Original Article

The Clinical Risk Index of Babies (CRIB) Score in India

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Abstract. ***Objective :*** To assess the usefulness of clinical risk index of babies (CRIB score) in predicting neonatal mortality in extremely preterm neonates, compared to birth weight and gestation. ***Methods :*** 97 preterm neonates with gestational age less than 31 weeks or birth weight less than or equal to 1500 g were enrolled for the prospective longitudinal study. Relevant neonatal data was recorded. Blood gas analysis results and the maximum and the minimum FiO_2 required by babies in first 12 hours of life were noted. Mortality was taken as death while the baby was in nursery. The prediction of mortality by birth weight, gestational age and CRIB score was done using the Logistic model, and expressed as area under the ROC curve. ***Results :*** The area under the ROC curve for birth weight, gestational age and CRIB score was almost the same, the areas being 0.829, 0.819 and 0.823 respectively. Hence CRIB score did not fare better than birth weight and gestational age in predicting neonatal mortality. ***Conclusion :*** The CRIB score did not improve on the ability of birth weight and gestational age to predict neonatal mortality in the study. **[Indian J Pediatr 2002; 69 (11) : 957-960]**

Key words : *CRIB Score; Preterm; Neonatal mortality*

The clinical risk index of babies (acronym-CRIB) is a scoring device developed in the west and introduced as a robust index of neonatal risk, to predict mortality and morbidity in extremely premature newborns[1]. Neonatal intensive care in India has now acquired considerable sophistication with the introduction of neonatal ventilators, onsite blood gas analysis, in-house facility for cranial ultrasound, etc. This study was conducted in a tertiary level neonatal unit to evaluate the CRIB score in India.

The time honoured system of birth weight specific mortality neglects other differences in risk, particularly those due to initial disease severity[2,3]. The score of Neonatal Acute Physiology (SNAP score) uses 26 variables and presumes to predict mortality and morbidity better than birth weight criteria alone[4]. However, the large number of variables make it cumbersome and precludes its routine use. The CRIB score was constructed by converting into integers the regression coefficients of independent ranges or categories of six routine clinical variables in a logistic model for hospital death.[5,6,7]

There have not been any studies on CRIB score published from India. It was therefore planned to study CRIB score prospectively in Indian babies to see how well it could predict neonatal mortality.

MATERIALS AND METHODS

The study was conducted at the neonatal unit of St. Stephen's Hospital, which is a large referral hospital. There are about 7000 deliveries annually in the hospital and about 1300 admissions to the neonatal unit each year. All preterm infants born consecutively from 1-5-97 to 30-11-97 and from 1-4-98 to 30-5-98 (total of 9 months) with birth weight less than or equal to 1500 gm or gestational age less than 31 weeks (n=105) were enrolled for the study in a prospective manner.

Birth weight was recorded for each baby as soon as it arrived in the nursery for admisssion. This was done using an electronic balance having a sensitivity of 10 g. Gestational age was assessed using the detailed Dubowitz score. This was done in the first 24 hours of birth. In 9 infants in whom their condition did not permit Dubowitz scoring or whose scoring could not be done for other reasons, post conceptional age was determined from the obstetric data. A detailed note of all the congenital abnormalities was made and they were scored according to the severity as in the original study on the CRIB score. 6 infants with invariably lethal congenital abnormalities, 2 with epidermolysis bullosa and one each with renal agenesis, asphyxiating thoracic dystrophy, large hydrocephalus and arthrogryposis multiplex congenita were excluded. Two infants whose parents refused any kind of treatment were also excluded from the study. In excluding children with invariably lethal abnormalities, we followed the protocol of International Neonatal Network. The remaining 97 were taken for statistical analysis.

All babies had saturations checked in the nursery. Those who were saturating normally in air did not have continuous monitoring. Saturations were checked at 8

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hourly intervals if children were not distressed and saturations were normal in air at the last time of checking. Blood gas was recorded at birth and further as dictated by the clinical requirements of each infant except babies whose saturation monitoring readings were normal throughout and who were not distressed. The maximum base excess recorded in the first 12 hours was noted. In those babies where blood gas estimation was not done, as it was not indicated, the base excess was scored as zero. The maximum and minimum fraction of inspired oxygen (FiO_2) required by the baby for maintaining the hemoglobin saturation between 88–95% in the first 12 hours was recorded. This was done recording readings on the air-oxygen blender in ventilated neonates or with a Miniox-3 meter to test oxygen concentration in babies under head box oxygen. The FiO_2 was checked as and when there was a change made in the flow rate of O_2 in the head box or FiO_2 was changed on the ventilator, depending upon the requirements of the baby as shown by the pulse oximeter. If FiO_2 was not recorded in an infant who required no respiratory support, oxygenation in the first 12 hours was assumed to be normal.

Each of these six parameters namely birth weight, gestational age, congenital malformations, maximum base excess, minimum and maximum FiO_2 were scored according to the scoring system of CRIB. The final CRIB score was then obtained by the arithmetic sum of individual scores of these parameters. Mortality statistics reflect death prior to discharge from the nursery. Babies discharged to home in a critical condition on the request of their parents were also considered as having died.

STATISTICAL ANALYSIS

All the six parameters constituting the CRIB score and the CRIB score as a whole were statistically analyzed by the 't' test. This was done for both survivors and non-survivors separately to look for any statistically significant difference between the two groups. In the end with hospital death as the dependant variable, Logistic model was used to analyze the prediction of mortality by the three prognostic variables–birth weight, gestational age and CRIB score. The predictive accuracy of these receivers were expressed as area under the receiven operative characteristic (ROC) curve and the results compared. ROC curves help to compare the performance of different tests, by plotting Sensitivity (or true positive rate) against 1-Specificity (or false positive rate). The area under the ROC curve, which denotes the predictive accuracy, varies from 0.50 (no apparent accuracy) to 1.00 (perfect accuracy)[8,9].

RESULTS

Fig. 1 shows the distribution of our cases by birth weight and gestational age. Most of the babies in this study were small for date, and their birth weight clustered below and around the third percentile for their age. The mean birth weight was 1213.20 g with S.D. of 225.88 (range : 670 to 1500 g). The mean birth weight of the male and the female cases was almost equal being 1210.83 and 1215.51 g respectively. The mean gestational age of the babies was

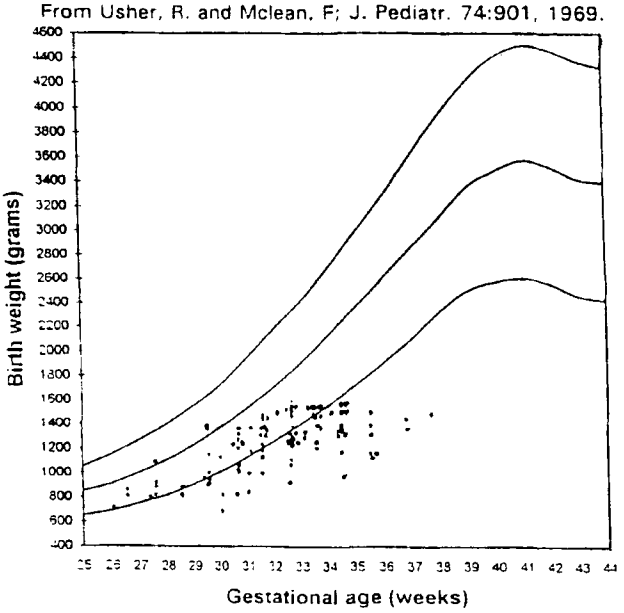

Fig. 1. Distribution of babies by birth weight and gestational age.

31.47 weeks (male – 30.96 weeks, female – 31.98 weeks). The babies ranged between 26 to 37 weeks with S.D. of 2.33.

Table 1 shows the population characteristics of the study on the basis of CRIB score. The CRIB score ranged

TABLE 1. Population Characteristics According to CRIB Score

CRIB score	Total cases (n = 97)	Male (n = 48)	Female (n = 49)
0-2	51	24	27
3-5	23	11	12
6-8	16	6	10
9-11	5	5	0
12-14	1	1	0
> 15	1	1	0

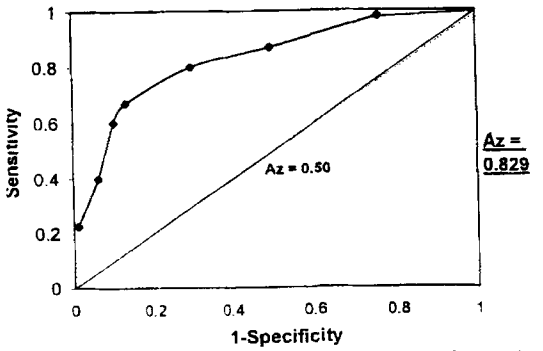

Fig. 2. Area under the ROC curve (Az) for prediction of mortality by birth weight

between 0 to 16 with mean of 3.36 and S.D. of 3.32. The mean CRIB score in male babies (3.90) was higher as compared to female babies (2.84).

Figs. 2, 3 and 4 show the predictive accuracy of birth weight, gestational age and CRIB score in foretelling

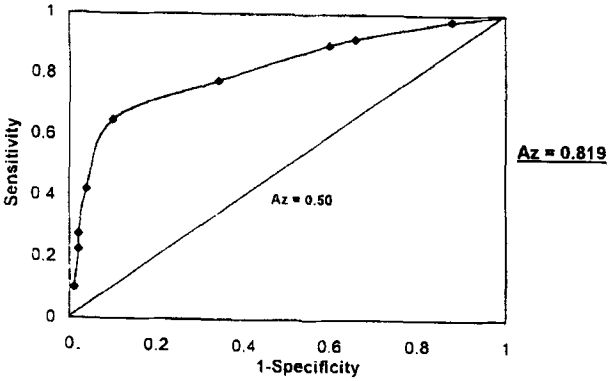

Fig. 3. Area under the ROC curve (Az) for prediction of mortality by gestational age

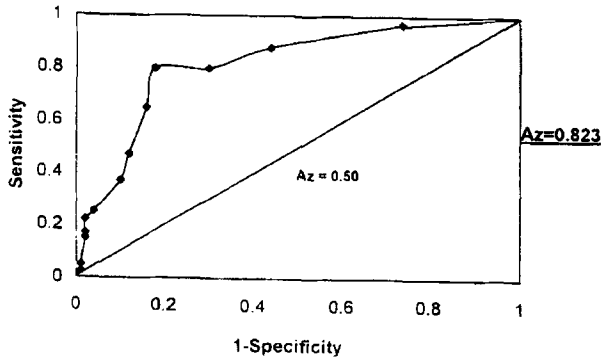

Fig. 4. Area under the ROC curve (Az) for prediction of mortality by CRIB score

mortality expressed as area under the ROC curve, which comes out to be 82.9%, 81.9% and 82.3% respectively. The predictive accuracy of all the three was almost equal.

DISCUSSION

Scoring systems that quantify initial risk have an important role in health services research, planning and clinical audit.[10-13] By facilitating more reliable comparisons of outcome, they allow better monitoring of the quality of care between and within hospitals over time, than does simple comparison of mortality[4,14,15]. However, if a clinical score is to achieve widespread acceptance by busy clinicians, it must be simple and accurate and must use routine data. CRIB score with only 6 variables is the simplest of the clinical scores with similar predictive accuracy.[1] This study looked at mortality against CRIB score under Indian conditions. The CRIB score was devised in the UK and validated there in National Health Services Hospitals.

A study conducted in South Africa also showed that the CRIB score was not more predictive of mortality than birth weight.[16] They had suggested that the addition of lowest oxygen requirement in the first 12 hours (min. FiO_2) and maximum partial arterial CO_2 pressure (max. $PaCO_2$) in the first 72 hours improved the accuracy of the score. The finding that CRIB was not more predictive of mortality than birth weight, found in another developing country, is similar to the present study findings.

In the West, the limits of viability have been pushed way below 28 weeks to approximately 24 weeks due to the availability of surfactant. In India, survival below 28 weeks is rare. Monetary constraints preclude the use of surfactant in most preterm babies. Thus, if all babies below 28 weeks gestation are to die, regardless of how well they appeared in the first 12 hours of birth, it is easy to understand that the measures of infant well-being in the initial hours of birth do not influence its chances of survival below 28 weeks of gestation. As we get more sophisticated with the management of such small babies and more of them survive, we may able to see CRIB score having more relationship with outcome.

Another reason for the poor showing of CRIB score in India could be the greater weightage given to birth weight but little to gestational age in the scoring system of CRIB. Birth weight less than 700 g scores 7 points while gestational age less than 24 weeks is given only 1 point[1]. In the West, as most babies have weight appropriate for age, the weight at birth could well be interchanged for gestational age and not influence survival separately. But in India, the population characteristics of preterm infant are quite different. The incidence of intrauterine growth retardation is more common here. Thus gestational age would be the critical factor influencing survival or mortality more than the birth weight. This flaw has been pointed out by Richard HB de Courcy Wheeler[7], but the factor is less crucial to the population he refers to as most babies are of appropriate weight for gestational age.

CONCLUSION

The predictive accuracy of CRIB score in foretelling mortality was 82%, which was similar to that of birth weight and gestational age. Hence, the CRIB score did not improve on the ability of birth weight or gestational age in predicting neonatal mortality in the study.

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