Clinical Risk Index for Neonates II score for the prediction of mortality risk in premature neonates with very low birth weight

Azadeh Jafrasteh (1)
Parastoo Baharvand (2)
Fatemeh Karami (3)

(1) Department of Pediatrics, Lorestan University of medical Sciences, Khorramabad, Iran.
(2) Assistant Professor, Department of Community Medicine, Lorestan University of medical Sciences, Khorramabad, Iran.
(3) BSc Student, Student Research Committee, Lorestan University of medical Sciences, Khorramabad, Iran.

Correspondence:
Parastoo Baharvand
School of medicine, Lorestan University of Medical Sciences,
Khorramabad, Lorestan, Iran
Email: Dr.baharvand@gmail.com

Abstract

Introduction: One of the most common methods of identifying neonatal mortality risk is the Clinical Risk Index for Babies scoring system (CRIB- II). The aim of this study is to investigate the value of CRIB II scoring system in prediction of mortality risk in premature neonates with birth weight less than 1500 gr.

Materials and methods: This descriptive-analytical investigation was conducted on premature neonates with very low birth weight (less than 1500 g) and gestational age less than 32 weeks who were hospitalized in NICU of Shahid Madani Hospital of Lorestan province (southwest of Iran) during a two-year period (January 2013 to December 2015). These neonates were hospitalized during the first 12 hours of life and evaluated according to CRIB II scoring system. After collecting and completing information about patients, the data was analyzed using SPSS software.

Findings: Of a total 272 neonates, 160 neonates (58.82%) died in the hospital. Mean scores of CRIB II were 6.1±2.7 and 9.7±3.1 for survivor neonates and non-survivor neonates respectively (PV<0.001). In a survey for specificity and sensitivity of CRIB II score in mortality prediction of premature neonates with birth weight lower than 1500 gr, it was observed that almost 83% (CI=74-91) of neonatal mortalities can be predicted.

Discussion and conclusion: This study showed that CRIB II index has higher value in prediction of mortality in premature neonates with very low birth weight.

Key words: Premature neonates, Mortality risk, CRIB II.

Please cite this article as: Jafrasteh A.et al. Clinical Risk Index for Neonates II score for the prediction of mortality risk in premature neonates with very low birth weight. *World Family Medicine*. 2017; 15(8):183-187. DOI: 10.5742/MEWFM.2017.93074

Introduction

Very low birth weight (VLBW) infants, weighing less than 1500 g at birth, represent about 1% of all births but account for 50% of neonatal deaths. Compared with infants weighing 2500 g or more, LBW infants are 40 times more likely to die in the neonatal period; VLBW infants have a 200-fold higher risk of neonatal death [1-3].

Contrary to reduction of neonatal mortality rate in recent years, the mortality rate of low birth weight infants has not reduced dramatically. In general, neonatal mortality is a hygiene index and it has a direct connection with the economic and social states of the countries. A higher percentage of premature neonatal mortalities occur in Neonatal Intensive Care Unit (NICU) and definitely, periodic investigation about the activities of these units can be effective in mortality reduction of this sensitive age range. To investigate and compare the activity of NICU, the adjustment of treatment results with primary state of the patient and disease intensity in hospitalization time is vital. Application of a tool that can identify an unwell patient in early hours of hospitalization, can be helpful for evaluation of the medical team activities. So to this end, numerous scoring systems have been developed in order to identify emergency patients in early hospitalization in NICU and before any kind of medical and curing activities that the Clinical Risk Index for Babies (CRIB), CRIB II, Score for Neonatal Acute Physiology (SNAP), Score for Neonatal Acute Physiology-Perinatal-Extension (SNAP-PE) and Neonatal Therapeutic Interventions Scoring System (NTISS) can be mentioned [4]. These scoring systems are different in terms of the type and the number of evaluated variables, and the type of scoring. CRIB scoring system has application in neonates with birth weight less than 1500 gr but SNAP can be used in all gestational ages and all weights [4].

For more than a decade, a clinical risks scoring system has been applied to evaluate the neonate's state and their mortality rate in NICU of the hospitals. Application of an index which is less affected by other interruptive indexes like steroid prophylaxis and to have more reliable results is essential. CRIB scoring system is comprised of 6 variables: birth weight, gestational age, congenital anomalies, minimum and maximum breathing oxygen percentage and maximum Base deficiency information that are investigated during the first 12 hours after hospitalization. In CRIB II scoring system, only 5 variables (birth weight, gestational age, neonate sex, maximum Base deficiency, baby's temperature at hospitalization time) are used to evaluate the premature neonates. These scoring systems have predicting values in determination of neonate mortality rates but there is no use for them in morbidity prediction of neonates [1, 4].

Neonatal mortality rate is affected by NICU facilities and the numbers of nurses. Most researchers believe that CRIB II scoring system has higher value for prediction of hospital premature neonatal mortality with birth weight lower than 1500 gr in comparison to weight and pregnancy age or both. Since all related variables are practical in our occasion, CRIB II scoring system was chosen to investigate the premature neonates.

This study is for evaluation of CRIB II scoring system in prediction of neonatal mortality rate at NICU ward of Shahid Madani hospital, Khorramabad, Iran.

Materials and Methods

In this descriptive analytical study that was carried out from January 2013 to December 2015 (two years) in NICU of Shahid Madani hospital (Khorramabad, Lorestan province), after obtaining permission from the ethics committee to do the study in vulnerable groups, informed written consent was taken from the parents. The study population included all live-born neonates with a birth-weight of ≤ 1500 gr and/or gestational age ≤ 32 weeks. Exclusion criteria were:
1) less than 23 weeks' gestation;
2) admission to NICU more than 12 hours after delivery;
3) presence of a lethal congenital malformation; 4) death within the first 12 hours of life.

The general characteristics of infants such as gender, type of birth and Apgar scores of first and fifth minutes, were extracted from the infants' cases and recorded in data collection forms. The parameters of CRIB-II were measured and recorded in data forms as follows: Gestational age was calculated using Ballard table or based on the first day of the last menstrual period (LMP). In cases where LMP was not known, gestational age was assessed using obstetric ultrasonography. The infants were weighed at the moment of admission with digital scale of ±20 precision based on gram unit. The infants' body temperature was measured axillary at the moment of admission in NICU using digital thermometer with a sensitivity of 0.1° C. Capillary blood gas analysis was performed in all infants. Infants' sex was determined through observing phenotype of genitalia.

After measuring mentioned parameters, CRIB-II score (range 0-27) (5) was calculated for each infant and the prediction rate of it concerning infants' outcome was found based on CRIB-II. The studied infants were followed up at 3 months of age and their outcome (dying or staying alive) was recorded in a data collection form. The data were analyzed using SPSS software and to determine the relationship between measured parameters Spearman correlation was used. A logistic model was used to analyze the prediction of mortality using the CRIB II score on admission. In all tests $P<0.05$ was considered as significant.

Results

In general, 272 neonates were investigated in this study and151 neonates (52.9%) and 121 neonates (47.1%) were boys and girls, respectively. In this study, 160 neonates (58.82%) died during hospitalization and 112 neonates (41.18%) survived during hospitalization and left the hospital. Gestational age, mean body temperature and

mean of base deficiency (based on the analysis of arterial blood gases) in survivor neonates were less than non-survivor neonates and these differences were statistically significant (Table 1).

The mean of CRIB II scores for non-survivor neonates and survivors was 9.7±3.1 and 6.1±2.7 respectively. Statistical analysis showed that the mean of CRIB II score in non-survivor neonates was much more than survivor neonates significantly (PV<0.001). The mean of hospitalization time for non-survivor neonates (5.1±4.5) was shorter than hospitalization time for survivor neonates (15±9.8); and this difference was statistically significant (PV<0.001). In survey for specificity and sensitivity of CRIB II score in mortality prediction of premature neonates with birth weight lower than 1500 gr, it was observed that almost 83% (CI=74-91) of neonatal mortalities can be predicted.

In the present study, we compared risk factors of neonatal mortality according to gestational age less than 30 weeks, body temperature less than 36.5 centigrade, Base deficiency less than -10, birth weight less than 1200 gr, hospitalization time shorter than 9 days and CRIB II score more or equal with 10 in survivor and non-survivor neonates. The results showed that 46% of non-survivor neonates and 9% of survivor neonates have gestational age less than 30 weeks and there was a marked difference between the two groups (PV<0.001). Also, other variants were significantly much better in survivor neonates than non-survivor neonates, and these differences were statistically significant (PV<0.001).

Discussion

In our investigations, it was observed that CRIB II score has a high value in prediction of premature neonates' mortality with birth weight lower than 1500 g, in a way that, CRIB II score could predict 83% of mortality cases in premature neonates that shows a high value of this index. Measurement of this index is very easy and fast because all applied variables are of routine investigations of low weight neonates; also these variants are not affected by human errors. Since prediction of neonatal mortality with very low birth weight (less than 1500 gr) reveals an outstanding impact on medical interventions, in different studies, and various indexed were studied (5-9).

Felice et al (2005) studied 147 neonates with birth weight less than 1500 gr or gestational age less than 31 weeks. They evaluated CRIB, CRIB II, birth age and birth weight for prediction of neonatal mortality; according to AUC, these indexes could predict mortality between 86% (birth age) to 92% (CRIB). The researchers did not observe any difference between investigated indexes in prediction of neonatal mortality (10). As it was mentioned previously, in our study all indexes were valuable in prediction of neonatal mortality.

Although in previous studies and our investigation, CRIB II declared higher values in comparison with other indexes like birth age and birth weight, there are some studies that have evaluated CRIB II as less predictive, and other indexes though showed there was no significant difference. In Baumer et al's study, between 1991 to 2006, 1485 premature neonates were studied. In this investigation based on AUC, CRIB 82%, birth weight 74%, birth age 71% and CRIB II 69% could predict mortality cases. Although there was no statistically significant difference between the indexes, CRIB II has lower value compared to other indexes. Asthere is no clear reason for these observations, researchers believe in the need for further studies (11).

Low birth weight and low gestational age are two main causes of numerous disorders in these neonates; also these two are the main reason for mortality in infancy and the first year after birth (12). Disease severity of the neonate at hospitalization time and some laboratory findings like Base deficiency rate are associated with the prognosis of the neonates. Application of CRIB as a simple way for evaluation of illness severity during hospitalization that can estimate the relative risk of neonatal mortality (13, 14).

In a survey to evaluate the CRIB II value for prediction of mortality rate of premature neonates in comparison with birth weight and gestational age, 97 neonates were investigated. The area under the ROC diagram was almost equal for birth weight, gestational age and CRIB II. The result of this research showed that the predictive value of CRIB II score in prediction of mortality rate in premature neonates is not more than birth weight and gestational age (15).

Table 1: Evaluated variables in CRIB II score in survivor and non-survivor neonates

Variable		Survivor neonates (N=112)	Non-Survivor neonates (N=160)	P-value
Sex	Male	54 (35.76%)	97 (64.24%)	<0.001
	Female	58 (47.93%)	63 (52.07%)	
Gestational age (weeks)		31.2±2.2	27.9±2.1	<0.001
Temperature (Celsius)		36.5±0.3	36.3±0.1	<0.001
Base deficiency (meq)		-15.4±5.4	-10.2±5.1	<0.001
Birth weight (gr)		1291±201	1044±223	<0.001

Mortality rate of premature neonates is evaluable by CRIB II. In an investigation to compare the ability of CRIB, CRIB II, birth weight and gestational age in prediction of premature mortality, 1,485 neonates were studied. The area under the AUC graph was 82% for CRIB, 74% for birth weight, 71% for gestational age, and 69% for CRIB II. The results of this investigation showed that CRIB II does not have any priority over birth weight, gestational age and CRIB in determination of mortality rate of premature neonates (16).

In an investigation to assess the ability of CRIB in determination of long-time prognosis of neural development in premature neonates, 455 neonates were studied. 386 neonates (89%) survived until clearance from hospital and 352 neonates (91%) were investigated mentally when they were 1 year old. There were 76 neonates (22%) with a major neural disorder. Higher CRIB score was assigned with major neural disorder (17). In addition, in another investigation, neonates with 13 CRIB II score or more at first hour after birth had major developmental disorders (18).

In another study which was conducted in Gorgan university of medical sciences, in order to evaluate the prognostic power of CRIB score in prediction of the consequence of premature VLBW neonates, 46 neonates with gestational age less than 37 weeks and birth weight lower than 1500 gr were assayed. Mortality rate in this research was 37% and the most prevalent reason of death was respiratory failure. The mean of birth weight, gestational age and the mean of CRIB score in the group of survivor neonates and non-survivor neonates was 1201, 934 gr and 30 and 28 weeks, and 3.76 and 11.47 respectively (19). In our investigation, CRIB II scoring system was used to determine the mortality risk in neonates with birth weight less than 1500 gr. The powerful point of the present study was that all mentioned variables in this study are measured routinely in all neonates with birth weight less than 1500 gr, and we did not need any further interventions. Considering this point, that neonatal state at first hours after birth is related to midwifery and obstetric issues of mother and problems of the neonate, the measurement of these variants at first hours after birth can be valuable in prediction of mortality and also higher score in CRIB II shows higher risk of mortality for neonate. About the birth weight variant in prediction of neonatal mortality, it should be said that, although for a long time it has been used as an index in determination of neonatal mortality, numerous studies have shown that prognosis of neonates with equal weights in NICU of different hospitals are different and that can be related to the applied equipment in these units, proportion of nurses to patients and other factors.

Limitations of the Study

The main limitation of our study was clearance of the neonates with personal satisfaction of the parents before conduction of the study and this issue was solved by substitution of other neonates.

Conclusions

According to our findings in this study, CRIB II has a higher value in mortality prediction of the neonates with birth weight lower than 1500 gr in a way that, it could predict 83% of mortalities in premature neonates with birth weight lower than 1500 gr and this shows the high value of this index. Since the prediction of neonatal mortality in VLBW neonates (less than 1500 gr) has a high value in medical interventions, CRIB II score is a trustable tool in neonatal mortality prediction and their classification is to make priority for medical interventions especially in absence of medical facilities

Results

1. Waldemar A. Prematurity and Intrauterine Growth Restriction. Robert M Kliegman, Stanton. Nelson textbook of pediatrics. 19th ed. Philadelphia: Saunders; 2011; 555-558.
2. Basu S, Rathore P, Bhatia BD. Predictors of mortality in very low birth weight neonates in India. Singapore Med J 2008; 49(7):556-60.
3. Kliegman Stanton RM. Nelson textbook of pediatrics. 19th ed. Philadelphia: Saunders; 2011
4. Horbar JD, Gould JB. Evaluating and improving the quality of neonatal care in neonatal perinatal medicine. Fanaroff AA, Martin RJ. Disease of the fetus and infant .9th ed. Philadelphia: Elsevier Mosby; 2011; 56-75.
5. Brito AS, Matsuo T, Gonzalez MR, de Carvalho AB, Ferrari LS. CRIB score, birth weight and gestational age in neonatal mortality risk evaluation. Rev Saude Publica 2003; 37(5): 597-602.
6. Gagliardi L, Cavazza A, Brunelli A, Battaglioli M, Merazzi D, Tandoi F, et al. Assessing mortality risk in very low birth weight infants: a comparison of CRIB, CRIB-II, and SNAPPE-II. Arch Dis Child Fetal Neonatal Ed 2004; 89(5): F 419-422.
7. Rastogi PK, Sreenivas V, Kumar N. Validation of CRIB-II for prediction of mortality in premature neonates. Indian Pediatr 2010; 47: 145-147.
8. Marete IK, Wasunna AO, Otieno PA. Clinical risk index for neonates (CRIB) II score as a predictor of neonatal mortality among low birth weight neonates at Kenyatta National Hospital. East Afr Med J 2011; 88(1): 18-23.
9. Guzmán Cabañas JM, Párraga Quiles MJ, del Prado N, Ruíz MD, García Del Río M, Benito Zaballo F, et al. Usefulness of Clinical Risk Index for Neonates based on birth weight in predicting hospital death and severe intra-ventricular hemorrhage in the SEN 1500 Spanish neonatal network. An Pediatr (Barc) 2009; 71(2): 117-127.
10. De Felice C, Del Vecchio A, Latini G. Evaluating illness severity for very low birth weight infants: CRIB or CRIB-II? J Matern Fetal Neonatal Med 2005; 17(4): 257-260.
11. Baumer JH, Wright D, Mill T. Illness severity measured by CRIB score: a product of changes in perinatal care? Arch Dis Child Fetal Neonatal Ed 1997; 77(3): F211- 215.
12. Vakrilova V. Scoring systems for assessing illness severity and predicting outcome in very low birth weight infants. Akush Ginekol (Sofiia) 2011; 50(1): 37-41.

13. Vakrilova L, Emilova Z, Sluncheva B. Using the CRIB as an early prognostic index for very low birth weight infants, treated in neonatal intensive care units. Akush Ginekol (Sofiia) 2007; 46 Suppl 1:66-73.
14. Prieto CL, Colomer BF, Sastre JB. Prognostic factors of mortality in very low birth weight infants with neonatal sepsis of nosocomial origin. Am J Perinatol 2013; 30(5): 353-358.
15. Khanna R, Taneja V,Singh S. The clinical risk index of neonates (CRIB) score in India. Indian J Pediatr. 2002; 69(11): 957-960.
16. Buhrer C, Metze B, Obladen M. CRIB, CRIB-II, birth weight or gestational age to assess mortality risk in very low birth weight infants? Acta Paediatr. 2008; 97(7): 899-903.
17. Buhrer C, Grimmer I, Metze B. The CRIB (Clinical Risk Index For Babies) score and neurodevelopmental impairment at one year corrected age in very low birth weight infants. Intensive Care Med 2000; 26: 325-329.
18. Lodha A1, Sauvé R, Chen S, Tang S, Christianson H. Clinical Risk Index for Babies score for the prediction of neurodevelopmental outcomes at 3 years of age in infants of very low birthweight. Dev Med Child Neurol. 2009;51(11):895-900.
19. Fouladinejad M, Behnampour N, Pashaei Zanjani A, Gharib MH, Akbari Kamrani M. The evaluation of predicting mortality risk of premature infants with very low birthweght by CRIB Score. J Gorgan Uni Med Sci. 2009;10(4):40-43. (In Persian)