A study of renal parameters and serum electrolytes level in newborns with birth asphyxia

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Abstract
Perinatal hypoxia is one of the most common primary cause of neonatal mortality and morbidity in India. WHO has defined perinatal asphyxia as a "failure to initiate and sustain breathing at birth." Asphyxiated newborns are more prone to hypoxic injury so in these cases any organ can be affected but the brain, myocardium, kidneys and bowels appear to be more sensitive.[1]
This study was conducted in asphyxiated newborns to interprets serum electrolytes levels and renal parameters levels in cases of birth asphyxia.
Materials and Methods: This study was done in 100 Newborn out of which 50 were cases & 50 were control from May, 2015 to May, 2016 were taken up for the study. The detailed perinatal history was obtained. Urine sample was collected by neonatal urobegs in cases and in control it was by spot sample. Blood sample were collected by routine venous sampling. Serum electrolytes levels and renal parameters were evaluated in cases and control.
Results: In our study male babies had higher incidence of birth asphyxia as compared to female babies. In our study blood urea nitrogen (BUN) and creatinine level was higher among cases. Therefore there is a linear correlation with severity of asphyxia. Urine sodium and urine creatinine also increased among cases and therefore they had a higher incidence with severity of asphyxia. In our study we found serum sodium level was lower among cases than the controls. There was linear correlation between severity of asphyxia. The serum potassium was higher among cases than control and serum calcium had lower with severity of birth asphyxia.
Conclusions: The study of Birth asphyxiated newborn shows that monitoring renal parameters and serum electrolytes helps in the early diagnosis and management of renal failure. Therefore they had a linear correlation with severity of birth asphyxia.

Keywords: Perinatal hypoxia, HIE, APGAR score, Serum electrolytes levels, Renal parameters.

Introduction
Perinatal hypoxia is one of the most common primary cause of neonatal mortality and morbidity in India. Perinatal asphyxia has an incidence of 1 to 6 per 1,000 live full-term births.[1]

According to latest estimates by World Health Organization (WHO), approximately 4 million babies die in neonatal period. Perinatal asphyxia and birth injuries together contribute to almost 29% of these deaths.[1,2] WHO has defined perinatal asphyxia as a "failure to initiate and sustain breathing at birth."[1,5]

The National Neonatal Perinatal Database (NNPD) 2000 used a similar definition for perinatal asphyxia. It defined moderate asphyxia as slow gasping breathing or an Apgar score of 4-6 at 1 minute of age and severe asphyxia was defined as no breathing or an Apgar score of 0-3 at 1 minute of age.[1,3]

In cases of birth asphyxia most of the organ like brain, kidneys, heart, lungs can be affected but Kidneys are more sensitive to oxygen deprivation so they leads to renal insufficiency approximately within 24 hours of hypoxic ischemic injury.

Aims and Objective
The aim of this study was to correlate the levels of serum electrolyte levels and renal parameters in cases of birth asphyxia.

Materials and Methods
The study was conducted at the Department of Pediatrics, Muzaffarnagar Medical College & Hospital, Muzaffarnagar. A total of 100 Newborn out of which 50 were cases & 50 were control from May, 2015 to May, 2016 were enrolled for the study.

Inclusion Criteria
1. Term (37-41 weeks), appropriate for gestational age (inborn & outborn)
2. Outborn with history of birth asphyxia (delayed cry of 5-10 min) and inborn with apgar score at 1 min (less than 7)

Exclusion Criteria
1. Any apparent major congenital abnormality
2. Preterm babies

A detailed physical & systemic examination was done. Gestational age was calculated by applying by modified Ballard's score. Birth asphyxia was diagnosed by APGAR score and hypoxic ischemic encephalopathy was diagnosed by SARNAT staging.[4]
All the newborn were evaluated for renal parameters-
Blood: Serum creatinine, blood urea nitrogen (BUN), Serum Electrolytes
Urine: Urine sodium, Urine Potassium.

Results

Table 1: Sex distribution in cases and controls

Sex Distribution	Case		Control	
	Count	%	Count	%
No. of Male	29	58 %	22	44 %
No. of Female	21	42 %	28	56 %
Total	50	100 %	50	100 %

The study included 50 cases (asphyxiated newborn) and 50 controls (normal newborn) with majority being males in cases and female in control group.

Table 2: Renal parameters among cases and controls

	Group	N	Mean (mg/dL)	Std.Deviation	Z
BUN	Cases	50	27.5	9.16	Z value-4.476
	Controls	50	21.7	2.73	P<0.0001
Serum creatinine	Cases	50	1.5	0.33	Z value-6.34
	Controls	50	1.1	0.3	P<0.0001
urine sodium	Cases	50	37.5	8.766	Z value-16.89
	Controls	50	15.7	2.53	P<0.0001
Urine creatinine	Cases	50	27.2	8.43	Z value-5.49
	Controls	50	18.9	6.57	P<0.0001

This study shows BUN level was higher among cases as compared to control and it was statistically significant. In our study serum creatinine levels were higher in cases as compared to controls and the difference between the groups were statistically significant. In our study urine sodium was found higher among the cases as compared the controls and the difference between the groups were statistically significant. In our study we found that urine creatinine was found to be higher among the cases than the controls and the difference between the groups were statistically significant.

Table 3: Serum electrolytes level among cases and controls

	Group	N	Mean (mEq/L)	Std. Deviation	P value
Serum sodium	Cases	50	133.6	3.35	
	Controls	50	138.2	1.999	P<0.0001
Serum potassium	Cases	50	5.2	0.9	P<0.0001
	Controls	50	4.3	0.2	
Serum calcium	Cases	50	8.0	0.785	P<0.0001
	Controls	50	9.2	0.1	

The study shows serum sodium levels was low in asphyxiated newborns as compared to the control and the difference between the two groups is statistically significant. Serum potassium was found higher in study group as compared to control and the difference between both the groups was statistically significant. In our study we found that serum calcium level was found lower among cases as compared to control population and the difference between the groups were statistically significant.

Discussion

Perinatal hypoxia contributes significantly to neonatal mortality and morbidity. HIE is the major consequence of perinatal asphyxia. In asphyxiated newborn most of the organ can be affected but the brain, myocardium, kidneys and bowels appear to be more sensitive to HIE. Kidneys are involved in 50%, brain involved in 28%, heart in 25% and lungs in 23% of cases.[2]

In cases of birth asphyxia Kidneys are more sensitive to oxygen deprivation which leads to renal insufficiency approximately within 24 hours of hypoxic ischemic injury.

This study interprets the association of electrolytes imbalance with severity of asphyxia. The study was done in total 100 newborns out of which 50 were included in case group and 50 were included in control group. Out of 50 asphyxiated newborn 29 (58%) were males and 21(42%) female. So there was higher incidence seen in the male babies. In other study which was done by Mac Donald shows that incidence of asphyxia was 54% in male babies and 46% in female babies.[12]

Finally this study interprets the statistically significant difference between the renal parameters. This study shows BUN levels was 27.5+9.16 in the asphyxiated newborns as compared to controls who had BUN level was 21.7+2.73 and it was statistically significant. In other similar study like Jayashree and her colleagues found BUN was 94+34.7

mg/dl among the cases as compared to controls who had a mean value of 25.6 mg/dl with majority of cases belonging to stage III HIE.

Similarly Gupta et al studied 70 asphyxiated neonates with mean blood urea value of 35.72+17.87 and other like Aggarwal and her colleagues 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.[5,8,10]

In our study we found mean serum creatinine levels was 1.5+0.33in case group and 1.1+0.3 in control and it was statistically significant difference between both the groups. While in Jayashree et al study found serum creatinine levels was 1.58+0.58 mg/dl among the cases as compared to controls it was 0.9 mg/dl, with majority of cases belonging to stage III HIE.

In other study like Gupta and colleagues studied 70 asphyxiated neonates and found the mean serum creatinine values was 1.08+0.49 as compared to controls was 0.88+0.26 mg/dl. Aggarwal and her colleagues studied 25 asphyxiated neonates and found the mean serum creatinine value was 1.0+0.5 mg/dl as compared to controls was 0.7+0.2 and it was statistically significant.[7,8,10]

In our study serum sodium value was133.9+3.9 mEq/L among the cases as compared to controls had 138.7+5.0 mEq/L as compared to similar study like P KMisra and colleagues also shows that decreased serum sodium levels in cases (128.28 + 0.45 mEq/L) as compared to controls (135.7 + 0.68 mEq/L). In other study which was done by B D Gupta with his colleagues found that babies with asphyxia had higher incidence of hyponatremia and the mean serum sodium levels in study group was 132.82+ 5.73 mEq/L which was lower than the control group of 135.82 + 3.99mEq/L.

As well as Pallab Basu and coworkers also found that mean serum sodium levels were significantly lower in asphyxiated babies (122 + 6.0 mEq/L) as compared to controls (138.8 + 2.7 mEq/L) and thye all study shows the similar as compared to our study.[5,6,11]

The mean serum potassium value was 5.27+0.95 mEq/L among the cases as compared to controls had 4.4+0.56 mEq/L. P K Misra with his coworkers found that serum potassium levels were increased in asphyxiated neonates as compared to controls. A similar study done by Pallab Basu and colleagues found that mean serum potassium levels were higher in asphyxiated babies as compared to controls with p value of <0.001.[11]

The mean serum calcium value among the cases was 8.1+0.73 mg/dl as compared to controls had 9.2+0.13 mg/dl. Pallab Basu and colleagues found that mean serum calcium levels were lower in asphyxiated babies (6.85 + 0.95 mg/dl) as compared to controls (9.50 + 0.51mg/dl) with p value of <0.001.[6]

Conclusion

Perinatal asphyxia is a most common cause of neonatal morbidity and mortality and also an important cause of neonatal Acute Renal Insult.

In asphyxiated neonates, correlation of biochemical parameters with the urine output is necessary to ensure that the kidneys are functioning optimally or not.

This study found that monitoring of serum electrolytes and renal parameters helps in the early diagnosis and management of renal failure. This study shows that serum electrolytes levels and renal parameters had a linear correlation with severity of birth asphyxia.

Conflict of Interest: None.

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