EFFECT OF PHOTOTHERAPY ON HYPOCALCEMIASrinivasa S¹, Renukananda S², Srividya G. S³**HOW TO CITE THIS ARTICLE:**

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ABSTRACT: Jaundice is the most common and important abnormal physical problem in the first week of life. Due to immaturity of the bilirubin metabolism approximately 60% of term new borns and 80% of preterms⁽¹⁾ develop jaundice in the first week of life which may require phototherapy. The commonly known side effects of phototherapy are loose stools, hyperthermia, dehydration fluid loss, skin burn, photoretinitis, low platelet count, increased red cell osmotic fragility, bronze baby syndrome, riboflavin deficiency and DNA damage.^(1,2) A lesser known side effect, but potential complication of phototherapy is hypocalcemia.⁽³⁾ An observational study was done in department of pediatrics, Kempegowda institute of medical sciences, Bangalore during the period December-2014 and January 2015. All the terms and preterms requiring photo therapy were enrolled in the study. Duration of phototherapy was ranging from 24 to 48 hours. Serum calcium was measured pre and post phototherapy 80% of babies developed hypocalcemia following phototherapy and also noticed that longer the duration of phototherapy more severe the hypocalcemia.

KEYWORDS: phototherapy, hypocalcemia.

INTRODUCTION: Jaundice is the most common and important abnormal physical problem in the first week of life. Bilirubin acts as a potential neurotoxin, and can affect various areas of brain like basal ganglia, brainstem nuclei, also affect auditory function. Kernicterus may cause permanent neurological impairment even in term newborns.

Due to immaturity of the bilirubin metabolism approximately 60% of term new borns and 80% of preterms⁽¹⁾ develop jaundice in the first week of life. A very small proportion of babies may show significant jaundice, hence no intervention is required. Among them about 5-10% may require active intervention in terms of phototherapy management which may be mandatory in such cases.

Jaundice is mainly due to immaturity in bilirubin metabolism resulting in imbalance between bilirubin production and elimination. Jaundice usually appear after 24 hours i.e between 24-72 hours of age. Due to physiologic immaturity premature babies are at a higher risk of developing hyperbilirubinemia.

The commonly known side effects of phototherapy are loose stools, hyperthermia, dehydration fluid loss, skin burn, photoretinitis, low platelet count, increased red cell osmotic fragility, bronze baby syndrome, riboflavin deficiency and DNA damage.^(1,2) A lesser known side effect, but potential complication of phototherapy is hypocalcemia⁽³⁾ (Hunter,2004).

Neonatal hypocalcemia is defined as total serum calcium concentration of <7mg/dl or ionized calcium concentration of < 4mg/dl (<1mol/L). Ionized calcium is important in biochemical processes like blood coagulation, neuromuscular excitability, cell membrane integrity and function, and cellular enzymatic and secretory activity.

Romagnoli et al (1979) for the first time suggested the association of hypocalcemia with phototherapy in preterm newborns. Similarly Hakanson & Bergstrom (1981) documented this

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observation in newborn rats. There are few studies on hypocalcaemic effect of phototherapy (Tan, 1991; Sethi et al, 1993; Hakanson & Bergstrom, 1981).

Hence, the present study was carried out to evaluate the ionized serum calcium level in newborns who had undergone phototherapy.

METHODS AND MATERIALS: An observational study was done in Department of Pediatrics, Kempegowda Institute of Medical Sciences, and Bangalore during the period December -2014 and January 2015. All the pre terms and terms requiring photo therapy were enrolled in the study. Among the 50 babies requiring photo therapy 37 were terms and 13 were pre-terms (less than 34 weeks). Among them 24 were males and 26 were females. Among the 50, 29, 1, 5, 15 neonates were admitted day-1, day -2, day-3, day-4 respectively. Among them 23 were SGA babies and the rest were AGA babies. Neonates who were at risk of hypocalcaemia such as neonatal asphyxia, respiratory distress, sepsis, infant of diabetic mother and maternal consumption of anticonvulsant were excluded. Serum calcium were measured pre and post phototherapy. Duration of phototherapy was ranging from 24 to 48 hours.

RESULTS: Among 50 children 40 children developed hypocalcemia post phototherapy and were treated with iv calcium. 11 were preterms and remaining 29 were term babies it was also noticed that longer the duration of phototherapy more severe the hypocalcemia.

Variable	Mean & Number (Percentage)
N=198	
Sex (male/female) (%)	24/26 (%) =0.92
Term to Preterm ratio	37:13
Age at the onset of hyperbilirubinemia (hrs)	29:50
AGA: SGA	27:23
Type of phototherapy	TSP 6 DSP 44

Graph 1

DISCUSSIONS: The regulation of calcium homeostasis in the newborn period has been of considerable interest.

At birth, the plasma calcium (Ca) level in cordblood exceeds that in maternal blood. During the early days of life, the plasma Ca level progressively decreases in normal infants, so by the second or third day of life, the level is lower than that found in older infants and children. In most normal full-term infants the plasma Ca level returns to normal by 10 days of life.⁽⁴⁾

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Phototherapy is an appropriate and safe measure to reduce indirect bilirubin level in newborns.

Roming et al was the first to suggest the association of hypocalcaemia in newborn following phototherapy.⁽⁵⁾

The mechanism of hypocalcaemic effect of phototherapy was reported by inhibition of pineal gland via transcranial illumination, resulting to decline of melatonin secretion; which blocks the effect of cortisol on bone calcium. Cortisol has a direct hypocalcemic effect and increases bone uptake of calcium and induces hypocalcaemia.⁽⁶⁾

In our term neonatal study population receiving 48 hours of phototherapy, a significant decrease in serum calcium was observed. ($p < 0.03$).

However, only 15 neonates (7.5%) developed hypocalcaemia below the acceptable threshold after 48 hours of phototherapy. Nevertheless none of our newborns had symptomatic hypocalcaemia. In another Iranian study, between 7% - 15% of term newborn receiving phototherapy developed hypocalcaemia. Alizade et al reported only ten.

(7%) newborns (4.2% females, 10.4% males) developing hypocalcaemia after 48 hours of phototherapy. Ehsanipoor et al⁽⁷⁾ and Karamifar et al⁽⁸⁾ reported 15% and 8.7% hypocalcaemia respectively in newborns receiving phototherapy. However the reported prevalence of hypocalcaemia in other countries was more than Iranian newborn reports. Yadavs⁽⁹⁾ reported 66% and Jain et al⁽¹⁰⁾ also observed hypocalcaemic effect of phototherapy in 30% term and 55% preterm neonates. Sethi et al has studied the effect of phototherapy in 20 term and 20 preterm hyperbilirubinemic neonates. They observed hypocalcaemia in 75% of term and 90% of preterm neonates after phototherapy.⁽¹¹⁾

Similarly, in 2006, Medhat from Cairo University observed 75% of term and 90% of preterm developed hypocalcaemia after phototherapy.⁽¹²⁾ Observation of the present study and another Iranian study is much lower than the above-mentioned studies from other countries.

The reason for this difference is not clear. However the type of fluorescent tube, serum vitamin D, bilirubin levels and also the patient's skin color may play a role. Muta et al reported a significant difference in the serum 25(OH) vitamin D levels between newborns suffering from hyperbilirubinemia and control groups.⁽¹³⁾ In a study done by Jain, the prevalence of hypocalcaemia was higher in newborns with higher concentration of serum bilirubin.⁽¹⁴⁾ In addition it might also be due to the fact that this study examined total serum calcium and not ionized calcium. Ionized calcium is the active component which is kept under control by the various physiological mechanisms involved in calcium homeostasis. Albumin and pH may influence the distribution of total serum calcium level, either bound or free and ionized calcium. Then, it can be considered one of the limitations of our study.

These findings justify further prospective studies in infants that would include concurrent measurements of ionized calcium and serum 25 (OH) vitamin D. Some reports recommend prescription of calcium to prevent early onset hypocalcaemia in premature newborns. Other similar advices are observed in sick infants of diabetic mothers and those with severe prenatal asphyxia.⁽¹⁵⁾

In conclusion, although phototherapy induces hypocalcaemia in term infants, but the incidence of phototherapy associated hypocalcaemia is not too high. There is a need to check of calcium level in symptomatic newborns that have suggested hypocalcaemia signs.

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