Open Access

Original Article

Utility of Clinical Risk Index for Babies (CRIB-II) Scoring System in Prediction of Mortality in Premature Babies Admitted at Neonatal Intensive Care Unit, Combined Military Hospital (CMH), Rawalpindi

Haider Ali Awan, Shakeel Ahmed Chaudhry, Yusra Zia, Andleeb Tariq, Namrah Fatima Mujeeb*, Huma Mir**

Department of Pediatrics, Combined Military Hospital, Rawalpindi/National University of Medical Sciences (NUMS) Pakistan, *Department of Family Medicine, Combined Military Hospital, Rawalpindi/National University of Medical Sciences (NUMS) Pakistan, **Department of Pediatrics, Ghulam Mohammad Maher Medical College, Sukkhur Pakistan

ABSTRACT

Objective: To assess the predictive accuracy of the Clinical Risk Index for Babies (CRIB-II) scoring system for mortality in pre-mature babies admitted in neonatal intensive care unit.

Study Design: Quasi-experimental.

Place and Duration of Study: Department of Pediatrics, Combined Military Hospital, Rawalpindi, Pakistan, from Jan to Jun 2023.

Methodology: A total of 280 neonates were assessed for CRIB-II score and predictive mortality. The CRIB-II score was assessed for all participants in the first 30 minutes of admission to NICU which included gender, gestational age, birth weight in grams on an electronic neonatal weight scale and base excess calculated by arterial blood gas analysis in addition to checking rectal temperature. Higher scores were hypothesized to associated with increased mortality.

Results: After analyzing the primary variables, median CRIB-II scores between both groups showed values of 15.00 (IQR=3.50) in Group N versus 8.00 (IQR=2.00) in Group S (p<0.001). ROC (Receiver operative characteristics) and AUC (area under the curve) analysis showed AUC was 0.962 (95% CI=0.933-0.990) with the best suitable cut-off for sensitivity and specificity at CRIB-II score of 7.5 consistent with a 98.8% sensitivity and 72.3% specificity for mortality.

Conclusion: CRIB-II is an effective scoring system for predicting mortality in NICUs for delivery of effective care.

Keywords: CRIB, Mortality, Neonate, Prediction, Pre-mature.

How to Cite This Article: *Awan HA, Chaudhry SA, Zia Y, Tariq A, Mujeeb NF, Mir H. Utility of Clinical Risk Index for Babies (CRIB-II) Scoring System in Prediction of Mortality in Premature Babies Admitted at Neonatal Intensive Care Unit, Combined Military Hospital (CMH), Rawalpindi. Pak Armed Forces Med J 2025; 75(6): 1123-1126. DOI: https://doi.org/10.51253/pafmj.v75i6.11200*

INTRODUCTION

Even with recent advancements, the incidence of pre-term birth, defined as delivery before 37 weeks of gestation was 15.22 million in 2019.[1] According to the recent WHO statistics, 13.4 million babies were delivered in 2020.[2] The associated complications of pre-maturity including low birth weight, small for age, respiratory complications and neonatal sepsis resulted in a mortality of 0.9 million pre-term neonates in 2019 alone.[3] With the burden of disease projected to be more in developing countries, special attention is required for neonatal care in pre-mature babies especially as in Pakistan alone, the projected rate of neonatal deaths is 42/1000 live births, surpassing that of India, Nepal, and Bangladesh.[4] Neonatal intensive care forms the first line of management for pre-mature babies and good initial care has been proven to decrease complications.[5] While institutional policies and protocols vary globally, the use of scoring systems to assess neonatal risk factors and early recognition of susceptible cases have been supported to decrease morbidity and mortality.[4] Some of the scoring systems that have been proposed in standardizing care and assess mortality and morbidity associated with pre-maturity are the Score for Neonatal Acute Physiology (SNAP), SNAP Perinatal Extension (SNAP-PE), the Clinical Risk Index for Babies (CRIB) and updated CRIB-II score.[6,7] These scoring systems have been proven to successfully assess for and predicting mortality in pre-term neonates especially pre-maturity before 32 weeks of gestation.[8] The aim of this study was to assess the predictive power of the CRIB-II scoring system, to assess the predictive accuracy of this scoring system for mortality in pre-mature babies admitted in neonatal intensive care units.

METHODOLOGY

This quasi-experimental study was carried out at the Department of Pediatrics, Combined Military Hospital (CMH), Rawalpindi, Pakistan, from January to June 2023, after taking approval form the Ethics Review Board vide letter no 483. The sample size was

Correspondence: Dr Haider Ali Awan, Department of Pediatrics, Combined Military Hospital, Rawalpindi Pakistan

Received: 24 Nov 2023; revision received: 31 Dec 2023; accepted: 18 Jan 2024

calculated using World Health Organization (WHO) sample size calculator, by keeping the confidence interval at 95%, margin of error at 5% with the population proportion of premature neonates delivered in Pakistan at 21.64%,[9] where minimum sample size came out to be 261.

Inclusion Criteria: All neonates delivered between 26 to 32 weeks of gestation and received in the NICU within 12 hours of delivery.

Exclusion Criteria: Neonates with major cardiac or respiratory disease, birth weight <500 grams, received in the NICU after 12 hours of delivery, on ventilatory support within 12 hours of delivery in the NICU or parents not giving consent.

Written informed consent was taken from all parents with details such as age, weight, co-morbidities, and gestational age confirmed through ultrasonography (USG) and Last Known Menstrual Period (LMP) before delivery. If there was a discrepancy in the LMP or it was undefined, the New Ballard score was used.[10] CRIB-II score was assessed for all participants with higher scores hypothesized to be associated with increased mortality. Primary variables measured were outcome of survivors and non-survivors as predicted by initial CRIB-II score. ROC analysis was done in assessing sensitivity and specificity of the test in predicting mortality. Demographic data were statistically described in terms of Mean±SD, frequencies, and percentages. All statistical calculations were performed using Statistical Package for Social Sciences (SPSS) version 26.0. Independent sample t-test was used to compare statistically significant means. Mann-Whitney U test was used to compare median values between both groups and a *p*-value of ≤0.05 was considered statistically significant.

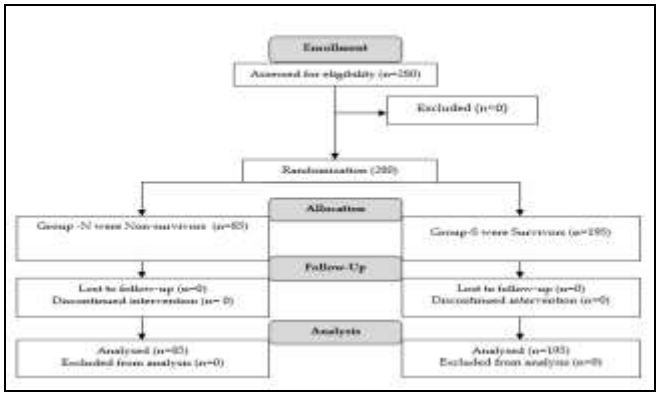

Figure-1: Patient Flow Diagram (n=280)

RESULTS

A total of 280 neonates were included in the study protocol designated non-survivors as Group N (n=85) and survivors as Group S (n=195) during analysis. Mean gestational age of neonates in Group N was 27.01±1.35 weeks versus 29.82±1.23 weeks in Group S (p<0.001). Post-delivery weight of the neonates after admission in NICU was 1014.11±89.43 grams in Group N versus 1170.66±91.70 grams in Group S (p<0.001). Gender distribution revealed 55(64.7%) males and 30(35.3%) females in Group N versus 138(70.8%) males and 57(29.2%) females in Group S as shown in Table.

Table: Demographics And CRIB-II Score Comparison Between Survivors and Non-Survivors, (n=280)

Variable	Group N (n=85)	Group S (n=195)	*p*-value (<0.05)
Mean gestational age (weeks)	27.01±1.35	29.82±1.23	<0.001
Mean weight (grams)	1014.11±89.43	1170.66±91.71	<0.001
Gender distribution			
Male	55 (64.7%)	138 (70.8%)	-
Female	30 (35.3%)	57 (29.2%)	-
Base Excess (meq/L)	-18.12±4.75	-7.60±2.72	<0.001
Rectal temperature (°Celsius)	33.88±1.12	35.21±1.16	<0.001
Median CRIB-II Score	15.00 (IQR=3.50)	8.00 (IQR=2.00)	<0.001
Mean duration of stay in NICU (days)	14.94±3.87	8.07±1.55	<0.001

When analyzing the primary variables, median CRIB-II scores between both groups showed values of 15.00 (IQR=3.50) in Group N versus 8.00 (IQR=2.00) in Group S (p<0.001). ROC (Receiver operative characteristics) and AUC (area under the curve) analysis showed AUC was 0.962 (95% CI=0.933-0.990) with the most suitable cut-off for sensitivity and specificity at CRIB-II score of 7.5 consistent with a 98.8% sensitivity and 72.3% specificity for predicting mortality as shown in Figure-2.

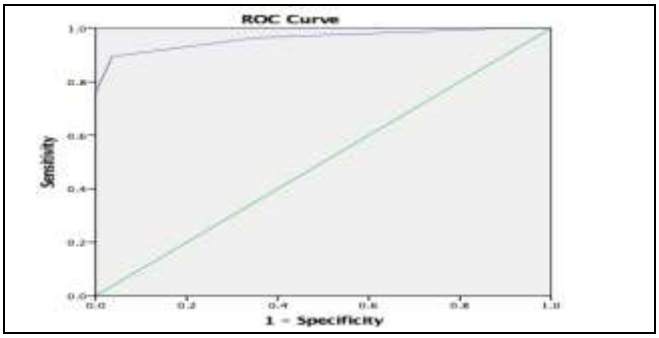

Figure-2: Sensitivity and Specificity with ROC Analysis For CRIB-II Score For Mortality, (n=280)

DISCUSSSION

Various international studies have recommended the use of the CRIB-II score because of its good sensitivity in predicting mortality, concluding that excellent power of the study and different demographic areas are not affected by diversity of sample.[8,11,12] Even though the score has found universal acceptance when it comes to predicting mortality, some authors argue that it has a low threshold in predicting the actual outcomes.[13] The results of our study were mainly in line with studies done internationally proving good validity with a strong predilection towards male neonates being non-survivors when compared with females for the same demographic characteristics, similar to another study.[14] where male neonates had higher mortality. Our study also found that mean weight of 1000 grams and less was associated with more adverse outcomes, consistent with another study.[13,15] Another local study also provided similar results and found a strong link with gestational age, a major factor in predicting mortality.[16] Mean duration of stay was also considerably increased in cases where CRIB-II scores were higher, also demonstrated in literarture.[16] A cut-off value of CRIB score 7.5 was found to be associated with the highest sensitivity and specificity, therefore our median values for survivors were around 8 with ranges between 6-9 but some studies propose a cut-off value of 9 or 11, however, considering the better care provided in developed setups, our cut-off for mortality may reflect our overburdened setups and paucity of resources as another local study,[17] also concluded that resource constraints hamper effective NICU care, which can decrease the cut-off scores for various prognostic scoring systems including CRIB-II scores.[18] Better resources and care would increase the cut-off validity of our scoring system and reflect improvement in the overall NICU care.

LIMITATIONS OF STUDY

The quasi-experimental, single-center design in one NICU limits the generalizability of the findings to other settings with different patient populations, resources, and clinical practices. The CRIB-II score was assessed only once within the first 30 minutes of admission, so dynamic changes in clinical status over time and their impact on mortality were not evaluated. Potential confounding factors such as variations in treatment protocols, comorbid conditions, and quality of perinatal care were not detailed, which may influence both CRIB-II scores and outcomes. In addition, while the AUC was high, the relatively modest specificity suggests a risk of overestimating mortality risk, and external validation in larger, multi-center cohorts would be necessary before broad implementation.

CONCLUSION

CRIB-II score can be an effective scoring system for predicting mortality and should be employed in NICUs for effective care.

Conflict of Interest; None.

Funding Source: None.

Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

HAA & SAC: Study design, data interpretation, drafting the manuscript, critical review, approval of the final version to be published.

YZ & AT: Conception, data analysis, drafting the manuscript, approval of the final version to be published.

NFM & HM: Data acquisition, critical review, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

REFERENCES

1. Cao G, Liu J, Liu M. Global, regional, and national incidence and mortality of neonatal preterm birth, 1990-2019. JAMA Pediatr 2022; 176(8): 787-796. https://doi.org/10.1001/jamapediatrics.2022.1622
2. Lincetto O, Banerjee A. World Prematurity Day: Improving survival and quality of life for millions of babies born preterm around the world. Am J Physiol Lung Cell Mol Physiol 2020; 319(5): L871-L874. https://doi.org/10.1152/ajplung.00479.2020
3. Armanian AM, Barekatain B, Sohrabi F, Salehimehr N, Mansourian M. The prevalence of complications of prematurity among 1000 newborns in Isfahan, Iran. Adv Biomed Res 2019; 8: 63. https://doi.org/10.4103/abr.abr_84_18
4. Saleem S, Tikmani SS, Goudar SS, Hwang K, Dhaded S, Guruprasad G, et al. Neonatal mortality among preterm infants admitted to neonatal intensive care units in India and Pakistan: A prospective study. BJOG 2023; 130(11): 1254-1264. https://doi.org/10.1111/1471-0528.17581
5. Lee H, Park JH, Cho H. Analysis of research on developmentally supportive care for prematurity in neonatal intensive care unit: A scoping review. Child Health Nurs Res 2022; 28(1): 9-20. https://doi.org/10.4094/chnr.2022.28.1.9
6. Vardhelli V, Murki S, Tandur B, Saha B, Oleti TP, Deshabhotla S, et al. Comparison of CRIB-II with SNAPPE-II for predicting survival and morbidities before hospital discharge in neonates with gestation ≤32 weeks: A prospective multicentric observational study. Eur J Pediatr 2022; 181(7): 2831-2838. https://doi.org/10.1007/s00431-022-04463-2
7. Adhisivam B. Clinical scores for sick neonates. Indian J Pediatr 2023; 90(4): 324-325. https://doi.org/10.1007/s12098-022-04308-9

8. Faridpour F, Shirinabadi Farahani A, Rassouli M, Shariat M, Nasiri M, Ashrafzadeh M et al. Clinical risk index for babies (CRIB-II) scoring system in prediction of mortality risk in preterm neonates in the first 24 hour. Evid Based Care 2020; 10(2): 58-63. https://doi.org/10.22038/EBCJ.2020.49219.2349
9. Hanif A, Ashraf T, Pervaiz MK, Guler N. Prevalence and risk factors of preterm birth in Pakistan. J Pak Med Assoc 2020; 70(4): 577-582.
10. Permatasari RD, Novina N, Aziz MA, Gamayani U, Primadi A. Correlation between gestational age estimated using last menstrual period, ultrasonogram, and the New Ballard Score. Perinatology 2024; 24(1): 46-50. https://doi.org/10.23886/ejki.24.1.46-50
11. van Beek PE, Andriessen P, Onland W, Schuit E. Prognostic models predicting mortality in preterm infants: Systematic review and meta-analysis. Pediatrics 2021; 147(5): e2020020370. https://doi.org/10.1542/peds.2020-020370
12. Rehman A, Hamid MH. Accuracy of CRIB II score in predicting the neonatal mortality in very preterm babies. Pak J Med Health Sci 2022; 16(3): 564.
13. Stomnaroska O, Danilovski D. The CRIB II (Clinical Risk Index for Babies II) score in prediction of neonatal mortality. Prilozi (Maked Akad Nauk Umet Odd Med Nauki) 2020; 41(2): 63-71. https://doi.org/10.2478/prilozi-2020-0021
14. Patra K, Karmakar BC. Neonatal mortality and neurodevelopmental outcome of very low birth weight newborns attending a rural tertiary care hospital, predicted by Clinical Risk Index for Babies Score II (CRIBS II). J Evol Med Dent Sci 2019; 8(19): 1521-1528. https://doi.org/10.14260/jemds/2019/336
15. Najeeb S, Ejaz E, Raza MA, Sarwar S, Gillani S, Afridi RU, et al. Importance of Clinical Risk Index for Babies score for predicting mortality among neonates. J Ayub Med Coll Abbottabad 2020; 32(4): 502-506.
16. Qasim S, Zahid S, Islam A, Anwar M, Siddique S, Rafique A et al. Clinical Risk Index score (CRIB II) as a predictor of neonatal mortality among premature babies. Pak J Med Health Sci 2022; 16(8): 70-. https://doi.org/10.53350/pjmhs2216870
17. Rehman R, Razzaq A, Ahmad AM, Rehman Z, Rehman R, Ateeq S et al. Effectiveness of the Extended Sick Neonatal Score in predicting mortality in a resource-constrained neonatal care unit. Pak Armed Forces Med J 2023; 73(1): 176-180. https://doi.org/10.51253/pafmj.v73i1.6880
18. Belsti Y, Nigussie ZM, Tsegaye GW. Derivation and validation of a risk score to predict mortality of early neonates at neonatal intensive care unit: The END in NICU score. Int J Gen Med 2021; 14: 8121-8134. https://doi.org/10.2147/IJGM.S336888