

ICTEROMETER: A USEFUL SCREENING TOOL FOR NEONATAL JAUNDICE

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ABSTRACT

One hundred and sixty one jaundiced newborns were investigated for the usefulness of perspex icterometer as a screening tool for neonatal jaundice. Along with serum bilirubin estimation, icterometer score was simultaneously obtained in all the cases. The correlation between serum bilirubin and icterometer score was high ($r=0.99$). The icterometer was useful in various subgroups. A high sensitivity, specificity, positive and negative predictive value was seen in all the groups. A possible role of icterometer in India for screening newborns with jaundice at peripheral level is highlighted.

Key words: Jaundice, Transcutaneous bilirubinometry

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Neonatal jaundice is one of the commonest problems seen in the neonatal period and approximately 6% babies suffer from serious jaundice needing intervention(1). Although clinical assessment of jaundice by an experienced person can be fairly accurate, it is common for a person not specially trained in neonatal care to mis-judge the severity of jaundice. Delay in referral or treatment of these babies can cause kernicterus and severe consequences to the neurodevelopment of these children.

Transcutaneous bilirubinometry has been found to be a simple and reliable non invasive method for screening of these newborns. It can help the clinician to decide when to obtain a blood sample to determine serum bilirubin. Minolta jaundicemeter is reported to be a useful and objective tool in Western as well as Indian babies for screening newborns with jaundice(2-5). The cost of Minolta jaundicemeter, however, restricts its widespread use. This study was, therefore, conducted to determine the usefulness of a cheaper perspex icterometer as a screening tool in neonatal jaundice.

Material and Methods

One hundred and sixty one neonates born at the Lady Hardinge Medical College and Associated Hospitals during September, 1989 to January, 1990 formed the study population. In all the infants, blood samples were drawn for serum bilirubin estimation because of presence of clinical jaundice. Blood was obtained by heel prick and serum bilirubin was estimated by TYPE BM2-TOYO BILIRUBIN ANALYSER (Photo Analyser) in our laboratory. A reading by Ingram icterometer was taken on the tip of the nose as described by Gossett and Oxon(6).

The data was analysed with respect to five groups: *Group I*—All infants (n=161); *Group II*—Term infants not under phototherapy (n=77); *Group III*—All preterm infants not under phototherapy (n=46); *Group IV*—Preterm infants of 35-36 weeks gestation and not under phototherapy (n=11); *Group V*—all infants under phototherapy (n=38). The data was analysed using regression analysis to obtain coefficient of correlation (r) between cutaneous values and total plasma bilirubin. Significance of the r value was obtained by direct reference to correlation coefficient table(7). An icterometer score of 3 (corresponding to serum bilirubin 10.03 mg/dl) was used as 'Cut Off' point to calculate sensitivity, specificity, positive and negative predictive value for each group.

Results

The mean serum bilirubin for all neonates was 9.99 ± 2.44 mg/dl while the range was 4.5-17.2 mg/dl. The mean birth weight was 2.24 ± 0.60 kg and gestation was between 31-42 weeks. *Table I* gives the birth weight, gestational age and bilirubin profile of all the five groups along with mean bilirubin level calculated by icterometer

scores. The correlation of icterometer score with serum bilirubin varied from 0.97-0.99 among different groups. It was slightly lower in preterm infants with 35-36 weeks gestation and in term infants. Infants under phototherapy also showed a good correlation. The mean and standard deviation bilirubin values for each icterometer score obtained in the present study are shown in *Table II*. Using an icterometer score of 3 as a 'cut off' point, the sensitivity, specificity, positive and negative predictive values were calculated for each group (*Table III*).

Discussion

Transcutaneous bilirubinometry is a reliable, yet non-invasive method that avoids the need for biochemical investigations which are invasive, time consuming and not uniformly available. As most of the babies in our country are looked after by health personnel who do not have adequate training in neonatal care, such screening devices assume even more importance. Minolta jaundicemeter has gained popularity in India and was found to be a useful screening device for neonatal jaundice(4,5,8). It is rather unfortunate that scarce literature is

TABLE I—Correlation of Serum Bilirubin with Transcutaneous Values Obtained by Icterometer

Group	No.	Gestation (Weeks)	Weight (kg)	Serum bilirubin* (mg/dl)	Icterometer* (mg/dl)	Correlation coefficient (r)
I	161	31-42	2.24 ± 0.60	9.99 ± 2.44	9.83 ± 2.54	0.99
II	77	37-42	2.69 ± 0.37	9.95 ± 2.86	10.00 ± 2.89	0.97
III	46	<37	1.68 ± 0.19	9.59 ± 1.92	9.03 ± 2.10	0.987
IV	11	35-36	1.85 ± 0.22	9.14 ± 1.74	8.24 ± 1.83	0.97
V	38	31-42	2.05 ± 0.62	10.69 ± 2.18	10.69 ± 1.96	0.99

*Values mean \pm SD.

All correlations were significant at p values <0.001.

TABLE II—Icterometer Scores and Corresponding Total Serum Bilirubin Values

Grading	No. (mg/dl)	Serum bilirubin* (mg/dl)	95% confidence limit (mg/dl)
2	13	6.41 ± 1.21	5.75 — 7.07
2½	45	8.09 ± 1.38	7.68 — 8.50
3	58	10.06 ± 0.97	9.81 — 10.31
3½	35	12.12 ± 0.97	11.80 — 12.44
4	10	15.18 ± 1.25	14.41 — 15.95

*Values are mean ± SD.

TABLE III—Parameters of Accuracy Based on 'Cut off' Point*

Group	Sensitivity	Specificity	Predictive value of +ve test	Predictive value of -ve test
I	93.1	70.3	78.4	89.7
II	97.4	71.1	77.6	96.4
III	79.2	77.3	79.2	77.3
IV	50.0	85.7	66.7	75.0
V	100.0	57.1	80.0	100.0

*Cut off point = 3 (10.03 mg/dl)

available from India regarding the use of perspex icterometer, a simple and much cheaper device(9). This particular device is in use for the last 30 years and has documented efficacy in white, oriental and black newborn population(10-12).

In the present study, a good correlation was found between plasma bilirubin and transcutaneous estimation of bilirubin (Table I). The correlation was highly significant in all the subgroups studied. A slightly lower correlation was found in Group II (term infants) and Group IV (preterm infants 35-36 weeks) though not significant statistically. Bhardwaj *et al.* also found an inferior correlation in babies approaching term(9). Skin thickness and vascularity of the skin can be possible explanations. The diminution of efficacy of the transcutaneous bilirubinometry during

phototherapy as reported by other workers(12,13) was not observed and a good correlation was seen in infants under phototherapy.

An icterometer score of 3 (corresponding to 10.03 mg/dl) was used as a cut off point as babies with more than 10 mg/dl of serum bilirubin need biochemical estimation for close monitoring. With this level of bilirubin, high sensitivity and specificity values were obtained (Table III). Although poor sensitivity values were seen in preterm infants with 35-36 weeks gestation smaller number of cases preclude any comment. The negative predictive values in all groups were also very high.

When evaluating icterometer as a potential screening tool compared to much tested Minolta Jaundicemeter, we must take into account not only the relative sen-

sitivity and specificity but also the cost and inter-observer variations. Minolta Jaundicemeter has been found not only to provide good precision and also inter-observer errors are not seen. Icterometer on the other hand is a much cheaper device. However, comparisons with icterometer precision are difficult to ascertain as individual's inherent ability to differentiate between shades of color is an important determinant. As an individual gains experience with icterometer, precision improves. The reason for a good correlation in our data may be due to the fact that all the readings in our study were taken by an experienced observer.

The present study thus clearly demonstrates the usefulness of perspex icterometer to assess serum bilirubin levels with reasonable accuracy. Using an icterometer score of 3 as cut off point, the need for biochemical estimation can be considerably reduced in term infants in postnatal wards and neonatal nursery. In a country like India, it can find a useful place at peripheral level for timely referral of newborns to places where facilities for phototherapy and exchange transfusion exist.

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