ORIGINAL ARTICLE

Acute Kidney Injury in Neonates with Birth Asphyxia at a Tertiary Care Hospital

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ABSTRACT

Objective: To determine acute kidney injury in perinatal asphyxia.

Setting: The Neonatal Intensive Care Unit, Paediatrics Department, Combined Military Hospital, Hyderabad from 1st July 2020 to 31st December 2020.

Methodology: One hundred and twenty neonates were included in the study. Lactate was sent within 30 min of birth in suspected birth asphyxia. Blood samples were collected from the neonates at 24 hours of life and sent for serum creatinine analysis to ascertain acute kidney injury in these children with perinatal asphyxia.

Results: There were 56.7% male and 43.3% female neonates. Mean gestational age was 38.05±1.22 weeks. Mean APGAR score was 4.64±1.32. Mean serum lactate and serum creatinine was 5.15±0.63 mmol/L and 128.03±6.17 µmol/L respectively. Fetal distress on cardiotocography was found in 47.5% cases while delayed cry was observed in 56.7% neonates. Most common grade of hypoxic ischemic encephalopathy was grade II in 57.55% neonates. 13.3% neonates were found to develop acute kidney injury.

Conclusion: Significant frequency of acute kidney injury was also noted in our study in neonates having birth asphyxia. Gender of neonate and mode of delivery was found to be having significant association with acute kidney injury.

Keywords: Frequency, Acute kidney injury (AKI), Perinatal asphyxia

INTRODUCTION

Perinatal mortality makes a significant proportion of under 5 mortality, especially in developing countries. Inspite of major advances in monitoring fetal development, perinatal asphyxia has a high incidence.[1] Perinatal asphyxia is a 3rd major cause of neonatal mortality (23%) after prematurity and neonatal sepsis with 28% and 26% mortality rates respectively. The mortality rate among asphyxiated neonates increases with severity of hypoxic ischemic encephalopathy (HIE) which has been associated with as high as 50 % mortalities and majority of these deaths occur in first month of life.[2] Birth asphyxia is an event which is associated with long-term consequences in neonatal time period. The incidence varies from 1-1.5% in different healthcare settingswith its relationship to birth weight and gestational age of the newborn.[3,4]

The WHO has defined perinatal asphyxia as "failure to initiate or sustain breathing at birth".[2] If a neonate cannot initiate and sustain effective breathing after birth, or has the intrauterine placental compromise, gaseous exchange is adversely affected and result in lactic acid accumulation. The resulting hypoxemia affects the oxygenation of vital organs including brain and can result in irreversible damage. Severe hypoxia may result in anaerobic glycolysis and production of a lactacidosis,[5] resulting in metabolic acidosis. This adversely affects cardiovascular functions and other organs, systemic hypoxic-ischemia results in multi-organ dysfunction. The lung injury can result from meconium aspiration, pulmonary hypertension or secondary to cardiac dysfunction.[2]Hypoxic-ischemia can damage myocardium resulting in elevated cardiac enzymes. The other organs affected include kidneys, liver and bone marrow.[6-10]

Kidneys show great level of sensitivity to oxygen deprivation, hence acute renal insufficiency is generally noted within 24 hours of HIE episode which can irreversible cortical necrosis. Early diagnosis and timely management of acute kidney injury is very important in these newborns to avoid other long-term adverse events.[11-12] A study conducted by Alaro et al[1] has reported acute kidney injury in 11.7% neonates presenting with perinatal asphyxia, who also demonstrated significant relationship of acute kidney injury with severity of HIE along with high mortality rate which was 71.4 % in AKI with birth asphyxia.

Thus, being an important contributor towards morbidity and perinatal mortality, early diagnosis of birth asphyxia may help in proper management of birth asphyxia and its related morbidities. AKI is quite commonly encountered and associated with poorer clinical outcomes in perinatal asphyxia.

MATERIALS AND METHODS

This study cross–sectional study was conducted at Neonatal Intensive Care Unit, Paediatrics Department, Combined Military Hospital Hyderabad from 1st July2020 to 31st December 2020. A total of 120 newborns with birth asphyxia (APGAR ≤8 at 5 min or delayed cry of ≥1 min or fetal distress on CTG with Elevated plasma lactate ≥4 mmol/L) were included. Patients having congenital malformations like Down syndrome and maternal drug

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addiction were excluded. Lactate was sent within 30 min of birth in suspected birth asphyxia. Blood samples were collected from the neonates at 24 hours of life and sent for Serum creatinine (acute kidney injury defined by a level of creatinine above 133 µmol/l). All data were entered and analyzed using SPSS-23.

RESULTS

There were 56.7% males and 43.3% females. Mean gestational age was 38.05±1.22 weeks Mean mother's age was 30.29±4.86 years.Mean birth weight was 3603.37±576.30 grams. Mean parity was 2.40±1.53. Mean APGAR score was 4.64±1.32.Mean serum lactate and serum creatinine was 5.15±0.63 mmol/L and 128.03±6.17 µmol/L respectively. 50% were delivered through Spontaneous Vaginal Delivery (SVD). Among all study subjects 73.3% of mothers got education till primary and below while 26.7% got education till secondary or above. Most of the mothers i.e. 75.8% were house wives. Fetal distress on cardiotocography(CTG) was found in 47.5% cases while delayed cried was observed in 56.7% neonates.

Table 1: Comparison of gender according acute kidney injury (n=120)

Gender	Acute Kidney Injury			P value
	Yes	No	Total	
Male	13 (81.3%)	55 (52.9%)	68 (56.75%	0.033
Female	3 (18.8%)	49 (47.1%)	52 (43.3%)	

Table 2: Comparison of age according acute kidney injury (n=120)

Gestational age	Acute Kidney Injury			P value
	Yes	No	Total	
≤38 weeks	13 (81.3%)	58 (55.85)	71 (59.2%)	0.054
>38 weeks	3 (18.8%)	46 (44.2%)	49 (40.8%)	

Table 3: Comparison of mother's age according acute kidney injury (n=120)

Maternal age	Acute Kidney Injury			P value
	Yes	No	Total	
≤30 years	9 (56.3%)	60 (57.7%)	69 (57.5%)	0.913
>30 years	7 (43.8%)	44 (42.3%)	51 (42.5%)	

Table 4: Comparison of birth weight according acute kidney injury (n=120)

Birth weight	Acute Kidney Injury			P value
	Yes	No	Total	
≤3,000 grams	2 (12.5%)	24 (23.1%)	26 (21.7%)	0.339
>3,000 grams	14 (87.5%)	80 (76.9%)	94 (78.3%)	

Table 5: Comparison of APGAR score according acute kidney injury (n=120)

APGAR score	Acute Kidney Injury			P value
	Yes	No	Total	
Severe (0-3)	-	12 (11.5%)	12 (10%)	0.152
Moderate (4-7)	16 (100%)	92 (88.5%)	108 (90%)	

Most common grade of HIE was grade II in 57.55% neonates.13.3% neonates were found with acute kidney injury. Stratification with respect to child gender, gestational age, mother's age, child birth weight, APGAR Score, delivery mode and HIE grade was done to observe effect of these modifiers on acute kidney injury. P-value ≤0.05 was considered as significant. The results showed significant association of acute kidney injury with child gender (p=0.033) and delivery mode (p=0.000) while no significant association was found with gestational age (p=0.054), mother's age(p=0.913), child birth weight (p=0.339), APGAR Score (p=0.152) and HIE grade (p=0.320) [Tables 1-7].

Table 6: Comparison of mode of delivery according acute kidney injury (n=120)

Mode of delivery	Acute Kidney Injury			P value
	Yes	No	Total	
LSCS	14 (87.5%)	28 (26.9%)	42 (35%)	0.001
SVD	1 (6.3%)	59 (56.7%)	60 (50%)	
Foreceps	1 (6.3%)	9 (8.7%)	10 (8.3%)	
Vaccum	-	8 (7.7%)	8 (6.7%)	

Table 7: Comparison of HIE grade according acute kidney injury (n=120)

HIE grade	Acute Kidney Injury			P value
	Yes	No	Total	
I	6 (37.5%)	32 (30.8%)	38 (31.7%)	0.320
II	10 (62.5%)	59 (56.7%)	69 (57.5%)	
III	-	13 (12.5%)	13 (10.8%)	

DISCUSSION

Acute renal injuries in perinatal asphyxia are a potential magnitude of adaptive mechanism and generally ARF is major complication which is associated with poor prognostic outcomes including permanent damage to the kidney that may be encountered in up to 40 % survivors [13-15].

In the present study, 56.7% were male and 43.3% were female. A study conducted in Kenya by Alaro et al[1] has also reported 60 % male gender predominance. A study conducted by Medani et al [16] from Sudan has also reported 59 % boys with birth asphyxia. A study conducted by Chishty et al [17] has also reported 2.6:1 male to female gender. A study conducted by Malik et al[18] has also reported 78% predominating male gender. Another study carried out by Afzal et al[19] has also documented 60 % male gender predominance. Mean gestational age was 38.05±1.22 weeks. Chisty et al[17] has also reported 39.18 weeks which is similar to that of the present study. Mean birth weight was 3603.37±576.30 grams. Mean mother's age was 30.29±4.86 years. The mother's age was further stratified in two groups. Mean parity was 2.40±1.53. The parity was further stratified in two groups. Mean APGAR score was 4.64±1.32.Mean serum lactate and serum creatinine was 5.15±0.63 mmol/L and 128.03±6.17 µmol/L respectively. A study conducted by Afzal et al[13] has also reported 27 % preterm births which is in compliance with our study results.

This study showed that 50% were delivered through SVD.Fetal distress on CTG was found in 47.5% cases while delayed cried was observed in 56.7% neonates. A study conducted by Medani et al[16]from Sudan has also reported 56.4 % vaginal deliveries. A study conducted in Kenya by Alaro et al[1] has also reported 33 % cesarean section deliveries. A study conducted by Chishty et al[17] reported only 16% cesarean section deliveries in these patients which is quite lower than our study results. A study

conducted by Afzal et al[19]has also reported 33% cesarean section deliveries.

Most common grade of HIE was grade II in 57.55% neonates.In our study, 13.3% neonates were found with acute renal failure. Stratification with respect to child gender, gestational age, mother's age, child birth weight, APGAR Score, delivery mode, mother's education, mother's occupation, and HIE grade was done to observe effect of these modifiers on acute renal failure. P-value ≤0.05 was considered as significant. The results showed significant association of acute renal failure with child gender (p=0.033) and delivery mode (p=0.000). A study conducted by Medani et al[16] from Sudan has reported 54.1 % AKI which is quite higher than our study results. A study conducted in Kenya by Alaro et al[1] has also reported 11.7 % AKI in birth asphyxia which is close to our study results.

CONCLUSION

Significant frequency of AKI was also noted in neonates having birth asphyxsia. Gender of neonate and mode of delivery was found to be significant association with AKI.

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