Diagnostic Utility of Measuring First Day Serum Bilirubin Levels in Management of Neonatal Hyperbilirubinemia

R Rama Krishna Paramahamsa¹, Gangina Sriram², Swetha Koneru², T Jaya Chandra⁴

¹Associate Professor, Department of Pediatrics, GSL Medical College, Rajahmundry, ²Associate Professor, Department of Pediatrics, GSL Medical College, Rajahmundry, ³Resident, Department of Pediatrics, GSL Medical College, Rajahmundry, ⁴Scientist Incharge, Central Research Laboratory, GSL Medical College, Rajahmundry.

Abstract

Background: Hyperbilirubinemia is the commonest finding in the first week of life, cause of concern for the parents and pediatricians. Objectives: With this study was carried to evaluate the predictive value of serum bilirubin level on day one postnatal age for identifying term neonates at risk for subsequent hyperbilirubinemia. Subjects and Methods: Study was conducted in GSL Medical College. Study protocol was approved by institutional ethics committee. Informed consent was collected from the parents/guardians of all the study participants. Neonates ≥ 37 weeks who were otherwise healthy were included in the study. First serum bilirubin measurement was estimated initially within 24±2 hours of life. Second serum bilirubin estimation was attempted if clinical assessment of serum bilirubin >10 mg/dl. Results: Total 200 healthy term newborns were evaluated; male female ratio was 1.2. The mean gestation period was 39.24±1.12 weeks. Maximum (58%; 116) women had full term normal vaginal delivery. The range of bilirubin on day one was 2.2 – 8.5mg/dl; majority newborns (86.5%) did not develop significant hyperbilirubinemia. Conclusion: Early screening and appropriate management of hyperbilirubinemia is needed for prevention of complications in the newborn. This decreases the significant burden of untreated severe neonatal jaundice, causing potential neurological sequelae.

Keywords: Serum, Bilirubin.

Corresponding Author: Dr Gangina Sriram, Associate Professor, Department of Pediatrics, GSL Medical College, Rajahmundry.

Received: November 2019
Accepted: November 2019

Introduction

Hyperbilirubinemia is the commonest finding in the first week of life, cause of concern for the parents and pediatricians. To the pediatrician jaundice remains the most common problem in the well-baby nursery. Jaundice is observed during the first week of life in approximately 60% of term infants and 80% of preterm infants. Bilirubin production is 2-3 times higher in normal term newborns compared with adults. Unconjugated (indirect) hyperbilirubinemia occurs as a result of excessive bilirubin formation and because the neonatal liver cannot clear bilirubin rapidly enough from the blood. Under normal circumstances, the level of indirect reacting bilirubin in umbilical cord serum is 1-3mg/dl and rises at a rate of less than 5mg/dl/24hrs. Immature new born brain is susceptible to toxicity from unconjugated bilirubin, resulting in neuro developmental or intellectual handicaps and finally frank kernicterus. Hence early detection and appropriate management of neonatal jaundice is of paramount importance in preventing kernicterus.

Although most newborns with jaundice are otherwise healthy, every baby who is jaundiced necessitates attention at the earliest to look for features of pathological jaundice because unconjugated bilirubin is potentially toxic to the central nervous system. Routine obstetric and neonatal hospital stays have decreased markedly in world during past 15 – 20 years. Early discharge of healthy term newborns after delivery has become a common practice because of medical and social reasons and economic constraints.

Several studies suggest that neonatal hyperbilirubinemia is the most common cause for readmission of healthy term babies discharged early. In up to 4% of term newborns who are readmitted to the hospital during their first week of life, approximately 85% are readmitted for jaundice. There have been reports of a correlation between bilirubin values on day one of life and subsequent hyperbilirubinemia. Infants with high serum bilirubin levels will have high peak subsequently. Infants who are clinically jaundiced in the first few days are more likely to develop hyperbilirubinemia.

With this study was carried to evaluate the predictive value of serum bilirubin level on day one postnatal age for identifying term neonates at risk for subsequent hyperbilirubinemia.

Subjects and Methods

Study was conducted in GSL Medical College. Study
protocol was approved by institutional ethics committee. Informed consent was collected from the parents / guardians of all the study participants. Neonates ≥ 37 weeks who were otherwise healthy were included in the study. Preterm babies <37 weeks gestational age, neonates with significant illness requiring NICU admission >12 hours, Rh-incompatibility, evidence of hemolysis, with major congenital malformations, with conjugated hyperbilirubinemia who were born with birth asphyxia, sepsisemia were not considered; Neonates who developed direct hyperbilirubinemia, features suggestive of sepsis, respiratory distress were excluded from the study. First serum bilirubin measurement was estimated initially within 24±2 hours of life. The babies were then followed up clinically using Kramer’s rule for appearance and progression of jaundice every 12 hours up to 5 days of life. Second serum bilirubin estimation was attempted if clinical assessment of serum bilirubin >10 mg/dl i.e. presence of jaundice below the level of umbilicus. Primary outcome was defined as presence of hyperbilirubinemia when serum bilirubin level ≥12 mg/dl at 25 to 48 hr of life, ≥15 mg/dl between 49 to 72 hr and ≥17 mg/dl beyond 72 hr of life. Bilirubin was estimated by diazo method of Pearlman and lee. Phototherapy was started for newborns with significant hyperbilirubinemia.

**Results**

Total 200 healthy term newborns were evaluated: male female ratio was 1.2. The mean gestation period was 39.24±1.12 weeks. Maximum (58%; 116) women had full term normal vaginal delivery. The range of bilirubin on day one was 2.2 – 8.5mg/dl; majority newborns (86.5%) did not develop significant hyperbilirubinemia.

**Discussion**

Early discharge of healthy term newborns from the hospital after delivery has recently become a common practice for medical, social and economic reasons. Hyperbilirubinemia is the most commonly reported cause for readmission during the early neonatal period.[11] The current guidelines of the American Academy of Pediatrics recommend follow-up for newborns discharged before 48 hours of life at 2 to 3 days postnatally,[12] However, a complete follow-up is not always possible because of the geography and climatic conditions, personal safety, or patient intolerance and the safety of relying on follow up visits after discharge is questionable as 10% of the population fails to return follow up visit. Hence it is crucial to catalogue the babies who are at risk for significant jaundice before they are sent away from the hands of the pediatricians, and to prevent the potential bilirubin neurotoxicity so that, many of the significantly jaundiced neonates could see the light of the day from the nightmare of bilirubin encephalopathy.

The present study included term healthy newborns >37 weeks. The incidence of neonatal jaundice was inversely proportional to gestational age; no newborn with gestational age >42 weeks had total serum bilirubin >4.9 mg/dl. With increasing gestational age incidence of jaundice was decreased. This was due to maturity of hepatic clearance. Agarwal et al.,[13] reported similar findings. The male female ratio significant hyperbilirubinemia, developed babies was 1.07; 52% (14/27) newborns who developed significant hyperbilirubinemia were male and 48% were female babies. Male gender is a known risk factor for hyperbilirubinemia.[14] In a study by Naranget al.,[15] the incidence of hyperbilirubinemia in male was 64.2%. Singhal et al.,[16] reported 56.8% and Alpay et al.,[17] reported 61.6% (37/60) hyperbilirubinemia among male babies. But incidence was found to be similar among gender by C.G vailaya et al.[18] Out of 200 participants, 116 newborns delivered by normal vaginal delivery; 76 by cesarean section and only 8 newborns required instrumentation either in the form of forceps or vacuum delivery. Oxytocin was mainly used to augment labor in 53% women. Out of 27 newborns who developed significant hyperbilirubinemia, oxytocin was used in mothers of 18 (67%) newborn babies. Peak serum bilirubin levels were higher in neonates born after oxytocin induction of labor. Similar findings were reported by Singh et al.,[19] DP Davis et al.[20]

The first bilirubin level was done at 22-26 hours of birth. There is variability in the time of appearance of jaundice from newborn-newborn and in the ability of professionals to see jaundice and estimate its severity coupled with the considerable range of TSB associated with its cephalocaudal progression. Moreover the observer variability and the influence of the skin color in clinically evaluating hyperbilirubinemia.

In present study Hyperbilirubinemia was defined as TSB level ≥12 mg/dl between 24 to 48 hr of life ≥15 mg/dl between 48 to 72 hr of life and 17 mg/dl beyond 72 hours of life.[21]

In present study hyperbilirubinemia was defined if total serum bilirubin level was ≥12 mg/dl between 24 to 48 hr of life and ≥15 mg/dl between 48 to 72 hr of life and 17 mg/dl beyond 72 hours of life.[22] As per Shivani et al.,[22] report, hyperbilirubinemia was defined as TSB level ≥12 mg/dl between 24 to 48 hr of life ≥15 mg/dl between 48 to 72 hr of life and 17 mg/dl beyond 72 hours of life. First bilirubin estimation was done at 24 ± 6 hours. Subsequent bilirubin estimation was done whenever clinical suspicion of jaundice exceed 10.0 mg%. Out of 200 newborns studied, 22 developed significant hyperbilirubinemia requiring phototherapy. TSB level of 6mg/dl or less was present in 136 (63.8%) newborns and only one developed hyperbilirubinemia. In the remaining 77 (36.2%) neonates with TSB > 6 mg/dl subsequent
hyperbilirubinemia developed in 21 (sensitivity 95%, specificity 70.6%). They concluded that Ideal cut off value was 5.0 mg/dl and babies with TSB levels higher than 6.0 mg% had a significant risk of developing hyperbilirubinemia. In one similar prospective study by Alpay et al., 117 concluded that use of 6mg/dl as critical value at 24 hours of life predicted nearly all term neonates (sensitivity 90%) with subsequent risk of significant hyperbilirubinemia (>17mg/dl) & will determine all those requiring phototherapy later on.

Conclusion

Early screening and appropriate management of hyperbilirubinemia is needed for prevention of complications in the newborn. This decreases the significant burden of untreated severe neonatal jaundice, causing potential neurological sequelae.

References

1. Stoll BJ, Kliegman RM. Jaundice and hyperbilirubinemia in the Newborn. In: Behrman RE, Kliegman RM, Jenson HB. Eds. Nelson Textbook of Pediatrics. 19thed. Philadelphia: WB Saunders Co; 2012; 603 – 604.
2. M.J.Maisels, Kring E. Length of Stay, Jaundice and hospital readmission. Pediatrics. 1998; 101: 995 – 998.
3. Report 2002 – 03, National Neonatal Perinatal Database Network NewDelhi: National Neonatology Forum of India, 2006
4. Narayana S, Aggarwal, Upadhyay A, Deorari AK, Sindh M, Paul VK. Survival and morbidity in extremely low birth weight (ELBW) Infants. Indian Pediatrics, 2003; 40(2): 130 – 135.
5. Hall RT, Simson S, Smith MT. Readmission of breast fed infants in the first two weeks of life. J perinatal 2000; 20: 432 – 437.
6. Lee K S, Perlman M, Balantyne M. Association between duration of neonatal hospital stay and readmission rate. J Pediatr. 1995; 127: 758 – 766.
7. Kiely M, Drum MA, Kessel W. Early discharge, risks, benefits and who decides. Clinperinatol. 1998; 25: 539 – 553.
8. Davidson LT, Merritt KK, Weech AA. Hyperbilirubinemia in the newborn. Am J Dis Child 1941; 61: 958 – 980.
9. Knudsen A. Prediction and non-invasive assessment of neonatal jaundice in the term healthy newborn infant. Acta Paediatr 1996; 85: 393 – 397.
10. Maisels MJ, Newman TB. Predicting hyperbilirubinemia in newborns: the importance of timing: Commentaries. Pediatrics 1999; 103(2): 493 – 495.
11. Hall, R.T.,S.Simon, M.T.Smith. Readmission of breastfed infants in first 2weeks of life. J Perinatal. 2000; 20: 433 – 437.
12. American Academy of Pediatrics, Committee on Fetus and Newborn. Hospital stay for healthy term newborns. Pediatrics. 1995; 96: 788 – 790.
13. Agarwal R, Kaushal M, Paul VK, Deorah. Early neonatal hyperbilirubinemia using first day serum bilirubin level. Indian Pediatrics 1997; 34: 429 – 432.
14. Watchko JF, Oski FA. Bilirubin 20 mg/dl = Vigintiphobia. Pediatrics 1983; 71(4): 660 – 663.
15. Narang A, Gathwala G, Kumar P. Neonatal Jaundice: An analysis of 551 cases. Indian Pediatr 1997; 34: 429 – 432.
16. Singhal PK, Singh M, Paul VK, Deorari AK, Ghorpade MG. Spectrum of neonatal hyperbilirubinemia: An analysis of 454 cases. Indian Pediatr 1992; 29: 319 – 325.
17. Alpay F, Sarici U, Tosuncuk H, Serdar MA, Inanc N, Gokcay E. The value of first day bilirubin measurement in predicting the development of significant hyperbilirubinemia in healthy term neonates. Pediatrics 2000; 106: e 16.
18. C.G. Raghavendravailaya, Sheila Aiyer. Early Prediction of Significant Neonatal Hyperbilirubinemia using Serum Bilirubin Levels in Healthy term & near term Newborns, Gujarat, India. J Pub Health Med Res 2014; 2(1): 14 – 19.
19. Sunit Singh, Meharban Singh. Pathogenesis of oxytocin-induced neonatal hyperbilirubinemia. J Neonat 2012; 12 (3): 332 – 338.
20. D P Davies, R Gomersall, R Robertson, P. Gray, A C Turnbull. Neonatal Jaundice and Maternal Oxytocin Infusion. British Med J 1973; 3: 476 – 477.
21. American Academy of Pediatrics. Practice parameters, Management of hyperbilirubinemia in the healthy term newborn Pediatrics 1994; 94(4): 558 – 567.
22. Shivani Randev, Neelam Grover. Predicting Neonatal Hyperbilirubinemia using first day serum Bilirubin levels. Indian J Pediatrics 2010; 77 (2): 147 – 150.

Copyright: © the author(s), 2019. It is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY 4.0), which permits authors to retain ownership of the copyright for their content, and allow anyone to download, reuse, reprint, modify, distribute and/or copy the content as long as the original authors and source are cited.

How to cite this article: Paramahamsa PRK, Srim G, Koneru S, Chandra TJ. Diagnostic Utility of Measuring First Day Serum Bilirubin Levels in Management of Neonatal Hyperbilirubinemia. Asian J. Clin. Pediatr. Neonatol.2019;7(4);14-16. DOI: dx.doi.org/10.21276/ajcpn.2019.7.4.3

Source of Support: Nil. Conflict of Interest: None declared.