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Research Article

EFFECT OF PHOTOTHERAPY ON SERUM BILIRUBIN AND IONIZED MAGNESIUM LEVEL IN HYPERBILIRUBINEMIC NEONATES

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ABSTRACT

Objectives: Jaundice is a main problem in the early neonatal period and it is suggested that there is a positive correlation between plasma ionized Mg levels and severity of hyperbilirubinemia in newborn. The aim of this study is to explore the association and to evaluate and interpret its clinical significance as well as to observe the effect of phototherapy on serum magnesium and bilirubin level in the cases of neonatal jaundice.

Methods: A prospective study was conducted on 60 neonates in neonatology unit, pediatrics department, all of them suffering from neonatal jaundice >6-20 mg/dl serum bilirubin level. Blood samples for determination of plasma Mg (total and ionized) and serum bilirubin levels were obtained from infants in 4, 6, and 10 days, and statistical analysis was performed.

Results: There was statistically significant difference in relation to ionized magnesium level before phototherapy mean±SD (0.57±0.03 mg/dl) and group after phototherapy mean±SD (0.54±0.02, $p<0.05$) correspondingly bilirubin level before phototherapy mean±SD (13.9±3 mg/dl) and after phototherapy (9±3.4 mg/dl, $p<0.05$).

Conclusion: From this prospective study, it is concluded that phototherapy decrease serum Mg level as it decreases serum bilirubin level, and therefore there is a positive relation between serum bilirubin and serum Mg levels and rising of magnesium during hyperbilirubinemia may be a physiological compensatory mechanism that counter toxic effect of bilirubin.

Keywords: Bilirubin, Ionized magnesium level, Phototherapy.

INTRODUCTION

Jaundice is the frequently prevalent occurrence and serious medical consideration in neonates. The clinical symptoms of yellowishness of the skin, nail bed, and sclera in neonates with jaundice are the consequence of deposition of unconjugated bilirubin [1]. Newborns appear jaundiced when it is >7 mg/dl, between one-quarter to half percentage of all term and higher than those percentage is prevalent in infants born before term develops clinical jaundice. Furthermore, 6.1% of well-term newborns have maximal serum bilirubin level over 12.9 mg/dl [1].

Magnesium is the fourth most plentiful cation in the body and its greater part is stored in intracellular compartment. However, the extracellular concentrations of magnesium that is of interest to the clinician due to its association in manifestation. The major organs system concerned with magnesium homeostasis are the gastrointestinal, skeletal, and renal, but the regulators influencing these organs at the cellular level yet unsettled. Hypermagnesemia is rarest and is observed mostly in those with renal failure and in geriatric, and documentation is that there is a positive correlation between plasma ionized Mg levels and severity of hyperbilirubinemia in newborn [2-4].

Therefore, 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 [5,6].

METHODS

This study was conducted on 60 full-term jaundice neonates with pathological hyperbilirubinemia over a period from August 2011 to August 2013 in neonatology unit, pediatrics department.

Inclusion criteria

Full-term neonates with pathological hyperbilirubinemia (neonatal hyperbilirubinemia was diagnosed when newborn infant has a peak bilirubin level from 7 to 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.

Methods

A total of 40 males and 20 females neonate were study subjects, blood samples for determination of plasma Mg and serum bilirubin levels were obtained from infants during veinpuncture and then following:

Laboratory investigations were performed:

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

Plasma magnesium levels were measured spectrophotometrically using ready for use kit.

Laboratory investigations were applied including total serum bilirubin before and 72 hrs after phototherapy, total serum magnesium before and after 72 hrs after starting of phototherapy.

Table 1 shows the bilirubin level before and after phototherapy in the studied neonates. There was statistically decrease in bilirubin level between group before phototherapy and after phototherapy.

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

Bilirubin level	n=60		Paired t	p-value
	Before Phototherapy	After Phototherapy		
Mean±SD Range	13.9±3 10-18.7 mg/dl	9±3.4 6-14 mg/dl	6.779	<0.001*

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

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

Total magnesium level	n=60		Paired t	p-value
	Before Phototherapy	After Phototherapy		
Mean±SD Range	2.3±0.7 1.82-3.9 mg/dl	2.0±0.5 1.4-2.78 mg/dl	4.134	0.002*

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

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

Ionized magnesium level	n=60		Paired t	p-value
	Before Phototherapy	After Phototherapy		
Mean±SD Range	0.57±0.03 0.53-0.61 mg/dl	0.54±0.02 0.50-0.58 mg/dl	3.12	0.0035*

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

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

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

DISCUSSION

Preterm newborns have a common hyperbilirubinemia in the early neonatal period [1].

One of the effective and safe therapy used for babies whose level is getting high is phototherapy potential adverse effects of which is usually minimal if appropriate precautions are taken, and there is no evidence to suggest that phototherapy has any adverse long-term effect [1].

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.

In agreement with our study, Sarici *et al.* [6] found a positive correlation between ionized Mg and the severity of hyperbilirubinemia in full-term newborns with neonatal jaundice.

Mehta and Petrova [7] 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 result.

Bhat *et al.* [8] and Gathwala *et al.* [9] concluded that postnatal magnesium sulfate treatment had a neuroprotective effect that protects brain from bilirubin toxicity, and this explain our results.

Mohsen *et al.* [10] concluded that increase in plasma IMg may be due to extracellular movement of Mg, a principally intracellular ion, ensuing from generalized cellular damage and disruption even incorporating to neurons and erythrocytes. This increase has neuroprotective role against promising toxicity risk of escalating serum bilirubin levels, and this may be the compensatory indigenous grounds for our results.

CONCLUSION

Hyperbilirubinemic state raises risk of potential bilirubin toxicity to gray matter of brain or cardiocyte, to compensate this effects extracellular movement of Mg, resulting from generalized cellular injury including neurons and erythrocytes occurs with possibility of a neuro and cardioprotective effect.

Phototherapy proportionately reduces bilirubin correspondingly to IMg suggesting positive correlation between serum bilirubin and serum Mg levels. The value of Mg treatment in the therapy of neonatal hyperbilirubinemia deserves further studies.

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