

Frequency of Hypomagnesemia in Neonates presenting with Hypocalcemia in a Tertiary Care Hospital

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ABSTRACT

Background: Hypocalcemia is a common neonatal occurrence, especially in neonates with high-risk including those babies born to diabetic mothers, neonates with perinatal asphyxia and premature babies. High calcium consumption can reduce magnesium absorption, while low magnesium intake can boost calcium absorption.

Aim: To assess the frequency of hypo-magnesemia in neonates presenting with hypocalcemia in a tertiary care hospital.

Design study: Cross sectional study.

Methodology: Total 160 fulfilling the inclusion criteria at Services Hospital, Lahore were enrolled through non-probability convenience sampling. Gestational age, birth weight, gender and feeding pattern) were noted. Blood sample was obtained by using 3cc BD syringe and 20G butterfly needle with the help of a nurse under sterile measures. All clotted samples were stored and sent to the Pathology lab for the assessment of magnesium level. Reports were assessed and if magnesium level <0.7mmol/L, then hypomagnesemia was labeled. Data was evaluated by using SPSS v.24. Quantitative data was presented as mean±SD. Qualitative data was presented as frequency and percentage. Chi-square test was applied with P-value ≤0.05 taken as significant.

Results: In this study, there were 75 (46.9%) male and 85 (53.1%) female neonates. The mean gestational age of neonates was 39.20±1.63weeks. The mean birth weight of neonates was 2.5±3.0kg. There were 46 (28.8%) who were on exclusive breast feeding, 55 (34.4%) were on formula feed while 59 (36.9%) were on both; breast and formula feed. The mean magnesium level of neonates was 0.90±0.63mmol/L. There were 113(70.6%) neonates with hypomagnesemia while 47 (29.4%) had normal magnesium level.

Practical Implication: Literature has reported that the frequency of hypomagnesemia is high in neonates with hypocalcemia. In Pakistan there is little local evidence available in this regard. The information gained through this study will help to improve our clinical practice and to update guidelines for early screening and management of infants with hypocalcemia with co-existence hypomagnesemia. **Conclusion:** It was concluded that the frequency of hypo-magnesemia was high in neonates with hypocalcemia in local population.

Keywords: Prevalence, Calcium, Electrolytes Imbalance and Neonates.

INTRODUCTION

Hypocalcemia is a common neonatal occurrence, especially in neonates with high-risk including those baby born to diabetic mothers, neonates with perinatal asphyxia and premature babies.¹ The skeleton contains 98 percent of the calcium in the body. It's found in both intracellular & extracellular environments. Magnesium, calcium and skeleton mineralization metabolic equilibrium is complicated and depends on a sufficient supply of nutrients, the growth of the intestine absorption process, and the impacts of many hormones.²

Calcium plays an important part in a variety of metabolic processes, including blood coagulation, excitability of the neuromuscular system, integrity of cell membranes and cellular enzymatic activity. The normal range has been found to be between 2.2 and 2.5mmol/L (8.8 and 10.6mg/dl) at various ages³.

Neonatal hypocalcemia is described as a serum and plasma calcium concentration of less than 2mmol/L in term infants and less than 1.75mmol/L in preterm infants. Early onset hypocalcemia (ENH) occurs within the first 3 days of birth, as opposed to late onset hypocalcemia, which occurs beyond 72 hours.¹ Late diagnosis increases neonatal morbidity and death by causing problems such as cardiac dysfunction, hypocalcemic seizures, and tetany⁴⁻⁶.

Magnesium is absorbed primarily in the small intestine, where it is taken by a saturable transport mechanism and passive diffusion via bulk water flow. Calcium and magnesium absorption are influenced by each other in the stomach; High calcium consumption can reduce magnesium absorption, while low magnesium intake can boost calcium absorption⁷.

Hypercalcemia & magnesemia inhibit magnesium absorption by activating the (CaSR), a G-protein-coupled receptor family

member⁸. Thomas et al., through a study found that in infant with hypocalcemia, the frequency of hypomagnesemia was 96.2% (75/78 cases)⁹.

Literature has reported that the frequency of hypomagnesemia is high in neonates with hypocalcemia. In Pakistan there is little local evidence available in this regard. The information gained through this study will help to improve our clinical practice and to update guidelines for early screening and management of infants with hypocalcemia with co-existence hypomagnesemia. By giving magnesium along with calcium we can effectively simultaneously manage hypocalcemia and hypomagnesemia to prevent morbidity due to calcium and magnesium deficiency.

Objective of the study is to assess the frequency of hypomagnesemia in neonates presenting with hypocalcemia in a tertiary care hospital.

METHODOLOGY

This descriptive cross sectional study was conducted in Medicine Department Service Hospital Lahore after permission from hospital ethical committee. It was done with the permission of the hospital's institutional review board. Patients gave their informed written consent. Total 160 fulfilling the inclusion criteria at Services Hospital, Lahore were enrolled through non-probability convenience sampling. All neonates up to 28 days of either gender and gestational age presenting with hypocalcemia (calcium level <2.00mmol/L) were included from the study. Neonates with life threatening condition and known metabolic disorder were excluded from the study.

Demographic details (name, gestational age, gender, birth weight and feeding pattern) were noted. Blood sample was obtained by using 3cc BD syringe and 20G butterfly needle with the help of nurse under sterile measures. Samples were stored and sent to Pathology Lab of the hospital for assessments of

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magnesium level. Reports were assessed and if magnesium level < 0.7 mmol/L, then hypomagnesemia was labeled.

Statistical analysis: Data was analyzed in SPSS 24. Gestational age & birth weight was presented as mean and SD. Qualitative data like feeding pattern, gender and hypomagnesemia were presented as frequency & percentage. Data was stratified according to gender, gestational age, birth weight & feeding pattern (breast feed, formula feed, breast + formula feed). Chi-square test was applied to compare hypomagnesemia in stratified groups with p-value less than 0.05 as significant.

RESULTS

In this study, total 160 neonates were included. There were 75(46.8%) male and 85(53.13%) females. The mean gestational age range of neonates was 39.20±1.63 weeks. The mean birth weight range of neonates was 2.5±3.0kg. The mean birth weight range of neonates was 2.5±3.0kg (Table-1).

Table-1: Descriptive statistic of gender and age

Descriptive		Frequency
Gender	Males	75(46.88%)
	Females	85(52.13%)
Gestational Age (37-42 weeks)	Mean±SD	39.20±1.63
Birth Weight (2.0-2.9Kg)	Mean±SD	2503.33±300.78

There were 46(28.8%) who were on exclusive breast feeding, 55(34.4%) were on formula feed while 59(36.9%) were on both; breast and formula feed as shown in Table-2.

Table-2: Frequency of Feeding Pattern

Variables	Frequency
Breast Feed	46 (28.75%)
Formula Feed	55 (34.38%)
Breast-Formula Feed	59 (36.88%)

The mean magnesium level of neonates was 0.90±0.63mmol/L. There were 113(70.6%) neonates with hypomagnesemia while 47(29.4%) had normal magnesium level as shown in Table-3.

Table-3: Frequency of Hypo-magnesemia

Parameters	Categories	Frequency%
Magnesium (0.35-2.2mmol/l)	Mean±SD	0.90±0.63
Hypomagnesemia	Yes	113(70.63%)
	No	47(29.38%)

Data was stratified for gestational age at birth. In 90 neonates born during 37-39 weeks, 64(71.1%) had hypomagnesemia. In 70 neonates born during 40-42 weeks, 49(70%) had hypomagnesemia. The difference was insignificant (p>0.05) Data was stratified for gender of neonate. In male neonates, 57 (76.0%) had hypomagnesemia. In female neonates, 56(65.9%) had hypomagnesemia. The difference was insignificant (p>0.05) as shown in table-4. Data was stratified for birth weight of neonate.

Table-4: Comparison between Hypomagnesemia with Gestational age, Gender, Birth Weight and Feeding Pattern

Parameters		Hypomagnesemia		p-value
		Yes	No	
Gestational age	37-39	64(71.1%)	26(28.9%)	0.878
	40-42	49(70%)	21(30%)	
Gender	Male	57(76%)	18(24%)	0.16
	Female	56(65.9%)	29(34.1%)	
Birth weight(gm)	2000-2500	63(75%)	21(25%)	0.201
	2501-3000	50(65.8%)	26(34.2%)	
Feeding Pattern	Breast Feed	35(76.1%)	11(23.9%)	0.241
	Formula Feed	41(74.5%)	14(25.5%)	
	Breast formula feed	37(62.7%)	22(37.3%)	

In neonates weighted 2000-2500grams, 63(75%) had hypomagnesemia. In neonates weighted 2501-3000grams, 50(65.8%) had hypomagnesemia. The difference was insignificant (p>0.05) as shown in table-4. Data was stratified for feeding

pattern of neonates. In neonates taking exclusive breast feeding, 35 (76.1%) had hypomagnesemia. In neonates taking formula feed, 41(74.5%) had hypomagnesemia. In neonates taking both breast feed and formula feed, 37 (62.7%) had hypomagnesemia. The difference was insignificant (p>0.05) as shown in table-4.

DISCUSSION

In our newborns, hypocalcemia was a major clinical and laboratory issue. Late diagnosis increases infant morbidity and death by causing problems such as cardiac dysfunction, hypocalcemic seizures and tetany.

In the reference study, hypomagnesemia was found as the next most common cause of hypocalcemia. This may be due to a dietary factor or a genetic disorder such as familial hypomagnesemia and secondary hypocalcemia, which requires regular magnesium treatment. ¹⁰ Magnesium (Mg₂) is required for growth of cells and the normal functioning of cells. Furthermore, little is known on how mother hypomagnesemia impacts foetal growth & development throughout pregnancy¹¹.

In our study, the mean magnesium level of neonates was 0.90±0.63mmol/L. There were 113(70.6%) neonates with hypomagnesemia while 47 (29.4%) had normal magnesium level. Thomas et al., through a study found that in infant with hypocalcemia, the frequency of hypomagnesemia was 96.2% (75/78 cases)¹².

113(70.6%) neonates with hypomagnesemia while 47(29.4%) had normal magnesium level. As compare to another study, 18 neonates had hypomagnesemia, 7(38.9%) had hypocalcemia & hypomagnesemia¹. A prior study found that neonatal hypomagnesemia can cause hypoparathyroidism, which leads to hypocalcemia¹³.

In 2020, a study conducted to determine the incidence of hypomagnesemia and hypocalcemia on day 1 & day 4r. Hypocalcemia affected 0.5 percent of the 400 newborns on their first day of life, while hypomagnesemia affected 1%. On day four of life, 10.5 percent of the 400 newborns had hypocalcemia, while 0 percent had hypomagnesemia. There were no incidences of hypocalcemia and hypomagnesemia occurring at the same time on Day 1 or Day 4 of life¹⁴.

In polycythemic newborns, hypomagnesemia (magnesium serum concentration of 1.50 mg/dL [0.71mmol/L]) & hypocalcemia (calcium serum concentration of 8.0mg/dL [2.1 mmol/L]) have been documented, and also in diabetic mother's infants¹⁵.

The hypothesis testing was done on neonatal polycythemia in IDMs and associated with increased level of serum concentration of calcitonin, hypocalcemia & hypomagnesemia. In 76 IDMs, magnesium and serum calcium concentrations were examined at 24 to 72 hours of age; at 24 hrs of age serum calcitonin was also measured.

Between 2 to 4 hours of neonates age, the peripheral venous spun hematocrit was assessed. In poly & non-polycythemic IDMs, the hypomagnesemia & hypocalcemia rate were same (0% /9% or 56%/49). Both groups had equal serum calcitonin concentrations. There was no relation between hematocrit & magnesium or calcium levels in the blood.; and have a strong association existed between hypocalcemia & hypomagnesemia¹⁶. Not much work has been done in this regard and no further studies were found in literature.

Limitations of study: Financial constrains and limited resources with no genetic workup and long follow-ups added to limitations. It was a single centre study.

CONCLUSION

It was concluded that frequency of hypo-magnesemia was high in neonates with hypocalcemia in local population. Now we have got the local evidence and found hypomagnesemia to be high in infants with hypocalcemia. Now in future, neonates with symptoms of hypocalcemia will also be screened for hypomagnesemia.

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Running head: Relationship between hypomagnesemia and hypocalcemia among neonates.

Conflict of interest: None

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