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# "SNAPPE-II (SCORE FOR NEONATAL ACUTE PHYSIOLOGY WITH PERINATAL EXTENSION) AS A PREDICTOR OF MORTALITY IN NICU."

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## ABSTRACT

The assessment of severity of illness with scoring system has been used to predict neonatal mortality in neonatal intensive care unit (NICU). Prospective study was conducted at tertiary care NICU between January 2008 to August 2009 to determine the validity of SNAPPE-II score in predicting the outcome in terms of mortality and duration of hospital stay. 248 newborns were enrolled in the study of which 34.2% were preterm, 61.2% were term and 4.4% were post-term .The crude NICU mortality rate was 15.7%.Higher SNAPPE- II scores correlated well with the outcome in terms of mortality. Among expired babies mean SNAPPE- II score was 45.7+/-18.689 compared to those among survived 21.04+/-15.418 which was statistically significant. Sensitivity, Specificity, Negative predictive value and Positive predictive value of SNAPPE-II score in predicting mortality were 76.9%, 87.1%, 52.6% and 95.3% respectively. For SNAPPE -II, ROC curve showed a cut off value of 37. Of the sample, 30 babies with a score of more than 37 expired while only 9 expired when the score was less than 37.SNAPPE- II is a useful tool in predicting illness severity in terms of mortality and morbidity in NICUs.

**KEY WORDS**: **SNAPPE-II, morbidity, mortality, survival**

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## INTRODUCTION

Advances in the neonatal intensive care have significantly increased survival and decreased morbidity among neonates admitted to the neonatal intensive care unit (NICU). The assessment of severity of illness is very important to determine prognosis, including predicting mortality in neonates hospitalized in the NICU. Some risk factors which were considered to influence the severity of illness like birth weight, gestational age, and sex are inaccurate. Therefore, we need to predict neonatal mortality more accurately by measuring biochemical and physiological changes[1-4]. The ideal scoring system for predicting severity of illness must fulfil certain criteria, i.e., it should be easy to apply, one that could be used to predict mortality and morbidity, has benefits on neonatal hospitalization cost, and one that can be used in all neonatal groups. Recently, many scoring systems have been developed to predict neonatal mortality in NICU like clinical risk index for babies (CRIB), CRIB II, score for neonatal acute physiology (SNAP), SNAP perinatal extension (SNAPPE), SNAPPE II[5-9]. The SNAPPE- II is considered as the best scoring system, because of its simplicity, rapidity, accuracy, and applicability for all birth weights. There are not many reports on SNAPPE-II as a predictor of illness severity in our country hence a prospective study was undertaken to evaluate the usefulness of SNAPPE- II score in determining illness severity and outcome with respect to mortality and morbidity.

## MATERIALS & METHODS

The study was conducted in tertiary neonatal unit of a teaching hospital. The unit provides intensive care to sick low birth weight neonates referred from community hospitals of Bangalore and surrounding states. Prospective study was conducted from January 2008 to August 2009.248 neonates admitted to NICU within 48 hours of birth were enrolled. Neonates who were discharged against medical advice within 24 hours, all home deliveries where exact APGAR scores were not known and neonates with major congenital malformations incompatible with life were excluded. Neonates admitted to NICU were first stabilized and resuscitated .Data was collected prospectively by doctors as well as trained nurses with in the first 12 hours of admission. Final score was computed as arithmetic sum of points assigned to each item.

**Table 1**
***Score for neonatal acute physiology with perinatal extension II***

| PARAMETER RANGE | SCORE POINTS |
|---|---|
| Mean blood pressure | |
| >30 | 0 |
| 20-29 | 9 |
| <20 | 19 |
| Lowest temperature | |
| >96 | 0 |
| 95-96 | 8 |
| <95 | 15 |
| Po2/fio2 ratio | |
| >2.5 | 0 |
| 1-2.49 | 5 |
| 0.3-0.99 | 16 |
| <0.3 | 28 |
| Lowest serum pH | |
| >7.2 | 0 |
| 7.1-7.19 | 7 |
| Multiple seizures | |
| no | 0 |
| yes | 19 |
| Urine output | |
| >1 | 0 |
| 0.1-0.9 | 5 |
| <0.1 | 18 |
| APGAR score | |
| >7 | 0 |
| <7 | 18 |
| Birth weight | |
| >1000 | 0 |
| 750-999 | 10 |
| <750 | 17 |
| Small for gestational age | |
| < 3rd percentile | 12 |

### STATISTICAL METHODS

The results were averaged (mean+/-standard deviation) for continuous data. To assess the optimal cut off scores, relative operating characteristics (ROC)curve was plotted for the SNAPPE -II score (expired vs survived) to compare the sensitivity and specificity of the score. The ROC curves show the sensitivity versus one minus the specificity for every possible cut off point. Optimal cut off points were determined by visually assessing which scores combines maximum sensitivity and optimal specificity. The area under curve (AUC) was used as an indicator of the ability of the scales to differentiate the mortality in neonates. Optimal cut off scores were determined for the purposes of screening,

diagnosis and dichotomization into groups of expired and survived. In addition, positive predictive values and negative predictive value were calculated for different cut off scores. Univariate analysis of the dichotomous variables encoded were performed by means of the Chi square test with Yates correction if required .The student 't" test was used to determine whether there was a statistical difference between male and female subjects in the parameters measured. One way analysis of variance (ANOVA) was used to test the difference between groups. In the entire test p value less than 0.05 was considered statistically significant. The data was analysed using SPSS package.

## RESULTS

248 newborns met the inclusion criteria and out of them 39 babies succumbed. The crude NICU mortality rate was 15.7%.Among the 248 babies 85 were preterm (34.2%),152 (61.2%) were term and 11(4.4%) were post –term babies. The mean gestational age of expired babies in our study was 37.10+/-3.56 and 37.34+/-2.993 in the survived groups respectively. Mean birth weight in the study was 2.317+/-0.74 kg. The mean birth weight in the survived babies was 2.32+/-0.73 and 2.26+/-0.78 in the expired babies respectively. Male to female ratio among admitted neonates was 2.1:1. Male babies had a higher mortality rate but it was not statistically significant.HIE (32.7%) was the commonest diagnosis followed by MAS (16.9%), HMD(13.3%) and sepsis (6.5%). Other diagnosis was NEC and late onset sepsis, meningitis, congenital pneumonia, TTNB etc. In our study HMD (30.3%) had highest mortality and the least was for NEC (8.33%).Higher SNAPPE II scores correlated well with the outcome in terms of mortality. Our study showed poor correlation in the range of 21-30. Among expired babies mean SNAPPE II score was 45.72+/-18.689 compared to those among survived 21.04+/-15.418 which was statistically significant. Area under the ROC curve by trapezoid rule was 0.849. Sensitivity, specificity, negative predictive value and positive predictive value and positive predictive value of SNAPPEII score in predicting mortality were 76.9%, 87.1%, 52.6% and 95.3% respectively. For SNAPPE II, ROC curve showed a cut off value of 37.Out of the sample, 30 babies with a score of more than 37 expired while only 9 expired when the score was less than 37. Mean length of stay among expired babies was 11.14+/-8.18 and among survived babies it was 5.41+/-5.14.The mean length of stay was found to increase from score of 11-40 and found to decrease for children with score of more than 40.In preterm the mean SNAPPE- II score in the survived babies was 14.87+/-13 and 31.7+/-16 in the expired group whereas it was 24.1+/-15 in case of survived and 52.8+/-15 in case of expired children in the term group.

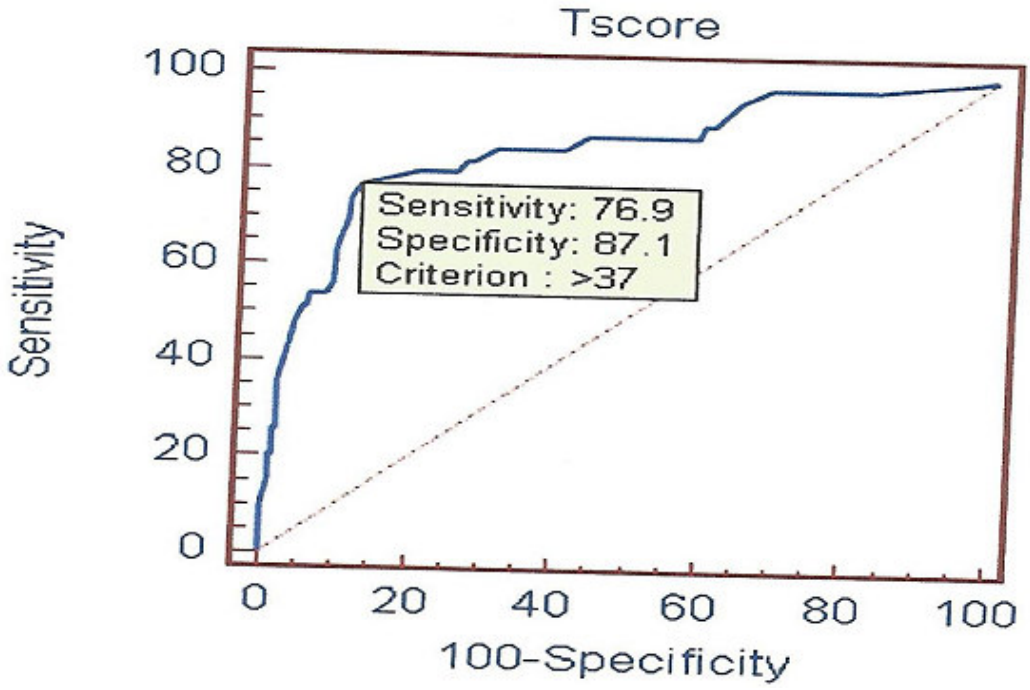
**Table 1**
***Frequency distribution of SNAPPE-II***

| SNAPPE II score | Discharged | Expired | total |
|---|---|---|---|
| 0-10 | 65 | 01 | 66 |
| 11-20 | 49 | 04 | 53 |
| 21-30 | 30 | 01 | 31 |
| 31-40 | 45 | 08 | 53 |
| 41-50 | 14 | 09 | 23 |
| 51-60 | 04 | 09 | 14 |
| 61-70 | 02 | 04 | 05 |
| 71-80 | 00 | 02 | 02 |
| >80 | 00 | 01 | 01 |
| total | 209 | 39 | 248 |

| Chi-square value | "p" value |
|---|---|
| 74.913 | <0.001 |

**Table 2**
***SNAPPE II in predicting mortality shows that among expired babies mean SNAPP II score is higher compared to those among survived which is statistically significant***

| Outcome | N | Mean SNAPPEII score | Std deviation | minimum | maximum | "t" value | "p" value |
|---|---|---|---|---|---|---|---|
| Discharged | 209 | 21.04 | 15.491 | 0 | 69 | 78.489 | <0.001 |
| Expired | 39 | 45.72 | 18.787 | 0 | 87 | | |
| Total | 248 | 24.84 | 18.277 | 0 | 87 | | |




## DISCUSSION

SNAPPE II is a scoring system which combines biochemical and physiologic function test. The higher the score of SNAPPE- II, the higher the mortality risk of neonates. Disturbance in one or more factors could result in higher SNAPPE- II score. The present study showed that the higher the score of SNAPPE -II, the higher the mortality predictor percentage. This result was similar to that found by the previous studies done by Richardson [11] et *al* in USA and Canada, by Mia[12] *et al* in Indonesia and Kadivar [13]*et al* in Iran. However, the cut-off point of SNAPPE II scoring system to predict the mortality in this study was different from that of previous studies. In our study, SNAPPE II score of 37 and above were associated with higher mortality. In a study conducted by Suksham Jain, Anuradha Bansal[14] found that the scores of 40 and above were associated with higher mortality. Area under the curve by ROC was found to be 0.849(95%CI 0.79-0.970 which is classified as good .In our study death of neonates with low scores can be explained by the fact that these neonates were stable at the time of admission when scoring was carried out ie within the first 12 hours, but later deteriorated due to changing hemodynamics and some of them, mostly preterm babies, acquired nosocomial infections .This reflects the drawback of scoring systems that do not take in to account the dynamics of disease progression. Thus in general, higher SNAPPE-II scores among the expired babies suggest that these neonates were critically ill, thus measuring illness severity risk. Limitations of the study: SNAPPE- II score doesn't correctly predict the outcome in neonates especially preterm babies who are going to deteriorate later due to nosocomial infections.

## CONCLUSION

SNAPPE- II is a good predictor of mortality irrespective of birth weight and gestational age. The score assists the clinician in identifying very sick neonates and prioritizing treatment to the neonates. It also helps in counselling the parents regarding the severity of illness and the probable cost of treatment .Scoring system may improve referral system if babies with higher scores would be referred to a tertiary centre for appropriate treatment. It can also be used to compare the quality of services between different NICUs with respect to outcome.

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