

Research Article

Phototherapy Induced Hypocalcemia in Neonates

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Abstract: The objective is to study the effect of phototherapy on serum calcium in neonates. A Cross sectional study was performed in a Tertiary care centre, Gandhi Medical College, Bhopal. Study group includes neonates with hyperbilirubinemia requiring phototherapy and control group include neonates having hyperbilirubinemia in physiological range. Study group and control group includes 60 and 30 neonates respectively. Half of them were term and half were pre terms. 66.7% of preterm and 30% of term babies developed hypocalcaemia after phototherapy which shows statistical significant difference when compared to control group (p value <0.001). Phototherapy induced hypocalcaemia is a significant problem especially in pre term babies.

Keywords: phototherapy, hypocalcaemia, jaundice, neonates

INTRODUCTION

Jaundice is one of the most important and frequent encountered medical condition among neonates. Fifty percent of term and 80% of preterm babies are jaundiced within the first week [1]. Neonatal jaundice is attributed to incersed RBC volume per kilogram, decreased RBC life span, increased enterohepatic circulation and defective uptake of bilirubin [2]. Newborn's immature liver often cannot remove bilirubin quickly enough, causing hyperbilirubinemia. Although basic physiology is same in term and preterm but still preterm babies are at higher risk. Mostly this hyperbilirubinemia is benign but because of potential adverse effects of bilirubin when on excess makes proper monitoring and management if required essential.

Phototherapy remains the mainstay primary treatment in neonates with hyperbilirubinemia [3]. However, it has many side effects and one of it is hypocalcaemia. There are only a few studies on phototherapy induced hypocalcaemia and that to with varying results [4, 5, 6, 7].

MATERIAL AND METHODOLOGY

This was a cross sectional study at Neonatal Intensive Care Unit (NICU) of Gandhi Medical College, Bhopal from October 2011 to September 2012 after taking ethical committee approval and parental consent.

Study group included all term and preterm neonates admitted with serum bilirubin in non physiological range and requiring phototherapy. Neonates having any other associated medical condition were excluded from this study.

Study group included 60 neonates while 30 neonates were served as control group. Among the study group 30 neonates were term and 30 neonates were preterm. Among 30 neonates of control group 15 each acted as a control for the two study groups. All neonates included in the study group had hyperbilirubinemia requiring phototherapy for atleast 48 hours and control group cases were neonates having hyperbilirubinemia but physiological range i.e. not requiring phototherapy.

In present study, gestational age of the newborn was calculated by the New Ballard Scoring system [8]. We consider hypocalcemia as a total serum calcium of less than 8mg/dl [9]. A diagnosis of neonatal jaundice was made when the total serum bilirubin was above the threshold for phototherapy for the age, gestation, weight and clinical features[3]. Seizures were – “reported or observed repeated involuntary muscle contractions, abnormal tonic extensions or jerky movements of any part of the limb, face or mouth that was not stimulus sensitive or repetitive abnormal chewing, ocular fixation or cycled fluttering, pedalling movements, lip smacking”[10].

Phototherapy was provided with four blue and two white lights placed at 30 cm from the neonates and delivering atleast 20 $\mu\text{W}/\text{cm}^2/\text{nm}$.

A detailed antenatal, perinatal history and examination of neonates was done in all cases of study and control group. Serum calcium was measured pre and post phototherapy of 48hrs. Complete blood count, C-Reactive Protein, S.bilirubin, blood groups of baby and mother was done as routine investigation in all cases. Neonates were assessed for features of hypocalcemia i.e. seizures, apnea, jitteriness, increased extensor tone, clonus, hyperreflexia and stridor.

RESULTS

The mean gestational age, birth weight and time of presentation of jaundice in preterm babies was 33.8 ± 1.02 weeks, $1.98 \pm 1.62\text{kg}$ and 3.7 ± 1.82 days respectively as compared to 34.10 ± 1.32 weeks, 2.14

± 1.84 kg and 3.9 ± 1.61 days in control group. In term babies mean gestational age, birth weight and time of presentation of jaundice was 38.2 ± 0.92 weeks, 2.78 ± 1.29 kg and 4.90 ± 1.54 days respectively as compared to 37.95 ± 1.68 weeks, 2.81 ± 1.61 kg and 5.32 ± 1.34 days in control group.

The serum calcium level pre phototherapy in preterm and term babies of study group was 8.82 ± 0.59 mg/dl and 9.32 ± 0.99 mg/dl respectively as compared to 8.79 ± 0.78 mg/dl and 9.43 ± 0.69 mg/dl in control group. But post phototherapy serum calcium in preterm and term babies was 6.64 ± 1.03 mg/dl and 7.58 ± 0.83 mg/dl respectively. 66.7% of preterm and 30% of term babies developed hypocalcaemia after phototherapy which shows statistical significant difference when compared to control group (p value <0.001).

Table-1: Serum Calcium in Preterm babies.

SERUM CALCIUM LEVELS	PRETERM NEONATES			
	STUDY GROUP		CONTROL GROUP	
	At 0 hr % (n)	After 48 hrs % (n)	At 0 hr % (n)	After 48 hrs % (n)
< 8 mg/dl	0% (0)	66.7% (20)	0% (0)	0% (0)
8-9 mg/dl	83.3% (25)	33.3% (10)	80% (12)	93.3% (14)
> 9 mg/dl	16.7% (5)	0% (0)	20% (3)	6.7% (1)
Mean Value	8.82±0.59	6.64±1.03	8.79±0.78	8.02±0.96

Table-2 : Serum Calcium in Term babies.

SERUM CALCIUM LEVELS	TERM NEONATES			
	STUDY GROUP		CONTROL GROUP	
	At 0 hr % (n)	After 48 hrs % (n)	At 0 hr % (n)	After 48 hrs % (n)
< 8 mg/dl	0% (0)	30% (9)	0% (0)	0% (0)
8-9 mg/dl	73.3% (22)	66.7% (20)	66.7% (10)	73.3% (11)
> 9 mg/dl	26.7% (8)	3.3% (1)	33.3% (5)	26.7% (4)
Mean Value	9.32±0.99	7.58±0.83	9.43±0.69	9.27±0.38

DISCUSSION

Phototherapy is the primary treatment in neonates with unconjugated hyperbilirubinemia since 1958 when Cremer *et al* at Rochford Hospital, Essex, United Kingdom emphasized its role in management[11]. Later on, Romagnoli *et al* in 1979 first suggest that phototherapy induces hypocalcaemia in babies [12].The mechanism of hypocalcaemic effect of phototherapy was suggested that it inhibits melatonin secretion from pineal glands which in turn blocks the effect of cortisol on bone calcium. This increases bone uptake of calcium and induces hypocalcaemia.

In present study 48.3% of neonates developed hypocalcaemia after 48 hrs of phototherapy. Out of these babies who developed hypocalcaemia 66.7%

were preterm babies and 30% were term. None of the babies in control group have reported serum calcium below 7mg/dl. This incidence of hypocalcaemia in neonates after phototherapy was in consonance with results of previous study of Monica *et al* in which 55% of preterm and 30% of term babies had developed hypocalcaemia [4]. Rajesh *et al* also reported statistically significant results when they studied effect of phototherapy on serum calcium levels in 50 neonates. 80% of preterm and 66.6% of term babies developed hypocalcaemia post phototherapy [5].

However these results were contradictory to the outcome of studies done by Paymanesh *et al* [7] and Srinivasa *et al*. [6]. Both studies concluded that

prevalence of phototherapy induced hypocalcaemia is not so high.

CONCLUSION

Neonate requiring phototherapy for hyperbilirubinemia are at higher risk for development of hypocalcemia. This risk is even more in case of pre term babies. Therefore, timely monitoring of serum calcium levels and calcium supplementation is suggested.

REFERENCES

1. Kumar RK; Neonatal jaundice. An update for family physicians. *Aust Fam Physician*. 1999;28(7):679-82.
2. Mary LP, Gregory, Martin CR, Cloherty JP; *Manual of Neonatal Care*, 7th ed. New Delhi: Wolter Kluwer (India) Pvt Ltd; 2012;p.304-339.
3. American Academy of Pediatrics; Management of Hyperbilirubinemia in the Newborn Infant 35 or More Weeks of Gestation. *Pediatric*. 2004;114:297-316.
4. Tandon M, Nayar D, Ramachandran S, Kapil U; Phototherapy Induced Hypocalcemia. *Indian Pediatr*. 1998;35(1):566-67.
5. Yadav RK, Sethi RS, Sethi AS, Kumar L, Chaurasia OS; The Evaluation of Effect of Phototherapy on Serum Calcium Level. *Peopl J Scientific Research*. 2012;5(2):1-4.
6. Srinivasa S, Renukananda S, Srividya GS; Effect of phototherapy on hypocalcemia. *J of Evolution of Med and Dent Sci*. 2015;4(24):4165-68.
7. Paymaneh AT, Sajjadian N, Eivazzadeh B; Prevalence of Phototherapy Induced Hypocalcemia in Term Neonate. *Iran J Pediatr*. 2013;23(6):710-711.
8. Ballard JL, Khoury JC, Wedig K, Wang L, Eilers-Walsman BL, Lipp R; New Ballard Score, expanded to include extremely premature infants. *J Pediatr*. 1991;119(3):417-23.
9. Abrams SA; *Manual of Neonatal Care*, 7th ed. New Delhi: Wolter Kluwer (India) Pvt Ltd; 2012;p.297-303.
10. Volpe JJ; *Neurology of the newborn*. 5th ed. Philadelphia: Saunders Elsevier, 2008. p.203-44.
11. Cremer RJ, Perryman PW, Richards DH; Influence of light on the hyperbilirubinaemia of infants. *Lancet*. 1958;1(7030):1094-97.
12. Romagnoli, Polidori C, Cataldi G, Tortotolo L, Signs GGB, Giuseppe; Phototherapy induced hypocalcemia. *J Pediatr*. 1979;94(5):815-16.