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Review

Biochemical changes in Asphyxiated Neonate presented with Convulsion

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Abstract

Background

Birth asphyxia is the commonest cause of neonatal morbidity and mortality and neurologic disabilities among survivors1. Biochemical disturbances occur in blood frequently in perinatal asphyxia. In presence of such disturbances it is difficult to control seizure and there is risk of further brain damage early recognition and prompt treatment of biochemical disturbances is essential for optimal management and satisfactory long term outcome.

Objective

The present study was carried out to assess serum electrolytes, calcium, magnesium and glucose status and demographic profile in asphyxiated neonates with convulsion.

Methodology

This cross sectional observational study was conducted in neonatal ward of Institute of Child Health & Shishu Shasthya Foundation Hospital, Mirpur-2, Dhaka over a period of six months from September 2016 to February 2017. A total 54 neonates with Perinatal asphyxia HIE stage II and HIE stage III presented with convulsion within 7days of life were included. Demographic profile, clinical presentation were taken by a structured questionnaire , and RBS, serum electrolyte, S ca+ and Mg+ were sent.

Result

Among 54 asphyxiated neonate with convulsion 11(20.37%) were found hyponatraemic, 15(27.7%) hypoglycemic, 8 (14.8%) hypocalcaemia, and 7(12.9%) hypomagnesemia. It was observed that majority 19(35.2%) patients had subtle, 13(24.1%) had clonic, 10(18.5%) had tonicity, 8(14.8%) had focal, 02(3.7%) had GTC and 02(3.7%) had tonic & clonic seizures. There was no significant difference of biochemical changes between HIE stage II and HIE stage III in this study.

Conclusion

Biochemical disturbances like hypocalcaemia, hypoglycemia, hypomagnesemia, hypernatremia, hyponatremia, hypokalamia etc occur frequently in birth asphyxiated neonates who suffered from convulsion either as an different cause or as an associated abnormality. So early recognition of this biochemical changes may reduce morbidity and mortality of neonate with perinatal asphyxia suffering from convulsion.

Key Words: Perinatal Asphyxia; Neonatal Seizures; Biochemical Abnormalities

Introduction

Birth asphyxia is the leading cause of neonatal morbidity and mortality and neurological disabilities among survivors [1]. Perinatal asphyxia occurs in 1% to 1.5% in neonates in developed countries. In developing countries, the incidence of perinatal asphyxia is greater [2]. In addition to pulmonary, renal and cardiac dysfunction, hypoxic ischemic encephalopathy develops in one third of asphyxiated newborns. Among

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patients with moderate HIE, 10% to 20% die and 30% to 40% develop neurodeficits, whereas 50% of patients with severe HIE die and almost all survivors develop neurodeficits [3].

Seizure occurs in about 50% of infants with HIE: in most cases, characteristically on the first or second day, usually in stage 2, rarely in stage 3, and never in stage1. Primary metabolic derangements occur during this period which is one of the common reasons of convulsion [4].

Presence of seizure does not constitute a diagnosis but it is a symptom of an underlying central nervous system (CNS) disorder due to systemic or biochemical disturbances [5]. Different types of biochemical abnormalities occur in asphyxiated neonate. These are hypocalcaemia, hypoglycemia, hypomagnesemia, hypernatremia, hyponatremia, hypokalamia etc. In their presence, it is difficult to control seizure and there is a risk of further brain damage. Early diagnosis and appropriate treatment of biochemical disturbance is essential for effective management and satisfactory long term outcome [6].

Among primary metabolic abnormalities that occur in patients with PNA, hypocalcaemia is the most common followed by hypoglycemia and hypomagnesaemia [7]. Very few references exist in our country showing biochemical changes in asphyxiated neonate with HIE and convulsion. It is important to know as because early recognition and treatment can significantly influence the outcome of asphyxiated neonate with HIE suffering from convulsion.

Biochemical disturbances like hypocalcaemia, hypoglycemia, hypomagnesemia, hypernatremia, hyponatremia, hypokalamia etc occur frequently in birth asphyxiated neonates who suffered from convulsion either as a different cause or as an associated abnormality [8]. Full recovery may not occur and many children are left with lifelong neurological impairment and in some cases, incapacitating disability. This creates a great burden for the family, as well as for the society. During the last 3 decades, under-five mortality and infant mortality rate (IMR) have decreased significantly in Bangladesh, but neonatal mortality remains very high. Out of 3.8 million babies born every year in Bangladesh, 1, 50,000 babies die in the first 28 days of life, which is equivalent to one newborn in every 3.4 minutes. This is an unacceptably high neonatal mortality (36/1000 live birth) (UNICEF; 2009). Early recognition and treatment of biochemical disturbances are essential for optimal management and satisfactory long-term outcome. There is a lack of information on this topic in the Bangladeshi literature. Considering these facts, the present study may help to reduce the occurrences of illness and its complications by improving antenatal, intrapartam and neonatal care services within our limited resources.

Materials and Methods

This cross sectional observational study was conducted in neonatal ward of Institute of Child Health & Shishu Shasthya Foundation Hospital, Mirpur-2, Dhaka over a period of six months from September 2017 to February 2017. A total 54 term neonates with Perinatal asphyxia HIE stage II and HIE stage III presented with convulsion within 7days of life of both sexes were included. Any Congenital malformations, Congenital or perinatal infection, Born with meconium stained liquor, clinically suspected for metabolic diseases and patients whose parents refuse to give written consent were excluded from study. After proper management of airway breathing, circulation according to standard guidelines, baseline demographic profile, clinical presentation were taken by a structured questionnaire , blood samples were collected just after clinical examination and RBS, serum electrolyte, S ca+ and Mg+ were sent. Hypocalcaemia is considered when S.Ca+ <7mg/dl, hypomagnesaemia (S.Mg+ <2 moml/L), hyponatraemia (S Na+<135mmol/L) , hypernatraemia (S.Na+ >150mmol/L), Hypokalemia (S.K+<3.5), hyperkalaemia (S.K+ >6moml/L) and Hypoglycemia RBS < 2.1 mmol/L.

Mild hypoxic-ischemic encephalopathy will be assumed according to modified Sarnat & Sarnat staging system if hyperexcitability or hypotonia persisted without seizures for 72 h after birth; moderate if the newborn is lethargic, hypotonia, weak primitive reflexes and seizures and severe if the infant has apnea, flaccid weakness, frequent seizures or coma.3 ml of venous blood will be collected from neonates with HIE stage II and III as soon as possible for the measurement of serum calcium, serum Mg, serum electrolyte and RBS. Convulsion was treated immediately. For data analysis, SPSS statistical package was used and analyzed using Chi-square(x2) Test and One-way ANOVA test.

Results

During this study period among 54 asphyxiated neonate with convulsion, 29(53.7%) patients were male newborn and 25(46.3%) were female. Male female ratio was 1.16:1.

It was found that majority 21(38.9%) newborn were delivered at clinic or Nagar Shasthya Kendra and 19(35.2%) and 14 (25.9%) had at home and hospital delivery respectively.

In this study it was observed that most delivery of newborn 31(57.4%) were by vaginal delivery, 21(38.9%) had LSCS and 02(3.7%) had assisted delivery forceps or ventose.

Regarding type of seizures of the patients, it was found that most asphyxiated neonate 19(35.2%) had subtle, 13(24.1%) had clonic, 10(18.5%) had tonic, 8(14.8%) had focal, 02(3.7%) had GTC and 02(3.7%) had tonic & clonic seizures. Among these seizure types majority 34(63.0%) patients had seizures duration of 1-5 minutes.

Seizure controlled by mostly phenobarbitone 32(59.3%),18(33.3%) convulsive neonate needed both phenobarbitone and phenytoin to control seizure and only 4 (7.4%) needed phenytoin alone.

Among 54 asphyxiated neonate with convulsion 11(20.37%) were found hyponatraemic, 15(27.7%) hypoglycemic, 8 (14.8%) hypocalcaemia, 7(12.9%) hypomagnesemia and 2(3.7%) had hypernatremia.

In this study the mean changes of biochemical parameters between HIE stage II and HIE stage III showed no significant difference. The mean S. Ca+ level is 8.30(±1.62) and 7.82(±1.9) in HIE stage II and III respectively showed no significant difference. Similarly RBS 3.92(±1.62) and 3.5(±1.16), Serum Na+132.85(±5.04) and 134(±4.70) , Serum K+ 4.22(±0.93) and 4.40(±0.66), Serum Chloride 98.7(±3.52) and 99.0(±4.80) ,serum Mg+ 1.77(±0.63) and 1.88(±0.53) in HIE stage II and III respectively showed no significant change.

Fig: 1 Sex distribution among 54 cases

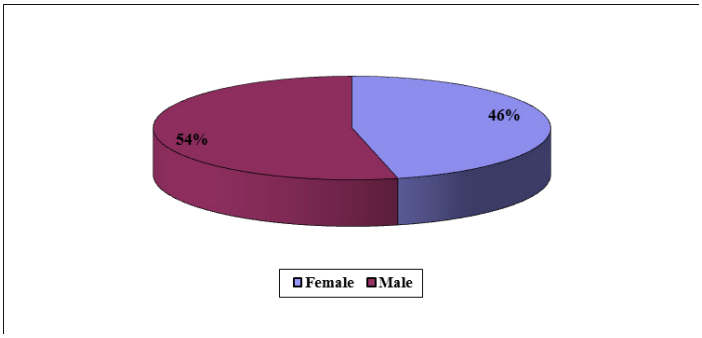

Fig:1 Pie chart shows sex distribution of the patients it was observed that majority 29(53.7%) patients were male newborn and 25(46.3%) were female. Male female ratio was 1.16:1

Table I: Distribution of the study patients by place of delivery (n=54)

Place of delivery	Frequency	Percentage
Home	19	35.2
Hospital	14	25.9
Clinic or Nagar Shasthya kendra	21	38.9
Total	54	100.0

Table I shows place of delivery of the patients, it was observed that majority 21(38.9%) patients had delivery at clinic or Nagar Shasthya Kendra.

Table II: Distribution of the study patients by mode of delivery (n=54)

Mode of delivery	Frequency	Percentage
Vaginal	31	57.4
LSCS	21	38.9
Assisted delivery forceps or ventose	02	03.7
Total	54	100.0

Table II shows mode of delivery of the patients, it was observed that majority 21(57.4%) patients had vaginal delivery, 21(38.9%) had LSCS and 02(3.7%) had assisted delivery forceps or ventose.

Table III: Distribution of the study patients by type of seizures (n=54)

Type of seizures	Frequency	Percentage
Focal	08	14.8
GTC	02	03.7
Tonicity	10	18.5
Subtle	19	35.2
Clonic	13	24.1
Tonic & Clonic	02	03.7
Total	54	100.0

Table III shows type of seizures of the patients, it was observed that majority 19(35.2%) patients had subtle, 13(24.1%) had clonic, 10(18.5%) had tonicity, 8(14.8%) had focal, 02(3.7%) had GTC and 02(3.7%) had tonic & clonic seizures.

Table IV: Distribution of the study patients by duration of seizures (n=54)

Duration of seizures	Frequency	Percentage
<1 min	12	22.2
1-5 min	34	63.0
>5 min	08	14.8
Total	54	100.0

Table VI shows duration of seizures of the patients, it was observed that majority 34(63.0%) patients had seizures duration tie of 1-5 minutes.

Table V: Distribution of the study patients by seizure controlled (n=54)

Seizure controlled by	Frequency	Percentage
Phenobarbitone	32	59.3
Phenytoin	4	7.4
Phenobabitone+phenytoin	18	33.3
Total	54	100.0

Table V shows seizure controlled by phenobarbitone 32(59.3%), phenytoin 4(7.4%), phenobabitone+phenytoin 18(33.3%).

Table VI: Biochemical changes among cases (n=54)

Investigations	Moderate HIE	Severe HIE	p value
Serum calcium	8.30 (±1.62)	7.82(±1.06)	0.30^{ns}
RBS	3.92(±1.62)	3.51(±1.16)	0.39^{ns}
Serum Sodium Na+	132.85(±5.04)	134.57(±4.70)	0.26^{ns}
Serum potassium	4.22(±0.93)	4.40(±0.66)	0.51^{ns}
Serum chloride	98.75(±3.52)	99.0(±4.80)	0.83^{ns}
Serum magnesium	1.77(±0.63)	1.88(±0.53)	0.59^{ns}

Table VI.-Shows 27.7% neonate had hypoglycemia, 20% had hyponatraemia , 14.8% had hypocalcaemia and 12.9% had hypomagnesaemia.

Table VII: Comparison of biochemical changes between Moderate and severe HIE (n=54)

Investigations	Moderate HIE	Severe HIE	p value
Serum calcium	8.30 (±1.62)	7.82(±1.06)	0.30^{ns}
RBS	3.92(±1.62)	3.51(±1.16)	0.39^{ns}
Serum Sodium Na+	132.85(±5.04)	134.57(±4.70)	0.26^{ns}
Serum potassium	4.22(±0.93)	4.40(±0.66)	0.51^{ns}
Serum chloride	98.75(±3.52)	99.0(±4.80)	0.83^{ns}
Serum magnesium	1.77(±0.63)	1.88(±0.53)	0.59^{ns}

Table VII shows comparison between investigations and point, it was observed that mean serum calcium, RBS, serum sodium Na+, serum potassium, serum chloride and serum magnesium were not significantly associated with moderate HIE and severe HIE.

Discussion

Sodium, potassium and calcium are the major electrolytes in human body, and any deviation from their normal levels in blood might cause convulsions and other metabolic abnormalities. Body should maintain optimum level of these electrolytes in blood [14,15]. Abnormalities in these electrolyte levels may be a risk factor for the brain injury for an already asphyxiated neonate [16]. Knowledge of these abnormalities among asphyxiated newborns is very valuable to the pediatricians as it is an important variable affecting perinatal mortality [17]. Immediate aggressive treatment of these abnormalities could modify the entire outcome of the babies18. This study was an attempt to determine the electrolytes disturbances among patients with birth asphyxia.

In present study shows PNA with Convulsion was more common in male babies (53.7%), these findings were in concordance of several previous studies [8-11].

It was found that majority 21(38.9%) newborn were delivered at clinic or Nagar Shasthya Kendra and 19 (35.2%) and 14 (25.9%) had at home and hospital delivery respectively in our study. Another study in India Ashoke et al [12] showed most delivery were at home, this difference may be due to their study area in rural place whereas our study in tertiary care urban area based. In this study it was observed that majority 31(57.4%) patients had vaginal delivery, 21(38.9%) had LSCS and 02(3.7%) had assisted delivery forceps or ventose which is similar to Ashoke et al [12].

In this study we found that most asphyxiated neonate 19(35.2%) had subtle followed by 13(24.1%) had clonic, 10(18.5%) had tonic, 8(14.8%) had focal, 02(3.7%) had GTC and 02(3.7%) had tonic & clonic seizures. Among these seizure types majority 34(63.0%) patients had seizures duration of 1-5 minutes. Aziz A et al [14], reported clonic convulsions are more common while Taksande et al, reported subtle seizures as the commonest and occurring in 50% cases [22].

In another study Sood et al [16] showed Seizure controlled by phenobarbitone 65% followed by Phenytoin and midazolam.

Similarly in present study mostly by phenobarbitone 32(59.3%) and 18(33.3%) convulsive neonate needed both phenobarbitone+ phenytoin to control seizure and only 4 (7.4%) needed phenytoin alone.

In present study among 54 asphyxiated neonate with convulsion 11(20.37%) were found hyponatraemic and kumar et al [18] showed 23% neonate with PNA had hyponatraemia which is similar to our study. It may be due to fluid overload as a result of renal compromise or due to inappropriate secretion of anti-diuretic hormone [17].

We found 15(27.7%) cases were hypoglycemic and this finding is in close agreement with others [19].

In this recent study 8 (14.8%) patients developed hypocalcaemia, 7(12.9%) hypomagnesaemia Feldman et al showed 11% neonate with PNA suffering from convulsion had hypocalcemia which is close to our findings but contrary to our findings of Serum magnesium 12.9% pt had hypomagnesaemia they found only 4% neonate had hypomagnesaemia 20. In our study no patient found to have hyperkalaemia, hypokalaemia, or hypochloremia, or hypernatraemia which is consistent with Gupte et al [18].

In this study the mean changes of biochemical parameters between HIE stage II and HIE stage III showed no significant difference. Naithani et al showed similar result in their study where they didn't get significant differences of biochemical changes between HIE stage II & HIE stage III [21].

Limitation of this study: This study is single centered study and biochemical parameter was not correlate with EEG changes and with that of USG.

Conclusion

Biochemical disturbances like hypocalcaemia, hypoglycemia, hypomagnesemia, hypernatremia, hyponatremia, hypokalamia etc occur frequently in birth asphyxiated neonates who suffered from convulsion either as a different cause or as an associated abnormality. So early recognition of this biochemical changes may reduce morbidity and mortality of neonate with perinatal asphyxia suffering from convulsion.

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