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### RESEARCH ARTICLE

#### EFFECT OF PHOTOTHERAPY ON SERUM CALCIUM LEVELS IN TERM NEONATES WITH UNCONJUGATED HYPERBILIRUBINEMIA.

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##### Key words:-

Unconjugated hyperbilirubinemia, phototherapy, serum calcium, term neonates.

#### Abstract

**Background:** Jaundice is one of the most common problems occurring in the neonatal period. Phototherapy plays a major role in its treatment. However, this treatment modality may itself result in inherent complications which even contributes to the development of convulsions. Hence this study is carried out to evaluate serum calcium levels in full term neonates receiving phototherapy for jaundice. **Aim and objective:** To determine the effect of phototherapy on serum calcium level in full-term hyperbilirubinemic neonates. **Methods:** After getting Ethical Committee approval informed, written consent from the mother the medical history, general examination, systemic examination of the neonate was carried out. This study was performed on 30 full-term jaundiced neonates (15 males and 15 females) receiving phototherapy. Laboratory tests including total serum bilirubin measured by Diazo method and serum calcium level measured by Arsenazo III method were carried out before and after 48 hours of phototherapy. **Results:** Statistical analysis was done using Paired t test. After 48 hours of phototherapy, there was a **significant decrease** in serum calcium levels from  $9.51 \pm 0.29$  mg/dl to  $8.38 \pm 0.31$  mg/dl ( $p=0.014$ ) in eighteen neonates (60%). None of the neonates were clinically symptomatic. **Conclusion:** This study shows a decrease in serum calcium levels in term infants exposed to phototherapy. Hence serum calcium should be monitored regularly for neonates receiving phototherapy.

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#### Introduction:-

Neonatal hyperbilirubinemia has been the most common physical finding during the first week of life. It affects nearly 80% preterm and 60% term neonates. Hyperbilirubinemia in neonate is due to liver's immature excretory pathway for bilirubin.

Unconjugated hyperbilirubinemia is a normal physiological occurrence in most of the infants. High values of unconjugated bilirubin could proceed towards bilirubin encephalopathy and later kernicterus through overwhelming permanent neurological development problems. Hence managing neonatal hyperbilirubinemia appropriately is of utmost importance.

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Phototherapy plays a major role in prevention and management of hyperbilirubinemia. Phototherapy transforms bilirubin into water soluble isomers which can be excreted without conjugation in the liver. The goals of phototherapy are to prevent the already elevated total serum bilirubin level from rising, to prevent the occurrence of encephalopathy or kernicterus and to prevent the total serum bilirubin from rising to a level that requires exchange transfusion.

As any treatment has its side effects, phototherapy also has its adverse effects like hyperthermia, feeding intolerance, loose stools, skin rashes, bronze baby syndrome, retinal changes, dehydration, hypocalcemia, redistribution of blood flow and genotoxicity .

Numerous investigations have been carried out to establish the safety of phototherapy in the management of neonatal hyperbilirubinemia. Hypocalcemia is one of the known adverse effects. Hypocalcemia is defined as total serum calcium level less than 8mg/dl in term and less than 7mg/dl in preterm babies. Therefore this study is aimed to evaluate phototherapy induced changes in serum calcium level in term neonates with unconjugated hyperbilirubinemia.

**Aim:-**

To determine the effect of phototherapy on serum calcium level in full-term hyperbilirubinemic neonates.

**Material and Methodology:-**

Prospective study was conducted in the Department of Paediatrics, Government Rajaji Hospital in co-ordination with the Institute of Physiology, Madurai Medical College, Madurai for a period of one year. Approval was obtained from the ethical committee of Government Rajaji Hospital, Madurai. This study was performed on 30 full-term jaundiced neonates (15 males and 15 females) receiving phototherapy.

A detailed antenatal, perinatal history and examination of neonates was done in all cases of study and control group.

**Control Group:-**

Consists of blood samples of the neonates in which serum bilirubin and calcium were measured before the onset of phototherapy.

**Study Group:-**

Consists of blood samples of the neonates in which serum bilirubin and calcium were measured after 48 hrs of phototherapy.

**Inclusion Criteria:-**

1. Cephalohematoma
2. External bruising
3. Breast feeding jaundice
4. Breast milk jaundice
5. Physiological jaundice

**Exclusion Criteria:-**

1. Neonatal asphyxia.
2. Preterm infants.
3. Infants of diabetic mothers.
4. Infants undergoing exchange transfusion.
5. Hemolytic anaemia / Rh / ABO incompatibility
6. Conjugated hyperbilirubinemia.
7. Sepsis.
8. Congenital malformations.
9. Respiratory distress.

**Blood investigations:**

The investigations include indirect bilirubin measured by Diazo method, Serum calcium measured by Arsenazo III method.

### Results and Observation:-

The serum calcium changes in term neonates receiving phototherapy for jaundice was analysed before and after phototherapy using **Paired t test**.

By means of **SPSS (Statistical Package for Social Sciences) software version 16**, analysis of statistics was performed.

The **statistical significance** was drawn at '**p**' value < 0.05.

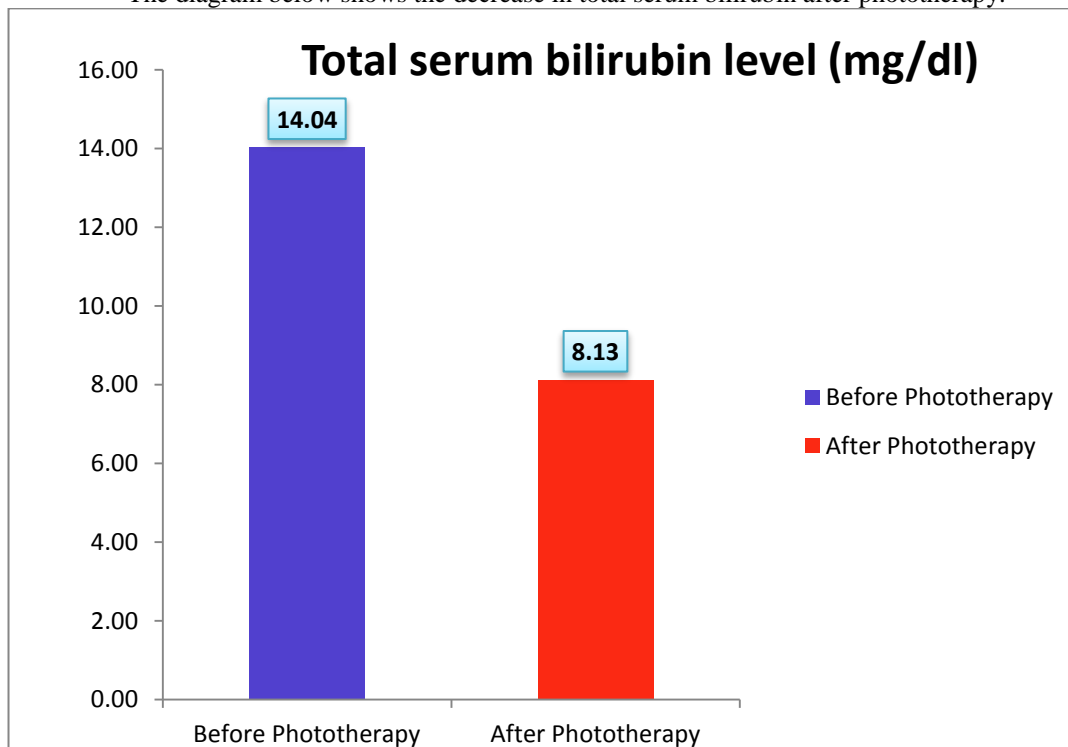
#### Analytical statistics of total serum bilirubin and serum calcium before and after Phototherapy

S No	Parameters	Before phototherapy (Mean $\pm$ Standard deviation)	After phototherapy (Mean $\pm$ Standard deviation)	p value
1.	Serum bilirubin (mg/dl)	14.04 $\pm$ 0.71	8.13 $\pm$ 0.40	0.001 Significant
2.	Serum calcium (mg/dl)	9.51 $\pm$ 0.29	8.38 $\pm$ 0.31	0.014 Significant

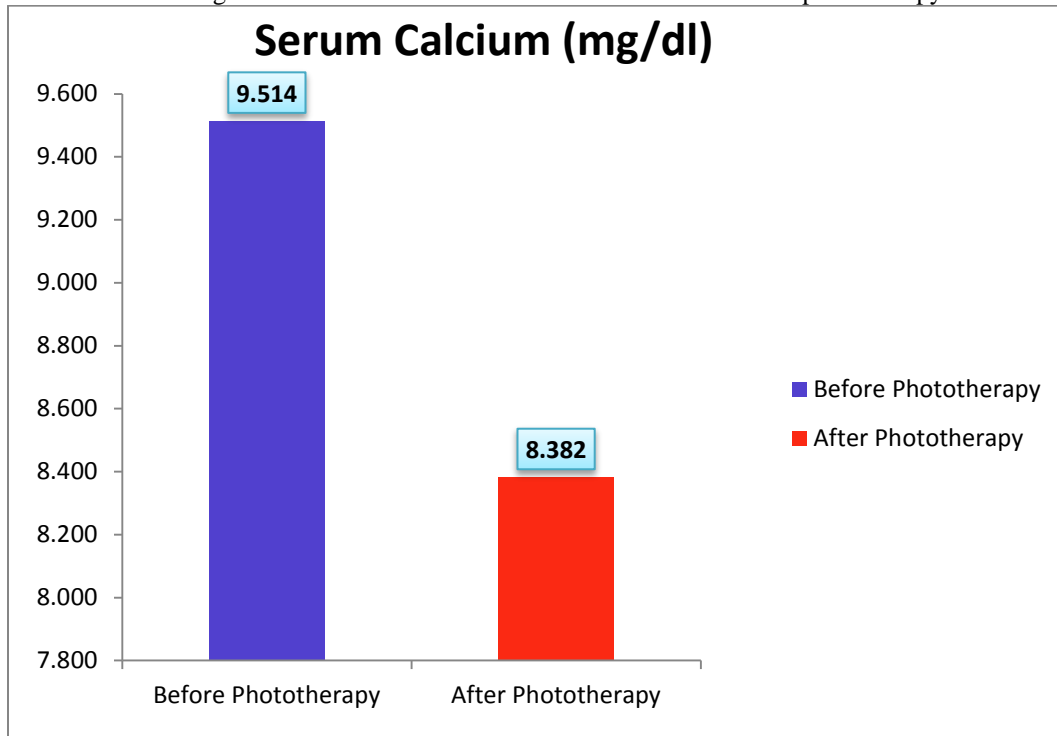
In the table above we compare the total serum bilirubin before and after phototherapy. It was found that the mean  $\pm$  SD of total serum bilirubin before phototherapy was 14.04  $\pm$  0.71 mg / dl and after phototherapy was 8.13  $\pm$  0.40 mg / dl. The total serum bilirubin decreased significantly after phototherapy with a p value of 0.001.

The mean  $\pm$  SD of serum calcium before phototherapy was 9.51  $\pm$  0.29mg / dl and after phototherapy it was 8.13  $\pm$  0.40 mg / dl. Levels of serum calcium decreased significantly after phototherapy when compared to values before phototherapy with p value 0.014 .

The diagram below shows the decrease in total serum bilirubin after phototherapy.



The diagram below shows the decrease in serum calcium after phototherapy



### Discussion:-

- This study was conducted on 30 term neonates with jaundice managed with phototherapy serum bilirubin and calcium were measured and compared before and after phototherapy. After 48 hours of phototherapy there was a **significant decrease** in serum calcium levels with **p value 0.014** in eighteen neonates (60%). None of the neonates were clinically symptomatic.
- Normal level of serum calcium is 9-11 mg per 100 ml. Calcium is an essential structural component of the skeleton and plays a key role in muscle contraction, blood coagulation, enzyme activity, neural excitability, secondary messengers, hormone release and membrane permeability.
- **In Hypocalcaemia** cellular permeability to sodium ions increases and thereby increasing cell membrane excitability leading to the development of seizures, apnea, jitteriness, increased extensor tone, clonus, hyperreflexia and stridors .

### Conclusion:-

The mechanism of hypocalcaemic effect of phototherapy was hypothesised by **Hunter and Hakinson in 2004** . There is inhibition of pineal gland secretion via transcranial illumination, resulting in decline of melatonin secretion. This blocks the effect of cortisol on bone calcium. Cortisol has a direct hypocalcemic effect and increases bone uptake of calcium and induces hypocalcaemia.

**Kim (2001)** in his study suggested that hypocalcemia was caused due to a reduction in parathormone secretion in jaundiced neonates who were treated with phototherapy.

In **Hooman's** study (2005) the significantly higher level of urinary calcium excretion was proposed to be the cause of hypocalcemia in phototherapy treated jaundiced neonates .

Significant decrease in calcium level was well evident in our study. Although the signs were not remarkable this decline may continue down to the threshold of hypocalcemia development.

Hence we suggest assessment of serum calcium along with routine measurement of serum bilirubin in neonates receiving phototherapy to prevent the development of neurological complications.

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