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CRIB (CLINICAL RISK INDEX FOR BABIES) SCORING SYSTEM IN PREDICTION OF MORTALITY IN PREMATURE BABIES

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Abstract:

Newborn baby mortality rate, particularly associated with the Low Birth Weight (LBW) babies, are of leading problem in the newborn, through the entire globe. A number of resources have been designed to predict preliminary mortality risk among the LBW babies. Most notable is the scoring system Clinical Risk Index for Babies also known as CRIB II score.

This particular study is performed to assess the application of CRIB II score as an effective resource to predict the risk for newborn mortality among the LBW babies and this refers to a prospective cohort study.

An overall trial of 135 low birth weight babies had been followed up from admittance till release, the 28th day of life or death no matter which came first. The total number of 135 infants had been registered within the study. Birth weight ranged from 600 – 2500g, with a average of 1600g. Total CRIB II score varied from 1 – 15, with a median of 5.5. Gestational age varied through 26 – 38 weeks. Complete mortality was 45.9%. Birth weight <-12mmol/l, temperature at admission >37.5 or 4 had been discovered to generally be considerably related to hospital newborn deathrate. Utilizing a cut-off point of 4, CRIB II score was discovered to create a sensitivity of 80.6%, uniqueness of 75.3%, and a prognostic value of 77.7% compared to 72.5, 71.2, and 71.8% respectively for birth weight. Gestational age was found to have even lower figures; 56, 75 and 66% for sensitivity, specificity and predictive values respectively.

CRIB II score of > 4 was discovered to have improved prediction for mortality among the list of LBW babies as compared to the customarily applied predictors and can be employed to differentiate care for such neonates for better outcome.

Keywords: *CRIB Scoring System; Mortality Prediction; Premature Newborns.*

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INTRODUCTION:

Newborn death rates are essential health indications which are considereded as proxy methods of health of the population. Infants mortality would be the leading aspect of newborn mortality accounting for about 60% of all infant deaths around the world. Newborn mortality rate has always been relatively elevated in the establishing as compared to developed countries. In Pakistan, newborn and child mortality happen to be shown to persist on elevated grounds with infant mortality rate of 73 per 1000 live births in 2008, 77 per 1000 live births in 2014 and 52 per 1000 live births in 2018 (Youssef, 2018).

Infants' mortality though was discovered to lead to 40% of all the infant mortality which includes a infant mortality rate of 33 deaths per 1000 live births revealed in 2013 and continues to be reasonably the same with rate of 31 deaths per 1000 live births reported in 2018. Half of the infants' fatalities can be assigned to acute perinatal asphyxia, low birth weight, prematurity and perinatal bacterial infections. The incidence of low birth weight around the world is 19% and about 9% of all newborns necessitate particular or infants intensive care. Scientific studies done in Pakistan have also revealed LBW to be a frequent issue and a leading cause of newborn mortality (Croes, 2016).

Birth weight specific infants' diseases such as for example intra-ventricular haemorrhage, severe group-B streptococcal pneumonia and pulmonary hypoxia have likewise attributed to inferior consequence. The maximum threat of neonatal mortality happens among newborns who weigh no more than 1000g at birth and those no more than 30 weeks gestation. As birth weight improves from 500g to 3000g, a logarithmic decline in neonatal mortality comes about. Low Birth weight is most likely the solitary the crucial element in neonatal mortality (Youssef, 2015).

Dissimilarities are found in birth weight specified mortality between geographical locations, countries as well as between different neonatal units. Due to these disparities, simple scoring methods for mortality risk have been formulated to take into account the other risk factors that contribute to neonatal mortality. These resources consist of clinical risk index for babies (CRIB) II, simplified acute physiology (SAPS), score for neonatal acute physiology (SNAP), and mortality probability model (MPM). Of these tools, CRIB II remains to become the most precise tool to figure out neonatal viability. Furthermore, CRIB II score has been discovered to be accurate predictor than birth weight alone (Croes, 2016).

CRIB II score is a validated measure of initial mortality risk and illness severity within one hour of admission that contains only five variables. It is simple to calculate and non-subjective. It is useful in identifying high-risk neonates, auditing of neonatal units and also provides a standardised mortality rate for performance comparison among neonatal units. CRIB II score takes into account the birth weight, gestational age, body temperature, base excess and sex of the baby to determine initial mortality risk (Croes, 2016). The total CRIB II score ranges from 0 to 27. The scores have further been classified into four levels as follows:

Level	Score
Level 1	0-5
Level 2	6-10
Level 3	11-15
Level 4	Above Fifteen

The greater the score, the more pathetic the prognosis, along with most severe prognosis in level 3 and 4. Preceding research indicates optimum cut off point founded on receiver operating attribute to be at score 4. CRIB II score produces a recalibrated and basic scoring system that eliminates the expected issues of initial treatment bias (de Courcy-Wheeler et al., 2015).

CRIB II score has been confirmed to correlate extremely with hospital neonatal mortality, the cost of hospitalization per day and fairly effective predictor for days on ventilator and length of hospital stay and this was obviously a much better predictor neonatal viability than APGAR score or any independent variables such as birth weight, gestational age, base excess, and temperature at

admission in predicting severity of illness. Furthermore, CRIB II score has been utilized to predict neurodevelopmental consequence in ELBW infants. CRIB II score is legitimate method of preliminary risk assessment even in ELBW in predicting hospital outcome (death or major brain lesions) more accurately than birth weight or gestational age alone (de Courcy-Wheeler et al., 2015).

METHODS:

This was a prospective longitudinal study where the subject were recruited between December 2015 to April 2017.The study was carried out at the Newborn Unit and Labour ward of a hospital of Lahore.

A quick clinical assessment was performed on the neonate to determine the need for emergency resuscitation followed by general physical examination. Baseline data such as respiratory rate, temperature and body weight (taken using a top pan balance-Zy-20 baby scale model and recorded to the nearest 50 grams) were taken on admission. Gestational age assessment was done using the Dubowitz method (This is the method used in institutions to determine the baby's gestational age).

Blood for arterial blood gas analysis was obtained using standard procedure for arterial blood withdrawal. The specimen was then labelled and transported to the laboratory immediately. The samples were analysed using an automated electrode (Rapid lab) blood gas analyser. Using the measured parameters PaO2, PaCO2, the value of the base excess was automatically derived by the machine.

CRIB II score was assigned and used to assess the medical viability of the neonates that were admitted at the hospital's neonatal care unit. The babies were then reviewed every morning thereafter until discharge, death or up to 28 days of life, whichever came first. During the follow up, weight gain, mode of feeding and the presence of any other morbidity were noted. The mothers' and babies' notes from maternity and antenatal clinic were also reviewed.

RESULTS:

This had been a prospective longitudinal research where in actuality the subject were enrolled between December 2015 to April 2017.The study was carried out at the Newborn Unit and Labour ward of a hospital of Lahore.

A brief clinical evaluation was carried out on the neonate to ascertain the requirement of emergency resuscitation followed by general physical examination. Standard data such as for instance respiratory rate, temperature and body weight (brought by using top pan balance-Zy-20 baby scale model and reported to the closest fifty grams) were taken on admission. Gestational age evaluation was accomplished using the Dubowitz method (This is the method used in institutions to determine the baby's gestational age).

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Table 1

Characteristics of the neonates admitted to the Newborn Unit

Characteristics	Range	Median
Birthweight (g)	600-2500	1600
Gestational age (weeks)	26 – 38	32
Temperature (0C)	33.4 - 38.4	36.2
Base excess (mmol/l)	- 24 to –2.1	- 8.2
Apgar score (at 5 min)	3 -10	8
Maternal age (years)	16 – 41	23
Maternal parity	0 -12	1

Source: (SAUVÉ et al., 2017)

The neonates admitted at the hospitals Newborn Unit were distributed into three levels according to the CRIB II score, with 61% being in level 1, 28% in level 2 and 11% in level 3. There was no neonate graded in level 4 (as mentioned in below table 2)

Table 2
Survival of the neonates as per the CRIB II score levels

CRIB II score	N=135	Dead N=62 (%)	Alive N=73 (%)	RR (CI= 95%)	p-value
Level I (0 –5)	82(61)	18(22)	64(73)	1	
Level II (6 –10)	38(28)	30(79)	8(21)	3.6 (2.3- 5.8)	<0.01
Level III (11–15)	15(11)	14(93)	1(7)	4.25 (2.8- 6.5)	<0.01
Level IV (>15)	0(0)				

Source: (SAUVÉ et al., 2017)

From the study, it was established that of the neonates who had a CRIB score of less than or equal to four, 18% died whereas those that were greater than 5, 73% died within 28 days (RR=4.1 p= 0.001). The non-survivors who scored favourably (≤ 5) had a longer duration of hospital stay compared to those who scored unfavourably (>5) who were more sick and therefore died earlier. For the survivors, those who scored unfavourably spent more time in the hospital compared to those who scored favourably. The latter were less sick and therefore got discharged home earlier. Below mentioned Table 3 assesses the reliability of CRIB II as predictor of survival of low birth weight neonates.

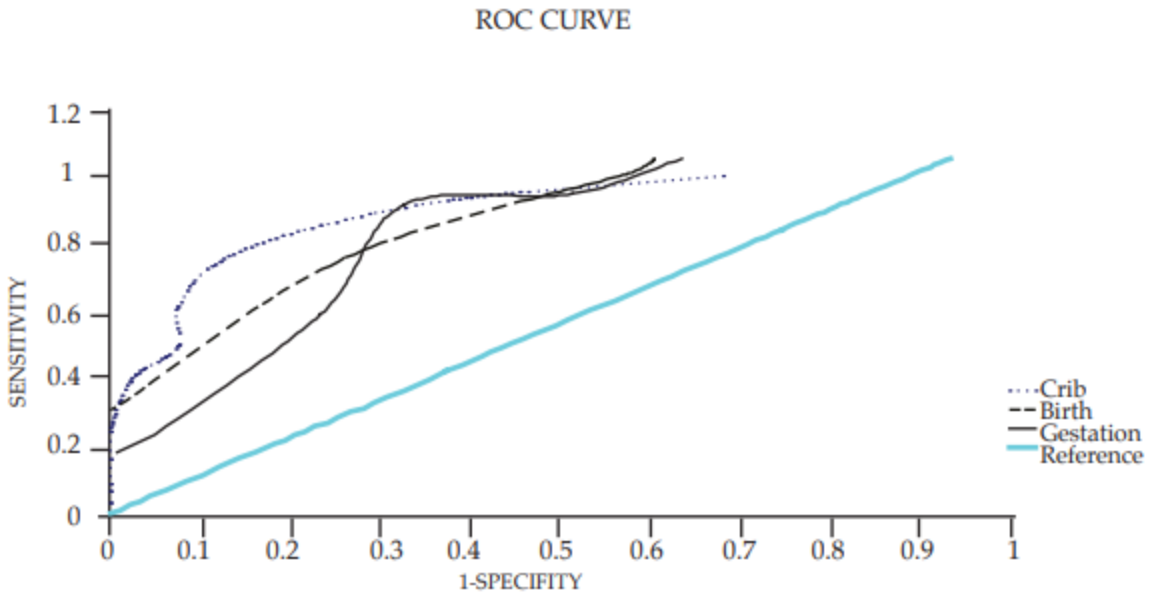
Table 3
Some of the characteristics of CRIB II as a predictor of neonatal mortality

Model	Sensitivity (%)	Specificity (%)	Predictive value (%)	PPV (%)	NPV (%)
Bithweight	72.5	71.2	71.8	68.1	75.3
Gestational age	56.4	75.3	66.6	66.0	67.0
CRIB II (cut off of 4)	80.6	75.3	77.7	83.3	82.1
CRIB II (cut off of 10)	32.3	98.6	68.1	95.2	63.2

Source: (SAUVÉ et al., 2017)

CRIB II score is recognized to get the highest sensitivity and prognostic value in the cut-off point of 4. At a cut off of 10 CRIB II appears to experience an impressive uniqueness (98.6%) but very low sensitivity (32.3%) Area under the ROC for CRIB II, birth weight and gestational age were 0.692, 0.608 and 0.682 correspondingly.

ROC curve for prediction of hospital neonatal mortality by CRIB II score, birthweight and gestational age



DISCUSSION:

All through the study researchers confirmed that CRIB II score was effortless to apply as the majority of its elements form component of the regimen care of preterm babies in our infants unit except for base excess estimation. No subjective variables are utilized consequently it is able to easily be recreated along with unskilled hands. Conversely, it is worthwhile noting that its application is restricted to features where arterial blood gas evaluation can be achieved. In Pakistan, its function might be minimal to referral hospitals. A simpler score system is necessary for the health facilities where arterial blood gas analysis is not routinely done (Rastogi, Sreenivas and Kumar, 2015).

This study had several limitations that could have contributed to different results compared to previous studies. The study considered all babies less than 2500g since this group was found to have high mortality in our setting (53%). In the study originating the CRIB II score, only babies less than 1500g were included. This may have affected accuracy levels of CRIB II score as shown by the lower ROC values compared to previous studies (Tarnow-Mordi et al., 2016).

As a consequence of logistical reasons, it was actually not possible to cover the Newborn Unit for 24 hours subsequently an important group of babies born at night was probably left out. This could additionally have impacted the reliability of the results. A considerable group of babies born by emergency Caesarean section has also been left out simply because their mothers have not been ready to give an informed consent within one hour of admission to the Newborn unit (Rastogi, Sreenivas and Kumar, 2015).

In this research the mean CRIB II score at admission was 5.5 (Range 1 –15). Overall mortality was found to be 45.9%. Survivors had a mean CRIB II score of 3.7, while non-survivors had a mean CRIB score of 7.7. This study compares well with another study in 2012 which found a mean CRIB II score of 4, range of 0 –19. However no babies had a CRIB II score of more than 15 in this study.

The quantitative expression of CRIB II score as a mortality predictor was assessed using the area under ROC curve. CRIB II score was confirmed to positively predict mortality and to have a better performance than birth weight and gestational age independently. Area under ROC curve for CRIB II, birth weight and gestational age were found to be 0.692, 0.608 and 0.682 respectively. However, the accuracy was found to be lower than the study that originated it (0.900 for CRIB II) (Tarnow-Mordi et al., 2016).

CONCLUSION:

Established within the research, it is actually recognized that CRIB II score is known as a much better predictor of neonatal mortality as compared to birth weight and gestational age separately. It is in addition discovered to be appropriate and for that reason it should switch out the conventional versions as the predictor of neonatal outcome. This is definitely in agreement with other researches. The sensitivity, uniqueness and predictive value of CRIB

II score were discovered to be better than anyone the conventional models separately. The area according to the receiver- operating characteristic (ROC) curve for predicting death was greater for CRIB II score than for birth weight or gestational age alone.

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