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Original Article

Assessing the Changes in Sodium and Potassium in Newborns Following Phototherapy for Neonatal Hyperbilirubinemia

V Thirunavukkarasu

Chief Civil Surgeon, Department of Paediatrics, Government Headquarters Hospital, Dindigul, Tamil Nadu, India

Abstract

Introduction: Hyperbilirubinemia can be treated either by phototherapy or exchange transfusion, or pharmacologic agents. Phototherapy plays a significant role in the prevention and treatment of hyperbilirubinemia.

Aim: This study aims to study the changes in sodium and potassium in newborns following phototherapy for neonatal hyperbilirubinemia.

Materials and Methods: This observational study was conducted in the Department of Paediatrics, Government Headquarters Hospital, Dindigul, from January 2019 to June 2019 in term neonates admitted in the neonatal intensive care unit receiving phototherapy. Pre- and post-phototherapy bilirubin, serum sodium, and potassium levels were measured.

Results: In 50 neonates included, the mean duration of phototherapy was 42.21 h. Pre-phototherapy, total bilirubin was 15.27 ± 2.51 mg/dl; indirect bilirubin was 12.61 ± 2.98 mg/dl. Post-phototherapy, total bilirubin was 9.02 ± 1.28 mg/dl and indirect bilirubin was 7.14 ± 2.12 mg/dl. Pre-phototherapy, serum sodium was 144.12 ± 3.24 mEq/L and serum potassium was 4.61 ± 0.91 mEq/L. Post-phototherapy, serum sodium was 135.24 ± 4.21 mEq/L and serum potassium was 4.11 ± 0.41 mEq/L.

Conclusion: The following phototherapy, serum sodium, and potassium levels significantly lower. When the length of phototherapy is longer, the frequency of sodium and potassium changes is more significant.

Key words: Hyperbilirubinemia, Newborn, Phototherapy, Potassium, Sodium, Term

INTRODUCTION

Neonatal jaundice is a yellowish discoloration of the skin, conjunctiva, and sclera from elevated serum or plasma bilirubin in the newborn period. The term jaundice is from the French word "jaune," which means yellow. Neonatal jaundice in most newborns is a mild and transient event. However, it is imperative to identify newborns with jaundice that do not follow this pattern, as failure to do so may lead to long-term sequelae.[1]

Neonatal jaundice is noted in >50% of newborns. It is more often physiological; however, sometimes serum bilirubin levels cross the normal range (as per the recommended guidelines by the American Academy of Pediatrics [<1–2 mg/dl/4 h]) to become pathological.[2]

Nevertheless untreated, severe unconjugated hyperbilirubinemia is potentially neurotoxic and conjugated hyperbilirubinemia is a harbinger of underlying severe illness. Neonatal hyperbilirubinemia is a reflection of the liver's immature excretory pathway for bilirubin. It is the most common reason for readmission of neonates in the 1st week of life in the current era of postnatal discharge from the hospital. Neonatal hyperbilirubinemia is a cause of concern for the parents as well as for the pediatricians.[3]

Phototherapy is started based on risk factors and the serum bilirubin level on the nomogram. Bilirubin absorbs light optimally in the blue-green range (460–490 nm) and is either photoisomerized and excreted in the bile or converted into lumirubin and excreted in the urine.[4]

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Corresponding Author: V Thirunavukkarasu, Chief Civil Surgeon, Department of Paediatrics, Government Headquarters Hospital, Dindigul, Tamil Nadu, India

As any treatment has its side effects, phototherapy also has its adverse effects such as electrolyte changes. A few studies are currently available that depict the adverse effects of phototherapy on serum sodium and potassium.

Aim

This study aims to study the changes in sodium and potassium in newborns following phototherapy for neonatal hyperbilirubinemia.

MATERIALS AND METHODS

This observational study was conducted in the Department of Paediatrics, Government Headquarters Hospital, Dindigul, from January 2019 to June 2019 in term neonates admitted in the neonatal intensive care unit receiving phototherapy. Inclusion criteria: Full-term neonates with unconjugated hyperbilirubinemia requiring phototherapy. Exclusion criteria: Newborns with perinatal asphyxia, with congenital anomalies, with jaundice lasting more than 14 days of life, any comorbidities, and neonates with conjugated hyperbilirubinemia were excluded from the study.

All neonates included in the study had a complete medical history and physical examination. Demographic and clinical variables of the infant were recorded at the time of admission and phototherapy duration. Maternal risk factors such as hypertension, diabetes mellitus, oligohydramnios, anemia, epilepsy, fever, any rash, and any medicine intake during pregnancy other than iron and folic acid supplementation were excluded from the study.

Blood specimens were obtained primarily by heel punctures. The minimally dangerous method to collect blood samples of neonates is the heel puncturing method. Merely, the micro amount of serum or plasma is needed for tests by the analyzers. Data were analyzed as pre-phototherapy and post-phototherapy using the Student's *t*-test.

RESULTS

In this study, 50 neonates were included, 26 male and 24 female babies with the mean gestational age of 37.54 weeks. The mean birth weight of neonates was 3.12 kg, 28% of neonates are low birth weight and 72% are normal birth weight. Out of 50 neonates, 14 (28%) were low birth weight babies, and 36 (72%) were normal birth weight babies. All neonates have undergone phototherapy in a mean duration of 42.21 h [Figures 1 and 2].

Before phototherapy, the total bilirubin was 15.27 ± 2.51 mg/dl; indirect bilirubin was 12.61 ± 2.98 mg/dl. Post-phototherapy, total bilirubin was 9.02 ± 1.28 mg/dl and indirect bilirubin was 7.14 ± 2.12 mg/dl. The difference between direct bilirubin and indirect bilirubin was statistically significant ($P < 0.0001$), respectively [Figure 3].

Before phototherapy, serum sodium was 144.12 ± 3.24 mEq/L and serum potassium was 4.61 ± 0.91 mEq/L. Post-phototherapy, serum sodium was 135.24 ± 4.21 mEq/L

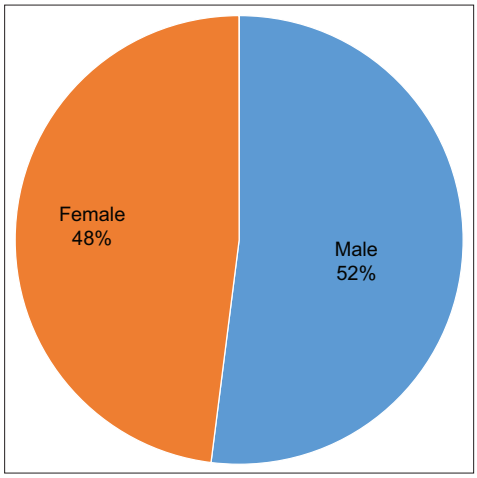

Figure 1: Gender distribution

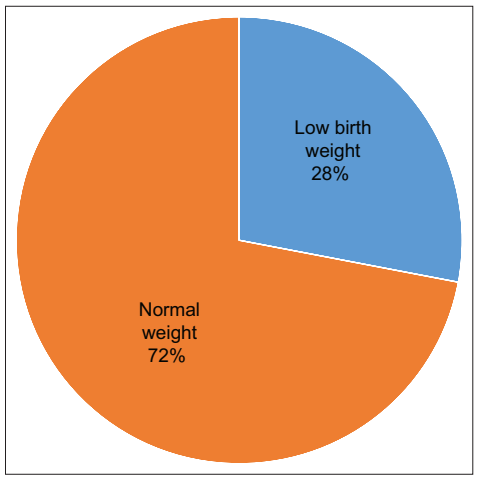

Figure 2: Birthweight distribution

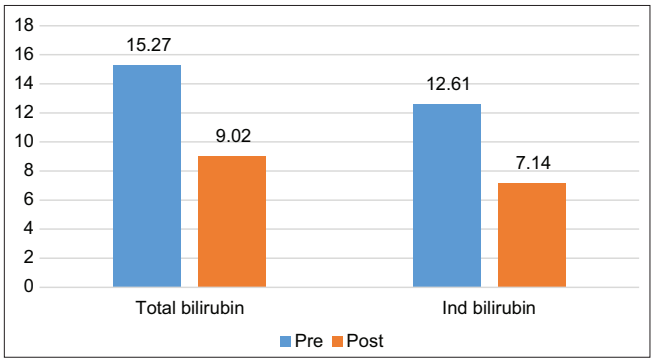

Figure 3: Bilirubin level distribution

and serum potassium was 4.11 ± 0.41 mEq/L. The difference between serum sodium and potassium was statistically significant ($P < 0.0001$), respectively [Figures 4 and 5].

DISCUSSION

Phototherapy has a significant function in the prevention as well as in managing hyperbilirubinemia.[5] Side effects of phototherapy are insensible water loss, watery diarrhea, hypocalcemia, bronze baby syndrome, hyperthermia, tanning of the skin, intolerance to feed, retinal damage, genotoxicity, erythema, and increased blood flow to the skin.[6] One of the side effects is diarrhea. A very small number of studies currently depict the side effects of phototherapy on sodium levels in serum. Since diarrhea causes a change in electrolyte levels in this study, we determine the levels of serum sodium and potassium and compare these levels before and after phototherapy in full-term neonates with unconjugated hyperbilirubinemia.[7]

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 a serum potassium level below 3.5 mEq/L. Curtis *et al.* studied diarrhea in jaundiced neonates treated with phototherapy. The study showed that absorption of sodium, chloride, and potassium was significantly impaired in the patients receiving phototherapy.[8] Beresford and Conolly stated that babies under phototherapy could have sodium imbalances due to insufficient fluid replacements.[9] The differential effect of other electrolytes with phototherapy has not been studied by other workers except that for Curtis *et al.* study which stated that absorption of water, sodium chloride, and potassium was significantly impaired in the patients receiving phototherapy.[8] Tan and Jacob, a study in healthy full-term neonates, demonstrated a transient raise in potassium levels after phototherapy, which was in contrast to the present study.[10] Reddy *et al.*, the study showed that sodium changes are significant, potassium and chloride changes were insignificant, which is in contrast to the present study where both sodium and potassium changes are significant.[11] In another study conducted by Bezboruah and Majumder 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.[12]

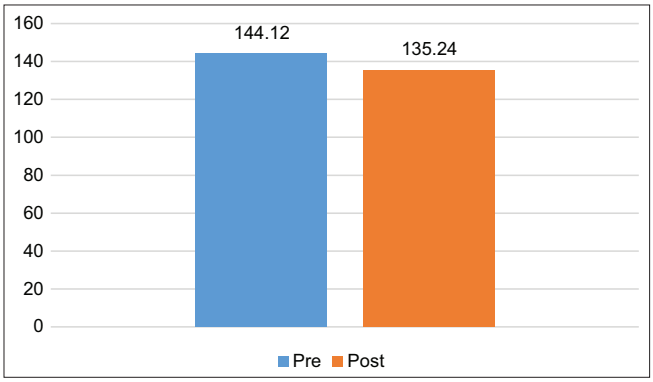

Figure 4: Serum sodium level distribution

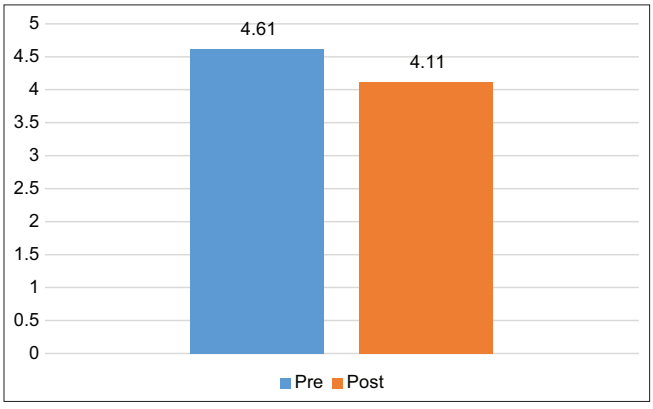

Figure 5: Serum potassium level distribution

CONCLUSION

The following phototherapy, serum sodium, and potassium levels significantly lower. When the length of phototherapy is longer, the frequency of sodium and potassium changes is more significant. As a result, we strongly recommend measuring serum sodium and potassium in neonates before and after phototherapy.

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