Rebound hyperbilirubinemia in term infants after phototherapy

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ABSTRACT

Objective: To determine whether a rebound in serum bilirubin level occurs within 24 hours after discontinuation of phototherapy in term infants with hyperbilirubinemia

Methods: A retrospective medical record review of term infants with hyperbilirubinemia requiring phototherapy who were admitted over 24 months, June 1999 to December 2001, at King Abdul-Aziz University Hospital, Jeddah, Kingdom of Saudi Arabia was completed. Total serum bilirubin levels (TSB) at and up to 24 hours after termination of phototherapy (follow-up levels) were recorded. The difference between mean TSB level at termination of phototherapy and at follow-up was calculated using the paired t test.

Results: Three hundred and one infants, 53% (n=161) were boys, mean ± standard deviation (SD) for gestational age was 39.4 ± 1.4 weeks, mean birth weight was 3200 ± 600g, mean TSB ± SD at termination of phototherapy was 193 ± 46 micromole/ liter (μmol/l) and at follow-up was 188 ± 45 μmol/l for all infants with either positive or negative direct coombs' test results. The difference in mean TSB level at discontinuation of phototherapy and at follow-up was statistically significant, (t=3.12, P= 0.002). The mean TSB level at termination of phototherapy was 179 ± 47 μmol/l and at follow-up was 177 ± 47 μmol/l for 65 infants with positive direct coombs' test results. This difference was statistically insignificant (t=0.725, P=0.47). The mean time interval between the termination of phototherapy and the measurement of follow-up TSB level was 8.3 ± 5.3 hour.

Conclusion: The rebound of bilirubin level after termination of phototherapy in otherwise healthy term infants is minimal; thus measurement of serum bilirubin is not required after termination of phototherapy and adds unnecessary expense, prolongs hospitalization, or both.

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Neonatal jaundice is a common problem in newborn infants. It occur in 60% of all newborns.[1] Although active treatment is not required in the majority of infants, severe jaundice can cause encephalopathy resultanting in handicap or death. Phototherapy is used worldwide for the treatment of neonatal jaundice.[2,3] The need for exchange transfusion has been significantly reduced since the introduction of phototherapy.[4] It is effective, noninvasive, convenient, easy to use and not expensive.[5,6] However the prolongation of phototherapy is not justified since it has many short-term and possible long-term side effects.[5,6] It leads to prolonged hospitalization and may negatively affect the mother infant bonding. At the same time, discontinuation of phototherapy too early may allow bilirubin to rise to unacceptable levels, which may require reinstitution of phototherapy. The American Academy of Pediatrics (AAP) Practice Parameter on the Management of Hyperbilirubinemia in Healthy term newborn suggests, that infants without hemolytic disease do not require observation for

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rebound hyperbilirubinemia and these infants may be discharged from the hospital after discontinuation of phototherapy.[4] Two previous studies[7,8] have showed that the magnitude of rebound in bilirubin level is clinically insignificant. However, measurement of bilirubin level within 24 hours after discontinuation of the phototherapy to detect any rebound increase in the bilirubin level is still a common practice. This practice lengthens the hospital stay and increases the laboratory expense.

The aim of this study was to determine whether clinically significant rebound in serum bilirubin level occurs within 24 hours after termination of phototherapy in term infants with either hemolytic or non-hemolytic hyperbilirubinemia. We hypothesized that the rebound bilirubin levels would be less than or equal to those at discontinuation of phototherapy.

Methods. A retrospective chart review was completed for all term infants who received phototherapy for hyperbilirubinemia between June 1999 and December 2001 at King Abdul-Aziz University Hospital (KAUH), Jeddah, Kingdom of Saudi Arabia (KSA). All healthy term infants (gestational age 37-42 weeks) regardless of the birth weight and the cause of jaundice were included in the study. Total serum bilirubin levels (TSB) at discontinuation and within 24 hour after discontinuation of phototherapy were required for inclusion in the study. Infants who failed phototherapy treatment and required exchange transfusion were excluded from the study. Data including date and time of birth, birth weight, gestational age, infant and mother blood groups, and Direct Coombs' test (DCT) results were collected. Date and time of initiation and discontinuation of phototherapy were obtained from nursing notes. Total serum bilirubin at discontinuation of phototherapy and at follow-up (first bilirubin level measured up to 24 hour after termination of phototherapy) were obtained from laboratory flow sheets. Any episode of reinstitution of phototherapy was noted. The Ethics and Research Committee approved the study in KAUH, Jeddah, KSA.

All values were expressed in mean ± standard deviation (SD). The difference between TSB levels at discontinuation of phototherapy and at follow-up were expressed as mean ± SD in micromole per litre (umol/l). Differences among mean values were assessed by paired t test. A P value of <0.05 was considered statistically significant.

Results. Data was available for 301 infants; 53% (n=161) were boys. Mean gestational age was 39.4 ± 1.4 week; mean birth weight was 3200 ± 600 gram (g). The mean age at initiation of phototherapy was 54.2 ± 41.2 hour and at termination of phototherapy was 105.7 ± 71.3 hour. The mean time interval between discontinuation of phototherapy and of follow-up measurement of TSB was 8.3 ± 5.3 hour. The mean TSB at initiation of phototherapy was 195 ± 78 umol/l. The mean TSB decreased from 193 ± 46 umol/l at termination of phototherapy to 188 ± 45 at follow-up. The mean difference in the TSB at termination of phototherapy and at follow-up was – 4 ± 8 umol/l (range 88-53). The difference in mean TSB at discontinuation of phototherapy and at follow-up was statistically significant ($t = 3.12$, $p = 0.002$). Sixty-five (22%) infants had a positive DCT result as of ABO incompatibility, 49 infants, Rhesus incompatibility, 11 infants and minor sub-blood group incompatibility, 5 infants. In these infants, the mean TSB decreased from 179 ± 46 umol/l at termination of phototherapy to 177 ± 47 umol/l at rebound. The difference between TSB at discontinuation of phototherapy and at follow-up was statistically insignificant ($t=0.725$, $p=0.47$). A 2nd course of phototherapy was initiated for 6 infants (**Table 1**). Three infants had thysiological jaundice, one infant had cephalohematoma and 2 infants had ABO incompatibility. However, reviewing the bilirubin levels in these infants revealed that the rebound TSB in these infants did not reach the phototherapy zone.

Discussion. Results of our study support our hypothesis that the rebound bilirubin levels in term infants with jaundice are less than the bilirubin levels at discontinuation of phototherapy. The difference in mean TSB at discontinuation and at follow-up was statistically significant in all infants regardless of the results of DCT. This difference was due to a decrease rather than an increase in bilirubin levels. However, the difference in TSB at discontinuation and at follow-up was statistically and clinically insignificant in infants with positive DCT results. The reinstitution of phototherapy in 6 infants who were to be discharged from the hospital is of concern. Two infants had ABO incompatibility, one infant had cephalohematoma and 3 infants had physiological jaundice. Further evaluation of these cases revealed that phototherapy was not necessary as the magnitude of rebound in bilirubin was small and did not reach the level at which phototherapy would be indicated. The mean TSB at which phototherapy was discontinued was 193 ± 46 umol/l. These values are below those recommended by AAP and are probably reflective of the wide variation in physician attitude toward management of hyperbilirubinemia.[3,9] American Academy of Pediatrics recommended that phototherapy be discontinued in healthy term infants when TSB falls below 14-15 mg/dl. (238-255 umol/l) Only 2 other previous studies have examined TSB at discontinuation of phototherapy in newborns. Lazar et al[7] included 58 infants who weighted >1500g and did not have hemolytic anemia. Phototherapy was

Table 1 - Characteristics of 6 infants requiring reinstitution of phototherapy.

GA*	BW†	Diagnosis	Age‡	Interval§	Bilirubin1[I]	Bilirubin2**
37	2330	Cephalohematoma	82	6	240	256
42	3570	Physiologic	45	12	155	181
40	2570	Physiologic	45	6	190	215
41	2750	Physiologic	53	24	160	186
39	2150	ABO**	77	20	205	230
38	3400	ABO	64	6	193	216

GA* - gestational age in weeks, BW† - birth weight in grams, ‡ - age in hours at termination of phototherapy
§ - time in hours between the 2 bilirubin measurements, [I] - level at termination of phototherapy, **- level at rebound
ABO** - one of the 4 blood groups

discontinued at a TSB of 13 ± 0.7 mg/dl (221±11.9 umol/l) in term infants and 10.7 ± 1.2 mg/dl (181.9±20.4 umol/l) in preterm infants. The magnitude of bilirubin rebound was 0.86 ± 1.0 mg/dl (14.6 ± 17 umol/l) in term infants and 0.83 ± 0.56 mg/dl (14.1± 9.5 umol/l) in preterm infants and occurred within the first 24 hours after cessation of phototherapy (mean 12.5 hours for term and 14.7 hours for preterm infants). No infant in that study required reinstatement of phototherapy. The difference between mean TSB at discontinuation of phototherapy and at rebound was statistically and clinically insignificant in both groups. Yetman et al[8] included 264 term and preterm infants. Phototherapy was discontinued at TSB of 12.2 ± 2.3 mg/dl (207.4± 39 umol/l) in term and preterm infants with birth weight of ≥ 1800 g and 7.5 ± 2.1 mg/dl (127.5±35.7 umol/l) in preterm infants with birth weight of 1000 – 1799 g. The magnitude of bilirubin rebound in the 2 groups was 0.3 ± 1.4 mg/dl (5.1±23.8 umol/l) and – 0.7 ± 1.5 mg/dl (-11.9±25.5 umol/l) and occurred within the first 24 hours after cessation of phototherapy (mean 17 ± 6 hour). A 2nd course of phototherapy was initiated for 2 term and 11 preterm infants with birth weight of <1800 g. The difference between mean TSB levels at discontinuation of phototherapy and rebound was statistically significant in the group of infants weighed ≥ 1800 g. This difference was mainly due to a decrease rather than an increase in bilirubin level. In our study, the measurement of follow-up bilirubin level was carried out earlier compared with the previous 2 studies (8.3 ± 5.3 hour). This may theoretically underestimates the peak rebound of bilirubin. Tan[3] recommended 2 consecutive bilirubin values <11 mg/dl (187 umol/l) as a guideline for termination of phototherapy and daily monitoring of bilirubin level for a minimum of 2 days to determine maximum rebound. Our practice does not support this recommendation. We excluded preterm infants from this study as these infants usually have other clinical problems so they routinely receive intensive clinical and laboratory monitoring in the neonatal care nursery. The limitations of this study include the retrospective nature of the study, the relatively low TSB at the time of termination of phototherapy and the relatively short period to follow-up TSB being measured. It is not clear if the rebound bilirubin levels would be significantly higher if phototherapy would be terminated at higher TSB or the follow-up TSB being measured at longer intervals. Based on the result of our study and the previous 2 studies, we conclude that routine measurement of bilirubin levels in healthy term infants after discontinuation of phototherapy is not needed and adds unjustified laboratory and personnel expenses. Our finding supports the AAP practice parameter on the management of hyperbilirubinemia in healthy term infants.

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Abstract

The objective of this prospective, randomized study was to compare the effectiveness of fiberoptic, conventional and combination phototherapy in decreasing bilirubin concentrations in neonatal nonhemolytic hyperbilirubinemia. Forty-six infants who were 36 weeks' gestation and more were randomly assigned to fiberoptic phototherapy (n=16) (Biliblanket, Ohmeda), conventional daylight phototherapy (n=15) and combination phototherapy (n=15) (fiberoptic and conventional). The groups were similar in clinical characteristics at study entry in terms of birth weight, age and bilirubin concentration. There were no statistically significant differences in the duration of treatment among the 3 groups (P=0.83) There were also no statistically significant differences among the 3 groups in the serum bilirubin postphototherapy. We conclude that the decrease in serum bilirubin concentration was comparable among fiberoptic, conventional and combination phototherapy groups.