ISSN: 2469-5769

Shaikh et al. Int J Pediatr Res 2024, 10:132
DOI: 10.23937/2469-5769/1510132
Volume 10 | Issue 1
Open Access

International Journal of Pediatric Research

ORIGINAL RESEARCH

Long-Term Follow-Up of Neonatal Hydronephrosis: Elucidation of Causes and Clinical Outcome

Saima Zeb Shaikh[1*], Vina Tresa[2] and Hafsa Shaikh[2]

[1]*Child Health Department, Sultan Qaboos University (SQUH), Oman*

[2]*Agha Khan University Hospital, Pakistan*

***Corresponding author:** *Saima Zeb Shaikh, Child Health Department, Sultan Qaboos University (SQUH), Oman*

Abstract

Importance: Hydronephrosis is a common condition in infants that can be caused by a variety of factors. The majority of infants with hydronephrosis have a good outcome, with resolved hydronephrosis. However, a significant number of infants have persistent hydronephrosis.

Objective: To determine the clinical characteristics and outcomes of infants with hydronephrosis.

Design: This was a descriptive study of 50 infants with hydronephrosis.

Setting: The study was conducted at the Department of Pediatric Nephrology, Sultan Qaboos University, in the Sultanate of Oman, over a period of 9 years from January 2011 to December 2020.

Participants: The study included 50 infants with hydronephrosis. The infants were diagnosed with hydronephrosis during the first year of life.

Outcomes and measures: The primary outcome was the resolution of hydronephrosis. The secondary outcomes were the presence of urinary tract infection, kidney function, and the need for surgical intervention.

Results: Among the 50 infants (42 males, 9 females), mean gestational age 22 ± 24.23 mg/dl. The most common diagnosis was of PUJ obstruction (34%), congenital hydronephrosis (8%), VUJ obstruction (6%), and PUJ dilation (12%). Approximately 50% infants received prophylactic antibiotics, with amoxicillin being the most common antibiotic. Surgical intervention included right pyeloplasty (34%) left pyeloplasty (32.1%) and ureteric reimplantation (15.1%). The majority of infants (82%) had resolved hydronephrosis with 18% having persistent hydropnephrosis. MAG3, MCUG, Renogram and DMSA were used to assess kidney function and obstruction. UTI occurred in 10%, kidney function impairement in 4% and further surgical intervention was required in 6%.

Keywords

Hydronephrosis, PUJ obstruction, Pyeloplasty, Uretic implantation

Introduction

Congenital Hydronephrosis (CH), is the most common urinary tract abnormality that is detected by prenatal ultrasounds where an estimated occurrence of 1-5% of all pregnancies [1,2]. Enlargement of the renal pelvis near the urine collection area in the kidney depicts the characteristics of Congenital hydronephrosis. Though CH can be caused by temporary dilatation related to maternal hormones during pregnancy [3], several of the underlying issues, such as PUJO, VUJ obstruction, PUVs, ureteric duplication, and MDK [4], can lead to the fixation of hydronephrosis.

The degree of the anterior-posterior diameter (APD) of the renal pelvis recorded in the ultrasound (US) is in direct proportion to the degree of the disease [5]. Widespread use of prenatal US has increased detection of CH, such that it is now often made prenatally with the intention of early recognition and management of potentially serious urinary tract anomalies [6]. Severity varies widely, as does whether surgical treatment is needed [7]. While some cases resolve spontaneously, others may require surgical intervention to avoid or treat recurrent UTIs, kidney stones, and CKD [8].

The decision for surgical intervention in CH is complex and based on factors such as the degree of

Citation: Shaikh SZ, Tresa V, Shaikh H (2024) Long-Term Follow-Up of Neonatal Hydronephrosis: Elucidation of Causes and Clinical Outcome. Int J Pediatr Res 10:132. doi.org/10.23937/2469-5769/1510132

Accepted: October 23, 2024: **Published:** October 25, 2024

Copyright: © 2024 Shaikh SZ, et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

hydronephrosis, presence or absence of associated anomalies, and general health status of the patient [9]. Several studies tried to determine whether persistent antenatal renal pelvis dilatation would be a useful indicator for the presence of a developmental abnormality, like VUR, UPJO, and PUVs [10-16]. Investigation of children with CH is undertaken to determine, among cases of transient hydronephrosis, those with clinically significant urological abnormalities [11]. However, the criteria used for identifying children at risk of renal damage remain controversial, and clinical guidelines for neonatal hydronephrosis continue to evolve [12].

This study aims for the retrospective review of etiologies and long-term outcomes of children who present with congenital hydronephrosis at our institution. We hope that, by analyzing data on a large cohort of patients, we will add to the current understanding of this complex condition and inform clinical decision-making.

Materials and Methods

This descriptive retro-prospective hospital-based study was conducted at the Department of Pediatric Nephrology, Sultan Qaboos University, in the Sultanate of Oman, over 9 years from January 2011 to December 2020. The ethical clearance was taken from the Sultan Qaboos University (SQU-V1 = June 2014). There were 50 infants diagnosed with congenital hydronephrosis, who underwent diagnostic process and management of their health condition during the study duration. All the neonates who were diagnosed and evaluated for congenital hydronephrosis at the Child Health Department SQUH are enrolled in the study. Their pertinent medical record including imaging modalities like ultrasound renal, renogram, and micturating cystourethrogram for evaluation of hydronephrosis is checked from the hospital information system (HIS) and recorded in an Excel data sheet. Children who completed the follow-up are included in the study while those patients who were lost for follow-up before completing their evaluation workup are excluded. Those patients who left the hospital before the complete resolution of hydronephrosis are also excluded.

Results

Table 1 shows the demographic and clinical characteristics of a group of 50 infants with hydronephrosis. The majority of the infants were male 42 (82%), with a mean gestational age of 22.0 ± 8.7

Table 1: Characteristics of children with hydronephrosis (N = 50).

Characteristics		**N = 50**	**Mean ± SD**
Gender			
	Male	41	22.07 ± 8.5
	Female	9	21.66 ± 10.29
Mean gestational age in months			22 ± 8.7
Serum creatinine at 1st visit (mg/dl)			38.22 ± 24.23
Age at 1st postnatal U/S (months)			2.65 ± 5.80
		Right	**Left**
Mean APD of the renal pelvis (U/S)		12.75 ± 12.61	8.40 ± 5.30
U/S other findings			
	Hydronephrosis (HN)		
	Normal	6	1
	Mild	1	2
	Moderate	4	8
	Severe	3	11
	Other findings		
	Pelvic kidney	1	0
	Ureterocoele	1	3
	Multicystic dysplastic	1	0
	PUJ dilation	1	1
	Hydroureter	1	1
	Tourous Ureters	0	1
	Cystic Swelling in Upper Pole	0	1
	Subtle Pelviectasis	0	1
	Renal Pelvis Shows mild fullness	0	1
	Multiple Tiny echogenic foci	0	1

Table 2: APD resolution and development and worsening of other findings.

Findings		Mean ± SD
Worsened at Age (in Months)		8.74 ± 10.86
Resolution at Age (In months)		9.35 ± 7.91
	Right	Left
Internal development of any worsening	14.86 ± 9.00	9.89 ± 2.80
Internal development of resolution	8.70 ± 4.34	7.43 ± 3.37
APD on last U/s (mm)	2.9 ± 5.66	5.57 ± 4.52

Table 2 shows the mean age in months at which hydronephrosis worsened and resolved, as well as the mean internal development of any worsening or resolution, and the mean Ambulatory peritoneal dialysis (APD) on the last ultrasound.

months while only 9 females were included with a mean gestation age of 21.66 ± 10.29 months. The mean serum creatinine at the first visit was 38.22 ± 24.23 mg/dL, and the mean age at the first postnatal ultrasound was 2.75 ± 5.80 months. The mean APD of the renal pelvis on the right side was 12.75 ± 12.61 mm, and the mean APD of the renal pelvis on the left side was 8.40 ± 5.30 mm. Hydronephrosis was present in 14 (38%) of the infants, with 6 having mild hydronephrosis, 8 having moderate hydronephrosis, and 5 having severe hydronephrosis. Other ultrasound findings included pelvic kidney (2%), ureterocoele (8%), multicystic dysplastic kidney (2%), PUJ dilation (4%), hydroureter (4%), tortuous ureters (2%), cystic swelling in upper pole (2%), subtle pelviectasis (2%), renal pelvis showing mild fullness (2%), and multiple tiny echogenic foci (2%). Table 2 shows the mean and standard deviation (SD) of several findings in patients with hydronephrosis. The mean age at which hydronephrosis worsened was 8.74 months, and the mean age at which it resolved was 9.35 months. The mean internal development to any worsening was 14.86 months for the right kidney and 9.89 months for the left kidney. The mean internal development to resolution was 8.70 months for the right kidney and 7.43 months for the left kidney. On the last ultrasound, the mean APD was 2.9 mm for the right kidney and 5.57 mm for the left kidney. These findings indicate that hydronephrosis is dynamic, with the likelihood of it worsening and resolving. The average age when hydronephrosis had worsened was almost equivalent to the average age when it had resolved, showing that the condition is frequently self-limiting. However, the mean internal development of any worsening was significantly higher compared with the mean internal development of resolution, which might mean it is more likely to worsen rather than resolve. The last ultrasound showed an average APD for the left kidney that was higher and, therefore, more likely to be affected by hydronephrosis compared to the right. All in all, these findings indicate that hydronephrosis is in fact variable in respect to severity and course. Patients with hydronephrosis have to be put on close observation to watch any worsening or resolving course of the same condition.

As shown in Table 3, the leading final diagnosis noted was PUJ obstruction, followed by VUR and PUJ dilation. The leading cause of hydronephrosis experienced in infants and children is PUJ obstruction. It refers to the narrowing of the junction between the ureter and the renal pelvis that causes obstructed passage of urine from the kidney. VUR is a condition in which urine from the bladder refludes up into the ureters and the kidneys. It could make the kidney prone to infections and kidney injury. PUJ dilation is that there tends to be a minor broadening at the junction of the pelvis of the kidney and the ureter. This will also compromise the free drainage of the kidney. Most of them were not given prophylactic antibiotics. Prophylactic antibiotics are sometimes used to avoid urinary tract infection in patients with hydronephrosis, but with little evidence of avoiding long-term kidney damage, most common surgical interventions were right pyeloplasty and left pyeloplasty. Pyeloplasty refers to the surgical widening of the ureteropelvic junction to ensure proper drainage of urine from the kidney. For the overwhelming majority of patients, this was a resolved outcome, only 18% having a continued diagnosis of hydronephrosis. This seems to speak to the effectiveness of managing hydronephrosis in most people. A significant minority, however, still had hydronephrosis. This would suggest that patients with hydronephrosis need to be clinically followed after their initial treatment. Based on Table 4, impaired kidney function was found in 36% of the patients diagnosed with hydronephrosis, followed by obstruction, hydronephrosis unfortunately (6.30).

The most YY common laterality was left (12.60%). The data obtained from the research reveal that many patients with hydronephrosis are at risk of kidney injury during their years of life. Close watching and regiment of treatment is maintained on the patients having hydronephrosis, even if they have a reasonable status of hydronephrosis or even normal renal raison. Reason being hydronephrosis may worsen UP\UP\High(□CT□), and even mild hydronephrosis may lead to kidney injury. Treatment for hydronephrosis depends on its severity and the presence or absence of complications. In some cases, hydronephrosis resolves on its own. However, in other cases, surgery may be required to widen the ureteropelvic junction or correct another underlying abnormality. Table Clinical characteristics and outcome in 50 infants with hydronephrosis.

Table 3: Final diagnosis and outcomes.

		f	%
Final diagnosis			
	PUJ Obstruction	17	34
	Congenital hn	4	8
	VUJ obstruction	3	6
	PUJ Dilation	6	12
	Antenatal HN	3	6
	VUR grade 4	1	2
	VUR Grade 5	3	6
	VUR	2	4
	UPJ Obstruction	2	4
	Ureterocoele	2	4
	Other	7	14
Prophylactic antibiotics			
	None	28	56
	Amoxicillin	13	26
	Augmentin	4	8
	Cotrimoxazole	2	4
	Ciprofloxacin	1	2
	Trimoxazol	1	2
	IV Cefazolin	1	2
Surgical intervention			
	Right pyeloplasty	18	34
	Left pyeloplasty	17	32.1
	Ureteric reimplantation	8	15.1
	Ureterocoele puncture	4	7.5
	Loop ileostomy, laparotomy, anorectoplasty	1	1.9
	Ureterocoele incision	1	1.9
	Stricture resection and vesicostomy	1	1.9
Persistent or resolved			
	Resolved	41	82
	Persistent	9	18

Table 4: Imaging tehniques utilized.

Other imaging		*f*	%
	None	19	38
	Mag3	18	36
	MCUG	4	8
	Renogram	5	10
	Xray	1	2
	DMSA	1	2
	Tc-99	1	2
	Voiding cystourethrogram	1	2
The result of other imaging			
	Kidney Function		
	Good	2	1.57
	Impaired	11	8.66
	Obstruction		
	Present	10	7.87
	Absent	16	12.60
	Hydronephrosis		
	Present	8	6.30
	Absent	18	14.17
	VUR		
	Present	5	3.94
	Absent	21	16.54
	Laterality		
	Left	16	12.60
	Right	15	11.81
	Bilateral	5	3.94

Table 2 Mean age in months at which hydronephrosis worsened and resolved mean internal development of any worsening or resolution mean Ambulatory peritoneal dialysis on the last ultrasound.

The most common final diagnoses revealed were PUJ obstruction in 34%, congenital hydronephrosis in 8%, VUJ obstruction in 6%, and PUJ dilation in 12%. About half of the infants were on display with prophylactic antibiotics, mainly amoxicillin, the most prescribed one. Several surgical interventions were carried out at this period, the most common interventions being pyeloplasty and ureteric reimplantation. Majority of the infants resolved honest hydronephrosis (82%). This gives the notion that this likely is an outcome of this condition.

Discussion

Hydronephrosis is a condition that is generally found to be very common in infants, predominating in 1-5% of neonates [13]. It can be described as the dilatation of the renal collecting system. It may be caused by various factors, for instance, urinary tract obstruction, vesicoureteral reflux, and primary vesicoureteral dysmotility [14].

In this study, we determined the clinical characteristics and outcomes of infants with hydronephrosis by review of 50 infant records. The most common final diagnoses were PUJ obstruction 34%, congenital hydronephrosis 8% VUJ obstruction 6% and PUJ dilation, 12%. About half of the infants were administered preventive medications, of which the most commonly medicated was amoxicillin. A fair number of interventions were surgical therein, consisting of pyeloplasty and ureteric reimplantation. A high percentage of infants were treated in a way whereby the hydronephrosis resolved, evidenced by the fact that most of them continued to suffer from this condition (82%). These results are consistent with the latest literature, which mentions 15% of hydronephrosis is because of PUJ obstruction [15]. Besides, the excellent success rate shown in this research about resolved hydronephrosis is encouraging for the same to hold expectancies that early diagnosis and treatment will bode well regarding long-term complications.

Some additional findings were also noted in this study. First, the mean age in which harbored worsening of hydronephrosis was 8.74 months, and mean age in which resolution took place was 9.35 months. This statistic clearly shows that worsening or improvement in hydronephrosis can be expected especially during this first year of life. Second, means for the internal development of worsening were 14.86 months; for the resolution, it was 8.70 months. Hydronephrosis of the kidney tends to indicate that its internal development may be a predictor of the course. Mean APD measured during the last ultrasound was 2.9 mm for the right kidney and 5.57 mm for the left kidney. The mean recorded directly allows clinically exploring APD as meaningful with its role in assessing severity in hydronephrosis.

These findings have some implications for further research and clinical practice. First, additional research is needed to determine the factors that predict disease progression or regression in the presence of hydronephrosis. This would help in designing a protocol for more individualized treatment of the infant with hydronephrosis. The second is further research to determine the best treatment option for an infant with hydronephrosis. Last, clinicians should know the natural history of hydronephrosis in infants and how to pick out those that are likely to progress or spontaneously resolve. Such information might be utilized for appropriately counseling and educating the parents of an infant with hydronephrosis.

Statement and Declaration

Acknowledgment

Special thanks to my consultant and the staff at Sultan Qaboos Hospital who helped me collect and review data for research purposes.

Conflict of Interest

No conflict of interest.

References

1. Yalçınkaya F, Özçakar ZB (2020) Management of antenatal hydronephrosis. Pediatr Nephrol 35: 2231-2239.
2. Lee RS, Cendron M, Kinnamon DD, Nguyen HT (2006) Antenatal hydronephrosis as a predictor of postnatal outcome: A Meta-analysis. Pediatrics 118: 586-593.
3. Lang J (2006) Urinary tract. Diagnostic ultrasound in small animal practice.Wiley Online Library 109-144.
4. Estrada CR, Peters CA, Retik AB, Nguyen HT (2009) Vesicoureteral reflux and urinary tract infection in children with a history of prenatal hydronephrosis--should voiding cystourethrography be performed in cases of postnatally persistent Grade II hydronephrosis. J Urol 181: 801-806.
5. Hong YK, Lee JH (2015) Evaluation and management of Antenatal hydronephrosis. Child Kidney Dis 19: 8-13.
6. Nef S, Neuhaus TJ, Spartà G, Weitz M, Buder K, et al. (2016) Outcome after prenatal diagnosis of congenital anomalies of the kidney and urinary tract. Eur J Pediatr 175: 667-676.
7. Yang Y, Hou Y, Niu ZB, Wang CL (2010) Long-term follow-up and management of prenatally detected, isolated hydronephrosis. J Pediatr Surg 45: 1701-1706.
8. Hsiao C-Y, Lin H-L, Lin Y-K, Chen C-W, Cheng Y-C, et al. (2014) Urinary tract infection in patients with chronic kidney disease. Turk J Med Sci 44: 145-149.
9. Heyns CF (2012) Urinary tract infection associated with conditions causing urinary tract obstruction and stasis, excluding urolithiasis and neuropathic bladder. World J Urol 30: 77-83.
10. Gökaslan F, Yalçınkaya F, Fitöz S, Özçakar ZB (2012) Evaluation and outcome of antenatal hydronephrosis: A prospective study. Ren Fail 34: 718-721.
11. Yamaçake KGR, Nguyen HT (2013) Current management of antenatal hydronephrosis. Pediatr Nephrol 28: 237-243.
12. Oliveira EA, Oliveira MCL, Mak RH (2016) Evaluation and management of hydronephrosis in the neonate. Curr Opin Pediatr 28: 195-201.

13. Ahmadzadeh A, Tahmasebi M, Gharibvand MM (2009) Causes and outcome of prenatally diagnosed hydronephrosis. Saudi J Kidney Dis Transpl 20: 246-250.

14. Chen F (2009) Genetic and developmental basis for urinary tract obstruction. Pediatr Nephrol 24: 1621-1632.

15. Ucar AK, Kurugoglu S (2020) Urinary ultrasound and other imaging for ureteropelvic junction type hydronephrosis (UPJHN). Front Pediatr 8: 546.

16. Yamin R, Moorani K, Shaikh M, Yamin S (2022) Clinical profile of children with posterior urethral valve at Tertiary Care Center. Pak J Med Sci 38: 1821-1826.