



Hypocalcemia in jaundiced neonates receiving phototherapy

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DEDICATION:-

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AIM OF STUDY

To determine the frequency of hypocalcemia in term and preterm neonates with jaundice receiving phototherapy.

INTRODUCTION

Jaundice is a common cause of morbidity encountered in neonates, mainly in the first week of life. It is an utmost concern for physicians and source of anxiety for parents.⁽¹⁾ Jaundice in newborns occurs when the level of bilirubin rises more than 5-6 mg/dl. It is observed in 60% of term and 80% of preterm neonates.⁽²⁾ In majority of cases, it is benign and no intervention is required. Approximately 5-10% of them have clinically significant jaundice that requires treatment.⁽³⁾ High bilirubin level may be toxic to the developing central nervous system and may elicit neurological impairment.⁽⁴⁾ Phototherapy is one of the modalities for management of hyperbilirubinemia in neonates which is convenient and readily available.⁽⁵⁾ Phototherapy may lead to various complications including skin rashes, diarrhea, hyperthermia, dehydration, retinal degeneration, bronze baby syndrome especially in cholestatic jaundice, opening of patent ductus arteriosus in low birth weight neonates and hypocalcemia.⁽⁶⁾ Neonatal hypocalcaemia is defined as total serum calcium concentration < 7 mg/dl or ionized calcium concentration < 4mg/ dl. Ionized calcium is crucial for many biochemical processes, including blood coagulation, neuromuscular excitability, and cellular enzymatic activities.⁽⁷⁾ The overall prevalence of hypocalcaemia in neonates receiving phototherapy was 8.7% in full-term newborns.⁽¹⁾ In another investigation, 90% of the preterm and 75% of term neonates experienced hypocalcaemia after phototherapy.⁽⁸⁾ Hypocalcaemia can cause serious manifestations like convulsions, apnea, laryngospasm, irritability, and jitteriness.⁽⁹⁾ Hence, phototherapy-induced hypocalcaemia can be a significant problem. This study was undertaken to determine hypocalcaemia, in neonates receiving phototherapy, by measuring serum calcium levels.

METHODS

The cross sectional study was carried out in the Neonatal Intensive Care Unit (NICU) and wards of Bint Alhuda teaching hospital. Study included 50 neonates who were admitted for phototherapy. Selection of cases was done by convenient sampling method. Neonates were divided in two groups- preterm and term. Informed consent was taken from their parents/guardians. Complete history and thorough physical examination was carried out in all the cases. Serum calcium was measured at initiation of phototherapy and 24 hours after completion of phototherapy. Neonates with jaundice requiring exchange transfusion, birth asphyxia, sepsis, and conjugated hyperbilirubinemia, infants of diabetic mother and with congenital anomalies were excluded from the study.

RESULTS

In the study, 50 neonates admitted in NICU for phototherapy were evaluated for hypocalcaemia. Among them 25(50%) were preterms and terms were 25(50%). Male newborns were 28(56%) and 22(44%) were females. Most of the neonates were exclusively breastfed 23(46%), 11(22%) of them were under lactogen feeding because of inadequate milk let down in mothers, and rest 16(32%) were under mixed feeding (mother's milk and lactogen).

	Preterm (Mean±SD) (n=25)	Term (Mean±SD) (n=25)	p-value
Serum calcium before phototherapy (mg/dl)	8.42±0.9	9.90±3.1	<0.01
Serum calcium after phototherapy (mg/dl)	8.12±3.4	8.73±4.2	<0.01

Table I: Comparison of serum calcium level before and after phototherapy

Frequency of hypocalcaemia after phototherapy was 20% and 32% in preterms and terms respectively. Mean serum calcium level before and after phototherapy was 8.42±0.9 mg/dl and 8.12±3.4 mg/dl in preterms, whereas it was 9.90±3.1 mg/ dl and 8.73±4.2 mg/dl in term neonates. Statistical analysis showed hypocalcaemia was significant in both the groups, preterms and terms (p<0.01) (Table I).

Total serum calcium level (mg/dl)	Before Phototherapy (n=50)		After Phototherapy (n=50)		p- value
	Mean	SD	Mean	SD	
	9.1	2.3	8.9	3.8	<0.01

Table II: Change in serum calcium level with phototherapy

In the present study, there was a significant decrease in serum calcium levels after phototherapy ($p < 0.01$). The mean values of serum calcium before and after phototherapy were 9.1 ± 2.3 mg/dl and 8.9 ± 3.8 mg/dl respectively (Table II). Of the 50 neonates in the study, 13(26%) showed hypocalcaemia after phototherapy; among those 13 neonates, 56% developed hypocalcaemia symptoms; 18% developed irritability/excitability, 38% developed jitteriness and none of them developed convulsions

DISCUSSION

Neonatal jaundice is a frequent cause of morbidity in newborns worldwide and significant cause of hospitalization, mainly in the first week.⁽¹⁾ Efficacy of phototherapy in treatment of hyperbilirubinemia in newborns has been well established. The efforts made around the globe recognize it as a potential complication with variable results, some showing severe hypocalcemia.⁽⁷⁾ Romagnoli et al. was the first to suggest the association of hypocalcaemia in a newborn following phototherapy.⁽¹¹⁾ Abrams SA hypothesized that phototherapy inhibits pineal secretion of melatonin which blocks the effect of cortisol on bone calcium. Cortisol unchecked exerts a direct hypocalcaemia effect and increases bone uptake of calcium as well.⁽¹²⁾ In a study by Khan et al. there were 62.6% males and 37.4% females.¹ Also in a study by Iran there were 49% female neonates and 51% were males.⁽¹³⁾ Observation in our study is similar to the above studies where number of male neonates is higher than that of females. Yadav et al observed that 66% of term and 80% of preterms developed hypocalcaemia after phototherapy.⁽⁷⁾ Sethi et al. reported that 90% of preterm neonates and 75% of full-term neonates developed hypocalcaemia after being subjected to phototherapy.⁸ This is in contrast to the present study where terms were 50% and preterms were also 50%. The selection method being convenient sampling method is attributed for this contrast. In the present study, mean serum calcium level before and after phototherapy was $8.42 \pm 0.9 \text{ mg/dl}$ and $8.12 \pm 3.4 \text{ mg/dl}$ respectively in preterms, whereas it was $9.90 \pm 3.1 \text{ mg/dl}$ and $8.73 \pm 4.2 \text{ mg/dl}$ respectively in term neonates. Statistical analysis showed hypocalcaemia was significant in both the groups, preterms and terms ($p < 0.01$). Similar to the study by Shrivastava J et al. where the serum calcium level before and after phototherapy in preterm babies was $8.82 \pm 0.59 \text{ mg/dl}$ and $6.64 \pm 1.03 \text{ mg/dl}$ respectively, whereas in term neonates it was $9.32 \pm 0.99 \text{ mg/dl}$ and $7.58 \pm 0.83 \text{ mg/dl}$ respectively. Hypocalcaemia after phototherapy was statistically significant ($p < 0.001$).¹⁴ Also in a study by Singh PK et al. the mean serum calcium level in the preterm neonates before and after phototherapy was $8.41 \text{ mg/dl} \pm 0.466$ and $7.1 \text{ mg/dl} \pm 0.793$ respectively. In term neonates the mean serum calcium level was $9.52 \text{ mg/dl} \pm 0.53$ and $8.42 \text{ mg/dl} \pm 1.1$ respectively. Change in calcium level was statistically significant ($p < 0.05$).⁽¹⁵⁾ In a study by Goyal S et al. mean serum calcium levels before phototherapy was $9.14 \pm 0.78 \text{ mg/dl}$ and it reduced to $8.53 \pm 0.77 \text{ mg/dl}$ after phototherapy. The reduction was statistically significant ($p < 0.001$).⁽¹⁶⁾ Alizadeh TP et al. in their study found the mean serum calcium levels before and after

phototherapy were 9.8 ± 0.8 mg/dl and 9.5 ± 0.9 mg/dl respectively. The difference in serum calcium level before and after phototherapy was statistically significant ($p=0.03$).⁽¹³⁾ Similar to the present study where mean values of serum calcium before and after phototherapy were 9.1 ± 2.3 mg/dl and 8.9 ± 3.8 mg/dl respectively. Also there was a significant decrease in serum calcium levels after phototherapy ($p < 0.01$). In the present study, 13 out of 50 neonates showed hypocalcaemia after phototherapy. Among them 56% were symptomatic; 38% developed jitteriness, 18% developed irritability/excitability, and none of them developed convulsions. Similar to the study by India . where 30% of hypocalcaemia neonates developed jitteriness, 20% developed irritability/excitability, 30% developed letharginess and none of the neonate developed convulsions.⁽⁷⁾ In a study done by India et al. 63.6% of hypocalcaemia preterm newborns had jitteriness and 27.3% had irritability whereas 50% of hypocalcaemia term neonates had jitteriness and 16.7% were irritable.

LIMITATIONS

Duration of phototherapy is not constant for all the neonates which might have affected the results. In the same manner, age at initiation of phototherapy is also not same in all cases, there might be exaggeration of physiological hypocalcaemia in some neonates. Also the number of cases taken in the current study is small, larger case number would have given more precise and more reliable results.

CONCLUSION

Phototherapy induced hypocalcaemia is a significant finding in neonates with jaundice. Therefore, estimation of calcium levels before and after phototherapy and close monitoring of neonates for signs of hypocalcaemia should be done as well as treated accordingly. A universal recommendation of calcium supplementation in neonates undergoing phototherapy is yet to be established but seems reasonable taking into account the evidence in various studies.

RECOMMENDATION

Since most infants with early-onset hypocalcemia are usually asymptomatic, serum, preferably ionized, calcium should be measured in infants having risk factors for hypocalcemia. Preterm infants with a gestational age <32 weeks, infants of diabetic mothers, and infants with severe prenatal asphyxia and a 1 min Apgar score of <4 who are at risk for hypocalcemia should be screened at 24 and 48 h after birth . For infants with an extremely low birth weight (birth weight <1000 g), calcium levels should be measured at 12, 24, and 48 h of birth. For preterm infants with a birth weight of 1000–1500 g, calcium level is measured at 24 and 48 h of birth. Monitoring of calcium levels should continue until values return to normal and calcium intake is adequate.

Hypocalcemia in jaundiced neonates receiving phototherapy

Name :

Age :

Gender :

Address :

Date of admission :

	Blood group and Rh	History of maternal diabetes	S.calcium before phototherapy	S.calcium after phototherapy
Term				
Preterm				

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