

# Serum electrolyte and calcium abnormalities in neonates with birth asphyxia

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**Abstract:** *Background: Birth asphyxia is defined as cessation of breathing or gasping type of breathing with Apgar score of less than 7 at 1 minute of age, with umbilical cord blood ph less than 7. Birth asphyxia is one of the leading cause of neonatal mortality in India and accounts for 23% of all neonatal deaths<sup>(1)</sup>. Hypoxic-ischemic encephalopathy (HIE) is a term that describes clinical evidence of encephalopathy with objective data to support a hypoxic-ischemic (HI) mechanism as the underlying cause for the encephalopathy. Objectives: To compare serum electrolyte and calcium levels at less than 12 hrs with levels at 24 – 48 hrs. and it's correlation with immediate short term outcome of neonates with birth asphyxia, severity of birth asphyxia and HIE staging. Methodology: Serum sodium, potassium and calcium estimation will be done at birth to 12 hours of birth and repeated at 24 to 48 hours of birth in full term neonates diagnosed with birth asphyxia. Sample will be collected by pricking a peripheral vein or when securing i.v.canula. Results: would be undertaken with SPSS. Conclusion: would be Based on findings of the study.*

**Keywords:** *electrolytes, birth asphyxia, HIE, neonates.*

## I. Introduction

Birth asphyxia is defined as slow gasping type of breathing or no breathing with Apgar score <7 at 1 minute of life, and umbilical cord blood pH of less than 7. While severe birth asphyxia is defined as acidemia that is pH < 7.0 as evident by cord blood gas analysis, with an APGAR score of 0 to 3 at >5 min of birth along with hypotonia, seizures, coma or hypoxic ischemic encephalopathy and systemic impairment in immediate neonatal period. In a developing country like India birth asphyxia is one of the main cause of neonatal mortality rate, accounts for 23% of all neonatal deaths<sup>(1)</sup>. The prevalence of Hypoxic-ischemic encephalopathy (HIE) is 0.1% to 0.5% of total live births. Fluid and electrolytes abnormalities are commonest derangements encountered in critical cases of birth asphyxia and any deviation from their normal level may lead to convulsions, shock, and major metabolic abnormalities. Usually hypernatremia is observed commonly in the early neonatal period because of many reasons like high insensible water loss. This insensible water loss is added by loss of fluid from gastrointestinal system, respiratory tract and skin. The kidneys of neonates with birth asphyxia have immature functions and cannot retain sodium leading to hyponatremia. The intravascular compartment have more than usual blood volume due to syndrome of inappropriate secretion of anti-diuretic hormone (ADH). The sodium levels are found to be lower than normal as there is loss of sodium from the renal collecting system due to inadequate absorption

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thereby high level of sodium in the urine. If the excess of sodium is reached in collecting duct, potassium reabsorption is more and thus serum levels of potassium are elevated and the sodium levels are low. The urine examination at this stage reveals high sodium concentration and low potassium levels. The potassium levels in the birth asphyxia are more due to metabolic acidosis, an invariable finding in severe birth asphyxia. In this situation, electrical balance is maintained partly by potential difference across the plasma membrane due to movement of potassium. The potassium is moved out of cells into the extracellular compartment. It can also occur due to acute renal failure secondary to birth asphyxia which leads to decreased excretion of potassium via kidneys because of which the occurrence hyperkalemia is seen. Clinically significant hypocalcaemia occurs in neonates with birth asphyxia, the reason for this abnormality is decreased in levels of Parathyroid hormone response.

**Objectives:** To compare serum electrolyte and calcium levels at less than 12 hrs with levels at 24 – 48 hrs. and its correlation with immediate short term outcome of neonates with birth asphyxia, severity of birth asphyxia and HIE staging.

## II. Methods

It is a prospective observational study will be conducted in the Department of Pediatrics of Jawaharlal Nehru medical college and Acharya Vinobha Bhave Rural Hospital, Sawangi(Meghe), Wardha located in central India. Full term neonates diagnosed with birth asphyxia will be enrolled after satisfying the inclusion criteria.

Inclusion criteria- All neonates admitted with diagnosis birth asphyxia.

A written informed consent will be obtained from parents of these neonates. Full term neonates with APGAR score less than 7 at 1 minute will be included. Serum electrolytes and calcium levels at <12 hours and 24-48 hours were measured using serum samples of neonates with birth asphyxia. Immediate short-term outcome of the neonate at discharge with neurological evaluation will be noted. This data will be collected and statistically analysed.

Bias: Assessing APGAR score

Study size: A sample size of 85 calculated in accordance with incidence in population (10%), incidence in study group (20%) with alpha error (0.05) considering beta error (0.2) and study power of (0.8).

Quantitative variables: Serum electrolyte and serum calcium levels

Statistical methods: Descriptive and inferential statistical analysis will be done using SPSS software version 20. Statistical comparison of mean values of serum sodium, potassium and calcium with severity of birth asphyxia will be performed by ANOVA. Bivariate analysis will be done to determine the correlation between serum electrolytes and apgar score. Chi-square/Fisher Exact test will be used to find the significance of study parameters on categorical scale between two or more groups.

## III. Expected Results

Participants: 85 full term neonates with birth asphyxia were enrolled after satisfying inclusion and exclusion criteria and informed consent will be taken from the parents

Descriptive data: serum samples of Inborn or outborn neonates with APGAR score <7 at 1 minute of age were collected either by pricking peripheral vein or after securing i.v. canula and the sample sent to the central laboratory within 12 hours of birth and repeat sample will be sent between 24 to 48 hours and the values will be correlated with immediate short term outcomes of neonates with birth asphyxia, severity of birth asphyxia, and HIE staging.

Outcome data: Would be undertaken with SPSS.

Main results: Hyponatremia, hyperkalemia and hypocalcemia in relation with HIE staging.

#### **IV. Discussion**

In a study by Rahman F (2017) <sup>(2)</sup> on electrolyte imbalance in asphyxiated neonates, out of 133 asphyxiated neonates 30.1% were hyponatremic, hypokalemia was observed in 6.0%, hyperkalemia was observed in 21.1% asphyxiated neonates.

Jitendra Thakur et.al. (2018) <sup>(3)</sup> in their study of prevalence of electrolyte disturbances like hyponatremia and hyperkalemia in perinatal asphyxia, found that electrolytes abnormality is a common observation. The sodium levels were low and potassium levels were high in severe birth asphyxia. These variations were probably secondary to renal, cerebral and hormonal disturbances.

In a study by Satheesh Kumar D. et.al. (2018)<sup>(4)</sup> on electrolyte abnormalities in asphyxiated newborns, the hyponatremia was statistically significant in all stages of birth asphyxia and hyperkalemia was significant only in HIE stage 3.

Pallab Basu et.al. (2010)<sup>(5)</sup> in their study on electrolyte status in birth asphyxia, noted that electrolytes like sodium and potassium were abnormal. Few hours after birth there were cases of hyponatremia and hyperkalemia. These changes were more prominent with the degree of birth asphyxia. A number of other articles related to various aspects of this study were reviewed <sup>(7-65)</sup>.

Limitation: It's a single centre study not a case control study. Long term sequelae can't be assessed if patient won't come for regular follow-up. We can't correlate electrolyte and calcium levels of outborn neonates if they were admitted after 12 hours of birth. We can't assess APGAR score in home deliveries.

Interpretation: The presence of hyponatremia and hyperkalemia was proportional to the degree of birth asphyxia. hyponatremia and hypocalcemia showed linear correlation with severity of birth asphyxia <sup>(6)</sup>

Generalisability: External validity of this study results is reliable if there are no bias in assessing APGAR score and no technical errors in measuring serum electrolytes and calcium levels of serum samples collected within 12 hours of birth and 24 to 48 hours of birth.

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