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STUDY ON CHANGES IN SERUM SODIUM AND POTASSIUM IN TERM NEONATES RECEIVING PHOTOTHERAPY

Pediatrics

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ABSTRACT

Introduction: Hyperbilirubinemia is one of the most common problems occurring in the neonatal period. Phototherapy plays a major role in its treatment. However, this treatment modality may itself result in complications which even contribute to the development of convulsions. Hence this study was carried out with the objective of evaluating the sodium and potassium changes in neonates receiving phototherapy for neonatal Hyperbilirubinemia.

Methods : A prospective hospital based observational study conducted on 74 term neonates admitted in the neonatal intensive care unit(NICU) receiving phototherapy at, Nalanda Medical College and Hospital, Patna, Bihar from June 1st to December 31 st 2018. From the neonates mother informed consent and written consent has been taken after explaining about the study. The medical history of the neonate is obtained from the neonates mother. General examination and systemic examination of the neonate are carried out. Serum bilirubin, sodium and potassium were determined before and after completion of phototherapy. A comparative study was done between before and after phototherapy groups to determine the incidence of sodium and potassium changes.

Results: The study group included 74 term neonates that were managed with phototherapy. Incidence of low birth weight babies was 31 (41.89%). Mean duration of phototherapy was 38.48±09.34 hours. The incidence of Sodium and potassium changes were found to be statistically significant after phototherapy ($p<0.01$) but neonates didn't develop any signs of hyponatremia and hypokalemia.

Conclusion: Babies receiving phototherapy can develop imbalances in sodium and potassium which were caused by inadequate replacements of fluids.

KEYWORDS

Hyperbilirubinemia , Phototherapy , newborn, Potassium, Sodium, term.

INTRODUCTION

Neonatal jaundice may be recognized in about 60% of infants born at full-term during first week of life [1]. In the first week of life, jaundice is usually unconjugated. Neonatal jaundice can be either physiological or pathological. Elevated levels of unconjugated bilirubin can lead to bilirubin encephalopathy and subsequently kernicterus, with devastating permanent neurodevelopment abnormality [2]. Conjugated hyperbilirubinemia indicates potentially serious intrahepatic or extrahepatic disorders or even systemic illnesses. Phototherapy and or exchange transfusion plays a significant role in treatment of hyperbilirubinemia. As any treatment has its side effects, phototherapy also has known adverse effects like hyperthermia in summer and hypothermia in winter, feed intolerance, loose stools, skin rashes, bronze baby syndrome, retinal changes, dehydration, hypocalcemia, redistribution of blood flow and genotoxicity[3]. Unlike other side effects a very few studies are currently available that depicts the adverse effects of phototherapy on serum sodium and potassium. So we aimed to study the serum sodium and potassium changes due to phototherapy.

METHODS

A prospective hospital based observational study conducted on 74 term neonates admitted in the neonatal intensive care unit(NICU), Nalanda Medical College and Hospital, Patna ,Bihar from June 1st to December 31 st 2018 receiving phototherapy. From the neonates mother informed consent and written consent has been obtained after explaining about the study. Complete maternal history was taken and maternal risk factors like hypertension, diabetes mellitus, oligohydramnios, anemia, epilepsy, fever, any rash, any drug intake during pregnancy other than iron and folic acid supplementation were ruled out. The medical history of the neonate is obtained from the neonates mother. General examination and systemic examination of the neonate are carried out. Neonates included in the study was those who have been receiving phototherapy for jaundice. Serum bilirubin, sodium and potassium were determined before and after completion of phototherapy. The first samples were considered as controls. A comparative study was made between before and after phototherapy groups to determine the incidence of sodium and potassium changes.

Demographic and clinical variables were recorded. It included birth weight, sex, gestational age, mode of delivery, age of appearance of icterus, maternal blood group and Rh status, baby blood group and Rh status, anthropometric measurements (weight, length and head circumference) of infant at the time of admission and duration of phototherapy.

Total and indirect serum bilirubin, serum sodium and potassium were checked at 0 hour (first sample) and at 48 hours of phototherapy or at discontinuation of phototherapy (second sample) whichever is earlier were recorded. The first sample was considered as control. Venous blood samples were collected from the neonates and sent for total bilirubin, indirect bilirubin, electrolytes, and blood group. Total and indirect bilirubin is measured by Diazo method: electrolytes (Na, K) by autoanalyser Erba EM 200 machine.

The collected data was analyzed using SPSS 16 software. Continuous variables were presented as mean and standard deviation of the mean (SD), while categorical variables are presented as number and percentage. Chi square test was used to know the association between different variables. P value<0.05 was considered statistically significant.

RESULTS

The study group included 74 neonates, 39 (52.70%) were male babies and 35(47.30%) were female babies, out of 74 neonates 43 (58.11%) were normal birth weight 31 (41.89%) were low birth weight babies. 14 neonates were delivered by normal vaginal delivery and 60 by lower segment caesarean section. Mean time of appearance of icterus was 104.60±48.10 hours. Mean duration of phototherapy was 38.48±09.34 hours respectively.

Table 1: Correlation of post phototherapy serum sodium with birth weight

Sodium levels	Normal	LBW	Total	P value
<135	3	19	22	P<0.01
135-145	40	12	52	
Total	43(58.11%)	31(41.89%)	74	

Following phototherapy 22 babies out of 74 showed serum sodium levels less than 135m Eq/L and 52 babies showed serum sodium levels between 135-145m Eq/L.

Table 2: Correlation of post phototherapy serum potassium with birth weight

Potassium levels	Normal	LBW	Total	p value
3.5-5.5	42	30	72	P <0.01
>5.5	1	1	2	
Total	43(58.11%)	31(41.89%)	74	

Following phototherapy 2 babies out of 74 showed serum potassium levels more than 5.5 m Eq/L and 72 babies showed serum potassium levels between 3.5 to 5.5 m Eq/L.

Table 3: Correlation of post PT serum electrolytes with duration of phototherapy

24 hours	48 hours		Total
Sodium			
<135	5	17	22
>135	15	37	52
Potassium			
3.5-5.5	20	52	72
>5.5	0	2	2

Table 3 shows the mean duration of phototherapy was 38.48±09. Number of neonates who received phototherapy for 48 hours (54 neonates) as compared to neonates who received phototherapy for 24 hours (20 neonates).

Table 4: Comparative evaluation of Bilirubin, sodium, potassium pre and post phototherapy in neonates

	Pre	Post	P value
Total bilirubin	20.41±1.57	14.03±1.05	<0.01
Sodium	140.24±2.50	137.17±3.83	<0.01
Potassium	4.24±0.48	3.95±0.31	<0.01

Changes in total bilirubin, sodium, potassium before and after phototherapy. Even though none of term neonates in present study developed signs of hyponatremia and hypokalemia, Sodium and potassium changes were significant in babies after 48 hours of phototherapy.

The P value obtained was<0.01 Thus, it is considered to be statistically significant. Overall, there was significant decline in serum sodium and potassium along with total bilirubin following 48 hours of phototherapy.

DISCUSSION

Newborns whose post- delivery hospital stay <72 hours are at a significantly greater risk for readmission than those whose stay is >72 hours. Phototherapy has emerged as the most widely used form of treatment and is the current therapy of choice to reduce severity of neonatal unconjugated hyperbilirubinemia. As any treatment has its side effects, phototherapy also has. Few studies are currently available that depicts the adverse effects of phototherapy on serum electrolytes. A few studies in the recent past, have stressed on the incidence of hypocalcemia following phototherapy and very few studies till date regarding the effect of phototherapy on sodium and potassium are done. Hence present study was designed to determine the sodium and potassium changes in neonates receiving phototherapy for neonatal jaundice. Hyponatremia, a very common electrolyte abnormality, is a serum sodium level <135 mEq/L. Both total body sodium and total body water determine the serum sodium concentration. Hyponatremia exists when the ratio of water to sodium is increased. Similarly, body water can be low, normal, or high. Hypokalemia is defined as serum potassium level below 3.5 mEq/L. Curtis MD et al, studied diarrhea in jaundiced neonates treated with phototherapy. Study showed that absorption of sodium, chloride and potassium was significantly impaired in the patients receiving phototherapy [4]. Beresford D et al and Conolly G et al, stated that babies under phototherapy can have sodium imbalances due to insufficient fluid replacements [5]. The differential effect of other electrolytes with phototherapy has not been studied by other workers except that for Curtis MD et al, study which stated that absorption of water, sodium chloride, and potassium was significantly impaired in the patients receiving phototherapy [4].Tan KL et al, study in healthy full-term neonates demonstrated a transient raise in potassium levels after phototherapy which was in contrast to present study [6]. Reddy AT et al, study showed sodium changes are significant, potassium and chloride changes were insignificant which is in contrast to present study where both sodium and potassium changes are significant[7]. In another study conducted by Bezboruh G and Majumder A K to show the "Electrolyte imbalance in neonates after Phototherapy", it was seen that 38.83% of the population were low birth weight neonates and 61.17% were normal birth weight neonates [8]. It is evident that in the present study phototherapy induced sodium and potassium changes was more in term LBW babies but the actual relationship in these babies with phototherapy has to be evaluated with larger sample studies.

CONCLUSION

Occurance of post phototherapy hyponatremia and hypokalemia were significant when phototherapy given for 48 hours, but the risk of hyponatremia and hypokalemia is low in healthy full-term neonates with normal birth weight. The risk is greater in LBW babies and hence this group of babies should be closely monitored for changes in sodium and potassium and should manage accordingly.

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