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PREVALENCE OF PHOTOTHERAPY INDUCED HYPOMAGNESEMIA IN TERM NEWBORNS WITH JAUNDICE

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ABSTRACT

Introduction: Hyperbilirubinemia(Jaundice) is common problem in neonates, is seen in about 60% of term neonates in first week and 80 % of preterm neonates. Phototherapy is the safest and commonly used treatment modality in neonatal jaundice. This study is aimed to measure the serum magnesium levels in neonates with hyperbilirubinemia before and after phototherapy to know the prevalence of phototherapy induced hypomagnesemia in term neonates. **Methodology:** This cross-sectional study was conducted on 100 term neonates with jaundice and receiving phototherapy, attending and admitted in Navodaya Medical College Hospital and Research Centre, Raichur. Study included full term neonates with unconjugated hyperbilirubinemia requiring phototherapy. Patient data was recorded in structured profoma. Serum bilirubuin level and magnesium level were sent before starting phototherapy and 48 hours after starting phototherapy. **Results:** There was statistically a significant difference in relation to magnesium level and ionized magnesium level before phototherapy and after phototherapy. No significant association was found between birth weight, postnatal age, mode of delivery, blood group incompatability and effect of phototherapy on s.magnesium level. **Conclusion:** The present study concludes that the phototherapy leads to a decrease in the levels of magnesium. The mean serum magnesium level reduced significantly after phototherapy in neonates with hyperbilirubinemia irrespective of age, sex, birth weight and mode of delivery. Phototherapy decreases bilirubin proportionately to IMg, implying that bilirubin and Mg levels in the blood have a positive relationship.

KEYWORDS: Hyperbilirubinemia; Phototherapy; Hypomagnesemia; Magnesium; Bilirubuin.

INTRODUCTION

Hyperbilirubinemia (Jaundice) is common problem in neonates, is seen in about 60% of term neonates in first week and 80% of preterm neonates.[1] Phototherapy is the safest and commonly used treatment modality in neonatal jaundice.[2]

The yellow color usually results from the accumulation of unconjugated, nonpolar, lipid-soluble bilirubin pigment in the skin.[3] The side effects of phototherapy includes electrolyte imbalance like hyponatremia, hypokalemia and hypocalcemia, dehydration, hyperthermia, feed intolerance, diarrhoea and retinal damage.

Newborns appear jaundiced when it is greater than 7 mg/dl, between 25-50% of all term newborns and higher percentage of premature infants develop clinical jaundice. Also, 6.1% of well term newborns have maximal serum bilirubin level over 12.9 mg/dl. Over 50% of all newborn infants become visibly jaundiced because there is marked physiological release of haemoglobin from the breakdown of red cells because of the high Hb concentration at birth. Hepatic bilirubin metabolism is less efficient in the first few days of life.

Magnesium is the fourth most abundant cation in the body and its vast majority is stored intracellularly. It is however, the extracellular concentrations of the mineral that is of interest to the clinician due to its association with symptoms and signs. The major organs involved in magnesium homeostasis are the gut, bone, and kidney, but the regulators affecting these organs at the cellular level are not yet fully understood. It is suggested that there is a positive correlation between plasma ionized Mg levels and severity of hyperbilirubinemia in newborn.[5,6]

Measurement of ionized magnesium (IMg) provides an accurate assessment of the unbound form of Mg, which is the biologically active form and is most insightful. There are many studies showing phototherapy leading to

hypocalemia but there are paucity of studies showing hypomagnesemia in term neonates after phototherapy.

Hence, this study is aimed to measure the serum magnesium levels in neonates with hyperbilirubinemia before and after phototherapy to know the prevalence of phototherapy induced hypomagnesemia in term neonates.

MATERIALS AND METHODS

This Cross-sectional study was conducted on 100 term neonates with jaundice and receiving phototherapy, attending and admitted in Navodaya Medical College Hospital and Research Centre, Raichur were considered during the study period from December 2020 to September 2022.

Inclusion criteria

Full term neonates with unconjugated hyperbilirubinemia requiring phototherapy.

Exclusion criteria

Newborns who had undergone exchange transfusion, had hemolysis, had been formula fed, had any congenital malformation, inborn errors of metabolism, proven sepsis or infection, or jaundice in the first 24 hours of life, or Phototherapy given for less than 48 hours or whose mothers had a history of diabetes were excluded.

METHODOLOGY

Written informed consent was taken from the patient parents to participate in the study. Full history taking with particular emphasis on prenatal, natal and post-natal gestational age, sex (male/female), weight, family history of her sibling admitted to NICU with jaundice, history of the time of appearance of jaundice and its extension, complete physical examination with assessing intensity of jaundice and correlation to activity and anemia. Measurement of total serum calcium (by spinreact calcium kit) serum magnesium levels (by spinreact magnesium kit), serum total and direct bilirubin (by spinreact bilirubin kits) before and 48 hours after end of exposure to phototherapy, blood grouping for mother and babies, hemoglobin concentration, reticulocytic count and Coomb's test were done. To perform phototherapy, the subjects were placed at 15 to 20 centimeters from the light source (blue fluorescent (neon) lights) with a wave-length range of 420 to 470 nm above their heads.

Patients were examined for the effect of phototherapy on serum level of calcium and magnesium by evaluating serum magnesium and serum calcium levels alterations before and after phototherapy in hospitalized hyperbilirubinemic newborns undergoing phototherapy.

Statistical Analysis

Data collected throughout history, basic clinical examination, laboratory investigations and outcome measures coded, entered and analyzed using Microsoft Excel software. Data were then imported into Statistical Package for the Social Sciences (SPSS version 25.0) software for analysis. According to the type of data qualitative represent as number and percentage, quantitative continues group represent by mean ± SD, the following tests were used to test differences for significance; difference and association of qualitative variable by Chi square test (x^2). Differences between quantitative independent groups by t test paired by paired t. P value was set at <0.05 for significant results & <0.001 for high significant result.

RESULTS

Table 1: Bilirubin level before and after phototherapy in neonates.

Bilirubin level	Before phototherapy(n=100)	After phototherapy(n=100)	Paired t	p-value
Mean±SD	14.2±1	9 ± 8.4	6.827	<0.001*
(Range)	10-18.6 mg/dl	7-13 mg/dl		

*p value is significant if<0.05, SD: Standard deviation

Table 1 shows mean bilirubin level value before phototherapy was 14.2±1 and after phototherapy was 9 ± 8.4. This reduction in bilirubin level was found to be statistically highly significant(p value<0.001).

Table 2: Total Magnesium level before and after phototherapy in neonates.

Total Magnesium Levels (mg/dl)	Before phototherapy(n=100)	After phototherapy(n=100)	Paired t	p-value
Mean±SD	2.81 ± 0.63	2.12 ± 0.43	8.946	0.000*
(Range)	1.82-3.9 mg/dl	1.4-2.75 mg/dl		

*p value is significant if<0.05, SD: Standard deviation

Table 2 shows mean total magnesium value before phototherapy was 2.81 ± 0.63 and after phototherapy was 2.12 ± 0.43. This reduction in s. magnesium was found to be statistically highly significant(p value<0.001).

Table 3: Ionized total magnesium level before and after phototherapy in neonates.

Ionized Magnesium Levels (mg/dl)	Before phototherapy(n=100)	After phototherapy(n=100)	Paired t	p-value
Mean±SD	0.58 ± 0.02	0.55 ± 0.02	11.319	0.000*
(Range)	0.53 -0.61 mg/dl	0.5 -0.61 mg/dl		

*p value is significant if<0.05, SD: Standard deviation

The mean ionized magnesium level value before phototherapy was 0.58 ± 0.02 and after phototherapy was 0.55 ± 0.02. This reduction in ionized magnesium level was found to be statistically highly significant(p value<0.001).

Table 4: Frequency distribution table showing change in serum magnesium value due to phototherapy.

Effect of photo therapy on total Magnesium	No. of Cases	Percentage
No Change	6	6.0
Decrease	79	79.0
Increase	15	15.0
Total	100	100.0

Table 4 show after phototherapy 79% babies had a reduction in total serum magnesium value followed by 15% increase in total magnesium value and 6% had no change.

DISCUSSION

Preterm newborns have a common hyperbilirubinemia in the early neonatal period. Phototherapy may be used for babies whose level is getting high. Phototherapy is safe and effective, potential adverse effects of phototherapy are usually minimal if appropriate precautions are taken and there is no evidence to suggest that phototherapy has any adverse long term effect.[4] However, this method may result in the development of some complications as hypocalcemia and hypomagnesemia.

The current study was aimed at investigating the effects of phototherapy on serum magnesium in infants with jaundice at Navodaya Medical College Hospital and Research Centre, Raichur. In the present study 59% were males and 41% were females. Our study subjects have a male to female ratio of 1.41:1. In a similar study by Imani et al[7] showed male preponderance with the male to female ratio of 1.3: 1. This male preponderance may be to the fact that male neonates are affected by neonatal jaundice more than female neonates. It may also be to the fact that the male children are given more attention than the female children as far as health-seeking behavior is concerned in our part of the world. The demographic health survey shows an almost similar number of male and female children in our country.

Results of the current study showed that the mean bilirubin level value before phototherapy was 14.2±1 mg/dl and after phototherapy was 9±8.4 mg/dl. The mean total magnesium value before phototherapy was 2.81±0.63 mg/dl and after phototherapy was 2.12±0.43 mg/dl. The mean ionized magnesium level value before phototherapy was 0.58±0.02 mg/dl and after phototherapy was 0.55 ± 0.02 mg/dl. This reduction in bilirubin, total magnesium and ionized magnesium level was found to be statistically highly significant(p value<0.001). Our study showed that there was statistically significant difference in relation to bilirubin level and a significant difference in relation to magnesium level between group of before phototherapy and after phototherapy.

Similar to the present study results, in a study undertaken by Imani et al[7], serum bilirubin and magnesium levels were measured before and after phototherapy, both of which showed a significant decrease. Also, Khosravi et al[8], reported that phototherapy can decrease the total magnesium. In a similar study by Thani et al[9], Khatab et al[10] and Ishfaq H et al[11] similar observations of fall in serum magnesium levels after phototherapy were observed in both the age groups of neonates with hyperbilirubinemia. The results of all these studies as well as the results of the present study showed that average serum magnesium level decreased after phototherapy. A study by Mehta R et al[12], argued that the increase in magnesium level may be associated with the increase in serum bilirubin level as a compensatory mechanism in neonates as the magnesium may have the possibility of a neuroprotective role in neonates with hyperbilirubinemia. The possible explanation of rise in magnesium levels in hyperbilirubinemia may be due to the bilirubin toxic effects.

In the present study, the serum level of magnesium decreased through relieving hyperbilirubinemia and it maybe that the increase in the plasma level of magnesium was due to synchronization with hyperbilirubinemia; hence, after decrease in bilirubin, the level of magnesium decreased.

Some of the limitations of the present study are that it didn't make compare calcium and magnesium levels and the sample size considered was 100, which is small and does not represent the general population of the country.

CONCLUSION

The present study concludes that the phototherapy leads to a decrease in the levels of magnesium. The mean serum magnesium level along with the mean total serum bilirubin level reduced significantly after phototherapy in neonates with hyperbilirubinemia irrespective of age, sex, birth weight and mode of delivery. Phototherapy decreases bilirubin proportionately to IMg, implying that bilirubin and Mg levels in the blood have a positive relationship. To assess the effectiveness of magnesium therapy in the treatment of baby hyperbilirubinemia, more research is needed.

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