# **Original Research Article**

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# Extended sick neonatal score in prediction of mortality of neonates transported to tertiary healthcare centre and its comparison with sick neonatal score and temperature, oxygenation, perfusion and blood sugar score

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#### **ABSTRACT**

**Background:** India contributes up to 25% of neonatal mortality worldwide. Most of the times, the patient deteriorates in-transit from periphery to tertiary healthcare facility. There is a need for reliable scoring system in analysis of neonates transferred to tertiary healthcare centers in prediction of in-hospital mortality. The aim of the research was to evaluate the efficiency of extended sick neonatal score in 'in-hospital' mortality prediction of neonates referred to tertiary healthcare institutes and to compare it with that of other scoring systems like sick neonatal score and temperature, oxygenation, perfusion and blood sugar (TOPS) score.

**Methods:** The research was a retrospective observational study. All extra-mural neonates admitted over a period of one month at neonatal intensive care unit (NICU) of our tertiary healthcare centre were considered after informed consent and the required parameters for scoring were assessed. Data was collected according to a pre-formed proforma.

**Results:** Over a period of one month, 145 neonates attended on arrival were analyzed according to the mentioned systems. Various cohorts were considered. Of the systems analyzed, extended sick neonatal score had the highest sensitivity and specificity, regardless of the cohort.

**Conclusions:** Extended sick neonatal score was more efficient than sick neonatal score and TOPS score in mortality prediction of sick neonates.

Keywords: Extended sick neonatal score, Sick neonatal score, TOPS score

#### INTRODUCTION

India is a major contributor for neonatal mortality worldwide. There is a paucity in facilities for management of neonatal health issues in rural areas, forcing referral to tertiary healthcare institutes. For intact survival, an effective and proper newborn transport to such institutes is important. There are multiple scoring systems available to analyze the status of well-being in such transported neonates, which can help evaluate the outcome. Three such systems are analyzed for their ease of use,

applicability and ability to predict in-hospital mortality. In the present study, comparison of three scoring systems has been done in prediction of in-hospital mortality in such neonates transported, namely extended sick neonatal score (ESNS), sick neonatal score (SNS) and temperature, oxygenation, perfusion and blood sugar (TOPS) score.

#### **METHODS**

A retrospective and observational study was conducted at the neonatal intensive care unit (ICU), at the Department of Pediatrics of Civil Hospital, Ahmedabad over a period of one month from 01 December 2018 to 31 December 2018. Informed written consent was taken from parents for enrolment into study.

#### Inclusion criteria

All extra-mural neonates referred to civil hospital, Ahmedabad, not falling under exclusion criteria, were included.

#### Exclusion criteria

Mod. Downes' score

Patients with major congenital malformation, patients requiring surgical intervention, patients who left against medical advice, and patients not willing to participate in the study were excluded.

On arrival, baby was assessed by measuring temperature, oxygen (O<sub>2</sub>) saturation, heart rate, blood pressure, respiratory efforts, capillary perfusion and blood sugar, as these are criteria in both TOPS score and SNS. The proposed extended variant of SNS, ESNS as devised by

Ray et al is SNS along with neurological assessment by moro reflex and respiratory assessment by Downes' score was analyzed and compared with SNS and TOPS score.<sup>3</sup> A cut-off was determined for each of the scoring systems using the receiver operating characteristic (ROC) curve for the whole cohort (<11 for ESNS, ≤9 for SNS) and the same cut-off was used in sub-cohorts as standard and the sensitivity (ability of the test to correctly identify true positives) and specificity (ability of the test to correctly identify true negatives) of the system for that score were calculated in predicting mortality of neonates. By comparing the result, accuracy of the scoring systems in mortality prediction of neonates referred to our centre was analyzed.<sup>2</sup>

## **RESULTS**

Of the 145 neonates enrolled, 84 (58%) were male and 61 (42%) were female. While 100 neonates were full-term (69%), 45 (31%) were pre-term. Primary indication for referral were septicemia (34%), birth asphyxia (29%), low birth weight (28%) and jaundice (9%). Mortality was observed in 55 neonates (38%).

<2

Score **Parameter** 0 2 1 36-36.5 36.5-37.5 Axillary temperature (°C) <36 Heart rate (BPM) Bradycardia or asystole >160 100-160 Respiratory effort Rate >60±retraction 40-60 Apnoea <5<sup>th</sup> 5-50<sup>th</sup>  $>50^{th}$ **Blood pressure (percentile)** Capillary refilling (sec) >5 3-5 <3 Random blood sugar (mg/dl) <45 45-60 >60 SpO<sub>2</sub> (%) <85 85-92 >92 Exaggerated/depressed Moro reflex Absent Appropriate

Table 1: Extended sick neonatal score.

Table 2: Sick neonatal score.

>6

Danamatan	Score					
Parameter	0	1	2			
Axillary temperature (°C)	<36	36-36.5	36.5-37.5			
Heart rate (bpm)	Bradycardia or asystole	>160	100-160			
Respiratory effort	Apnoea	Rate>60±retraction	40-60			
Blood pressure (percentile)	<5 <sup>th</sup>	5-50 <sup>th</sup>	>50 <sup>th</sup>			
Capillary refilling (sec)	>5	3-5	<3			
Random blood sugar (mg/dl)	<45	45-60	>60			
SpO <sub>2</sub> (%)	<85	85-92	>92			

Table 3: TOPS score.

	Score	
Parameter	0	1
Axillary temperature ( <sup>0</sup> C)	<36.5	≥36.5
Capillary refilling (sec)	≥3	<3
Random blood sugar (mg/dl)	<45	>45
SpO <sub>2</sub> (%)	<90	≥90

Table 4: Sensitivity and specificity of mortality prediction in whole cohort.

Scoring system	Mortality	Cut-off score	Sensitivity	Specificity
ESNS	55/145	<11	0.94	0.83
SNS	55/145	≤9	0.86	0.78
TOPS	55/145	≤4	0.92	0.80

Table 5: Table evaluating the sensitivity and specificity of mortality prediction in term and pre-term cohort.

Scoring system	Cut-off score	Mortality	Sensitivity	Specificity	Mortality	Sensitivity	Specificity
Cohort	•	Term			Preterm		
ESNS	<11	33/100	0.93	0.85	22/45	0.97	0.90
SNS	≤9	33/100	0.88	0.79	22/45	0.84	0.77
TOPS	<u>≤</u> 4	33/100	0.93	0.84	22/45	0.94	0.83

Table 6: Sensitivity and specificity of mortality prediction in asphyxiated and septicemic neonates.

Scoring system	Cut-off score	Mortality	Sensitivity	Specificity	Mortality	Sensitivity	Specificity
Cohort	•	Septicaemia	ļ	-	Asphyxia		
ESNS	<11	23/49	0.91	0.95	28/42	0.96	0.88
SNS	≤9	23/49	0.86	0.75	28/42	0.86	0.74
TOPS	≤4	23/49	0.90	0.81	28/42	0.97	0.83

Table 7: Comparison of similar studies.

Cooring greatern	Present study		Somosri et al		
Scoring system	Sensitivity	Specificity	Sensitivity	Specificity	
ESNS	0.94	0.89	0.86	0.90	
SNS	0.86	0.76	0.90	0.67	
TOPS	0.90	0.81	-	-	

Table 4 demonstrates the sensitivity and specificity of mortality prediction of whole cohort for the cut-off set to different scoring systems. Of all the systems for whole cohort, ESNS had more sensitivity and specificity in mortality prediction followed by SNS and TOPS score.

Table 5 demonstrates that ESNS has more sensitivity and specificity in mortality prediction followed by SNS and tops score for both term and pre-term cohorts.

Table 6 demonstrates that ESNS has more sensitivity and specificity in mortality prediction followed by SNS and TOPS score for both asphyxiated and septicemic cohorts.

In accordance with the study conducted by Somosri et al, our study demonstrates more specificity with ESNS (Table 7).<sup>2</sup>

## **DISCUSSION**

In our present study ESNS had a strong correlation with SNS and TOPS in predicting mortality in sick hospitalized neonates. It is a comprehensive and uncomplicated scoring system which can be used easily even by other healthcare workers and can be applied within a short duration. There are many other systems that are used for analysis of the neonates like the score for neonatal acute physiology

(SNAP) score as described by Richardson et al which uses 34 signs and lab results and score for neonatal acute physiology and SNAP perinatal extension (SNAPPE II) which uses parameter that require monitoring for at least 12 hours. <sup>4,5</sup>

To overcome these drawback SNS was preferred for rapid analysis.<sup>6</sup> With ESNS considering the neurological component and severity of respiratory distress, better prediction of outcome can be seen with its usage especially in patients of perinatal asphyxia and respiratory distress syndrome.

A similar study conducted by Ray et al comparing efficiency of ESNS in term and preterm neonates showed a sensitivity of 85.9% against 94% of our study and specificity 89.8% against 83% of our study.<sup>2</sup>

Another study, as conducted by Mansoor evaluating modified sick neonatal score (MSNS) a variant of SNS with weightage to maturity and birth weight had set the cut off as according to ROC curve generated and it had a sensitivity of 80% and specificity of 88.8%. This system can be used effectively in predicting mortality irrespective of the gestational age or diagnosis of the neonates transferred from rural setting to tertiary center in a resource limited setting.

#### **CONCLUSION**

ESNS is a fast and effective system that can be used in predicting mortality of neonates referred to tertiary health care centre and it better than other scoring systems like SNS and TOPS score.

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