



The Effect of Phototherapy on Serum Ionized Calcium Levels in Neonates with Unconjugated Hyperbilirubinemia

KEYWORDS

Hypocalcemia , Phototherapy , Hyperbilirubinemia

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ABSTRACT Aim: To study the occurrence of hypocalcemia in neonates with hyperbilirubinemia after 48 hours of continuous phototherapy and to compare the results between term and preterm neonates. Methods: This study was performed on 200 neonates with unconjugated hyperbilirubinemia (155 term and 45 preterm) who were given phototherapy in Neonatal Intensive Care Unit (NICU). Serum ionized calcium levels were checked before and after 48 hours of phototherapy. The prevalence of hypocalcemia after 48 hours of phototherapy was observed and compared between full term and preterm neonates. Neonates who had conjugated hyperbilirubinemia, asphyxia, respiratory distress, hemolytic anemia, sepsis were excluded from the study. Results: 85/200 neonates (42%) developed hypocalcemia. 61/155 full term neonates (39%) and 24/45 preterm neonates (53%) developed hypocalcemia after 48 hours of phototherapy. Conclusion: Significant decline in serum ionized calcium level is observed in neonates receiving phototherapy for hyperbilirubinemia.

Introduction

Neonatal hyperbilirubinemia is one of the common conditions confronting neonatologists in their day to day practice. About 60% of term and 80% of preterm infants develop jaundice in the first week of life.¹ Hyperbilirubinemia leading to bilirubin encephalopathy is a devastating brain injury, which can cause permanent neurodevelopmental handicap.² Fortunately, a noninvasive and easily available treatment, phototherapy, is effective in degrading unconjugated bilirubin.³

When comparing blue, blue-green, green, and white light, researchers found that blue light was the most effective in degrading bilirubin. Therefore, phototherapy with blue light is widely used in the clinical practice.⁴ It may produce adverse effects such as dehydration, temperature instability, skin rashes, loose stools, retinal damage, hypocalcemia, bronze baby syndrome and redistribution of blood flow.⁵

Hypocalcemia is one of the known adverse effects. 90% of preterm and 75% of fullterm neonates develop hypocalcemia after being subjected to phototherapy.⁶ Hypocalcemia is defined as total serum calcium of less than 7 mg/dL (1.75 mmol/L) or ionized calcium less than 1 mmol/L (4 mg/dL) in preterm infants and less than 8 mg/dL (2 mmol/L) or ionized calcium less than 1.2 mmol/L (4.8 mg/dl) in term neonates.⁷ Hypocalcemia can cause serious complications like convulsions, apnoea, irritability, jitteriness.⁸ Hence, phototherapy induced hypocalcemia is a significant problem. Few studies recommend that in order to prevent hypocalcemia, babies should be given calcium as prophylaxis.⁹ So this study was undertaken to evaluate the occurrence of phototherapy induced hypocalcemia and to compare it between full term and preterm neonates.

Materials & methods

The present study was a cross sectional study conducted from May 2012 to May 2014 in a NICU of D. Y. Patil Hospital, Kolhapur after obtaining clearance from

the institutional ethical committee. 200 Newborns (155 term and 45 preterm neonates) admitted in the NICU at our hospital and fulfilling the criteria of jaundice and requiring phototherapy, aged less than 2 weeks were included in the study. Neonates were classified on the basis of gestational age into full term and preterm with the help of the New Ballard's Score. Neonates with conjugated hyperbilirubinemia, birth asphyxia, septicemia, renal failure and abnormal electrolyte status detected before phototherapy were excluded from the study.

Detailed history and examination of neonates admitted with jaundice was carried out, according to a predesigned proforma. After obtaining informed consent from parents and guardians, blood samples in all the admitted neonates were drawn from a peripheral vein for serum bilirubin level estimation and serum ionized calcium before and after 48 hours of phototherapy. Total serum bilirubin was estimated by Diazomethod. Ionized serum calcium was determined by calcium ion selective electrode method. Hypocalcemia was considered with ionized calcium less than 1 mmol/L (4 mg/dL) in preterm infants and <1.2 mmol/L (4.8 mg/dl) in term neonates.⁹ The neonates were clinically assessed for features of hypocalcemia i.e. jitteriness, lethargy, apnea and convulsions. Statistical analysis was performed using Quickcal (Instat) software. The 'p' value was calculated and p value <0.05 was taken as statistically significant. Paired t test was used for comparing the ionized calcium levels before and after 48 hours of phototherapy whereas Z test for proportion was used to compare the various percentages of hypocalcemic neonates.

Results

In the present study, all the cases had developed jaundice after 72 hours of life.

Table 1: Comparison Of Ionized Calcium Levels Before And After Phototherapy

TERM	MEAN VALUE OF IONIZED CALCIUM BEFORE 48HRS OF PHOTOTHERAPY (mmol/L)	MEAN VALUE OF IONIZED CALCIUM AFTER 48HRS OF PHOTOTHERAPY (mmol/L)	P - VALUE
FULLTERM NEONATES	1.27±0.07	1.07±0.18	<0.0001
PRETERM NEONATES	1.07±0.18	0.891±0.12	<0.0001

Table 1 shows that after exposure to 48 hours of continuous phototherapy, in preterm neonates, there was a significant fall in serum ionised calcium level ($p < 0.0001$). Similarly, in term neonates there was a significant fall in serum ionised calcium level ($p < 0.0001$).

Figure 1: Percentage Of Hypocalcemic Neonates After 48 Hours Of Phototherapy

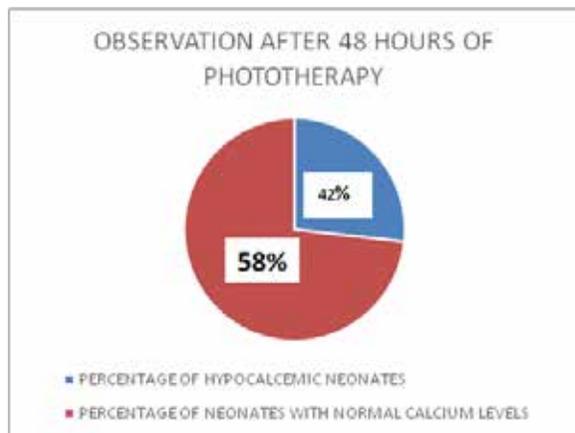


Figure 1 above shows that 85/200 (42%) neonates developed hypocalcaemia.

Table 2: Comparison Of Percentage Of Hypocalcemic Term And Preterm Neonates After 48 Hours Of Phototherapy

TERM	NO. OF HYPOCALCEMIC NEONATES AFTER 48 HOURS OF PHOTOTHERAPY	PERCENTAGE OF HYPOCALCEMIC NEONATES AFTER 48 HOURS OF PHOTOTHERAPY
FULL TERM(n=155)	61	39
PRETERM(n=45)	24	53

Table 2 shows that 24/45 (53%) preterm and 61/155 (39%) term neonates developed hypocalcemia after 48 hours of phototherapy. Thus, the percentage of hypocalcaemia

was statistically highly significant ($p < 0.048$) in preterm neonates.

Table 3: Percentage Wise Comparison Of Symptomatic Hypocalcemic Neonates

Symptom	Fullterm	Preterm	P value
Lethargy	6(10%)	4(16%)	0.47
Jitteriness	7(11%)	8(33%)	0.034
Convulsions	0	0	-
Apnoea	0	0	-

Table 3 shows that of the 61 term neonates who had hypocalcemia, 13 were symptomatic. Out of them, 7 (11%) developed jitteriness, 6 (10%) were lethargic and none of them developed apnoea or convulsions. Of the 24 preterm neonates who had hypocalcemia after exposure to phototherapy, 12 became symptomatic. Out of them, 8 (33%) developed jitteriness, 4 (16%) lethargy and none of them developed apnea or convulsions (Table 3).

Discussion

This study shows significant decline in serum ionized calcium levels to the hypocalcemic level in neonates who had been given phototherapy. Also a higher percentage of preterm neonates were symptomatic showing the effect to be significantly more in them. Preterm neonates are physiologically prone for hypocalcemia. Thus by subjecting them to phototherapy we put them at a higher risk for developing hypocalcemia eventually causing serious complications.

An older study¹⁰ had reported the effects of phototherapy in 20 term & 20 preterm neonates with jaundice in which 75% of term & 90% of preterm neonates developed hypocalcaemia after phototherapy. Another study¹¹ observed hypocalcaemic effect of phototherapy in 30% term and 55% preterm neonates. Both studies showed the effect to be more in preterm neonates. A recent study¹² on 63 term neonates showed a statistically significant decline in serum calcium levels after phototherapy. Another recent study⁷ observed that after 48 hours of phototherapy given to 15 term neonates and 15 preterm neonates, 66.6% of term neonates and 80% of preterm neonates developed hypocalcemia.

It has been shown that by covering the heads of the neonates during phototherapy, its effect on calcium level is prevented significantly proving the effect of phototherapy on the pineal gland eventually causing hypocalcemia.¹³ An earlier study showed a higher incidence of symptomatic hypocalcemia in preterm neonates mainly jitteriness and irritability¹⁰ similarly, another study recently reported a higher incidence of jitteriness and irritability in preterm neonates subjected to phototherapy.¹⁴ We too have observed similar results among preterm neonates in our study though none of the neonates developed apnoea or convulsions. Correlating the findings of the present study with the previous few studies indicate that there is a significant decline in serum calcium to the hypocalcemic level in neonates subjected to phototherapy. Neonates requiring phototherapy are at a higher risk of developing hypocalcemia. Therefore, it is suggested that in neonates subjected to phototherapy administration of prophylactic calcium might be considered.

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