Total and Fractionated Bilirubin during the First Week in the Neonatal Intensive Care Unit

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Abstract

Background. Fractionated bilirubin requires more blood (0.6 ml) than total bilirubin alone (0.2 ml). Our focus during the first week in the Neonatal Intensive Care Unit (NICU) is on prevention of Bilirubin Induced Neurologic Dysfunction and kernicterus, which do not require fractionation. We wanted to determine the benefit of knowing fractionated bilirubin in the first week.

Methods. In this retrospective study, data were obtained from the first week for 1202 NICU inborn admissions.

Results. Direct bilirubin was more than 2.0 mg/dl in only six infants (0.6%). Five had multisystem injury from hypoxic ischemic events. One also had congenital cytomegalovirus and another had a postoperative liver hematoma. Weekly multichem profiles would have detected these abnormalities. No specific therapy was initiated for any of these infants.

Conclusions. Converting to total bilirubin alone would not alter treatment, but could reduce iatrogenic blood loss by 2.4 ml per infant.

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Introduction

Jaundice exists when a newborn has a high level of bilirubin in the blood.[1] Bilirubin is produced from hemoglobin when red blood cells breakdown. While in utero, the placenta allows fetal unconjugated bilirubin to transfer to the mother for conjugation and excretion. After birth, the newborn adapts and the liver begins to conjugate bilirubin so it can be excreted in the stool. The increase in conjugation takes about three days for full-term infants and longer for premature infants. The unconjugated bilirubin rises and causes jaundice. Most jaundice is not harmful; however, bilirubin may be a concern for infants with other illnesses, including prematurity. The complications of elevated bilirubin are Bilirubin Induced Neurologic Dysfunction (BIND) and a more devastating permanent syndrome, kernicterus.[2]

The diazo reaction, the routine clinical testing method for serum bilirubin, identifies direct bilirubin, the component that reacts rapidly to the diazo reagent.[3] With an accelerator, the diazo reaction measures total bilirubin (TB); this additional component we call the indirect fraction. Although highly variable, total bilirubin is the clinical surrogate used to predict the risk of BIND and kernicterus. Clinicians use frequent determinations (daily or more often) of TB to guide therapy.[4] Therapeutic interventions include phototherapy and exchange transfusion to reduce TB and the attendant risks of BIND and kernicterus.

Direct Bilirubin (DB) results monitor the excretion process, which may be impaired, by infection or long term parenteral nutrition. Both disease states typically present later in the neonatal course.[5] TB can be done on a blood sample of 0.2 ml used for blood gas and electrolyte determination. Fractionated bilirubin requires 0.6 ml. Daily or more frequent determinations of bilirubin are obtained in the first week to prevent BIND and kernicterus. Later in the course,

weekly monitoring of alkaline phosphatase, renal function, fractionated bilirubin and liver enzymes is obtained for those on long term parenteral alimentation.

Our initial objective was to determine the number and results of the bilirubin determinations during the first seven days for our Neonatal Intensive Care Unit (NICU) admissions. The second objective was to determine if any clinical insight was gained by having the direct bilirubin results during this period of time. If these infants could be managed without fractionating the bilirubin in the first week, the reduction in iatrogenic blood loss may prevent anemia and reduce transfusions.

Methods

The NICU at Wesley Medical Center has a data warehouse for information from the admission, transfer, discharge summaries, and daily progress notes, including laboratory results. These codified and text fields are stored in a series of tables in Microsoft SQL.

In this retrospective descriptive study, data were obtained from the first seven days of a convenience sample of 1202 inborn NICU admissions (7290 bilirubin levels) from January 1, 2010 to December 31, 2011. A threshold for DB of more than 2 mg/dl was set as clinically significant. Any specific intervention or diagnostic testing that was pursued in the first week related to any of the elevated direct bilirubin levels was recorded. Infants with documented inborn errors of metabolism, positive initial blood culture, or major congenital anomaly were excluded.

The research dataset was de-identified to protect patient privacy. The project was approved by the Institutional Review Board.

Results

After reviewing 1201 infants (see Table 1), only six infants (0.6%) were identified with DB more than 2 mg/dl in the first week. Of the six infants, five had multisystem injury from hypoxic ischemic events near birth. One of these also had congenital cytomegalovirus and one had surgery for a persistent vitelline duct with a liver hematoma.

Table 1. Birth weight and gestational age of infants.

	Birth Weight	Gestational Age
Mean	33	2168
SD	4	857
Median	34	2105
25th Percentile	31	1569
75th Percentile	36	2671

Discussion

Given that none of the conditions associated with elevated DB require targeted intervention during this time frame, conversion to TB alone in the first seven days of the patients in the NICU would reduce iatrogenic blood loss by an average of 2.4 ml/infant and would not alter treatment plans. The weekly fractioned bilirubin was adequate for the management and prevention of conditions associated with conjugated hyperbilirubinemia.

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