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Etiology of Hydronephrosis in Neonates

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Abstract

Background: Hydronephrosis as a major health issue, has a significant contribution to the loss of kidney function and dialysis. Based on this the aim of this was to evaluate the probably etiology of hydronephrosis in neonates.
Methods: We have evaluated 314 neonates with fetal hydronephrosis (by ultrasonography) as a study group. Cases were followed by voiding cystourethrogram 3 weeks after the start time. In addition, we took a Diethylenetriaminepentaacetic Acid scan at the end of 1st month of childbirth. At the end, we evaluated data based on the statistical analysis. Based on these examinations, etiology of hydronephrosis were examined and recorded.
Results: In total 314 infants with hydronephrosis (55.7% male and 44.3% female) were included. Idiopathic cause (42%) as the most common etiology and vesicoureteric reflux as 2nd most common etiology of hydronephrosis have been evaluated (37.4%).
Conclusions: Based on this finding, different causes can induce hydronephrosis as a different etiology; therefore, we can control and reduce hydronephrosis by checking vesicoureteric reflux as the most common possible etiology.

Keywords: Complications, Prognosis, Hydronephrosis, Neonates

1. Background

Fetal hydronephrosis as one of the most common abnormalities that has occurred in fetals, affecting 0.17 to 2.3% of pregnancies, is found in the prenatal ultrasound examination (1, 2). It occurs as kidney swelling due to failure of normal drainage of the urine from the kidney to the bladder (3, 4). This condition commonly affects only 1 kidney, however, it may involve both kidneys (5, 6). Hydronephrosis is not a primary condition and results from other underlying diseases that result from a blockage or obstruction in the urinary tract (7-9). Acute unilateral obstructive uropathy is one of the most common causes of hydronephrosis, other causes include a torsion of ureteropelvic junction, tumors in or near the ureter, and narrowing of the ureter from congenital defect or injury (2, 10, 11). Clinical manifestations are based on the duration of obstruction; mild symptoms include frequently urinating and increase in urge to urinate (12-14). Other potential symptoms include abdominal or flank sharp pain, nausea, vomiting, incomplete voiding, urinating, pain, and fever (15, 16). This has been diagnosed by an ultrasonography, and since treatment focuses on getting rid of blocking flow of urine based on the obstruction reasons, it represents a transient condition that resolves maturation of tubular function, increasing ability of reabsorption, and maturation of ureteropelvic junction in the kidney (3, 17, 18). Based on this content, hydronephrosis has a high prevalence in children and its etiology varies in different studies. Therefore, the aim of this was an etiology evaluation in neonates with hydronephrosis.

2. Methods

2.1. Study Setting

This is a hospital-based study that was done in the pediatric clinic of Amir Kabir Hospital.

2.2. Study Population

This cross sectional, double blinded clinical trial study was conducted on 314 neonates. The study population included male and females who were diagnosed as fetal hydronephrosis by a pregnancy ultrasonography. Neonates were referred as a unilateral or bilateral anterior-posterior diameter (APD) with more than 5 millimeters in the 28

weeks of pregnancy. Patients with contrast sensitivity and lack of appeasement or follow-up by parents were excluded from the study.

2.3. Measurements

Ultrasound screening in early pregnancy was done. Based on APD, we divided hydronephrosis severity into mild, moderate, and severe, 5 to 9.9 mm as mild, 10 to 14.9 mm as moderate, and more than 15 as severe. In addition, gestational diagnosed ages of hydronephrosis and amniotic fluid volume status have been determined based on the pregnancy ultrasound. In the first 3 weeks of childbirth, the kidneys and urinary tract ultrasonography were done in neonates. In the first month of the childbirth, VCUG and Tc99m-DTPA scan were done in infants, based on these tests, UPJO, VUR, PUV, UVJO, ureterocele, and infection, probably etiology, have been determined. The demographic and clinical checklist information were completed by parents. At the end, SPSS program was used as the analytical method.

2.4. Ethical Considerations

Ethical issues have been completely observed by the authors, these issues were included as plagiarism, data fabrication, double publication, and others. Also, the ethical committee of Arak University of Medical Sciences approved the study protocol.

2.5. Statistical Analysis

Data was collected by the SPSS program and an analysis was conducted by the t-test for quantitative, in frequency, and x^2 for qualitative data. We have used the Fisher's exact test in correlation between hydronephrosis severity and study variables. The significance level was considered as $P < 0.05$.

3. Results

In total, 314 children (Table 1) with hydronephrosis were included (175 males (55.7%) and 139 females (44.3%)), familial history was seen in 6 children (1.8%), the average gestational age in 250 children (79.6) was term and preterm. As shown in Table 2, since 132 children (42%) are idiopathic and do not have a clear etiology in our examination, most common etiology of hydronephrosis in this study was VUR, which was seen in 100 children (31.8%). The lowest prevalence was ureterocele. The mean birth weight was 3430 $\pm$ 44.2 (g). In regards to disease severity, 19 children have severe hydronephrosis, in regards to the amniotic volume, 26 children were polyhydramnius and 22 children were oligohydramnios, and 253 children were normal in the DTPA scan. As shown in Table 3, in the hydronephrosis severity section, severe and moderate severity in VUR etiology, and mild severity in idiopathic etiology, was most common, which was a statistically significant difference in the 2 groups (P = 0.0001). In addition, as shown in Table 4, gender and gestational age in different groups of hydronephrosis etiology were significantly different (P = 0.0001).

Table 1. Demographic Information in Children with Hydronephrosis

Variables	No (%)
Gender	
Male	175 (55.7)
Female	139 (44.3)
Familial History of Hydnephrosis	
Sister	4 (1.2)
Brother	2 (0.6)
Gestational age	
Term	250 (79.6)
Preterm	64 (20.4)
Post Term	0 (0)

4. Discussion

Our results showed etiology prevalence in hydronephrosis and its correlation with different factors such as gender, gestational age amniotic fluid volume, hydronephrosis severity, birth weight, familial history, and severity of hydronephrosis. The following, in the most relevant studies, have been discussed.

Lee et al. in a large metaanalysis, demonstrated that the risk of any postnatal pathology in mild hydronephrosis was 11.9% and the risk of vesicoureteral reflux was not significantly different among all severity (19). Ali et al. in a descriptive retrospective study, evaluated hydronephrosis etiology and their treatment at 2 teaching hospitals of Khyber Pukhtoon Khawa. They have concluded that since obstructive etiology requires surgical correction, physiological hydronephrosis and VUR can be treated by medical treatment. Vemulakonda et al. conducted a study regarding prenatal hydronephrosis. In this study, they evaluated surgical intervention prognosis in this type of hydronephrosis and concluded that it has good prognosis in neonates (20). Niu et al. in a study regarding ureteral polyps as an etiological factor, evaluated 15 cases with hydronephrosis. They have examined UPJ with 3D images and concluded that although it is a important etiology in hydronephrosis, its diagnosis is difficult (21). Yiee et al. in

Table 2. Clinical Information in Children with Hydronephrosis

Variables	No (%)
Cause of Hydronephrosis	
VUR	100 (31.8)
UPJO	60 (19.1)
PUV	0 (0)
Idiopathic	132 (42)
Infection	13 (4.2)
Ureterocele	0 (0)
UVJO	9 (2.9)
Birth Weight, mean ± SD	34.30 ± 44.2
Hydronephrosis Severity	
Mild	193 (61.4)
Moderate	102 (32.4)
Sever	19 (6.2)
Amniotic Fluid Volume	
Normal	266 (84.8)
Polyhydramnius	26 (8.3)
Oligohydramnios	22 (6.9)
DTPA scan	
Normal	253 (80.7)
Impairment drainage	61 (19.3)

Table 3. Correlation between Severity and Etiology of Hydronephrosis

Variables	Hydronephrosis Severity		
	Mild	Moderate	Sever
UPJO	17 (9)	37 (36.2)	6 (33.3)
UVJO	0 (0)	9 (9)	0 (0)
Infection	2 (1.1)	11 (10.7)	0 (0)
VUR			
I, II	35 (18)	2 (2)	0 (0)
III, IV, V	9 (4.5)	41 (40.5)	13 (66.7)
Idiopathic	130 (67.4)	2 (2)	0 (0)

a study regarding management of hydronephrosis, concluded that ultrasounds, voiding cystourethrograms, and nuclear renograms for diagnosis and surveillance are the best management approach in children (22). Kaya et al. in a study regarding hydronephrosis etiology, evaluated 65 children with hydronephrosis in the department of pediatrics nephrology. They have concluded that the problem in terms of diagnosis, monitoring, and treatment of

Table 4. Etiology of Hydronephrosis Associated with Gender and Gestational Age

Variables	UPJO	UVJO	Infection	VUR	Idiopathic
Gender					
Male	33 (55)	5 (55.6)	7 (53.8)	56 (56)	74 (56)
Female	27 (45)	4 (44.4)	6 (46.2)	44 (44)	58 (44)
Gestational Age					
Term	48 (80)	7 (77.8)	10 (76.9)	80 (80)	105 (79.5)
Preterm	12 (20)	2 (22.2)	3 (23.1)	20 (20)	27 (2.5)
Post Term	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)

antenatal hydronephrosis was not constituted (23). Sudhakar et al report procidentia uteri as an etiology of hydronephrosis. In this they have concluded that use of vaginal pessary to prolapse reduction, reversed the obstructive uropathy (24). Drake et al. considered ureteropelvic obstruction as a possible etiology of hydronephrosis in children. In this, they have been reported and reviewed 88 children and infants affected with hydronephrosis secondary to ureteropelvic obstruction (25).

However, due to the very few clinical studies that have been carried out regarding etiology of hydronephrosis, further studies will be needed. It is suggested to evaluate the impact on the gestational age on accuracy of the ultrasonography in diagnosing and grading of hydronephrosis, maternal and fetal factors, and UTI effects on prognosis of hydronephrosis.

4.1. Conclusions

VUR is the most common etiology of hydronephrosis in neonates. Therefore, we can control and reduce hydronephrosis by checking VUR as the most common possible etiology. In addition, deference of prevalence in the male and female gender showed that female sex hormones have a protective effect on prevalence and prognosis of hydronephrosis.

Footnote

Conflicts of Interest: The authors declared no competing interests.

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