ASIAN JOURNAL OF PHARMACEUTICAL AND CLINICAL RESEARCH

INNOVARE ACADEMIC SCIENCES
Knowledge to Innovation

Vol 18, Issue 11, 2025

Online - 2455-3891
Print - 0974-2441

Research Article

POSTNATAL FOLLOW-UP AND OUTCOME OF INFANTS DIAGNOSED WITH ANTENATALLY DETECTED HYDRONEPHROSIS: AN OBSERVATIONAL STUDY

AKASH YADAV, SINDHU N, GAUTAM MUTHU

Department of Radiodiagnosis, Rajarajeswari Medical College and Hospital, University - Dr. M.G.R. Educational and Research Institute, Bengaluru, Karnataka, India
***Corresponding author: Akash Yadav; Email: akashrao9896@gmail.com**

Received: 04 August 2025, Revised and Accepted: 15 September 2025

ABSTRACT

Objectives: The objectives of this study were to evaluate the postnatal outcomes of neonates with antenatally detected hydronephrosis (ANH), to determine the prevalence of associated urinary tract anomalies such as pelviureteric junction obstruction (PUJO), vesicoureteral reflux (VUR), and posterior urethral valves (PUV), and to assess the requirement for surgical versus conservative management

Methods: This prospective observational study included 60 neonates diagnosed with ANH based on antenatal ultrasound criteria (anteroposterior renal pelvic diameter >4 mm in the second trimester or >7 mm in the third). Postnatal evaluations included serial ultrasonography and, in selected cases, micturating cystourethrogram. Hydronephrosis was graded using the Society for Fetal Urology system. Primary outcomes included resolution rates, incidence of urinary tract anomalies, surgical intervention rates, and urinary tract infection occurrence. Data were analyzed using SPSS v23. $p<0.05$ was considered statistically significant.

Results: Among 60 infants, 68.3% were male, with a male-to-female ratio of 2.2:1. Hydronephrosis was unilateral in 54 cases (90.0%) and most commonly left-sided. On initial postnatal ultrasound, 63.3% had mild, 25.0% moderate, and 11.7% severe hydronephrosis. Till the time of final follow-up, 44 (73.3%) cases resolved spontaneously without intervention. Specific pathologies identified were PUJO (11.7%), VUR (13.3%), and PUV (3.3%). Surgical intervention was required in 13.3% of infants. The reduction in hydronephrosis severity from antenatal to postnatal imaging was statistically significant ($p<0.001$).

Conclusion: Most cases of ANH resolve without any interventions. Serial postnatal follow-up using ultrasonography is important for identifying infants at risk for the presence of clinically significant anomalies such as PUJ obstruction, VUR, and PUV. Regular follow-up facilitates timely intervention while avoiding unnecessary procedures in low-risk cases.

Keywords: Hydronephrosis, Antenatal diagnosis, Pelviureteric junction obstruction, Vesicoureteral reflux, Postnatal ultrasound.

 DOI: http://dx.doi.org/10.22159/ajpcr.2025v18i11.56779. Journal homepage: https://innovareacademics.in/journals/index.php/ajpcr

INTRODUCTION

Antenatally detected hydronephrosis (ANH) is one of the common congenital anomalies identified on routine obstetric ultrasonography. Its incidence is reported to range from 1% to 5% of all pregnancies [1]. The widespread use of prenatal ultrasonography has led to an increased recognition of urinary tract anomalies with hydronephrosis constituting majority of these findings [2]. While many cases are transient and resolve spontaneously, a significant proportion of infants with ANH are at risk of having urinary tract pathologies. These pathologies include ureteropelvic junction obstruction, vesicoureteral reflux (VUR), and posterior urethral valves (PUV). If left untreated, these pathologies may eventually impair renal function [3]. Consequently, systematic postnatal follow-up and timely intervention remain critical for preventing long-term renal morbidity.

The natural history of antenatal hydronephrosis is variable, and its severity on prenatal imaging does not always reliably predict the underlying pathology or clinical outcome [4]. Mild cases often regress or remain stable without significant sequelae, whereas moderate-to-severe hydronephrosis may suggest clinically relevant obstruction or reflux. Neonatal and infant follow-up depends on a combination of imaging modalities, including postnatal ultrasonography, voiding cystourethrography (VCUG), and diuretic renography. The timing and frequency of these postnatal investigations continue to be debated. Many researchers have recommended maintaining a balance between the need for early diagnosis on the one hand and the avoidance of unnecessary radiation exposure on the other hand [5].

The outcome of infants with ANH depends mainly on the timely detection of significant urinary tract pathology and the initiation of appropriate management that may even include surgical interventions. Several observational studies have reported favorable outcome in infants with mild hydronephrosis. However, cases associated with severe and significant obstructive uropathy may necessitate surgical interventions to prevent progressive renal damage [6]. Postnatal urinary tract infections (UTIs) represent a potentially preventable complication in these infants. This further underscores the importance of structured follow-up and prophylactic strategies. Thus, understanding the spectrum of outcomes following antenatal detection is essential for managing these infants [7].

Despite advances in prenatal and postnatal diagnostic approaches, there is a lack of consensus regarding standardized follow-up protocols. This is more so in terms of risk stratification, timing of interventions, as well as long-term surveillance. Some guidelines advocate aggressive postnatal imaging for all infants with ANH, while others recommend a selective approach based on severity and progression. This heterogeneity in follow-up protocols complicates clinical decision-making and also makes it difficult to properly counsel the parents [8].

In this context, it is important to undertake studies that systematically examine the postnatal course and outcomes of infants diagnosed with ANH. Existing literature reports considerable variability in resolution rates, frequency of underlying uropathy, and long-term prognosis. Furthermore, there are controversies regarding predictors of adverse

outcomes and the most effective surveillance strategies. The present study, therefore, aims to address this knowledge gap by evaluating postnatal follow-up and outcomes in infants with ANH, with a focus on identifying risk factors for persistent or clinically significant hydronephrosis.

METHODS

This prospective observational study was carried out in the department of radiology of a tertiary care medical institute over a period of 2 years. A total of 60 neonates with ANH were enrolled consecutively in this study on the basis of predefined inclusion and exclusion criteria. The sample size was calculated on the basis of an expected prevalence of postnatal urinary tract pathology in 35–40% of cases with ANH, with a 95% confidence interval and an allowable error of 10%. Using the standard statistical formula for a single population proportion, the minimum sample size required was 55. To account for potential loss to follow-up and incomplete data, 60 cases were finally included in the study. Antenatal hydronephrosis was defined based on ultrasonographic criteria as an anteroposterior renal pelvic diameter (APD) >4 mm in the second trimester or >7 mm in the third trimester. Informed written consent was obtained from the parents or legal guardians before enrolment. Since it was a purely observational study, institutional ethics committee approval was waived. Demographic details of all neonates were noted. A detailed clinical evaluation was done at birth, including sex distribution, perinatal history, and laterality of hydronephrosis and presence of any relevant family history of renal disease was noted.

Infants were systematically followed postnatally using a stepwise protocol. The first ultrasound was performed between the 3rd and 7th day of life. This was done to avoid underestimation due to neonatal oliguria. Follow-up ultrasounds were then scheduled at 1 month and again at 6 months of age to assess either progression or resolution of ANH. Infants with persistent or moderate-to-severe hydronephrosis at 6 weeks underwent further evaluation with micturating cystourethrogram (MCU). Each infant was followed for a minimum of 6 months. The duration of follow-up was extended for selected infants who required surgical intervention. This was done to ensure a balance between identification of significant anomalies that may require interventions while minimizing unnecessary invasive investigations. Hydronephrosis was graded according to the Society for Fetal Urology (SFU) system on the basis of APD measurements on ultrasound examination [9].

Infants with persistent hydronephrosis beyond 6 weeks of life or those with moderate-to-severe hydronephrosis at presentation underwent further evaluation. This included the MCU to detect VUR and PUV. In selected cases, diuretic renography with technetium-99m mercaptoacetyltriglycine or diethylenetriaminepentaacetic acid is used to evaluate renal drainage and differential renal function in suspected pelviureteric junction obstruction (PUJO). For this study, "medical treatment" referred exclusively to conservative management, which included low-dose antibiotic prophylaxis to prevent UTI and treatment of symptomatic UTIs as required. These infants did not undergo surgical intervention during the follow-up period but were monitored with serial ultrasonography. Surgical intervention was recommended in cases of proven obstructive uropathy associated with impaired drainage or a decline in differential renal function.

The primary outcomes assessed were the rate of spontaneous resolution of hydronephrosis. The distribution of postnatal urinary tract anomalies such as PUJO, VUR, and PUV was also analyzed. The number of cases requiring surgical interventions and the incidence of UTI during the follow-up period was also noted. Each case was followed for a minimum of 6 months, with extended follow-up undertaken in infants requiring additional intervention.

Data were entered and analyzed using Statistical Package for Social Sciences version 23.0 (IBM Corp., Armonk, NY, USA). Continuous variables, such as APD, were expressed as mean ± standard deviation, while categorical variables, such as gender distribution, laterality, severity, and outcomes, were presented as frequencies and percentages. The Chi-square test was used to study associations between the severity of antenatal hydronephrosis and postnatal outcomes. Continuous variables were compared using Student's t-test or one-way analysis of variance. For statistical purposes, a $p<0.05$ was considered statistically significant.

Inclusion criteria

- Neonates with antenatal ultrasonography performed after 20 weeks of gestation, showing APD >4 mm in the second trimester or >7 mm in the third trimester
- Both unilateral and bilateral cases of antenatal hydronephrosis
- Term neonates (≥37 weeks of gestation).

Exclusion criteria

- Neonates with major congenital anomalies incompatible with life
- Cases with known chromosomal syndromes
- Infants with incomplete antenatal or postnatal data
- Neonates born before 37 weeks of gestation.

RESULTS

Among the 60 neonates with ANH, 41 (68.3%) were male and 19 (31.7%) were female. There was a male preponderance in studied cases with a male-to-female ratio of 2.2:1 (Fig. 1).

With respect to laterality, hydronephrosis was most commonly observed on the left side in 38 (63.3%) cases, followed by the right side in 16 (26.7%) cases, while bilateral involvement was noted in 6 (10.0%) cases. Regarding the gestational age at which hydronephrosis was first detected, majority were diagnosed between 21–28 weeks in 32 (53.3%) cases, followed by 29–33 weeks in 16 (26.7%) cases, 12–20 weeks in 8 (13.3%) cases, and above 33 weeks in 4 (6.7%) cases (Table 1).

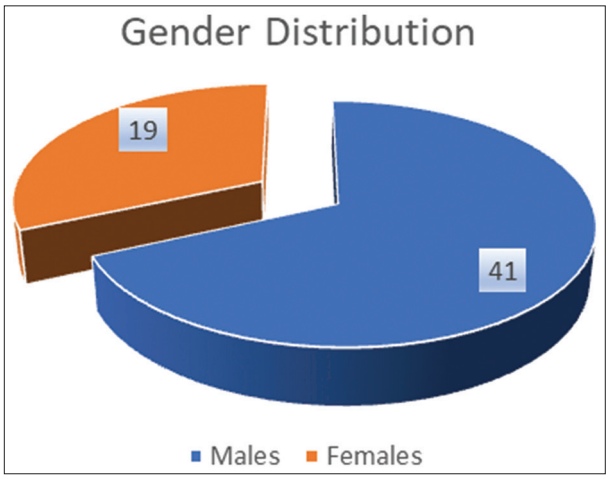

Fig. 1: Sex incidence in the study population (n=60)

Table 1: Gestational age at which fetal hydronephrosis was detected (n=60)

Parameter	Side	No. of cases	Percentage
Unilateral versus bilateral	Left	38	63.3
	Right	16	26.7
	Bilateral	6	10.0
	Total	60	100
Gestational age at the time of detection of hydronephrosis	12–20 weeks	8	13.3
	21–28 weeks	32	53.3
	29–33 weeks	16	26.7
	33–37 weeks	4	6.7
	Total	60	100

On antenatal ultrasound examination, grading of hydronephrosis severity according to the SFU system showed that out of 60 cases, 31 (51.7%) cases had mild hydronephrosis, whereas moderate and severe hydronephrosis was seen in 17 (28.3%) and 12 (20.0%) cases, respectively (Figs. 2 and 3).

On comparing antenatal with first postnatal ultrasonography, a significant reduction in the severity of hydronephrosis was observed. Antenatally, 38 (63.3%) cases were mild, 15 (25.0%) were moderate, and 7 (11.7%) were severe, whereas on the first postnatal scan, 28 (46.7%) were mild, 9 (15.0%) were moderate, and 5 (8.3%) were severe. In addition, 18 (30.0%) cases demonstrated complete resolution of hydronephrosis on postnatal follow-up. Of the 18 cases that showed resolution on the first postnatal scan, the majority had antenatal APD measurements in the lower range (mean 5.6 ± 0.4 mm, SFU grade 1–2). This suggests that many of these represented borderline pelvic dilatation, which normalized promptly after establishment of neonatal diuresis. This reduction in severity and resolution of cases was statistically significant (p<0.001) (Table 2).

MCU was performed in selected cases, with more than half of the cases, i.e., 31 (51.7%), not undergoing the procedure. Among those evaluated, 10 (16.7%) had normal findings, while abnormalities were documented in the remainder. Pelviureteric junction obstruction was detected in 7 (11.7%) cases, unilateral VUR in 5 (8.3%) cases, bilateral VUR in 3 (5.0%) cases, and PUV in 2 (3.3%) cases. A further 2 (3.3%) infants showed equivocal or other findings (Table 3).

With respect to outcomes, 18 (30.0%) infants showed complete resolution of hydronephrosis on the first postnatal ultrasound, while an additional 26 (43.3%) resolved completely by the last follow-up without requiring any intervention. Among the remaining cases, 8 (13.3%) had persistent hydronephrosis and were managed conservatively with medical treatment, and 8 (13.3%) required surgical intervention during the follow-up period (Table 4).

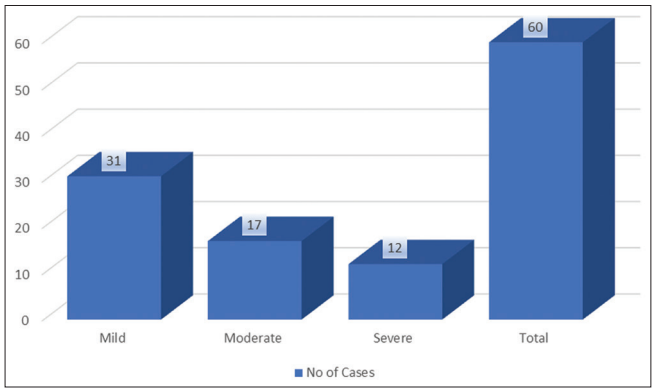

Fig. 2: Severity of hydronephrosis on antenatal ultrasound

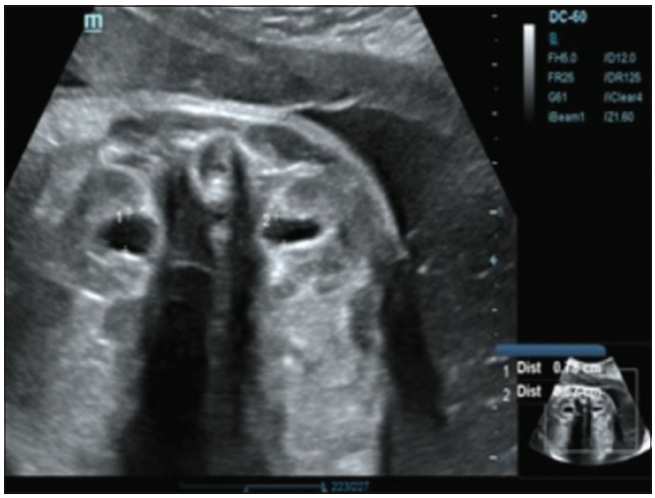

Fig. 3: Ultrasound image showing antenatally detected hydronephrosis with bilateral renal pelvic dilatation

DISCUSSION

This observational study was undertaken to analyze the postnatal course and outcomes of infants diagnosed with ANH. In this study, most cases of hydronephrosis were mild and resolved spontaneously whereas a subset required medical or surgical intervention. In this study, 73.3% of infants demonstrated complete resolution of hydronephrosis during follow-up, a figure consistent with the resolution rates of 60–70% reported by Lee *et al*. in a prospective study evaluating the natural history of ANH [10]. Similarly, Ismaili *et al*. reported that over 60% of mild-to-moderate ANH cases resolved without intervention [11]. Resolution of majority of cases without any interventions supported the conservative approach for low-grade hydronephrosis. However, in cases of severe hydronephrosis, further investigation and appropriate interventions may be required.

Our study reaffirmed the observation that male infants are more frequently affected by ANH. In this study, male-to-female ratio was found to be 2.2:1. Similar male preponderance in cases of ANH has also been

Table 2: Comparison of severity of hydronephrosis on antenatal and first postnatal ultrasound (n=60)

Severity of hydronephrosis	Antenatal ultrasound No. of patients (%)	First postnatal ultrasound No. of patients (%)
No hydronephrosis	0 (0.0)	18 (30.0)
Mild hydronephrosis	38 (63.3)	28 (46.7)
Moderate hydronephrosis	15 (25.0)	9 (15.0)
Severe hydronephrosis	7 (11.7)	5 (8.3)
Total	60 (100)	60 (100)

p<0.001 (Significant)

Table 3: Micturating cystourethrography findings in studied infants

MCU findings	No. of cases	Percentage
MCU not done	31	51.67
Normal MCU	10	16.67
Pelviureteric junction obstruction	7	11.67
Unilateral VUR	5	8.33
Bilateral VUR	3	5.00
PUV	2	3.33
Others/Equivocal	2	3.33
Total	60	100

MCU: Micturating cystourethrogram, VUR: Vesicoureteral reflux, PUV: Posterior urethral valve

Table 4: Outcome of infants with antenatally diagnosed hydronephrosis (n=60)

Outcome	No. of cases	Percentage
Completely resolved on the 1st postnatal ultrasound	18	30.0
Completely resolved by the last follow-up without any intervention	26	43.3
Persistent but stable on medical treatment (antibiotic prophylaxis±UTI management)	8	13.3
Surgical intervention required	8	13.3
Total	60	100

UTI: Urinary tract infection

reported by Sairam *et al*., who noted a male predominance in 70% of their ANH cases [12]. Moreover, unilateral hydronephrosis (particularly on the left side) was more prevalent than bilateral involvement. Similar predominance of unilateral ANH has also been reported by Braga *et al*., who documented left-sided predominance in 60% of cases [13].

Our analysis showed that 25% of infants had moderate and 11.7% had severe hydronephrosis on initial postnatal ultrasonography. 38 (63.3%) infants had mild hydronephrosis (mean AP diameter of 5.8 ± 0.6 mm), while 15 (25.0%) had moderate hydronephrosis (mean AP diameter of 8.6 ± 0.7 mm) and 7 (11.7%) had severe hydronephrosis (mean AP diameter of 12.4 ± 1.2 mm). This categorization using SFU grading and AP diameter of renal pelvis correlates well with renal outcomes, as demonstrated by Riccabona *et al*., who reported that increasing APD and SFU grade are significant predictors of underlying obstructive pathology [14]. Diuretic renography and VCUG were employed selectively in infants with persistent or severe hydronephrosis. This selective approach has been endorsed by authors such as Cooper *et al*. who recommended a selective strategy to minimize unnecessary investigations without compromising diagnostic yield [15]. Our data showed a statistically significant reduction in the severity of hydronephrosis on follow-up ultrasound, confirming that a sizable proportion of infants initially diagnosed with moderate or severe ANH may improve without intervention.

Postnatal investigations identified pathologic causes in 25% of cases, with PUJO being the most common, followed by VUR and PUV. Similarly, Gradwell *et al*. also reported PUJO as the predominant pathology among neonates with persistent postnatal hydronephrosis. Pathologies, including PUJO and severe VUR, often necessitate surgical interventions [16]. The identification of VUR and PUV emphasizes the need for MCU in selected cases, particularly when hydronephrosis persists or is bilateral. Zerin *et al*. reported that VUR was the single most common urologic diagnosis and was the only postnatal abnormality in 9% cases of ANH. Based on these findings, the authors concluded that neonates with ANH should be routinely screened for reflux by voiding cystography [17]. Similarly, Herz *et al*. emphasized the role of early diagnosis and prophylactic antibiotics in reducing UTI incidence in these infants [18].

Approximately 13.3% of our cohort required surgical intervention, primarily for PUJO or high-grade VUR with renal impairment. This is similar to the results from a study by Onen, who reported a surgical intervention rate of 10–15% in infants with antenatal hydronephrosis who were followed postnatally for resolution or progression of ANH [19]. In contrast, the conservative management group, including those who received antibiotic prophylaxis without surgery, demonstrated stable or improved renal outcomes. This supports the framework proposed by Nguyen *et al*., who emphasized individualized management protocols based on hydronephrosis severity and functional studies, rather than a one-size-fits-all approach [20]. Despite variation in clinical practice, these studies support a stratified protocol that integrates serial ultrasonography and selective functional imaging to guide decision-making.

CONCLUSION

Majority of the cases of ANH resolve spontaneously in infancy without the need for any active intervention. However, a small subset of ANH cases is associated with significant anomalies such as PUJO, VUR, or PUV that may require surgical intervention. Postnatal imaging, such as serial ultrasound examinations, enables the timely detection of pathologies such as PUJO, VUR, or PUV and guides further management, including the need for surgical interventions. Structured follow-up protocol, therefore, is important for the prevention of long-term renal morbidity while avoiding unnecessary invasive procedures in low-risk infants.

AUTHORS CONTRIBUTION

AY-Overall study concept and design; development of clinical protocol; manuscript editing and critical revision. SN - Concept and design of the study, prepared the first draft of manuscript, interpreted the results, reviewed the literature, and manuscript preparation. GM - Concept, coordination, statistical analysis and interpretation, preparation of manuscript, and revision of the manuscript.

CONFLICT OF INTEREST

None.

AUTHOR FUNDING

None.

REFERENCES

1. Sinha A, Bagga A, Krishna A, Bajpai M, Srinivas M, Uppal R, *et al*. Revised guidelines on management of antenatal hydronephrosis. Indian J Nephrol. 2013 Mar;23(2):83-97. doi: 10.4103/0971-4065.109403, PMID 23716913, PMCID PMC3658301
2. Wong J, Rickard M, Dos Santos J, Lorenzo AJ. Antenatal hydronephrosis: An updated review on postnatal care and management. Curr Opin Pediatr. 2025 Aug 22;37(5):473-81. doi: 10.1097/MOP.0000000000001485, PMID 40842394
3. Has R, Sarac Sivrikoz T. Prenatal diagnosis and findings in ureteropelvic junction type hydronephrosis. Front Pediatr. 2020 Sep 4;8:492. doi: 10.3389/fped.2020.00492, PMID 33014923, PMCID PMC7498649
4. Balasankar S, Balasubramanian J. A study on postnatal evaluation and follow-up of infants with antenatally detected hydronephrosis. Int J Contemp Pediatr. 2017;4(5):1677-81. doi: 10.18203/2349-3291.ijcp20173716
5. De Roo R, Voskamp BJ, Kleinrouweler CE, Mol BW, Pajkrt E, Bouts AH. Determination of threshold value for follow-up of isolated antenatal hydronephrosis detected in the second trimester. J Pediatr Urol. 2017 Dec;13(6):594-601. doi: 10.1016/j.jpurol.2017.06.001, PMID 29133166
6. Akyol Onder EN, Yilmaz O, Taneli C, Ertan P. Outcomes of children with isolated antenatal hydronephrosis. Pediatr Int. 2024 Jan-Dec;66(1):e15843. doi: 10.1111/ped.15843, PMID 39696908
7. Sencan A, Carvas F, Hekimoglu IC, Caf N, Sencan A, Chow J, *et al*. Urinary tract infection and vesicoureteral reflux in children with mild antenatal hydronephrosis. J Pediatr Urol. 2014 Dec;10(6):1008-13. doi: 10.1016/j.jpurol.2014.04.001, PMID 24863985
8. Yalçınkaya F, Özçakar ZB. Management of antenatal hydronephrosis. Pediatr Nephrol. 2020 Dec;35(12):2231-9. doi: 10.1007/s00467-019-04420-6, PMID 31811536
9. Fernbach SK, Maizels M, Conway JJ. Ultrasound grading of hydronephrosis: Introduction to the system used by the society for fetal urology. Pediatr Radiol. 1993;23(6):478-80. doi: 10.1007/BF02012459, PMID 8255658
10. Lee RS, Cendron M, Kinnamon DD, Nguyen HT. Antenatal hydronephrosis as a predictor of postnatal outcome: A meta-analysis. Pediatrics. 2006 Aug;118(2):586-93. doi: 10.1542/peds.2006-0120, PMID 16882811
11. Ismaili K, Hall M, Donner C, Thomas D, Vermeylen D, Avni FE, *et al*. Results of systematic screening for minor degrees of fetal renal pelvis dilatation in an unselected population. Am J Obstet Gynecol. 2003 Jan;188(1):242-6. doi: 10.1067/mob.2003.81, PMID 12548224
12. Sairam S, Al-Habib A, Sasson S, Thilaganathan B. Natural history of fetal hydronephrosis diagnosed on mid-trimester ultrasound. Ultrasound Obstet Gynecol. 2001 Mar;17(3):191-6. doi: 10.1046/j.1469-0705.2001.00333.x, PMID 11309166
13. Braga LH, McGrath M, Farrokhyar F, Jegatheeswaran K, Lorenzo AJ. Society for Fetal Urology classification vs urinary tract dilation grading system for prognostication in prenatal hydronephrosis: A time to resolution analysis. J Urol. 2018 Jun;199(6):1615-21. doi: 10.1016/j.juro.2017.11.077, PMID 29198999
14. Riccabona M, Avni FE, Blickman JG, Dacher JN, Darge K, Lobo ML, *et al*. Imaging recommendations in paediatric uroradiology: Minutes of the ESPR workgroup session on urinary tract infection, fetal hydronephrosis, urinary tract ultrasonography and voiding cystourethrography, Barcelona, Spain, June 2007. Pediatr Radiol. 2008 Feb;38(2):138-45. doi: 10.1007/s00247-007-0695-7, PMID 18071685
15. Cooper CS, Andrews JI, Hansen WF, Yankowitz J. Antenatal hydronephrosis: Evaluation and outcome. Curr Urol Rep. 2002 Apr;3(2):131-8. doi: 10.1007/s11934-002-0024-5, PMID 12084205

16. Gradwell LE, Neel AK, Somani BK. Predictive tools and scoring systems for surgical intervention in antenatal hydronephrosis and pelviureteric junction obstruction: An ATLAS based on comprehensive review of literature. Urol Ann. 2025 Jul-Sep;17(3):133-43. doi: 10.4103/ua.ua_88_25, PMID 40843405
17. Zerin JM, Ritchey ML, Chang AC. Incidental vesicoureteral reflux in neonates with antenatally detected hydronephrosis and other renal abnormalities. Radiology. 1993 Apr;187(1):157-60. doi: 10.1148/radiology.187.1.8451404, PMID 8451404
18. Herz D, Merguerian PA, McQuiston L, Hulbert WC, Snyder HM. Antibiotic prophylaxis for children with prenatal hydronephrosis. J Urol. 1997;158(3 Pt 2):1178-80. doi: 10.1016/s0022-5347(01)64460-6
19. Onen A. Treatment and outcome of prenatally detected newborn hydronephrosis. J Pediatr Urol. 2007 Dec;3(6):469-76. doi: 10.1016/j.jpurol.2007.05.002, PMID 18947797
20. Nguyen HT, Herndon CD, Cooper C, Gatti J, Kirsch A, Kokorowski P, *et al*. The society for fetal urology consensus statement on the evaluation and management of antenatal hydronephrosis. J Pediatr Urol. 2010 Jun;6(3):212-31. doi: 10.1016/j.jpurol.2010.02.205, PMID 20399145