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Original Research Article

Study of Serum Magnesium Level in Newborn with Indirect Hyperbilirubinemia Before and after Phototherapy

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Conflict of interest: Nil

Background:

Introduction: Newborn jaundice, also known as hyperbilirubinemia, is a common occurrence in neonatal medicine. Severe sickness can potentially result in kernicterus and neurological damage. The most important N-methyl-D-aspartate receptor antagonist is magnesium ion. Phototherapy is the most popular treatment for jaundice, although the effect of phototherapy on serum magnesium has received less study.

Material and method: This prospective study was conducted in the paediatric department of this hospital from March 2019 to March 2020. This study comprised healthy term neonates weighing more than 2400 g who were hospitalised to the pedatric department with a birth age of 3-13 days due to hyperbilirubinemia. All parents or guardians of the babies were thoroughly told about the study before it began, and we ended up with a sample size of 140 newborns.

Result: Serum bilirubin magnesium and ionised magnesium concentrations in the examined newborns before and after phototheraphy showed a statistically significant decrease in bilirubin levels between groups before and after phototheraphy.

Conclusion: Extracellular Mg movement, which occurs as a result of generalised cellular injury in neurons and erythrocytes, may have a neuroprotective and cardioprotective effect by compensating for the effects of hyperbilirubinemic state, which increases the risk of bilirubin toxicity to grey matter of the brain or cardiocyte. 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.

Keyword: Hyperbilirubinemia, Magnesium, Phototheraphy

Introduction

In neonates, jaundice is a common occurrence that requires immediate medical attention. Unconjugated bilirubin deposits in the skin, nail bed, and sclera of babies with jaundice, turning the skin, nail bed, and sclera yellow. [1]

Neonates appear jaundiced when it exceeds 7 mg/dl; clinical jaundice affects one-quarter to half of all term infants, and higher percentages are typical in infants born before term. Furthermore, the maximum blood bilirubin level in well-term newborns is over 12.9 mg/dl in 6.1 percent of them. [2] Hyperbilirubinemia is a serious medical condition that is the leading cause of infant hospitalisation in Southeast Asia. [3]

Indirect hyperbilirubinemia (nonconjugated) and direct hyperbilirubinemia (conjugated) are the two kinds of jaundice in newborns (conjugated). Direct hyperbilirubinemia has little effect on the brain, whereas indirect hyperbilirubinemia is toxic and detrimental. When indirect bilirubin levels in neuronal cells reach dangerously high levels, it accumulates in the nerve membrane, permanently harming the central nervous system. [3]

Bilirubin buildup in the neurons of the brain basal ganglia causes encephalopathy, Kernicterus, and athetoid cerebral palsy. High bilirubin levels in newborns, in contrast to adult jaundice, impair the neurological system, which is linked to the neonate's blood-brain barrier not fully maturing. [4-7]

Magnesium is the body's fourth most abundant element, with the vast bulk of it stored in intracellular compartments. The relationship between extracellular magnesium concentrations and manifestation, on the other hand, is important to doctors. The gastrointestinal, skeletal, and renal systems are the main organ systems involved with magnesium homeostasis, despite the fact that the regulators regulating these organs at the cellular level are still unknown. Hypermagnesemia is uncommon, occurring largely in the elderly and those with renal failure, and there is evidence that plasma ionised Mg levels are linked to the severity of hyperbilirubinemia in infants.[2]

Phototherapy is the most common treatment for hyperbilirubinemia. Hyperthermia, fever, diarrhoea, changes in blood cells, cytokines, and vitamins, as well as ocular and dermatological disorders, can all be side effects of phototherapy. [3] Bilirubin deposition in neurons results in irreversible neuronal damage. Bilirubin binds to the phospholipids of NMDA receptors that are found in plasma membranes. Magnesium is an NMDA antagonist that inhibits bilirubin's neurotoxic effects. Phototherapy has been linked to a number of side effects in the treatment of neonatal hyperbilirubinemia, but nothing is known about how it affects serum magnesium levels. [8]

In this study, the level of serum magnesium in neonates with indirect hyperbilirubinemia was examined before and after phototheraphy.

Material Method:

This prospective study was conducted in the paediatric department of this hospital from March 2019 to March 2020. This study comprised healthy term neonates weighing more than 2400 g who were hospitalised to the pedatric department with a birth age of 3-13 days due to hyperbilirubinemia. All parents or guardians of the babies were thoroughly told about the study before it began, and we ended up with a sample size of 140 newborns.

Inclusion criteria:

Pathogenic hyperbilirubinemia in full-term neonates with an unconjugated bilirubin/total bilirubin ratio less than 80% (defined as a peak bilirubin level in the serum ranging from 7 to 20 mg/dl within 10 days after birth in terms)

Exclusion criteria

If the direct bilirubin level is greater than 20%, the patient should have an exchange transfusion. Neonates having cephalohematoma, congenital malformations, inborn metabolic abnormalities, sepsis, or whose mother was given magnesium sulphate antenatally at any point during pregnancy.

Hemolytic hyperbilirubinemia is a condition in which the liver produces too much bilirubin. To participate in this study, all neonatal parents or guardians signed a written informed permission form. The study was authorised by the Faculty of Medicine's Ethics Committee.

Phototheraphy procedure:

As needed, they received single, double, and extended phototherapy. Intensive phototherapy uses eight fluorescent lamps, four from the upper part and four from the lower part, each with a micro W/cm2/nm of more than 30 micro W/cm2/nm. Single phototherapy uses four fluorescent lamps, double phototherapy uses two three-lamp devices on both sides (upper) and at a distance of 15 to 20cm from the newborn, and single phototherapy uses two three-lamp devices on both sides (upper) and at a distance of 15 to 20cm from

Biochemical analysis:

- Serum magnesium and bilirubin concentration was measured by AU480 analyser.

Statistical significant:

The data was analysed using the SPSS software programme, version 20.0. The mean and standard deviation were calculated. Because the probability value was less than 0.05 (p0.05), it was considered statistically significant.

Result:

Table 1: serum Bilirubin, magnesium and ionized magnesium concentration in cases of newborn hyperbilirubinemia .

Parameter	Before phototheraphy	After phototheraphy	P -value
Bilirubin (mg/dl) Mean±SD	14.9±3.1	8.95±3.1	<0.001
Magnesium (mg/dl) Mean±SD	2.4±0.8	1.9±0.4	<0.001
Ionized (mg/dl) mean±SD	0.55±0.02	0.52±0.01	<0.001

Table no 01 showed the serum bilirubin magnesium and ionized magnesium concentration before and after phototheraphy in the studied newborn there was statistically decrease in bilirubin level between group before and after phototheraphy

Discussion:

Total serum magnesium levels in neonates with jaundice were examined before and after phototherapy in this investigation.

In the early neonatal period, preterm babies are prone to hyperbilirubinemia. For babies whose blood sugar levels are rising, phototherapy is an effective and safe treatment option. Side effects are usually minor if measures are taken, and there is no evidence that phototherapy has any long-term negative consequences. [9]

According to our findings, there was a statistically significant change in bilirubin levels and a significant shift in magnesium levels between the before and after phototherapy groups. The average serum magnesium level fell following phototherapy, according to the findings of these two investigations and the current study. The amounts of bilirubin and magnesium in ionized plasma were found to be positively related in a study conducted by Sarici et al. The magnesium level of ionised serum in the group with severe hyperbilirubinemia was substantially greater than in the moderate group. In this group, there was also a positive and significant relation between serum

magnesium levels and hyperbilirubinemia severity.

Sarici et al. [10] In full-term newborns with neonatal jaundice, researchers discovered a link between ionised Mg and the degree of hyperbilirubinemia.

Mehta and Petrova [11] The rise in plasma ionised Mg was indicated to play a neuroprotective or compensatory role against the growing toxicity risk of rising serum bilirubin levels, which matched our findings.

Gathwala et al. and Bhat et al. [12,13] Our findings show that postnatal magnesium sulphate treatment protects the brain against bilirubin toxicity by having a neuroprotective effect.

Karambin et al.14 conducted another study. Neonatals have an average intrauterine age of 38 weeks and a weight of 3221 g, and 90% of jaundiced babies are under the age of five days. They detected a drop in serum magnesium levels in response to phototherapy in both double phototherapy surgeries. [14]

Conclusion:

Extracellular Mg movement, which occurs as a result of generalised cellular injury in neurons and erythrocytes, may have a neuroprotective and cardioprotective effect by compensating for the effects of hyperbilirubinemic state, which increases the risk of bilirubin toxicity to grey matter of the brain or cardiocyte. 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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