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.

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, Khorraramabad, 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 (Khorraramabad, 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 and 151 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
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).

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).

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

<table>
<thead>
<tr>
<th>Variable</th>
<th>Survivor neonates (N=112)</th>
<th>Non-Survivor neonates (N=160)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>54 (35.76%)</td>
<td>97 (64.24%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Female</td>
<td>58 (47.93%)</td>
<td>63 (52.07%)</td>
<td></td>
</tr>
<tr>
<td>Gestational age (weeks)</td>
<td>31.2±2.2</td>
<td>27.9±2.1</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Temperature (Celsius)</td>
<td>36.5±0.3</td>
<td>36.3±0.1</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Base deficiency (meq)</td>
<td>-15.4±5.4</td>
<td>-10.2±5.1</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Birth weight (gr)</td>
<td>1291±201</td>
<td>1044±223</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>
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 after birth (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**