

Effect of Phototherapy on Serum Calcium Levels in Neonates in A Tertiary Care Hospital

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ABSTRACT

Background: Phototherapy is the most common method to treat neonatal jaundice. The effect of phototherapy on serum calcium levels is a questionable issue. **Objective:** To study the effect of phototherapy on serum calcium levels in neonates with physiological unconjugated hyperbilirubinemia. **Study Design:** Longitudinal type of descriptive study. **Settings:** Neonatology Department of The Children's Hospital, Faisalabad. **Duration:** Six months (1st October 2020 to 30th March 2021). **Methods:** This study was conducted on 101 term neonates with unconjugated hyperbilirubinemia, requiring phototherapy. The serum calcium levels and total serum bilirubin levels were checked before and after phototherapy. Neonates were monitored for clinical features of hypocalcemia i.e., jitteriness, lethargy and seizures. **Results:** Hypocalcemia was observed in 41.58% of neonates after phototherapy. The difference between pre and post phototherapy serum calcium levels was found to be statistically significant ($p < 0.005$). Seizures were observed in 4(3.96%) neonates undergoing phototherapy. **Conclusion:** Hypocalcaemia has a significant association with phototherapy. So, serum calcium levels should be checked in babies undergoing phototherapy.

Keywords: Hypocalcemia, Phototherapy, Neonatal jaundice.

INTRODUCTION

Jaundice neonatorum (JNN), is a frequent observation in early neonatal age.¹ It affects almost 60% of babies born at term and 80% of preterm babies during the first week of life.²

There are different causes of JNN and usually it does not require any treatment. However, 10% of the affected neonates require intervention due to high bilirubin levels as, if unchecked, high bilirubin levels can damage the neurons resulting in loss of hearing, vision, and cerebral palsy.^{3,4}

Phototherapy is the mainstay of treatment in unconjugated hyperbilirubinemia. Exposure to photo lights converts bilirubin to photo isomers which are excreted in the urine.¹

The main complications of phototherapy include electrolyte imbalance, temperature instability, loose

motions, rash, bronze baby syndrome and hypocalcemia.⁵

Hypocalcemia (level of fewer than 8 milligrams per deciliter in full-term and less than 7 milligrams per deciliter in preterm babies) can be clinically asymptomatic.^{2,6}

It can cause symptoms like cardiac arrhythmia, apnea, fits, irritability, and cardiac failure.^{2,7} The long-term sequel of hypocalcemia includes physical and mental handicaps.⁸ Cortisol enhances the uptake of calcium by bones resulting in hypocalcemia while melatonin has an inhibitory effect on cortisol. The secretion of melatonin by the pineal gland is blocked by phototherapy resulting in loss of inhibition of cortisol leading to hypocalcemia.^{7,9}

The study was carried out to determine the frequency of hypocalcemia in our patients undergoing phototherapy,

so that our institutional guidelines regarding screening of jaundiced babies for hypocalcemia may be modified.

METHODS

This longitudinal type of descriptive study was conducted in Neonatology Department of The Children's Hospital, Faisalabad Pakistan from 1st October 2020 to 30th March 2021 (Six months).

Non-probability consecutive sampling technique was used. A sample size of 101 neonates was calculated by 7% frequency of outcome factor, confidence limit of 5% with a level of significance of 95%.¹⁰

All healthy full-term neonates admitted in the neonatal unit with unconjugated hyperbilirubinemia requiring phototherapy according to the NICE guidelines were included in the study.

Premature babies (babies delivered before 37 weeks of gestation), babies having Rh incompatibility, sepsis, serum bilirubin levels reaching the threshold for exchange transfusion, conjugated hyperbilirubinemia and conditions causing hypocalcemia (infant of diabetic mother, sodium bicarbonate therapy, asphyxia neonatorum). Hypocalcemia before initiation of phototherapy were excluded from the study.

The neonates meeting the inclusion criteria were enrolled in the study and written/informed consent was taken from parents. The relevant antenatal, natal, postnatal and family histories were taken. A detailed physical examination was carried out.

Septic workup including complete blood count (CBC), C-reactive protein (CRP), and blood culture, blood group of baby and mother, random blood sugar, serum calcium and serum bilirubin (direct and indirect fractions) were taken at admission. The serum calcium and serum bilirubin levels were performed on Siemens Dimensions EXL 200 Biochemistry Analyzer. The threshold of phototherapy was determined according to NICE guidelines charts. Babies were placed at 20 centimeters distance from blues fluorescent neon lights with a wavelength of 420 to 470 nm. Eyes and genitalia were covered. Serum bilirubin (direct and indirect) and serum calcium levels were repeated after 48 hours of phototherapy or at the cessation of phototherapy if it was done earlier than 48 hours.

The data were entered in SPSS version 25. Quantitative variables were expressed as mean and Standard Deviation. Qualitative variables were given as frequencies and percentages. Comparison of pre and post phototherapy serum calcium was analyzed as an independent sample T-test.

RESULTS

A total of 104 neonates were included in the study. Three babies were excluded due to incomplete data. The mean bilirubin level at admission was 16.42 ± 5.81 mg/dL. The mean bilirubin after phototherapy was 8.79 ± 3.92 mg/dL. The mean serum calcium level at admission was 8.76 ± 0.76 mg/dL. The mean serum calcium levels after 48 hours of phototherapy were 7.98 ± 1.12 mg/dL. Hypoglycemia was observed in 42(41.58 %) of babies which is statistically significant ($p= 0.000$). Seizures were observed in 4 (3.96%) of patients.

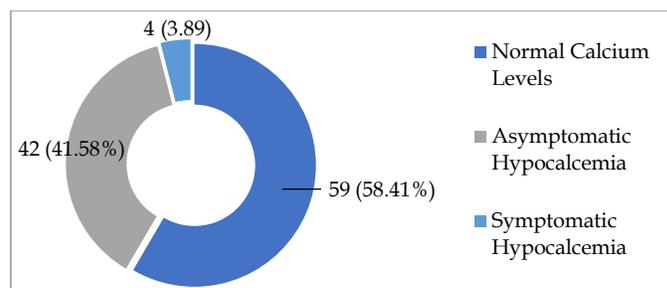
Table 1: Mean serum bilirubin levels (Before & after phototherapy)

	Mean \pm Std. Deviation	P-Value
Mean Serum Bilirubin at Admission (mg/dl)	16.42 \pm 5.8138	0.000
Mean Serum Bilirubin after Phototherapy (mg/dl)	8.79 \pm 3.9274	

Table 2: Mean serum calcium levels (Before & after phototherapy)

	Mean \pm Std. Deviation	P-Value
Serum Calcium at Admission (mg/dl)	8.76 \pm .7630	0.000
Serum Calcium at 48 hours (mg/dl)	7.98 \pm 1.1227	

Figure 1: Post phototherapy Profile of serum Calcium levels



DISCUSSION

Phototherapy is the most common modality used for the treatment of neonatal hyperbilirubinemia.² The effect of phototherapy on serum calcium levels was first observed by Romagnoli *et al.*¹¹ The mean serum calcium levels before phototherapy in our study were 8.76 ± 0.76 mg/dL while the pre phototherapy levels observed by Abhishek were 8.9 ± 0.7 mg/dL while an Egyptian study noticed the pre-phototherapy serum calcium levels to be 9.6 ± 30.79 mg/dL.^{5,9}

The serum calcium levels after phototherapy observed in our study were 7.98 ± 1.12 mg/dL which was statistically significant ($p=0.00$) and coincides with the studies

conducted by Goyal 8.53 ± 0.77 mg/ dL ($p=0.001$) and Shahida 9.241 ± 0.24 mg/dL ($p=0.043$).^{2,12} In our study, 42 (41.58%) of the babies developed hypocalcemia following phototherapy. It is similar to an Indian study in which 35% babies had this complication.²

The study conducted by Tehrani found that only 7.5 % of neonates suffered hypocalcemia after phototherapy.¹³ However, on the contrary, Rajesh noticed a frequency of 66.6% and Sridhar noted that 64% had hypocalcemia.^{14,15} The association of hypocalcemia with phototherapy was found to be statistically significant ($p<0.005$) in our study which is consistent with the studies conducted by Rajesh, Gafaar and Narang.^{9,14,16}

Symptomatic hypocalcemia (seizures) was seen in 4 (3.96%) of babies. Summit Goyal observed jitteriness in 2.8% of babies undergoing phototherapy. The frequency of seizures was high in an Indian study in which 10% of patients developed hypocalcemic seizures. On the contrary, no patient had symptomatic hypocalcemia in studies conducted by Tehrani *et al* and Reddy *et al* which may be explained by the small sample size in these studies.^{2,13,17,18}

CONCLUSION

Phototherapy for jaundice neonatorum results in a significant fall in serum calcium levels which is mostly asymptomatic. Therefore, serum calcium levels should be monitored in babies undergoing phototherapy.

LIMITATIONS

The study was conducted in only one set-up.

SUGGESTIONS / RECOMMENDATIONS

We suggest that routine monitoring of serum calcium levels should be done in the neonates undergoing phototherapy owing to the risk of phototherapy related hypocalcemia.

CONFLICT OF INTEREST / DISCLOSURE

There was no conflict of interest.

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