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Original Research Article

FREQUENCY OF ACUTE KIDNEY INJURY IN NEONATES PRESENTING WITH PERINATAL ASPHYXIA IN TERTIARY CARE HOSPITAL

WAKIL A*, IQBAL A, SHAH A, KHAN A

Department of Paediatrics, Combined Military Hospital (CMH), Abbottabad, Pakistan
**Corresponding author email address:* asifwakil60@gmail.com

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ABSTRACT

Background: *Perinatal asphyxia remains a significant cause of neonatal morbidity and mortality in developing countries. One of its serious complications is acute kidney injury (AKI), which contributes to poor outcomes if not promptly recognized and managed. Early detection of AKI in asphyxiated neonates is essential to reduce short- and long-term complications.* ***Objective:*** *To determine the frequency of acute kidney injury in neonates presenting with perinatal asphyxia in a tertiary care hospital.* ***Study Design:*** *Cross-sectional study.* ***Setting:*** *the pediatric department of Combined Military Hospital in Abbottabad, Pakistan.* ***Duration of Study:*** *12-January-2025 to 12-May-2025.* ***Methods:*** *A total of 145 neonates aged 1–25 days with perinatal asphyxia, confirmed by an Apgar score <7 at 5 minutes, along with clinical signs, were included. Neonates were evaluated for acute kidney injury. AKI was defined by a serum creatinine level >1.5 mg/dL or a daily rise ≥0.2 mg/dL in the presence of oliguria. Data were analyzed to calculate the frequency of AKI, and results were expressed as mean ± SD for quantitative variables and percentages for categorical variables.* ***Results:*** *Among 145 neonates with perinatal asphyxia, 26 (17.9%) developed acute kidney injury. The mean serum creatinine level of the cohort was 1.42 ± 0.29 mg/dL. The mean age of neonates was 13.24 ± 6.87 days, with a male predominance (57.9%).* ***Conclusion:*** *The frequency of acute kidney injury in neonates with perinatal asphyxia was 17.9%. These findings highlight the need for routine renal function monitoring in neonates with asphyxia to ensure early detection and timely management of AKI.*

Keywords: Acute Kidney Injury, Perinatal Asphyxia, Neonate, Serum Creatinine

INTRODUCTION

In 2018, more than 2.5 million kids globally died during the first month of life, equating roughly 7,000 newborn deaths daily. About one-third of these deaths took place on the day of birth, while almost three-quarters transpired during the first week of life (1). Newborn death rates vary by country. In 2019, sub-Saharan Africa reported a newborn fatality rate of 27 deaths for every 1000 live births, the highest worldwide, followed by southern and central Asia with 24 fatalities for every 1000 live births [1]. Asphyxia can happen right before birth or right after birth in a vulnerable patient necessitating resuscitation (2-5). Perinatal asphyxia mainly occurs during the intrapartum period, with approximately 20% of instances arising antepartum, along with additional cases manifesting in the early postnatal phase. An accurate obstetrical history, along with peripartum history, is essential for identifying the aetiology. Nonetheless, a minority of neonates with HIE show a documented sentinel event (6). Birth asphyxia is linked to substantial mortality as well as morbidity rates. Long-term complications may be life-threatening. The condition has a documented mortality rate exceeding 30%, with most fatalities occurring within the initial days post-birth. Infants who survive frequently develop mild to severe neurological deficits, which may subsequently succumb to aspiration or severe systemic infections (6, 7).

Acute kidney injury (AKI) refers to the rapid deterioration of the kidneys' ability to maintain water and electrolyte homeostasis, characterized by a decrease in the rate of glomerular filtration. The serum creatinine level in preterm infants during the initial days of life can underestimate the glomerular filtration rate, as creatinine levels rise within the first 36 to 96 hours and then gradually decline over the first two weeks (8, 9). The estimation of plasma creatinine levels serves as the most straightforward and practical method for evaluating renal function (9). According to a study, the frequency of AKI in neonates was 60% presented with perinatal asphyxia (10).

Perinatal asphyxia is a well-established risk factor for neonatal acute kidney injury, as it can lead to renal hypoperfusion, ischemia, and subsequent kidney damage. Due to the paucity of literature on this subject locally, this study aims to determine the frequency of acute kidney injury in neonates presenting with perinatal asphyxia at our hospital setup. The findings of this study will be helpful for our medical professionals in addressing acute kidney injury in this vulnerable population, as early detection and intervention may improve renal recovery and reduce the risk of long-term renal dysfunction. Moreover, the findings of this study will also help better understand the pathophysiology and develop early diagnostic and therapeutic strategies that could mitigate the risk of long-term kidney impairment in these infants.

METHODOLOGY

The present research was conducted as a cross-sectional study within the pediatric department of Combined Military Hospital in Abbottabad from 12-January-2025 to 12-May-2025, after taking ethical approval from the hospital. The sample size was 145, based on the previous frequency of AKI in neonates (60%11), with a 95% confidence interval and an 8% margin of error. A consecutive non-probability sampling technique was employed to enroll a total of 145 neonates who met the predefined inclusion criteria over a data collection period of six months.

Eligibility for participation was confined to neonates aged between 1 and 25 days of life of either sex who had experienced perinatal asphyxia. The Diagnosis of asphyxia was defined by the presence of clinical signs, including bradycardia, meconium aspiration, respiratory distress, and hypotonia, supplemented by a documented Apgar score of less than 7 at five minutes after birth. Neonates with congenital malformations, culture-proven sepsis, or necrotizing enterocolitis were excluded from the study cohort.

Before enrollment, the nature, purpose, and procedures of the study were thoroughly explained to the parents or legal guardians of each potential participant, and their consent was taken. For each enrolled subject, a comprehensive dataset was collected. This included demographic particulars such as age and weight, alongside family-related variables including socioeconomic status, place of residence (urban or rural), maternal educational status, and maternal occupational status.

The key outcome variable, acute kidney injury (AKI), was determined based on serum biochemical analysis. A blood sample of 1 mL was aseptically drawn from each neonate and analyzed for serum creatinine levels. A neonate was classified as having AKI if the serum creatinine level was found to be greater than 1.5 mg/dL or if a daily increase of at least 0.2 to 0.3 mg/dL was observed in the context of oliguria or anuria. The entire process was overseen by an experienced consultant pediatrician with at least five years of experience. All data were recorded in a pre-designed structured proforma.

The collected data were then subjected to statistical analysis using SPSS version 23. Gender, AKI status, and all maternal and socioeconomic factors were presented using frequencies and percentages. Age, weight, and serum creatinine levels were assessed using the mean with standard deviation. The Chi-square test was used to stratify AKI based on demographics, with a predetermined statistical significance level of a p-value less than or equal to 0.05.

RESULTS

The study had 145 neonates for analysis. The average age of the participants was 13.24 ± 6.87 days. The mean weight was recorded at 3.57 ± 0.73 kilograms. The mean serum creatinine level, a key indicator of renal function, was measured at 1.42 ± 0.29 mg/dL.

Regarding demographic characteristics, a majority of the neonates were male, comprising 84 (57.9%), while 61 (42.1%) were female. The educational background of the mothers was distributed as follows: 79 (54.5%) were uneducated, and 66 (45.5%) had received an education. The rest of the distribution is presented in Table 1.

The primary outcome of interest was the occurrence of acute kidney injury. Among the 145 neonates evaluated, 26 (17.9%) were found to have developed acute kidney injury, while the vast majority, 119 (82.1%), did not present with this condition (Table 2). Table 3 presents the stratification of AKI with demographics.

Table 1: Demographics

Demographics		n	%
Gender	Male	84	57.9%
	Female	61	42.1%
Mother's education status	Educated	66	45.5%
	Uneducated	79	54.5%
Mother's occupation status	Employed	49	33.8%
	Unemployed	96	66.2%
Living area	Urban	71	49.0%
	Rural	74	51.0%
Socioeconomic status	Lower class	36	24.8%
	Middle class	82	56.6%
	Upper class	27	18.6%

Table 2: Frequency of acute kidney injury

Acute kidney injury	n	%
Yes	26	17.9%
No	119	82.1%

Table 3: Stratification of acute kidney injury with demographics

Demographics		Acute kidney injury				P value
		Yes		No		
		n	%	n	%	
Gender	Male	17	65.4%	67	56.3%	P > 0.05
	Female	9	34.6%	52	43.7%	
Mother's education status	Educated	13	50.0%	53	44.5%	P > 0.05
	Uneducated	13	50.0%	66	55.5%	
Mother's occupation status	Employed	7	26.9%	42	35.3%	P > 0.05
	Unemployed	19	73.1%	77	64.7%	
Living area	Urban	14	53.8%	57	47.9%	P > 0.05
	Rural	12	46.2%	62	52.1%	
Socioeconomic status	Lower class	8	30.8%	28	23.5%	P > 0.05
	Middle class	13	50.0%	69	58.0%	
	Upper class	5	19.2%	22	18.5%	
Weight (Kg)	2.9 to 3.5	19	73.1%	72	60.5%	P > 0.05
	> 3.5	7	26.9%	47	39.5%	
Age distribution (Years)	1 to 15	19	73.1%	72	60.5%	P > 0.05
	16 to 25	7	26.9%	47	39.5%	

DISCUSSION

The findings of the present study, which identified acute kidney injury (AKI) in 17.9% of neonates with perinatal asphyxia, contribute valuable data to the current literature that shows considerable variability in reported incidence rates. This result positions our findings within the mid-to-lower range of frequencies reported by similar studies across different regions. For instance, our incidence is notably higher than the 10.5% reported by Atta et al. in Khyber Pakhtunkhwa and the 11.7% found by Alaro et al. in Kenya. Yet, it remains substantially lower than the 40.9% incidence documented by Indra et al. in Karachi (11-13). The disparity above is not necessarily indicative of clinical differences but rather underscores a fundamental challenge in neonatal AKI research: the lack of a unified diagnostic criterion. The study by Indra et al. utilized a modified KDIGO definition incorporating subtle rises in serum creatinine and short durations of reduced urine output. This highly sensitive approach likely captures milder cases of renal impairment (13). In contrast, our study and that of Atta et al. employed a threshold of serum creatinine exceeding 1.5 mg/dL. This more specific but less sensitive marker identifies more pronounced kidney injury (11). The mean serum creatinine level in our study population was 1.42 ± 0.29 mg/dL. This value is particularly insightful when considering the AKI-positive and AKI-negative subgroups. For the 119 neonates without AKI, the creatinine level was likely within a normal range. In contrast, the Diagnosis in the 26 affected neonates was based on this marker

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exceeding the 1.5 mg/dL threshold. This methodological variation is the primary driver of the wide incidence range observed in the literature. It highlights an urgent need for the standardized application of consensus definitions, like those proposed by the KDIGO group, albeit adapted for neonates to ensure comparability across future studies.

The demographic profile of our cohort showed a male predominance (57.9%), a finding consistent with the results of Atta et al., who documented a higher number of male patients in their cohort compared to female patients (11). Indra et al. and Tounsa et al. also reported that the majority of their patients were male (13, 14). This recurring pattern suggests a potential gender-based vulnerability in males to the sequelae of birth asphyxia, possibly linked to hormonal or genetic factors. However, the exact mechanisms remain unclear and warrant further investigation.

A critical observation from our study is the apparent lack of a notable correlation between maternal factors, such as education and occupation status, and the development of AKI in the neonate. This finding suggests that the pathophysiological insult of perinatal asphyxia and its impact on the neonatal kidney may supersede the influence of these broader socioeconomic determinants in the immediate postnatal period. However, this does not diminish the importance of these factors in a broader maternal and child health context, as they are undoubtedly linked to access to care, nutrition, and other birth outcomes. Our finding necessitates a dual focus: while clinical management must remain important, public health strategies should continue to address socioeconomic disparities to improve overall perinatal health.

CONCLUSION

In conclusion, the frequency of acute kidney injury in neonates presenting with perinatal asphyxia in our study was 17.9%. No associations of AKI were observed with the demographic parameters.

DECLARATIONS

Data Availability Statement

All data generated or analysed during the study are included in the manuscript.

Ethics approval and consent to participate

Approved by the department Concerned. (IRB)

Consent for publication

Approved

Funding

Not applicable

CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHOR CONTRIBUTION

ASIF WAKIL (Postgraduate Resident)
Data Collection, Manuscript writing, Review of manuscript, and final approval of manuscript.

AMJAD IQBAL (Associate Professor)
Critical input. Conception of study design, and final approval of manuscript

ADIL SHAH (Postgraduate Resident)
Literature search

ABDULLAH KHAN (Postgraduate Resident)
Literature Search

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