THE OUTCOME OF PHOTO-THERAPY ON SERUM CALCIUM VALUES IN TERM NEONATES: A CROSS SECTIONAL STUDY

Abstract:

Background*: In the management of hyperbilirubinemia in neonates, phototherapy is an important treatment modality. Photo-therapy can cause skin rashes, diarrhoea, increase in body temperature, retinal damage and bronze baby syndrome. Photo-therapy is thought to influence serum calcium levels by inhibiting pineal melatonin secretion.*

Aims & objectives*: The aim of this research was to see how photo-therapy affected serum calcium values in a term neonate.*

Material & methods*: Over the course of six months, 74 neonates were studied in the neonatology department of a tertiary healthcare centre in Central India.*

Results*: Calcium values fell in 77 % of the neonates in our sample, but only one case fell into significant symptomatic hypocalcemic range (1 percent).*

Conclusion*: According to the findings, neonates who are receiving photo-therapy have a higher risk of falling into the hypocalemic range. As a result, neonates should be strictly observed for calcium shifts and treated appropriately.*

Key Words*: Photo-therapy, Serum Calcium Values, Term Neonate.*

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INTRODUCTION

Jaundice is a significant issue in neonates. Elevated bilirubin can be possibly harmful to the developing central nervous system and can result in permanent neurological damage[1,2]. In the first week of life, about 60% of term neonates and 80% of pre-term neonates become noticeably jaundiced[3]. In the vast majority of subjects, there is no need for management. Around 5–10% of them have clinically relevant hyper-bilirubinemia, for which photo-therapy is needed.

The key cause of neonatal hyper-bilirubinemia is the immaturity of liver's bilirubin excretory pathway, which is the most common explanation for repeat admission of

neonates in the first week of existence in today's post-natal discharge period[4,5]. The presence of jaundice in neonates is a source of worry for both parents and neonatologists. Raised values of unconjugated bilirubin can cause bilirubin encephalopathy and, in turn, kernicterus, which can result in devastating, long-term neuro-developmental disabilities[6]. Conjugated hyper-bilirubinemia suggests the existence of potentially severe hepatic or systemic diseases.

As a consequence, careful management of neonatal hyper-bilirubinemia is important. The management modalities are photo-therapy and exchange transfusion. In the management of hyper-bilirubinemia in neonates, phototherapy is very important[7,8]. Photo-therapy can cause skin rashes, diarrhoea, elevation in body temperature, retinal degenerations and bronze baby syndrome[9,10]. Phototherapy is thought to block the influence of cortisol on bone calcium by inhibiting pineal melatonin secretion. Apnea, seizures, jitteriness, irritability, raised extensor tone, hyper-reflexia, and stridor are common symptoms of hypocalcemia.

AIMS & OBJECTIVES: The aim of this study was to see how photo-therapy affects serum calcium values in term neonates who need it according to standard guidelines.

MATERIAL AND METHODS:

The present study was conducted in the Dept. of Neonatology at Jawaharlal Nehru Medical College Sawangi (Meghe), Wardha. The study included term neonates admitted to the neonatal intensive care unit with hyper-bilirubinemia who complied with the inclusion and exclusion requirements. Neonates having the following were not included in the study: Jaundice in first 24 hrs of life, birth asphyxia, Neonatal sepsis, Jaundice longer than fourteen days, and neonates that had exchange transfusions or were on Total Parenteral Nutrition. A sample size of 74 was estimated using the following assumptions: form 1 error likelihood of 0.05, power of 0.8, paired difference to be observed of 0.2, and predicted SD of difference from previous research of 0.8. If necessary, sepsis testing was performed. Calcium was repeated after 48 hours of initiation of phototherapy. The blood samples were taken under aseptic conditions by doctors & were examined within 15 minutes of being drawn.

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Bilirubin Measurement: The Diazo approach is used to evaluate complete and direct bilirubin (Diazotized sulfanilic test). In the presence of ethylene-glycol and dimethyl sulfoxide, bilirubin reacts with diazotized sulfanilic acid to create azo-bilirubin, an intensely coloured diazo dye. The colour intensity is proportional to the amount of bilirubin present.

Calcium measurement: The Arsenazo III method is used to assess calcium values. Principle: At pH 6.5, arsenazoIII combines with calcium ions to form a coloured chromophore with a 650 nm absorbance that is proportional to calcium concentration. A semi-automated analyser, ERBA Chem, was used to calculate both calcium and bilirubin. Within 15 minutes of drawing blood, the sample was immediately analysed.

RESULTS

Table 1: Comparison of calcium levels in the blood (n =74)

Time point	Average	Standard Deviation	Average Difference	SD Difference	Percentage of change	Z value	P value
Before Phototherapy	9.84	0.26	0.33	0.40	3.24	8.6	0.000
After Phototherapy	9.24	0.33				2	1

(UNIT – mg/dl)

Before and after phototherapy, the average SD of calcium was 9.84 ± 0.26 mg/dl and 9.24 ± 0.34 mg/dl, respectively, with a significant p value (0.05).

Table 2: Changes in calcium values after photo-therapy (n = 74)

Type of variation	Neonates	Percentage
Reduced	57	77 %
Raised	14	20 %
No Change	3	3 %

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Calcium values dropped in 77 percent of the neonates in our sample, but only one case (1 percent) was symptomatic and had a substantial fall to symptomatic hypocalcemia range.

Table 3: Comparison of reduction in calcium level with age(n =74)

Age	Decrease		Total
	Present	Absent	
< 3 DAYS	22	10	32
>3 DAYS	35	7	42
Total	57	17	74

The chi-square statistics is 3.4, with p value being 0.06, i.e. insignificant. The decrease in calcium was not related to age of the newborn.

Table 4: Comparison of decrease in calcium with gender of neonates (n=74)

Gender	Decrease		Total
	Present	Absent	
Males	31	10	41
Females	26	7	33
Total	57	17	74

The chi-square statistics is 0.03, with p value being 0.42, i.e. insignificant. The decrease in calcium was not related to sex of the newborn.

Table 5: Neonates with clinical presentation of hypocalcemia (n=1)

Clinical Features	No of subjects	Percentage
Irritability	1	100 %
Jitteriness	1	100%

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Irritability (100%) and jitteriness were the most common symptoms in our sample that indicated hypocalcemia (100 percent). There were no other signs or symptoms, such as lethargy or apnea. One child who had convulsions and was given IV calcium was disqualified from this study.

DISCUSSION

In our study, we found that only 77% neonate were hypocalcemic after photo-therapy. In contrast to our findings, other studies found higher rates of hypocalcemia in term neonates, such as 7% (10) in Taheri et al[7], 9% (9) in Gheshmi et al[8], and 67 percent (16) in Prabhakar et al[9]. Hypocalcemia was more common in both preterm and term research groups in researches like Karamifar et al[10] (9 % and 23 % in term and pre-term respectively), Yadav et al[1] (67 % and 80 % in term and pre-term respectively), and Arora et al[11] (56 % and 43 % in term and pre-term respectively).The higher frequency of hypocalcemia in these researches can be attributed to the hypocalcemia cut-off value of 8 mg/dl in term neonates, as opposed to our research, which used a cut-off of 7 mg/dl in term neonates.

Hypocalcemia prevalence was elevated only in Yadav et al[1], despite a cut-off of 7 mg/dl; this possibly explained by Yadav et al smaller sample size. The occurrence of Hypocalcemia, or a drop in serum calcium values after photo-therapy, was unaffected by the neonate's gender, weight, or age. In our study, the average serum calcium before and after photo-therapy was 9.84 mg/dl ± 0.26 and 9.24 mg/dl ± 0.33, respectively, and the difference was significant with a p value of 0.0001, which was similar to other studies such as Eghbalian et al[12], where the average calcium was 9.85 ± 1.23 and 9.09 ± 0.93 before and after photo-therapy with a significant p value, and also researches like Karamifar et al[10] and Taheri et al[7], where the average calcium was 9. In our sample, one hypo-calcemic neonate was extremely irritable (100%) and jittery.Photo-therapy can be the primary cause of irritability. Yadav et al[1], Jain et al[12], and Arora et al[11] all documented symptomatic Hypo-calcemia.

According to Jain et al[12], 50 percent of hypo-calcemic term neonates were jittery and 16.7% were irritable. According to Yadav et al[1], eight hypo-calcemic term neonates were

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symptomatic, with three (30%) experiencing jitteriness, twenty percent experiencing irritability, and three (30%) experiencing lethargy but no convulsions. Symptomatic Hypo-calcemia, such as jitteriness, was observed in 3 (10%) term neonates and 1 preterm(4%) neonates by Arora et al[11].

CONCLUSION

According to the results, neonates who are undergoing photo-therapy have a higher risk of dropping into the hypo-calcemic range of serum calcium values. Hypocalcemia increases the permeability of cells to sodium ions and the excitability of cell membranes. Apnea, seizure, jitteriness, raised extensor tone, clonus, hyperreflexia, and stridor are common symptoms. As a result, neonates should be closely observed for calcium shifts and treated accordingly. Calcium values should be verified in neonates that have been exposed to photo-therapy for more than 48 hours and handled accordingly.

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