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Original Research Article

POSTNATAL MAGNESIUM SULFATE THERAPY IN TERM NEONATES WITH BIRTH ASPHYXIA

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ABSTRACT

Background: The World Health Organization says that approximately 16,000 children, who are below 5 years old, lose their lives everyday. Pre-term birth, infectious diseases, and birth related complications are the most common aetiologies of childhood deaths. Worldwide, neonatal asphyxia leads to 23% of newborn mortality as observed by the World Health Organization. A well-known cause of neuro-motor disability is perinatal asphyxia and one-third to one-half develops mental retardation and cerebral palsy. Magnesium sulphate is neuroprotective and it prevents calcium from entering the neurons by blocking these NMDA receptors. The objective is to observe the improvement of short-term neurological outcomes due to postnatal magnesium sulfate therapy in term neonates with birth asphyxia. Study design is a randomized control study. This study was conducted at Sindh Institute of Child Health Neonatology Sukkur (SICHN) / Children Hospital Sukkur from August 2024 to August 2025.

Materials and Methods: This is a randomized control study which was conducted in the Neonatal Intensive Care Unit (NICU) of the hospital. The lottery method was used for randomisation. Term neonates who had arrived in the NICU within 6 hours of delivery and had birth asphyxia were a part of this study. To determine the sample size, the "Open Epi Software" was used. There were a total of 140 neonates involved in this study. All of the participants were divided equally into 2 groups, having 70 neonates in each group. Magnesium sulphate was given to group A. The dose of magnesium was 250 mg/kg diluted in 20 ml of 10% dextrose water, infused over 45 minutes at admission. The other group, group B, received only supportive measures along with standard monitoring.

Results: There were a total of 140 neonates involved in this study. All of the participants were divided equally into 2 groups, having 70 neonates in each group. Group A was the treatment group which was given the dose of magnesium sulphate while group B was the control group. The majority of the population was males in both the groups. Group A had 55.7% males while group B had 71.4% males.

Conclusion: Although therapeutic body cooling is the recommended treatment for birth asphyxia, magnesium sulphate is also a good option as it reduces the frequency of seizures and duration of hospital stays.

Keywords: infectious diseases, birth related complications, neonatal asphyxia, neurotransmitter glutamate

INTRODUCTION

The World Health Organization says that approximately 16,000 children, who are below 5 years old, lose their lives everyday.[1] Pre-term birth, infectious diseases, and birth related complications are the most common aetiologies of childhood deaths. Worldwide, neonatal asphyxia leads to 23% of newborn mortality as observed by the World Health Organization.[2] In well developed countries, the incidence of birth asphyxia is 1 to 2 per 1000 live births while in under developed countries, it is up to 5 per 1000 live births.[3] According to research, Pakistan's neonatal mortality rate (NMR) is 41 per 1000 live births and 20.9% of these deaths are due to birth asphyxia.[4] A well known cause of neuro-motor disability is perinatal asphyxia and one-third to one-half develops mental retardation and cerebral palsy.[5]

In neonatal asphyxia, calcium enters the nerve cells and causes cellular damage by activating different enzymes.[6] Calcium enters mainly because of the neurotransmitter glutamate. It acts on N-methyl-D-aspartate (NMDA) receptors.[7] Magnesium sulphate is neuroprotective and it prevents calcium from entering the neurons by blocking these NMDA receptors. Magnesium sulphate has anti-inflammatory, anti-apoptotic, anticonvulsant, and antioxidant effects which allows it to be neuroprotective.[8,9]

The recommended treatment of birth asphyxia is therapeutic body cooling along with supportive treatment.[10] However, in our Neonatal Intensive Care Unit (NICU), there was a lack of trained staff and there were poor resources. Because of this, we faced difficulties in applying therapeutic body cooling. On the other hand, magnesium sulphate is less costly, readily available, has a very few side effects, and is easy to administer. Therefore, it can be a good treatment option along with supportive treatment in our NICU. We conducted this study to observe the improvement of short-term neurological outcomes due to postnatal magnesium sulfate therapy in term neonates with birth asphyxia.

MATERIALS AND METHODS

This is a randomized control study which was conducted in the Neonatal Intensive Care Unit (NICU) of the hospital. The lottery method was used for randomisation. Term neonates who had arrived in the NICU within 6 hours of delivery and had birth asphyxia were a part of this study. As per the World Health Organization, birth asphyxia refers to the failure of establishing spontaneous breathing at the time of birth. To assess the severity of birth asphyxia, the Sarnat criteria was used. To determine the sample size, the "Open Epi Software" was used. There were a total of 140 neonates involved in this study. The Ethical Review Committee approved this research.

Exclusion criteria

Neonates who were premature and had dysmorphic features were not a part of this study. Moreover, those with other co-morbidities such as intracranial haemorrhage, gross congenital anomalies, and sepsis were also excluded.

Mortality was referred to as death. Morbidity was evaluated based on the frequency and duration of seizures, ability to take feed, grade of birth asphyxia, and neurological issues such as hypotonal hypertonia and decreased neonatal reflexes at the time of discharge from hospital. All of the participants were divided equally into 2 groups, having 70 neonates in each group. Magnesium sulphate was given to group A. The dose of magnesium was 250 mg/kg diluted in 20 ml of 10% dextrose water, infused over 45 minutes at admission. This was repeated at 24 hours and 48 hours. After every 10 minutes during and after the magnesium sulphate was given, vital signs were monitored. The vitals signs include respiratory rate, oxygen saturation, pulse rate, temperature, and capillary refill time. Before the first dose, baseline calcium phosphorus, serum magnesium, and potassium levels were measured. Later, these were also measured on day 2, 3, and 4. The other group, group B, received only supportive measures along with standard monitoring. SPSS version 27 was used to analyse the data. The results were expressed in terms of frequencies and percentages. The Chi-square test was applied. A p-value of <0.05 was considered as statistically significant.

RESULTS

There were a total of 140 neonates involved in this study. All of the participants were divided equally into 2 groups, having 70 neonates in each group. Group A was the treatment group which was given the dose of magnesium sulphate while group B was the control group. [Table 1] shows the distribution of gender among both the groups.

Table 1

Gender	Group A (n=70)		Group B (n=70)	
	N	%	N	%
Female	31	44.3	20	28.6
Male	39	55.7	50	71.4

[Table 2] shows the baseline characteristics of the study participants.

Table 2

Baseline Characteristics	Group A (n=70)		Group B (n=70)	
	N	%	N	%
Weight for gestation				
AGA	61	87.1	59	84.2
SGA	6	8.5	2	2.8
LGA	3	4.4	9	13.0
Risk factor				
Prolonged Rupture of Membrane (PROM)	9	12.8	13	18.7
Meconium stained liquor (MAS)	48	68.5	26	37.1
Prolonged Labour	13	18.7	61	44.2
HIE Grade				
I	16	22.8	28	40.0
II	49	70.0	37	52.8
III	5	7.2	5	7.2

[Table 3] shows the outcomes of both the groups.

Table 3

Outcomes	Group A (n=70)		Group B (n=70)	
	N	%	N	%
Seizures				
Present	38	54.2	42	60.0
Absent	32	45.8	28	40.0
Frequency of seizures	38	54.2	41	58.5
Duration of seizures				
<48 hours	27	71.1	11	26.9
>48 hours	11	28.9	30	73.1
Neurological status				
Normal	61	87.1	59	84.2
Abnormal	9	12.9	11	15.8
Suck feed at discharge				
Present	61	87.1	59	84.2
Absent	9	12.9	11	15.8
Hospital stay duration				
<60 hours	48	68.5	31	44.3
>60 hours	22	31.5	39	55.7
Outcome				
Survived	70	100.0	70	100.0
Expired	0	0.0	0	0.0

DISCUSSION

The major cause of mortality, morbidity, and long-term neurological sequelae in new born babies, who are less than 28 days old, is perinatal asphyxia.[11] There are different factors that affect the severity of asphyxia such as developmental state of organs and metabolic disturbances. Significant advancements have been made to understand the pathophysiological mechanism of asphyxia. However, therapeutic interventions are still under progress. According to studies, Pakistan has the most number of neonatal mortality and neonatal asphyxia.[12]

In our study, the frequency of seizures was higher in the control group as compared to the magnesium sulphate group. These results are similar to the study of Siddiqui et al.[13] However, there was a study conducted in Japan which showed no difference in duration of seizures in both the groups.[14] In our study, neurological improvement in group A was higher than it was in group B. Similar results were achieved by Sajid et al. who revealed that improvement in neurological status was 75.8% vs 45.4%.[15]

In our study, the early establishment of sucking reflex and feeding at discharge was present in 87.1% in group A and 84.2% in group B. All the neonates included in our study survived. It may be due to less number of newborns with grade III birth asphyxia in our study. However, previous research showed a few deaths of those newborns who had received magnesium sulphate.[16,17] Our study also showed a significant difference in the duration of hospital in both groups. Group A had a shorter duration of hospital stay as compared to group B. This was similar to previous studies conducted in the past.[18-20]

The recommended treatment of birth asphyxia is therapeutic body cooling along with supportive treatment. However, in our Neonatal Intensive Care Unit (NICU), there was a lack of trained staff and there were poor resources. Because of this, we faced difficulties in applying therapeutic body cooling. There are also a few limitations of this study. First is the small sample size. Secondly, we failed to get a long-term follow-up for developmental and neurological assessment.

CONCLUSION

Although therapeutic body cooling is the recommended treatment for birth asphyxia, magnesium sulphate is also a good option as it reduces the frequency of seizures and duration of hospital stays.

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