



## Study the association of serum electrolyte changes with short term outcome in cases of birth asphyxia requiring admission in SNCU

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### Abstract

Perinatal Asphyxia is one of the major causes of Neonatal Morbidity and Mortality all across the world. It is also one of the primary indications for admission in neonatal unit. Electrolyte imbalance in any critical patient has been associated in increased morbidity and mortality in a critical care setting. The asphyxiated neonate is also at enhanced risk of diselectrolytemia. Disorders of sodium balance have been associated with increased mortality in neonates. This study was done at a tertiary care unit to determine the incidence of electrolyte imbalance in asphyxiated new-born. Out of 777 neonates enrolled for study about 48% neonates had disorders of sodium imbalance and about 20% neonates had disorders of Potassium imbalance. Disorder of calcium imbalance was the most frequent (about 74%)

### Keywords

Neonate, Asphyxia, Hyponatremia, Hyperkalaemia

### Introduction

WHO estimates that 4 million neonatal deaths occur yearly due to birth asphyxia [1] Birth asphyxia is defined as the presence of hypoxia, hypercapnia, and acidosis leading the newborn to systemic disturbance probably electrolyte disturbance also [2, 3]. In neonates with perinatal asphyxia there might be hyponatremia due to increased secretion of anti-diuretic hormone (ADH) in neonates [4]. The other reason for hyponatremia is, that the capacity of sodium re-absorption is limited [5]. Other contributing factors to hyponatremia are partial resistance to aldosterone [6].

In newborns the rise in level of serum potassium can be explained from the fact that birth asphyxia is associated with acidosis, and more than one-half of the excess hydrogen ions are buffered in the cells. It can also be due to acute renal failure secondary to birth asphyxia.



Clinically significant hypocalcemia occurs in asphyxiated newborns [7]. The etiology behind this is a sluggish response in PTH secretion to the postnatal fall in plasma calcium concentration. Knowledge of these electrolyte disturbances is very valuable as it can be an important parameter affecting perinatal morbidity, mortality and ongoing management.

This study was started with the aim to study association of serum electrolyte changes with severity of birth asphyxia requiring admission in SNCU of Department of Pediatrics, Pt JNM Medical College & Dr B R Ambedkar Memorial Hospital Raipur C.G.

### Data and methods

The present study was a cross sectional observational study was conducted after approval from institutional ethics committee in SNCU of Department of Pediatrics, Pt JNM Medical College & Dr B R Ambedkar Memorial Hospital Raipur C.G. Total of 777 neonates with HIE were included in study during data collection period of January 2020 to December 2020. Demographic details and clinical profile of neonates with birth asphyxia was collected. Data of biochemical investigations and their details were recorded in specified format. Data was entered in Microsoft excel and analyzed using IBM-SPSS-20 version. Ethical consideration was taken care and informed consent was taken from the care takers of neonates.

### Results

**Table 1: Demographic and clinical profile of study subjects**

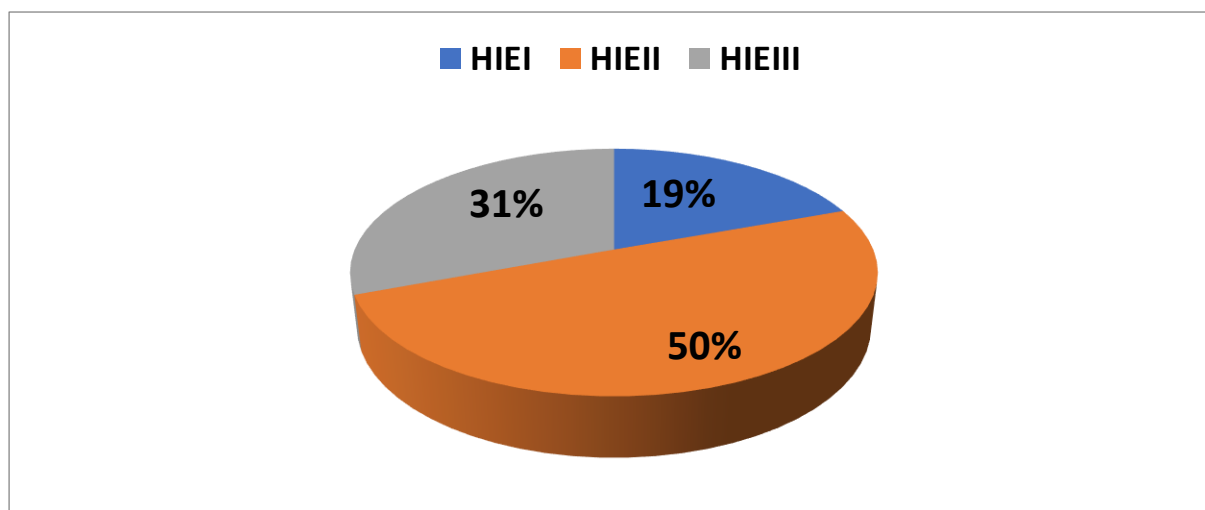
Sex	Freq.	Percent
Female	286	36.81
Male	491	63.19
Type of Admission	Freq.	Percent
Inborn	340	43.76
Out born (Health Facility Referred)	434	55.86
Out born(Community Referred)	3	0.39
Maturity	Freq.	Percent
Full term (37-42 WEEKS )	774	99.61
Post term (=>42 Weeks)	3	0.39
Age in days at the time of admission	Freq.	Percent
0 day	539	69.37



Sex	Freq.	Percent
1 day	146	18.79
2 day	44	5.66
3 day	25	3.22
4 day	17	2.19
5 day	4	0.51
6 day	2	0.26
<b>Total</b>	<b>777</b>	<b>100</b>

In present study 777 neonates with perinatal birth asphyxia were included in the study and of those majority 63.19% were male. Type of admission of study subjects in NICU revealed that, 55.86% were Out-born (Health Facility Referred) and 43.76% were inborn admissions. Among study subjects admitted in NICU almost all cases were full term except 3 cases which were post term. The age of newborns at the time of admission in NICU, Maximum 69.37% were admitted on the same day of their birth. 18.79% were admitted ion 1<sup>st</sup> day and 5.66% were admitted on 2<sup>nd</sup> day. (Table 1)

**Graph 1: Grading of HIE in admitted newborns (N=777)**



In present study grading of HIE in admitted newborns shows that, half 49.81% were in HIE stage II, 30.76% were in HIE stage III and 19.43% were in HIE stage I. (Graph 1)



**Table 2: Level of sodium, potassium and calcium in study subjects**

Sodium level	Freq.	Percent
Hypernatremia	34	4.38
Hyponatremia	339	43.63
Normal	404	51.99
Potassium level	Freq.	Percent
Hyperkalaemia	126	16.22
Hypokalaemia	32	4.12
Normal	619	79.67
Calcium level	Freq.	Percent
Hypercalcemia	30	3.86
Hypocalcaemia	540	69.5
Normal	207	26.64
Total	777	100

The mean sodium level in HIE admitted neonates was  $136.26 \pm 5.81$  meq/L; 43.63% had Hyponatremia and 4.38% had Hypernatremia. The mean potassium level in HIE admitted neonates was  $4.84 \pm 0.66$  meq/L; 4.12% had Hypokalemia and 16.22% had Hyperkalemia. The mean calcium level in HIE admitted neonates was  $0.94 \pm 0.19$  meq/L; 69.5% had Hypocalcemia, and 3.86% had Hypercalcemia. (Table 2)

**Table 3: Association b/w Grading of HIE and Sodium level in study subjects**

Sodium level	Grading of HIE			Total	P value
	HIEI	HIEII	HIEIII		
Hypernatremia	26	8	0	34	0.001
	17.2%	2.1%	0.0%	4.4%	
Hyponatremia	0	130	209	339	
	0.0%	33.6%	87.4%	43.6%	
Normal	125	249	30	404	
	82.8%	64.3%	12.6%	52.0%	
Total	151	387	239	777	
	100.0%	100.0%	100.0%	100.0%	



In HIE-III grading 87.4% newborns were hyponatremia and in HIE-II grading 33.6% were in Hyponatremia. Statistically significant association b/w changes in sodium level and Grading of HIE in study subjects (P=0.001) (**Table 3**)

**Table 4: Association b/w Grading of HIE and Potassium level in study subjects**

Potassium	Grading of HIE			Total	P value
	HIEI	HIEII	HIEIII		
Hyperkalaemia	18	51	57	126	0.001
	11.9%	13.2%	23.8%	16.2%	
Hypokalaemia	0	6	26	32	
	0.0%	1.6%	10.9%	4.1%	
Normal	133	330	156	619	
	88.1%	85.3%	65.3%	79.7%	
Total	151	387	239	777	
	100.0%	100.0%	100.0%	100.0%	

In HIE-III grading 23.8% newborns were hyperkalemia and in HIE-II grading 13.2% were in Hyperkalemia. Statistically significant association b/w changes in potassium level and Grading of HIE in study subjects (P=0.001) (**Table 4**)

**Table 5: Association b/w Grading of HIE and Calcium level in study subjects**

Calcium	Grading of HIE			Total	P value
	HIEI	HIEII	HIEIII		
Hypercalcemia	6	23	1	30	0.001
	4.0%	5.9%	.4%	3.9%	
Hypocalcaemia	96	252	192	540	
	63.6%	65.1%	80.3%	69.5%	
Normal	49	112	46	207	
	32.5%	28.9%	19.2%	26.6%	
Total	151	387	239	777	
	100.0%	100.0%	100.0%	100.0%	



In HIE-III grading 80.3% newborns were in hypocalcemia and in HIE-II grading 65.1% were in Hypocalcemia. Statistically significant association b/w changes in calcium level and Grading of HIE in study subjects (P=0.001) (**Table 5**)

Among all the admitted newborns 30.5% were died and 61.13% were discharged after treatment

## **Discussion**

The present study conducted to measure the association b/w serum electrolyte changes with severity of birth asphyxia requiring admission in SNCU of a tertiary care teaching hospital.

In present study majority of 63.19% were male neonates. Similar findings were reported by Kumar SD et al (2018) that in their study female to male ratio were 3:1 and Thakur, Jitendra et al (2018) also reported that of enrolled cases 60 (68%) were male. [8] [9]

In present study 55.86% were Out-born (Health Facility Referred) and 43.76% were inborn admissions. Whereas almost all cases were full term except 3 cases which were post term. Simiyu, I.N. et al (2017) reported that one third of the pre term had hypoxic ischemic encephalopathy compare to two-third of full term.[10] Sugunakar Reddy B et al (2019) reported that in birth asphyxia newborns mean gestational age of study population was 38 weeks.[11]

In present study majority of the neonates 49.81% were in HIE stage-II, 30.76% were in HIE stage-III and 19.43% were in HIE stage-I. Studies from the similar settings by Kumar SD et al (2018) reported that 47% fell under HIE stage 1, 37% and 16% were in HIE stage 2 and HIE stage 3 respectively. [8] Acharya A et al (2020) reported that majority of the asphyxiated babies were having moderate HIE (HIE II) (57.33%), whereas mild and severe stages were seen in 15.33%, and 27.34% of babies, respectively. [12]

The mean sodium level in neonates was  $136.26 \pm 5.81$  meq/L. Out of total newborns 43.63% had Hyponatremia. Out of 239 HIE-III grading neonates; 87.4% (209) newborns were hyponatremia and in 387 HIE-II grading neonates 33.6% (130) were in Hyponatremia. Basu P et al (2010) reported that mean serum sodium level was significantly lower ( $122.1 \pm 6.0$  mEq/L vs  $138.8 \pm 2.7$  mEq/L;  $P < 0.001$ ), in cases than controls.[13] Masood N et al (2016) reported that Hyponatremia showed linear correlation with severity of birth asphyxia [14]



The mean potassium level in HIE admitted neonates was  $4.84 \pm 0.66$  meq/L. Out of total newborns 4.12% had Hypokalemia and 16.22% had Hyperkalemia. Out of 239 HIE-III grading neonates 23.8% (57) newborns were hyperkalemia and in 387 HIE-II grading neonates 13.2% (51) were in Hyperkalemia. Kumar SD et al (2018) reported that Hyperkalemia was significant with increased severity of birth asphyxia. [48] Thakur, Jitendra et al (2018) reported that the values of potassium among different severity of asphyxia were significantly different ( $p$ -value < 0.001). [9]

The mean calcium level in HIE admitted neonates was  $0.94 \pm 0.19$  meq/L. Out of total newborns 69.5% had Hypocalcemia and 3.86% had Hypercalcemia. Out of 239 HIE-III grading neonates 80.3% (192) newborns were in hypocalcemia and in HIE-II grading neonates 65.1% (252) were in Hypocalcemia. Basu P et al (2010) reported that mean serum calcium level was found lower ( $6.85 \pm 0.95$  mg/dl vs  $9.50 \pm 0.51$  mg/dl;  $P < 0.001$ ) in cases than controls. Among cases, a strong positive linear correlation was found between the serum calcium levels and their Apgar scores. [8] Masood N et al (2016) reported that hypocalcemia showed linear correlation with severity of birth asphyxia.[9]

## Conclusions

From present study we conclude that asphyxiated babies develop hyponatremia hyperkalemia and hypocalcemia but to reach to definite conclusion further studies are required. Hyponatremia, hyperkalemia and hypocalcemia has significant relationship with morbidity and mortality of asphyxiated newborns. If inappropriate fluid and electrolytes are given, serious morbidity and mortality can result from fluid and electrolyte imbalance. So measurement of serum electrolyte is the best way to measure the baby's electrolyte status and the adequacy or excess of electrolyte intake. Hence early identification and time-based intervention of electrolyte abnormality in the early post asphyxiated period will significantly reduce the morbidity and mortality.

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