

## Original Article

# Biochemical Findings of Neonatal Seizures: a hospital-based study

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### Abstract:

**Background:** Neonatal seizures are seizures that happen within the first 28 days of life; they are serious emergency that need to be quickly diagnosed in order to start immediate treatment.

**Methodology:** This cross-sectional study was conducted in the Department of Paediatrics of the Jalalabad Ragib-Rabeya Medical College Hospital in Sylhet. The study\* was done from July 2013 to December 2013. The study included 100 neonates who experienced seizure episodes. A detailed history was taken and thorough physical examinations were performed after acquiring written consent. A complete blood count, urine R/M/E (routine microscopic examination), blood glucose, total serum calcium, and serum electrolytes (sodium, potassium, and chloride) levels were done in all 100 neonates.

**Results:** 100 hospitalized newborns were evaluated, of which 43% were born to primi mothers and 57% to multipara mothers, 37% of newborns were delivered at home while 63% were born in a hospital. The majority (60%) of births were through normal vaginal delivery (NVD) and 73% of the mothers reported being in good health in the antenatal period. Biochemical study of these patients revealed that 20% of newborns experienced hypoglycemia, 13% of patients had hypokalemia, 30% had hyponatremia, 27% of newborns had hypochloremia, while 43% had hypocalcaemia.

**Conclusion:** The most frequent biochemical abnormality in neonatal seizure according to this study was hypocalcemia (43%) and hyponatremia (30%).

**Key words:** biochemical, hypoglycemia, hyponatremia, hypokalemia, hypochloremia, neonatal seizure, subtle, tonic-clonic

JSWMC 2024 [14(01)] P: 18-22

### Introduction:

The central nervous system of the newborn is physiologically underdeveloped. Despite the fact that the cortical neurons stop dividing in the second trimester of pregnancy, it appears that glial cells, dendritic processes and myelination grow after birth and in the early postnatal period.<sup>1</sup> Neonatal seizures is the most frequent neurological manifestation which may harm the developing brain which may impede DNA synthesis, glial proliferation, differentiation and myelination.<sup>2</sup>

The prevalence of newborn seizures is 1.5% worldwide.<sup>3</sup> Neonatal seizures are common in Bangladesh, occurring 2-3 per 1000 live births at term and 10-15 per 1000 preterm births.<sup>4</sup> In clinical practice, clinicians observed many types of seizure in neonates. The main causes of seizures include birth asphyxia, metabolic abnormalities, sepsis, kernicterus, intracranial hemorrhage, brain malformation and numerous additional unknown causes.<sup>5</sup>

High-risk newborns are susceptible to seizures caused by biochemical disturbances and they respond well with treatment.<sup>6</sup> Biochemical disturbances occur frequently in neonatal seizures either as an underlying cause or as an associated abnormality. These are hypoglycaemia, hypocalcaemia, hyponatremia, hypomagnesemia etc. Different studies suggested that about two-thirds of neonates with seizures demonstrated one or more biochemical abnormalities in their sera. In their presence it is difficult to control seizures and there is a risk of further brain damage. Early recognition and treatment of biochemical

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disturbances are essential for optimal management.

It is challenging to manage seizures when biochemical abnormalities are present, and there is a possibility of sustaining permanent brain damage.<sup>7</sup> For accurate classification and treatment rapid establishment of diagnostic and therapeutic interventions is necessary. The goal of the current study was to identify the biochemical findings in newborns who had seizures.

### Methodology:

This study is cross-sectional and observational in design, was carried out in the Neonatal unit of department of Paediatrics at the Jalalabad Ragib-Rabeya Medical College Hospital in Sylhet from July 2013 to December 2013. All newborns admitted to the neonatal ward for seizure within the first 28 days of life comprised the study population. The exclusion criteria for this study included neonates with seizures after 28 days of life, neonates with congenital anomalies as well as those whose guardian refused to participate. Consecutive convenient sampling technique was applied to select the sample. Total 100 newborns who had seizures was enrolled in the study. Within 12 hours of admission, enrollment for the study was completed. Before giving their written consent, the patient's legal guardians were thoroughly informed about the details of the study procedure and the goals of the study. A detailed obstetrical history such as maternal parity, antepartum maternal health, mode as well as place of delivery was noted and a physical examination was performed. For each seizure episode that was reported by the mother and later witnessed by the resident doctors on duty. Clinical data such as age of onset, duration and type of seizures were recorded.

Before initiating any specific treatment other than anti-convulsant therapy, a complete blood count, urine R/M/E, blood glucose, total serum calcium, and serum electrolytes (sodium, potassium, chloride) levels were undertaken as soon as possible.

The statistical analysis was completed using SPSS version 22 (Statistical Package for the

Social Sciences). Frequencies and percentages were used to express the variables.

### Results:

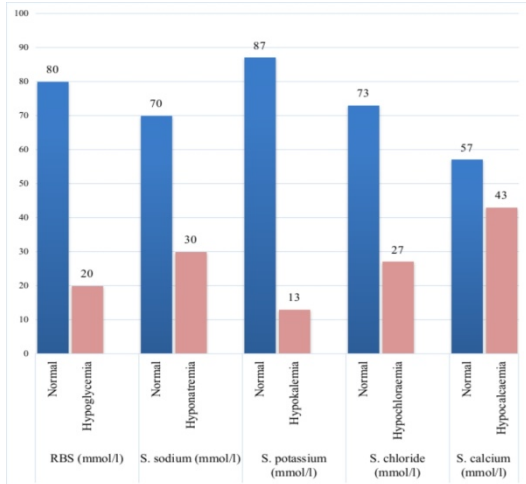
Of a total 100 hospitalized neonates studied, 43% were delivered from primi mother, 57% were delivered from multipara mother and 37% of neonates were born at home, the rest (63%) were born in the hospital. The majority (60%) was delivered by normal vaginal delivery (NVD) and the antepartum health of 73% of the mothers was good (Table 1).

Hypoglycemia affected 20% of neonates, 30% had hyponatremia and 13% had hypokalemia. Hypochloremia affected 27% and hypocalcaemia affected 43% of neonates (Figure 1). The subtle seizure was the most commonly found (67%) seizure among neonates (Figure 2).

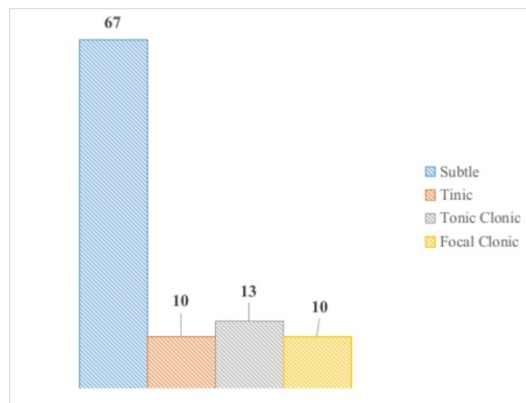
**Table 1: Characteristics of the mothers of neonates suffered from seizure (N=100)**

Characteristics		Number of patients	Percentage
Maternal parity	Primipara	43	43
	Multipara	57	57
Place of delivery	Home	37	37
	Hospital	63	63
Mode of delivery	NVD	60	60
	LUCS	40	40
Antepartum maternal health	Good health	73	73
	DM	3	3
	PET	17	17
	HTN	7	7

NVD= normal vaginal delivery; LUCS= lower uterine cesarean section; DM= diabetic mellitus; PET= Pre-eclampsia; HTN= hypertension; N= total number of subjects.



**Figure 1: RBS (random blood sugar), serum sodium, potassium level (mmol/l), chloride and calcium level (mmol/l) in study population (N=100)**



**Figure 2: Types of seizure in neonates (N=100)**

### Discussion:

The neonatal period is a period of intense physiological synaptic excitability.<sup>8</sup> Seizures are possibly the most important and common indicator of significant neurologic dysfunction in the neonatal period. Neonatal seizures typically involve biochemical abnormalities which are commonly misdiagnosed. In order to aid in early diagnosis, treatment and a better prognosis for neonatal seizures, this study examined the biochemical abnormalities in neonatal seizures.

In current study, 57% of the mothers were multipara. The majority of newborns (63%) were delivered in a hospital. Normal vaginal delivery was the method of delivery in 60% of

instances, while LUCS (lower uterine cesarean section) occurred in 40% of cases. The study by Paswan and Singh 2018, found that the majority (88.0%) of infants with seizures were delivered vaginally, followed by LUCS delivery (9.6%) and forceps delivery (2.4%), had comparable findings.<sup>9</sup>

Out of 100 newborns, 63% were delivered in a hospital and 37% at home. In a different study, Das et al. discovered that 98.3% of babies were born in a hospital.<sup>10</sup> Due to the continued prevalence of home delivery in our country, this conflict is rather clear.<sup>11</sup> According to our assessment of maternal health, 73% of pregnant mothers had good health. Pre-eclampsia affected 17% of women, hypertension affected 7%, and diabetes affected 3% of the mother. Mansour et al. 2023 also observed similar findings.<sup>12</sup>

In the current study, the blood counts (CBC) of every infant were normal. Hypocalcaemia (43%) was found to be the most prevalent biochemical anomaly. The results of this study varied from those of the other studies. Shah et al. (2008) observed hypocalcaemia in 11% of neonates.<sup>13</sup> Hypocalcaemia was the most prevalent biochemical abnormality in Paswan and Singh 2018. 9.6% of newborns had hypocalcaemia as the underlying factor in their seizures.<sup>11</sup> Mansour et al. 2023 found hypocalcaemia in 26% of neonates.<sup>12</sup> Eighty-eight full-term and preterm newborns participated in a study by Marzoki 2010 to identify the biochemical causes of neonatal seizures. Forty-two patients (47.7%) of the whole population have metabolic abnormalities; of them, 16 patients (18.1%) had hypomagnesemia, 8 patients (9%) had hypocalcaemia. In 6 patients (6.8%), hypocalcaemia and hypomagnesemia were found.<sup>14</sup>

Even healthy-term infants experience a fall in calcium levels within 24 hours after delivery, which occurs during the first 72 hours of life before achieving a considerable oral intake of milk. This condition is known as early neonatal hypocalcaemia. This is due to the abrupt cessation of transplacental calcium supply, relative hypoparathyroidism of neonates and the target cell's relative unresponsiveness to

parathyroid hormone. Due to undeveloped renal functioning in newborns, hyperphosphatemia and secondary hypocalcaemia also occur.<sup>15</sup>

An estimated 30% of newborns had hyponatremia in present study. According to Marzoki 2010, 6.8% of neonates had hyponatremia.<sup>15</sup> In 6% of newborns, Mansour et al. 2023 detected hyponatremia in their study. Hyponatremia (65%) was noted in 65% of neonates, according to Das et al. 2016.<sup>16</sup>

In our findings, 20% of newborns experienced hypoglycemia. Almost comparable to our study, Shah et al. (2008) observed that 22% of infants developed hypoglycemia.<sup>12</sup> Marzoki 2010 found 6.8% had hypoglycemia in their study. The researcher observed a significant relationship between the onset of seizure and hypoglycemia ( $p < 0.05$ ).<sup>14</sup> According to Das et al. 2016, hypoglycemia (66.7%) was the most commonly found biochemical abnormality in neonatal seizures.<sup>10</sup> In our study, 27% of the newborns had hypocalcaemia. Hypokalemia affected 13% of neonates in our findings. Masduzzaman et al. 2020 found hypokalemia in 1.67% of 90 neonates.<sup>16</sup> Neonatal hypocalcaemia (25.8%), hypernatremia (17.65%), and hypoglycemia (45.8%) were all noted by Bezboruah and Das in 2019.<sup>17</sup>

**Conclusion:** The most frequent biochemical anomaly, according to the study's findings, was hypocalcemia (43%) and hyponatremia (30%). Neonates were also found to have hypochloremia (27%), hypoglycemia (20%), and hypokalemia (13%). The study population's follow-up was not done. There is a need for prospective studies on newborn seizures' effects on long-term neurological and developmental outcomes.

**Ethical clearance:** Taken from institutional ethics committee.

**Conflict of interest:** Nil.

**Funding:** This study did not receive any grant.

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