

Evaluation of effect of phototherapy on serum calcium level

Sameer Kumar Jain

Associate Professor, Department of Paediatrics, Lakhiram Agrawal Memorial Medical College, Raigarh, Chhattisgarh, INDIA.

Email: jainsameer66@rediffmail.com

Abstract

Jaundice is one of the most common problem that can occur in the newborn. The study group included 200 neonates (155 term and 45 preterm). All had hyperbilirubinemia. The entire neonate included in the study group required management with phototherapy. Neonate who had conjugate hyperbilirubinemia, asphyxia, respiratory distress, sepsis and hemolytic anemia were excluded from the study. Measurement of ionized serum calcium was done before and after 48 hours of institution of phototherapy. The prevalence of hypocalcemia after 48 hours of phototherapy was observed and compare between full term and preterm neonate. After 48 hours of phototherapy a significant fall in serum calcium level in 39% of term and 53% of preterm neonate was observed. It is suggested that calcium level be assessed in neonates treated with phototherapy for more than 48 hours and managed accordingly.

Keywords: Hyperbilirubinemia, Hypocalcemia, Phototherapy.

Address for Correspondence:

Dr. Sameer Kumar Jain, Associate Professor, Department of Paediatrics, Lakhiram Agrawal Memorial Medical College, Raigarh, Chhattisgarh, INDIA.

Email: jainsameer66@rediffmail.com

Received Date: 21/05/2015 Revised Date: 29/05/2015 Accepted Date: 01/06/2015

Access this article online	
Quick Response Code:	Website: www.medpulse.in
	DOI: 02 June 2015

INTRODUCTION

Jaundice is an important problem in the first week of life. About 60% of term and 80% of preterm infants develop jaundice in first week of life.¹ In most cases it is benign and no intervention is required. Approximately 5-10% of them have clinically significant hyperbilirubinemia in whom the use of phototherapy becomes mandatory. High bilirubin level may be toxic to the developing brain and may cause neurological impairment even in term newborns. Hypocalcemia is defined as total serum calcium of less than 7mg/dl (1.75m mol/L) or ionized calcium less than 4 mg/dl (1 m mol/L) in preterm infants and less than 8 mg/dl (2 m mol/L) or ionized calcium less than 4.8 mg/dl (1.2 m mol/L) in term neonates.² The commonly known side effects of phototherapy are loose

stools, hyperthermia, dehydration, skin burn, photo retinitis, low platelet count, increased red cell osmotic fragility, bronze baby syndrome, riboflavin deficiency and DNA damage. A lesser known side effect, but potential complication of phototherapy is hypocalcemia (Hunter, 2004). Romagnoli *et al* (1979) for the first time suggested the association of hypocalcemia with phototherapy in preterm newborns.³ There are few studies on hypocalcaemic effect of phototherapy (Tan, 1991; sethi *et al* 1993; Hakanson and Bergstrom, 1981).⁴ Hence, this study was undertaken to evaluate the occurrence of phototherapy induced hypocalcemia and to compare it between full term and preterm neonate.

MATERIAL AND METHODS

The study was carried out in the neonatal intensive care unit (NICU) of the Department of Paediatrics, L.A.M. Medical College Raigarh from September 2014 to June 2015 after taking approval from the institutional ethical committee. 200 newborns (155 term and 45 preterm) admitted in the NICU, fulfilling the criteria of jaundice and requiring phototherapy, aged less than 2 weeks were included in the study. Neonate with conjugated hyperbilirubinemia, birth asphyxia, septicemia, renal failure and abnormal electrolyte status excluded from the study. Complete history and thorough physical examination was carried out in all the cases. Besides

routine investigation, ionized serum calcium and total serum bilirubin levels, before and after 48 hours of phototherapy were estimated. Total serum bilirubin was estimated by Diazo method. Ionized serum calcium was determined by acid base analyzer machine. The neonates were clinically assessed for features of hypocalcemia i.e. jitteriness, irritability/excitability, letharginess and convulsion, as well as other complication like rash, loose stool, fever and dehydration. Hypocalcemia in the neonate was managed with intravenous calcium; none of them required anticonvulsant drug. The results were analyzed using paired and unpaired students *t* test.

RESULTS

In the present study, none of the cases developed jaundice before first 24 hours of life.

Table 1: Comparison of Ionized Calcium Levels before and After Phototherapy

Gestational Maturity	Mean Value of Ionized Calcium before 48 Hours of Phototherapy (m mol/L)	Mean Value of Ionized calcium after 48 hours of phototherapy (m mol/L)	P- Value
Full Term	1.27±0.07	1.07 ± 0.18	<0.0001
Pre Term	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 ionized calcium level ($p < 0.0001$). Similarly, in term neonates there was a significant fall in serum ionized calcium level ($p < 0.0001$).

Table 2: Comparison of Percentage of Hypocalcemic Term and Preterm Neonates After 48 Hours of phototherapy

Gestational Maturity	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	Full term	Preterm	P Value
Lethargy	6(10%)	4(16%)	0.47
Jitteriness	7(11%)	8(16%)	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 apnoea or convulsions.

DISCUSSION

The efficacy of phototherapy in prevention and treatment of hyperbilirubinemia in newborn infants has been well established. Romagnoli *et al* (1979) was the first to suggest the association of hypocalcaemia in the phototherapy in preterm newborn. Gutcher and Odell (1983) observed significant decrease in serum calcium level in newborn rats after exposure to fluorescent daylight.⁵ Hypocalcaemia increases cellular permeability to sodium ions and increased cell membrane excitability. The signs are usually non-specific like apnea, seizure, jitteriness, increased extensor tone, clonus, hyperreflexia, and stridor (Laryngospasm) Sethi *et al* (1990) has studied the effects of phototherapy in 20 term and 20 preterm hyperbilirubinemic neonates.⁶ They observed that 75% of term and 90% of preterm neonates developed hypocalcaemia after phototherapy, Similarly, Medhat (2006) of Cairo University observed that 75% of term and 90% of preterm developed hypocalcaemia after phototherapy.⁹ Observation of the present study is much lower than the above studies. Jain *et al* (1998) also observed hypocalcaemic effect of phototherapy, in 30% term and 55% preterm neonates.⁷ which are in agreement with our study. Hunter (2004) hypothesized that phototherapy inhibits pineal secretion of melatonin which blocks the effect of cortisol on bone calcium.⁸ Cortisol unchecked exerts a direct hypocalcaemic effect and increases bone uptake of calcium as well. It has been shown that by covering the heads of neonate during phototherapy, its effect on calcium level is prevented significantly proving the effect of phototherapy on pineal gland eventually causing hypocalcemia. Neonates requiring phototherapy are at a higher risk of developing hypocalcemia. Therefore, it is suggested that newborn requiring phototherapy administration of calcium may be considered in them.

REFERENCE

1. Rennie, Burman-Roy S, Murphy MS(2010) Neonatal jaundice : BMJ.340:C2409.
2. Oden J, Bourgeois M. Neonatal endocrinology. Indian J Pediatr. 2000;67:217-23.
3. Romagnoli C, Polidori G, Cataldi L, Tortorolo SG, Segni G: Phototherapy induced hypocalcaemia. The Journal of Pediatrics, 1979; 94(5): 813-816.

4. Hakanson DO, Bergstrom WH: Phototherapy induced hypocalcemia in newborn rats. Prevention by Melatonin. *Science*, 1981;214(4522):807-809.
5. Gutcher GR, Odell GB; Hypocalcaemia associated with phototherapy in newborn rats: Light source dependence. *Photochemistry and Photobiology*, 1983; 37(2):177-180.
6. Sethi H, Saili A, Dutta AK: Phototherapy induced hypocalcaemia. *Indian Pediatrics*, 1993; 30(12):1403-1406.
7. Jain, BK, Singh H, Singh D, Toor NS: Phototherapyinduced hypocalcemia. *Indian Pediatrics*, 1998;35(6):566-567
8. Hunter KM: Hypocalcaemia. In: *Manual of Neonatal Care*. JP Cloherty, EC Eichenwald, AR Stark (eds.): 5th Edn.: Lippincott Williams and Wilkins, Philadelphia. 2004; pp.579-588.
9. Medhat FB: Assessment of phototherapy induced hypocalcaemia. Thesis submitted for M.Sc. Pediatrics in Cairo University. Classification no. 8461; 2006.
10. Tan KL: Phototherapy for neonatal jaundice. *Clinics in Perinatology*, 1991; 18(3):423-439.
11. Ehsanipour F. The effect of Hat on phototherapy induced hypocalcaemia in icteric newborns. *Journal of Iran University of medical Sciences*. 2008; 15(58).P25-9.

Source of Support: None Declared
Conflict of Interest: None Declared