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Effect Of Head Covering On Phototherapy On Serum Calcium And Serum Bilirubin.

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ABSTRACT

Phototherapy used in neonatal hyperbilirubinemia is associated with many adverse effects. Among these hypocalcemia is unpronounced. The reason behind this is hypothesized to be due to a reduction in melatonin levels caused by phototherapy. Weconducted a study to assess the depth of impact of head covering on Phototherapy on serum Calcium levels and serum Bilirubin. We conducted an observational cohort study that included 72term neonates who were treated in the Department of Pediatrics Government Raja Mirasudar Hospital, Thanjavur Medical College, Tamil Nadu, India in the year between January 2020 to March 2021. They were divided into two groups. One group was subjected to phototherapy with their head covered with a dark-colored hat and the other group without head covering. Serum calcium and serum bilirubin were taken before starting phototherapy and 48 hrs after stopping phototherapy. The data were analyzed using SPSS software and paired tests and unpaired tests were used. After 48 hrs of phototherapy mean serum calcium level in the control group without a head covering was significantly lower when compared to another group with a head covering. A total of 8 babies developed hypocalcemia which was 22.2%. However, the study also showed that there was no significant difference in serum bilirubin levels between the two groups. Head covering will prevent phototherapy-induced hypocalcemiaand it does not affect the rate of reduction of serum bilirubin.

Keywords: Hypocalcemia, phototherapy, serum bilirubin, Neonatal Jaundice.

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INTRODUCTION

Neonatal hyperbilirubinemia is one of the common indications for new admission in the newborn period. Usually, all neonates will have serum bilirubin morethan 1 mg/dl. Jaundice is the most common morbidity during 1st week of life [1]. About 60% of term and 80% of preterm babies develop clinical jaundice. Neonatal hyperbilirubinemia is the most common cause of readmission after discharge from hospitalization. Neonatal hyperbilirubinemia is due to changes involved in the production, metabolism, and excretion of bilirubin in newborns. It is due to increased bilirubin load to immature hepatocytes and decreased bilirubin clearanceby immature liver. Thus, neonatal jaundice can be both physiological and pathological. Physiological hyperbilirubinemia doesn't require any kind of treatment. However, some babies with rapid increases in serum bilirubin levels (pathological hyperbilirubinemia) require treatment as they can produce life-threatening complications [2]. Phototherapy is the most commonly used and noninvasive mode of therapyfor neonatal hyperbilirubinemia with minimal side effects. As any treatment has its side effects, phototherapy also has its own set of adverse effects like dehydration, loose stools, erythematous rash, temperature instability, electrolyte imbalances, and bronze baby syndrome [3]. Hypocalcemia following phototherapy is one such complication. The etiologyof hypocalcemia is believed to be either due to a decrease in melatonin level and corticosterone secretion or increased urinary calcium excretion [4]. Hypocalcemia in newborns increases cellular permeability to sodium ions and increases the excitability of cell membranes which can produce complications likejitteriness, apnea, seizures, clonus, stridor, and hyperreflexia. To prevent this phototherapy-induced hypocalcemia, several methods and techniques were tried. One among them is the proper covering of the head during the phototherapy [5]. However, there were several differences of opinion arise concerning the efficacy of head covering during phototherapy. With these in view, to assess the exact prevailing fact, this study was conducted to assess the impact of head covering on Phototherapy on serum Calcium levels and serum Bilirubin [6].

MATERIALS AND METHODS

This randomized controlled trial was done Department of Pediatrics Government Raja Mirasudar Hospital, Thanjavur Medical College, Tamil Nadu, India in the years between January 2020 to March 2021. Neonates admitted for treatment of hyperbilirubinemia were included in the study. A Newborn admitted with hyperbilirubinemia was initially examined to look for the extent of icterus. Newborns with icterus up to palms and soles were selected and 2 ml of blood sample was taken for each baby. Serum bilirubin total, direct, and indirect levels were sent for analysis. 1ml of serum was stored for estimation of serum calcium. Bilirubin results were obtained within 1 hour and those babies with unconjugated hyperbilirubinemia with bilirubin levels which comes under the phototherapy range as per AAP nomogram were taken up for study. Using that serum sample stored serum calcium level was estimated before starting phototherapy. The babieswere randomly assigned to experimental and control groups based on simple random sampling. A total of 72 neonates were included which was divided into two groups. Group PHC (phototherapy with head covered) were subjected to phototherapy with their head covered using a dark-colored hat which covers from sinciput to occiput along with eye padding and genitals padding. Group P (Phototherapy without head cover) was subjected to phototherapy without head covering. Neonates were put under LED phototherapy units. 48 hrs after phototherapy a repeat sample of serum calcium and serum bilirubin total, direct and indirect levels were taken. The data were entered in an MS Office Excel sheet and analyzed using SPSS version 16. Continuous data with normal distribution was expressed as meanwith standard deviation. An unpaired or independent sample 't' test was used to compare the mean values between the two groups. A paired 't' test was used to compare the means between before and after phototherapy. $P<0.05$ was considered statistically significant.

RESULTS

Table 1: 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)	19.9	2.3	19.3	1.93	0.176(NS)
Direct bilirubin(mg/dL)	1.36	0.93	1.2	0.8	0.411(NS)
Indirect Bilirubin(mg/dL)	18.6	2.4	18.1	2.17	0.355(NS)

The mean age of the study population was 4.1 days in Group P and 3.8 days inGroup PHC with no

statistical significance. The mean serum bilirubin at the start of the study was 19.9 in group P and 18.6 in group PHC with no significant differencep (p=0.176). Also, direct and indirect bilirubin in both groups was found to be similar before the start of the study. (Table 1)

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	9.43	0.81	9.44	0.82	0.954 (NS)
After Treatment	8.6	1.2	9.39	0.54	0.001 (SIG)
P value#	0.001 (SIG)		0.761 (NS)		-

The mean serum calcium level before phototherapy was 9.44 in group PHC and 9.43 in group P with no significant difference (p =0.954). After 48 hours of phototherapy, the mean serum calcium levels in cases were 9.39 while the control group showed a decline in serum calcium levels with a mean of 8.66 which was significant (p<0.0001) (Table 2).

Table 3: Comparison of bilirubin levels after phototherapybetween cases and controls

Parameters	Group P (N=36)		Group PHC (N=36)		P value
	Mean	SD	Mean	SD	
Total bilirubin(mg/dL)	5.68	3.14	5.73	3.23	0.938 (NS)

Eight babies were found to have developed hypocalcemia in the control group (22.2%). We found that the mean reduction in serum bilirubin level was 5.68 in the control group and 5.73 in cases with no statistical significance (p=0.938) (Table 3)

DISCUSSION

Neonatal hyperbilirubinemia is one of the common indications for readmission in the first week of life. Phototherapy is the most effective and noninvasive mode of therapy in the management of neonatal jaundice with evidencedating back to 1958 when Cremer et al first studied the effect of light on serum bilirubin levels [5]. Romagnoli et al [6] were the first to find an association between hypocalcemiaand phototherapy through his study. H. Karamifer et al [7], B.K Jain et al [8], Sethi et al [9], and many more proved thehypocalcemic effect of phototherapy. All the studies unanimously concluded that the incidence of hypocalcemia was higher in preterm babies when compared to term babies. Hunter et al hypothesized that the hypocalcemia following phototherapywas due to the blocking effect of melatonin[3]. This was further backed by the results of a study done by Hackonson Do et al in newborn rats [10]. Eshanipour et al conducted a study to verify this hypothesis by covering thehead with a hat to prevent hypocalcemia proved that head covering prevents hypocalcemia [11]. We conducted a similar kind of study in our institute to test the hypocalcemic effect of phototherapy and hypothesize that it is due to the blocking of melatonin. In our study, we found that there was a significant reduction in serum calcium levels in the control group when compared to cases. In our study, 8 babies in the control group developed hypocalcemia which was 22.2%. None of the babies in our study developed symptomatic hypocalcemia. We also compared the rate of reduction of serum bilirubin in both groups to assess whether head covering had any effect on the primary goal of phototherapy ie bilirubin reduction. We found that the mean reduction in serum bilirubin level was 5.68 in the control group and 5.73 in cases with no statistical significance. A study by Ezzeldin Z et al [12] examined if wearing a hat to cover one's head can shield one from hypocalcemia brought on by phototherapy. The mean Ca levels in the two groups on admission were reported to be the same. However, there was a tendency toward a higher Ca level in the group wearing the helmet after 48 hours of phototherapy; 8.74±0.95 mg/dL compared to 8.51±0.24 mg/dL in the control group. In addition, only 9.7% of newborns in the hat group had a statistically significant decrease in the incidence of hypocalcemia, compared to 24.2% in the group without hats. Fewer neonates with covered heads developed hypocalcemia in our study as compared to neonates whose heads were not covered, according to Mulye S et al [13]. These results, however, were not statistically significant. Neonatal head covering at phototherapy, according to research conducted in other nations, had a significant impact. Therefore, we suggest that a sizable multicenter investigation be carried out in our nation to ascertain the precise importance. According to Barekatain B et al [14], there was no statistically significant difference between

the intervention and control groups' mean serum calcium levels before phototherapy, which were 8.72±1.12 and 8.79±0.87 mg/dL, respectively. Following treatment, calcium levels were 8.9±0.82 and 8.43±0.91, respectively, in the intervention and control groups. This difference between the two groups was statistically significant. After phototherapy, the mean serum calcium levels in the intervention group increased whereas they declined in the control group. The t-test indicated that there was a significant difference between the two groups. After 48 hours of beginning phototherapy, 19% of subjects in both groups developed hypocalcemia, according to research by Sorour EII et al [15]. The incidence of hypocalcemia differed statistically significantly between the groups with and without hats, being 26% in the former and 12% in the latter. They conclude that baby heads should be covered during phototherapy to prevent phototherapy-induced hypocalcemia. In contrast, according to Bibi A et al [16] study fewer infants with covered heads than those whose heads were not covered experienced hypocalcemia. However, these outcomes were not statistically significant.

CONCLUSION

From the study, we concluded that phototherapy can produce hypocalcemia in neonates and it can be prevented by covering the head with a hat while administering phototherapy. Further, this head covering will not affect the reductionof bilirubin levels during phototherapy.

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