# Effect of phototherapy on total serum calcium level in preterm (weighing more than 1500gm) and term neonates with hyperbilirubinemia

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**Abstract:**

**Aim - To determine effect of phototherapy on total serum calcium level in preterm( weighing more than 1500 gm) and term neonates with hyperbilirubinemia.**

**Method- This study was performed on 100 jaundiced preterm and term neonates out of which 58 male and 42 female that were managed with phototherapy. Our study was a prospective study conducted in SIMS Hapur from October 2019-September 2021 to see total calcium level before and after 48 hr of phototherapy. Detail regarding gestational age, sex, birth weight, mode of delivery, day of life, symptom of hypercalcemia, were collected. Neonate (2-28 day of life), gestational age more than 34 week, birth weight >1500 gm was included in the study.**

**Result- The study included 34 preterm and 66 terms new born. Total serum calcium levels at baseline and 48 hours after phototherapy was 9.33 ± 0.90 mg/dl, 7.98 ± 0.37 mg/dl respectively in term neonates and 8.75 ± 1.11 mg/dl, 7.78 ± 0.45 mg/dl, respectively in preterm neonates. Incidence of decrease in calcium level s in study was 71%.**

**Conclusion- This study reveals that the total serum calcium level declined after treatment with phototherapy. Jitteriness was most commonly found in this study in both groups. Therefore, this study recommends monitoring total serum calcium level till cessation of phototherapy.**

***Keyword- Phototherapy, Preterm, Term, Hyperbilirubinemia***

**Introduction:**

Neonatal hyperbilirubinemia (NH), is the most common disorder of early neonatal period (first week of life) affecting approximately 60% of term and 80% of preterm neonates[1].Phototherapy plays a significant role in the treatment and prevention of hyperbilirubinemia in neonates. But some adverse effects of phototherapy have also been reported[2].The commonly known side effects of phototherapy are loose stools, hyperthermia, fluid loss, skin burn, photo retinitis, low platelet count, increased red cell osmotic fragility, bronze baby syndrome, riboflavin deficiency and DNA damage. A lesser-known but potential adverse effect of phototherapy is hypocalcemia[3].Hypocalcemia is defined as total serum calcium level less than 8mg/dl in term and less than 7mg/dl in preterm babies is an important metabolic aberration in neonatal period due to its ill effects on neurological and cardiac functions. Hypocalcemia may be asymptomatic particularly early onset hypocalcemia or symptomatic in the form of jitteriness, lethargy, apnea, high pitched cry, stridor, irritability and seizures. Uninhibited effect of corticosteroids due to decreased synthesis of melatonin from pineal gland under phototherapy is thought to be responsible for hypocalcemia[4].Thus; hypocalcaemia is a significant problem in neonates subjected to phototherapy which is a commonly used modality of treatment for neonatal hyperbilirubinemia. Present study was conducted to study the effect of phototherapy on serum calcium level[4.]

**Material and Methods:**

This was a prospective hospital-based study conducted on **100 cases** of neonatal jaundice requiring phototherapy, admitted in pediatric NICU of SIMS Hospital during October 2019 - September 2021.

**Study design**: Prospective study

**Set-up**: Pediatrics department, Saraswathi Institute of Medical Sciences, Hapur.

**Age group**: 2-28 days of life

**Sample size**: 100

Newborns will be selected on the basis of inclusion and exclusion criteria given below:

**Inclusion Criteria:**

1. Neonates (2-28 day of life) requiring phototherapy

2. Neonates with gestational age more than 34 week of gestation
3. Neonates weighing more than 1500gm.

**Exclusion Criteria:**

1. Newborns with Congenital anomaly
2. Newborns with ABO and Rh incompatibility

Neonates with hyperbilirubinemia were evaluated through a thorough history, (details regarding gestational age, sex, birth weight, mode of delivery, day of life, symptoms of hypercalcemia, were collected) and detailed examination clinical assessment and TCB monitoring was done.

**Sample collection:** 1.5 to 2 ml venous blood sample was collected in plain vial for serum bilirubin level, total calcium level and 1 ml venous blood sample in EDTA vial for Hb, PCV, reticulocyte count and peripheral smear for other investigations. Total serum calcium levels were estimated before and after 48 hr. of phototherapy. Total serum calcium was estimated ( by Automatic analyzer system-TurboChem 100) & after lab investigations, cases were treated and the neonates were clinically assessed for features of hypocalcemia I.e., Jitteriness, irritability, convulsion etc.

**Statistical Analysis:** Data was entered in Microsoft Excel and imported in IBM SPSS Version 25.0 for further analysis. Descriptive statistical analysis was done and continuous variables were described as mean and standard deviation. Student's't' test was used for pair match samples with a confidence limit of 95%. The p-value <0.05 was considered significant.

**RESULTS:**

Mean body weight is 2.712 ± 0.44 kg. Male babies were higher i.e., 58% as compared to female babies i.e., 42%. Maximum 64% children were included of weight >2.5 kg. Mean age of starting phototherapy was 3.48 ± 1.38 days. Mean total bilirubin on admission was 18.93 ± 2.52 mg/dl. Duration of phototherapy was 48 hours (in our study). The proportion of neonates delivered by NVD was 62% (62) and by cesarean section was 38% (38).

**Table 1: Symptomatic and asymptomatic decrease in calcium level in pre term and term neonates exposed to phototherapy.**

| | Preterm (n = 34) | Term (n = 66) |
|---|---|---|
| Total hypocalcemia | 25 (73.52%) | 46 (69.69%) |

Total 71% (71 out of 100) neonates developed decrease in calcium level. Which was found more in Preterm neonates?

**Table 2: showing symptom of decrease in calcium level and their frequency in preterm and term neonate.**

| | | Newborn | |
|---|---|---|---|
| | | Preterm (n = 34) | Term (n = 66) |
| Irritability | N | 6 | 14 |
| | Percent | 17% | 21.21% |
| Jitteriness | N | 12 | 22 |
| | Percent | 35.29% | 33.33% |

Jitteriness was more in preterm group.

**Table 3: Showing comparison between mean total serum calcium before and after 48 hours of photo therapy in term neonates.**

| Parameter | Before Phototherapy(Mean ± SD) | After Phototherapy (Mean ± SD) | |
|---|---|---|---|
| Serum calcium [mg/dl] | 9.33 ±0.90 | 7.98 ±0.37 | t-statistic = - 11.27 p<0.0001 |

**Table 4: Showing comparison between mean total serum calcium level before and after 48 hours of photo therapy in preterm neonates.**

| Parameter | Before Phototherapy (Mean ± SD) | After Phototherapy (Mean ± SD) | |
|---|---|---|---|
| Serum calcium ( mg/dl) | 8.75 ±1.11 | 7.78 ±0.45 | t-statistic= -4.72 p<0.0001 |

Total serum calcium levels at baseline and at 48 hours after phototherapy was 9.33 ±0.90 mg/dl and 7.98 ±.37 mg/dl respectively in term neonates and 8.75 ±1.11mg/dl and 7.78 ±0.45mg/dl respectively in preterm neonates. (p<0.0001)

There was maximum range of serum calcium level between 9-9.9mg/dl before phototherapy and between 8-8.9 mg/dl 48 hours after phototherapy.

**Table 5: Frequency distribution table of total serum calcium levels before phototherapy in all 100 neonates.**

| S.No | Calcium before phototherapy( mg/dl) | Frequency | % |
|---|---|---|---|
| 1. | 7-7.9 | 13 | 13 |
| 2. | 8-8.9 | 28 | 28 |
| 3. | 9-9.9 | 38 | 38 |
| 4. | 10-10.9 | 21 | 21 |

**Table 6: Frequency distribution table of total serum calcium levels 48 hour after phototherapy**

| **S.No** | **Calcium after phototherapy[mg/dl]** | **Frequency** | **%** |
|---|---|---|---|
| 1 | 7-7.9 | 46 | 46 |
| 2 | 8-8.9 | 54 | 54 |
| 3 | 9-9.9 | 0 | 0 |

**Discussion:**

Present study consisted of 100 neonates with neonatal jaundice. The mean total serum bilirubin and serum calcium showed a significant fall after exposure to phototherapy in both preterm as well as term neonates. In total, 73% preterm cases and 69.69% term cases had developed hypocalcemia. Preterm neonates are more prone for decrease in calcium level after phototherapy.

**Eghballian, A. Monsef et al** study was proposed to investigate phototherapy induced hypocalcemia in hyperbilirubinemia neonate. 63 healthy term newborns of >2.5 kg undergoing phototherapy was selected bilirubin and calcium level were determined before and after termination of phototherapy. There was a direct relationship between duration of phototherapy and development of hypocalcemia.[5] This study was corresponding to our study.

**Medhat** of Cairo University observed that 75% of term & 90% of preterm developed hypocalcaemia after phototherapy.[6] Observation of the present study are in agreement with the above study

In study by **Yadav RK et al**, the comparison between mean serum calcium levels post phototherapy was significant between preterm and term neonates p <0.0001.[2] Result was similar to our study.

In a study by **Goyal S et al**, the mean serum calcium levels before phototherapy were 9.14 ± 0.78 mg/dl and it was decreased to 8.53 ± 0.77 mg/dl after phototherapy treatment. The difference before and after phototherapy the serum calcium levels were found to be statistically significant p<0.001.[7] In our study Mean ± SD of total serum calcium levels before phototherapy was 9.13 ± 1.05 mg/dl (n = 100) and after 48 hours of phototherapy it was 7.91 ± 0.41 mg/dl (n= 100) (p<0.0001). There was significant association exist between serum calcium level before and after phototherapy.

**Conclusion-** This study reveals that the total serum calcium level declined after treatment with phototherapy. Jitteriness was most commonly found in this study in both groups. On clinical assessment preterm developed more symptoms of decline in calcium level than term neonates. Decrease in calcium level in neonates was managed with oral and intravenous calcium gluconate. All of our neonates got improved and discharged none of them required exchange transfusion. Therefore, this study recommends monitoring total serum calcium level till cessation of phototherapy.

**Limitations** -The major limitation of our study was the small sample size. Due to limited investigation available in our hospital, only total serum calcium level could be done and ionized calcium could not be done.

**References**:

1. Xiong T, Qu Y, Cambier S, Mu D. The side effects of phototherapy for neonatal jaundice: What do we know? What should we do? Eur J Pediatr 2011; 170:1247-55.
2. Rajesh Kumar Yadav, R.S. Sethi, Anuj S. Sethi, Lalit Kumar, Om Shankar Chaurasia. The Evaluation of Effect of Phototherapy on Serum Calcium Level. People's Journal of Scientific Research 2012; 5(2):1-4.
3. Madhu Goyal, Rambabu Sharma, D R Dabi. Phototherapy induced hypocalcemia in neonates: A case–control prospective study. Indian J Child Health. 2018; 5(3):211
4. Arora S, Narang GS, Singh G. Serum Calcium Levels in Preterm and Term Neonates on Phototherapy. J. Nepal Paediatr. Soc 2014; 34:24-8
5. Ebhbalian F, Monsef A. Phototherapy-induced hypocalcemia in icteric newborn. Iran J Med Sci 2002; 27:169-71
6. Medhat FB; Assessment of phototherapy induced hypocalcemia. Thesis submitted for M.Sc. Pediatrics in Cario University. Classification no.8461:2006
7. Goyal S, Srivastava A, Bhattacharjee P, Goyal I, Malhotra K. Effect of phototherapy on serum calcium levels in neonates receiving phototherapy for neonatal jaundice, Int J Res Med Sci.2018;6:1992-5.