

Phototherapy-Induced Hypocalcemia in Icteric Newborns

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Abstract

Background: Phototherapy plays a significant role in the treatment and prevention of hyperbilirubinemia as well as the management of subsequent complications in the newborn. However, this treatment modality may itself result in the development of hypocalcaemia and create serious complications including convulsion and related conditions.

Objective: This study was under-taken to investigate phototherapy-induced hypocalcemia in hyperbilirubinemic neonates.

Methods: 63 healthy term newborns of >2.5 kg undergoing phototherapy were selected. Plasma bilirubin and calcium levels were determined before and after termination of phototherapy.

Results: The difference between pre- and post-phototherapy plasma calcium levels were found to be statistically significant ($p < 0.05$). The decline in plasma calcium level at times reached hypocalcemia threshold.

Conclusion: Phototherapy in icteric neonates lowers serum calcium level.

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Keywords • Hypocalcaemia • hyperbilirubinemia • phototherapy.

Introduction

Hyperbilirubinemia is a common and, in most instances, a benign condition in the newborn. Nevertheless severe and untreated form of indirect hyperbilirubinemia is highly associated with toxic damage of nervous system.^{1,2} Phototherapy may lead to complications including skin rash, diarrhea, rise in temperature, dehydration, damage to DNA, chills, trauma to the eye, nasal obstruction secondary to eye occlusion, and bronze baby syndrome.¹⁻³ hypocalcemia can also occur during phototherapy.

Patients and Method

Sixty-three healthy term newborns over 2.5 kg of weight, admitted to the newborn ward of Ghaem and Ekbatan Hospitals of Hamadan

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between July and October 2001 because of indirect hyperbilirubinemia were exclusively subjected to phototherapy. Before and after termination of phototherapy, blood samples were taken for determination of calcium and bilirubin levels.

The exclusion criteria in this study comprised: The newborns with icterus in the first 24 hours of life, premature newborns, infants of diabetic mothers, and those with an Apgar score <7 at birth. Excluded were also newborns whose mothers had history of taking anti-convulsants (phenobarbital), and those whose mothers had history of hyperthyroidism or signs and symptoms related to this condition at the time of pregnancy. Cow milk fed newborns, those who had blood exchange or venous nutrition therapy, patients who received bicarbonate, newborns suspected of having sepsis or systemic infections, and those newborns with jaundice lasting >14 days were excluded from the study too.

For all phototherapy-treated newborns, a four blue light fluorescent lamp phototherapy equipment (wave length of 410-470 nm) placed at a distance of 30-40 cm was applied.

Results

The mean duration of phototherapy in these newborns was 3.0 days, ranging from 1 to 7 days. It was found that the blood calcium level declined considerably and continued at times to the threshold of hypocalcemia. Mean±SD serum calcium level decreased significantly ($p<0.001$) from a baseline value of 9.85 ± 1.23 mg/dl (before phototherapy) to 9.09 ± 0.93 mg/dl, after phototherapy. We encountered, only one case of symptomatic hypocalcemia in the form of apnea while phototherapy led to considerable decline in serum bilirubin level of icteric newborns. The duration of phototherapy correlated the probability of hypocalcemia incidence.

Discussion

Phototherapy is an appropriate and relatively safe measure in reducing indirect bilirubin level in newborns. This is especially true when serum bilirubin level has not reached the level to induce kernicterus.¹⁻⁵

One of the adverse effects of phototherapy in the newborns is induction of hypocalcemia.² Phototherapy-induced hypocalcemia has been reported in several studies.⁸⁻¹¹ In one study,⁶ it was observed that by administration of melatonin to the newborn rat, it is possible to prevent phototherapy-induced hypocalcemia. It can also be prevented by covering and protection of occipital region of rats.⁶ In a study by Dutte, et al,⁷ considerable decrease in serum calcium level was observed particularly into

premature newborns, and prophylactic administration of calcium for newborns under phototherapy was recommended.

Phototherapy leads to inhibition of pineal gland via transcranial illumination, resulting in a decline in melatonin level and, in turn, diminishing corticosteron to finally decrease calcium resorption from bones, producing hypocalcemia. This hypothesis, based on studies on rabbit suggests that melatonin, by stimulating corticosteron release, lowers calcium absorption in bones, thus decreasing secretion of melatonin which is secondary to phototherapy causes, bone calcium uptake increases and as a result, hypocalcemia develops.^{6,12}

In the present study, it was observed that phototherapy induces considerable decline in serum calcium level in icteric newborn therapy and this decline may continue down to the threshold of hypocalcemia development. In the majority of cases in this study, calcium decrease in the newborns under phototherapy was not accompanied by signs and symptoms found in hypocalcemia such as apnea, cyanosis and/or convulsion; only one case of symptomatic hypocalcemia in the form of apnea was observed.

There was a direct relationship between duration of phototherapy and development hypocalcemia. It is recommended that in order to prevent development of hypocalcemia in phototherapy-treated newborns, one of two following measures be carried out.

1. Newborns under phototherapy should be given oral calcium as prophylaxis.
2. Parallel to the covering of the eyes that is routinely done to prevent retinal damage, measures be taken for covering head and occipital area of these newborns using a special hat during phototherapy, so that light effect from phototherapy on newborns' pineal gland and consequently melatonin decrease and hypocalcemia is prevented.

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