

## Study of Effect of Phototherapy on Serum Calcium Level in Newborn in a Tertiary Care Hospital

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### Abstract

*Introduction:* Jaundice is observed during first week of life in approximately 60% of term neonates and 80% of preterm neonates. Phototherapy is one of the routine methods for management of hyperbilirubinemia. It can produce adverse effects such as skin rashes, loose stools, hypocalcemia and many other complications. In our study serum calcium level measured 48 hours after phototherapy in study-group and without phototherapy in control-group. *Aims:* 1) To study effect of phototherapy on serum calcium level. 2) To study symptomatic hypocalcemia after phototherapy. *Method:* Ninety term babies were included in study, seventy babies in study group and twenty in control group. Study group was selected as babies requiring phototherapy and control group as those not requiring. The study group was managed with phototherapy and not control group. Serum calcium levels measured before and after 48 hours of phototherapy and of control. *Result:* 50/70 neonates (71%) term babies developed hypocalcemia after phototherapy. No baby from control group developed hypocalcemia. Fifty percent babies of study group had symptomatic hypocalcemia. *Conclusion:* Neonates requiring phototherapy are at a higher risk of developing hypocalcemia. Therefore, it is suggested that calcium should be given in newborn requiring phototherapy.

**Keywords:** Phototherapy; Hyperbilirubinemia; Hypocalcemia; Jaundice.

### Introduction

Hyperbilirubinemia is a common and in most cases, benign problem in neonates. Jaundice is observed during first week of life in approximately 60% of term neonates and 80% of preterm neonates. Untreated severe unconjugated hyperbilirubinemia is potentially neurotoxic [1]. Phototherapy is one of the routine method for management of hyperbilirubinemia.

It plays a significant role in treatment of hyperbilirubinemia. However, it has many side effects. It can produce adverse effects such as dehydration, temperature instability, skin rashes, loose stools, retinal damage, hypocalcemia, bronze baby syndrome, redistribution of blood flow and genotoxicity [2-4].

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Hence, phototherapy induced hypocalcemia is a significant problem. Neonatal hypocalcemia is defined as total serum calcium concentration of <7 mg/dl or ionized calcium concentration of <4 mg/dl (<1mol/L). Ionized calcium is crucial for many biochemical processes, including blood coagulation, neuromuscular excitability, cell membrane integrity and function, and cellular enzymatic and secretory activity.

### Aims and Objectives

1. To study hypocalcemia in neonates with hyperbilirubinemia after 48 hours of phototherapy
2. To study other complications of phototherapy

### Inclusion Criteria

1. Term newborns requiring phototherapy without any illness were selected in the study group
2. Term babies matched for age, sex and gestational age with bilirubin levels not high enough to start of phototherapy were selected in the control group.

### Exclusion Criteria

1. Newborns having illness other than hyperbilirubinemia
2. Newborns requiring exchange transfusion

### Material and Methods

#### Method

The study was carried out in the Neonatal Intensive Care Unit (NICU) of the Department of Paediatrics, P.D.V.V.P.'s Medical College Ahmednagar, from March 2015 to August 2015 after taking approval from the institutional ethical committee. Written consent taken from parents before inclusion in the study.

Ninety term newborns were included in study,

seventy newborns in study group and twenty in control group. Complete history and thorough physical examination was carried out in all the cases of study and control group. In control group twenty term newborns matched for age, sex, gestational age and not requiring phototherapy were selected.

The study group was managed with phototherapy and not control group.

Serum calcium and total bilirubin and indirect bilirubin levels measured before and after 48 hours of phototherapy in study group and without phototherapy in control group. The study group received continuous phototherapy for 24 hours with a spectral irradiance minimum of 30 *micro W/ cm square/ nm* at 450 nm keeping a distance of 45 cm. Optimum room temperature maintained. All cloths removed except protection of eyes and genitalia done.



Fig. 1: Newborn receiving phototherapy

### Results

Z test was used for statistical analysis. In the study group, none of the term cases developed jaundice before first 24 hours of life. 20% of cases had onset of jaundice between 24 to 72 hours, while majority of cases (80%) had onset of jaundice after 72

hours. Whereas in control group, all the cases developed jaundice after 72 hours.

Before phototherapy there was no significant difference in serum calcium level in study and control group. After 48 hours of phototherapy in neonates of the study group, there was significant fall in calcium level ( $p < 0.005$ ).

Table 1: Measurement of serum calcium after 48 hours of phototherapy in study and control group

Serum calcium( mol/l )	Study Group (70)	Control Group(20)
>11	2 (2.9%)	18
7.1-11	18 (25.7%)	2
<7	50(71.4%)	0

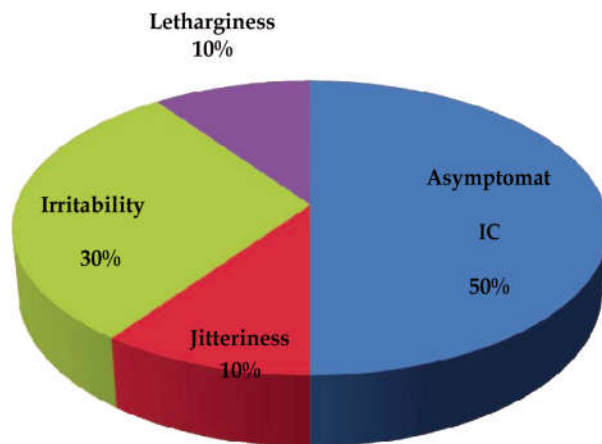
**Table 2:** Distribution of cases according to symptoms in symptomatic hypocalcemic

Symptoms	Cases	Controls
Jitteriness	21	0
Irritability/ excitability	7	0
Lethargic	7	0
Convulsion	0	0

Before phototherapy there was no significant difference in serum calcium level in study and control group. 50/70 neonates (71%) term babies developed hypocalcemia after phototherapy. No baby from control group developed hypocalcemia. After 48 hours of phototherapy in neonates of the study group, there was significant fall in calcium level ( $p < 0.005$ ).

So in our study 50% neonates becomes symptomatic hypocalcemia.

Of the 50 term neonates that developed hypocalcemia.



**Fig. 2:** Observation of symptoms of hypocalcemia in the study group

**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 [5]. Similarly, Hakanson & Bergstrom (1981) documented this observation in newborn rats [6]. Gutcher & Odell (1983) observed significant decrease in serum calcium level in newborn rats after exposure to fluorescent daylight [7]. 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 & 20 preterm hyperbilirubinemic neonates [8]. They observed that

75% of term & 90% of preterm neonates developed hypocalcaemia after phototherapy. Similarly, Medhat (2006) of Cairo University observed that 75% of term & 90% of preterm developed hypocalcaemia after phototherapy [9]. Observation of the present study are in agreement with the above studies. Jain et al (1998) also observed hypocalcaemic effect of phototherapy, in 30% term and 55% preterm neonates, which is much lower than the above mentioned studies. Hunter (2004) hypothesized that phototherapy inhibits pineal secretion of melatonin which blocks the effect of cortisol on bone calcium [10]. Cortisol unchecked exerts a direct hypocalcemic effect and increases bone uptake of calcium as well.

**Conclusion**

Neonates requiring phototherapy are at a higher risk of developing hypocalcemia.

Therefore, calcium should be given in newborn requiring phototherapy.

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