

Effect of Phototherapy on Serum Calcium Levels in Newborn

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1. Introduction

Jaundice is an essential problem in the newborn period. Increased bilirubin levels may be hazardous to the developing central nervous system and may cause irreversible neurological impairment even in term newborns.

Nearly 60% of term newborns and 80% of preterm's become visibly icteric in the first week of life. In the majority of cases, it is usually benign, and no intervention is required. Approximately 5 - 10% of them have clinically significant hyper - bilirubinemia, in whom the use of phototherapy becomes mandatory.¹

The main reason for neonatal hyperbilirubinemia is the liver's immature excretory pathway for bilirubin. It is the most common reason for the re - admission of neonates in the first week of life in the current era of postnatal discharge from the hospital.²

Jaundice in neonates is a cause of concern for the parents as well as for the Paediatricians.³

Elevated levels of unconjugated non - hemolytic bilirubin can lead to bilirubin encephalopathy subsequently, kernicterus, with devastating, permanent neuro-developmental handicaps.⁴

Conjugated hyperbilirubinemia indicates potentially dangerous hepatic disorders or systemic illnesses. Hence appropriate assessment and management of neonatal hyperbilirubinemia are of importance.

Phototherapy, exchange transfusion, and pharmacological treatment are the primary modalities of treatment. Phototherapy treatment may also lead to undesired side effects, including diarrhea, skin rashes, retinal degenerations, a rise of body temperature, nasal obstruction, bronze baby syndrome, etc.⁵ Nonetheless, no change in blood ions metabolites are reported except for calcium concentration.⁶

It's hypothesized that phototherapy inhibits the pineal secretion of melatonin, which blocks the effect of cortisol on bone calcium. Unchecked cortisol exerts a direct hypercalcemic surge and increases bone uptake of calcium as well.⁷ membrane integrity, and function, neuromuscular excitability, cellular enzymatic activity.

Hypocalcemia increases cellular permeability to sodium ions and increased cell membrane excitability. The signs are usually non - specific, like apnea, seizure, jitteriness, irritability, increased extensor tone, hyperreflexia, and stridor (laryngospasm).¹

The present study is aimed at research and evaluates the effect of phototherapy on serum calcium levels in newborns requiring phototherapy, according to the American Association of Paediatrics guidelines.

Aims and Objectives

To study the effect of phototherapy on serum calcium levels in term neonates requiring phototherapy according to AAP guidelines.

2. Methodology

Source of Data: Inborn Neonates admitted to NICU with hyperbilirubinemia who met the inclusion and exclusion criteria were included in the study

Type of Study: Hospital - based prospective observational study

Inclusion Criteria:

Term AGA neonates with unconjugated hyperbilirubinemia requiring phototherapy according to AAP guidelines.

Exclusion Criteria:

- Newborns with, Jaundice in the initial 24 hours of life
- Icterus lasting more than 14 days
- Born to a diabetic mother
- Neonatal sepsis
- Birth asphyxia

Babies who had exchange transfusion or were on TPN

SAMPLE SIZE: Postulating the probability of type 1 error as 0.05 with a power of 0.8, paired difference to be recognised as 0.2 and expected Standard Deviation from the previous study as 0.8, the required sample size of 128 was calculated, assuming loss during follow up and 150 cases who met the inclusion and exclusion criteria were included in the study.

Data Collection

- Written consent was taken from the parents. .150 cases who met the inclusion and exclusion criteria were included in the study after obtaining approval of the institutional ethical committee.
- A detailed history and examination was done and recorded. Sepsis screening is done wherever required.
- These newborns were analysed using a standardized proforma. The proforma include antenatal, natal, postnatal history, anthropometry data, signs and symptoms of hypocalcemia. . Doctors with aseptic precautions drew the blood samples, and no squeezed samples were used, and the samples were analyzed immediately within 15 minutes after drawing blood.

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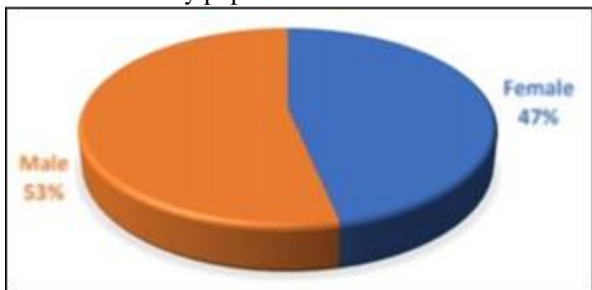
- Phototherapy was given by blue fluorescent lamps (410 - 470nm) placed at a distance of 30 - 40cms from the neonates who required phototherapy according to AAP guidelines. The eyes and genitalia were covered with the head exposed to phototherapy.
- Serum calcium level of less than 7.0mg/ dl is defined as hypocalcemia.

Statistical Analysis

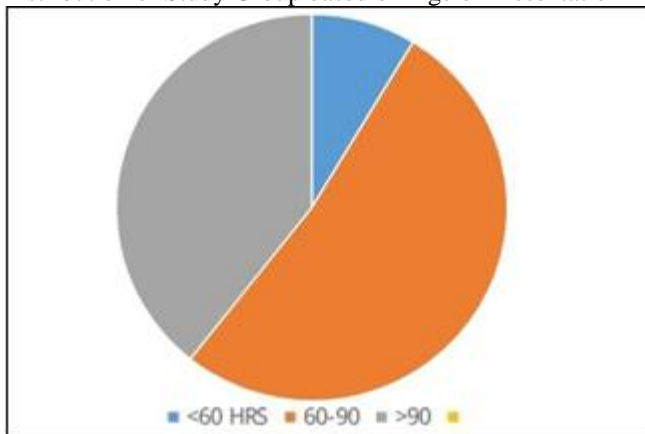
Neonatal and Maternal data were collected in predesigned proforma. Data shall be analyzed using SPSS 22.0, and R environment ver.3.2.2 were used for the analysis and evaluation of the data, and Microsoft Word and MS Excel have been used to generate graphs, tables, etc. For quantitative data, mean and standard deviation (SD) were calculated for qualitative data percentages calculated. A chi - square test was used for comparing differences between categorical variables. For comparison between the means, Wilcoxon matched test was used, and the Students t - test used. For interpretation of results, significance shall be adopted at p - value < 0.05 at a 95% confidence int

3. Result

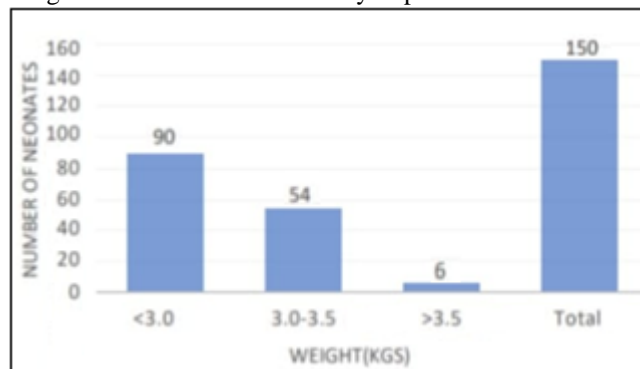
Distribution of Study population based on sex



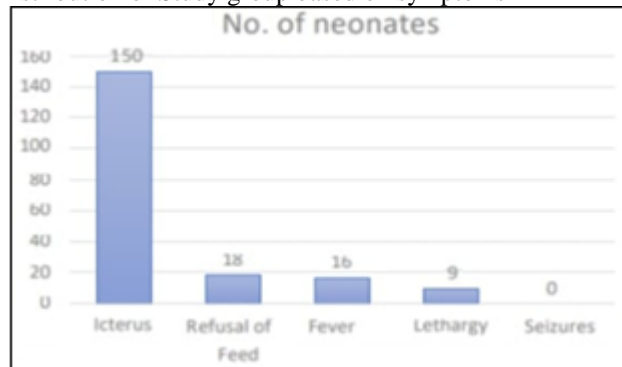
Distribution of Study Group based on Age of Presentation



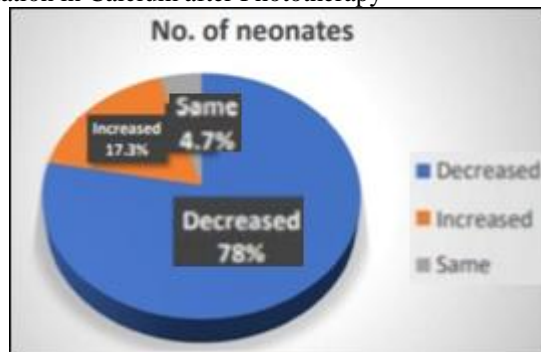
Weight wise Distribution of Study Population



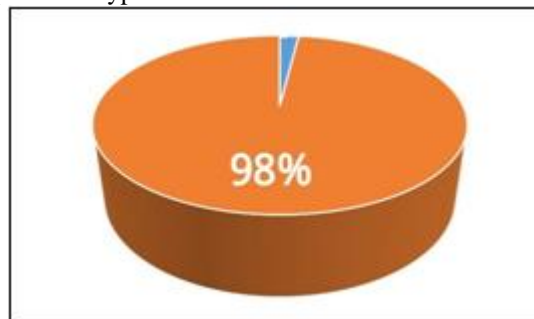
Distribution of Study group based on symptoms



Variation in Calcium after Phototherapy



Distribution of Study population based on signs and symptoms of hypocalcemia



Analysis of Lab Parameters

Comparison of Mean Serum Bilirubin before and after Phototherapy by Wilcoxon matched Test (n=150)

Time Point	Mean	SD	Mean Diff.	SD Diff	T-Value	p-Value
Before Treatment	17.22	1.93				
After Treatment	7.75	1.44	9.469	0.5	55.613	<0.001

Comparison of Mean Serum Calcium before and after Phototherapy by Wilcoxon matched Test (n=150)

Time Point	Mean	SD	Mean Diff.	SD Diff	T-Value	p-Value
Before Treatment	9.09	0.66	0.455	-0.14	9.834	<0.001
After Treatment	8.63	0.80				

4. Discussion

Among the study population the mean serum calcium levels before and after phototherapy in our study were 9.09+/- 0.66 and 8.63+/- 0.80 respectively.

In our study, there was a reduction in calcium levels after phototherapy in 78% neonates and was not associated with age, sex, and weight of the newborn.

But significant fall to the hypocalcemic range was observed in 3 cases. So, the incidence of hypocalcemia was found to be only 2 %, and both the hypocalcemic neonates were symptomatic.

Out of the three hypocalcemic neonates, all of them showed jitteriness (100%) and irritability (100%), and none of them showed any symptoms of convulsions or apnea

5. Conclusion

The study shows that neonates under phototherapy for unconjugated hyperbilirubinemia are at higher risk of reduction in serum calcium levels occasionally even to the hypocalcemic range and development of symptoms of hypocalcemia. Hence, babies should be closely monitored for variations in calcium and should be treated accordingly.

References

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