

Acute kidney injury in neonatal septicemia

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Abstract

Objective: Acute kidney injury is most common disease among the Newborn admitted in NICU. The aim of our study to find out Prevalance, associated factors and outcome of Acute kidney injury.

Material and Method: observational hospital based single center retrospective cohort study.

- Duration: Jan – 2020 to Dec. 2020, Conducted at J K Lon Hospital Govt. medical College, Kota.

Neonatal sepsis is diagnosed on the basis of either positive sepsis screen or a positive blood culture in symptomatic neonates. Acute renal failure is defined as S. Creatinine > 1.5mg/dl. Total neonates’ positive sepsis screen 452, out of which 136 neonate associated AKI.

Result: Total 452 neonates having septic screen positive, 136/452 neonates with sepsis had AKI; having higher average duration of stay in hospital (14 days) having higher mortality (40.4%) than neonatal sepsis without AKI (24.3%). Neonatal septicemia with AKI more seen in term (77.9%) (p value 0.002) than preterm (22.1%), low birth weight (p value 0.001) (68.6%) and but have no sex predilection and late onset sepsis

having significant association with AKI (p value < 0.001).

Conclusion: AKI in neonatal septicemia more in low birth weight, term children than preterm, Late onset sepsis, having higher duration of stay in hospital and higher mortality.

Keywords: New Born, Acute Kidney Injury, Neonatal Sepsis, NICU.

Introduction

Acute kidney injury (AKI) is a commonly seen disease among ill neonates, admitted to neonatal intensive care units (30%) (1). Decreased renal perfusion, low glomerular filtration rate, increased renal vascular resistance, and high plasma renin activity are cause for acute renal impairment in the sick newborn (2). Neonatal AKI may be transient and reversible if underlying disorders appropriately treated.

The known contributing factors for AKI divided into two major causes -

a) Post Natal cause: neonatal septicemia, respiratory distress syndrome, low birth weight, prematurity, intracranial hemorrhage, perinatal asphyxia, dehyd

ration, genitourinary abnormality, necrotizing enterocolitis, drug nephrotoxicity, Male gender.

b) Antenatal cause: preeclampsia, premature rupture of membranes and antenatal steroid treatment.

There is multiple contributing factor is involved in the pathogenesis of AKI in neonates with septicemia(1,4-8). It is important to prevent AKI by rapid diagnosis of patients with risk factors and effective treatment of individuals with AKI so that can reduce the mortality of septic new born in our NICU set up. The aim of this study was to identify the risk factors and outcome of AKI in neonates with documented septicemia in our NICU center in J. K. Lon hospital associated with medical college Kota. We are studying postnatal factors associated with AKI which generally encountered in our setup.

Methods

Study Type: Observational hospital based single center retrospective cohort study.

Study Place: At JK lone Hospital associated with Govt. Medical College Kota.

Study Duration: Jan.-2020 to Dec.- 2020,

Selection {inclusion} Criteria of Patient: All Neonate admitted in NICU with a) positive sepsis screen b) Positive blood culture.

Exclusion criteria: Gestational age <28 weeks, all new born those parents do not wants to be part of study. Neonates with severe perinatal asphyxia, maternal history of renal dys function, major congenital anomalies, congenital anomalies of the kidney and urinary tract, genetic syndromes, and post operative AKI were excluded.

Procedure

Neonatal sepsis is diagnosed on the basis of either positive sepsis screen or a positive blood culture in

symptomatic neonates. Acute Kidney Injury is defined as Serum Creatinine >1.5mg/dl.

Total neonates positive sepsis screen 452, out of which 136 neonate associated AKI.

Sepsis screen

Components	Abnormal values
Total leukocyte count	<5000/mm ³ ->30, 000 1 ST Day of life >15000 rest day of life
Absolute neutrophil count	<1750/mm ³
Immature/total neutrophil	>0.2
µESR	1 st 7 day of life,> age+2, and>10 mm in 1 st hour after 7 day
S.CRP	>1mg/Dl

Any of 2 sepsis screen positive for neonatal sepsis or Blood culture positive single criteria for neonatal sepsis. Diagnosis of AKI was established based on one or more of the following criteria:

- 1) Serum Creatinine (Cr) > 1.5mg/ dl after the first 48-72 hours of life with normal maternal serum Cr.
- 2) Doubled serum Cr level during hospital admission
- 3) Increasing serum Cr level at a rate of 0.3mg/dL/24h.
- 4) Blood urea nitrogen (BUN) >20mg/ dl on two separate occasions at least 24 hours apart. This study was performed on 452 neonates with sepsis screen positive, divided into 2 groups with AKI (n=136) and without AKI (n=316) during Jan-2020 to Dec. 2020 in J.K. Lone hospital. Septicemia was suspected in neonates with fever, poor feeding, vomiting, lethargy, or irritability; it was confirmed by a positive neonatal sepsis screen. The sepsis screen positive new born death (total death) is divided into neonates expired with AKI and neonates expired without AKI. Neonates with sepsis with AKI divided into two group (a) Term and Preterm, (b) Low birth weight (<2.5kg) and normal birth weight (2.5kg or

> 2.5kg). (c) Early onset sepsis and Late onset sepsis (d) Inborn neonates and out born neonates. (e) neonatal sepsis with AKI in Male neonates and in Female neonates and P value calculated of each group to see significant association between them.

The average duration of stay in hospital of Neonates with sepsis is divided into two group (a) Average duration of stay in hospital of Neonates with sepsis with AKI (b) The average duration of stay in hospital of Neonates with sepsis without AKI.

Ethical Approval

Appropriate ethical approval was taken from ethical committee and informed consent was taken from parents /guardians.

Statistical Analysis

SPSS statistical software was used for analysis and values were reported as mean +/- SD [for values following a normal distribution]. The degree of association between all variables studied was analyzed using Pearson coefficient of correlation.

Results

Out of the 452 neonates with sepsis, 136 had neonatal sepsis with AKI and 316 neonatal sepsis without AKI. Out of 136 neonates with sepsis with AKI. Term neonates were 106 (77.9%) preterm neonates were 30 (22.1%). Out of 136 neonates LBW were 93/ 136 (68.6%) and Normal birth weight were 43/136(31.37%). Out of 136 neonate inborn neonates with sepsis with AKI were 40/136 (29.4%) and out born neonates with sepsis with AKI were 96/136 (70.5%). Out of 136 neonates with sepsis with AKI early onset sepsis with AKI were 40/136 (29.4%) late onset with AKI Were 96/136 (70.56%). Total neonates expired 132/452 (29.20%), Neonates expired with AKI were 55/136 (40.4%) in which septicemia with AKI with shock were 44/55

(80%). Neonates expired without AKI were 77/ 316 (24.3%) in which septicemia without AKI with shock were 23/77 (30%). Average duration of stay in hospital neonatal sepsis with AKI were 14 days and neonatal sepsis without AKI = 8days. In Neonatal sepsis with AKI no. of male were = 64/ 136 (47.2%) (total no. of males were 254); and no. of female were = 72/ 136 (52.9%) (total no. of female were 198).

The comparison table 1. showing that AKI is more associated with LBW infants P values 0.001, Late onset sepsis P value <0.0001, sepsis with shock p value <0.001, Term infant 0.002, mortality is more associated with AKI infant P values 0.02.

In table 2. showing that in our study AKI is significantly associated with Meningitis P value 0.03, NEC P value 0.05, Asphyxia P value 0.02 and neonatal septicemia P value 0.02. In case of Pneumonia and CHF there is no significant association with AKI seen.

Table 3. showing that septicemia associated with AKI having significant percentage death 40% but in septic neonates without AKI having 24.3% death. In our study the total death percentage was 29.2% in which neonate associated with AKI having 40% death and without AKI having 24.3% death.

Discussion

Renal dysfunction occurs in 30% of neonates with septicemia. Recovery and prognosis of acute renal failure depend on the underlying etiology, early diagnosis, hemodynamic instability, multi organ failure with application of mechanical ventilation, Vaso pressor treatment, and renal replacement therapy (1,4,6,7). Most patients in the present study had predisposing factors for AKI, such as infections, birth asphyxia and maturity (1,7). In our study, AKI seen in male and female with equal incidence which having different conclusion in study Azar Nickavar et al, where AKI more common in

male than female which is secondary to the increased incidence of septicemia and respiratory distress syndrome in male infants (1,5,6). However, in a study by Momtaz et al., a higher incidence was reported in female neonates (8). In our study AKI was more common in term and low birth neonates, which showing different result from study Azar Nickavar et al where AKI frequent in preterm infants (1,2,6). In a study by Mathur et al., low birth weight was an important risk factor for AKI in neonates with septicemia and was more common in small and sick infants (3). In our study the AKI Associated with neonatal septicemia having higher incidence of mortality and hospital stay duration, showing similar conclusion with other studies Azar Nickavar et al (1), Mathur et al (3), Gaurav Jaggrawal et al (9). In our study the AKI is more common in late onset sepsis showing similar conclusion with Gaurav Jaggrawal et al (9) study. Our study also showing that AKI significantly associated with meningitis (p value 0.03), NEC (P value 0.05), Asphyxia (p value 0.02) and neonatal septicemia (p value 0.02) and higher percentage (40%) mortality associated with AKI.

Limitation of Study

This is a Single Center Study, short duration study, relatively small sample size while study need multiple center data and large sample size for other disease specific association of death with AKI.

Conclusion

The present observational study clearly reveal that AKI is a very common entity among septic neonates. Low birth weight is an important risk factor for the development of AKI in septic neonates.

The high mortality among septic neonates with AKI stresses the need for septic neonates to be screened for renal failure. In newborn having septicemia with AKI having more duration of stay.

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Tables

Table 1: Comparison of Septic Neonates with and without AKI.

No of subjects	With AKI (136)	Without AKI (316)	P value
LBW	93	134	0.001
Late onset sepsis	55	94	<0.0001
Sepsis with shock	44	16	<0.0001
Term	106	162	0.002
Mortality	55	88	0.02

Table 2: Comparison of neonates with and without AKI

	Total cases (452)	With AKI (136)	Without AKI (316)	P value
Meningitis	74	22	52	0.03
Pneumonia	164	30	134	0.995
NEC	20	10	10	0.05
Asphyxia	34	16	18	0.02
Septicemia	156	56	100	0.02
CHF	4	2	2	0.5

Table 3: Comparison of Septic Neonates death with and without AKI

	Total	Aki	Without Aki
Cases	452	136	316
Death	132	55	77
Percentage	29.2 %	40.4 %	24.3 %