ORIGINAL ARTICLE

Outcome of Acute Renal Failure in Neonates and Its Associating Factors

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ABSTRACT

Objective: To identify various predisposing causes and immediate consequences in new-borns presenting with acute renal failure.

Study design: The study design was case series.

Place & duration: In the Pediatric department of Shifa International Hospital, Islamabad for one-year duration from September 2020 to August 2021.

Material and Methods:A total of 1300 cases were assessed for acute renal failure (ARF)and 98 established cases of ARF being included in the research. The neonates (0-28 days old) who met the criteria for ARF, i.e., anuria/oliguria plus a serum creatinine level more than 1.5 mg/dl, were included in this research. The patient's relevant medical history, physical examination, and laboratory tests were recorded on a separate proforma after given informed permission for the procedure. Each patient's outcome was precisely documented. The statistical software for social sciences was used to examine the data (SPSS20.0). A p-value of less than < 0.05 was considered significant.

Results:A total of 98 cases (7.5 percent) were studied, with 68 (69.4 percent) males and 30 (30.6 percent) females. The ratio of males to females was 1.6:1. According to the study results, the mean age was 9.85± 7.20 days and the mean weight was 2.54± 0.65 kg. The majority of the infants were delivered at a hospital (73.5 percent). The most prevalent ARF symptoms in our neonates were birth asphyxia (30.6%), sepsis (24.5%), respiratory distress syndrome (RDS) (11.2%), and dehydration (9.2%), bleeding in (4.1 percent) and meconium aspiration in 3(3.1 percent). CCF and neurogenic bladder were both present in two patients. In 4 individuals, obstructive uropathy was found, including 2 cases of urethral valve (PUV) blockage and 2 cases of pelvic ureteric junction obstruction (PUJO). Neonates with ARF had a 28.5 percent overall death rate (28 cases).

Conclusion: When it comes to neonates in critical care, acute renal failure is a frequent concern to observe. More than one predisposing factor for acute renal failure was present in the majority of the patients. Preventing acute renal failure in infants may be accomplished by early identification of risk factors and prompt treatment of underlying diseases.

Keywords: Renal failure, Sepsis, Birth asphyxia, Neonates

INTRODUCTION

The glomerular filtration rate (GFR) is an indicator of kidney function as it rapidly declines in acute kidney injury (AKI), also called acute renal failure (ARF)[1-2]. AKI plays a significant role in the morbidity and death of severely sick infants[3-4]. AKI causes nitrogenous waste product excretion to be impaired, as well as water and electrolyte control and acid-base regulation. One of the most prevalent newborn crises observed in the NICU is acute renal failure (ARF)[5]. Acute renal failure develops in newborn neonates due to a variety of causes and risk factors. Birth asphyxia and sepsis were the most prevalent reasons in this research, both of which led to the high fatality rate[6]. The incidence of ARF in hospitalised neonates is estimated to be about 1% in most studies (8- 24 percent)[7]. The most basic and widely used biomarker of new-born renal function is the blood creatinine level. The maternal creatinine concentration is reflected in the serum creatinine concentration shortly after delivery[8]. Plasma creatinine levels steadily drop from 1.1 mg/dl in term new-borns (1.3 mg/dl in preterm infants) to 0.4 mg/dl in the average. In average, each doubling of serum creatinine corresponds to a 50% drop in GFR[9].

Increased plasma creatinine concentration exceeding 1.5 mg/dl for at least 24 hours in term new-borns strongly suggests ARF diagnosis. To diagnose ARF in a new-born child, the GFR must be measured or the plasma creatinine must be followed over time. Urine is passed by new-borns at or shortly after delivery, and usually during the first 24 hours of life. Any variation from this pattern is cause for concern about ARF[10]. Increased blood urea nitrogen (BUN) and creatinine levels, even in the absence of decreased urine production, are significant indications of ARF. Nearly two-thirds of ARF instances in new-borns are prerenal, a third are intrinsic-renal, and the rest are generally post-renal. The majority of instances of ARF in new-borns is self-limiting and responds effectively to conservative care, with sufficient urine output restored within 48-72 hours[10-11]. The aetiology of ARF in neonates is multifactorial, and ARF in new-borns generally has one or more linked contributing factors. The most prevalent related complications are birth asphyxia and sepsis in the majority of cases. Development of ARF in infants has been related to a variety of factors including dehydration, haemorrhage, respiratory distress syndrome (RDS), congestive cardiac failure (CCF), and the use of nephrotoxic medicines[12].

The immediate fate of ARF in infants is strongly reliant on the underlying aetiology, other organ abnormalities, and renal replacement treatment facilities (RRT). In neonates with multi-organ failure, mortality is higher and morbidity is substantially higher. So, we undertook this study with the purpose of understanding the magnitude of various causes and consequences of ARF so that, based on this knowledge, interventions to prevent or minimise mortality and morbidity might be developed, such as screening and early treatment.

MATERIAL AND METHODS

This descriptive case series was undertaken at the Pediatric department of Shifa International Hospital, Islamabad for one-year duration from September 2020 to August 2021. Acute renal failure was found in 98 out of the 1300 patients. Regardless of gender, weight, or gestational age, 98 individuals were assessed for the relationship and result of ARF. Anuria (no urine pass for at least 24 hours) or oliguria were considered significant if the urine pass was less than 0.05. The hospital's ethical review committee granted permission (ERC). After describing the study's benefits and drawbacks, the parents/caretakers gave their informed permission. Non-consenting parents' new-borns and syndromic babies were not included in the research. A detailed history was evaluated, including demographic data, urine output, predisposing variables, ARF relationship, and result. Every patient was given a thorough physical examination. A delayed cry, a history of resuscitation, and/or an APGAR score of 5 minutes after delivery were used to identify cases of birth asphyxia. When septicemia was suspected, the appropriate workup was performed, including a CBC, blood C/S, urine D/R, C/S, and CSF testing. When appropriate, S/E and ABGs were also performed. Relevant investigations such as

ultrasonography KUB, MCUG, and MAG3 were conducted out for obstructive uropathy and congenital renal malformation. For respiratory distress syndrome, an X-ray of the chest was taken (RDS). ECG and ECHO were used to diagnose congestive heart failure (CCF). All instances of ARF were treated conservatively, as per the hospital's usual policy. Intake and output, vital signs, and capillary refill time (CRT) were all closely monitored. Serial measurements of serum electrolytes and renal function were taken.

RESULTS

A total of 98 cases (7.5 percent) were studied, with 68 (69.4 percent) males and 30 (30.6 percent) females. The ratio of males to females was 1.6:1. According to the study results, the mean age was 9.85± 7.20 days and the mean weight was 2.54± 0.65 kg. The majority of the infants were delivered at a hospital (73.5 percent).70.4 percent of the ARF cases were termwhereas 18 (18.4%) were preterm and 11 (11.2%) were post term. Table 1 shows the demographic characteristics of the research participants.

Table 1:

Age in days	Frequency	Percentage	P-value
01 -7	42	42.8	
08 -15	26	26.5	0.001
16 -28	30	30.6	
Gender			
Male	68	69.4	
Female	30	30.6	<0.001
Weight in kg			
<1.5	9	9.2	
1.6- 2.5	12	12.3	
2.6 - 3	46	46.9	<0.001
> 03	31	31.6	
Gestational age			
Full term	69	70.4	
Pre term	18	18.4	<0.001
Post term	11	11.2	
Place of birth			
Hospital	72	73.5	<0.001
Home	18	18.4	

The most prevalent ARF symptoms in our neonates were birth asphyxia (30.6%), sepsis (24.5%), respiratory distress syndrome (RDS) (11.2%), and dehydration (9.2%), bleeding in (4.1 percent) and meconium aspiration in 3(3.1 percent). CCF and neurogenic bladder were both present in two patients. In 4 individuals, obstructive uropathy was found, including 2 cases of urethral valve (PUV) blockage and 2cases of pelvic ureteric junction obstruction (PUJO). Polycystic kidney, hypoplastic kidney, and multicystic dysplastic kidney each had one case.
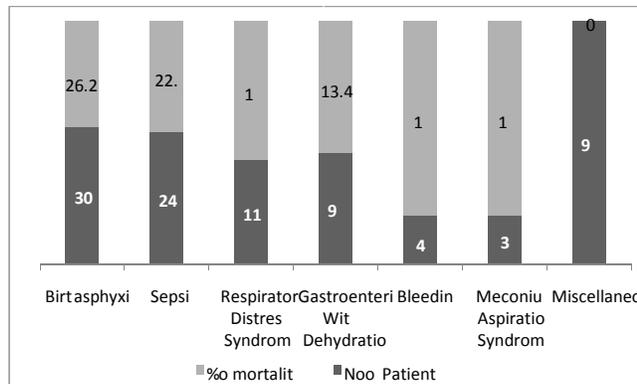

Figure 1: depicts the frequency of etiological profiles and mortality.

Out of 98 neonates, 41 had > 10 WBC in urine D/R, and 18 of the 41 had a positive culture. In eight cases, U/S KUB identified congenital renal abnormalities; however, 64 cases were found to have just renal parenchymal alterations, with the remainder being normal. In 64 patients, the CRT was more than 3 seconds. There were 61children in which mean blood pressure was low, while 37 instances in which it was normal. S/E tests were done in all cases, and the results revealed that 74 patients had iso-natremia, 15 had hyponatremia, and 9 had hypernatremia.

In 40cases, hypokalaemia was detected, 39 cases were of hyperkalemiac, and 19 patients had normal serum potassium levels. Almost every child had a urine output of less than 1 ml/kg/hr at the time of presentation. In 85 patients, the urinary output improved in 72 hours, 7 patients in 96 hours, and 6 patients in a total of seven days with conservative treatment. An ABG was conducted on 60 individuals, 40 of whom exhibited mild to severe metabolic acidosis. Study subjects stayed on average for two weeks. All of the patients were treated conservatively, and none of them were dialyzed due to a lack of facilities in our NICU. Neonates with ARF had a 28.5 percent overall death rate (28 cases). Furthermore, male new-borns had a significant death rate. In instances of birth asphyxia (26.2 percent) and sepsis, total mortality was likewise high. It was surprising to see that there was no mortality in patients of congenital renal malformation associated with obstructive uropathy in this study. 84 individuals made a significant recovery and were able to be released from the hospital with little complications. Contrary to expectations, there was no mortality among patients with congenital renal malformation and obstructive uropathy, according to the findings.Seven patients were sent to the surgical department, whereas five patients disobeyed medical advice.

Table 2:

Test	Mean ± SD	Minimum	Maximum
Blood Urea	119.11± 37.24	53	251
Within 24 hrs	112.1 ± 31.98	51	241
03 Days	94.22 ± 20.15	40	162
05 Days	68.51 ± 17.21	39	132
07 Days	49.10 ± 10.99	21	70
S. creatinine	3.1 ± 1.1	1.8	7.4
Within 24 hrs	2.90 ± 1.09	1.9	5.1
03 days	2.60 ± 0.89	1.8	4.2
05 days	2.30 ± 0.75	1.4	4.9
07 days	1.90 ± 0.54	1.3	3.7

The findings of the study participants' renal function tests are shown in Table 2.

DISCUSSION

In Pakistan, there is a scarcity of information on the causes, risk factors, and outcomes of acute renal failure in new-borns. Pre-renal, renal, and postrenal acute renal failure are the three kinds of acute renal failure[12-13]. The most prevalent kind of ARF is pre-renal failure, which is caused by poor renal perfusion. It is treatable and has a good prognosis if discovered early and the necessary therapy is implemented. Males predominated in this survey, which is similar to many previous studies[14]. This finding might be attributed to gender bias. It is assumed that males are more likely to develop sepsis and RDS. Birth asphyxia and infection were the major causes of new-born ARF in this investigation[15]. Many foreign researchhas cited similar findings. The most common cause of neonatal ARF was birth asphyxia (26.2percent)[16-17]. This is owing to the high occurrence of birth asphyxia in our setting, which is caused by untrained dais and traditional birth attendants doing home births (TBAs). In Mortazavi et alinvestigation's birth asphyxia was found in 29.8% of patients. According to Aired and colleagues, birth asphyxia occurs in 53.4 percent of ARF patients, which is rather significant and contradicts our findings. ARF was found in 17.2 percent of neonates hospitalized with birth asphyxia, according to Nouri and colleagues[18-19]. Renal involvement is common in neonates who have suffered from birth asphyxia, and it is linked to the degree of brain impairment. Because ARF linked

with birth asphyxia is usually non-oliguria, the s. creatinine level in severely asphyxiated infants should be checked regularly. In our research, sepsis caused ARF in 24.5 percent of patients, which is consistent to earlier studies. Shock, disseminated intravascular coagulation (DIC), bleeding, and heart failure are all potential causes of ARF in septic newborns. In an Indian research, 26 percent of septic neonates had ARF, according to Mathur and colleagues[20].

ARF has a significant mortality rate in septic new-borns, with 50-78 percent of cases apparently ending in death. RDS was discovered in 11.2 percent of patients in this research, which is in contrast to Mortazavi's finding of 25.20 percent RDS. If the expectant woman has pregnancy-induced hypertension or a prolonged rupture of membrane (PROM), the risk of new-born RDS may be reduced because the stress of these scenarios might help the infant's lungs to develop sooner. Dehydration was identified in 9.2 percent of our patients, however Mortazavi reported dehydration in 24.2 percent of his cases, about twice what we discovered in our research[21-22]. It's possible that this is due to a delay in seeking medical help. Obstructive uropathy was found in 4 patients in this research, which is comparable to a study from Iran that found 6 cases of obstructive uropathy. Congenital renal malformation was identified in three instances in our investigation, whereas six cases were reported from Iran[23-24]. This might be due to the similarity in how hereditary disorders appear. ARF was found in 7.5 percent of the patients in the present investigation, compared to 2.83 percent in an Iranian study. This might be due to a lack of information about the need of obtaining medical treatment, which could lead to cumulative kidney harm. Our research found an overall death rate of 28.5 percent, which is close to studies from adjacent countries that found mortality rates of 20.5 percent and 20.0 percent, respectively[25].

CONCLUSION

One of the most prevalent newborn crises observed in the NICU is acute renal failure (ARF). Acute renal failure develops in newborn neonates due to a variety of causes and risk factors. Birth asphyxia and sepsis were the most prevalent reasons in this research, both of which led to the high fatality rate.

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