

Acute Kidney Injury: Incidence And Mortality in Critically ill Neonates

Sajid Hussain Sherazi¹, Sidra Farooq², Sadaf Liaqat³, and Asima Khanam⁴

ABSTRACT

Objective: To examine the incidence of acute kidney injury and associated mortality in neonates admitted in neonatal intensive care unit.

Study Design: Prospective study.

Place and Duration of Study: This study was conducted at the Department of Pediatrics, Niazi Medical College Sargodha from 1st July 2018 to 30th June 2019.

Materials and Methods: Total 240 critically ill neonates of both gender admitted to NICU were analyzed in this study. Patients age from 2 to 30 days. Patients detailed history including age, sex and causes of admission to NICU were recorded after taking consent from patient's parents and guardians. Serum creatinine >1.5mg/dl and BUN >20mg/dl on admission and at 24 hours was defined to have acute kidney injury. Risk factors of acute kidney injury and mortality rate were examined.

Results: Twenty six (10.83%) patients had acute kidney injury, in which 18 (69.23%) patients were males while 8 (30.77%) were females with mean age 6.34±5.68 days. 16 (61.54%) patients were preterm and 10 (38.46%) were term neonates. 15 (57.69%) neonates had low birth weight while 11 (42.31%) had normal birth weight. The most common risk factor was sepsis found in 17 (65.38%) neonates followed by birth asphyxia 12 (46.15%) and shock in 7 (26.92%). All patients had one or more risk factors associated to AKI. Mortality rate was significantly high in patients with AKI as compared to patients with non-AKI 34.62% vs. 25 (11.68%).

Conclusion: The incidence rate of acute kidney injury was high in critically ill neonates admitted to NICU. Mortality rate was also high in patients with AKI as compared to non-AKI patients.

Key Words: Critically ill neonates, acute kidney injury, Mortality

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INTRODUCTION

Acute kidney injury (AKI) is a complex disorder and has clinical manifestations ranging from mild dysfunction to complete acute kidney failure. The lack of a universal definition for AKI, till recently, has rendered comparative studies limited and harder to achieve.¹ Acute kidney injury in the newborn is a common problem in the neonatal intensive care unit (NICU) and ranges from 6% to 24%.^{2,3} Many underlying factors may contribute to AKI development, such as asphyxia, respiratory distress syndrome and urogenital anomalies.⁴

In a full-term neonate, the kidney functions are not fully mature and functional maturation continues in the postnatal age. Under normal circumstances, the kidneys adapt to various endogenous and exogenous stresses. However, in sick neonates and in stressful conditions like sepsis and shock, the adaptive capacities of the kidney may be overcome, leading to renal dysfunction.⁵ Permanent renal damage may develop in survivors of AKI in up to 40% of the cases.⁶ It is diagnosed on the basis of clinical history such as decreased urine production (oliguria), and laboratory findings such as elevated blood urea nitrogen and creatinine. Although non-oliguric neonatal kidney injury is being detected with increasing frequency.⁷

A wide variety of predisposing factors such as asphyxia (40%), sepsis (22%), feeding problems (18%), and heart failure, prematurity and urogenital anomalies are commonly reported causes of AKI in the developed countries.⁸ Mortality among hospitalized neonate due to kidney injury was 20-50% and patient with sepsis had significantly higher rate.^{9,10}

The present study was conducted aimed to examine the frequency of acute kidney injury and associated mortality and risk factors in critically ill neonates admitted to NICU.

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MATERIALS AND METHODS

This prospective study was conducted at Department of Pediatrics, Niazi Medical College Sargodha from 1st July 2018 to 30th June 2019. Total 240 critically ill neonates of both gender admitted to NICU were analyzed in this study. Patients ages ranges from 2 to 30 days. Patient’s history including age, sex and causes of admission to NICU were recorded after taking consent from patient’s parents and guardians. Neonates with several congenital anomalies, with post-operative AKI, patients with maternal history of AKI were excluded. Blood samples were collected from all the patients to examine the blood urea, serum creatinine and serum electrolytes. Serum creatinine >1.5mg/dl and BUN >20mg/dl was defined to have acute kidney injury. Urine output <1ml/kg/h defined oliguria. Risk factors of acute kidney injury and mortality rate was examined. Data was analyzed by SPSS 24. Chi square test was applied to compare the mortality among AKI and non-AKI patients. P-value less than 0.05 were considered as statistically significant.

RESULTS

Twenty six (10.83%) patients had acute kidney injury (Fig. 1). In which 18 (69.23%) patients were males while 8 (30.77%) were females with mean age 6.34±5.68 days. 16 (61.54%) patients were preterm and 10 (38.46%) were term neonates. 15 (57.69%) neonates had low birth weight while 11 (42.31%) had normal birth weight. 16 (61.54%) patients were oliguric and 10 (38.46%) patients were non-oliguric (Table 1)

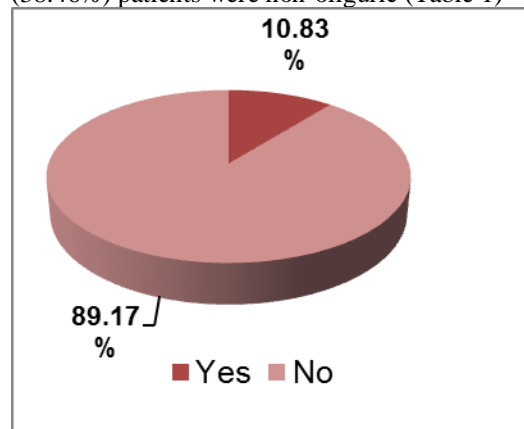


Figure No.1: Frequency of acute kidney injury among all the patients

The most common risk factor was sepsis found in 17 (65.38%) neonates followed by birth asphyxia 12 (46.15%), shock in 7 (26.92%), nephrotoxic drug use in 4 (15.38%), surgical cause in 4 (15.38%) and intrauterine growth retardation (IUGR) in 3 (11.54%) patients. All patients had one or more risk factors associated to AKI (Table 2).

At admission and at 24 hours the mean serum creatinine value, mean blood urea nitrogen (BUN) value, mean

serum sodium value and mean serum potassium value was 2.7±1.24 and 2.6±1.02, 54.3±22.5 and 43.3±21.5, 129.8±5.4 and 127.6±4.3, 6.1±2.3 and 5.8±2.01 (Table 3)

Mortality rate was significantly high in patients with AKI as compared to patients with non-AKI 34.62% vs. 25 (11.68%) [Table 4]

Table No. 1: Demographical details of AKI patients (n=26)

Variable	No.	%
Age (days)	6.34±5.68	
Gender		
Male	18	69.23
Female	8	30.77
Gestational age		
Term	10	38.46
Preterm	16	61.54
Birth weight		
Normal	11	42.31
Low	15	57.69
Oliguric		
Yes	16	31.54
No	10	38.46

Table No. 2: Risk factors associated to acute kidney injury

Risk factors	No.	%
Sepsis	17	65.38
Asphyxia	12	46.16
Shock	7	26.92
Nephrotoxic drugs	4	15.38
Surgical cause	4	15.38
IUGR	3	11.54

Table No 3: Serum creatinine and serum electrolyte among AKI patients

Variables	At admission	At 24 Hours
Serum creatinine mg/dl	2.7±1.24	2.6±1.02
BUN mg/dl	54.3±22.5	43.3±21.5
Serum potassium mmol/l	6.1±2.3	5.8±2.01
Serum sodium mmol/l	129.8±5.4	127.6±4.3

Table No 4: Comparison of mortality between AKI and non-AKI patients

Mortality	AKI	Non-AKI	P value
Yes	9 (34.62%)	25 (11.68%)	0.036
No	17 (65.38%)	189 (88.32%)	

DISCUSSION

Acute kidney injury is one of the most common life threatening disorders found all over the world with high rate of morbidity and mortality.^{11,12} Neonates admitted to NICU due to critical illness were on high risk to

develop AKI. Many of studies reported that AKI rate was high in neonates admitted to NICU.^{13,14} the present study was conducted to examine the prevalence of acute kidney injury in critically ill neonates admitted to NICU. Also examine the mortality among AKI and non-AKI patients. In our study 240 neonates were analyzed. Out of 240 patients 26 (10.83%) neonates had developed acute kidney injury. A study conducted by Haider et al¹⁵ regarding frequency of acute kidney injury in critically ill neonates and reported incidence rate of AKI was 4.66% among 300 neonates. A study conducted in Turkey reported the incidence rate of AKI was 8.4%.¹⁶ another multicenter studies reported the incidence rate of AKI among newborn was 29.9%.¹⁷ In present study majority of patients were males 69.23% as compared to females 30.77% with mean age 6.34±5.68 days. These results showed similarity to several previous studies in which male patients were high in numbers as compared to females with ages ranging 1 to 30 days.^{18,19}

In this study, the most common risk factor was sepsis found in 17 (65.38%) neonates followed by birth asphyxia 12 (46.15%), shock in 7 (26.92%), nephrotoxic drug use in 4 (15.38%), surgical cause in 4 (15.38%) and IUGR in 3 (11.54%) patients. All patients had one or more risk factors associated to AKI. A study by Haider et al¹⁵ reported sepsis was the most common predisposing factor found in 71.43% followed by birth asphyxia in 52.86% and shock 21.43%. Another study conducted by El-Badawy et al¹⁹ reported that sepsis was the most common risk factor for developing AKI in neonates. In our study we found that preterm neonates and neonates with low birth weight had high incidence rate of AKI as compared to non-AKI patients. Many of previous studies reported that preterm delivery and low birth weight were the most common risk factors associated in developing acute kidney injury.²⁰⁻²²

In present study mortality rate was significantly high in patients with AKI as compared to patients with non-AKI 34.62% vs. 25 (11.68%). These results showed similarity to many of other studies in which patients with AKI had high mortality rate 15 to 35% as compared to patients with non-AKI.^{23,24}

CONCLUSION

Acute kidney injury is a common clinical disorder with high rate of mortality and morbidity especially in critically ill neonates. The incidence rate of acute kidney injury was high in critically ill neonates admitted to NICU. Preterm, low birth weight, sepsis, birth asphyxia and shock were the factors associated to AKI. Mortality rate was also high in patients with AKI as compared to non-AKI patients.

Author's Contribution:

Concept & Design of Study: Sajid Hussain Sherazi
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Revisiting Critically: Sajid Hussain Sherazi, Sidra Farooq
Final Approval of version: Sajid Hussain Sherazi

Conflict of Interest: The study has no conflict of interest to declare by any author.

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