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ORIGINAL ARTICLE

Frequency of various causes of acute kidney injury in neonates in a tertiary care hospital neonatal intensive care.

Muhammad Ayyaz[1], Abubakar Sadiq[2], Ijaz Hussain[3], Wasimullah[4], Zeenat Jehan[5]

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ABSTRACT... Objective: To determine the frequency of causes of acute kidney injury in neonatal. **Study Design:** Cross Sectional study. **Setting:** Neonatology Ward, Saidu Teaching Hospital. **Period:** July 2020 to June 2021. **Material & Methods:** A total of 257 neonates were selected having AKI and included in the study. Various causes and risk factors for AKI were assessed and patients were followed till the outcome. **Results:** A total of 257 patients having AKI were included and data was collected. Of the total selected newborns gender distribution was 57.97% (149/257) males and female were 42.02% (108/257). Mean age was 5.1 ± 4.6 days. 73.15% babies were delivered at term gestation and 26.84% were delivered preterm. 90.27 % babies were delivered through normal vaginal delivery and 9.7% were delivered through caesarean section. Among the total 257 included babies 27.62% were having history of hypoxic ischemic encephalopathy and 45.52% were diagnosed as sepsis on positive blood culture or septic screening. Oliguria was present in only 38.13% of the babies and urine output was normal in 61.86%. 95.71% babies were not having renal malformations. Renal profile of the babies showed with mean serum creatinine of 2.57 mg/dl. Mean sodium level was 139.16 mg/dl and mean potassium level was 3.59 mg/dl. 26.45% of the total patients died and the mortality rate was 29% in patient having sepsis as compared to 25% of patient having hypoxic ischemic encephalopathy. **Conclusion:** AKI in NICU is very common and needs a proper evaluation and management strategies. Neonatologist should be aware of the various causes of AKI and should be able to diagnose it on time. In neonates having AKI, oliguria is not that much common therefore it is recommended not to wait for a decrease urine output but to screen all the high risk neonates for AKI with serum creatinine level. Mortality in neonates due to AKI was high specifically in male gender having sepsis, HIE or oliguria.

Key words: (AKI) Acute Kidney Injury, (HIE) Hypoxic Ischemic Encephalopathy, (NICU) Neonatal Intensive Care Unit.

INTRODUCTION

Acute kidney injury (AKI), and its impact on the overall morbidity and mortality in Neonatal intensive care unit (NICU) is one of the most common problems that neonatologist faces. In many studies its prevalence in NICU is reported from 3-8% to a very high prevalence of 24% in some hospitals.[1,2,3] AKI is defined as the sudden deterioration of renal functions in the form of derangement in excretion of nitrogenous metabolic waste and imbalance of fluid, electrolyte and acid base. In many cases it is represented in the form of decrease in GFR with decrease in creatinine clearance and urine output, as suggested by paediatric RIFLE criteria. Persistent rise in creatinine level of more than 1.5mg/dl for and after the first 24 to 48 hours of life is an indication of AKI.[4,5] AKI is associated with a variable amount of mortality and morbidity in neonates and some studies the mortality due to AKI is reported to be 25 % of the critically ill neonates.[6] Over the past decade a remarkable advancement in the understanding of diagnosis and management of AKI along with its morbidity and mortality in critically ill children has been achieved.[7] AKI in the paediatric and neonatal age group is also related to long term complication especially chronic kidney disease.[8] Most of the new-born babies pass urine in the first 24 hours after birth and if the urine output is less than 1ml/

1. FCPS (Pediatric), Post graduate resident, Saidu Group of Teaching Hospital Swat.
2. FCPS (Pediatric), Post graduate resident, Saidu Group of Teaching Hospital Swat.
3. FCPS (Pediatric), Postgraduate Resident Paediatric, Saidu Group of Teaching Hospital Swat.
4. FCPS (Pediatric), Postgraduate Resident Paediatric, Saidu Group of Teaching Hospital Swat.
5. FCPS (Pediatric), Postgraduate Resident Paediatric, Saidu Group of Teaching Hospital Swat.

Correspondence Address:
Dr. Muhammad Ayyaz
Department of Paediatric
Saidu Group of Teaching Hospital Swat.
ayyazaazee120@gmail.com

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kg/hr it is called oliguria. Beside decrease in urine output, raise in urea and creatinine level is a good predictor of AKI.[9,10]

The causes of AKI are divided into pre-renal, renal and post renal, with the pre-renal as the most common cause of AKI in neonates due to hypo perfusion and ischemia and which if not treated properly can lead to intrinsic renal failure.[11] Kidneys of the new-borns are at risk of renal failure due to hypo perfusion for various reasons like high renal vascular resistant, high plasma renin activity, low glomerular filtration and decrease renal absorption of sodium in proximal tubules. The outcome of the patients with AKI is invariably dependent on the cause of AKI include multiorgan failure and the availability of renal replacement therapy.[12,13] Considering its high prevalence in the neonates and its high mortality ranging from 20-50% it is important to understand various causes and its timely management.[14]

There is very little, or no work done on neonatal AKI in this region of Pakistan. The main purpose of this study was to establish the prevalence of AKI in neonates along with its risk factor and short-term outcome in Saidu Group of Teaching hospital which is a tertiary care hospital and a referral point for many places.

MATERIAL & METHODS

A cross sectional study was performed in neonatal intensive care unit of Saidu Group of Teaching Hospital (SGTH) Swat. SGTH is a tertiary care hospital and is the referral centre for the district swat and also of nearby districts of Shangla, Bunir and Dir. The sample size was estimated to be 177 through open epi sample size calculator as the prevalence of AKI in neonates admitted to NICU was 20%.[4] A total of 257 patients were included in the study from July 2020 to June 2021 after approval from ethical committee (15/ERB/2021). All the babies age less than 28 days of either sex who had AKI were included in the study. Acute kidney injury was defined by serum creatinine level of more than 1.5 mg/dl. On the basis of urine out output of less than 1ml/kg/hr patients were defined as oliguria.[4,5] Babies that need peritoneal dialysis were excluded from the study. After informed written consent was taken from all patients attendants and data was collected categorically including the major risk factors for acute kidney injury gestational age, birth weight, current weight, birth asphyxia, culture positivity, shock, necrotising enterocolitis, meningitis, pneumonia early and late onset sepsis, oliguria and any congenital anomalies. All patients were examined for local urethral abnormalities, palpable bladder and kidneys for any obstructive pathology and for decrease urine output. Radiological studies were performed for any evidence of renal and urethral anomaly.

All the collected data was analysed using statistical package for social science version 22(SPSS 22). Frequency and proportions were calculated for categorical variable and mean and standard deviation were taken for continuous variables. Association between categorical variables were calculated by using chi square test. A p value of less than 0.05 was considered significant.

RESULTS

A total of 257 patients having AKI were included and data was collected. Of the total selected newborns gender distribution was 57.97% (149/257) males and female were 42.02% (108/257). Mean age was 5.7 $\pm$ 4.6 days. 73.15% babies were delivered at term gestation and 26.84% were delivered preterm. 90.27 % babies were delivered through normal vaginal delivery and 9.7% were delivered through caesarean section. Among the total 257 included babies 27.62% had history of hypoxic ischemic encephalopathy and 45.52% had diagnosed sepsis on positive blood culture or septic screening. Oliguria was present in only 38.13% of the babies and urine output was normal in 61.86%. 95.71% babies had no renal malformations. Renal profile of the babies showed with mean serum creatinine of 2.57 mg/dl. Mean sodium level was 139 mg/dl and mean potassium level was 3.59 mg/dl. 26.45% of the total patients died and the mortality rate was 29% in patient having sepsis as compared to 25% of patient having hypoxic ischemic encephalopathy (Table-I and II).

Variables		Total	Prognosis				P-Value
			Death		Discharge		
			Values	%	Values	%	
Gender	M	149	39	26%	110	74%	0.814
	F	108	29	27%	79	73%	
Gestation	FTP	188	52	28%	136	72%	0.134
	PT	69	16	23%	53	77%	
MOD	Caessarian	25	7	28%	18	72%	0.716
	NVD	232	61	26%	171	74%	
Delay cry	Yes	71	18	25%	53	75%	0.615
	No	186	50	27%	136	73%	
Sepsis	EO	79	20	25%	59	75%	0.664
	LO	38	11	29%	27	71%	
	No	140	37	26%	103	74%	
Dehydration	Yes	114	31	27%	83	73%	0.662
	No	143	37	26%	106	74%	
Oliguria	Yes	98	32	38%	71	72%	0.554
	No	159	41	26%	118	74%	
Renal malformation	Yes	11	3	27%	8	73%	0.901
	No	246	65	26%	181	74%	

Table-I

Variables		Total	Prognosis				P-Value
			Death		Discharge		
			Values	%	Values	%	
Creatinine	<2	92	22	24%	70	76%	0.456
	2.1-4.0	153	40	26%	113	74%	
	>4	12	6	50%	6	50%	
Urea	<30	59	13	22%	46	78%	0.148
	31-80	173	49	28%	124	72%	
	>80	25	6	24%	19	76%	
Na	<135	55	13	24%	42	76%	0.405
	136-145	178	51	29%	127	71%	
	>145	24	4	17%	20	83%	
K	<4	173	49	28%	124	72%	0.994
	4.1-5.5	80	17	21%	63	79%	
	>5.5	4	2	50%	2	50%	

Table-II

DISCUSSION

Kidneys in neonatal period are very prone to injury in systemic diseases due to hypo perfusion and raised renin level and increased vascular resistance. Pre renal AKI is much more common and can lead to intrinsic renal damage if not corrected timely.[4,15]

The neonatal kidneys are vulnerable to injury in form of acute tubular necrosis for various physiologic reasons; in the form of decrease glomerular filtration rate, low renal perfusion and high plasma renin and decrease sodium balance.[12,13] In the present study of the total cases of AKI there was a male predominance and male to female ratio was 1.3:1. The same male predominance pattern was also observed in other studies from Iran[16] and in one other study[3] This biased may be due to the gender as male babies seeks more medical aid than female.

Gestational age in our study showed that AKI was more prevalent in term babies (73.15%) as compare to preterm (26.84%) babies in

comparison to other study this percentage is comparable to 81.2% in term and 19.8% in preterm[17] and it was much less than reported in one study as term 96.7% and preterm as 3.3%.[19] Mean weight at diagnosis of AKI was 2.7 kg comparable and equal to other studies[17,19] there was no significant impact of weight on prevalence of AKI.

AKI in neonates has been observed mainly in the first two weeks of life and in our study the mean age of diagnosis was 5.7 ± 4.6 days (range 1 to 28 days) it is comparable with other studies that also shows AKI in neonate with mean age of 7.59 and 6.2 days.[17,18] The most common risk factor identified in our study was sepsis 45.52% and early onset neonatal sepsis was observed in 67.52 % of patient of the septic patients. It was comparatively higher than other studies which shows sepsis prevalence if 35.6% and 22.2%.[17,18] The reason for this high prevalence of sepsis is due to the underdeveloped region. Hypoxic ischemic encephalopathy was the second most common cause identified in our study. It was observed in 27.62% of babies and it was comparatively low than observed in other studies i.e. 47.5% and 40%.[17,18] and it was much high in comparison to 6.7% reported in one study.[19]

Decrease renal perfusion identified by oliguria was observed in 38.13% of patient which was comparably equal to other study 40%[18] and higher as compare to 26.7%.[19] The mortality in patient with oliguria was high 38.77% as compared to non oliguric patient. Congenital renal anomalies were observed in 4.29 % of patient and it was nearly equal to reported in a study 4%.[19]

CONCLUSION

AKI in NICU is very common and needs a proper evaluation and management strategies. Neonatologist should be aware of the various causes of AKI and should be able to diagnose it on time. In neonates having AKI, oliguria is not that much common therefore it is recommended not to wait for a decrease urine output but to screen all the high risk neonates for AKI with serum creatinine level. Mortality in neonates due to AKI was high specifically in male gender having sepsis, HIE or oliguria.

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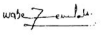
AUTHORSHIP AND CONTRIBUTION DECLARATION

No.	Author(s) Full Name	Contribution to the paper	Author(s) Signature
1	Muhammad Ayyaz	Concept, design of study, writing manuscript, collection of data.	
2	Abubakar Sadiq	Collection of data and review.	
3	Ijaz Hussain	Collection of data and statistical analysis.	
4	Wasimullah	Data collection.	
5	Zeenat Jehan	Data collection and critical review.