

## ORIGINAL ARTICLE

# Accuracy of CRIB II Score in Predicting the Neonatal Mortality in very Preterm Babies

ABDUL REHMAN<sup>1</sup>, MUHAMMAD HAROON HAMID<sup>2</sup><sup>1</sup>Senior Registrar, Pediatric Medicine Unit-1, King Edward Medical University, Mayo Hospital, Lahore<sup>2</sup>Chairman & Professor of Pediatric Medicine, King Edward Medical University, Mayo Hospital, LahoreCorrespondence to: Abdul Rehman, Email: [dr\\_abdul\\_rehman@hotmail.com](mailto:dr_abdul_rehman@hotmail.com)**ABSTRACT****Objective:** To determine the accuracy of Clinical Risk Index for Babies (CRIB) II score to predict mortality in very preterm babies.**Methodology:** In this cross-sectional study at Neonatal Intensive Care Unit (NICU) of The Children's Hospital, Lahore, 145 very preterm neonates admitted in NICU were enrolled. We determined gestational age, weight, rectal temperature and base excess for both genders within first hour of the admission. The collected data was entered on CRIB II score chart and risk of mortality was calculated. The babies were reviewed daily in NICU till final outcome (mortality or no mortality).**Results:** In this study, out of 145 patients, 47.59%(n=69) were females and 52.41%(n=76) were males. Mean±SD for gestational age, birth weight, rectal temperature, base excess and CRIB II score was 29.90±1.70 weeks, 1171.31±192.16 grams, 36.92±0.39 degrees Celsius, -3.63±6.63 and 5.03±3.04 respectively. Actual mortality rate was 36.55%(n=53) whereas 63.45%(n=92) had no mortality; Predicted mortality rate on CRIB II score was 41.38% (n=60) whereas 58.62%(n=85) had no mortality. Accuracy of CRIB II score to predict mortality in very preterm babies admitted in NICU of The Children's Hospital, Lahore was 84.14%. It had sensitivity of 84.91%, specificity of 83.70%, (PPV) of 75.00% and (NPP) of 90.58%. Area under the receiver operating characteristics (ROC) curve was 0.840 (std. error=0.035; p-value=0.000).**Conclusion:** We concluded that CRIB II score is a valid clinical score with higher accuracy to predict neonatal mortality in very preterm babies.**Keywords:** Very Preterm Babies, Neonatal Mortality, CRIB II Score, Predictive Accuracy**INTRODUCTION**

Preterm birth rate has been estimated to be 11.1% of live births, giving a worldwide about 15 million preterm births. Pakistan was at the 4<sup>th</sup> number after India, China and Nigeria, among 10 countries with the highest preterm birth rate. Worldwide, preterm birth is the 2<sup>nd</sup> largest direct cause of mortality after pneumonia in children under 60 months of age.<sup>1</sup> Risk of neonatal mortality is significantly high in babies less than 32 weeks of gestation or less than 1kg at birth.<sup>2</sup> Low birth weight has always been remained most significant factor in predicting neonatal mortality.<sup>2,3</sup> Birth weight itself is consequence of preterm birth or intrauterine growth restriction or both.<sup>4</sup> Studies have shown that both birth weight and gestational age have positive association with mortality. The low birth weight and gestational age; the higher the neonatal mortality.<sup>5</sup> Severity of illness upon hospitalization is among the others factors that affect the neonatal mortality and morbidity.<sup>3</sup>

Neonatal mortality has significantly decreased among neonates admitted in NICU due to advances in the intensive care. However, disparities exist in neonatal mortality among NICUs in different regions or even in the same hospital. These disparities cannot be explained by simple factors like birth weight and gestational age because such factors do not cover dimensions of severity of illness. This problem has been resolved by using prognostic scoring systems that are not only useful tools in NICUs to predict neonatal mortality but also allow standardized comparison of outcomes among different NICU units.<sup>5,6,7</sup>

CRIB II score has five variables (birth weight, gestational age, base excess, body temperature and sex of the baby).<sup>8</sup> It is a valid tool of neonatal mortality and predicts outcome accurate than any other variable like gestational age, birth weight, temperature and base excess.<sup>2,9</sup> CRIB II score starts from 0 and ends at 27. Prognosis becomes worse as we move from 0 to 27. It can be divided into four levels based upon score. Level 1, 2, 3 and 4 for scores 0 to 5, 6 to 10, 11 to 15 and 15-27 respectively.<sup>2,5</sup>

The Children's Hospital Lahore has no Obstetric Unit and all neonates are either home delivered or have been referred from other hospitals. There are many factors that can alter patient's outcome; for instance, patient may have been received either from home or other hospitals, may or may not have received initial treatment from referring hospital, age of patient on receiving, time to reach the hospital and difference of medical care while shifting. CRIB II has been validated in many parts of the world but

variability do exist in its accuracy and optimal cutoff value in different populations. The rationale of this study is to evaluate the accuracy of CRIB II while predicting mortality of neonates in very preterm babies admitted in NICU of The Children's Hospital, Lahore.

**METHODOLOGY**

A total of 145 preterm babies with gestational age of 23-32 weeks, admitted to NICU in first twelve hours of life, were included in the study. Whereas babies with birth weight <500 grams, admission after 12 hours of birth, surgical emergencies, major congenital anomalies (Anencephaly, Gastroschisis, Omphalocele), genetic disorders e.g., Down's Syndrome, Congenital adrenal hyperplasia and declined consent by parents were excluded. We calculated age of the gestation from 1<sup>st</sup> day of the last menstrual cycle or by using New Ballard scoring chart in case of undefined LMP<sup>6</sup>. Weight was calculated in grams using an electronic scale and rectal temperature was recorded after placing the thermometer in rectum for one minute. Base excess was noted from ABGs. All the parameters (gestational age, weight, temperature and base excess) for both genders were collected within first hour of the admission in NICU to avoid treatment bias. The collected data was entered on CRIB II score chart and risk of mortality was calculated. The babies were reviewed daily in NICU till final outcome (mortality or no mortality). We used 20<sup>th</sup> version of SPSS for data analysis.

**RESULTS**

Among total 145 patients, mean±SD for age of gestation, birth weight, rectal temp, base excess and CRIB II score was 29.90±1.70 weeks, 1171.31±192.16 grams, 36.92±0.39 degrees Celsius, -3.63±6.63 and 5.03±3.04 (Table No.1). Gender distribution showed that male 52.41%(n=76) and 47.59%(n=69) females. Predicted mortality rate on CRIB II score was 41.38% (n=60) whereas 58.62%(n=85) had no mortality. Actual mortality rate was 36.55%(n=53) whereas 63.45%(n=92) had no mortality (Table No.2). Area under the receiver operating characteristics (ROC) curve was 0.840 (std. error=0.035; p-value=0.000). Accuracy of CRIB II score in predicting the neonatal mortality in very preterm babies admitted in NICU of The Children's Hospital and Institute of Child Health, Lahore was 84.14%. It had sensitivity of 84.91%, specificity of 83.70%, positive predictive value (PPV) of

75.00% and negative predictive value (NPP) of 90.58 % (Table No.3).

Table 1: Descriptive Characteristics

	Minimum	Maximum	Mean	Std. Deviation
Gestation Age (weeks)	26	32	29.90	1.70
Weight (g)	700	1450	1171.31	192.16
Rectal Temp. (°C)	36.1	37.6	36.92	0.39
Base Excess	-20.00	6.00	-3.63	6.63
CRIB II Score	1	12	5.03	3.04

Table 2: Frequency Distribution

	Frequency	Percent
Male cases	76	52.41
Female cases	69	47.59
Total	145	100.00
CRIB II Predicted Mortality	60	41.38
CRIB II Predicted No Mortality	85	58.62
Total	145	100.00
Actual Mortality	53	36.55
Actual No Mortality	92	63.45
Total	145	100.00

Table 3: Accuracy of CRIB II Score

CRIB II	Mortality (Positive)	Mortality (Negative)	Total
+ve	TP (a) 45	FP (b) 15	a + b 60
-ve	FN (c) 8	TN (d) 77	c + d 85
Total	a + c 53	b + d 92	145

Sensitivity = 84.91%

Specificity = 83.70

PPV = 75.00%

NPV = 90.58 %

Accuracy rate = 84.14 %

## DISCUSSION

In our study, CRIB II score was valid clinical score, in our study, in predicting neonatal mortality in very preterm babies admitted in NICU with higher accuracy of 84.14% at cut off value of  $\geq 4$ . It had sensitivity of 84.91%, specificity of 83.70%, PPV of 75.00% and NPV of 90.58 %. Area under the receiver operating characteristics (ROC) curve was 0.840 (std. error=0.035; p-value=0.000). We compared our results with an Egyptian study<sup>5</sup> in which CRIB II score with cutoff value of 11 had sensitivity of 94.9% with specificity 82.4%, PPV 74.0% and NPV as 96.8%. Area under the ROC curve was 0.968. In a Kenyan study<sup>2</sup>, with a cutoff value of 4, CRIB II score had 80.6% sensitivity, 75.3% specificity, PPV as 83.3% and NPV as 82.1%. Area under the ROC curve was found to be 0.692. Mohkamet al<sup>7</sup> found that CRIB II score with cutoff point of 5 had sensitivity of 69.6%, specificity 63.0%, PPV=76.2% and NPV=54.8%. Area under the ROC curve was 0.698.

Above mentioned studies<sup>2,5,7</sup> including our study showed that areas under the ROC curve were more than 0.5 which indicate that CRIB II score has good discriminating ability to predict mortality or survival of neonates. Disparities among sensitivity, specificity, PPV, NPV and cut off value can be explained by local mortality rate and management differences. In our study actual mortality rate was 36.55% almost equal to Egyptian study (34.5%) but lower than Kenyan study (45.9%). In our study, ROC curve analysis also showed that at cut off value of 3.5, sensitivity of CRIB II score would be 75.5% with false positive rate of 25% while on cut off value of 4.5 it would be 75.5% and 23.9 % respectively. It favors cut value of 4 in our population which accords with previous studies<sup>2,10</sup>.

Mohkamet al<sup>7</sup> found CRIB (AUC=0.817) a valid tool for predicting neonatal mortality better than CRIB II (AUC=0.698), however, in another study<sup>11</sup> CRIB II (AUC=0.91) was found to be slightly better than CRIB (AUC=0.90). CRIB performed poorly in predicting neuro-developmental outcomes at 12months of corrected age in very low birth weight (VLBW)babies.<sup>12</sup> Lago et al<sup>13</sup>

found CRIB score as a valid tool in predicting short term hospital outcomes even in extremely low birth weight babies but it correlated poorly with neurodevelopmental outcomes at 18 months of corrected age. Fowlie et al<sup>14</sup> used CRIB with cranial ultrasound and concluded that CRIB performed more accurately than individual birth weight, gestational age or cranial ultrasound but CRIB should only be used as supportive tool with clinical judgement for prognosis. Ana Lúcia F and others<sup>15</sup> examined CRIB score and found it a valid score. We did not compare the original CRIB score with CRIB II in our study.

Rastogi and others<sup>16</sup> evaluated validity of CRIB II score and concluded that CRIB II score was a good tool in predicting the neonatal mortality in preterm babies with gestational age of less 32 weeks. Abhay Lodha and others<sup>17</sup> evaluated CRIB II score in preterm infants at 36 months of corrected age for long term neuro developmental outcomes (sensitivity 83%; specificity 84%).

In summary, CRIB II is a valid tool to predict mortality in preterm babies in different populations worldwide including our local population. However, The Children's Hospital, Lahore has no Obstetric Unit and all of neonates are received from other hospitals or home delivered. So, our findings cannot be generalized. We recommend that it should be evaluated in local population to find out its validity and optimal cut off value.

## CONCLUSION

We concluded that CRIB II score is a valid clinical score with higher accuracy in predicting neonatal mortality in very preterm babies admitted in NICU.

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