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Clinical risk index for babies II (CRIB II) and weight to predict mortality in preterm infants less than 32 weeks treated with surfactant

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Abstract

Objective: *To determine the usefulness of the Clinical Risk Index for Babies II (CRIB II) and weight to predict mortality in preterm infants < 32 weeks treated with exogenous surfactant.* **Material and Methods:** *Design: cohort for diagnostic test. Preterm babies < 32 weeks who received exogenous surfactant in a third level of care were included. The cutoff for CRIB II was evaluated and considered as score > 10 and weight < 750 grams; monitoring was performed until discharge or death.* **Results:** *RNP data analyzed 105 babies; 55/105 (52%) were female, the mean value ± 1.4 weight 2 grams and 29 + 2 weeks gestational age. Mortality was found in 16/105, of which 15/16 had a score > 10 on the CRIB II index. Survival was found in 89/105 and index > 10 points in 2/89. Based on these results we found: sensitivity 93%, specificity 98%, positive predictive value 88%, negative predictive value 98%. With weight < 750 grams, mortality occurred in 10/16 and survival in 17/89; sensitivity 62%, specificity 81%, positive predictive value 37%, and negative predictive value 92%.* **Conclusions:** *The CRIB II index is more useful than weight for predicting mortality in preterm infants less than 32 weeks treated with surfactant.*
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Introduction

Thirteen million preterm neonates (PTN) are born worldwide[1], with a mortality reported of 19% among those younger than 32 weeks gestational age[2].

There are some factors that predict mortality and disease severity in neonates, including perinatal background characteristics, birth weight, gestational age and severity of disease within the first hours of life[3,4].

Some authors have considered the Clinical Risk Index for Babies II (CRIB II) to predict early neonatal mortality in PTNs with 22 to 32 weeks gestational age. This index is based on a score that assesses gestational age, birth weight, gender, body temperature at Neonatal Intensive Care Unit (NICU) admission and base excess within the first 12 h of life[5].

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The CRIB II was created in 2003. Currently, there are great medical advances in the neonatal area, such as exogenous surfactant administration. The purpose of this study was to assess the usefulness of CRIB II and weight to predict mortality in PTNs younger than 32-week gestational age treated with exogenous surfactant within the first hour after birth.

Material and methods

The present study was conducted from January to December 2012 in a NICU from a tertiary care center, the Obstetrics and Gynecology Hospital of the National Medical Center of the Mexican Institute of Social Security in Guadalajara (México).

Study design

Cohort to assess a diagnostic test.

Inclusion and exclusion criteria

PTNs with 22 to 32 weeks gestational age that had received exogenous surfactant within the first hour after birth and had their weight and CRIB II assessment recorded within the first 12 h after birth were included. PTNs with mortality due to congenital malformations and indeterminate gender were excluded.

Sample size

The number of PTNs was calculated with a p-value of 0.5, 80% power and an odds ratio of 2.2 and, using these values, a sample size of 105 PTNs was obtained.

Study groups

Gold standard: mortality. Diagnostic tests: CRIB II (cutoff point: ≥ 10 points) and weight (cutoff point: ≤ 750 g).

Development of the study

In a previously elaborated structured questionnaire, the following data were recorded: gestational age (assessed with Ballart' new method[6]), gender, birth weight, base excess within the first 12 h of extrauterine life and body temperature at the moment of NICU admission.

CRIB II

Data of the PTNs included in the study were investigated by researchers who rated, using a score, the following clinical characteristics found in clinical records: gender, gestational age and birth weight (highest score: 15 points), body temperature at NICU admission (highest score: 5 points) and base excess expressed as mmol/l within the first 12 h of life (highest score: 7 points). The CRIB II highest score is 27 points[4,6].

Statistical analysis

To find out the utility value of the CRIB II and weight to predict mortality in < 32 weeks PTNs treated with surfactant, a Bayesian analysis was used[7,8]. In this research, sensitivity was defined as the likelihood of a ≥ 10 CRIB II score and weight ≤ 750 g being more useful to predict mortality among ≤ 32 weeks gestational age PTNs with early surfactant administration. Specificity was defined as the probability of excluding mortality among ≤ 32 weeks gestational age PTNs with a ≥ 10-point CRIB II score and weight ≤ 750 g. The positive predictive value was defined as the likelihood of mortality with a ≥ 10-point CRIB II score and ≤ 750 g weight, whereas the positive likelihood ratio was defined as the likelihood of mortality with a ≥ 10-point CRIB II score and ≤ 750 g weight, and the negative likelihood ratio, as the likelihood of not having mortality with a ≥ 10-point CRIB II score and weight ≤ 751 g. Frequencies and percentages were used for qualitative variables, and means and standard deviations for quantitative variables. The chi-square test was used to compare the difference in proportions between groups, and Student's t-test was used to compare mean differences. A p-value < 0.05 was considered to be statistically significant. The SPSS 10 program was used to analyze the data.

Ethics

The protocol was approved by the Research Committee, with the authorization number R-2008-1310-21. The study was conducted following the principles of the Declaration of Helsinki[9]. The investigators did not perform any intervention.

Results

Figure 1 shows the study profile. One hundred and five PTNs younger than 32 weeks gestation were included. Mortality occurred in 16/105, with a ≥ 10-point CRIB II score being found in 15/16. Survival was 89/105 PTNs and 2/89 had a ≥ 10-point score. Mortality was found with ≤ 750 g weight in 10/16 PTNs. Survival was 89/105 and in 17/89, a ≤ 750 g weight was found.

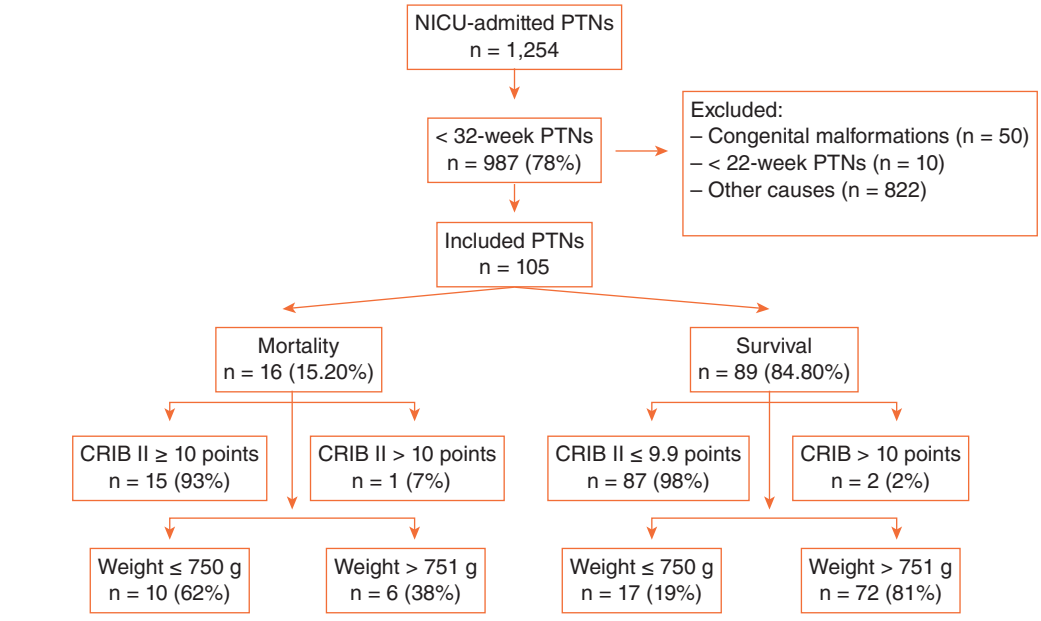

Figure 1. *Study profile.*

Table 1 shows the clinical characteristics comparison of the PTNs with mortality/survival. A mortality mean value with statistically significant differences was found in: temperature 36 + 2/37 + 2 (p = 0.01), base excess -22 + 2/7 + 2 (p = 0.01) and male gender 10/16 (63%)/58/89 (65%) (p = 0.01). Exogenous surfactant was administered to all PTNs, and all required standard mechanical ventilation.

The utility value of the CRIB II to predict mortality in surfactant-treated < 32-week PTNs is shown in table 2. A 93% sensitivity, 98% specificity, 88% positive predictive value, 98% negative predictive value and 97% test accuracy were found. With regard to the usefulness of weight to predict mortality, 62% sensitivity, 81% specificity, 52% positive predictive value and 93% negative predictive value were found.

Table 1. Comparison of CRIB II clinical characteristics on mortality or survival in PTNs younger than 32 weeks gestation treated with surfactant*

Characteristics	Mortality (n = 16)	Survival (n = 89)	p
Gestational age, mean + SD	28 + 2	30 + 2	0.09
Weight, mean + SD	1.4 + 2	1.5 + 2	0.07
Male gender, n (%)	10 (63)	40 (45)	0.01
Temperature, mean + SD	36 + 2	37 + 2	0.01
Base excess + SD	-22 + 2	7 + 2	0.01

*Fisher's exact test was used to compare the difference between proportions and Student's t-test was used to compare the mean differences.

Table 2. Utility value of CRIB II and weight to predict mortality in PTNs younger than 32 weeks treated with exogenous surfactant*

	CRIB II		Weight	
Variable	**Result**	**95% CI**	**Result**	**95% CI**
Sensitivity	93	68-99	62	36-84
Specificity	98	91-99	81	81-95
Positive predictive value	88	62-97	37	20-57
Negative predictive value	98	92-99	92	83-96
Positive likelihood ratio	41	10-165	3	2-6
Negative likelihood ratio	0.06	0.01-0.43	0.46	0.24-88
Test accuracy	97	91-99	78	89-85
Prevalence	15	9.23-23.8	15	9-24

*The mortality outcome was used as the gold standard to calculate sensitivity, specificity and other values of the diagnostic test for CRIB II and weight.

Discussion

In this study, a > 10 CRIB II score was found to have high sensitivity, specificity and predictive values to predict mortality in PTNs younger than 32 weeks gestational age receiving surfactant within the first hour after birth. These results are important in the clinical area setting in order to try to improve medical decisions and to offer appropriate and opportune treatment.

There are some mortality predictors in newborns, such as gestational age. Some authors have found an overall mortality of 10%[10]. In this investigation, 15% mortality was found in PTNs younger than 32 weeks gestation treated with surfactant within the first hour after birth.

Some investigations have described that weight and gestational age influence on mortality: the lower the gestational age and weight, the higher the mortality; furthermore, these factors represent a risk for morbidity[11-13]. However, it is difficult to predict mortality with weight and gestational age, since they do not account for disease seriousness. Therefore, it is important to know the mortality prognosis through physiological disturbances that occur within the first hours after birth; this helps to opportunely identify these alterations in order to start treatment on time, which can improve survival in preterm newborns.

Some scales take into account clinical features present in newborns to predict mortality and have been proven to be more useful than weight. This demonstrates that it is important for other perinatal risk factors and physiological conditions occurring within the first hours of life to be assessed, which can be accomplished with CRIB and CRIB II[4,5,14-16].

Some authors have considered the CRIB[17] to be more useful than gestational age and weight to predict mortality. Furthermore, in an investigation it was used to predict intraventricular hemorrhage in very low and extremely low birth weight premature infants[18].

Some studies have demonstrated that a CRIB II score higher than 10 can predict mortality in low-weight premature babies[4,5]. Additionally, some authors have validated the CRIB II to predict mortality and have found it to be a good index to predict it[19]. Similar results were found in this investigation, with high sensitivity, specificity and positive and negative values to predict mortality with a CRIB II score higher than 10 in comparison with weight.

One of the limitations of this study is that it is unknown if treatment monitoring was adequate and one disadvantage was that prenatal and perinatal background conditions were not taken into account to predict mortality.

One of the advantages of using the CRIB II in newborns is that it is an easy-to-use index, and it only requires a structured questionnaire to assess their data, which can be recorded in the medical file and would be useful for neonatologists and pediatricians when informing the parents on a probable mortality diagnosis. Another advantage is that it allows for acidosis to be opportunely detected, which could be tried to be timely corrected and thus avoid an increased production of free radicals that would generate

oxidative stress with cell damage and could result in other conditions and future sequels. The start of adequate and opportune treatment can reduce days of hospital stay and costs for the institution on the short and long term. Additionally, newborns could be early integrated to their families, with less sequels and better quality of life.

Conclusions

CRIB II is useful to predict mortality in PTNs younger than 32 weeks treated with surfactant. It is important for further investigations assessing the severity of different conditions with this index to be conducted, which will help for opportune treatments to be established.

Declaration of conflicts of interest

The authors declare not having any type of conflict of interest.

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