TRANSCUTANEOUS BILIRUBINOMETRY IN MALAY, CHINESE AND INDIAN TERM NEONATES

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SUMMARY

The transcutaneous (Tc) bilirubinometer was evaluated in 105 jaundiced neonates, comprising 38 Malays, 37 Chinese and 30 Indians, who had not been treated with phototherapy or exchange transfusion. Tc bilirubin index and serum bilirubin concentration correlated at statistically significant levels in all the three racial groups. Unlike the Chinese and Malay babies, the action levels, using Tc bilirubin index, in the Indian babies are not reliable due to the wide variation of skin pigmentation.

Neonatal jaundice is conventionally monitored by estimation of serum bilirubin level. This involves blood sampling. The transcutaneous (Tc) bilirubinometer, however, is non-invasive, small and portable. In this study, the use of the Tc bilirubinometer in the management of neonatal jaundice in the three racial groups was evaluated.

MATERIALS AND METHODS

The population studied consisted of jaundiced term babies delivered in the Maternity Hospital, Kuala Lumpur. The gestation of these babies were assessed by Dubowitz score. [1] All the babies had not yet been subjected to phototherapy or exchange transfusion. The neonates were divided into three groups according to their racial origins.

The degree of icterus was assessed by one person (N.Y.B.) using the Tc bilirubinometer (Minolta Camera Co. Ltd., Japan). Three consecutive readings were obtained from each baby over the forehead region and the mean value was calculated.

One ml of venous blood was taken from each baby immediately before or after the Tc bilirubinometer readings. The blood specimens placed in dark envelopes were taken to the laboratory. The total serum bilirubin values were measured by the Jendrassik's method. [2] The results were evaluated statistically by determining the coefficient of correlation and applying Student's t-test.

RESULTS

Of the 105 babies studied, 37 were Chinese, 38 were Malay and 30 were Indian (Table I). There was linear correlation between the Tc bilirubin index and serum bilirubin values in all three racial groups of babies (Figs. 1,2,3).

Unlike the Malay babies, the Tc bilirubin index and serum bilirubin values of the Indian babies were scattered very widely on both sides of the regression line (Fig. 3). The Chinese babies showed wide dispersion of these values only at serum bilirubin values above 200 μmol/l (Fig. 2).

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TABLE I
DATA OF BABIES STUDIED

	Malay	Chinese	Indian
Number	38	37	30
Female:Male	16:22	11:26	15:15
Birth weight (kg):			
mean	3.0	3.2	2.9
S.D.	0.5	0.4	0.6
Gestation (weeks):			
mean	40.0	40.1	40.1
S.D.	0.9	1.0	1.2
Age (days):			
mean	2.9	3.5	3.2
S.D.	1.0	1.3	2.7

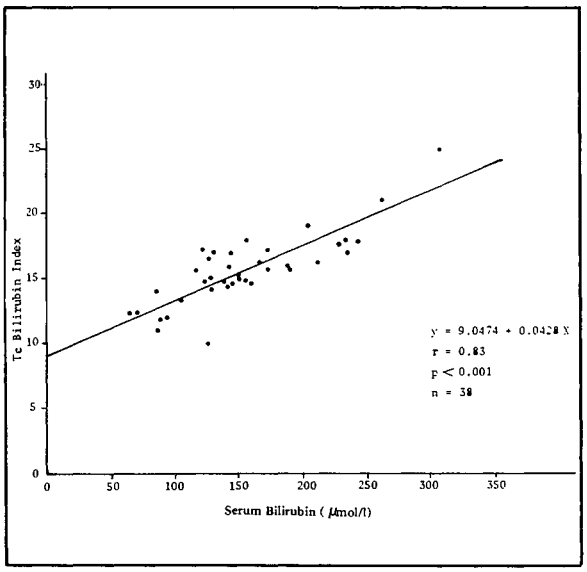

Fig. 1 Correlation between Tc bilirubin index at forehead and serum bilirubin values of Malay babies.

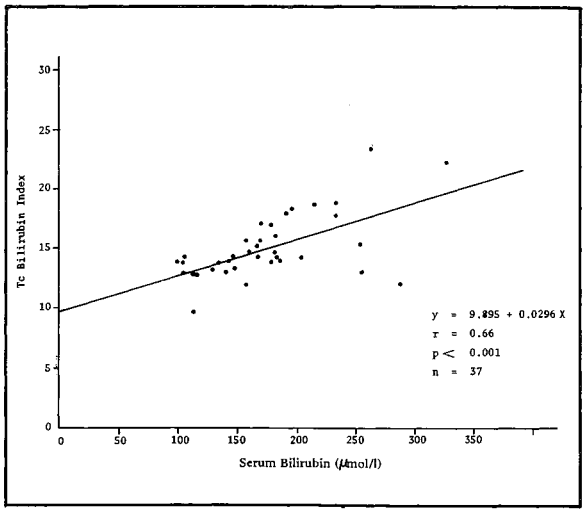

Fig. 2 Correlation between Tc bilirubin index at forehead and serum bilirubin values of Chinese babies.

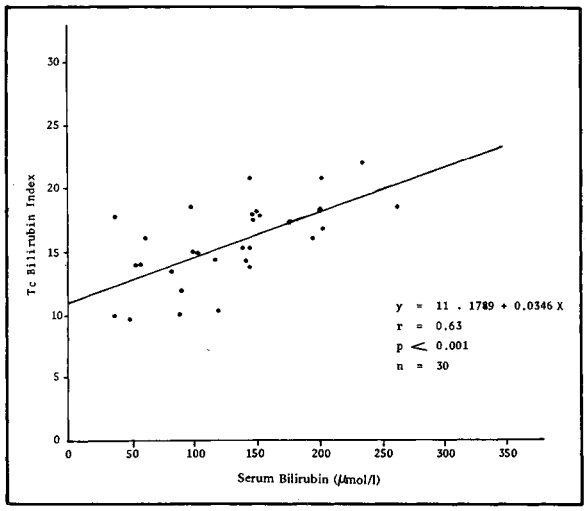

Fig. 3 Correlation between Tc bilirubin index at forehead and serum bilirubin values of Indian babies.

During the course of the study, it was noted that the degree of skin pigmentation of the Malay babies was fairly uniform compared to the other two racial groups. The Indian babies showed marked variation in skin pigmentation from the very dark to the very fair. The Chinese babies showed less variation than the Indian babies but more than the Malay babies.

DISCUSSION

This study supports other findings [3,4,5,6], that there is correlation between the Tc bilirubin index and the serum bilirubin values. However, the Tc bilirubin indices tend to overestimate the serum bilirubin levels. Compared with the Tc bilirubin readings in the Caucasian babies,[4,6] the Tc bilirubin indices in the Malay, Chinese and Indian babies of corresponding serum bilirubin levels tend to be

higher. This could be explained by the fact that the Tc bilirubin indices are affected by the degree of skin pigmentation of the babies in the study.

The action levels, as recommended by the manufacturer, are defined as the Tc bilirubin indices above which blood needs to be taken for estimation of serum bilirubin values and treatment instituted when necessary. Table II shows the action levels of Tc bilirubin indices for the three racial groups derived from the respective graphs in Figs. 1,2, and 3. The serum bilirubin values used are based on Avery's guidelines for management of neonatal hyperbilirubinemia at different age groups. [7]

The action levels of Tc bilirubin indices in Chinese and Malay babies are comparable. The chances of under-and overtreatment are not great using these indices. However, for the Indian babies, the action levels are not reliable. As shown by the widely scattered values on both sides of the regression line (Fig. 3), the use of action levels may lead to over or undertreatment in the Indian babies. From the practical point of view, in a multiracial population of widely varied degree of skin pigmentation, the Tc bilirubinometer cannot be relied upon to determine accurately when to initiate treatment of jaundiced babies.

It is logical that the next step is to group the population under study according to the degree of skin pigmentation. However, it was found that it was too subjective to grade the different degree of skin pigmentation. Moreover, even if this was successful, and the action levels were determined for the different grades of skin pigmentation, it would be very difficult to use these values accurately in practice. This is because not all medical and nursing workers would have graded the patients' skin pigmentation similarly.

TABLE II
BILIRUBIN INDICES FOR ACTION LEVELS

Serum bilirubin levels (μmol/l)	Race		
	Malay	Chinese	Indian
85	12. 5	12.5	14
170	16.25	15	17

Two Chinese babies with serum bilirubin values of more than 250 μmol/l had low Tc bilirubin indices (Fig. 2). Both these babies had severe jaundice due to ABO incompatibility within the first 24 hours of life. Kramer [8] noted that in the presence of very rapidly rising serum bilirubin level, there may be a lag in the progress of dermal icterus. This could explain the low Tc bilirubin indices in these two babies since the transcutaneous bilirubinometer works by detecting the intensity of the skin bilirubin colour.

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REFERENCES

[1]Dubowitz L M S, Dubowitz V, Goldberg C. Clinical assessment of gestational age in the newborn infant. *J Paediatr* 1970; 77: 4-5.

[2]Jendrassik L, Grof P. *Biochem J* 1938; 297: 81-89.

[3]Tan K L. Transcutaneous bilirubinometry in fullterm Chinese and Malay infants. *Acta Paediatr Scand* 1982; 71: 593-596.

[4]Hegyi T, Hiatt I M, Indyk I. Transcutaneous bilirubinometry. I. Correlations in term Infants. *J Paediatr* 1981; 98: 454-457.

[5]Yamanouchi I, Yamauchi Y, Igarashi I. Transcutaneous bilirubinometry: Preliminary Studies of noninvasive transcutaneous bilirubinometer in Okayama National Hospital. *Paediatrics* 1980; 65: 195-202.

[6]Tudehope D I, Chang A. Multiple site readings from a transcutaneous bilirubinometer. *Med J Australia* 1982; 18: 102-105.

[7]Avery G B (ed). *Guidelines for Management of Neonatal Hyperbilirubinemia. Neonatology.* Philadephia: J. B. Lippincott, 1975.

[8]Kramer L I. Advancement of dermal icterus in the jaundiced newborn. *Am J Dis Child* 1969; 118: 454-458.