



A STUDY OF RENAL FAILURE IN TERM BIRTH ASPHYXIATED NEONATES IN A TERTIARY CARE CENTER

Paediatrics

Dr. Rohit M. Kukade*

Resident, Department Of Paediatrics, Grant Government Medical College And Sir JJ Hospital, Mumbai *Corresponding Author

Dr. Shruti Dhale

Associate Professor, Department Of Paediatrics, Grant Government Medical College And Sir JJ Hospital, Mumbai

ABSTRACT

Background: Perinatal asphyxia is a major cause of neonatal morbidity and mortality, often leading to acute kidney injury (AKI). This study aimed to assess the incidence of AKI in term neonates with birth asphyxia and its correlation with Hypoxic-Ischemic Encephalopathy (HIE) staging and Apgar scores. **Methods:** An observational study was conducted on 115 term neonates with birth asphyxia in the NICU of Grant Government Medical College. Renal function was assessed using serum urea, creatinine, electrolytes, and urine output. HIE was classified using Sarnat and Sarnat staging. **Results:** AKI was observed in 22 (19.13%) neonates, most commonly in HIE Stage 2 (72.7%). Non-oliguric AKI predominated (91%). No AKI was found in mild asphyxia. Mean serum creatinine and urea levels were lower compared to prior studies. **Conclusion:** AKI is a significant complication in asphyxiated neonates, especially with moderate and severe HIE. Monitoring of urea, creatinine and serum electrolytes is essential, as urine output alone may not reliably indicate renal injury.

KEYWORDS

Perinatal Asphyxia, Acute Kidney Injury, Hypoxic Ischemic Encephalopathy, Sarnat and Sarnat Staging

INTRODUCTION

Perinatal asphyxia is described by the WHO as "failure to initiate and sustain breathing during birth."¹

A similar definition of prenatal asphyxia was used in the National Neonatal Perinatal Database (NNPD) 2000. An Apgar score of 0-3 at 1 minute of age or no breathing was described as severe asphyxia. It was characterized as moderate asphyxia as slow gasping breaths or an Apgar score of 4-6 at that time.²

Apgar scores 7 at 1 minute (including moderate and severe asphyxia) were recorded in 9% of all intramural deliveries, according to National Neonatal Perinatal Database (NNPD) 2003 data gathered from 17 tertiary neonatal critical care centers in India. At 5 minutes of age, 2.5% of infants still had Apgar scores below 7. Less than 1% of infants required cardiac compressions or medicines for resuscitation at birth, while 4.5% of infants required bag and mask ventilation.

Perinatal asphyxia contributes for 20% of all cases of perinatal asphyxia. Approximately 1.5% of all infants displayed HIE symptoms. One-third of all stillbirths were caused by perinatal hypoxia, which was very common.³

The incidence of prenatal hypoxia is between 8 and 9%, in India. It is responsible for 45.1% of stillbirths and 28.8% of neonatal deaths.^{4,5,6} Hypoxia and ischemia can cause damage to almost every tissue and organ of the body and various target organs involved have been reported to be kidneys in 50% followed by CNS in 28%, CVS in 25% and lungs in 23% cases. As kidneys are very sensitive to oxygen deprivation, renal insufficiency may occur within 24 hours of a hypoxic ischemic episode, which if prolonged, may even lead to irreversible cortical necrosis. Early recognition of renal failure is important in babies with HIE to facilitate appropriate fluid and electrolyte management as a stable biochemical milieu is vital. Hypoxia and ischemia can cause damage to almost every tissue and organ in the body.⁷

Asphyxia is a significant contributor to acute kidney injury (AKI) and temporary kidney dysfunction, particularly within the first five days after birth. In asphyxiated full-term infants, the kidneys are the organs that sustain the most damage.

Methodology:

It is an observational study conducted in N.I.C.U of GRANT GOVERNMENT MEDICAL COLLEGE. A total of 115 cases of term neonates with perinatal asphyxia were included in this study. At the time of enrollment, and informed written consent was obtained from the parents. A detailed perinatal history was recorded and clinical examination was done. Newborns identified as appropriate for gestational age by applying the New Ballard score and by percentile

chart. Diagnosis of birth asphyxia was made by Apgar score, Gestational age, birth weight, relevant perinatal history, findings on physical examination, and systemic examination.

Severity of perinatal asphyxia determined by Sarnat and Sarnat staging system and divided in mild HIE (stage I), moderate HIE (stage II) and severe HIE (stage III).

Urine output, urea, creatinine and serum electrolyte was sent to the biochemistry lab by taking peripheral venous blood samples, initially within 24hrs of birth, 48 hrs and At 72hr.

Selection Criteria:

Inclusion Criteria: Term newborn (gestational age 37 weeks and more) with a history of birth asphyxia or evidence of neurological abnormalities (seizure, coma, hypotonia) suggestive of Hypoxic Ischemic Encephalopathy or immediate neonatal resuscitation including bag and mask ventilation as evidenced by a low Apgar score <7 at 5 minutes of age.

Exclusion Criteria: Congenital abnormalities of the kidneys and urinary tract, cardiopulmonary malformation, babies with septicemia, and respiratory distress syndrome. Those born to mothers with diabetes mellitus and hypertension are treated with diuretics and on drugs (antiepileptics/antidepressants/sedatives), and preterm babies.

RESULTS

In my study out of 115 cases of asphyxia, 39 (33.9%) were mild, 46 (40%) were moderate and 30 (26.1%) were severe, respectively.

Also out of 115 cases of asphyxia, 38 (33.0%) were stage 1 HIE, 56(48.69 %) were Stage 2 and 21 (18.27 %) were Stage 3 HIE respectively.

The mean serum urea i.e., 20.36 ± 9.23 , the mean serum creatinine levels in 115 cases were 0.39 ± 0.44 , mean serum sodium i.e., 135.03 ± 1.44 and mean serum potassium i.e., 4.01 ± 0.44 .

In our study AKI is present in 22 cases (19.13%), whereas 93 cases (80.8%) did not show the presence of AKI.

Table 1: Incidence Of Acute Renal Failure According To The Hie Staging (N=115).

AKI	HIE STAGE 1	HIE STAGE 2	HIE STAGE 3	TOTAL
PRESENT	04(18.18%)	16 (72.72%)	02(10.10%)	22(100%)
ABSENT	34(36.56%)	40(43.01%)	19(20.43%)	93(100%)
Total	38(33.05%)	56(48.69%)	21(18.27%)	115(100%)

The above table shows the presence of AKI in cases as per HIE staging. Among the 38 cases of HIE stage 1, 4 cases (18.8%) showed the

presence of AKI. Among the 40 cases of HIE stage 2, 16 cases (72.2%) showed the presence of AKI. Among the 19 cases of HIE stage 3, 2 cases (10.10%) showed the presence of AKI..

Table 2: Incidence Of Acute Renal Failure With Severity Of Asphyxia According To Apgar Score

SEVERITY OF ASPHYXIA	MILD	MODERATE	SEVERE	TOTAL
AKI PRESENT	0 (0%)	13 (59.09%)	09 (40.91%)	22 (100%)
AKI ABSENT	39 (41.9%)	33 (35.54%)	21 (22.53%)	93 (100%)
TOTAL	39 (33.9%)	46 (40%)	30 (26.1%)	115 (100%)

The above table shows the presence of AKI in cases as per the grading of asphyxia. No cases showed AKI in the cases with mild birth asphyxia.

Among the 33 cases of moderate birth asphyxia, 13 cases (59.09%) showed the presence of AKI.

Among the 21 cases of severe birth asphyxia, 9 cases (40.91%) showed the presence of AKI.

Table 3: Distribution Of Cases According To The Presence Of Oliguria In Aki

Oliguria	Cases (n=22)	Percentage
Present	2	9 %
Absent	20	91%

Out of total 22 cases with AKI 2 cases (9 %) had oliguria and 20 (91 %) were non-oliguric.

DISCUSSION

B.D Gupta et al^[8] (2005), in their study, demonstrated that 25%, 88%, and 100% of cases of stage 1, Stage 2, and stage 3 HIE had AKI respectively. A study done by Matata Et al^[9] (2015) in 2015 found that 0%, 31.4%, and 34% of stage 1, 2, and 3 HIE cases had AKI respectively. In our study presence of Acute Kidney Injury (AKI) according to HIE staging was found to be 18.1% in Stage 1, 72.7% in Stage 2, and 10.1% in Stage 3 out of the 22 cases with AKI. There is an increased incidence of AKI in Stage 2 and Stage 3 HIE with maximum cases belonging to Stage 2 AKI, which is discordant with other studies that suggest maximum incidence of AKI in Stage 3 HIE.

B.D Gupta et al^[8] (2005) in their study, found mean serum creatinine levels to be 1.08 ± 0.49 . Bansal et al^[10] found it to be 1.5 ± 0.33 . In another study by Jayashree Et al^[11] (1991) mean serum creatinine levels were 1.58 ± 0.58 and Aggarwal Et al^[12] (2005) calculated it to be 1.0 ± 0.5 . In our study, the mean serum creatinine levels in 115 cases were 0.39 ± 0.44 which is much lower than the mean serum creatinine levels found in the above mentioned studies.

In a study done by Bansal et al^[10] UREA levels were 27.5 ± 9.16 in the asphyxiated newborns. In another similar study, Jayashree and her colleagues^[11] found urea was 94 ± 34.7 mg/dl among the cases, with the majority of cases belonging to stage III HIE. Similarly, B.D Gupta et al^[8] studied 70 asphyxiated neonates with a mean blood urea value of 35.72 ± 17.87 , and others like Aggarwal and her colleagues^[12] studied 25 asphyxiated neonates and found the mean serum urea value was 33.6 ± 11.5 mg/dl and among the cases was 25.7 ± 7.2 mg/dl. In our study the mean serum urea value was 20.36 ± 9.23 which is concordant with the various other studies.

In a study done by Bansal et al^[10] serum sodium value was 133.9 ± 3.9 mEq/L among the cases as compared to similar studies like P K Misra and colleagues^[13] also shows decreased serum sodium levels in cases (128.28 ± 0.45 mEq/L). In another study which was done by B.D Gupta with his colleagues^[8] found that babies with asphyxia had a higher incidence of hyponatremia and the mean serum sodium levels in the study group were 132.82 ± 5.73 mEq/L. In our study the mean serum electrolytes were serum sodium 135.03 ± 1.44 and serum potassium 4.01 ± 0.44 , which is not concordant with the above studies as hyponatremia is not evident.

In our study, mean urine output in all the cases with AKI was found to be 0.28 ± 0.36 ml/kg/hour in oliguric neonates and 1.2 ± 0.14 ml /kg /hour in non-oliguric neonates.

Oliguria is present in 2 cases (1.7%) and the rest cases 113 (98.3 %)

urine output is within normal limit.

CONCLUSION

Perinatal asphyxia is a paramount reason for neonatal AKI. In neonates suffering from asphyxia, it is essential to correlate biochemical parameters with urine output to confirm that the kidneys are operating at their optimal level.

As evident in my study, maximum cases are non-oliguric variety and hence urine output measurement as criteria may not be the best predictor for diagnosis of Acute Kidney Injury. This study confirmed that the observation of serum electrolytes and kidney parameters aids in the prompt diagnosis and treatment of renal failure.

Hence there is a need to closely monitor and have a greater suspicion in all cases of perinatal asphyxia..

REFERENCES

- Chetty S, Kajjam SK, Patel A. Incidence of acute renal failure in birth asphyxia and its correlation with hypoxic-ischemic encephalopathy staging. Indian J Child Health. 2017;387-389
- Sarnat HB, Sarnat MS. Neonatal encephalopathy following fetal distress- A clinical and electroencephalographic study. Arch Neurol. 1976;33(10):695-706.
- Mac Donald HM, Mulligan JC, Allen AC, Taylor PM. Neonatal asphyxia, Relationship of obstetric and neonatal complication to neonatal mortality in 38,405 consecutive deliveries. J Pediatr. 1980;96(5):898-902
- Network NN. National Neonatal Perinatal Database-report for the year 2002-2003. NNF NNPD network; New Delhi. 2005.
- Lawn JE, Cousens S, Bhutta ZA, Darmstadt GL, Martines J, Paul V, et al. Why are 4 million newborn babies dying each year?. The Lancet. 2004;364(9432):399-401.
- Vamne A, Thanna RC, Pathak S, Chavan N. A Study on Serum Calcium Level in Birth Asphyxia. Int J Health Sci Res. 2015;5(4):147-151.
- Ahire NV, Patil SV, Patel ND, Sonawane R, Joshi D. A Comparative Study of Renal Parameters and Serum Calcium Levels in Birth Asphyxiated Neonates and Normal Neonates. MVP J Med Sci. 2017;4(2):97-101.
- Gupta BD, Sharma P, Bagla J, Parakh M, Soni JP. Renal failure in asphyxiated neonates. Indian Pediatr. 2005;42(9):928-934
- Matata SN, Nkidiaka ED, Aloni MN. The prevalence of acute kidney injury in neonates with birth asphyxia is higher in the Democratic Republic of Congo than in Western countries. Acta Paediatr [Internet]. 2015;104(12):1274-7.
- Bansal S, Kabra N, Singhal S, Singh S, Bassi M. A study of renal parameters and serum electrolytes level in newborns with birth asphyxia. IP Int J Med Paediatr Oncol [Internet]. 2019;5(2):51-3
- Jayashree G, Dutta A, Sarna M, Saili A (1991) Acute renal failure in asphyxiated newborns. Indian Pediatr 28:19-23
- Aggarwal A, Kumar P, Chowdhary G, et al. Evaluation of renal functions in asphyxiated newborns. J Trop Pediatr. 2005 Oct;51(5):295-9. Epub 2005 Jul 13.
- Misra PK, Kumar A, Natu SM, Kapoor RK, Srivatsava KL and Das K. Renal failure in symptomatic perinatal asphyxia. Indian Pediatric 1991;28:1147-