Original Article

Incidence of Hyponatremia in Neonates Receiving Phototherapy for Neonatal Hyperbilirubinemia

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ABSTRACT

Objective: To determine the incidence of hyponatremia in neonates receiving phototherapy for neonatal unconjugated hyperbilirubinemia.

Study Design: Descriptive case series study.

Place and Duration of Study: This study was conducted at the Department of Paediatrics, Sheikh Zayed Hospital Lahore, and Sir Ganga Ram Hospital Lahore from March 2020 to September 2020.

Materials and Methods: One hundred and eighty neonates and their demographic data were obtained. Blood sample was collected from the neonates included in the study for total bilirubin and serum sodium. Phototherapy was administered by senior consultant having experience more than 5 years after their post- graduation to avoid bias as per operational definition. Serum sodium was checked before phototherapy and at 48 hours of phototherapy.

Results: Seventy-seven (42.78%) were between 0-15 days of life while 103 (57.22%) were between 16-28 days of life with mean age was 15.03±5.78 days. One hundred and six (58.89%) were males and 74 (41.11%) were females. Mean serum sodium levels before treatment were recorded as 143.65±3.87 while 140.72±4.28 after treatment. Hyponatremia in neonates receiving phototherapy for hyperbilirubinemia was recorded as 16 (8.89%).

Conclusion: The frequency of hyponatremia is not much higher in neonates receiving phototherapy but it should also be considered that the previous results are varied.

Key Words: Neonatal hyperbilirubinemia, Phototherapy, Hyponatremia

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INTRODUCTION

Almost all the newborn develops an unconjugated serum bilirubin level more than 30 µmol/L (1.8 mg/dL) during the first week of life.[1] Term neonates have 60% and preterm neonates 80% have neonatal jaundice typically at 2-4 days of life.[2] Incidence of neonatal hyperbilirubinemia varies with ethnicity, race, geography, gender, gestational age, and financial status.[3,4]

Neonatal hyperbilirubinemia can occur either due to physiological cause or pathological cause. Physiological hyperbilirubinemia (unconjugated) reflects a normal transitional phenomenon. It occurs due to increased breakdown of foetal erythrocytes (increased load of bilirubin), decreased capacity of the liver to produce conjugated bilirubin and is exaggerated by breast feeding, dehydration etc.[5] Pathological causes include sepsis, ABO and/or Rh incompatibility, RBC membrane defects, G6PD deficiency, conjugating enzyme deficiencies, increased enterohepatic circulation, hypothyroidism, galactosemia etc.

Neonatal hyperbilirubinemia is treated by phototherapy, pharmacotherapy, and exchange transfusion. Phototherapy is non-invasive procedure use of visible light to transform bilirubin into water soluble isomers without conjugation in the liver.[6] However, various studies have revealed its side effects as diarrhea, feed intolerance, retinal changes, hyperthermia, dehydration, skin rashes, genotoxicity, bronze baby syndrome, electrolyte imbalances.[7] Electrolyte imbalance is a major concern as it leads to increased risk of morbidity and mortality. The relation between hypocalcaemia and phototherapy is well established by various studies, however a little is known about effect of phototherapy on sodium levels.

A study published in 2020 shows incidence of hyponatremia to be 19.3% in term and 29.4% in preterm infants after 48 hours of phototherapy.[8] Another regional study conducted in 2019 in India has shown incidence of hyponatremia to be 13.59% in

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neonates receiving phototherapy which was relatively more in preterm and low birth weight infants as compared to full term and healthy neonates.[9] Hyponatremia in neonates is a significant problem, however, only few studies are conducted to establish its relationship with phototherapy. More regional and international studies should be conducted to know the incidence of hyponatremia in neonates receiving phototherapy. This study will therefore be helpful in recognizing the frequency of sodium imbalance in relation to gestational age, gender and birth weight before and after the phototherapy hence the preventive measures should be applied.

MATERIALS AND METHODS

This descriptive case series study was conducted from 8th March 2020 to 8th September 2020 at Paediatric Medicine Department of Sir Ganga Ram Hospital and Sheikh Zayed Hospital, Lahore. A total of 180 neonates were included in the study by non-probability consecutive sampling technique. We included all the neonates of either gender having unconjugated hyperbilirubinemia as per operational definition and on mother feed or standard formula feed. We excluded all the neonates who developed jaundice on first day of life, jaundice lasting more than 14 days, signs and symptoms of sepsis, ABO/Rh incompatibility, history of birth asphyxia, hypothyroidism, G6PD deficiency, IUGR, obvious congenital malformations, infant of diabetic mother, conjugated hyperbilirubinemia, history of exchange transfusion, mother taking anti-convulsive and/or abnormal electrolyte status (Na < 135 meq/L before the start of phototherapy.

After selection of neonates according to inclusion and exclusion criteria were admitted to Neonatal Unit and filling detail history and examination was done. 2 cc of venous blood samples were collected for serum bilirubin and sodium. They were subjected to standard phototherapy as per operational definition, of wavelength 425-275 nm, at 25-30 cm from the skin after covering eyes and genitalia. After 48 hours of phototherapy sodium level was sent again. Total and direct bilirubin was measured by diazo method and sodium by auto analyzer Erba EM 200 machine.

The data was entered and analyzed through SPSS-20 Data was stratified for age, gender, preterm birth, and low birth weight baby to address effect modifiers. Post stratification Chi-square test was applied taking p-value ≤ 0.05 as significant.

RESULTS

There were 106 (58.89%) males and 74 (41.11%) females with mean age 15.03±5.78 days and gestational age 39.11±4.25 weeks (Table 1). Mean birth weight, serum bilirubin levels and sodium level before and after phototherapy of the patients are shown in Table 2.

There were 16 (8.89%) neonates have hyponatremia and 164 (91.11%) have no hyponatremia (Table 3). There was no significant difference in age, gender and significant difference was found in preterm birth weight (Table 4).

Table No.1: Frequency of age, gender and gestational age (n=180)

Variable	No.	%
Age (days)		
0-15	77	42.78
16-28	103	57.22
Gender		
Male	106	58.89
Female	74	41.11
Gestational age (weeks)		
<37	43	23.89
≥ 37	137	76.11

Table No.2: Mean birth weight, serum bilirubin levelsand sodium level before and after phototherapy of the patients

Variable	Mean±SD
Birth weight (kg)	2.94±1.01
Bilirubin	
Before treatment	17.12±4.87
After treatment	13.48±3.71
Sodium levels	
Before treatment	143.65±3.87
After treatment	140.72±4.28

Table No.3: Frequency of hyponatremia in neonates receiving phototherapy for neonatal hyperbilirubinemia (n=180)

Hyponatremia	No.	%
Yes	16	8.89
No	164	91.11

Table No.4: Comparison of hyponatremia according to age, gender, preterm birth and low birth weight

Variable	Hyponatremia		P value
	Yes	No	
Age (days)			
0-15	7	70	0.95
16-28	9	94	
Gender			
Male	9	97	0.82
Female	7	67	
Preterm birth (weeks)			
<33	11	33	0.000
33-36	5	131	

DISCUSSION

During the first days of life neonatal jaundice can occur which can be treated by phototherapy which plays significant role in prevention and treatment of this condition.[10] It is widely available non-invasive treatment with relatively fewer side effects as compared to other modes of treatment. Electrolyte disturbance is one of the commonest side effects of phototherapy. In

one study hypocalcaemia is one of the major side effects [11] Another study shows that 90% of preterm and 75% of full-term neonates develop low calcium level post phototherapy [12]

In our study, 77 (42.78%) 0-15 days of life 103 (57.22%) were between 16-28 days age with mean age was 15.03±5.78 days, 106 (58.89%) were males and 74 (41.11%) were females. Mean serum sodium levels before treatment were recorded as 143.65±3.87 while 140.72+4.28 after treatment incidence of hyponatremia was recorded as 16 (8.89%).

A study done in 2015, reported the incidence of hyponatremia after phototherapy was 6% which was more in low birth weight (birth weight<2.5kg) babies (17.2%, p<0.001) and preterm neonates (<37 weeks of gestation) (17.6%, p< 0.001) than in normal weight babies (2.6%) and term neonates (3.1%) and in 17.4% babies (p<0.001).[13] Another study reported similar statistics of low sodium level after phototherapy was 6% more in LBW babies 17.2% (p<0.001) and 17.6% in preterm birth (p<0.001)[14] which are consistent with our study findings.

A recent study published in 2019 studied 206 cases, out of which 27 patients (13.6%) developed hyponatremia after phototherapy [9] The low sodium level was more in preterm (18.31%) and low birth weight neonates (18.75%) as compared to term (11.02%) and normal weight neonates (10.32%). The results of this study show significantly higher incidence of hyponatremia as compared to our study.

This study has some limitations as phototherapy is one of the commonest non-invasive measures for the treatment of hyperbilirubinemia. We must need large scale of data in the form of these samples large samples in multiple setups and look for the association of sodium imbalance in these children despite of limitations this study contributes important finding to the limited literature on the outcomes among the newborns.

CONCLUSION

The conclusive finding of our study is that hyponatremia is not much higher in neonates receiving phototherapy, but it should also be considered that the results of previous studies are varied some of them reported the higher incidence of hyponatremia. Serum sodium level must be checked in babies having phototherapy.

Author's Contribution:

Concept & Design of Study:	Lubna Riaz
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Conflict of Interest: The study has no conflict of interest to declare by any author.

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