

## SUPINE VERSUS TURNING POSITION ON BILIRUBIN LEVEL DURING PHOTOTHERAPY IN HEALTHY TERM JAUNDICED NEONATES

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### ABSTRACT

Position changes are believed to increase the efficacy of phototherapy and this practice is routinely used in all neonatal departments in our country. The aim of this study was to determine the effect of routine turning on the total serum bilirubin (TSB) concentration versus only supine position.

In a randomized clinical trial fifty healthy term jaundiced neonates who were admitted to the neonatal ward were selected. All babies were healthy term jaundiced neonates more than 48 hours of age delivered after an uncomplicated pregnancy and had indirect hyperbilirubinemia with TSB  $\geq 15$  mg/dL in 49- to 72-hour-old jaundiced infants and equal or more than 17 mg/dL in  $\geq 72$ -hours-old ones. Twenty five (turning group) babies were changed from supine to prone position every 150 minutes followed by a break of the 30 minutes for feeding and routine nursing care. The supine group (n=25) were kept in the supine position during the entire study period.

TSB was obtained before phototherapy, 12, 24, and 48 hours after phototherapy. The analysis of data was done by SPSS and paired T and T independent student test.

These two groups were similar in age, sex, weight at admission, duration of phototherapy, hematocrit and reticulocyte count. The average of bilirubin in these two groups, before phototherapy ( $p=0.93$ ), 12 ( $p=0.58$ ), 24 ( $p=0.74$ ) and 48 hours ( $p=0.93$ ) after phototherapy respectively were not significant.

The results of this study demonstrated that TSB is not affected by the baby's position during phototherapy.

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#### INTRODUCTION

Phototherapy is by far the most widely used treatment for hyperbilirubinemia and it is both safe and effective. Even though phototherapy has been used on millions of infants for more than 30 years,<sup>1,2,3</sup> specific questions

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regarding methods of optimizing efficacy remain unanswered. Position changes are believed to increase the efficacy of phototherapy<sup>4,5,6</sup> and this practice is routinely used in approximately all neonatal departments in our country. The aim of this study was to determine the effect of routine turning versus supine position on the total serum bilirubin (TSB) concentration during phototherapy.

### PATIENTS AND METHODS

In a randomized clinical trial fifty term jaundiced neonates who were admitted to the neonatal ward of Emam-Reza Hospital, a University Hospital affiliated to Mashhad University of Medical Sciences, Mashhad, Iran were selected.

All babies were healthy exclusively breastfed,  $\geq 49$  hours postnatal age, birth weight more than 2500 grams, and delivered at 38th - 41st weeks of gestational age after an uncomplicated pregnancy. They had indirect hyperbilirubinemia with total serum bilirubin (TSB)  $\geq 15$  mg/dL in 49- to 72-hour-old jaundiced infants and equal or more than 17 mg/dL in  $\geq 72$ -hour-old ones (same as the practice parameter of AAP7). Infants with hemolytic disease, infection, congenital anomaly, closed hemorrhage (cephalhematoma), and metabolic disease were excluded. After parental permission, twenty-five babies (turning group) were randomly changed from supine to prone position every 150 minutes according to Shinwell's study<sup>9</sup> followed by a break of 30 minutes for feeding and routine nursing care. The supine group (n=25) were kept in the supine position during the entire study period.

Total and direct serum bilirubin level were measured at the beginning, 12, 24 and 48 hours after phototherapy. Measurement of bilirubin and phototherapy were continued until the TSB declined to less than 14 mg/dL. All infants in this study were examined two days after discharge in the outpatient clinic for evaluation of recurrent jaundice. Laboratory investigations included complete blood count, blood group typing of babies and their mothers, direct and indirect Coombs' tests, reticulocyte count, serum bilirubin level (total and direct), blood peripheral smear and erythrocyte G6PD level. The clinical examination, gestational age, birth weight, sex, age, weight at admission, serial TSB and direct bilirubin were recorded. TBS was measured by using a Unistat® Bilirubinometer (Reichert- Jung, Germany). The determination of direct bilirubin was made by colorimetric method of Lathe and Ruthven.

Each phototherapy unit contained four blue fluorescent tubes (TL20W/52) at a wavelength of 420-480 nm positioned 20 cm above the infant's mattress. During phototherapy, the infant's were naked except for a diaper and eye cover. Baby temperature was measured every four hours.

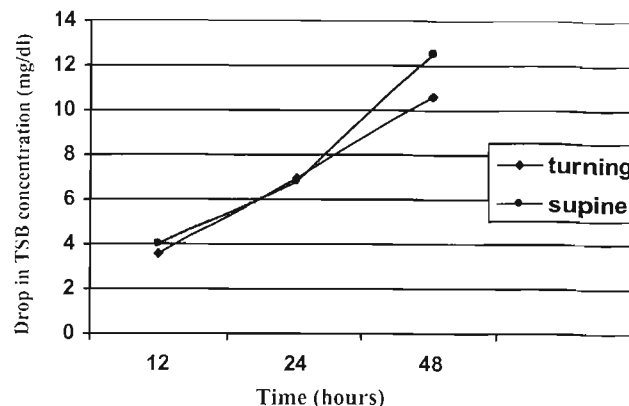


Fig. 1. Response to phototherapy: Drops in bilirubin levels (mg/dl  $\pm$  SD)

The obtained data were analyzed with SPSS. Numerical variables were compared between the two groups using the Independent Student's t-test, chi-square test and Mann-Whitney. P-value of less than 0.05 was considered statistically significant.

### RESULTS

There was no statistically significant difference between the two groups in sex, postnatal age, weight at admission and duration of hospitalization ( $p=0.76, 0.93, 0.85$  and  $0.94$  respectively). In addition, there was no significant difference between the two groups regarding reticulocyte count and hematocrit (Table I).

Therefore the two groups were comparable. The mean TSB in the two groups at enrollment, after 12 hours, 24 hours and 48 hours of phototherapy was not significant ( $p=0.93, 0.58, 0.74, 0.93$  respectively), Table II. As Figure 1 shows after phototherapy there was a significant drop in TSB in both groups.

During hospitalization and two days after discharge in the outpatient clinic no side effects were observed.

### DISCUSSION

The present study showed that turning of term infants with hyperbilirubinemia does not increase the efficacy of phototherapy.

Vogl<sup>8</sup> has suggested that turning the infant during

phototherapy causes a large drop in total serum bilirubin concentration. He believed that the efficacy of phototherapy is directly correlated with the concentration of bilirubin in the skin. Thus, when the skin is blanched, phototherapy would be expected to be ineffective.<sup>9,10</sup> Yamauchi<sup>11</sup> et al. compared turning every 6 hours with no turning in 44 full-term healthy newborns with hyperbilirubinemia, demonstrating that total decrease of skin bilirubin on the surface of the body is not affected by the baby's position during phototherapy.

It is known that the primary action site of phototherapy is the skin and subcutaneous capillary bed in 2mm of surface area of the skin.<sup>8,11</sup> In addition, bilirubin

molecules leave the intravascular space by diffusion along a concentration gradient which is maximal close to blood vessels.<sup>10</sup> During phototherapy bilirubin molecules in the extravascular space act as a filter that absorbs the photons and prevents their reaction with bilirubin in the vascular space. Water soluble isomers which are produced, diffuse back into the circulation and are subsequently excreted in the bile.<sup>10,12</sup> These isomers presumably are formed rapidly in the skin, subcutaneous tissue and in capillaries.<sup>5</sup> Being more polar, all isomers continuously shift the equilibrium to promote more isomer formation.<sup>11</sup> After blanching of the skin photons can reach the capillaries in the dermis and react directly with intravascular bilirubin.

**Table I.** Baseline characteristics of the neonates.

	Supine	Turned	P value
<b>Weight at admission (grams)</b> Mean	3043.6	3024.4	0.85*
<b>Male/Female ratio</b>	1.7	2.1	0.76**
<b>Duration of phototherapy (hours)</b> Mean ± SD	35.4±12.0	35.1±10.2	0.94*
<b>Age at start of phototherapy (days)</b> Mean	6.1	6	0.93*
<b>Hematocrit at start of phototherapy (%)</b> Mean ± SD	46.5±3.9	46.4±6.1	0.99*
<b>Reticulocyte at start of phototherapy (%)</b> Mean ± SD	1.7±0.9	1.5±0.7	0.49*

T-Test \*, Chi-square test \*\*

**Table II.** Changes in serum bilirubin level during phototherapy.

	Supine	Turned	P-value
<b>Bilirubin at start of phototherapy</b> mg/dl Mean ± SD	18.8±2.5	18.8±2.1	0.93*
<b>Bilirubin at 12 hours after phototherapy</b> mg/dl Mean ± SD	14.8±2.5	15.2±1.8	0.58*
<b>Bilirubin at 24 hours after phototherapy</b> mg/dl Mean ± SD	12.2±2.7	12.1±2.0	0.74*
<b>Bilirubin at 48 hours after phototherapy</b> mg/dl Mean ± SD	9.5±2.4	9.6±2.1	0.93**

T-Test \*, Mann-Whitney test \*\*

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The time required for diffusion of bilirubin into and out of the extravascular space has been estimated to be 1-3 hours.<sup>5</sup> Therefore by saving the diffusion time, intravascular photoisomerisation may be more efficient. Increased amount of blood available for interaction with photons of light due to the hyperemic effect of phototherapy may also enhance intravascular photoisomerisation. Thus it is reasonable to assume that bilirubin can also undergo photoisomerisation when bound to albumin in the blood.

The result of our study, comparing a turning group in which position changes occurred every 150 minutes during phototherapy and a supine position continuously demonstrated that a change in position every 150 minutes was not effective in increasing the decline in total serum bilirubin. We do not exclude the use of the turning position, even if it is as effective as the supine position but we recommend its use be limited in healthy full-term infants with hyperbilirubinemia who have no sign of hemolysis.

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### REFERENCES

1. Owa JA, Osinaike AI: Neonatal morbidity and mortality in Nigeria. *Indian J Pediatr* 65: 441-9, 1998.
2. Mac Mohon JR, Stevenson DK, Oski FA: Physiologic jaundice, In: Taeusch HW, Ballard RA (eds), *Avery's Diseases of the Newborn*. 7th ed., Philadelphia: W.B. Saunders, pp. 1003-7, 1998.
3. Stoll BY, Kliegman RM: Jaundice and hyperbilirubinemia in the newborn. In: Behrman RE, Kliegman RM, Jenson HB. (eds), *Nelson Textbook of Pediatrics*. 17<sup>th</sup> ed., Philadelphia: W.B. Saunders, pp. 592-8, 2004.
4. Vogl TP: On the dynamics of phototherapy. In: Brown AK, Showacre J, (eds). *Phototherapy for Neonatal Hyperbilirubinemia, Long-Term Implications*. NIH publications, 76(6): 219-25, 1974.
5. Halamek LP, Stevenson DK: Neonatal jaundice and liver disease, In: Fanaroff AA, Martin RJ, (eds), *Neonatal Perinatal Medicine: Disease of the Fetus and Infant*, 7<sup>th</sup> ed., New York: Mosby, pp. 1309-34. 2002.
6. Tudhope DI, Chong A: Noninvasive method of measuring bilirubin levels in newborn infants. *Med J Aust*, 1:165-168, 1982.
7. American Academy of Pediatrics Practice Parameters: Management of hyperbilirubinemia in the healthy term newborn. *Pediatrics* (4): 558-64, 1994.
8. Vogl TP: Phototherapy of neonatal hyperbilirubinemia: Bilirubin in unexposed areas of the skin. *J Pediatr* 85(5): 707-10, 1974.
9. Cremer RJ: Influence of light on the hyperbilirubinemia of infants. *Lancet* 1:1094-97, 1958.
10. Shinwell ES, Sciaky Y, Karplus M: Effect of position changing on bilirubin level during phototherapy. *Journal of Perinatology* 22: 226-9, 2002.
11. Yamauchi Y, Kasa N, Yamanouchi I: Is it necessary to change the baby's position during phototherapy? *Early Hum Dev* 20: 221-7, 1989.
12. Myara A, Sender A, Volettev: Early changes in cutaneous bilirubin and serum bilirubin isomers during intensive phototherapy of jaundice neonates with blue and green light. *J Biol Neonate* 71: 75-82, 1997.