ORIGINAL RESEARCH PAPER

Paediatrics

KEY WORDS: Hypocalcemia, phototherapy, serum bilirubin, Neonatal Jaundice

SERUM CALCIUM AND SERUM BILIRUBIN AFFECTED BY HEAD COVERING DURING PHOTOTHERAPY

Vyshnavi Kakarla*
Department of Paediatrics, Meenakshi medical college hospital and research institute, Kancheepuram, Tamilnadu, India *Corresponding Author

Mogulla Pravalika
Department of Paediatrics, Meenakshi medical college hospital and research institute, Kancheepuram, Tamilnadu, India

Ubaidur Rahman
Department of Paediatrics, Meenakshi medical college hospital and research institute, Kancheepuram, Tamilnadu, India

ABSTRACT

Background: When used for neonatal hyperbilirubinemia, phototherapy has a lot of negative side effects. which hypocalcemia is barely noticeable. The fall in melatonin level brought on by phototherapy is thought to be the cause of this. We conducted a study to determine the extent to which head coverings during phototherapy affected the levels of serum calcium and bilirubin. **Medthods:** We treated 72 term newborns who were receiving care at the Department of Pediatrics in an observational cohort research. Two groups were created out of them. With one group receiving phototherapy while wearing a dark-colored hat, and the other group receiving it without one, Before beginning phototherapy and 48 hours after ceasing phototherapy, serum calcium and serum bilirubin were measured. The paired-t test and unpaired-t test were applied during the data analysis using SPSS software. **Results:** When compared to the other group with a head covering, the mean blood calcium level in the control group without a head covering was considerably lower after 48 hours of phototherapy. Hypocalcemia affects a total of 8 infants, or 22.2%. However, the study also revealed that there was no discernible difference in the two groups' reductions in serum bilirubin levels. **Conclusion:** Wearing a head covering will stop phototherapy-induced hypocalcemia, and it has no impact on how quickly serum bilirubin is lowered.

INTRODUCTION

Neonatal hyperbilirubinemia is a frequent reason for a newborn hospitalisation. Serum bilirubin levels in newborns typically exceed 1 mg/dl. During the first week of birth, jaundice is a frequent morbidity1. Clinical jaundice affects about 60% of term newborns and 80% of preterm babies. The most frequent reason for readmission following hospital discharge is neonatal hyperbilirubinemia.

Changes in the newborn's synthesis, metabolism, and excretion of bilirubin are what cause neonatal hyperbilirubinemia. Insufficient bilirubin clearance by the developing liver and increased bilirubin burden to immature hepatocytes are to blame. So, there are both pathological and physiological causes of newborn jaundice. Treatment for physiological hyper bilirubinemia is not necessary. However, certain infants with a significant rise in blood bilirubin levels need to be treated since they can cause complications[1].

The most popular and least harmful form of non-invasive therapy for neonatal hyperbilirubinemia is phototherapy. Phototherapy has its own set of negative side effects, including electrolyte imbalances, dehydration, watery stool, erythema rash, thermal fluctuation, and bronze baby syndrome[2].

One such side effect of phototherapy is hypocalcemia. The decreases in melatonin levels and corticosterone secretion, as well as increased urine calcium excretion, are thought to be the causes of hypocalcemia[3]. In babies with hypocalcemia, the cell membranes are more excitable and permeable to sodium ions, which can lead to issues like lightheadedness, apnea, seizures, clonus, stridor, and hyperreflexia. Several approaches and procedures were tested to try and prevent this phototherapy-induced hypocalcemia.

One of them is wearing an appropriate head covering while receiving phototherapy. Regarding the effectiveness of wearing a head covering during phototherapy, there have been a number of divergent views expressed[4]. With these considerations in mind, a study was done to evaluate the effect of head covering on Phototherapy on blood calcium levels and serum bilirubin levels in order to determine the precise state of affairs.

MATERIALS AND METHODS

From January 2020 to March 2021, this Cohort study was carried out at the Meenakshi Medical College Hospital and Research Institute. The study comprised neonates hospitalized for treatment of hyperbilirubinemia. To determine the amount of icterus, a newborn hospitalized with hyperbilirubinemia underwent an initial examination.

About 2 ml of blood were drawn from each newborn who had icterus that reached their palms and soles. The total, direct, and indirect levels of serum bilirubin were sent for evaluation. For the estimation of serum calcium, 1 ml of serum was kept. Within an hour, bilirubin values were acquired, and those infants with unconjugated hyperbilirubinemia who had bilirubin levels that fell within the phototherapy range according to the AAP nomogram were selected for the trial. Before beginning phototherapy, the stored blood calcium level was calculated using that serum sample. Based on basic random sampling, the infants were randomly assigned to the experimental and control groups. There were 72 neonates in all, which were split into two groups. Group PHC (phototherapy with head covered) participants had phototherapy while wearing a dark-colored headgear that covers the entire head from the sinciput to the occiput and is padded around the eyes and genitalia. Phototherapy was administered without a head covering to Group P (phototherapy). Neonatals were placed beneath LED phototherapy equipment. A second sample of blood calcium and serum bilirubin total, direct, and indirect levels were collected 48 hours after phototherapy.

The information was entered into an MS Office Excel spreadsheet and examined with SPSS version 19. The mean and standard deviation were used to express continuous data having a normal distribution. The mean values in between two groups were compared using the unpaired sample 't' test. To evaluate the means among before and after phototherapy, a paired "t" test was performed. Statistics were judged significant at P0.05.

RESULTS:

With no statistical significance, the mean age of the study group was 4.1 1.2 days in Group P and 3.9 1.0 days in Group PHC. At the beginning of the research, the mean serum bilirubin levels were 19.9 in group P and 18.6 in group PHC, with no discernible difference (p=0.158). Before the study began, it was discovered that both groups' levels of indirect and direct bilirubin were comparable. (Table 1)

Mean serum calcium level before phototherapy was 9.48±0.62 in group PHC and 9.57±0.57 in group P with no significant difference (p =0.824). After 48 hours of phototherapy the mean serum calcium levels in cases was 9.57±0.37 while control group shows a decline of serum calcium levels with mean of 8.65±1.1 which was significant (p<0.0001) (Table 2).

About 25% of newborns developed hypocalcemia in control group (22.2%) and only 2.8% of cases developed hypocalcemia in PHC group where the difference in proportion was significant. We found that the mean reduction in serum bilirubin level was 5.73 in control group and 5.68 in cases with no statistical significance (p=0.884) (Table 3)

DISCUSSION

In the first week of life, neonatal hyperbilirubinemia is one of the frequent causes for readmission. Evidence supporting phototherapy's effectiveness and non-invasiveness, dates back to the year 1958 when Cremer et al conducted the first study on the impact of light on serum bilirubin levels[5]. Through their research, Romagnoli et al[6] were the first to discover a connection between hypocalcemia and phototherapy. The hypocalcemic effect of phototherapy was demonstrated by H. Karamifer et al.[7], B.K. Jain et al.[8], Sethi et al.[9], and many others. All of the investigations came to the same conclusion: Preterm babies had a higher frequency of hypocalcemia than term neonates. Hunter et al. proposed that phototherapy's ability to counteract the effects of melatonin3 was the cause of the hypocalcemia that followed treatment. The outcomes of a study conducted on newborn rats by Hackonson Do et al[10]. provided additional support for this.

Eshanipour et al[11] carried out a study to support this theory by using hats to prevent hypocalcemia demonstrated that wearing a hat protects hypocalcemia. In order to evaluate the hypocalcemic impact of phototherapy and the theory that it results from melatonin blocking, we carried out a similar type of investigation in our institute.

In our investigation, we discovered that the serum calcium levels in the control group were much lower than those in the cases. In our study, 8.2%, or 8 infants in the control group, experienced hypocalcemia. In our investigation, no infant experienced symptomatic hypocalcemia. In order to determine if head coverings had any impact on the primary goal of phototherapy, namely bilirubin reduction, we also examined the rate of reduction of serum bilirubin in both groups. In the control group, the mean drop in serum bilirubin levels was 5.68, and in cases where there was no statistical significance, it was 5.73.

The question of whether wearing a hat to cover one's head can protect one from hypocalcemia brought on by phototherapy was investigated in a study by Ezzeldin Z et al[12] On admission, the two groups' mean Ca levels were reported to be equal. After 48 hours of phototherapy, there was a propensity for a higher Ca level in the group wearing the helmet: 8.740.95 mg/dL as opposed to 8.510.24 mg/dL in the control group. Additionally, only 9.7% of infants in the group wearing hats experienced a statistically significant decline in the frequency of hypocalcemia, as opposed to 24.2% in the group not wearing hats.

According to Mulye S et al[13], less newborns with covered heads experienced hypocalcemia throughout our investigation than those whose heads were left uncovered. However, these outcomes lacked statistical significance. According to study carried out in other countries, newborn head covering at phototherapy had a substantial effect. Therefore, we recommend that a significant multicenter inquiry be conducted in our country to determine the exact importance.

The mean serum calcium levels in the intervention and control groups before phototherapy, which were 8.721.12 and 8.790.87 mg/dL, respectively, were not statistically different, according to Barekatain B et al[14].

Following treatment, the intervention and control groups' calcium levels were 8.90.82 and 8.430.91, respectively. It was statistically significant that these two groups differed from one another. The mean serum calcium levels in the intervention group rose after phototherapy while they fell in the control group. The t test revealed a substantial distinction between the two groups.

According to studies by Sorour EII et al.[15], 19% of individuals in both groups experienced hypocalcemia after starting phototherapy for 48 hours. Between the groups wearing hats and those without, there was a statistically significant difference in the incidence of hypocalcemia, with 26% in the former group and 12% in the latter. They arrive to the conclusion that in order to avoid phototherapy-induced hypocalcaemia, newborn heads should be covered during phototherapy.

Contrarily, fewer infants with covered heads than those whose heads were not covered developed hypocalcemia, according to a study by Bibi A et al[16]. These results, however, lacked statistical significance.

CONCLUSION

According to the study, phototherapy can cause hypocalcemia in newborns, which can be avoided by wearing a cap while providing the treatment. Additionally, the reduction in bilirubin levels during phototherapy will not be impacted by this head covering.

Table1: Comparison of Bilirubin levels before phototherapy between the cases and controls

Parameters	Group P (N=36)		Group PHC(N=36)		P value*
	Mean	SD	Mean	SD	
Total bilirubin (mg/dL)	19.3	2.3	19.5	1.5	0.158 (NS)
Direct bilirubin (mg/dL)	1.35	0.7	1.6	0.9	0.435 (NS)
Indirect Bilirubin (mg/dL)	18.1	2.2	18.6	2.12	0.332 (NS)

*Independent Sample T test

Table 2: Comparison of serum calcium levels before phototherapy between groups

Serum calcium (mg/dL)	Group P (N=36)		Group PHC (N=36)		P value*
	Mean	SD	Mean	SD	
Before Treatment	9.57	0.57	9.48	0.62	0.824 (NS)
After Treatment	8.65	1.1	9.57	0.37	0.001 (SIG)
P value#	0.001 (SIG)		0.866 (NS)		-

*Independent Sample T test and # Paired T test

Table 3: Comparison of bilirubin levels after phototherapy between cases and controls

Parameters	Group P (N=36)		Group PHC (N=36)		p value
	Mean	SD	Mean	SD	
Total bilirubin (mg/dL)	5.73	3.23	5.68	3.46	0.884 (NS)

***Independent Sample T test was used to test the hypothesis**

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