Original Article

The Accuracy of Clinical Risk Index for Babies (CRIB-II) for Predicting Mortality of Severely-ill Preterm Neonates

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ABSTRACT

Background: In Pakistan neonatal mortality rate is 47.3 among 1000 live births. Predictors of neonatal mortality risk can be used to prioritize the care for neonates and to improve the outcome. **Objective:** To determine the accuracy of clinical risk index for babies (CRIB-II) for predicting mortality of severely ill preterm neonates. **Study Design:** A Cross Sectional Study. **Settings:** NICU, Department of Pediatrics Unit I and Unit II, Mayo Hospital, Lahore Pakistan. **Duration:** From January 22, 2016 to July 30, 2016. **Methodology:** 200 cases fulfilling the selection criteria (Gestational age 26-34 weeks, Preterm admitted in NICU within 12 hours of birth), were included in the study by nonprobability, Consecutive Sampling. Babies with lethal malformations were excluded. Data required for CRIB II score was collected and analyzed by SPSS. **Results:** Out of the 200 cases, 102 patients were male (51 %). Age varies from 1 hour to 9 hours of life with mean of 5.8. Gestational age ranges from 28 weeks to 33 weeks with mean age is 30 weeks. Patients had following diagnosis with number of cases: Respiratory distress syndrome 54; Early onset sepsis 30; PT, JNN, EOS 22; Mild Asphyxia 18; Prematurity 14; RDS, EOS 14; Moderate Asphyxia 10; prematurity, Jaundice neonatorum 8; IUGR 8; Early onset sepsis, DIC 4; PT, NEC, EOS 4. CRIB score has sensitivity of 77.7 %, specificity of 65.4 %. It has positive predictive value of 64.8 %, negative predictive value of 78.2 % & clinical accuracy of 71%. **Conclusion:** CRIB II score has clinical accuracy of 71 % determining prognosis of severely ill preterm neonates in term of mortality.
Keywords: CRIB II score, Neonatal Mortality, Prematurity.

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INTRODUCTION

Preterm birth is defined as child birth occurring before 37 completed weeks.[2] With improved and advanced perinatal care, the incidence of preterm birth is increasing worldwide and that of perinatal mortality decreasing.[2] Preterm babies are at risk of high morbidity and mortality.[3] Preterm birth is the second leading cause of under five deaths and accounts for 35% of neonatal death directly or indirectly via infections or respiratory distress syndrome.[2]

Neonatal mortality accounts for 62% of the infant's death worldwide. In Pakistan neonatal mortality rate is 47.3 among 1000 live births with main causes being prematurity (26%), asphyxia (26%), and infections (23%).7% of world neonatal deaths occur in Pakistan, the reason being suboptimal care provided to the mother and the newborn. Lesser the gestational age, more will be the morbidity and mortality.[8]

Care of Preterm & low birth weight babies is a specialized care in secondary and tertiary care centers & require huge finances. So, by identifying the factors leading to premature and low weight births, a state cannot only lower its neonatal mortality rate but also use the resources adequately to save babies in time and thus decreasing the length of hospital stay.[10] Factors predicting neonatal mortality can be used to prioritize the care for vulnerable neonates and improve the outcome. Various scoring systems predict mortality risk in preterm neonates like SNAP, SNAPPE, CRIB and CRIB-II. Each has different sensitivity and specificity.[9] SNAP also predicts well the neurological disability at 1 and 3 yrs. of life.[16] Flaws of this

scoring system were complexity of the large number of variables and data collection in first 24 hours of life.[19]

CRIB-II has been found to be a good tool for predicting neonatal mortality in a setting where facility for blood gas analyses is available.[10] CRIB-II has the advantage among other scores systems, of being easier to collect data, in first 12 hours, with just 5 variables (gender, weight, gestational age, temperature and base excess), all except base excess being captured at admission and altered less over time. CRIB II is simpler to calculate either manually or with computer. Other scoring systems are complex and extensive with data collected in up to 30 minutes per patient.[11] There is also a need of a safe transport in neonates for a better outcome along with treatment given and interventions done.[20]

CRIB-II has not been adopted in Pakistan yet so data regarding its reliability and applicability in local settings is lacking. This study aims to assess the reliability of Clinical Risk Index for Babies Update in predicting the neonatal mortality in Mayo Hospital Lahore, which when combined with physicians judgment will give a better outcome by prioritizing care for the neonates at risk, will be helpful in counseling of the parents about prognosis and predicting the length of hospital stay. If significant results are obtained, CRIB II can be adopted in neonatal intensive care units of the country. To assess the accuracy of CRIB II for predicting mortality of severely ill preterm neonates.

METHODOLOGY
Study Design: Cross Sectional Study.

Settings: NICU, Department of Pediatrics Unit-I and Unit-II, Mayo Hospital, Lahore Pakistan.

Duration: 22-01-2016 to 30-07-2016.

Sample Technique: Nonprobability consecutive sampling.

Sample Size: 200 cases.

Inclusion Criteria: 200 Babies fulfilling inclusion criteria (Gestational age 26-34 weeks on Ballard score and Preterm admitted in NICU within 12 hours of birth) were included.

Exclusion Criteria: Babies with Birth weight <600 grams (at admission) and >3 SD or Lethal malformations on clinical examination (ASD, VSD, PDA, TOF) or Indeterminate gender or Twin pregnancy or Refusal to give informed consent were excluded from study.

Methods: Informed consent was taken from parents/guardian of the neonate. Birth weight was recorded by digital electronic scale in gram. Gestational age was recorded in weeks assessed by Ballard score. Axillary temperature was recorded within 1st hour of admission by using digital thermometer, in Centigrade. Base excess was measured in mmol/liter using blood gas analyzer. CRIB II score assessed by adding scores of sex, birth weight, gestational age, temperature within one hour of admission and base excess during the first 12 hour in specified formula. CRIB II score was labeled as positive (>4) or negative score (< 4). The preterm was followed up till discharge, 28th day of life or death whichever comes first. Data was analyzed by SPSS version 20. Sensitivity, specificity, PPV, NPV & accuracy of CRIB II was calculated by 2x2 table 1,2 taking mortality as gold standard.

RESULTS

200 patients were enrolled in study after getting informed consent from parents. Out of them 102 patients were male (51%) and 98 were female (49%). Age varies from 1 hour to 9 hours of life with mean of 5.8 & standard deviation of +/- 1.8. 49 patients presented in 1-4 hours of life which makes only 24.5% of all cases. Majority of patients 75.5% (151 in number) admitted between 5-9 hours of life.

Gestational age ranges from 28 weeks to 33 weeks with mean age is 30.7 weeks, & standard deviation of +/- 1.2. 15% percent of cases (30 in number) had a gestational age of 28-29 weeks. A majority of 110 patients belonged to a group of gestational age of 30-31 weeks that makes 55% of all cases. 60 patients (30%) had gestational age of 32-33 weeks. Birth weight ranges from 1.4 kg to 2.6 kg with mean of 2.0 and & standard deviation of +/- 0.19. 142 patients (71%) had birth weight between 1-2 kg. 58 patients (29%) had birth weight of 2-3 kg.

These 200 hundred enrolled patients have following diagnosis with actual number of cases and percentages in descending order: Respiratory distress syndrome 54(27%), Early onset sepsis 30(15%), PT, JNN, EOS 22(11%), Mild Asphyxia-neonatorum 18(9%), Prematurity 14(7%), Respiratory distress syndrome, Early onset sepsis 14(7%), Moderate Asphyxia-Neonatorum 10(5%), prematurity, Jaundice neonatorum 8(4 %), %), IUGR 8(4%), Prematurity, Apnea of prematurity 8(4%), Severe Asphyxia-Neonatorum 6(3%), Early onset sepsis, DIC 4(2%), PT, NEC, EOS 4(2%).

Accuracy of CRIB II score was comparable in both male and female i.e. 68.6% in male or 66.6% in female. In male: Sensitivity was 65.8%, Specificity 70.4%, PPV 60%, NPV 75%. In female Sensitivity was 87.7%, Specificity 59.1% PPV 68.2%, NPV 82.8%. When data was stratified with gestational age, accuracy was found 100 % in group of gestational age 28-29 weeks. In this group CRIB-II score was 100% sensitive and it has positive predictive value of 100%. In gestational age group of 32-33 weeks: CRIB-II score had Sensitivity 83.3% Specificity 77.7%; PPV29.4 %; NPV 97.6%; Accuracy 78.3%. Patients with gestational age of 30-31 weeks; it has Sensitivity 64.8%, Specificity 53.5%, PPV 57.3%, NPV 61.2%, Accuracy 35.2%.

On Stratification of CRIB II score & Mortality with respect to Age in Hours; group of neonates who presented at 1-4 hours of life, it has Sensitivity 71.4%, Specificity 85.7%, PPV 78.9%, NPV 80%, Accuracy 79.6%. For a group who presented at 5-9 hours of life: has Sensitivity 79.7%, Specificity 58.5%, PPV 61.8%, NPV 77.4%, Accuracy 68.2%. When data of Stratification of CRIB II score & Mortality Stratified with respect to Birth Weight, it showed group of neonates with 1-2 kg birth weight has Sensitivity 79.2%, Specificity 56.9 %PPV 68.5%, NPV 69.8 %, Accuracy 69%. For group of birth weight 2-3 kg, Sensitivity 69.2%, Specificity 77.7%, PPV 47.3%, NPV 89.7%, Accuracy 75%.

CRIB score was positive in 108 patients and negative in 92 patients. Out of 108 positive patients, mortality occurred in 70 patients and 38 patients survived. Out of 92 patients with negative CRIB score 20 patients expired and 70 patients survived. 90 patients who got expired, out of them 70 had positive CRIB score and 20 had negative CRIB score. CRIB score in my study has sensitivity of 77.7%, specificity of 65.4% & P value of <0.001It has positive predictive value of 64.8%. It has negative predictive value of 78.2%. It has a clinical diagnostic accuracy of 71%.

Table 1: CRIB Score status and mortality

CRIB score status	Mortality of Patient		Total
	Yes	No	
Positive	70 (TP)	38(FP)	108
Negative	20 (FN)	72(TN)	92
Total	90	110	200

Table 2: Showing diagnostic accuracy of CRIB-II Score

Diagnostic Accuracy	Percentage/ Value
Sensitivity	77.7%
Specificity	65.4%
Positive Predictive Value	64.8%
Negative Predictive Value	78.2%
Accuracy	71%
P- Value	<0.001

DISCUSSION

Neonatal mortality is an important parameter in measuring efficiency of some health system and growth of nation. Although there are many factors that lead of neonatal deaths in rural areas like unsterilized cutting of umbilical cord, delay in initiation of breastfeeding and not giving colostrum as first feed to the baby[17] and asphyxia. And also, when we know the causes that are causing death in neonates, it will help in planning in order to reduce mortality. For example, if we know that asphyxia is highly prevalent cause of neonatal deaths, then we will address this issue and make strategies and ways that will improve resuscitation of newborns and ultimately will reduce neonatal mortality. In this way in countries like Pakistan we can have better resource allocation and will proceed to millennium development goal of reducing infant mortality rate.

Similarly, when by some scoring system even at admission we can categorize some newborn as having high chances of mortality, this can help us in providing and allocating more intensive care to this newborn and ultimately may help in decreasing morbidity and mortality.

According to Fleisher and co-workers described that the main feature of an effective scoring system, which must be present are: that it must be easy to use, so that all parameters can be filled easily. If it will be having more invasive parameters then its applicability will be affected. Next thing for an effective scoring system is that applicability in hospitalization, as if it will be more practical and applicable and it will be more effective.[4]

Next important parameter is that its ability to predict mortality & morbidities.[4] We have different scoring system in newborn babies. CRIB-II score was used in my study. Age of my study patients ranged from 1 hour to 9 hours of life. Majority of patients 75.5% (151 in number) admitted between 5-9 hours of life. This is due to fact that our health care facility that is mayo hospital Lahore has no obstetrics unit within hospital premises. This University hospital has affiliated centers and hospitals where deliveries are conducted & babies are shifted to neonatal ICU in mayo hospital Lahore for better management.

On stratification of CRIB II score and mortality in respect of birth weight, age of presentation, gestational age & gender: results showed that accuracy was comparable in males and females. As for as birth weight and age of presentation; is concerned clinical accuracy was also almost comparable in those groups. One interesting finding was that when analyzed for gestational age, in group of 28-29 weeks CRIB II score was 100% specific and accuracy was also 100%. This finding is explained on the basis that incidence and severity of complications of prematurity is inversely proportional to gestational age. Lesser the gestational age, more will be chances of severe complications that result in mortality.

My study showed that CRIB-II score has sensitivity of 77.7% Mladen Jašić *et al*: showed that CRIB-II score has Sensitivity and specificity were 77% and 88% respectively.[4] I. K. Marete *et al*: study showed CRIB II score was found to have a sensitivity of 80.6%, specificity of 75.3%, and a predictive value of 77.7% compared to 72.5, 71.2, and 71.8% respectively.[6] In a study done in Italy for comparing the ability of CRIB, CRIBII, and SNAPPE-II scoring systems in predicting neonatal mortality it was found that CRIB II score had the greatest ability of mortality prediction in comparison to CRIB and SNAPPE-I. Zahraa Mohamed Ezz – Eldin study CRIB II score with cutoff point of ≥ 11 was the most sensitive (94.9%) with the predictive value (74.0%) and specificity (82.4%), negative predictive value of 96.8%[7] Claudio de Felice study shows CRIB-II sensitivity 80.0%, specificity of 85%, Positive predictive value 90.7%, Negative predictive value 96.4 %.[12]

CONCLUSION

CRIB-II score is 77.7% and 65.4% specific in predicting prognosis of Severely ill preterm neonates in term of mortality. It has a diagnostic clinical accuracy of 71 %. CRIB II score has a Positive predictive value of 64.8% & Negative Predictive Value of 78.2% determining mortality of severely ill preterm neonates. This scoring system can reliably be used to determine prognosis of Severely ill preterm neonates in term of mortality & to standardize care provided to the at-risk neonates when combined with clinician evaluation.

LIMITATIONS

Study was conducted on 200 patients. Large scale studies need to be conducted to determine applicability of CRIB-II score in local hospitals.

SUGGESTIONS / RECOMMENDATIONS

CRIB-II scoring should be part of initial evaluation of preterm babies and should be documents.

CONFLICT OF INTEREST / DISCLOSURE

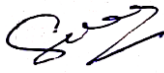There is no conflict of interest involved.

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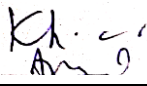
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