IMPACT OF A HEAD COVERING ON PHOTO-THERAPY INDUCED HYPO-CALCAEMIA IN FULL-TERM NEONATES WITH HYPER-BILIRUBINEMIA

Abstract:

Background*: Hyper-bilirubinemia causes yellowish discoloration of the sclera and skin in newborns and is one of the most common disorders that neonatologists face on a daily basis. In the first week of life, 60 percent of term and 80 percent of preterm babies have jaundice. In neonates with unconjugated hyper-bilirubinemia, photo-therapy is the most common treatment.*

Objective: *To compare the occurrence of hypocalcemia in full-term icteric neonates with and without head covering during photo-therapy.*

Material & Methodology*: Two hundred and eight full-term neonates were split into two groups for photo-therapy for hyper-bilirubinemia. The heads of the participants in the study group were covered with a hat. Before beginning photo-therapy, serum bilirubin and serum calcium levels were assessed, as well as after 48 hours of photo-therapy. SPSS software was used to tabulate and analyse the data.*

Results: *Ninety-four (45%) of the 208 neonates in the sample were males, while 114 (55%) were females. The average age was 5.56 ±2.78 days, and the average weight was 3.04 ±0.58 kilograms. Out of 208 neonates, 44 (21%) had hypocalcemia. Hypocalcemia occurred in 28 neonates in the control group and 16 neonates in the study group. There was no symptomatic hypocalcemia in any of the newborns. The p-value for the Chi square test was 0.2. Since this value is greater than 0.05, it is not statistically important.*

Conclusion*: In comparison to neonates whose heads were not covered, fewer neonates with covered heads experienced hypocalcemia in our research. However, these findings were not statistically important. However, Research in other countries found that neonatal head cover at phototherapy had a substantial impact. As a result, we propose that a major multicenter study be performed in our country to determine the exact significance.*

Keywords*: Head covering, Hyper-bilirubinemia, Hypocalcemia, Neonatal jaundice, Photo-therapy.*

INTRODUCTION

It is normal for newborns to develop jaundice in their first few days of life. Jaundice affects 55 percent of full-term neonates around the world, according to reports. According to a study performed at a neonatal center, 28 percent of babies presented with jaundice[1]. This incidence was estimated at 37 percent in another study conducted in Swat. High bilirubin levels are usually harmless, but in a limited number of neonates, they can cause acute bilirubin encephalopathy, which can lead to kernicterus. Kernicterus affects 0.5 to 1.3 neonates per 1 lakh live births in developed countries, while it affects 3 percent of all neonates admitted to hospitals in developing countries[2,3]. Untreated hyperbilirubinemia can cause severe complications that can be avoided with early detection. These neonates are mostly treated with photo-therapy, with only a few requiring exchange transfusions[4,5]. The aim of treatment is to lower the level of unconjugated bilirubin to a safe level. With new and improved phototherapy equipment and techniques, the need for exchange transfusions has reduced.

Photo-therapy is associated with few risks, including hyperthermia, rash, diarrhoea, dehydration, DNA damage, retinal damage, bronze baby syndrome, patent ductus arteriosus in preterm infants, and calcium deficiency[6-8]. In babies, persistent hypo-calcaemia can cause convulsions, apnoea, and tetany. Cortisol causes hypocalcaemia by increasing calcium absorption in the bones. Melatonin, a hormone produced by the pineal gland, blocks the effects of cortisol on bones[9].The pineal secretion of melatonin is blocked during photo-therapy, and the effect of cortisol is unopposed, resulting in hypocalcemia. Some researchers recommend intravenous calcium to prevent hypocalcemia during photo-therapy, but rapid infusion in neonates may cause cardiac arrest or hypotension[10,11]. As a result, other strategies for preventing hypocalcemia should be investigated[12]. Hypo-calcemia can be avoided by shielding the heads of neonates during photo-therapy, according to a study conducted in Iran. They found that the sample group (covered heads) had a lower rate of hypocalcemia (14%) than the control group (uncovered heads) at the end of the study (39 percent).To our knowledge, there hasn't been much research on this subject in India[13,14]. If we can avoid hypocalcemia in neonates by covering their heads

during photo-therapy, we will not only use this technique in our neonatal unit, but we will also campaign for it in other hospitals to save babies from photo-therapy-induced hypo-calcaemia.

OBJECTIVE: To compare the occurrence of hypocalcemia in full-term icteric neonates with and without head covering during photo-therapy.

METHODOLOGY: This one-year prospective, comparative, case control study took place in the neonatal intensive care unit of a neonatology department at a medical college in Central India. In each category, the sample size was determined to be 104. There were a total of 208 neonates in the study. A non-probability (consecutive) sampling method was used. The study included neonates with a gestational age of more than 37 weeks, a weight of more than 2.5 kg, normal serum calcium levels before phototherapy, and hyper-bilirubinemia (as defined by the operational definition). Since any of these conditions can alter serum calcium levels, neonates with a history or evidence of asphyxia, sepsis, exchange transfusion, haemolytic anaemia, or hypothyroidism were excluded. After the analysis was accepted by the hospital's ethics review committee, neonates were assessed using inclusion and exclusion criteria. The research was explained to the parents, and they signed a written informed consent form. Full-term stable neonates were randomly divided into two groups using computer-generated codes that were placed in envelops. During photo-therapy, a stockinette cap was used to cover the heads of neonates in one group (study group), while the heads of neonates in the other group (control group) were not covered and were exposed. Sex, weight, serum total bilirubin level, and serum calcium level were documented before starting photo-therapy. Full blood count and reticulocyte count ruled out hemolytic anaemia, and C-reactive protein ruled out sepsis. Photo-therapy with four 40-watt blue lamps with a wave length of 420-470 nanometers was started on a regular basis. The neonate was held at a 40-centimeter distance from the lamps. The serum calcium level were measured 48 hours post initiation of photo-therapy. SPSS version 2.0 was used to evaluate the data collected. For qualitative variables like gender and the frequency of hypocalcemia, as well as quantitative variables like age, calcium, and bilirubin levels, frequencies and percentages were determined. Stratification was used to regulate effect

modifiers such as age and gender. The chi-square test was used after stratification. A p-value of less than 0.05 was considered significant.

Operational definitions: Neonate: Age range: 0 to 28 days. Hypo-calcemia is a condition in which the body's calcium levels are low Total serum calcium 1.9 mmol/L in neonates aged 0-10 days, and total serum calcium 2.25 mmol/L in neonates aged >10 days, estimated 48 hours after photo-therapy commencement. Hyper-bilirubinemia was defined as serum total bilirubin levels of >188mol/L on day one, >257mol/L on day two, >306mol/L on day three, and >342mol/L on day four.

RESULTS

A total of 208 term neonates with hyper-bilirubinemia were included in this study. Male neonates made up 45 percent of the total, while female neonates made up 55 percent. Their average age was 5.56 ±2.78 days, and their average weight was 3.02±0.58 kilograms. The demographic data in both groups was identical, as shown in table I.

Table-I: Demographic data of patients

Gender	Control	Study
Male	44	50
Female	60	54
Age (Days)	4.38 ± 1.42	5.56 ± 2.78
Weight (Kg)	2.50 ± 0.70	3.04 ± 0.58

The mean serum total bilirubin level in all neonates was 381.32 ±45.31 mmol/L before photo-therapy, and 268.29 ± 46.46 mmol/L after 48 hours of photo-therapy. Before and after photo-therapy, the levels in the control group were 379.21 ± 43.4 mmol/L and 266.60 ±48.38 mmol/L, respectively. Before and after photo-therapy, the study group had 382.45 ±48.60 mmol/L and 270.43 ±45.48 mmol/L, respectively.

Table-II: Frequency of hypocalcemia after photo-therapy

Hypo-calcemia	Control	Study	p-value
Occurred	28 (27 %)	16 (15 %)	
Not occurred	76 (73 %)	88 (85 %)	0.2

Similarly, before starting photo-therapy, all neonates' mean serum calcium was 2.40 ±0.28 mmol/L, and after 48 hours, it was 2.08 ±0.28 mmol/L. Before and after photo-therapy, the levels in the control group were 2.36 ±0.28 mmol/L and 1.48 ±0.24 mmol/L, respectively. In the study group, it was 2.46 ±0.24 mmol/L before photo-therapy and 2.18 ±0.26 mmol/L after photo-therapy, respectively. In both groups, serum calcium levels decreased, but the decrease in serum calcium levels was greater in the control group.

Table-III: Stratification of hypocalcemia with or without covering the head with respect to age

Age Group	Hypo-calcemia	Control	Study	Total	p-value
<3 days	Yes	6	2	8	0.2
	No	20	26	46	
>3 days	Yes	22	14	36	0.3
	No	56	62	118	
Total		104	104	208	

Out of 208 neonates, 44 (21%) had hypocalcemia. There was no symptomatic hypo-calcemia in any of the newborns. Hypocalcemia found in 28 neonates in the control group and 16 neonates in the study group. Table II provides more details. Tables III and IV demonstrate the age and gender stratification of hypocalcemia with and without head covering.

Table-IV: Stratification of hypocalcemia with or without covering the head with respect to Gender

Age Group	Hypo-calcemia	Control	Study	Total	p-value
Male	Yes	10	10	20	0.8
	No	34	40	74	
Female	Yes	18	6	24	0.08
	No	42	48	90	
Total		104	104	208	

DISCUSSION:

Phototherapy is a relatively safe and effective way to lower bilirubin levels in newborns with jaundice. However, complications such as hypocalcemia may occur. Hypocalcemia may also be accompanied by jitteriness, irritability, and lethargy. The neonates in the control group received photo-therapy in the traditional manner. Hypocalcemia affected 27% of neonates, but they were asymptomatic[15]. In term neonates, a study published in 2015 found similar findings.After photo-therapy, 30% of term neonates experienced hypocalcemia, according to the report. A higher percentage of neonates experienced hypocalcemia and were symptomatic in a few other trials. Hypocalcemia in neonates undergoing photo-therapy was studied in a research conducted in India. According to the findings, 67 percent of neonates experienced hypocalcemia, with 81 percent of hypocalcemic neonates being symptomatic[16]. Similarly, after photo-therapy, 66 percent of term neonates experienced hypocalcemia, according to another study.

However, a small number of studies claim that photo-therapy has no effect on calcium levels in neonates with hyper-bilirubinemia. There have been a few experiments in which the head was covered to minimize the sensitivity of the pineal gland to photo-therapy, resulting in lower hypocalcemia. When neonates' heads were covered, they experienced a substantial decrease in hypocalcemia. In Egypt, an analysis involving 124 neonates was carried out. They found that 24 % of neonates in the group without hats and 9.7% of neonates in the hat group experienced hypocalcemia[17].After 48 hours of photo-therapy, 24% of term neonates with exposed heads and 11% of term neonates with covered heads experienced hypocalcemia, according to another study conducted in Egypt.

In a related study from Iran, 72 full-term newborns were included. According to their findings, 39% of neonates with an exposed head and 14% of neonates with a covered head experienced hypocalcemia. Hypocalcemia found in 27% of the neonates in our sample who had their heads exposed. This percentage is close to that found in Egyptian studies, but lower than that found in Iranian studies[18]. Fifteen percent (15%) of the neonates in our sample who had their heads covered developed hypocalcemia. This result is similar to that of an Iranian study, but it is higher than that of an Egyptian study. Despite the fact that our research showed a reduction in hypocalcemia by covering the heads of neonates, our

findings were statistically insignificant in comparison to all of the previous studies that had shown substantial results. Another research in Iran found that covering the heads of icteric preterm infants during photo-therapy reduced hypocalcemia significantly. In this sample, the control group had hypocalcemia in 53% of the babies, while the head covered group in just 6% of the neonates.

Another Iranian research found that covering the heads of neonates during photo-therapy reduced hypocalcemia significantly[19]. According to the t-test, the difference between the two classes was important (p=0.03). During the analysis, we encountered a few limitations. To ensure that the neonates' heads were protected at all times during phototherapy, even during feeding, close contact with them was needed. Observing symptomatic hypocalcemia necessitates close supervision. However, due to a staffing crisis, this was not always possible. The research was carried out in a single centre with a limited sample size. To better understand the importance of head covering, further research should be performed in several centers with a broad sample size.

CONCLUSION

Many studies have shown that phototherapy causes hypocalcemia, and a few studies have shown a substantial reduction in hypocalcemia when the neonate's head is covered. While our analysis found that head covering reduced hypocalcemia, the results were statistically insignificant. To assess the exact importance of this intervention, more broad studies should be performed. If significant, it is a simple and inexpensive way to prevent hypo-calcemia in neonates undergoing photo-therapy.

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