

Original Research Article

TO STUDY THE PREVALENCE OF ACUTE KIDNEY INJURY IN PRETERM NEWBORN IN SPECIAL NEWBORN CARE UNIT

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ABSTRACT

Background: Acute kidney injury (AKI) is a significant cause of morbidity and mortality among preterm neonates admitted to Special Newborn Care Units (SNCUs). Diagnosis is commonly based on serum creatinine rise and reduced urine output, although serum creatinine is a delayed marker of renal dysfunction. Preterm neonates are highly vulnerable to AKI because of immature nephrogenesis, poor renal perfusion, sepsis, hemodynamic instability, and exposure to nephrotoxic interventions.

Materials and Methods: This prospective observational study was conducted in the SNCU of Kamla Raja Hospital, Department of Pediatrics, Gajra Raja Medical College, Gwalior, Madhya Pradesh, over a period of 24 months. All preterm neonates (<37 weeks gestational age) admitted during the study period were screened for AKI using KDIGO criteria. Clinical details, maternal risk factors, laboratory investigations, urine output, AKI staging, and outcomes were recorded. Data were analyzed using SPSS version 20, and $p < 0.05$ was considered statistically significant.

Results: The prevalence of AKI among preterm neonates was 7.5%. Male neonates constituted 67% cases. Stage I AKI was most common (47%), followed by Stage II (31%) and Stage III (22%). Neonatal sepsis (37%), shock (19%), dehydration (14%), and perinatal asphyxia/HIE (12%) were major associated morbidities. Mortality was observed in 32% neonates and was significantly higher in Stage III AKI and very preterm neonates ($p < 0.0001$). Maternal complications such as APH, pre-eclampsia, eclampsia, and chorioamnionitis showed significant association with AKI severity and mortality. Hyperkalemia and hypocalcemia were also significantly associated with poor outcome.

Conclusion: AKI is a common and serious complication among preterm neonates admitted to SNCU. Early recognition, routine renal monitoring, prompt management of sepsis and electrolyte abnormalities, and identification of maternal risk factors are essential to improve neonatal outcomes and reduce mortality.

Keywords: Acute kidney injury, AKI, Preterm neonates, Special Newborn Care Unit, SNCU, KDIGO staging.

INTRODUCTION

Acute kidney injury (AKI) is classically defined as a sudden decline in kidney function resulting in derangements in fluid balance, electrolytes, and waste products. Currently, the diagnosis of AKI is dependent on a rise in serum creatinine (SCr) or

decrease in urine output. According to Youssef D 2015,^[1] SCr is a suboptimal biomarker as it is a marker of kidney function, not damage. As a result, there is a significant delay in the rise of SCr after an insult (forty-eight to seventy-two hours) and a significant amount of function has to be lost before SCr will rise (fifty percent of the GFR).

Acute kidney injury is a common occurrence in the Special Newborn Unit (SNCU). While the exact prevalence is unknown, available data show a variable incidence of 6-24% percent in SNCU. In utero nephron development begins at 5 weeks' gestation and continues to 34–36 weeks of gestation. The majority of nephrogenesis occurs late in pregnancy with up to 60% of nephrogenesis occurring in the third trimester. The kidneys of Preterm neonates are particularly susceptible to hypoperfusion because of high renal vascular resistance, high plasma renin activity, low glomerular filtration, decreased intracortical perfusion rate, and decreased reabsorption of sodium in the proximal tubules in the first few days of life.

The pathophysiology of neonatal AKI is complex and multifactorial. In preterm neonates, AKI is typically a result of renal hypoperfusion (pre-renal causes), ischemia-reperfusion injury, sepsis-associated inflammation, exposure to nephrotoxic drugs, and hemodynamic instability. Compounding this vulnerability are frequent exposures to therapeutic interventions such as mechanical ventilation, vasopressors, and antibiotics. AKI in this population often develops as a complication of another primary illness, making it difficult to detect early without active surveillance.

Several maternal factors can impair nephrogenesis or compromise fetal perfusion, leading to an increased predisposition to renal dysfunction after birth. Recognizing these maternal factors is crucial, as they offer opportunities for early identification, prenatal counseling, and risk stratification. Importantly, maternal risk factors are often preventable or manageable with timely antenatal care, and their identification can guide delivery planning and early neonatal monitoring.

Neonatal AKI has been shown to be associated with adverse outcomes including increased length of mechanical ventilation, prolonged length of stay, and rise in mortality. Despite the high prevalence and significant consequences of AKI in preterm neonates, there remains a paucity of data, particularly from SNCU settings in developing countries.

Understanding the prevalence, clinical profile, associated maternal and neonatal risk factors, and outcomes of AKI in preterm neonates admitted to SNCUs is vital for:

- Enhancing clinical awareness and early detection of AKI.
- Informing maternal risk screening protocols.
- Guiding neonatal resuscitation and fluid management.
- Reducing AKI-associated morbidity and mortality.

There is a critical need for local studies that:

- Accurately determine the prevalence of AKI in preterm infants admitted to SNCUs.
- Identify modifiable risk factors such as sepsis, hypotension, perinatal asphyxia and maternal risk factor

- Evaluate the short-term outcomes including mortality, duration of hospital stays, electrolyte derangements and renal recovery.

Aim and objectives:

- To study prevalence of acute kidney injury in preterm neonates in Special Newborn Care Unit
- To find out prevalence of acute kidney injury in preterm neonates in Special Newborn Care Unit
- To study the clinical outcomes, severity and mortality associated with Acute Kidney Injury.
- To study the associated maternal and neonatal risk factors of Acute Kidney Injury.

MATERIALS AND METHODS

This prospective observational study was conducted at Special Newborn Care Unit (SNCU), Kamla Raja Hospital, Department of Pediatrics, Gajra Raja Medical College, Gwalior (M.P.) Written informed consent was obtained from the parents.

Study Design: This prospective observational study was conducted to evaluate the prevalence, clinical course, risk factors, severity, and outcomes of acute kidney injury (AKI) in preterm neonates admitted to the Special Newborn Care Unit (SNCU).

Study Setting: The study was carried out in the Department of Pediatrics, Kamla Raja Hospital, affiliated with Gajra Raja Medical College, Gwalior, Madhya Pradesh.

Study Population: The study included all preterm neonates (<37 weeks gestational age) admitted to the SNCU during the study period of 24 months. Eligible neonates were screened for AKI and followed throughout their hospital stay.

Inclusion Criteria

- Preterm neonates (<37 weeks gestational age) admitted to the SNCU.
- Neonates diagnosed with AKI during hospital stay within the first 28 days of life.

Exclusion Criteria

- Term neonates (≥ 37 weeks gestational age).
- Parents or guardians who declined consent for participation in the study.

Sample Size: After obtaining approval from the Institutional Ethics Committee, all preterm neonates admitted to the SNCU during the 24-month study period were enrolled. A total of 1332 preterm neonates were admitted, among which 100 neonates developed AKI, giving a prevalence of 7.5%. These neonates were further evaluated for risk factors, severity, and outcome.

Ethical Considerations

- Ethical approval was obtained from the Institutional Ethics Committee of Gajra Raja Medical College, Gwalior, Madhya Pradesh (Approval No. 131/IEC-GRMC/2023).
- Written informed consent was obtained from parents or guardians before enrolment.
- Confidentiality of all patient-related information was strictly maintained throughout the study.

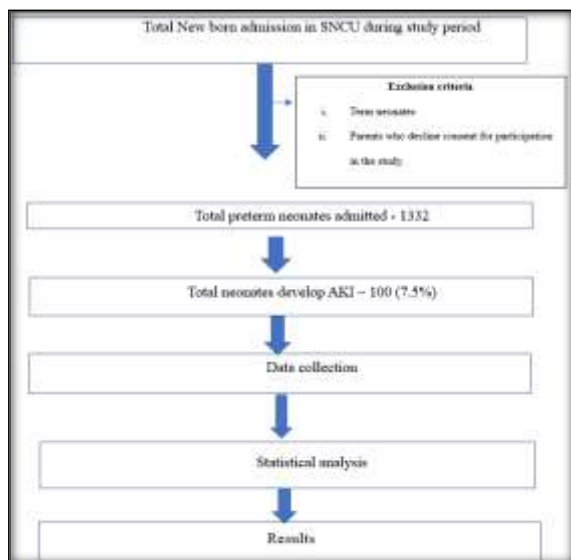


Figure 1: Study flow chart

Methodology: After approval from the Institutional Ethics Committee (IEC), the study was initiated in the SNCU of Kamla Raja Hospital, Gwalior.

Enrolment and Consent: Eligible preterm neonates admitted to the SNCU were identified, and informed written consent was obtained from their parents or guardians after explaining the objectives, procedures, risks, and benefits of the study.

Clinical Assessment and Data Collection: Baseline demographic details, birth history, and maternal history were recorded on admission. Clinical parameters including gestational age, birth weight, mode of delivery, Apgar score, and maternal risk factors were documented. Anthropometric measurements such as weight, length, and head circumference, along with vital parameters including heart rate, respiratory rate, and capillary refill time, were recorded.

Laboratory Investigations: Blood samples were collected under aseptic precautions on days 1, 3, and 7 of admission. Laboratory investigations included serum creatinine, blood urea nitrogen (BUN), and serum electrolytes including sodium, potassium, and calcium. Urine output monitoring was also performed whenever required.

Follow-up and Outcome Assessment: Neonates diagnosed with AKI were monitored throughout their SNCU stay. Serial clinical and laboratory assessments were performed on days 3 and 7. Final outcomes were recorded as discharge, referral, or death.

Statistical Analysis: Data were analyzed using SPSS software version 20. Statistical analysis was performed using the paired t-test. A p-value >0.05 was considered statistically insignificant, p<0.05 statistically significant, and p<0.01 highly significant.

RESULTS

The present study, male neonates constituted the majority of cases, accounting for 67% (n=67), while females comprised 33% (n=33), indicating a male predominance among preterm neonates with AKI. Early neonates (0–7 days) represented 51% (n=51) of cases, which was slightly higher than late neonates (49%, n=49). Most neonates had low birth weight, with 32% weighing 1000–1499 g and 16% weighing <1000 g. AGA neonates comprised 64%, while 36% were SGA. According to prematurity, 42% were late preterm, 34% moderate preterm, and 24% very preterm. [Table 1]

The prevalence of acute kidney injury (AKI) among preterm neonates in the present study was 7.5%. Out of a total of 1,332 preterm neonates admitted during the study period, 100 neonates developed AKI, while 1,232 neonates did not develop AKI.

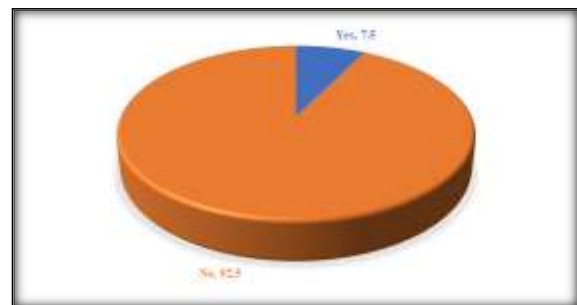


Figure 2: Prevalence Of Acute Kidney Injury Among Preterm Neonates.

Table 1: Baseline Characteristics and Clinical Profile of Preterm Neonates with AKI (n = 100)

Variables	Category	Number of Cases	Percentage
Gender	Male	67	67
	Female	33	33
Age of Neonate	Early Neonate (0–7 days)	51	51
	Late Neonate (8–28 days)	49	49
Birth Weight (grams)	<1000	16	16
	1000–1499	32	32
	1500–1999	24	24
	2000–2499	28	28
	≥2500	0	0
Fetal Growth	AGA	64	64
	SGA	36	36
	LGA	0	0
Degree of Prematurity	Very Preterm	24	24
	Moderate Preterm	34	34
	Late Preterm	42	42
Socioeconomic Status	Lower Class (V)	38	38

	Upper Lower (IV)	25	25
	Lower Middle (III)	18	18
	Upper Middle (II)	12	12
	Upper Class (I)	7	7
Mother's Age (Years)	21–25	30	30
	26–30	39	39
	31–35	31	31
ANC Complications	None	14	14
	APH	8	8
	PROM	8	8
	Pre-eclampsia	11	11
	GDM	10	10
	Eclampsia	9	9
	H/o Chorioamnionitis	7	7
	Oligohydramnios	13	13
	Thyroid Disorders	6	6
	Polyhydramnios	14	14
Mode of Delivery	NVD	56	56
	Emergency C-section	44	44
ANC Steroid Use	Yes	36	36
	No	64	64

The majority belonged to lower socioeconomic class (38%). Most mothers were aged 26–30 years (39%). Common ANC complications included polyhydramnios (14%), oligohydramnios (13%), pre-eclampsia (11%), and GDM (10%). Normal vaginal

delivery was seen in 56% cases, while 44% underwent emergency caesarean section. Only 36% mothers received antenatal steroids, whereas 64% had no ANC steroid exposure. [Table 1]

Table 2: Morbidity Profile, AKI Severity, and Clinical Outcome among Preterm Neonates with AKI (n = 100)

Variables	Category	Number of Cases	Percentage
Morbidity Profile	Perinatal Asphyxia & HIE	12	12
	Neonatal Sepsis	37	37
	NEC	5	5
	Dehydration	14	14
	Shock	19	19
	Respiratory Distress	5	5
	Others	8	8
Serum Creatinine Values during First 48 Hours	SCr rise <0.3 mg/dL	14	14
	SCr rise ≥ 1.5 – $1.9 \times$ baseline	45	45
	SCr rise ≥ 2.0 – $2.9 \times$ baseline	26	26
	SCr rise $\geq 3 \times$ baseline	15	15
Urine Output	≥ 0.5 ml/kg/h	19	19
	<0.5 ml/kg/h $\times 6$ – 12 h	52	52
	<0.5 ml/kg/h for >12 h	22	22
	<0.3 ml/kg/h for ≥ 24 h	7	7
KDIGO Stage	Stage I	47	47
	Stage II	31	31
	Stage III	22	22
Clinical Outcome	Discharged	61	61
	Died	32	32
	Referred Out	4	4
	LAMA	3	3
Duration of Hospital Stay	<3 Days	20	20
	3–7 Days	34	34
	>7 Days	46	46

Neonatal sepsis was the most common morbidity associated with AKI, seen in 37% cases, followed by shock (19%), dehydration (14%), and perinatal asphyxia with HIE (12%). NEC and respiratory distress were observed in 5% cases each. Regarding serum creatinine, 45% neonates showed a rise of ≥ 1.5 – 1.9 times baseline, while 26% had a rise of ≥ 2.0 – 2.9 times baseline and 15% had ≥ 3 times rise, indicating significant renal dysfunction in many neonates.

Oliguria was common, with 52% neonates having urine output <0.5 ml/kg/hr for 6–12 hours, while 22%

had oliguria for >12 hours and 7% had severe oliguria (<0.3 ml/kg/hr for ≥ 24 hours). According to KDIGO staging, Stage I AKI was most common (47%), followed by Stage II (31%) and Stage III (22%). Regarding outcomes, 61% neonates were discharged, whereas mortality was observed in 32% cases. Referred and LAMA cases accounted for 4% and 3%, respectively. Hospital stay was prolonged in many neonates, with 46% staying for >7 days, while 34% stayed for 3–7 days and 20% for <3 days. [Table 2]

Table 3: Association of Clinical Variables with Outcome among Preterm Neonates with AKI

Variables	Category	Discharged N(%)	Died N(%)	Total N(%)	P-value
KDIGO Stage	Stage I	38 (62.30)	6 (18.75)	44 (47.31)	<0.0001*
	Stage II	18 (29.51)	11 (34.38)	29 (31.18)	
	Stage III	5 (8.20)	15 (46.88)	20 (21.51)	
	Total	61 (100.00)	32 (100.00)	93 (100.00)	
Degree of Prematurity	Very Preterm	7 (11.50)	17 (53.10)	24 (25.80)	<0.0001*
	Moderate Preterm	23 (37.70)	11 (34.40)	34 (36.60)	
	Late Preterm	31 (50.80)	4 (12.50)	35 (37.60)	
	Total	61 (100.00)	32 (100.00)	93 (100.00)	
ANC Complications	None	10 (16.39)	4 (12.50)	14 (15.05)	0.074
	APH	3 (4.92)	5 (15.63)	8 (8.60)	0.008*
	PROM	5 (8.20)	2 (6.25)	7 (7.53)	0.073
	Pre-Eclampsia	5 (8.20)	6 (18.75)	11 (11.83)	0.012*
	GDM	5 (8.20)	3 (9.38)	8 (8.60)	0.078
	Eclampsia	3 (4.92)	6 (18.75)	9 (9.68)	0.004*
	H/o Chorioamnionitis	4 (6.56)	3 (9.38)	7 (7.53)	0.037*
	Oligohydramnios	10 (16.39)	3 (9.38)	13 (13.98)	0.071
	Thyroid Disorders	4 (6.56)	0 (0.00)	4 (4.30)	0.091
	Polyhydramnios	12 (19.67)	0 (0.00)	12 (12.90)	0.180
	Total	61 (100.00)	32 (100.00)	93 (100.00)	
Socioeconomic Status	Lower (V)	26 (42.62)	8 (25.00)	34 (36.56)	0.076
	Upper Lower (IV)	15 (24.59)	9 (28.13)	24 (25.81)	
	Lower Middle (III)	11 (18.03)	8 (25.00)	19 (20.43)	
	Upper Middle (II)	6 (9.84)	4 (12.50)	10 (10.75)	
	Upper Class (I)	3 (4.92)	3 (9.38)	6 (6.45)	
	Total	61 (100.00)	32 (100.00)	93 (100.00)	
Dyselectrolytemia	Hyperkalaemia	8 (11.75)	16 (50.00)	24 (24.00)	0.003*
	Hyponatremia	20 (29.40)	12 (37.50)	32 (32.00)	0.063
	Hypocalcaemia	15 (22.10)	14 (43.80)	29 (29.00)	0.038*

A significant association was observed between KDIGO stage and neonatal outcome ($p<0.0001$). Mortality increased with severity of AKI, with 46.88% deaths in Stage III compared to only 18.75% in Stage I, indicating poor prognosis in severe AKI. Degree of prematurity was also significantly associated with outcome ($p<0.0001$). Very preterm neonates had the highest mortality (53.10%), whereas late preterm neonates showed better survival with 50.80% discharged and only 12.50% deaths. Among ANC complications, APH (15.63%, $p=0.008$), pre-eclampsia (18.75%, $p=0.012$), eclampsia (18.75%, $p=0.004$), and chorioamnionitis (9.38%, $p=0.037$) were significantly associated with mortality,

suggesting adverse maternal conditions increased neonatal risk.

Socioeconomic status did not show a statistically significant association with outcome ($p=0.076$), although mortality was comparatively higher in lower and lower-middle socioeconomic groups. Among dyselectrolytemia, hyperkalemia showed a strong association with mortality, being present in 50% of deaths versus 11.75% of discharged neonates ($p=0.003$). Hypocalcemia was also significantly associated with poor outcome (43.80% deaths, $p=0.038$), whereas hyponatremia was not statistically significant ($p=0.063$). [Table 3].

Table 4: Association between ANC Complications and Severity of AKI (n = 100)

ANC Complications	Stage I n (%)	Stage II n (%)	Stage III n (%)	Total n (%)	P-value
None	8 (17.02)	3 (9.68)	3 (13.64)	14 (14.00)	0.083
APH	1 (2.13)	5 (16.13)	2 (9.09)	8 (8.00)	0.041*
PROM	4 (8.51)	2 (6.45)	2 (9.09)	8 (8.00)	0.088
Pre-Eclampsia	3 (6.38)	6 (19.35)	2 (9.09)	11 (11.00)	0.038*
GDM	6 (12.77)	3 (9.68)	1 (4.55)	10 (10.00)	0.091
Eclampsia	2 (4.26)	6 (19.35)	1 (4.55)	9 (9.00)	0.042*
H/o Chorioamnionitis	3 (6.38)	3 (9.68)	1 (4.55)	7 (7.00)	0.068
Oligohydramnios	4 (8.51)	3 (9.68)	6 (27.27)	13 (13.00)	0.004*
Thyroid Disorders	4 (8.51)	0 (0.00)	2 (9.09)	6 (6.00)	0.210
Polyhydramnios	12 (25.53)	0 (0.00)	2 (9.09)	14 (14.00)	0.110
Total	47 (100.0)	31 (100.0)	22 (100.0)	100 (100.0)	—

A significant association was observed between certain ANC complications and severity of AKI. APH was significantly associated with higher AKI stages, particularly Stage II AKI (16.13%) ($p=0.041$). Similarly, pre-eclampsia showed a significant association with Stage II AKI (19.35%) ($p=0.038$), while eclampsia was also significantly linked with Stage II severity (19.35%) ($p=0.042$).

Oligohydramnios showed the strongest association with severe AKI, with 27.27% neonates in Stage III AKI ($p=0.004$), indicating increased risk of severe renal dysfunction. PROM, GDM, chorioamnionitis, thyroid disorders, and polyhydramnios did not show statistically significant association with AKI severity. However, polyhydramnios was more commonly observed in Stage I AKI (25.53%).

DISCUSSION

The present prospective observational study was conducted in the SNCU of Kamla Raja Hospital, Gajra Raja Medical College, Gwalior, to evaluate the prevalence, severity, risk factors, and outcomes of acute kidney injury (AKI) among preterm neonates. A total of 100 preterm neonates were included in the study and assessed using KDIGO criteria.

Prevalence of AKI: The prevalence of AKI in the present study was 7.5%, which is comparable to Daga et al,^[2] (6.3%) and Timovska et al,^[3] (6.5%). Bansal et al,^[4] reported a lower prevalence of 4.24%, whereas Nagaraj et al,^[5] Gupta et al,^[6] and the AWAKEN study reported higher prevalence rates of 26%, 20.3%, and 30%, respectively. The lower prevalence in the present study may be due to inclusion of only inborn preterm neonates and early KDIGO-based monitoring.

Gender Distribution: Male predominance was observed in the present study, with 67% males and 33% females. Similar findings were reported by Timovska et al,^[3] (68% males), Hingorani et al,^[7] and Mortazavi et al,^[8] suggesting increased susceptibility of male neonates to AKI.

Severity of AKI: According to KDIGO staging, 47% neonates had Stage I AKI, 31% had Stage II, and 22% had Stage III AKI. Similar stage distribution was reported by Nagaraj et al,^[5] and Gupta et al.^[6] The AWAKEN study by Askenazi et al,^[9] also demonstrated that advanced AKI stages were associated with increased mortality and prolonged hospital stay.

Risk Factors and Associated Morbidities: Neonatal sepsis was the most common associated morbidity (37%), similar to reports by Mortazavi et al,^[8] and Timovska et al.^[3] Shock (19%), dehydration (14%), and perinatal asphyxia/HIE (12%) were also major contributors. Previous studies by S. Ramesh et al,^[15] and Gohiya P. et al,^[10] also identified HIE as a major risk factor for AKI.

Outcome: In the present study, 61% neonates were discharged, while mortality was observed in 32% cases. Similar mortality rates were reported by Gupta et al,^[6] (28.3%) and Nagaraj et al,^[5] (30.7%). AlGadeeb et al,^[11] reported higher mortality (41.5%), while the AWAKEN study showed significantly increased mortality among neonates with AKI.

Severity of AKI and Outcome: A significant association was observed between KDIGO stage and outcome ($\chi^2=23.02$, $p<0.0001$). Mortality increased from 18.75% in Stage I to 46.88% in Stage III AKI. Similar findings were reported by Gupta et al,^[6] Nagaraj et al,^[5] and Kumar et al,^[14] confirming KDIGO staging as an important prognostic indicator.

ANC Complications and Outcome: APH, pre-eclampsia, eclampsia, and chorioamnionitis showed significant association with mortality and AKI severity. Similar findings were reported by El-Gamasy et al,^[16] Gabria et al,^[12] and Gupta et al,^[6]

highlighting the role of maternal complications in neonatal renal injury.

Degree of Prematurity and Outcome: Very preterm neonates had significantly higher mortality (53.1%) compared to late preterm neonates (12.5%) ($p<0.0001$). Similar observations were reported by Aziz et al,^[13] Gupta et al,^[6] and AlGadeeb et al,^[11] indicating that lower gestational age is associated with poor renal and overall neonatal outcomes.

Electrolyte Abnormalities and Outcome: Hyperkalemia and hypocalcemia were significantly associated with mortality in the present study. Hyperkalemia was present in 50% of deaths ($p=0.003$), while hypocalcemia was observed in 43.8% of non-survivors ($p=0.038$). Similar findings were reported by Gupta et al,^[6] Nagaraj et al,^[5] and Kumar et al., emphasizing the importance of electrolyte monitoring in neonatal AKI.

CONCLUSION

The present prospective observational study highlights that acute kidney injury (AKI) is a significant complication among preterm neonates admitted to the SNCU and is associated with considerable morbidity and mortality. The prevalence of AKI in the present study was 7.5%, indicating that renal dysfunction is a common clinical problem in preterm newborns. Male gender, low birth weight, very preterm gestation, neonatal sepsis, shock, dehydration, and perinatal asphyxia/HIE were identified as important risk factors associated with AKI. Neonatal sepsis emerged as the most common associated morbidity. KDIGO staging proved to be an effective tool for assessing AKI severity and predicting neonatal outcomes.

The study demonstrated that increasing severity of AKI was significantly associated with higher mortality. Stage III AKI, very preterm neonates, and electrolyte abnormalities such as hyperkalemia and hypocalcemia showed particularly poor outcomes. Maternal antenatal complications including APH, pre-eclampsia, eclampsia, and chorioamnionitis were also significantly associated with adverse neonatal outcomes. Most neonates required prolonged hospitalization, reflecting the substantial healthcare burden associated with neonatal AKI. Early diagnosis through regular renal function monitoring, prompt management of sepsis and hemodynamic instability, careful fluid and electrolyte correction, and intensive supportive care are essential to improve survival among preterm neonates with AKI.

Recommendations: Based on the findings of the present study, routine screening for acute kidney injury (AKI) using KDIGO criteria should be implemented in all high-risk preterm neonates admitted to SNCU for early detection and timely intervention. Special attention should be given to neonates with risk factors such as sepsis, shock, very low birth weight, and perinatal asphyxia. Strengthening early recognition and aggressive

management of maternal antenatal complications, along with improved intrapartum and neonatal care, may help reduce AKI incidence. Regular monitoring of renal function and electrolytes, especially potassium and calcium, should be ensured to prevent complications and improve outcomes. Capacity building of healthcare staff and implementation of standardized neonatal AKI management guidelines are also essential to reduce morbidity and mortality. Further multicentric studies are recommended to validate these findings and assess long-term renal outcomes.

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