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Comparative Study of Efficacy of Head Cap Versus Calcium Supplementation in Preventing Phototherapy Induced Hypocalcemia in Neonates

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Abstract

Context: Phototherapy treatment for hyperbilirubinemia in neonates may result in development of hypocalcaemia. The study is done to assess role of calcium prophylaxis and head cap in the prevention of phototherapy induced hypocalcemia. *Aims:* To compare the efficacy of head cap versus calcium supplementation in preventing phototherapy induced hypocalcemia. *Settings and Design:* Prospective study undertaken in NICU at JSS Hospital, Mysuru from January 2013 to June 2014. *Methods and Material:* This study was conducted on 150 full term neonates (50 in each group: Group A - only phototherapy, Group B - phototherapy receiving oral calcium prophylaxis, Group C - phototherapy with head cap). Serum ionized calcium levels were measured before and after phototherapy. *Statistical analysis used:* Statistical analysis done by SPSS software 19.0 version. *Results:* In control group (Group A), 28 (58.3%) neonates showed decrease in serum ionized calcium levels following phototherapy out of which, 11 (22.9%) developed hypocalcemia. Mean serum ionized calcium levels before phototherapy was 1.193 mmol/L and after phototherapy 1.06 mmol/L. In group Group B, 27 (56.3%) showed a decrease in serum ionized calcium levels following phototherapy of which, three (6.3%) developed hypocalcemia. The mean serum ionized calcium levels before phototherapy was 1.219 mmol/L and after phototherapy 1.172 mmol/L. In Group C, 30 (62.5%) neonates showed a decrease in serum ionized calcium levels following phototherapy of which, nine (18.8%) developed hypocalcemia. Mean serum ionized calcium levels before phototherapy was 1.25 mmol/L and after phototherapy, it was 1.14 mmol/L. None of the neonates in all group who showed a drop in serum ionized calcium levels below one mmol/L developed any signs of hypocalcemia. *Conclusions:* Neonates under phototherapy can develop hypocalcemia as a complication. Oral calcium supplementation to neonates under phototherapy would be beneficial in preventing phototherapy induced hypocalcemia.

Keywords: Hyperbilirubinemia; Phototherapy; Ionized Calcium; Hypocalcemia; Head Cap.

Introduction

Phototherapy is a safe and effective modality of treatment for neonatal hyperbilirubinemia. Adverse effects include loose stools, hyperthermia, dehydration fluid loss, skin burn, photoretinitis, low platelet count, increased red cell osmotic fragility, bronze baby syndrome, riboflavin deficiency and DNA damage [1]. A lesser known side effect, but potential complication of phototherapy is hypocalcemia [2].

There are few studies on hypocalcemic effect

of phototherapy with controversial results and even fewer studies on the role of calcium therapy and head cap in the prevention of phototherapy induced hypocalcemia, hence this study was done.

Materials and Methods

After obtaining ethical clearance from the institution, this comparative prospective study was undertaken in NICU at JSS Hospital, Mysuru from January 2013 to June 2014. Full term neonates weighing more than 2.5 kgs with unconjugated hyperbilirubinemia requiring phototherapy were included. Neonates who were preterm, post-term, with jaundice in first 24 hours of life, infant born to diabetic mother, with birth asphyxia, mother on anti-convulsants, with previous exchange transfusion, septic were excluded. After written informed consent, 150 full term neonates with unconjugated hyperbilirubinemia requiring phototherapy were included in the study. Six neonates had hypocalcemia before starting phototherapy and were not continued in the study. 144 children continued in the study and they were consecutively allotted into the following three categories with each group comprising of 48 neonates. Neonates in Group A were subjected to phototherapy only. Neonates in Group B were supplemented with oral calcium (with cardiac monitoring) during phototherapy. Neonates in Group C were provided with cotton caps covering their head and occiput during phototherapy. Serum ionized calcium levels measured before and at 48 hours of phototherapy or at the end of phototherapy in case the duration of phototherapy was less than 48 hours. All neonates were subjected to double surface phototherapy which was based on the american academy of pediatrics subcommittee 2004 guidelines for management of hyperbilirubinemia in the newborn infant 35 or more weeks of gestation. All statistical measurements are done using SPSS software 19.0 version. The following statistical methods were employed in the present study. Chi-square test, contingency table analysis, one-way ANOVA, and 't' test - independent samples.

Results

The mean gestational age was 38.5 wks, 38.60 wks, 38.51 wks in group A, B and C respectively. There were 29 males and 19 females in group A, 26 males and 22 females in group B and 25 male and 23 female in group C. Mean serum bilirubin was 20.16, 19.86 and 19.18 mg/dl in group A, B and C respectively before phototherapy and mean duration of phototherapy was 34.58 hrs, 35.83 hrs and 36.5 hrs in group A, B and C as shown in table 1. The mean serum ionic calcium level was 1.193, 1.219 and 1.25 mmol/l before initiation of phototherapy in group A, B and C and following phototherapy fall in mean serum ionic calcium was 0.132, 0.046 and 0.093 mmol/l respectively which was statistically significant. Eleven neonates in group A, three neonates in group B and nine neonates in group C developed hypocalcemia following phototherapy but none of the neonates developed signs and symptoms of hypocalcemia. The fall in serum ionic calcium was statistically significant as shown in table 2.

Table 1: Results of mean gestational age, mean serum bilirubin, mean weight and mean duration of phototherapy in three groups.

Groups	Mean Gestational Age	Mean Serum Bilirubin	Mean Weight	Mean Hours of Phototherapy
Control	38.51 ± 1.10	20.16 ± 2.3	2.99 ± 0.25 kg	34.58 ± 9.1
Calcium supplementation	38.66 ± 1.14	19.86 ± 2.6	2.85 ± 0.24kg	35.83 ± 9.0
Head cap	38.51 ± 1.00	19.18 ± 3.3	2.81 ± 0.23kg	36.50 ± 8.9

Table 2: Mean serum ionized calcium before and after phototherapy.

Groups	Mean calcium before PT*	Mean calcium after PT	Mean fall in calcium after PT	P value	No of Hypocalcemia
Control	1.193±0.093	1.06±0.30	0.132	0.002	11
Calcium supplementation	1.219±0.098	1.172±0.153	0.046	0.048	3
Head cap	1.250±0.09	1.14±0.24	0.093	0.001	9

*PT - Phototherapy

Discussion

Neonatal hypocalcemia is defined as ionized calcium less than less than 4.8 mg/dL (1.2 mmol/L ionic) in term neonates [3]. Phototherapy is not without potential adverse effects, one of them being hypocalcemia. Hypocalcaemia has been reported as a reaction to phototherapy in premature and full-term newborns [4,5].

In the present study, mean serum ionized calcium levels in the control group before phototherapy was 1.193 ± 0.106 mmol/L and after phototherapy it was 1.06 ± 0.30 mmol/L (p=0.002). This is comparable to the one study [1] where the mean serum ionized calcium levels in neonates under phototherapy was 1.196 ± 0.0548 before and 0.98 ± 0.1426 after phototherapy (p<0.005) which is statistically significant. Similar observations were documented by one study [6], in which 60 neonates were subjected to phototherapy and a significant fall in both total and serum ionized calcium levels was observed in 90% following phototherapy. There is large variations in the incidence of hypocalcemia following phototherapy in different studies [1,5,6,7] ranging from 7 to 66%, however in present study 11 out of 48 neonates in control group (22.9%) developed hypocalcemia.

In group B who were provided with oral calcium supplementation during the course of phototherapy, only three (6.3%) developed hypocalcemia but none of these neonates were symptomatic which is similar to two studies [8,9] where as other studies [10] showed features of hypocalcemia in the form of irritability and jitteriness. Our study shows that supplementation of oral calcium during phototherapy reduces incidence of hypocalcemia similar to other studies [6,10].

In group C, nine out of 48 (18.8%) neonates with protective head cap during phototherapy developed hypocalcemia and none were symptomatic which is consistent with the two studies [7,8]. Though two studies have shown that covering the head of the neonate during phototherapy can prevent hypocalcemia [5,10], the present study did not show similar results.

The duration of phototherapy in present study was 48 hrs similar to other studies [1,8,9]. In the present study serum ionized calcium levels were measured before and after stopping phototherapy where as other studies [4,7,10] study serum calcium levels were measured after 24 hours or 48 hrs of discontinuation of phototherapy. There was no correlation between hypocalcemia and serum bilirubin level similar to the observation made by other study [7]. Several studies have suggested the use of calcium prophylaxis and head cap in the prevention of phototherapy induced hypocalcemia [4,6,9,10]. The limitation of the study was allocation of neonates into groups was done consecutively. The strength of the study was serum ionic calcium was measured rather than serum calcium levels.

Conclusion

Oral calcium supplementation during phototherapy reduces chances of developing phototherapy induced hypocalcemia as compared to those neonates who were protected with head cap during phototherapy. Hypocalcemia can occur as a complication following phototherapy in neonates.

Key Messages

Neonates under phototherapy can develop hypocalcemia as a complication following phototherapy. Oral calcium supplementation to neonates under phototherapy would be beneficial in preventing phototherapy induced hypocalcemia.

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Conflict of Interest: Nil

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