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POSTNATAL EVALUATION AND CLINICAL OUTCOMES OF ANTENATALLY DETECTED HYDRONEPHROSIS: A RETROSPECTIVE OBSERVATIONAL STUDY

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ABSTRACT

Background: Antenatally detected hydronephrosis, currently referred to as prenatal urinary tract dilatation, is the most frequent fetal urinary tract abnormality and poses challenges in distinguishing transient dilatation from clinically significant congenital uropathies after birth. This study aimed to evaluate the postnatal evaluation of antenatally detected hydronephrosis and determine outcomes including resolution, urinary tract infection (UTI), postnatal uropathy, and need for surgery.

Materials and Methods: This retrospective observational study was conducted over 1 year at a tertiary-care teaching hospital and included 50 consecutive neonates with antenatally detected hydronephrosis who had documented postnatal follow-up. Antenatal and postnatal ultrasound data were reviewed, including laterality and renal pelvic anteroposterior diameter (APD). Severity was graded using trimester-specific antenatal APD thresholds and fixed neonatal APD criteria. All neonates underwent renal and bladder ultrasonography after 48–72 hours of life, with serial follow-up imaging. Micturating cystourethrogram (MCUG) and diuretic renography were performed selectively in suspected reflux/obstruction or moderate-to-severe hydronephrosis. Primary outcomes were resolution, improvement, persistence, or progression of hydronephrosis; secondary outcomes were UTI and surgical intervention.

Results: Most cases were first detected at 21–28 weeks (54%). There was male predominance (72%), and unilateral involvement was common (80%), with left-sided hydronephrosis (52%) more frequent than right-sided (28%). Antenatally, hydronephrosis was mild in 64%, moderate in 26%, and severe in 10%. On first postnatal ultrasound 28% had complete resolution. MCUG was performed in 24%, showing vesicoureteral reflux in 8% and posterior urethral valves in 4%. Overall, 72% resolved (28% immediately; 44% during follow-up), while 14% required surgery. UTI (12%) and surgery (14%) rose with higher first postnatal APD severity (p=0.010); all severe cases required surgery.

Conclusion: Most antenatally detected hydronephrosis resolved without intervention. First postnatal ultrasound severity strongly predicted UTI and surgical requirement, supporting early postnatal risk stratification and selective MCUG use.

Keywords: Hydronephrosis, Prenatal Diagnosis, Ultrasonography, Urinary Tract Infections, Vesico-Ureteral Reflux.

INTRODUCTION

Antenatally detected hydronephrosis—now often termed prenatal urinary tract dilatation (UTD)—is the commonest fetal urinary tract abnormality identified on routine obstetric ultrasonography and is reported in approximately 0.6–5.4% of pregnancies, with bilateral involvement in a substantial minority.[1] The rising detection rate reflects widespread second-trimester anomaly scanning and improved ultrasound resolution, but it has also created a large cohort of neonates requiring postnatal evaluation despite highly variable clinical significance.[1] Many affected infants are otherwise well at birth, yet clinicians must rapidly distinguish physiological/transient dilatation from obstructive uropathy, vesicoureteral reflux (VUR), and other congenital anomalies of the kidney and urinary tract (CAKUT) that may predispose to urinary tract infection (UTI), renal functional impairment, and later morbidity.[2] This diagnostic uncertainty carries practical consequences: parental anxiety, repeated imaging, prophylactic antibiotic use in selected groups, and timely referral for surgical assessment when indicated.[3,4] Consequently, understanding how antenatally detected hydronephrosis evolves after birth—and which infants develop clinically meaningful outcomes—remains central to rational, risk-stratified care.[3]

A major challenge in this field has been heterogeneity in defining and grading dilation across studies and clinical pathways. The Society for Fetal Urology (SFU) grading system and measurement of anteroposterior renal pelvic diameter (APRPD) have long been used to communicate severity and guide surveillance, yet interobserver variability and inconsistent thresholds limit comparability and prognostication.[4] To address this, a multidisciplinary consensus proposed the UTD classification system, integrating pelvic and calyceal dilation with parenchymal appearance, ureteral and bladder abnormalities, and gestational age to harmonize prenatal and postnatal descriptors.[5] This framework was designed to improve correlation between ultrasound phenotypes and the likelihood of clinically important uropathies, thereby reducing both missed significant disease and unnecessary invasive testing in low-risk infants. However, while consensus classifications support standardized reporting, real-world practice still varies in timing of the first postnatal ultrasound, indications for voiding cystourethrography (VCUG) and nuclear renography, thresholds for antibiotic prophylaxis, and criteria for discharge from follow-up.[6] Such variability is particularly consequential in resource-limited settings, where repeated imaging and specialist access may be constrained and where local epidemiology of infections and follow-up adherence can influence outcomes.

The natural history of antenatally detected hydronephrosis is favorable for many infants, but is strongly influenced by initial severity and associated ultrasound findings. Contemporary guidelines and cohort data indicate that a large proportion resolves prenatally or during infancy, while minority of infants may ultimately have urological abnormalities requiring intervention.[7] Importantly, severity-based risk stratification is supported by systematic review evidence: the probability of identifying a postnatal abnormality rises steeply from mild to moderate and severe dilation. These postnatal diagnoses include VUR, ureteropelvic junction obstruction (UPJO), primary megaureter, and less commonly lower urinary tract obstruction, each carrying different trajectories and treatment implications. Although many cases of UPJO and mild non-obstructive dilation may be managed expectantly with serial ultrasonography, progressive dilation, declining differential renal function, recurrent febrile UTIs, or symptoms can necessitate operative management. Therefore, the postnatal evaluation of hydronephrosis is not merely an imaging question; it is tightly linked to infection risk, renal preservation, and the timing of escalation from surveillance to intervention.[8]

Clinical outcomes extend beyond anatomic resolution to include UTIs, antibiotic exposure, invasive testing, and long-term renal health. Infants with higher-grade dilation and concomitant ureteral or bladder abnormalities are consistently recognized as higher risk for febrile UTIs and for clinically significant CAKUT. These infants should be screened regularly with simple tests to diagnose UTI.[9] Selected cases can further undergo VCUG and functional imaging. Longitudinal evidence also suggests that, while most persistent cases improve or stabilize in early childhood, a minority remain dilated for years and a small but important subset may demonstrate permanent renal injury, particularly when moderate-to-severe dilation persists postnatally or when parenchymal abnormalities are present. These observations underscore two competing priorities: avoiding delayed diagnosis of significant obstruction or reflux that could compromise renal outcomes, while minimizing unnecessary imaging, radiation exposure, antibiotic prophylaxis, and prolonged follow-up in children with self-limited dilation.[10]

Despite advances in classification and guidance, important knowledge gaps remain. First, the predictive performance of antenatal grading (APRPD/SFU/UTD) for clinically meaningful outcomes—recurrent febrile UTI, need for surgery, and renal functional sequelae—varies across settings due to differences in imaging protocols, referral pathways, and follow-up duration. Second, much of the literature mixes heterogeneous populations (isolated dilation versus complex CAKUT, unilateral versus bilateral disease), limiting the ability to counsel families with precision. Third, there is ongoing uncertainty regarding which infants can be safely discharged early and which require prolonged surveillance to detect late progression or recurrent symptoms, particularly among those with persistent moderate dilation but no early functional

compromise. In this context, the present retrospective observational study is designed to characterize the postnatal evaluation of antenatally detected hydronephrosis within our cohort and to determine clinical outcomes—including resolution/persistence patterns, incidence of postnatal uropathies and UTIs, and need for surgical intervention—thereby helping to refine locally applicable, risk-adapted follow-up strategies and address existing uncertainties in prognostication and management.

MATERIALS AND METHODS

This retrospective observational study was conducted in the department of radiodiagnosis of a tertiary-care teaching hospital. The duration of study was 1 year. During this period a total of 50 consecutive cases of antenatally detected hydronephrosis with postnatal follow-up at our institution were included. Approval was obtained from the Institutional Ethics Committee prior to commencement of data collection. All patient identifiers were removed during data extraction to maintain confidentiality.

Clinical and imaging data were retrieved from the hospital's Radiology Information System (RIS), Picture Archiving and Communication System (PACS), obstetric records, neonatal files, and pediatric urology follow-up records. Antenatal ultrasonography (USG) reports were reviewed in detail and gestational age at first detection of fetal hydronephrosis was noted. The other parameters which were noted included laterality (unilateral/bilateral), renal pelvic anteroposterior diameter (APD) in millimeters, presence of calyceal dilatation, ureteric dilatation, presence of bladder abnormalities, amniotic fluid status, and presence of any other associated congenital anomalies. Serial antenatal scans were analysed from records to determine the antenatal course of hydronephrosis (regression, stability, or progression).

Severity grading was done by APD-based classification criteria. Antenatal hydronephrosis was categorized using trimester-specific APD thresholds whereas postnatal hydronephrosis was graded using fixed neonatal APD thresholds [Table 1].

Table 1: AP diameter of Renal Pelvis Bases Severituy classification.

Period of Assessment	Mild	Moderate	Severe
Second trimester (16–27 weeks)	4–6 mm	7–10 mm	≥10 mm
Third trimester (≥28 weeks)	7–9 mm	10–15 mm	≥15 mm
Postnatal period	<10 mm	10–15 mm	>15 mm

For the purpose of this study, a postnatal renal ultrasound was considered normal when the renal pelvic APD measured <5 mm with no calyceal dilatation, normal renal parenchymal thickness, and absence of ureteric or bladder abnormalities. Resolution of hydronephrosis was defined as normalization of postnatal ultrasound findings according to these criteria.

All neonates underwent renal and bladder ultrasonography after 48–72 hours of life to avoid physiological neonatal dehydration-related underestimation of pelvic dilatation. Follow-up ultrasonography was performed at 4–6 weeks, 3 months, 6 months, and subsequently based on severity and clinical course. Reports of Additional investigations carried out were also analysed. These additional investigations included micturating cystourethrogram (MCUG) in cases with suspected vesicoureteral reflux or lower urinary tract obstruction and diuretic renography (MAG3 scan) in infants with moderate-to-severe hydronephrosis.

Primary outcomes included postnatal evaluation categorized as resolution of hydronephrosis (normalization of USG), improvement (decreased APD of renal pelvis), persistence (no change in APD of renal pelvis), and progression (increased APD of renal pelvis). Secondary outcomes included documented urinary tract infections (UTIs) and requirement for surgical intervention.

Statistical analysis was performed using standard statistical software. Continuous variables were expressed as mean ± standard deviation. Categorical variables were presented as frequencies and percentages. Associations between antenatal severity, postnatal severity and clinical outcomes were analyzed using the Chi-square test or Fisher's exact test as appropriate. For statistical purposes a p-value less than 0.05 was considered statistically significant.

Inclusion Criteria

- Antenatally diagnosed hydronephrosis diagnosed on the basis of antenatal ultrasound.
- Neonates with documented postnatal follow-up imaging
- Availability of complete antenatal and postnatal APD measurements recorded on antenatal and postnatal ultrasound examinations.

Exclusion Criteria

- Absence or incomplete postnatal ultrasonography follow-up.
- Major congenital anomalies incompatible with longitudinal evaluation.
- Neonates with genetic syndromes or chromosomal anomalies.

RESULTS

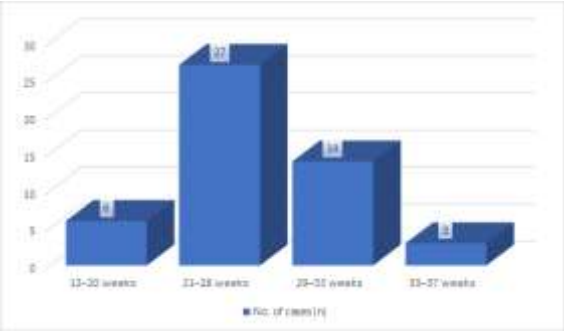

Figure 1: Distribution of gestational age at first antenatal detection of hydronephrosis.

More than half of the cases (54.0%) were first detected between 21–28 weeks of gestational age. Detection during 29–33 weeks accounted for 28.0% of cases. Early second trimester detection (12–20 weeks) was less frequent (12.0%). The least number of cases (6.0%) were identified during 33–37 weeks, indicating that most diagnoses occurred during routine mid-trimester anomaly scanning [Figure 1].

A clear male predominance was observed in cases of antenatally detected hydronephrosis. Out of the 50 studied cases there were 36 (72%) males and 14 (28%) females. Hydronephrosis was predominantly unilateral (80.0%). Left-sided involvement (52.0%) was more common as compared to right-side (28.0%). Bilateral hydronephrosis was detected in 20.0% of cases. These findings suggest both a male preponderance and a tendency toward unilateral, particularly left-sided, involvement [Table 2].

Table 2: Sex and laterality distribution of antenatally detected hydronephrosis.

Parameter	Category	No. of cases (n)	Percentage (%)
Sex	Male	36	72.0
	Female	14	28.0
	Total	50	100
Laterality	Left unilateral	26	52.0
	Right unilateral	14	28.0
	Total unilateral	40	80.0
	Bilateral	10	20.0
	Total	50	100

According to antenatal APD classification, mild hydronephrosis constituted the majority (64.0%). Moderate severity accounted for 26.0%, while severe hydronephrosis was seen in only 10.0% of cases. This distribution indicates that most antenatal detections were low-grade dilatations. Severe antenatal dilation was relatively uncommon, representing one in ten cases [Table 3].

Table 3: Antenatal severity distribution of hydronephrosis using APD-based grading.

Antenatal APD severity category	No. of cases (n)	Percentage (%)
Mild (5-9 mm)	32	64.0
Moderate (10-15 mm)	13	26.0
Severe (> 15 mm)	5	10.0
Total	50	100

On first postnatal ultrasound 14 (28.0%) neonates showed complete resolution. The proportion of mild cases decreased from 64.0% seen antenatally to 48.0% in post-natal period during first postnatal ultrasound. Moderate and severe categories also reduced slightly (16.0% and 8.0%, respectively) at the time of first postnatal ultrasound. The overall severity of antenatally detected hydronephrosis reduced at the time of first postnatal ultrasound and the difference was statistically significant [Table 4].

Table 4: Comparison of antenatal and first postnatal severity grading.

Severity category	Antenatal USG n (%)	First postnatal USG n (%)	p value
Normal (< 5mm)	0 (0.0)	14 (28.0)	<0.001
Mild (5-9 mm)	32 (64.0)	24 (48.0)	
Moderate (10-15 mm)	13 (26.0)	8 (16.0)	
Severe (> 15 mm)	5 (10.0)	4 (8.0)	
Total	50 (100)	50 (100)	

MCUG was performed in 24.0% of cases, primarily in those with persistent or higher-grade dilation. Among the total cohort, 12.0% had normal MCUG findings. Vesicoureteral reflux (VUR) was seen in 4 (8.0%) cases and posterior urethral valves (PUV) could be identified in 2 (4.0%). The majority of patients (76.0%) did not require MCUG [Table 5].

Table 5: Distribution of MCUG utilization and diagnostic findings.

MCUG status / finding		No. of cases (n)	Percentage (%)
MCUG not done		38	76.0
MCUG Done	Normal MCUG	6	12.0
	Unilateral VUR	3	6.0
	Bilateral VUR	1	2.0
	PUV	2	4.0
	Total	50	100

Overall prognosis was favorable. Resolution occurred in 72.0% of cases. Out of the resolved cases resolution occurred immediately in 14 (28.0%) cases and during further follow-up in 22 (44.0%) cases . Surgical intervention was required in 7 (14%) with clinically significant obstruction or complications. These findings indicate that most antenatally detected hydronephrosis resolves or remains stable without surgery (Table 6).

Table 6: Final clinical outcomes during follow-up.

Outcome	No. of cases (n)	Percentage (%)
Resolved on first postnatal USG	14	28.0
Resolved during follow-up	22	44.0
Persistent but stable	7	14.0
Surgical intervention	7	14.0
Total	50	100

The incidence of UTI and surgical intervention increased progressively with higher postnatal APD severity. No UTIs or surgeries were observed in the neonates who had normal APD of renal pelvis at the time of first postnatal ultrasound. In contrast, 75.0% (3 out of 4) of severe cases developed UTI, and 100.0% (all 4 cases) required surgery. Moderate cases also showed elevated risk (25.0%) for UTI as well as need for surgery. These associations were statistically significant for both UTI and surgery (p = 0.010) [Table 7].

Table 7: Relationship between postnatal APD severity, UTI occurrence, and need for surgery.

First postnatal APD category	Total n	UTI n (%)	Surgery n (%)	P value
Normal (< 5mm)	14	0 (0.0)	0 (0.0)	0.010
Mild (5-9 mm)	24	1 (4.2)	1 (4.2)	
Moderate (10-15 mm)	8	2 (25.0)	2 (25.0)	
Severe (> 15 mm)	4	3 (75.0)	4 (100.0)	
Total	50	6 (12.0)	7 (14.0)	

DISCUSSION

In this retrospective cohort of 50 infants with antenatally detected hydronephrosis there was a predominantly benign postnatal course. Overall complete resolution occurred in 36 (72%) cases (28% on the first postnatal ultrasound and a further 44% during later follow-up ultrasound examinations). Surgery was required only in 7 (14%) cases. These findings are similar to established knowledge that most prenatally detected renal pelvic dilatation improves spontaneously. Only a smaller subgroup progresses to clinically significant obstruction or reflux. These cases progressing to significant obstruction usually have severe hydronephrosis on antenatal ultrasound scans. Lee et al demonstrated a strong gradient of postnatal pathology risk with increasing antenatal severity thereby supporting severity-based counselling of parents.[11] Similarly, Sidhu et al in a systematic review focused on isolated antenatal hydronephrosis reported that low-grade dilation stabilizes or resolves in majority of the cases. The authors further reported that higher grades have a greater probability of persistence and need for intervention.[12] In our dataset, the antenatal distribution was skewed toward mild disease (64%), which likely contributed to the high overall resolution rate and comparatively fewer cases requiring surgical intervention. The gestational timing of detection—most commonly between 21 and 28 weeks—also reflects routine anomaly scanning practices.

A key contribution of our results is the clear postnatal "downshift" in severity distribution ($p < 0.001$), reinforcing the importance of early postnatal reassessment after the physiologic neonatal period. Contemporary diagnostic frameworks attempt to standardize this transition from prenatal to postnatal risk assessment. Nguyen et al emphasized integrating APRPD with calyceal dilation, parenchymal appearance, ureteral and bladder findings to better predict meaningful uropathy and rationalize testing.[13] Complementing this, Hwang and colleagues validated postnatal UTD risk groupings by demonstrating strong associations between high-risk ultrasound features (including APRPD ≥15 mm, peripheral calyceal dilation, ureteral dilation, parenchymal abnormalities, and bladder abnormalities) and subsequent surgical intervention.[14] Our findings are congruent with this approach: infants classified as severe by postnatal APD (>15 mm) represented a small subgroup (8%) but carried a disproportionate clinical burden—75% developed UTI and 100% required surgery. The clinical implication is that postnatal imaging severity

(and particularly the presence of additional structural features, if captured) should drive escalation to functional assessment and closer surveillance, whereas infants who normalize early or remain mild may be candidates for reduced follow-up intensity.

In this study MCUG was performed in 12 (24%) of infants. Out of these 12 cases detecting VUR was seen in 4 (8%) cases and posterior urethral valves (PUV) were present in 2 (4%). The modest VUR prevalence in our cohort is lower than other studies. This is likely due to the fact that in these cases MCUG was done only in selected cases. Estrada et al evaluated children with persistent postnatal SFU grade II hydronephrosis and reported a substantial prevalence of VUR among those screened, while also suggesting that identification of reflux with subsequent prophylaxis reduced febrile UTI risk in that setting.[15] In contrast, de Kort et al argued that infants with antenatal renal pelvic dilatation up to 15 mm had a low incidence of UTI and surgery and a benign course of VUR, supporting non-invasive follow-up and limiting VCUG to those with ureteric dilation or other concerning features.16 Our data support a middle path consistent with many guidelines: reflux and lower urinary tract obstruction are important diagnoses but are most efficiently detected when imaging and/or clinical features justify VCUG rather than as a universal screen. Notably, the detection of PUV in 4% underscores the importance of bladder and urethral assessment—particularly in male infants with bilateral disease, worsening dilation, thick-walled bladder, or poor urinary stream—because delayed diagnosis has high stakes for renal outcome.

UTI burden in our cohort was 12% overall, but strongly severity-dependent ($p = 0.001$), suggesting that a "one-size-fits-all" prophylaxis strategy may be inefficient. Braga et al conducted a randomized placebo-controlled study in infants with higher-grade prenatal hydronephrosis.[17] The study highlighted both the feasibility challenges as well as need for larger multicenter trials to define which subgroups truly benefit from antibiotic prophylaxis. Similarly, Easterbrook et al in a systematic review, concluded that antibiotic prophylaxis may be beneficial primarily in high-grade hydronephrosis.[18] However the authors emphasized that the overall evidence quality is limited and confounded by heterogeneity in reflux prevalence. In our study no UTI occurred in infants whose first postnatal scan was normal, and UTI was rare in mild hydronephrosis (4.2%). Moderate and severe categories showed clinically meaningful risks. Thus, prophylaxis decisions in our context was prioritized in infants with moderate-to-severe postnatal APD.

Finally, the question of long-term follow-up—who can be safely discharged and who requires prolonged surveillance—remains central to reducing family burden and resource utilization without compromising renal outcomes. Herthelius et al in a 12–15-year follow-up study, reported excellent long-term outcomes in children with favorable early postnatal findings (notably low APD with no calyceal dilation and normal bladder/ureters/parenchyma), supporting early discharge criteria for truly low-risk infants.[19] In another study Rodriguez et al emphasized that persistent moderate-to-severe dilation, parenchymal abnormalities, and complex CAKUT phenotypes account for the minority at risk of renal injury and prolonged morbidity, reinforcing the need to tailor follow-up to postnatal phenotype rather than antenatal detection alone.[20] Our cohort's strong association between first postnatal severity and both UTI and surgery argues that early postnatal APD-based stratification can serve as a pragmatic surrogate where full UTD feature reporting is not consistently available. In resource-constrained settings, this is particularly relevant: a structured pathway that discharges early-normal infants, provides ultrasound-based monitoring for mild stable cases, and reserves VCUG/renography and specialist escalation for moderate-to-severe or clinically complicated cases may achieve high-value care. Future prospective work with larger samples and standardized UTD reporting would strengthen prediction of intervention thresholds, quantify renal functional trajectories, and refine local algorithms for prophylaxis and imaging—especially for the intermediate-risk infants who drive most uncertainty in day-to-day practice.

CONCLUSION

Out of infants with antenatally detected hydronephrosis majority showed a largely favorable postnatal course. Majority of the neonates showed complete resolution and surgical intervention was required in only in minority of infants predominantly with severe postnatal APD. Postnatal severity strongly predicted both chances for UTI as well as future need for surgery. These findings support early risk stratification using first postnatal ultrasound. Selective use of MCUG can be used to detect vesicoureteric reflux as well as posterior urethral valves.

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