

Prevalence of Phototherapy-Induced Hypocalcemia

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Abstract

Background: Hyperbilirubinemia is the single most common abnormal physical finding in the first week of life and is commonly managed by phototherapy with its inherent complications. A lesser known complication of the phototherapy is hypocalcemia.

Objective: To study the prevalence of phototherapy-induced hypocalcemia and to compare it between premature and full-term babies.

Methods: This study was performed on 153 jaundiced neonates (62 premature, 91 full-term) that were managed with phototherapy. These neonates were completely normal on physical examination. Serum calcium was checked on arrival, 48 hours after starting phototherapy and 24 hours after discontinuation of the treatment. The first samples were considered as controls. A comparative study was made between these groups to determine the prevalence of hypocalcemia.

Results: Twenty-two neonates (14.4%) developed hypocalcemia. There were significant differences between the prevalence of hypocalcemia in premature (22.6%) and full-term neonates (8.7%) ($p=0.018$). None of the hypocalcemic neonates was symptomatic clinically. Serum levels of calcium returned to normal 24 hours after discontinuation of phototherapy in almost all hypocalcemic neonates.

Conclusion: The study shows that neonates under phototherapy are at high risk of hypocalcemia. This risk is greater in premature neonates.

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Keywords • Hypocalcemia • phototherapy • hyperbilirubinemia

Introduction

Hyperbilirubinemia is a common problem among neonates. Untreated severe indirect hyperbilirubinemia is potentially neurotoxic. The effectiveness of phototherapy in the management of neonatal hyperbilirubinemia has been demonstrated in many controlled clinical trials.¹⁻³

Phototherapy might be a contributing factor to neonatal hypocalcemia. Based on animal studies, it has been suggested that phototherapy may lead to a decrease in melatonin secretion.

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Prevalence of phototherapy-induced hypocalcemia

Table 1. The comparison of serum calcium (mg/dl) in 153 icteric newborns. Values are mean±SD

Subjects	n	Before phototherapy	48-hr after phototherapy	p value	24-hr after discontinuation phototherapy
Full-term	91	9.53±0.92	9.30±1.11	0.043	9.69±0.86
Preterm	62	8.73±1.38	8.40±1.71	0.039	8.71±1.14

Subsequently, glucocorticoid secretion is decreased leading in turn, to an increase in bone calcium uptake, which results in hypocalcemia.⁴

In this report, we studied the prevalence of hypocalcemia in preterm and full-term newborn infants submitted to phototherapy.

Patients and Methods

The study was performed on 153 neonates (62 premature and 91 full-term) who were managed with phototherapy because of jaundice. These neonates were completely normal on physical examination. Babies suffering from neonatal asphyxia, respiratory distress, hemolytic anemia, sepsis, congenital malformations, infants of diabetic mothers and infants undergoing exchange transfusion were excluded. Premature neonates were divided into two groups:

1. Moderately premature (gestational age ≤31-34 wks+6 days);
2. Borderline premature (gestational age >35-36 wks+6 days).

Serum calcium was checked on arrival, 48 hours after starting phototherapy and 24 hours after discontinuation of the treatment. We considered hypocalcemia as a total serum calcium of <7 mg/dl in premature infants and as a total serum calcium of <7.5 mg/dl in full-term babies. Data on age, sex, weight, gestational age, blood group, hemoglobin, reticulocyte count, platelet count, bilirubin and maternal blood group were recorded. Light treatment was provided by a phototherapy unit with four 40-watt blue fluorescent tubes, placed at 40 cm distance from the skin. A comparative study was done in these groups for evaluating the prevalence of hypocalcemia. The data analysis was done by Student's t test and χ^2 test.

Results

The study was done on 62 premature infants (39 males, 23 females) and 91 full-term infants (49 males, 42 females).

The mean±SD chronological age and weight of premature neonates was 6.71±3.7 days and 2077±316 grams, respectively. The mean chronological age and weight of full-term infants was

5.69±2.6 days and 2889±474 grams, respectively.

G6PD deficiency was detected in 16% of premature and 17.6% of full-term neonates. The mean±SD serum bilirubin concentration was 18.0±2.4 mg/dl in full-term infants and 16.2±3.0 mg/dl in preterm infants. The mean±SD hemoglobin level of full-term and preterm infants was 16.8±2.7 g/dl and 17.1±2.0 mg/dl, respectively. Table 1 shows the comparison between serum calcium levels in full-term and preterm infants.

Twenty-two newborn infants developed hypocalcemia 48 hours after phototherapy was started (p=0.017). The prevalence of hypocalcemia was 22.6% in premature babies and 8.7% in full-term newborn. The difference was statistically significant (p=0.018). There was no significant correlation between serum calcium values and sex, weight or serum bilirubin level. Twenty-four hours after discontinuation of phototherapy, the total serum calcium returned to normal value.

The prevalence of hypocalcemia was 24% in moderate premature neonates and 19% (p=0.4) in borderline premature infant.

Discussion

Hyperbilirubinemia is a common problem in neonates.¹ Phototherapy is effective in reducing bilirubin level.^{1,2} Common complications of phototherapy include loose stool, skin rash, hyperthermia and bronze baby syndrome. A less known complication of phototherapy is hypocalcemia.

Sethi⁷ reported that 90% of preterm neonates and 75% of full-term neonates developed hypocalcemia after being subjected to phototherapy. The pathogenesis of hypocalcemia induced by light is not well-known.² Zecca, et al,⁶ reported that administration of 25-hydroxy vitamin D₃ was not able to lower the incidence of the phototherapy-induced hypocalcemia in preterm infants. He concluded that vitamin D was unlikely to play an important role in the pathogenesis of phototherapy-induced hypocalcemia. Hakanson Do, et al,^{3,5} reported that when young rats were exposed to white fluorescent light, the serum concentration of calcium did decrease. He showed that this calcium drop was accompanied by a decrease in serum melatonin concentration. This effect can be prevented by shielding the occiput, by inhibiting corticosterone synthe-

sis, and by administration of exogenous melatonin. They also reported that propranolol could reduce serum calcium by inhibiting synthesis of melatonin. Light-induced hypocalcemia may result from increased calcium uptake by bone when the blocking effect of melatonin decreases after pineal inhibition by transcranial illumination.³

In a study done by Jain,⁸ the prevalence of phototherapy-induced hypocalcemia was 55% in preterm infants and 30% in full-term neonates. Among the affected preterm babies with hypocalcemia 63.6% had jitteriness and 27.3% had irritability. In the hypocalcemic full-term neonates 50% had jitteriness and 16.7% were irritable. To prevent hypocalcemia, they recommended administration of supplemental calcium in the neonates treated by phototherapy. In our study, 22.6% of preterm and 8.7% of full-term infants developed hypocalcemia. The reason for this difference is not clear. However, the type of fluorescent tubes used may play a role. We used blue light phototherapy, and as Gutcher and coworkers⁹ reported in their study, blue and green light did not lead to hypocalcemia in their rats compared to daylight phototherapy. None of our hypocalcemic patients became symptomatic. The serum calcium returned to normal value in all cases 24 hours after the discontinuation of phototherapy.

In a study done by Jain,¹⁰ the prevalence of hypocalcemia was higher in patients with high concentrations of serum bilirubin. The difference, however, was not statistically significant. We could not detect any correlation between hypocalcemia and serum bilirubin level. In the present study, phototherapy-induced hypocalcemia in moderate premature neonates was more than borderline premature neonates. This may be due to higher penetration of light in premature infants. It is suggested that although phototherapy induces hypocalcemia in newborn infants, no calcium supplement seems to be required except in symptom-

matic cases.

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