The Bhutani Nomogram Reduces Incidence of Severe Hyperbilirubinaemia in Term and Near Term Infants

Abstract:

P O'Reilly, O Walsh, NM Allen, JD Corcoran
Rotunda Hospital, Parnell Sq, Dublin 1

Abstract

Very high bilirubin levels can have devastating neurodevelopmental effects on infants including hearing loss and cerebral palsy. A previous study in our institution determined the rate of, and factors associated with, bilirubin values above exchange transfusion level. Since this study the Bhutani nomogram was introduced to help identify infants at risk of severe hyperbilirubinaemia. In our study we looked at the initial serum bilirubin taken in infants ≤36 weeks and ≤2.5kgs. Our results show that since this nomogram was introduced there has been a significant reduction in the number of infants reaching exchange transfusion levels. We also showed that the Bhutani nomogram could successfully be used in a population of unknown direct Coombs status.

Introduction

Severe neonatal hyperbilirubinaemia can lead to devastating acute and long-term neurological complications including deafness and cerebral palsy. Among the preventable factors leading to severe hyperbilirubinaemia in the first days of life are inadequate risk-assessment prior to hospital discharge and early discharge home of term or near term infants without adequate follow-up of bilirubin levels. The Bhutani nomogram (Figure 1) is in widespread use in the USA and Canada for early identification and assessment of infants at risk of severe hyperbilirubinaemia. It can be applied once an infant is 12 hours old. This nomogram stratifies risk for later development of hyperbilirubinaemia requiring treatment into low-risk, low-intermediate risk, high-intermediate risk and high-risk groups. It is of proven value in estimating risk in populations who are known to direct Coombs test negative. Previously, we reported on the incidence of severe hyperbilirubinaemia at our institution. Following this study the Bhutani nomogram was introduced into clinical practice as part of the systematic approach to identify, treat and follow up infants at risk of severe hyperbilirubinaemia. Treatment of severe hyperbilirubinaemia may require exchange transfusion. The aim of our study was to see if the introduction of this nomogram had led to a reduction in cases of infants presenting with an initial total serum bilirubin (TSB) above exchange transfusion level.

Methods

Prior to discharge every newborn infant has a transcutaneous bilirubin (TcB) level checked (using the JM-103S Bilimeter). TcB is then followed by TSB measurement and direct Coombs testing if the operating range of the bilimeter is exceeded (over 200µmol/L) or if the infant falls into the intermediate or high-risk group on the Bhutani nomogram. We used similar methods and exclusion criteria to the previous study with the results from a previous study. This previous study looked at cases of infants reaching exchange transfusion level in our hospital. We used similar methods and exclusion criteria to the previous study to ensure accurate comparison.

The Bhutani nomogram was introduced into practice in our institution in mid-2011. We determined the initial TSB taken in a population of infants ≤36 weeks gestation and ≤2.5kgs, born in 2012, who were cared for on the post-natal wards. We excluded infants of mothers who were Rhesus negative or who had atypical antibodies as these infants had their direct Coombs status known from cord blood sampling. This allowed us to establish the efficacy of the nomogram in a population of infants of unknown direct Coombs status. These TSB values were obtained from our lab database. We took the initial TSB value for every infant who had a TSB measured between 12-72 hours of life. We plotted initial TSB values on the American Academy of Pediatrics exchange transfusion graph. We compared these results to the previous study. Mann-Whitney U test was used to compare mean TSBs and mean time of first TSB. Fisher's Exact test was used to compare numbers requiring exchange transfusion.

Results

There were 8288 infants eligible after exclusion criteria. Of these, 1001 infants had at least one TSB performed. We compared our 2012 results with the results from the previous study performed over two years (2007 and 2008). Table 1 shows that TSBs were performed earlier (Mean 57.1 hours), with average TSBs being lower (Mean 173µmol/L). When compared to the previous period of observation, where there were 14 infants above exchange transfusion level, the current study shows that no infant reached this level.

Discussion

Since the introduction of the Bhutani nomogram there has been a significant reduction in the number of infants reaching exchange transfusion levels. Bhutani's original study when formulating the nomogram excluded infants known to be direct Coombs positive. This study shows that the Bhutani nomogram can also be successfully used in a population of unknown direct Coombs status. The rate of TSBs being performed increased since the introduction of the nomogram. However, this level is still lower than the rate of TSBs being performed were TcB is not being utilised. In conclusion the Bhutani nomogram can be effectively used to predict risk of severe hyperbilirubinaemia and determine appropriate follow up and monitoring of high-risk infants. We recommend that the Bhutani nomogram be utilised in all Irish maternity hospitals as part of a systematic approach to reduce the risk of bilirubin encephalopathy and kernicterus.

Correspondence: P O'Reilly
Rotunda Hospital, Parnell Square, Dublin 1
Email: peteroreilly86@gmail.com

Acknowledgments

Many thanks to J O'Loughlin, C Kirkham and K Conway of the Rotunda Hospital.

References
