(International Print/Online Journal)

SJIF IMPACT FACTOR: 5.565
PUBMED-National Library of Medicine ID-101739732

ISSN (Print): 2209-2870
ISSN (Online): 2209-2862

International Journal of Medical Science and Current Research (IJMSCR)
Available online at: www.ijmscr.com
Volume 5, Issue 3, Page No: 1401-1405
May-June 2022

IJMSCR

Frequency of Hypomagnesemia in Jaundiced Term Neonate Under Phototherapy

Sabah Hassan Ali Al Atwani[1], Bahaa Mohammed Hasan[2], Tagreed Sami SharafAldeen[3], Jasim Mohammed Hashim[4], Alaa Jumaah Manji Nasrawi[5]

[1]Department of Pediatrics, Faculty of Medicine, University of Karbala, Iraq.
[2,3,4]Department of Pediatrics, Faculty of Medicine, University of Kufa.

***Corresponding Author:**
Sabah Hassan Ali Al Atwani
Assistant Professor, Department of Pediatrics, faculty of Medicine, University of Karbala, Iraq

Type of Publication: Original Research Paper
Conflicts of Interest: Nil

Abstract

Background: In babies, jaundice is the most common condition that necessitates medical attention (affects 60 % and 80% of full and preterm neonates, respectively are affected in the first week after delivery). The most prevalent reason for hospitalization in the first days of life is neonatal hyperbilirubinemia. One of the most common ways for treating hyperbilirubinemia is photo theory. In the tree and the prevention of hyperbilirubinemia, phototherapy plays a crucial role. This therapy method, however, may result in the formation of certain compositions, such as hypomagnesemia induction.

Objective: is to assess the phototherapy effect on the level of serum magnesium in term newborns with neonatal hyperbilirubinemia who undergo phototherapy.

Methods: From January 2021 to November 2021, a cross-sectional study was done at Al-Zahraa Hospital, Najaf city. This study included 64 newborns (35 males and 29 females) with neonatal hyperbilirubinemia who were admitted to a newborn nursery. Before phototherapy, the concentration of magnesium in the blood was measured. Phototherapy was used on every neurology patient. Seven magnesium was assessed after 48 hours of phototherapy and found to be consistent with the prior amount.

Results: the result point to significant drop in serum magnesium after phototherapy when compared to serum magnesium before phototherapy (P 0.001). Only six couples (serum magnesium 1.6 mg/dl) developed hypomagnesemia. Nine of them were showing signs of illness.

Conclusions: According to the findings of this cross-sectional study, phototherapy lowers serum magnesium levels while decreasing serum bilirubin levels, indicating that there is a positive correlation between serum magnesium and serum bilirubin levels.

Keywords: Jaundice,neonates, Phototherapy

Introduction

Neonatal jaundice is a yellowing condition that affects a newborn's skin and other tissues. In neonates, the jaundice is visible clinically if total serum bilirubin level of greater than 85 mol/l (5 mg/dL), although in adults, a level of 34 mol/l (2 mg/dL) is required to be detectable by naked eye. (1)

The yellow color in the skin is caused by a buildup of unconjugatedbilirubin. This unconjugated bilirubin is a byproduct of heme catabolism in reduce cells, resulting from a series of enzymatic as well as non-enzymatic reactions.(2)

In neonates with unconjugated hyperbilirubinemia, phototherapy is the most common treatment. This therapeutic premise was found quite by chance in England in the 1950s, and it is currently arguably the most widely used therapy in neonates (apart from preventative medicines).(3)

Three different processes have been postulated to explain why phototherapy is effective in lowering TB levels in neonates. More than 80% of the increased bilirubin removal during phototherapy might be attributed to the photoisomerization pathway.

Phototherapy is generally thought to be harmless, however it can cause rat or loose cat feces, overheating, and dehydration. The "bronze baby" synodrome, characterized by a blue, grayish-brown staining of the seven and urine, affects only a small percentage of infants. Bronze-baby syndrome is thought to arise when porphyrin photoproducts, particularly carry porphyrins, build up in the skin and are excreted through the stomach by cholestasis.

Magnesium is the most common cation in the stomach, and it functions as a cofactor in over 300 enzyme systems that control a wide range of physiological activities in the body, such as synthesis of protein, function muscle and neuron, control of blood glucose, and regulation blood pressure [(4)]. Magnesium is necessary for energy synthesis, oxidative phosphorylation, and glycolysis to take place. It contributes to the structural development of bone and is required for the creation of DNA, RNA, and the antioxidant glutathione. Magnesium also plays a role in the active transport of calcium and potassium ions across cell membranes, which is required for nerve conduction, muscle contraction, and a normal heart rhythm.[(4)]About 25 g of magnesium is contained in an adult's body, with 50 to 60 percent of it in the bones and the rest in the soft tissues [(5)]. Total magnesium levels in blood serum are fewer than 1%, and these levels are regularly monitored. Magnesium levels in the blood should be between 0.75 and 0.95 millimoles (mmol)/L. Hypomagnesemia cut value when serum magnesium concentration less than 0.75 mmol/L. Magnesium homeostasis is maintained by the kidney, which excretes about 120 mg of magnesium into the urine each day. Urinary excretion is reduced when magnesium levels are low.[(6)]

Irritability, tremors, and convulsions are all signs of hypomagnesemia, as are they of hypocalcemia.

Phototherapy was used to discover how to depress the pineal gland using transcranial light, which resulted in a drop in melatonin levels. Melatonin increases cortisol release, which reduces calcium and magnesium absorption, resulting in hypomagnesemia and hypocalcemia. [(7,8)]

Phototherapy is the most common treatment for neonatal jaundice, although it has adverse effects, one of which is hypomagnesemia. [(9,10)]

Aim of study

To see how blood affects serum magnesium levels in term babies with severe neonatal jaundice.

Patients and Method

A cross-sectional study conducted in Al Zahraa maternity and children hospital in Najaf city, on healthyfull-term neonateswith hyperbilirubinemia from the 15thof January to the 10thof November 2021.

We include 86 term neonates in this study, other neonate with the followings criteria were excluded from the study:

1. Cases of neonatal sepsis that are likely based on clinical criteria.
2. Neonates with hemolytic disorders are number two.
3. Those suffering from cholestasis.
4. Bilirubin level within exchange transfusion range
5. Those who have had a previous blood transfusion.
6. If you have jaundice for more than 14 days, you should see a doctor.
7. Neonates who are born prematurely.
8. Those who refused to participate since their blood was on the line.
9. Children born to diabetic moms, those with hyperparathyroidism, or those who have received magnesium sulfate during pregnancy.

Procedure:

After receiving written consent from the parents, a detailed history and thorough physical examination were conducted. Investigations include; Complete blood picture, ABO and Rh type for neonates and their mothers, direct Coombs test, serum albumin, serum bilirubin levels (total and direct), and total serum magnesium were all performed as part of a

Volume 5, Issue 3; May-June 2022; Page No 1401-1405

baseline study for all infants.TSB was measured by pricking the heal with a heparinized capillary (Vitrex produced by DANEMARK) tube, centrifuged with a centrifugation apparatus (HEMATOKRIT 210) with serial number 0000526 01 00 at 10000 rounds per minute, and then placed in an APEL / JAPAN bilirubinometer.

Venous blood (1 ml) was drawn from vein and placed in a test tube. The blood sample was centrifuged with a centrifugation apparatus (Kokusan – Japan) serial number 138660 at 4000 rounds per minute, and the serum was then deposited in a Beckman Coulter AU480. A second sample was taken 48 hours following exposure to phototherapy for the same study. Hypomagnesemia is defined when blood magnesium level of less than 1.6 mg/dl.

According to the American Academy of Pediatrics' phototherapy guidelines, all neonates get conventional phototherapy. The traditional phototherapy method involves placing eight fluorescent tubes (Philips TL 20W/52) within 40-50 cm of the infant (Octophoto made by Fanem Brazil).

The research's goal was to study the differences between the mean of serum magnesiumleveland total serum bilirubinbefore and after phototherapy. 22 newborns were dropped from the trial because they did not complete phototherapy session for the 48-hour, while the remaining 64 neonates finished the study.

Statistical analysis:

The information was entered into a database and evaluated with the SPSS software (version 23). The mean and standard deviation were calculated using descriptive analysis. For comparison, a student t-test was utilized with a p value <0.05 considered as significant.

Result

This is cross-sectional research to study the effect ofphototherapy on magnesium levels at admission and four hours after treatment. All causes of neonatal hyperbilirubinemia in the study group were treated solely with phototherapy, with the likelihood of phototherapy-induced hypomagnesemia being thoroughly monitored.

The table 1 show demographic and lab. characteristicsupon admission.

CHARACHTERESTICS		LEVEL
Age		3.8750±0.9343 [days]
Gestational age		38.359±1.0136 [weeks]
Weight		3.325±0.441 [kg]
Sex	Male(number) percent	(35) 56%
	Female(number) percent	(29) 44%
Way of delivery	Vaginal delivery,(number) percent	(44) 69%
	Cesarian section,(number) percent	(20) 31%
Feeding	Exclusive breast,(number) percent	(31) 48.44%
	bottle,(number) percent	(14) 21.87%
	Mixed,(number) percent	(19) 29.69%
PCV		55.656±5.154%
Serum Albumin		2.954±0.286(gm/dl)

Volume 5, Issue 3; May-June 2022; Page No 1401-1405

The amount of bilirubin in the newborns investigated before and after phototherapy is shown in table 2. Between the groups that received phototherapy before and after, there was a statistically significant drop in bilirubin levels.

Table 2. the level of TSBbeforephototherapy and 48 hours later.

	Total serum bilirubin before phototherapy (mg/dl) (Mean ± SD)	Total serum bilirubin after phototherapy (mg/dl) (Mean ± SD)	P-value
Newborn[64]	17.769 ± 1.167	13.652 ± 0.888	0.0001

Serum magnesium concentration in neonates before and post phototherapy are shown in Table 3. there was a statistically significant difference.

Table 3. Serum magnesium concentration before phototherapyand 48 hour later.

	magnesium level before phototherapy (mg/dl) (Mean ± SD)	magnesium level after phototherapy (mg/dl) (Mean ± SD)	P-value
Newborn[64]	1.969 ± 0.177	1.800 ± 0.216	0.0001

Discussion

As noted by Cremer et al in 1953, neonatal jaundice is the leading causes of admissionNICU, and phototherapy is the best and safest treatment options for neonatal jaundice. Phototherapy, like any other safe procedure, has its own set of adverse effects. Hypomagnesemia is one of the documented negative effects of phototherapy.

The serum magnesium level of the current student had decreased from the initial value following phototherapy. Before phototherapy, the mean value of serum magnesium was (1.969±0.177) mg/dl, and after phototherapy, the mean value was (1.800±0.216) mg/dl. Based on the t-test, this decrease in mean serum magnesium value was statistically significant (p value 0.001). Despite the fact that 91 percent of neonates had a lower magnesium value following phototherapy, only 6 (9 percent) newborns suffered hypomagnesemia. These findings are similar to those of an Iranian study conducted by B. Ravichander et al (2018), which found that hyperbilirubinemia can reverse damage to the brain and other tissues caused by increased bilirubin levels. Phototherapy lowers bilirubin levels while also lowering magnesium levels. [(11)]

Another study by Imani, Mahmood, et al. (2012) found that phototherapy can lower total magnesium and total bilirubin levels in the blood, which is similar to the current study. [(12)]

Ahmad pour Kacho Mousa et al (2014) obtained a similar finding, stating that phototherapy can lower serum magnesium levels in terming neonates with hyperbilirubinemia, and the quantity of this decrease can induce any indication or symptom. [(13)]

According to Mohsen et al. (2012), a rise in plasma Mg could be attributed to extracellular movements of Mg, which is primarily an intracellular ion, as a result of broad cellular injury, which includes neurons and erythrocytes. This increase has a neuroprotective effect while also raising the risk of toxicity associated with increased serum bilirubin levels, which could explain our findings. [(14)]

Sarici et al (2004) showed a strong association between Mg and the degree of hyperbilirubinemia in full-term newborns with neonatal jaundice, which is consistent with our findings. [(15)]

Conclusions

We infer that phototherapy lowers serum magnesium concentration through lowering serum bilirubin

Volume 5, Issue 3; May-June 2022; Page No 1401-1405

levels, and that serum bilirubin and serum Mg levels have a positive relationship.

Recommendations

Although there is a considerable decrease in serum magnesium levels following phototherapy, the incidence of hypomagnesemia in healthy full-term neonates is rare. As a result, it is not recommended to use prophylactic magnesium as a prophylaxis in full term newborn during phototherapy treatment, though neonatologist should be aware about the risk of hypomagnesaemia and use magnesium supplementation if the level is too low.

References:

1. Click, R; Dahl-Smith, J; Fowler, L; DuBose, J; Deneau- Saxton, M; Herbert, J . "An osteopathic approach to reduction of readmissions for neonatal jaundice". Osteopathic Family Physician (January 2013) Volume 5, Issue1selected pp. A1-A8, e1-e2, 1-62.
2. Dennery, PA, Seidman, DS, Stevenson, DK. Neonatal hyperbilirubinemia. N Engl J Med 2001; 344:581.
3. AAP Clinical Practice Parameter Subcommittee on Hyperbilirubinemia: Management of Hyperbilirubinemia in the Newborn Infant 35 or More Weeks of Gestation. Pediatrics 2004; 114: 297-316.
4. Mimouni F, Tsang RC. Perinatal magnesium metabolism: personal data and challenge for the 1990s. Magnes Res. 1991; 4:109-117.
5. Rude RK. Magnesium. In: Ross AC, Caballero B, Cousins RJ, Tucker KL, Ziegler TR, eds. Modern Nutrition in Health and Disease. 11th ed. Baltimore, Mass: Lippincott Williams & Wilkins; 2012:159-75.
6. Gibson, RS. Principles of Nutritional Assessment, 2nd ed. New York, NY: Oxford University Press, 2005.
7. Institute of Medicine (IOM). Food and Nutrition Board. Dietary Reference Intakes: Calcium, Phosphorus, Magnesium, Vitamin D and Fluoride. Washington, DC: National Academy Press, 1997.
8. Ganong WF. In: Ganong WF. ed. Hormonal control of calcium metabolism and the physiology of bone. Review of medical physiology. 22th ed. California: Lange Medical Publications 2005. 352-383.
9. Yadav RK, Sethi RS, Sethi AS, et al. The evaluation of effect of phototherapy on serum calcium level. Peopl J Scientifc Research 2012; 5: 1-4.
10. Paymaneh AT, Sajjadian N, Eivazzadeh B. Prevalence of phototherapy induced hypocalcemia in term neonate. Iran J Pediatr 2013; 23: 710–711.
11. Ravichander B, Kundu S. Effect of double surface phototherapy on serum magnesium levels in term and late preterm neonates. J. Evid. Based Med. Healthc. 2018; 5(4), 315-318.
12. Imani, Mahmood; Rezaee-pour, Mahmood; Mohamdi, Mehdi;et al ; Study of relationship between total Magnesium and total bilirubin levels in neonates' sera before and after phototherapy;Razi Journal of Medical Sciences . Sep2012, Vol. 19 Issue 100, p54-61. 8p.
13. AhmadpourKachoMousa ;ZahedpashaYadollah; Soleimani Rad Hossein et al; effect of phototherapy on serum megnesium level in term neonate with hyperbilirubinemia;Medical journal of Mashad university of medical sciences ; Dec.2014,volume 47 ,P 751 to 755.
14. Abdel Mohsen A, Afify MF, Allam E, et al. Role of magnesium ion in neonatal jaundice. Life ScienceJournal 2012; 9: 2274-2278.
15. Sarici SU, Serdar MA, Erdem G, et al. Evaluation of plasma ionized magnesium levels in neonatal hyperbilirubinemia. Pediatr Res 2004; 55:243-247.

Volume 5, Issue 3; May-June 2022; Page No 1401-1405