

The Management of Neonatal Jaundice After Discontinuation of Phototherapy

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Abstract

In contrast to the initiation of treatment for neonatal jaundice, specific guidelines for discontinuation of phototherapy and subsequent management of the infants are lacking. The current study aims at documenting the current practice and examining if babies can be discharged from phototherapy without routine evaluation for rebound hyperbilirubinaemia. Between January and May 1998 inclusively, all neonates aged under two weeks with a birth weight $\geq 2,200$ grams admitted for phototherapy were recruited for the study. Babies were excluded if they required intensive care, received parenteral nutrition, or were receiving antibiotics at the time of discontinuation of phototherapy. 154 infants were enrolled. Seven (4.5%) babies required a second course of phototherapy because their SB rebounded into the treatment range. When compared with those babies not requiring treatment again, they had a higher mean SB (234.3 vs 204.1, $p < 0.001$) and were more likely to be younger than five days of life (3/7 vs 16/147, $p = 0.041$) when phototherapy was first stopped. Other factors like sex, cephalhaematoma, glucose 6 phosphate dehydrogenase deficiency, blood groups, Coombs' test, onset of jaundice, and haemoglobin level were not found to be significant. If a threshold of SB ≤ 216 $\mu\text{mol/L}$ (or 234 $\mu\text{mol/L}$ less 2 standard deviations) were used for discontinuation of phototherapy without routine evaluation for rebound hyperbilirubinaemia, 61% of the "well" babies in this study would have had an earlier discharge. Thus, a more structured guideline on the management of discontinuation of phototherapy is indicated for evaluation of our current practice.

Key words

Neonatal jaundice; Phototherapy; Clinical protocols; Patient discharge

Introduction

Jaundice or hyperbilirubinaemia is a common neonatal condition, especially in the Orientals.¹ While the majority of cases are non-specific in origin, a proportion may be secondary to infection, breast feeding, liver disorders and haemolytic diseases. The latter conditions include glucose 6 phosphate dehydrogenase (G6PD) deficiency and thalassaemic syndromes that are particularly prevalent in

Southeast Asia. The majority of babies recover without any sequelae, but some babies develop bilirubin encephalopathy or kernicterus because of the severe jaundice. The use of exchange transfusion is an effective rescue for babies with severe hyperbilirubinaemia, especially in those with haemolytic disease secondary to Rhesus incompatibility. However, it is a procedure bound with potentially serious complications. Phototherapy, with its well established safety and efficacy in reducing SB, has been used and recommended to treat babies with less severe jaundice in order to avoid exchange transfusions.²

Guidelines on the management of babies with neonatal jaundice, especially on the initiation of treatment like phototherapy and exchange transfusion, are widely published.^{3,4} In our locality, we follow the local recommendations in which thresholds adjusted for gestational age or birth weight are used for the initiation of phototherapy.⁵ For the term neonate at 72 hours of life or more, phototherapy is indicated when the SB level exceeds 250 $\mu\text{mol/L}$. The thresholds are 220 and 130 $\mu\text{mol/L}$

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Received March 19, 1999

L at 48 and 24 hours, respectively. Specific causes for the jaundice are not looked for unless the clinical features suggest haemolysis, cholestasis, or sepsis. Cord blood screening for G6PD deficiency and congenital hypothyroidism is performed for all babies, however. SB levels are monitored at 4-24 hours intervals according to the severity of jaundice.

Phototherapy is discontinued when the SB drops below 250 $\mu\text{mol/L}$ and rebound jaundice is monitored at 4-24 hours later. These, however, are not specified in the guidelines and are up to the discretion of the attending paediatrician. Irrespective of the clinical course, all babies will be referred to the local maternal and child health center upon discharge for neonatal care and routine immunizations. As only a minority of cases required a second course of phototherapy, we hypothesize that we may be overzealous in the medical care of jaundiced babies after discontinuation of phototherapy. A prospective, observational study is therefore carried out to document the current practice and to see if babies can be discharged from phototherapy without routine evaluation for rebound hyperbilirubinaemia.

Materials and Methods

The study was carried out in the Special Care Baby Unit in Tuen Mun Hospital from January to May 1998 inclusively. Babies admitted for phototherapy were recruited into the study provided the birth weight is 2,200 grams or above. They were excluded if any of the following was present: (1) requiring intensive care, (2) receiving parenteral nutrition, or (3) receiving antibiotics at the time of discontinuation of phototherapy. These criteria were used to select a group of relatively "well" babies who might benefit from an early discharge. Management was accorded to the local protocol and has been described above. The following clinical and laboratory features were noted: sex, asphyxia defined as an Apgar score of 6 or less at birth, clinical sepsis defined as the use of systemic

antibiotics, early onset of jaundice (onset within first 48 hours of life), use of exchange transfusion, G6PD deficiency, positive Coombs' test, and haemoglobin level. SB levels recorded at the time of initiation of phototherapy, maximum level during phototherapy, the level at which phototherapy was discontinued, and the rebound level after discontinuation of treatment were collected for analysis. The age of the babies when phototherapy was stopped was also analysed. Capillary blood samples were used for bilirubin determination and venous samples were used if the baby needed a venepuncture for other reasons. For comparison, babies were divided into two groups: those who required re-initiation of phototherapy within 72 hours of stopping phototherapy and those who did not. Comparison of means by Student's t-test, test for normal distribution and comparison of non-parametric variables by Fisher's exact test were carried out using the statistic package SPSS 7.5 for Windows.

Results

One hundred and fifty-six neonates were recruited during the study period. Two of them were admitted at over two weeks of age and were excluded for further analysis. Of the remaining 154 babies, there were 88 (57%) boys and 66 (43%) girls. Their phototherapy commenced at a mean of 5.3 (1-11) days of life and stopped at a mean of 6.4 (3-13) days. The mean SB at the start of phototherapy was 267 (94-417) $\mu\text{mol/L}$, and the mean SB when phototherapy was discontinued was 205 (128-262) $\mu\text{mol/L}$. Two patients had SB levels that were below the thresholds at the time when phototherapy commenced, but the subsequent measurements were above the necessary thresholds corresponding to the guidelines.

Seven neonates (4.5%) had a rebound hyperbilirubinaemia that exceeded 250 $\mu\text{mol/L}$ and were put on phototherapy again. Their clinical and laboratory features were compared with those who did not require a second course of phototherapy (Table 1). The SB level

Table 1 Clinical and laboratory features of the studied babies.

Clinical and laboratory parameters	Infants requiring second phototherapy		Remark
	No	Yes	
Number	147	7	
Sex (male:female)	83:64	5:2	NS
Asphyxia (yes:no)	0:147	0:7	-
Sepsis (yes:no)	3:144	0:7	NS
Cephalhaematoma (yes:no)	9:138	0:7	NS
Coombs' test (positive:negative)*	2:11	-	-
G6PD (deficient:non-deficient)	12:135	1:6	NS
Onset of jaundice (<48h:>48h)	31:116	2:5	NS
Exchange transfusion (yes:no)	1:146	0:7	NS
Haemoglobin, mean (SE), g/dl	16.8 (0.29)	16.6 (0.98)	p=0.83
SB at discontinuation of PT, mean (SE), $\mu\text{mol/L}$	204.11 (2.03)	234.29 (3.46)	p<0.001
Stopping PT before day 5	16:131	3:4	p=0.041

*Coombs test was performed in 13 babies, NS = Not significant by Fisher's Exact Test.

and the age of the babies when phototherapy was terminated were significantly different factors. The group of babies requiring a second phototherapy had a higher mean SB (234.29 vs 204.11 $\mu\text{mol/L}$, $p < 0.001$) and was more likely to be younger than five days of life (3 out of 7 vs 16 out of 147, $p = 0.041$).

Discussion

Jaundice is a common, usually non-specific and self-limiting disorder in the neonatal period. In a study involving 1,238 full term Chinese babies, 87% were found to have clinical jaundice and 24% had a peak SB greater than 204 $\mu\text{mol/L}$.⁶ The occasional association with a primary pathological process such as infection, hepatic and haemolytic diseases calls for alertness in the attending paediatrician to look out for suspicious clinical features during the initial assessment. As kernicterus is a recognized complication of severe hyperbilirubinaemia, exchange transfusion has been developed as an effective preventive measure. To circumvent the potential risks of exchange transfusion, paediatricians have employed phototherapy to handle jaundice of milder severity.^{1,2} These approaches are best summarized in the national guidelines published by the American Academy of Pediatrics (AAP) and the Canadian Pediatric Society.^{3,4} Guidelines for management of neonatal jaundice are also available in our locality.⁵

Specific recommendations on the initiation of phototherapy are well described in these guidelines. The thresholds at which phototherapy is used are often adjusted according to the gestational age, birth weight and age of the jaundiced babies. On the contrary, criteria for discontinuation of phototherapy are less well described. Tan suggests that phototherapy can be taken off when the SB drops to $< 185 \mu\text{mol/L}$ on two consecutive readings for a minimum duration of 24 hours.⁷ The AAP suggests that phototherapy may be discontinued when the SB falls below 238 to 255 $\mu\text{mol/L}$, based on a study by Lazar et al. who showed that the average bilirubin rebound is less than 15 $\mu\text{mol/L}$ in infants without haemolysis.⁸ The AAP also recommends that no further measurement of SB is necessary in these babies unless phototherapy is initiated early and discontinued before the infants is 3 to 4 days old. Following the AAP recommendation, Yetman et al. examined 264 babies of different gestational ages and found no significant difference between the SB levels at discontinuation of phototherapy and at rebound.⁹ The relatively low incidence of restarting phototherapy in clinically well infants as exemplified in this study would also support this approach.

Few studies have assessed the effect of specific risk factors on the rebound in SB levels after completion of phototherapy or the need to re-institute phototherapy. The magnitude of rebound does not seem to correlate with gestational age or the level at which phototherapy is stopped.⁸ G6PD deficiency, with or without clinical parameters of haemolysis has not been found to be a determining factor.¹⁰ Except for the SB level and the age of the newborns at the time when phototherapy is stopped, the individual positive risk factors assessed in this study is too small in number to give any meaningful conclusion. A more structured approach is needed if the significance of these factors is to be verified.

Not surprisingly, the SB level at the time of discontinuation of phototherapy is a significant factor associated with a need to start phototherapy again in jaundiced babies, especially if treatment is stopped before five days of life when the SB usually peaks. If the mean SB less 2 standard deviations in the group of babies requiring a second phototherapy, i.e. 216 $\mu\text{mol/L}$, was used as a threshold for follow up evaluation of rebound hyperbilirubinaemia, over 60% of the infants would have been discharged without an additional venepuncture and waiting for the laboratory result. With the same threshold, none of those babies with significant rebound would have been missed. This level is close to that of 222 $\mu\text{mol/L}$ arbitrarily chosen by Lazar et al. for discontinuation of phototherapy in term infants in their study.⁸ The potential reduction in hospital cost, maternal-infant separation and parental anxiety is obvious.

The decision to terminate phototherapy in a well infant with jaundice is often made in a balance of factors as mentioned above. As the main purpose of phototherapy is to avoid the necessity for exchange transfusion rather than to prevent neurotoxicity directly,¹¹ it is logical to stop when there is a clear trend that jaundice is resolving. It should be mentioned that our criteria for starting and re-starting phototherapy are relatively conservative when compared with other standards. In the light of revised understanding on bilirubin neurotoxicity in the otherwise well term babies, the American and Canadian authorities have recommended a higher threshold of SB for these purposes.^{3,4} Thus, we suggest that a more structured guideline on the discontinuation of phototherapy and further study in this respect are needed to better our current practice on the management of neonatal jaundice.

Acknowledgement

We thank the nursing staff of the Special Baby Care Unit for their contribution in data collection.

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