



“EFFECT OF PHOTOTHERAPY ON TOTAL SERUM CALCIUM AND SERUM BILIRUBIN LEVELS IN NEONATE WITH JAUNDICE - A PROSPECTIVE HOSPITAL BASED INTERVENTIONAL STUDY IN A TERTIARY CARE CENTRE IN HAPUR, U.P”

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ABSTRACT Aim - To determine effect of phototherapy on total serum bilirubin level and total serum calcium level in neonates with jaundice.

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 hospital-based study conducted in SIMS Hapur from October 2019- March 2021 to see total bilirubin level and total calcium level before and after phototherapy. Detail regarding gestational age, sex, birth weight, mode of delivery, day of life, symptom of hypercalcemia, were collected. Neonate (1-15 day of life), gestational age > 28 weeks, birth weight >1000 gm were included in the study.

Result- The study included 34 preterm and 66 term new born. Total serum bilirubin levels at baseline, 24 hours, 48 hours after phototherapy was 19.30 ± 2.64 , 15.83 ± 2.75 , 11.45 ± 2.13 mg/dl respectively in term neonates and 18.25 ± 2.16 , 15.2 ± 2.24 , 11.70 ± 1.14 mg/dl, respectively in preterm neonates. In total, 73% preterm cases and 69.69% term cases had developed hypocalcemia.

Conclusion- The decrease in total serum calcium levels was more in a preterm. A neonate requiring the phototherapy is at the high-risk developing hypocalcemia. Therefore, we should monitor total calcium level and supplemental calcium (oral or the iv) in symptomatic hypercalcemic neonates on phototherapy.

KEYWORDS :

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 neonates¹.

Phototherapy plays a significant role in the treatment and prevention of hyperbilirubinemia in neonates. But some adverse effects of phototherapy have also been reported². 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 hypocalcemia³.

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, hypotonia, 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 hypocalcemia⁴.

Thus, hypocalcemia 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, its duration on serum calcium levels in term and preterm babies⁴.

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–March 2021.

Study Design: Prospective interventional study

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

Study Period: October 2019–March 2021

Age Group: 1-15 days of life

Sample Size: 100

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

Inclusion Criteria:

1. Neonates (1-15 day of life) requiring phototherapy
2. Neonates with gestational age more than 28 week of gestation
3. Neonates weighing more than 1000gm
4. Breast milk jaundice
5. Breast feeding jaundice

Exclusion Criteria:

1. Newborns < 24 hr. of life and >15 day of life
2. Newborns with gestational age less than 28 completed weeks, weighing less than 1000 gms
3. Newborns with Congenital anomaly
4. Newborns with ABO and Rh incompatibility

Neonates with hyperbilirubinemia were evaluated through a thorough history, (detail regarding gestational age, sex, birth weight, mode of delivery, day of life, symptom of hypercalcemia, were collected) and detailed examination clinical assessment and TCB monitoring was done. 1.5 to 2 ml venous blood sample was collected in plain for serum bilirubin level, total calcium level and 1 ml venous blood sample transportation in EDTA vial for Hb, PCV, reticulocyte count and peripheral smear for other investigations. Total serum bilirubin and total serum calcium levels were estimated before and after phototherapy. Total serum bilirubin and 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 analyzed on SPSS Version 22 and tabulated in MS Excel. 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 statistically significant and p-value <0.0001 was highly significant.

RESULTS-

Out of 100 neonates, 58(58%) were male and 47(47%) were female out of which 34 (34%) were preterm and 66 (66%) were term new born. Out of 100 neonates 62% neonate had normal vaginal delivery and 38% delivered by cesarean delivery. Mean birth weight was 2.71 ± 0.44

kg. Maximum (64%) children had birth weight more than 2.5 kg. Mean \pm SD of day of starting of phototherapy was 3.48 ± 1.36 days.

Table 1: Symptomatic And Asymptomatic Hypocalcemia In Pre Term And Term Neonates Exposed To Phototherapy

	Preterm	Term
Symptomatic	18/34 (52%)	36/66(54.54%)
Asymptomatic	7/34(20.58%)	10/66(15.15%)
Total hypocalcemia	25/34(73.52%)	46/66(69.69%)
No hypocalcemia	9/34(26.47%)	20/66(30.30%)

Total 71% (71 out of 100) neonates developed hypocalcemia. Hypocalcemia was found more in Preterm neonates. In total, 73% preterm cases and 69.69% term cases had developed hypocalcemia.

Table 2: Showing Symptom Of Hypocalcemia And Their Frequency In Preterm And Term Neonates

		Newborn		Total
		Preterm	Term	
Irritability	N	6	14	20
	Percent	17%	21.21%	20%
Jitteriness	N	12	22	34
	Percent	35.29%	33.33%	34%
Nil	N	16	30	46
	Percent	47%	45%	46%
Total	N	34	66	100
	Percent	34%	66%	100%

Jitteriness was most commonly found in our study in both preterm and term group.

Table 3: Showing Comparison Between Mean Total Serum Bilirubin And Serum Calcium Levels Before And After Receiving 24 Hours Of Phototherapy In Term.

S. No	Parameters	Before phototherapy [Mean \pm SD]	After phototherapy [Mean \pm SD]	
1	Serum Bilirubin [mg/dl]	19.30 \pm 2.64	15.83 \pm 2.75	t- statistic= -7.39 p<0.0001
2	Serum Calcium [mg/dl]	9.33 \pm 0.90	8.69 \pm 0.57	t- statistic= -4.88 p<0.0001

Table 4: Showing Comparison Between Mean Total Serum Bilirubin And Serum Calcium Before And After 24 Hours Of Photo Therapy In Preterm.

S. No	Parameter	Before phototherapy	After phototherapy	
1	Serum bilirubin [mg/dl]	18.25 \pm 2.16	15.2 \pm 2.24	t-statistic= -5.715 p<0.0001
2	Serum calcium [mg/dl]	8.75 \pm 1.11	8.23 \pm 0.77	t-statistic= -2.244 p<0.05

Table 5: Showing Comparison Between Mean Total Serum Bilirubin And Serum Calcium Before And After 48 Hours Of Photo Therapy In Term.

S. No	Parameter	Before Phototherapy	After Phototherapy	
1	Serum bilirubin [mg/dl]	19.28 \pm 2.64	11.45 \pm 2.13	t-statistic= - 18.75 p<0.0001
2	Serum calcium [mg/dl]	9.33 \pm 0.90	7.98 \pm 0.37	t-statistic= - 11.27 p<0.0001

Table 6: Showing Comparison Between Mean Total Serum Bilirubin And Serum Calcium Before And After 48 Hours Of Photo Therapy In Preterm

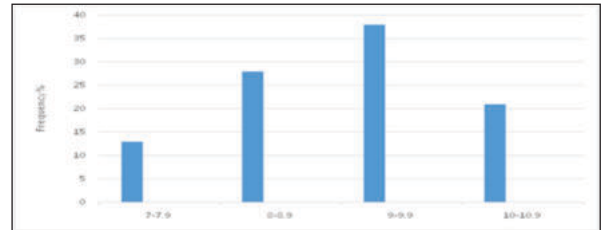
S. No	Parameter	Before Phototherapy	After Phototherapy	
1	Serum bilirubin	18.25 \pm 2.16	11.70 \pm 1.14	t-statistic= -15.63 p<0.0001
2	Serum calcium	8.75 \pm 1.11	7.78 \pm 0.45	t-statistic= -4.72 p<0.0001

Total serum bilirubin levels at baseline, 24 hours, 48 hours after phototherapy was 19.28 ± 2.64 , 15.83 ± 2.75 , 11.45 ± 2.13 mg/dl

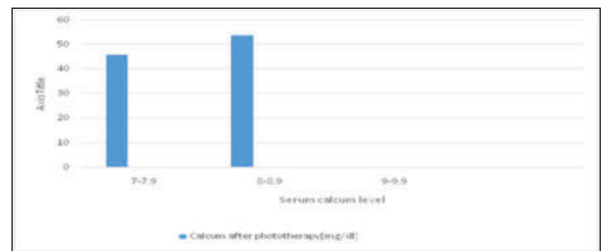
respectively in term neonates and 18.25 ± 2.16 , 15.2 ± 2.24 , 11.79 ± 1.96 , respectively in preterm neonates. (p<0.0001)

Total serum calcium levels at baseline and at 48 hours after phototherapy was 9.33 ± 0.90 and 7.98 ± 0.37 mg/dl respectively in term neonates and 8.75 ± 1.11 and 7.78 ± 0.45 mg/dl respectively in preterm neonates. (p<0.0001)

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



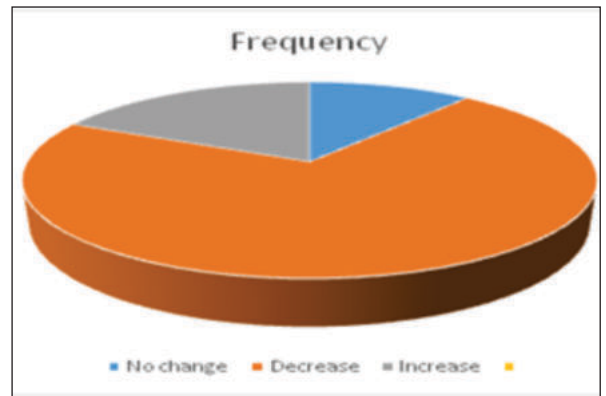
Graph1: Frequency Distribution Of Serum Calcium Value Before Phototherapy In All 100 Neonates.



Graph 2: Showing Frequency Distribution Of Serum Calcium Level 48 Hour After Phototherapy

Table 7: Frequency Distribution Table Showing Change In Serum Calcium Level After Phototherapy.

S.No	Effect of phototherapy on serum calcium	Frequency	Percentage
1	No change	11	11%
2	Decrease	71	71%
3	Increase	18	18%
	Total	100	100%



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 hypocalcemia.

Eghballian, A. Monsef et al study was proposed to investigate phototherapy induced hypocalcemia in hyperbilirubinemic 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 \pm SD of total serum calcium levels before phototherapy was 9.13 ± 1.05 mg/dl and after 48 hours of phototherapy it was 7.91 ± 0.41 mg/dl ($p < 0.0001$). There was significant association exist between serum calcium level before and after 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.

CONCLUSION-

The present study reveals that the total serum bilirubin, total serum calcium levels declined significantly in the neonates after treatment with phototherapy. The decrease in total serum calcium levels was more in a preterm. Jitteriness was most commonly found in our study in both preterm and term group. Therefore, we should monitor total calcium level till cessation of phototherapy and neonates should be watched for symptom like jitteriness, irritability, convulsion. Asymptomatic hypocalcemic neonates should be given oral calcium, and Symptomatic hypocalcemic neonate should be given intravenous calcium in their IV fluids.

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