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Study of serum magnesium levels in neonatal jaundice: The effect of phototherapy.

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Abstract

Background: Jaundice is a significant problem in early neonatal period. It is suggested that there is a positive correlation between plasma ionized Mg levels and severity of hyperbilirubinemia in newborn.

Methods: A prospective study was conducted on 120 neonates in neonatology unit, Pediatrics Department, Tanta University Hospital from August 2013 to August 2014. All of them suffering from neonatal jaundice. Blood samples for determination of plasma Mg (total and ionized) and serum bilirubin levels were obtained from infants.

Results: There was statistically a significant difference in relation to magnesium level between group of before phototherapy and group of after phototherapy. There was statistically a significant difference in relation to ionized magnesium level between group of before phototherapy and group of after phototherapy.

Conclusion: We concluded that Phototherapy decrease serum Mg level as it decrease serum bilirubin and there is a positive relation between serum bilirubin and serum Mg levels.

Recommendation: Oral magnesium supplementation and covering head during phototherapy in order to prevent reaching light to the pineal gland and so prevention of melatonin decrease which leads to the prevention of hypomagnesemia

Keywords: Neonate, Magnesium, Jaundice, Phototherapy.

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Introduction

Jaundice is the most common condition requiring medical attention in newborns. The yellow coloration of the skin and sclera in newborns with jaundice is the result of accumulation of unconjugated bilirubin [1].

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 [1].

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. Hypermagnesemia is rare and is seen mostly in those with renal failure and in the elderly. It is suggested that there is a positive correlation between plasma ionized Mg levels and severity of hyperbilirubinemia in newborn [2,3].

Measurement of Ionized Magnesium (IMg) provides an accurate assessment of the free form of Mg, which is the physiologically active form and is most reflective of the biologically active and not easily measurable intracellular Mg fraction [4-6].

Phototherapy leads to depression of pineal gland by transcranial illumination, resulting in a decrease in melatonin level [7-11]. Melatonin stimulates secretion of cortisone, which decreases calcium and magnesium absorption leading to hypocalcemia and hypomagnesemia [12-17].

Phototherapy remains the main primary management in neonatal jaundice, however, it has many side effects and one of it is hypomanesemia [18-20].

The aim of this work is to study the effect of phototherapy on serum magnesium in cases of neonatal jaundice.

Patients and Methods

This study was conducted on 120 full-term jaundice neonates with pathological hyperbilirubinemia over a period from August 2013 to August 2014 in Neonatology Unit, Pediatrics Department and Tanta University Hospital.

This study was approved by the ethical committees of Faculty of Medicine, Tanta University, Egypt (approval code: 2959/12/14).

Informed consents of the parents after a complete description of the study were obtained.

Inclusion Criteria

Full-term neonates with pathological hyperbilirubinemia (neonatal hyperbilirubinemia was diagnosed when newborn infant has a peak bilirubin level from 6-20 mg/dl in serum within 10 days of birth in terms) and having unconjugated bilirubin/total bilirubin ≥ 80%.

Exclusion Criteria

Direct bilirubin>20% - Exchange transfusion cases.

Neonates with cephalohematoma, congenital malformation, inborn errors of metabolism, sepsis or whose mother was antenatally administered magnesium sulfate at any time during gestation. Hemolytic hyperbilirubinemia. All parents or guardians of neonates gave a written informed consent to participate in this study. The study was approved by the Ethics Committee of Faculty of Medicine, Tanta University.

Methods

All neonates enrolled in the study were subjected to the following:

1. Full history taking laying stress on a family history of jaundice, anemia,
2. A family history of liver disease
3. A sibling with jaundice or anemia
4. Birth weight and mode of delivery
5. Determination of Apgar score at one and 5 min
6. Assessment of gestational age using Ballard score
7. Thorough clinical examination

Laboratory investigations:

1. Complete blood count
2. Blood group and subgroup typing and Rh of the mother and infant
3. Serum total and direct bilirubin level
4. Serum magnesium level.(total and ionized)

Blood samples for determination of plasma Mg and serum bilirubin levels were obtained from infants during venipuncture. Plasma magnesium levels; was measured spectrophotometrically using ready for use kit [12-15].

Imaging studies (abdominal ultrasonography).

Results

Table 1 shows the bilirubin level before and after phototherapy in the studied neonates. There was statistically a highly significant decrease in relation to bilirubin level between group of before phototherapy and group of after phototherapy.

Table 2 shows total magnesium level before and after phototherapy in the studied neonates. There was statistically a significant difference in relation to magnesium level between group of before phototherapy and group of after phototherapy.

Table 3 shows ionized magnesium level before and after phototherapy in the studied neonates. There was statistically a significant difference in relation to ionized magnesium level between group of before phototherapy and group of after phototherapy.

Discussion

Hyperbilirubinemia is a very common problem during the early neonatal period in term and preterm newborns [1].

Phototherapy may be used for babies whose level is getting high. Phototherapy is safe and effective, potential adverse

Table 1. *Bilirubin level before and after phototherapy in cases of neonatal hyperbilirubinemia*

Bilirubin level	Before Phototherapy (N=120)	After Phototherapy (N=120)	paired t	P-value
Mean ± SD	14.9 ± 3	10 ± 3.4	6.779	<0.001*
(Range)	10-18.7 mg/dl	6-14 mg/dl		

*P value is significant if <0.05

Table 2. *Total magnesium level before and after phototherapy in cases of neonatal hyperbilirubinemia*

Total magnesium level(mg/dl)	Before Phototherapy (N=120)	After Phototherapy (N=120)	paired t	P-value
Mean ± SD	2.6 ± 0.7	2.1 ± 0.5	4.234	0.002*
(Range)	1.82-3.9	1.4-2.78		

*P value is significant if <0.05

Table 3. *Ionized magnesium level before and after phototherapy in cases of neonatal hyperbilirubinemia*

Ionized Magnesium Level(mg/dl)	Before Phototherapy (N=120)	After Phototherapy (N=120)	paired t	P-value
Mean ± SD	0.57 ± 0.03	0.54 ± 0.02	3.12	0.0035*
(Range)	0.53-0.61	0.50-0.58		

*P value is significant if <0.05

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 [1].

Hamed et al. [4] concluded that lining the incubator with reflecting surface as aluminum foil is very cheap effective way to enhance the effect of phototherapy. Using aluminum foil as reflecting surface had good effect on distribution of irradiation upon the neonate, and resulted in increasing the surface area exposed to irradiation and decreases the neonate serum bilirubin; this will decrease the expenses and the hazards of unnecessary prolonged NICU stay.

Our study showed that there were statistically a highly significant difference in relation to bilirubin level and a significant difference in relation to magnesium level between group of before phototherapy and group of after phototherapy.

In agreement with our study, Sarici et al. [7] found a positive correlation between ionized Mg and the severity of hyperbilirubinemia in full term newborns with neonatal jaundice.

Mehta et al. [8] suggested the possibility of a neuroprotective role or a compensatory mechanism in plasma ionized Mg increase against emerging toxicity risk of increasing serum bilirubin values and this agreed with our results.

Bhat et al. [9] and Gathwala et al. [10] concluded that postnatal magnesium sulfate treatment had a neuroprotective effect that protect brain from bilirubin toxicity and this explain our results

Mohsen et al. [11] concluded that increase in plasma IMg may be due to extracellular movement of Mg, a principally intracellular ion, resulting from generalized cellular injury including neurons and erythrocytes. This increase has neuroprotective role against emerging toxicity risk of increasing serum bilirubin levels and this may give a reason for our results.

Conclusion and Recommendations

Phototherapy decrease serum Mg level as it decreases serum bilirubin and there is a positive relation between serum bilirubin and serum Mg levels. We suggest that increase in plasma IMg may be due to extracellular movement of Mg, resulting from generalized cellular injury including neurons and erythrocytes with possibility of a neuroprotective role or a compensatory mechanism of increased IMg levels to reduce bilirubin toxicity. The value of Mg treatment in the therapy of neonatal hyperbilirubinemia deserves further studies.

References

1. Gregory MLP, Martin CR, Cloherty JP. Neonatal hyperbilirubinemia. In: Cloherty JP, Eichenwald EC and Stark AR (eds). Manual of Neonatal Care, 7th ed. Chapter 26, Lippincott-Raven Philadelphia 2012. 304-339.
2. Spiegel DM. Normal and abnormal magnesium metabolism. In: Schrier RW, editor. Renal and electrolyte disorders, 7th edition. Philadelphia: Lippincott William & Wilkins 2010. 229-250.
3. Chaim K and Uri SA. Magnesium homeostasis and hypomagnesemia in children with malignancy. Pediatr Blood Cancer 2013; 60:734-740.
4. Hamed ME, Eman GAN, Rahma SB. The outcome of using different modalities of phototherapy on neonatal serum bilirubin. Tanta University, Faculty of Nursing, Pediatric Nursing Department 2014.
5. Xi Q, Hoenderop JG, Bindels RJ. Regulation of magnesium reabsorption in DCT. Pflugers Arch 2009; 458: 89-98.
6. Izzedine H, Bahleda R, Khayat D, et al. Electrolyte disorders related to EGFR-targeting drugs. Crit Rev Oncol Hematol 2010; 73: 213-219.
7. Sarici SU, Serdar MA, Erdem G, et al. Evaluation of plasma ionized magnesium levels in neonatal hyperbilirubinemia. Pediatr Res 2004; 55:243-247.
8. Mehta R, Petrova A. Ionized magnesium and gestational age. Indian J Pediatr 2007; 74: 1025-1028.
9. Bhat MA, Charoo BA, Bhat JI, et al. Magnesium sulphate in severe perinatal asphyxia: A randomized placebo controlled trial. Pediatrics 2009; 123:764-769.
10. Gathwala G, Khera A, Singh J, et al. Magnesium for neuroprotection in birth asphyxia. J Pediatr Neurosci 2010; 5:102-104.
11. Abdel Mohsen A, Afify MF, Allam E, et al. Role of magnesium ion in neonatal jaundice. Life Science Journal 2012; 9: 2274-2278.
12. Sarici SU, Serdar MA, Erdem G, et al. Evaluation of plasma ionized magnesium levels in neonatal hyperbilirubinemia. Pediatr Res 2004; 55: 243-247.
13. Tunçer M, Yenice A, Ozand P. Serum Mg, Ca, total protein levels in maternal and cord blood and its clinical significance. Turk J Pediatr 1972; 14: 13-22.
14. Misra PK, Kapoor RK, Dixit S, Seth TD. Trace metals in neonatal hyperbilirubinemia. Indian Pediatr 1988; 25: 761-764.
15. Pintov S, Kohelet D, Arbel E, et al. Predictive inability of cord zinc, magnesium and copper levels on the development of benign hyperbilirubinemia in the newborn. Acta Paediatr 1992; 81: 868-869.
16. Karamifar H, Pishva N, Amirhakimi GH. Prevalence of phototherapy induced hypocalcemia. IJMS 2002; 4: 166-168.
17. 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.
18. 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.

19. Srinivasa S, Renukananda S, Srividya GS; Effect of phototherapy on hypocalcemia. J of Evolution of Med and Dent Sci 2015; 4: 4165-4168.

20. Paymaneh AT, Sajjadian N, Eivazzadeh B. Prevalence of phototherapy induced hypocalcemia in term neonate. Iran J Pediatr 2013; 23: 710–711.

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