcome ( $P=0.731$ ). Table 6 presents the cross-tabulation of the patient's gender and their outcome. According to chi-square test, a significant relationship exists between gender

**Table 4.** Association of outcome and severity of hydronephrosis (HY)

Affected Side	Variables	No. (%)	Total
		Cumulative	
Unilateral	Improvement	40(47.6)	47.6
	Surgery	18(21.4)	69
	Increase HY	26(31)	100
	Total	84(100)	
Bilateral	Improvement	36(45)	45
	Surgery	24(30)	75
	Increase HY	20(25)	100
	Total	80(100)	

Abbreviations: HY: Hydronephrosis.

**Table 5.** The relationship between the mean age of patients and outcome

Variables	No.	Mean
Improvement	72	35.34
Surgery	42	23
Increasing HY	46	38.70
Total	164	33.12

Abbreviations: HY: Hydronephrosis.

**Table 6.** Cross tabulation of the patients' gender and their outcome

Variables	No. (%)		
	Male	Female	Total
Spontaneous improvement	12(30)	64(51.6)	76(46.3)
Surgery	20(50)	22(17.7)	42(25.6)
Increasing HY	8(20)	38(30.6)	46(28)
Total	40(100)	124(100)	164(100)

HY: Hydronephrosis.

and outcome ( $P=0.016$ ). The female gender was associated with more spontaneous improvement and the male gender was associated with more need for surgical intervention.

## Discussion

Undoubtedly, prenatal ultrasound is vital to find urinary tract abnormalities. It is essential to early diagnose and manage urinary tract abnormalities. PUV is tissue leaflets that expand from the prostatic urethra to the external urinary sphincter. PUV represents the most common cause of lower urinary tract obstruction in boys, affecting 1 in 4000 to 8000 male infants. During the gestational period, PUV should be suspected in the following conditions, failure of the bladder to empty, the concomitant presence of bilateral and sometimes unilateral HY, and oligohydramnios. Sometimes a thick-walled megabladder may be seen, and the dilated posterior urethra may take the shape of a keyhole. In extreme cases, a distended kidney or bladder may rupture with extravasation of urine, resulting in urinary ascites during fetal life [1, 10]. In our study compared to the study conducted by Pourissa et al, HY was more common in women while in Pourissa's study, it was more common in men. In both of these studies, unilateral HY was more common (in our study 52%, and Pourissa's study 72%). According to the classification in that study, mild HY was observed in 47.3%, moderate in 33.3%, severe in

15.9%, and highly severe in 3.6% of cases [8]. In our study, no severe HY was observed; therefore we classified our cases as mild (45%) moderate (34%), and severe (20%). Ghane et al evaluated 100 children with HY. In that study, only 21% of cases had a prenatal diagnosis and 45% of them had reflux, 11% underwent surgery due to PUV and 5% improved over time. In our study, 46% of patients improved spontaneously and did not require surgical intervention. A total of 12 children had PUV and 30 children had a ureteropelvic junction obstruction (UPJO) and surgical intervention. Our study was mostly similar to Ghane's study [11]. In our study, none of the patients had systemic disease associated with reflux or HY. This study was conducted to evaluate the short-term outcomes of patients with antenatal HY. Six independent factors were evaluated, including age, sex, the severity of HY, reflux and unilateral or bilateral involvement. In our study, age, severity of HY, reflux, unilateral or bilateral reflux did not have any significant relationship with outcome. However, gender was a crucial factor. Men had more surgical interventions and women had a better outcome with a spontaneous improvement of reflux over time. All men with PUV underwent surgical intervention. After surgery, mean serum creatinine and HY showed better indices during the next 1 to 3 years.

## Conclusion

Prenatal screening of HY is vital. Some antenatal HY, especially in women resolves without any intervention over time. All men with bilateral or unilateral HY should be evaluated with VCUG. Long-term evaluation is also essential in all cases.

## American Journal of Obstetrics and Gynecology (AJOG) at a Glance

A. Why was the study conducted? Because prenatal sonographic examinations are routinely performed in almost all pregnancies, we decided to find the exact prevalence of prenatal HY and its impact on the children's health and its outcome in a tertiary centre.

B. What are the key findings? According to our findings, prenatal HY is more common in male fetuses, mostly unilateral and mild as well as transient. More severe forms (such as PUV) need immediate interventions and sonography is essential to detect such cases.

C. What does this study add to what is already known? This study emphasizes the importance of early and timely diagnosis and follow-up of such cases. Since the study was conducted in a tertiary hospital, the incidence of severe cases may be more than in other centres.

## Ethical Considerations

### Compliance with ethical guidelines

This study was approved by the Ethics Committee of the [Tehran University of Medical Sciences](#).

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### Authors' contributions

All authors equally contributed to preparing this article.

### Conflict of interest

The authors declared no conflict of interest.

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