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Study of Serum Calcium Changes in Neonates Receiving Phototherapy for Neonatal Hyperbilirubinemia

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A B S T R A C T

Introduction: Phototherapy is considered to be a risk factor for hypocalcemia and its mechanism is probably multifactorial.***Objective:*** 1) To determine the effect of phototherapy on serum Calcium level in neonates receiving phototherapy. 2) To compare Serum Calcium level changes in preterm and term neonates.***Study Design***: present study is a prospective hospital based comparative study conducted over a period of 1yr.***Result***: The study included 100 neonates. The majority of study participants i.e, 75 were born at term whereas, 25 were born preterm. Among preterm infants, the mean serum calcium level before phototherapy was 8.96±0.62 mg/dl, which decreased to 8.39±0.76 mg/dl after phototherapy. Among term infants, the mean serum calcium level before phototherapy was 9.08±0.61 mg/dl, which decreased to 8.38±0.77 mg/dl after phototherapy.***Conclusion***: The present study suggested that phototherapy is associated with significant reductions in serum calcium particularly in term infants. Preterm infants also showed significant changes in serum calcium levels, emphasizing their vulnerability and the need for close monitoring.

Keywords: Neonatal hyperbilirubinemia, Phototherapy, Preterm, Term neonates.

INTRODUCTION

Phototherapy employs blue wavelengths of light to change unconjugated bilirubin in the skin. The bilirubin is then converted to less toxic water-soluble photo-isomers that are excreted in the bile and urine without conjugation. As every treatment has its side effects, phototherapy also is known to cause its adverse effects. Phototherapy has a negative impact on numerous parts of the oxidant and antioxidant defence system in newborns with hyperbilirubinemia and exposes them to fatal oxidative stress [1].

In the recent years, limited research showed that phototherapy should be considered as a risk factor for hypocalcemia and its mechanism is probably based on the effect of phototherapy on the decrease of melatonin leading to decrease in melatonin, spatter of reduced glucocorticoid, and increase in calcium absorption from bone that causes hypocalcemia [2].

Neonates receiving phototherapy have reduced level of parathyroid hormone which leads to hypocalcemia. It is also reported that urinary excretion of calcium was significantly higher in patients exposed to phototherapy [3].

Objectives:

1. To determine the effect of phototherapy on serum Calcium level in neonates receiving phototherapy.
2. To compare Serum Calcium level changes in preterm and term neonates.

Materials & Methods:

The present study is a prospective hospital based comparative study conducted over a period of1yr. The study

participants/ subjects consist of neonates with gestational age >35weeks with neonatal hyperbilirubinemia as per AAP guidelines for neonatal jaundice, who were admitted in the department of Paediatrics, Sri Siddhartha Medical College Hospital, Tumkur. A total of 100 subjects were assessed before and after phototherapy for serum calcium.

RESULTS:

The study included 100 neonates. The majority of study participants i.e, 75 were born at term whereas, 25 were born preterm. The majority of the participants were male (57%) while female participants were 43% (Table 1).

Among preterm infants, the mean serum calcium level before phototherapy was 8.96±0.62 mg/dl, which decreased to 8.39±0.76 mg/dl after phototherapy. The p-value for this change was 0.0055. Among term infants, the mean serum calcium level before phototherapy was 9.08±0.61 mg/dl, which decreased to 8.38±0.77 mg/dl after phototherapy. The p-value for this change was <0.0001.

Table 1: Distribution of subjects according to sex

Sex	Frequency (n)	Percentage (%)
Female	43	43
Male	57	57
Total	100	100

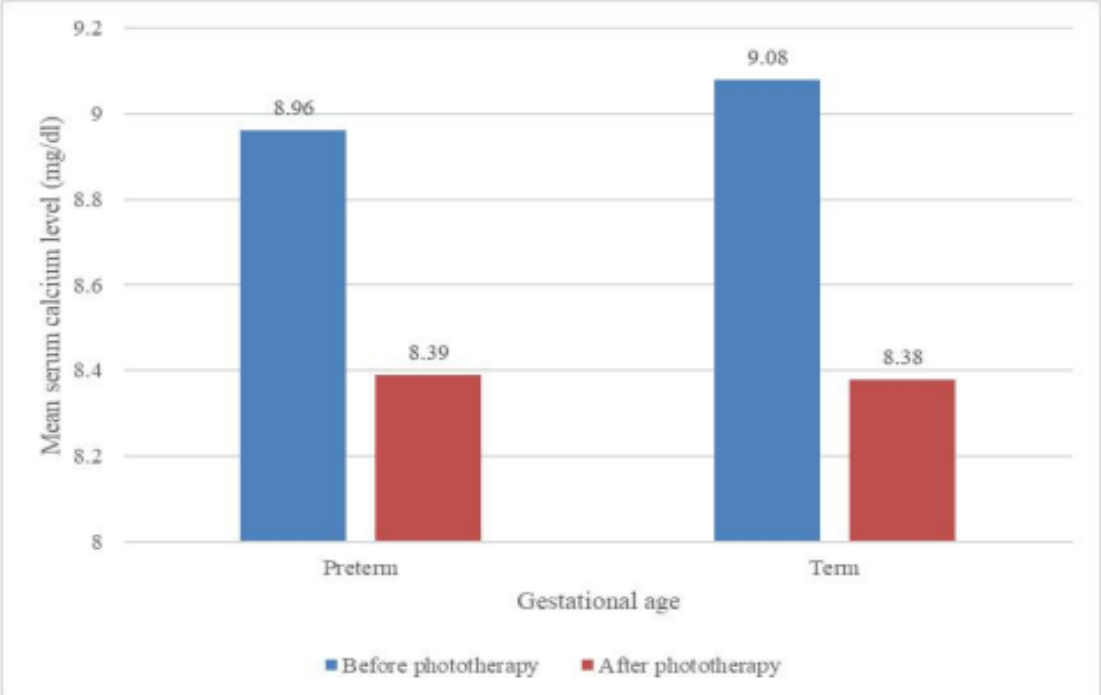

Figure 1: Comparison of serum calcium level before and after phototherapy in term and preterm neonates

DISCUSSION

This study aimed to evaluate the effects of phototherapy on serum calcium levels in neonates with hyperbilirubinemia, comparing the changes between preterm and term infants. The key findings indicate that while phototherapy effectively reduces bilirubin levels in both preterm and term neonates, it has significant impact on serum calcium levels.

In this study, the majority of neonates were born at term (n=75), followed by preterm (n=25). Males were more prevalent than females, with a ratio of 57% to 43%.

A statistically significant reduction in serum calcium levels was observed in both preterm and term neonates post-phototherapy. Preterm neonates showed a decrease from 8.96±0.62 mg/dl to 8.39±0.76mg/dl (p = 0.0055), and term

neonates had a reduction from 9.08±0.61 mg/dl to 8.38±0.77mg/dl (p< 0.0001). These findings indicate that phototherapy may contribute to hypocalcemia, which aligns with previous studies suggesting a potential risk of decreased calcium levels during phototherapy (Table 2). This necessitates monitoring and possibly supplementing calcium in neonates undergoing phototherapy. Moreover, it was shown that fluorescent light reduced serum calcium and serum melatonin concentrations. Light-related hypocalcemia was explained by the inhibition of the pineal gland through transcranial illumination. The hypocalcemic effect of light was suggested to be associated with an acute increase in corticosterone-mediated bone calcium uptake due to decreased melatonin levels. Moreover, in our study setting we used LED phototherapy that causes of dehydration and insensible water loss thus no significant changes in electrolytes were noted. Additionally, compared to term infants, preterm babies were reported to have a higher risk of phototherapy-related hypocalcemia. As a result, calcium supplements were recommended for preterm infants during phototherapy [4].

Table 2: Comparison of serum calcium level before and after phototherapy between studies

Studies		**Serum calcium level (mg/dl)**		**P-Value**
		Before phototherapy (mean±SD)	**After phototherapy (mean±SD)**	
Purohit A, Verma SK *et al*., [5]		9.4±0.73	8.4±0.68	<0.05
Gozetici AM *et al*., [6]		9.98	9.55	<0.05
Lidia C *et al*., [7]		9.47	9.23	0.025
Sharma S *et al*., [8]		9.14±0.46	8.09±0.55	<0.05
Srivastava S *et al*., [9]		9.67±1.23	8.85±1.17	<0.001
Present study	Pre-Term	8.96±0.62	8.39±0.76	0.0055
	Term	9.08±0.61	8.38±0.77	<0.0001

CONCLUSION

The present study suggested that phototherapy is associated with significant reductions in serum calcium particularly in term infants. Preterm infants also showed significant changes in serum calcium levels, emphasizing their vulnerability and the need for close monitoring.

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