Outcome of Antenatal Renal Pelvic Dilatation – Review of Cases from a Tertiary Care Center, in the Armed Forces Hospital, Southern Region, Saudi Arabia

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Abstract

Background: Renal pelvic dilatation (RPD) is the most common abnormality discovered on antenatal ultrasound. Unfortunately, little is known about antenatal hydronephrosis (ANH) and its associated etiology and outcomes. This study aimed to determine the incidence of antenatal RPD to evaluate antenatal resolution/progression and post-natal outcome. Also, this study aims to determine the outcome of patients diagnosed with ANH.

Methodology: The current study followed a retrospective design. Data were collected from the medical records of infants born between 2019 and 2021, with dilated fetal renal pelvis in Armed Forces Hospital, Southern Region, Saudi Arabia. According to the radiological report on the follow-up, the patients were categorized based on their pelvic anteroposterior diameter (APD) detected on the second-trimester ultrasound into: APDs of 5-9.9 mm, 10-14.9 mm, and above 15 mm were classified as mild dilatation, moderate hydronephrosis, and severe hydronephrosis, respectively.

Results: Among patients with RPD, 43.5% had mild dilatation while 33.3% had moderate hydronephrosis and 23.2% had severe hydronephrosis. There was no significant difference in incidence of RPD between mothers of different ages (P=0.302). Moreover, 69.6% of the patients were male with male: female ratio of 2.3:1. Among patients with RPD, 47 infants had good outcomes (68.1%), while 22 patients had poor outcomes. There was a significant difference in outcomes of patients with RPD according to their severity, where mild dilatation had the highest percentage of good outcomes as 86.7% of children with mild dilatation had good outcomes compared with 47.8% of infants with moderate hydronephrosis and 62.5% of those with severe hydronephrosis (P=0.009).

Conclusion: Male infants have higher risk for developing RPD, although gender is not a predictor for severity or outcomes. Among patients with RPD, most patients have good outcomes.

Key Words: Renal pelvic dilatation, antenatal hydronephrosis, infancy, ultrasonography, outcome, retrospective research design.

Introduction

Fetal renal pelvic dilatation (RPD) is the most common abnormality discovered on antenatal ultrasound. The incidence is 1-5% of all pregnancies. RPD may be unilateral or bilateral, but unilateral RPD is more common. It is two times more common among male fetuses, with the male-to-female (M: F) ratio being 2.5:1[1]. Antenatal hydronephrosis (ANH) is the most common congenital abnormality. It is often detected during pregnancy through an antenatal ultrasound (US) examination. This condition is defined as dilated renal pelvis and calyces in neonates [2].

Fetal hydronephrosis is often picked up incidentally on a routine antenatal ultrasound scan. Once detected, the anxiety of both the treating obstetrician and the parents persists until the baby is born and often after [3]. Different classification systems and cut-offs have been used for the detection of RPD. The diagnosis is based on an increased anteroposterior diameter (APD) of the renal pelvis in the transverse plane. Based on renal pelvic APD, it can be further classified into mild, moderate, and severe [4].

Recent studies have reported that ANH is the most common antenatally discovered urinary tract abnormality and that in most cases, ANH is resolved within two months after birth. However, this finding was challenged by other studies suggesting no consensus on the classification and management of ANH to date [5].

One of the current controversies that stems from it is that it is difficult to determine whether this condition is pathological or transient on US imaging. While most cases of ANH resolve spontaneously, the inability to predict the outcome can cause caregivers extreme concern, which could be easily avoidable by early testing. The early detection of persistent ANH may be essential to prevent the progression of renal damage. The effects of untreated ANH manifest as an initial increase in intra-tubular pressure, progressing to the compression of renal blood vessels, culminating in decreased renal perfusion, ischemic tubular atrophy, and thinning of renal cortex and medulla; all these factors contribute to irreversible loss of renal function. Unfortunately, little is known about ANH and its associated etiology and outcomes. Due to the distress associated with this disorder, it is imperative to predict the outcomes and detect the condition during the antenatal stage to determine prognosis and the best course of treatment [2].

Prior research has been done regarding antenatal RPD. A study conducted in Karachi, Pakistan aimed to determine the incidence of antenatal renal pelvic dilatation evaluated antenatal resolution/progression and post-natal outcome. The study concluded that the incidence of RPD is low, and the outcomes were normal in most cases [1]. Another study was conducted at King Abdulaziz University Hospital, Saudi Arabia. It aimed to determine the outcome of patients diagnosed with ANH. The study found that patients with ANH were more prone to develop urinary tract infections (UTIs). Patients with several ANH comorbidities were associated with poor prognoses [2]. Another study was conducted at King Abdulaziz University Hospital, and aimed to determine antenatally diagnosed congenital hydronephrosis incidence and outcomes in a large cohort. The study found that congenital hydronephrosis is the commonest. A large percentage resolved within two months after birth, but underlying anatomical abnormalities were found in 12.1%. Therefore, all babies with antenatally detected hydronephrosis should be examined by ultrasound postnatally, but further radiological investigations should only be performed for persistent, significant APD ≥10 mm [5].

However, little is known about ANH and its associated etiology and outcomes, especially in the Middle East [2]. Therefore, the present study aimed to determine the incidence of antenatal RPD to evaluate antenatal resolution/progression and post-natal outcome.

Methofology

The current study followed a retrospective research design. Data were obtained from the medical records of infants born between 2019 and 2021, with RPD in the Armed Forces Hospital, Southern Region (AFHSR), Saudi Arabia.

Sampling & Sample Size

The inclusion criteria comprised infants born with RPD, who were delivered and treated at the AFHSR. To reduce bias and confounding effects, the exclusion criteria were fetuses with RPD <5 mm, those with other significant abnormalities, and those with loss of follow-up. A purposeful consecutive sampling approach was adopted.

Measures:

We recorded patients' demographic data, fetal parameters, treatment data, laboratory and radiology reports, and patient outcomes. According to the radiological report on the follow-up, the patients were categorized into one of the following three groups based on pelvic APD detected during the second-trimester ultrasound: APDs of 5 to 9.9 mm; 10 to 14.9 mm and above 15 mm were classified as mild dilatation, moderate hydronephrosis, and severe hydronephrosis, respectively. Renal outcomes were assessed postnatally as 'good prognosis', including patients whose RPD improved or resolved, or 'poor prognosis', for patients whose RPD progressed and resulted in complications, such as parenchymal scarring and chronic kidney disease (CKD) with hypertension (HTN).

Data Analysis

The Statistical Package for Social Sciences (IBM, SPSS version 26) was used for data analysis. Descriptive statistics were performed. Frequencies and percentages were calculated for categorical variables, while the mean and standard deviation (SD) was calculated for quantitative variables. The Chi-square (X^2) and Fisher's exact tests were applied, when appropriate, for comparisons between groups to determine significance of differences.

All p-values <0.05 were considered statistically significant.

Ethical Consideration

Ethical approval was obtained from the Institutional Review Board (IRB) at AFHSR. All parents were informed about the adopted privacy policy for their children's data.

Results

In this study, we included 120 newborns who were delivered and treated at the AFHSR. Among those infants, the prevalence of RPD according to classification system of APD was 57.5%. Among patients with RPD, 43.5% had mild dilatation while 33.3% had moderate hydronephrosis and 23.2% had severe hydronephrosis (Figure 1). Among mothers, 55.0% of them did not have any comorbidities, while hypertension was presented in 10.8% of them, while diabetes mellitus and asthma presented in 7.5% and 6.7% had iron deficiency anemia (Figure 2).

Among newborns, transient tachypnea of the newborn (TTN) was the main condition presented in 30.8% of children, while neonatal jaundice and respiratory distress syndrome were presented in 17.5% each (Figure 3).

Among infants with abnormal APD, 66.7% of the mothers were younger than 40 years old, with mean age of (Mean±SD: 33.9±7.9 years). There was no significant difference in incidence of RPD according to mothers' age. Moreover, parity of 46.4% of the mothers of infants with abnormal APD was 1-3, while parity of 43.5% was 4-7. There was significant difference in incidence of RPD according to parity (P=0.042). Furthermore, 50.7% of mothers of infants with abnormal APD did not have any comorbidities. Moreover, 69.6% of the patients were males, with male: female ratio of 2.3:1. However, incidence of RPD did not differ according to infants' gender. Moreover, 46.4% of patients had APGAR score of 9, while 29% had APGAR score of 8. The only significant factor affecting severity of RPD was maternal comorbidities, where having commodities was associated with more severe conditions (Table 1).

Among patients with RPD, 47 infants had good outcomes (68.1%), while 22 patients had poor outcomes. There is a significant difference in outcomes of patients with RPD according to their severity (p=0.009), where infants with mild dilatation had the highest percentage of good outcomes (86.7%), compared with 47.8% with moderate hydronephrosis and 62.5% with severe hydronephrosis. No significant differences were present regarding gender and APGAR score (P=0.196, 0.120 respectively). However, it seems that male infants were associated with better outcomes than females (72.9%, 57.1% respectively), as shown in Table (2).

Table (3) shows that 18.6% of infants had severe (grade I-V) postnatal micturating cystourethrogram (MCUG), while 17.1% had moderate pelviureteric junction (PUJ) and 14.3% had severe posterior urethral valve (PUV). Furthermore, 89.9% of infants had no associated renal anomaly, while 4.3% had polycystic kidney disease (PKD). Moreover, 44.9% needed both medical and surgical management, while 43.5% needed medical management and 10.1% needed surgical management.

Table 1: Demographic factors of participants with normal and abnormal APD and according to severity of RPD

Characteristics	Anteroposterior Diameter				Severity of RPD					
	Normal		Abnormal		Mild		Moderate		Severe	
	No.	%	No.	%	No.	%	No.	%	No.	%
Mothers' age										
• <40 years	40	78.4	46	66.7	17	56.7	17	73.9	12	75.0
• ≥40 years	11	21.6	23	33.3	13	43.3	6	26.1	4	25.0
P-value	0.157				0.302					
Parity										
• 1-3	24	47.1	32	46.4	11	36.7	12	52.2	9	56.3
• 4-7	26	51.0	30	43.5	14	46.7	9	39.1	7	43.8
• ≥8	1	2.0	7	10.1	5	16.7	2	8.7	0	0.0
P-value	0.117				0.042†					
Maternal comorbidity										
• None	31	60.8	35	50.7	17	56.7	10	43.5	8	50.0
• Present	20	39.2	34	49.3	13	43.3	13	56.5	8	50.0
P-value	0.180				0.996					
Child's gender										
• Male	41	80.4	48	69.6	21	70.0	16	69.6	11	68.8
• Female	10	19.6	21	30.4	9	30.0	7	30.4	5	31.3
P-value	0.180				0.996					
APGAR score										
• 6	3	5.9	4	5.8	0	0.0	2	8.7	2	12.5
• 7	9	17.6	9	13.0	1	3.3	5	21.7	3	18.8
• 8	12	23.5	20	29.0	9	30.0	7	30.4	4	25.0
• 9	27	52.9	32	46.4	16	53.3	9	39.1	7	43.8
• 10	0	0.0	4	5.8	4	13.3	0	0.0	0	0.0
P-value	0.180				0.996					

† Statistically significant

Table 2: The relation between outcomes of infants and their demographic factors

		Outcome				
		Good (n=47)		Poor (n=22)		P
		No.	%	No.	%	Value
Hydronephrosis severity as shown at 1st postnatal ultrasonography	Mild	26	86.7	4	13.3	0.009†
	Moderate	11	47.8	12	52.2	
	Severe	10	62.5	6	37.5	
Gender	Male	35	72.9	13	27.1	0.196
	Female	12	57.1	9	42.9	
APGAR Score	6	3	75.0	1	25.0	0.120
	7	5	55.6	4	44.4	
	8	17	85.0	3	15.0	
	9	18	56.3	14	43.8	
	10	4	100.0	0	0.0	

† Statistically significant

Table 3: Patients' outcomes and management

Variables	No.	%
Postnatal MCUG		
• None	2	2.9
• Mild (grade I-V)	8	11.4
• Mild PUJ	6	8.6
• Mild PUV	3	4.3
• Moderate (grade I-V)	5	7.1
• Moderate PUJ	12	17.1
• Moderate PUV	5	7.1
• Severe (grade I-V)	13	18.6
• Severe PUJ	6	8.6
• Severe PUV	10	14.3
Associated renal anomaly		
• None	62	89.9
• PKD	3	4.3
• Single kidney	1	1.4
• Trisomy 13	1	1.4
• Cystic hygroma	1	1.4
• Spina bifida	1	1.4
Postnatal treatment		
• None	1	1.4
• Medical	30	43.5
• Surgical	7	10.1
• Both	31	44.9

MCUG: Micturating cystourethrogram
PUJ: Pelvi-ureteric junction
PUV: Posterior urethral valve
PKD: Polycystic kidney disease

Figure 1: Severity of RPD as assessed by APD

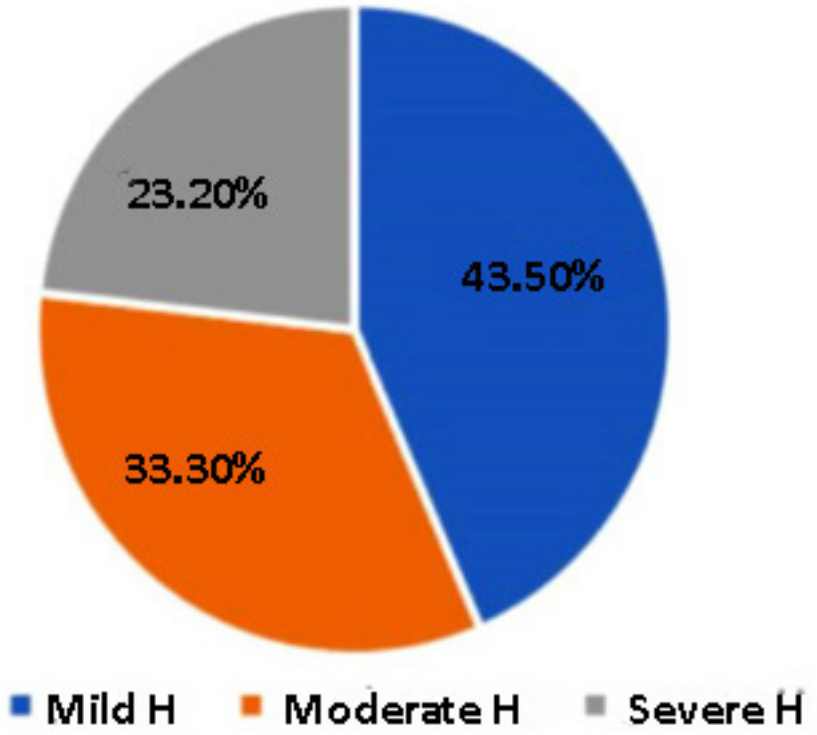


Figure 2: Maternal Comorbities

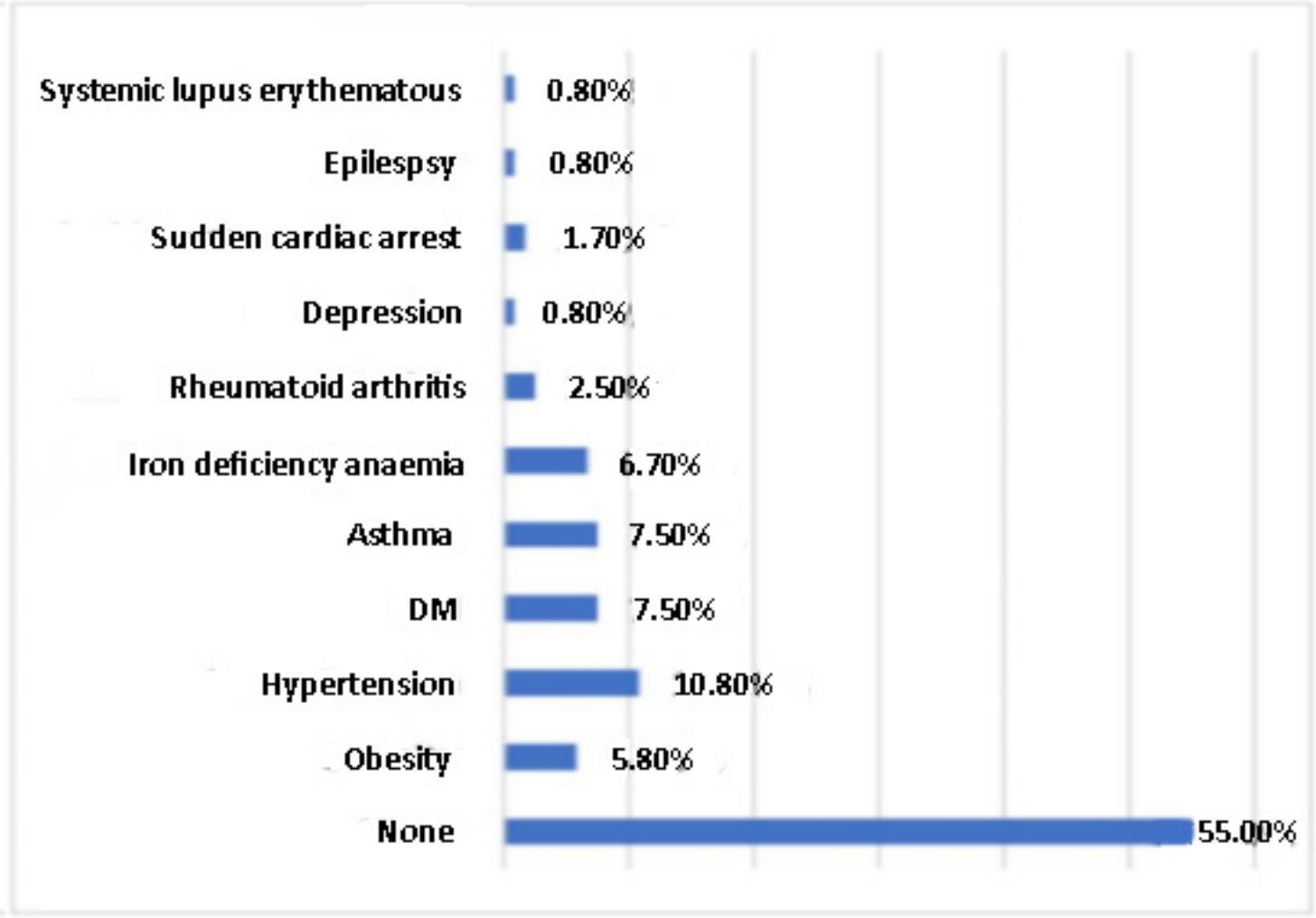
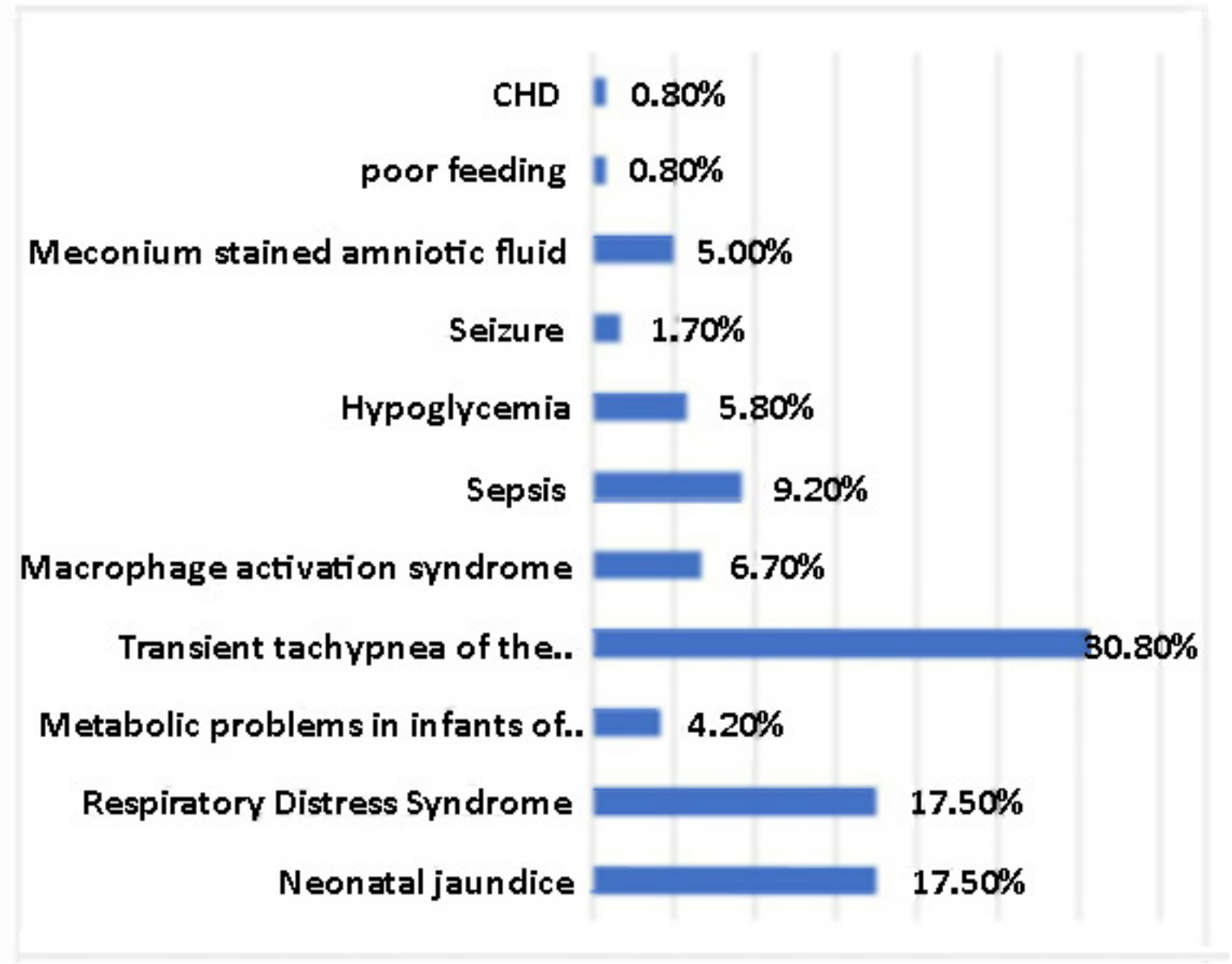


Figure 3: Neonatal characteristics



Discussion

The current study aimed to determine the incidence of antenatal RPD to evaluate antenatal resolution/progression and post-natal outcomes. In addition, this study aimed to determine the outcome of patients diagnosed with ANH.

In our study, we found that 57.5% of children with ANH had transient hydronephrosis. This is in accordance with that reported by Lee et al., who noted that most patients (64%) with ANH had transient hydronephrosis [6]. However, another study found that only 24% of patients had transient hydronephrosis [7].

Moreover, we found that 43.5% had mild dilatation, while 33.3% had moderate hydronephrosis and 23.2% had severe hydronephrosis. In a previous study, 34.9% of children had mild dilatation while 25.4% had moderate hydronephrosis and 39.7% had severe hydronephrosis [7]. Moreover, Cherian et al. reported that 30.1% of infants had mild hydronephrosis, while 43.9% and 25.8% had moderate or severe hydronephrosis, respectively [3].

The present study identified a male predilection among our patients, with a male-to-female ratio of 2.3:1. This is in agreement with those reported by several studies. Safdar et al. reported that 70.3% of infants with ANH were males [2], while Cherian et al. reported that males represented 74.3% of patients [3], and Kari et al. reported that 73.8% of patients were males [5]. Nevertheless, some other studies showed that ANH was 2.5 times more common among females [8–10].

The mean age of mothers in the current study among infants with ANH was 33.9 years, which is higher than that reported in some previous studies [3,5]. Moreover, our study showed that 68.1% of infants showed good outcomes. Similarly, Safdar et al. reported that 48.4% of children with ANH had good outcomes [2]. Furthermore, the study of Kari et al. showed that 48.4% of children with ANH had good prognosis [5].

Despite the unequal gender ratio considering outcomes of the condition, good or poor outcomes of ANH did not differ significantly according to gender of patients. This finding has been also reported by Safdar et al. [2].

In our study, we found that severity of antenatal renal pelvis dilatation was the only factor significantly associated with the outcomes in children with ANH. This result is in agreement with those reported by the meta-analysis of Lee et al., which included 1,308 neonates from 17 studies and showed that the risk of postnatal pathology was proportionate with increasing degree of antenatal renal pelvis dilatation, from 11.9% in mild, to 45.1% in moderate, and 88.3% in severe dilatation [6].

It has been shown that fetuses with minimal pelvic dilatation of 5-9 mm have lower risk of postnatal pathology than those more than 15 mm, who require more close follow-up [11–13]. Several studies have shown that between 78% and 96% of mild ANH cases had good outcomes [1,5,6,9,14]. Kari et al. and Chaudhary and Shah suggested that the outcome is possibly associated with the severity of ANH [5,15].

We found that 18.6% of the infants had severe postnatal MCUG (grade I-V), which is lower than that reported in a previous study which showed that 25% of infants were diagnosed with MCUG [5]. Moreover, 44.9% of children in the present study needed both medical and surgical management while 43.5% of them needed medical management and 10.1% needed surgical management. In a previous study conducted by Chaudhary and Shah, the authors reported that only 12.8% of patients needed surgery [15]. Moreover, another study conducted in Qatar showed that among 311 babies, 14.4% of the cases needed operative interventions [16].

The high percentage of surgical interventions in our patients could be attributed to the nature of our tertiary care hospital, which mainly receives more referred severe conditions than those referred to other hospitals. According to many investigators, an APD of 10 mm or more is considered abnormal [17–19], and 5 mm is recommended by other investigators as cut-off [20,21].

This study had some limitations including its retrospective design, which may lead to absence of some relevant information, and the possible inappropriate reporting of cases. Moreover, this study was conducted in single-center hospital, thus, the generalizability of the results is quite limited. More investigations should be conducted in different hospitals in order to collect larger samples.

In conclusion, male infants have higher risk for developing RPD, although gender is not a predictor for severity or outcomes. Among patients with RPD, most patients have good outcomes.

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