



## “Validity of Sick Neonatal Score (SNS) for predicting mortality in neonates admitted to a tertiary care centre” – Retrospective observational study

### KEYWORDS

Neonatal transport, SNS, prior stabilization

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### ABSTRACT

**BACKGROND:** In India there is a paucity of studies which have analysed the degree of illness at admission and its relation to outcome. This study was done to correlate the degree of sickness of a neonate at arrival as assessed by sick neonatal score with outcome.

**OBJECTIVE:** To validate SNS for predicting mortality in neonates admitted in a tertiary care centre and the role of prior stabilization of sick neonates before transport.

**METHODS:** This retrospective observational study was conducted in a tertiary care government neonatal unit in south India. All neonates admitted to the hospital between July 2016 – Dec 2016 were included. All baseline characteristics, transport details and SNS were obtained from emergency room form.

**RESULTS:** Emergency room forms of 1142 neonates were reviewed. Most neonates were brought from home (21.2%). 108 Neonatal ambulance (49.2%) was the predominant mode of transport, followed by private ambulance (12.3%). The average SNS for all neonates was 12.2 while it was 9.18 for those who expired & 12.9 for those who were discharged. An ROC showed the cut off value of SNS for predicting the mortality as  $\leq 12$  with a sensitivity of 85.41% and a specificity of 84.37%. Among the neonates with SNS  $< 12$ , prior stabilisation was associated with a favourable outcome ( $p < 0.001$ ). Need for immediate cardiorespiratory support post transport was associated with very poor outcome [OR 26.06 (15.69, 43.28)].

**CONCLUSION:** SNS is a useful scoring system to predict outcome of sick neonates and sick neonates transported with prior stabilization had a favourable outcome

### Introduction

Non institutional births constitute a significant proportion of total births in developing country like India. Though institutional delivery and in-utero transport of newborn is safest but unfortunately preterm delivery and perinatal illness cannot be always anticipated resulting in continued need of transfer of these babies after delivery.<sup>2,3</sup> Neonatal outcome depends considerably on the level of sickness at arrival to a tertiary centre. Most of neonatal transports in India are carried out without any pre-transport stabilization or care during transport. Many of these newborns thus transported are cold, hypoxic and hypoglycemic and many of the babies transferred this way have serious clinical implications. 4-6 In India there is a paucity of studies which have analysed the degree of illness at admission and its relation to baby outcome. This study was done to correlate the degree of sickness of a neonate at arrival as assessed by sick neonatal scoring and pre-transport stabilization with outcome.

### Methods

This retrospective observational study was conducted in a tertiary care government neonatal unit in south India after due approval from the Institute Ethics committee. ER forms of all neonates admitted to the hospital between July 2016 – Dec 2016 were reviewed. Neonate with malformations or diseases not compatible with life were excluded.

Demographic data & basic details like date and time of arrival at newborn emergency department, baby name, identity no, age at arrival (days), sex and admission weight (grams) were collected from the ER proforma. Birth history like mode of delivery (Labour natural/ LSCS [elective/ emergency]/ Forceps delivery/ vacuum extraction), date of birth and time of birth, place of referral and its grading (Primary Health Centre/ Community Health Centre/ Employees' State Insurance Hospital/ General Hospital/ Private Hospital/ Medical College), birth Weight (grams), Maternal details like

maternal age (years), consanguinity (first/ second/ nil), Obstetrical code (gravida, para, live, abortion), EDD, gestational age were collected from the ER proforma. Detailed transport data like referred hospital, mode of transport (neonatal ambulances/ general ambulances/ without ambulances), reasons for referral/ complaints, prior hospitalization, treatment received, duration of transport, distance traveled, transport team composition and need for intervention before transport were collected from the ER proforma. SNS, as described in table 1 was calculated from ER data. Secondary measurements were: neonatal outcome such as mortality and the need for cardiorespiratory support immediately post transport, defined as the need for intubation or the administration of new inotropic drugs or an increase in dose greater than 50% in the ER after admission.

Data was analyzed using SPSS v.20. All continuous data were described using Mean $\pm$ SD or Median[IQR] based on the normality assumption. Categorical variables were represented as frequency and percentages. Univariate logistic regression was done between all clinical parameters and baby's outcome (expired or alive). The factors which ever significant in univariate analysis were included for multivariate analysis. ROC curve analysis were done to find the SNP score cut off point to predict the mortality.

**Table 1 Sick Neonatal Score(SNS)**

Variable	SCORE		
	0	1	2
<b>Respiratory effort</b>	Apnea or Grunting	Tachypnea ( $>60$ /min) with or without retractions	Normal (40-60/min)
<b>Heart rate</b>	Bradycardia/ Asystole	Tachycardia ( $>160$ /min)	Normal (100-160/min)
<b>Mean BP</b>	$< 30$	30-39	$>39$
<b>Axillary temp(<math>^{\circ}</math>C)</b>	$< 36$	36-36.5	36.5-37.5

Capillary filling time(s)	>5	3-5	< 3
Random blood sugar(mg/dl)	< 40	40-60	>60
SPO2 ( in room air)	< 85%	85-92%	>92%

Results

ER forms of 1142 neonates, who fullfill the inclusion criteria ,were reviewed. Table 2 shows the baseline characteristics of neonates admitted.

Table 2 Baseline characteristics of neonates included

CHARACTERISTICS	FREQUENCY(%) (N=1142)
MATERNAL Gravida	
Primi	671(58.76%)
Multi	471(41.24%)
NEONATAL GA <sup>‡</sup>	36.93±2.97
Birth weight <sup>‡</sup>	2.54±0.68
GENDER	
Male	658(57.62%)
Female	479(41.94%)
Ambiguous	5(0.44%)
DISTANCE TRAVELLED (N=638) <sup>‡</sup>	24(8,46)
DURATION OF TRAVEL (N=638) <sup>‡</sup>	1(0,5,2)
Age at admission <sup>‡</sup>	4(0,6,16)
PRIOR STABILIZATION	
Yes	81(7.09%)
No	1061(92.91%)
SNS <sup>‡</sup>	12.24±2.06
CARDIO-RESPIRATORY SUPPORT POST TRANSPORT	
Yes	98(8.58%)
No	1044(91.41%)
HOSPITAL STAY	
<=7 Days	728(63.75%)
>7 Days	414(36.25%)
OUTCOME	
Discharged	902(78.98%)
Expired	185(16.2%)
LAMA	30(2.63%)
Ref	7(0.61%)
In treat	18(1.58%)

<sup>‡</sup>Mean±SD; <sup>‡</sup>Median[IQR]

Most neonates were brought from home(21.2%). Neonates were referred from corporation health post (18.2%), District hospital(17.5%) primary health care(14.2%), Private nursing home(15.2%), Government medical college(8.8%) and private medical college(3.4%).

Most of the neonates were transported by 108 Neonatal ambulance( 49.2%) ( fig.1) followed by private ambulance(12.3%). Other modes of transport include: 108 General ambulance(12.3%),car(10.5%), auto(10%), bus (8.8%), train (3.4%) and two wheeler(1%).

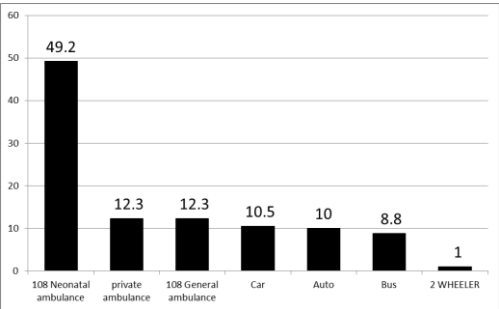


Fig.1:MODE OF TRANSPORT

The average SNS for all neonates was 12.2 while it was 9.18 for those who expired & 12.9 for those who were discharged .An ROC showed the cutoff value of SNS for predicting the mortality as ≤ 12 with a sensitivity of 85.41% and a specificity of 84.37%( fig.2)

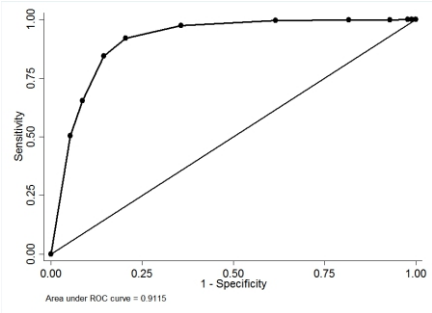


Fig.2 ROC curve for predicting mortality in SNS

The mortality rate in different gestational ages in our study group was as follows( fig.3): 55.36% (≤30 weeks) , 24.77% (31-34 weeks), 16.92% (35-37weeks) and 11.95%(>37 weeks). The overall mortality rate was 16.97% during the study period.

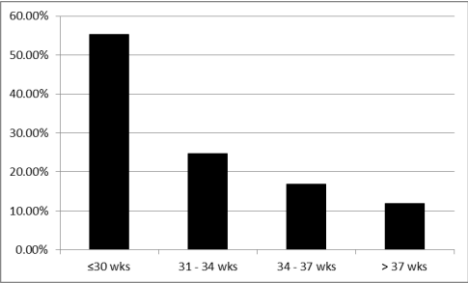


Fig.3 The mortality rate in different gestational ages

Among the neonates with admission SNS < 12, prior stabilisation was associated with a favourable outcome. ( Table.3)

Table 3. Effect of prior stabilization on outcome of neonates with SNS < 12

PRIOR STABILIZA TION	OUTCOME		TOTAL	P-VALUE
	EXPIRED	DISCHARGED		
YES	30(37.03%)	51(62.9%)	81(100%)	0.001
NO	128(58.7%)	90(41.2%)	218(100%)	
TOTAL	158	141	299	

Gravida [OR 0.85(0.62,1.17)] Mode of delivery[OR 0.78(0.56,1.09)] distance travelled [OR 1.0(1.0,1.01)] and duration of transport [OR 1.6 (1.15,2.3)] doesnot correlate with outcome whereas increasing gestational age [OR 0.82(0.78,0.86)] was associated with a favourable outcome. Need for immediate cardiorespiratory support post transport was associated with very poor outcome [OR 26.06 (15.69, 43.28)].(Table.4)

Table.4 Logistic regression : Analysing Risk factors for outcome (death)

Parameter	Overall (n=1087)	
	Odds ratio	Adjusted odds ratio
GA (WEEKS)	0.82(0.78,0.86) <sup>‡</sup>	0.84(0.79,0.89) <sup>‡</sup>
GRAVIDA		
Multi	0.85(0.62,1.17)	
Primi (ref)		
MODE OF DELIVERY		
LSCS	0.78(0.56,1.09) <sup>‡</sup>	
NVD (ref)		

<b>Cardiorespiratory support post transport</b>		22.57(13.12,38.83) <sup>‡</sup>
<b>Yes</b>	26.06(15.69,43.28) <sup>‡</sup>	
<b>No(ref)</b>		
<b>Prior stabilisation</b>		
<b>Yes</b>	10.92(6.63,18) <sup>‡</sup>	9.19(5.14,16.43) <sup>‡</sup>
<b>No(ref)</b>	-	-

<sup>‡</sup>P<0.001;

### Discussion

In our study, a SNS of  $\leq 12$  predicted mortality with a sensitivity of 85.4% and a specificity of 84.37%. The average SNS for all neonates was 12.2 while it was 9.18 for those who expired & 12.9 for those who were discharged. In a previous study conducted by Rathod et al., a score of  $\leq 8$  predicted mortality with a sensitivity of 58.3 % and specificity of 52.7 % and the average SNS for all neonates was 10 while it was 6 for those who expired.<sup>7</sup> This may be due of different demographic profile of the neonates admitted. Most of the neonates (49.2%) were transported by 108 neonatal ambulance service provided by GVK EMRI. This was in contrast to a study conducted in Pondicherry where only 11% of neonates were transmitted in 108 ambulances.<sup>7</sup> This shows the better utilization of 108 ambulance services in Tamil nadu and also improvement in 108 neonatal ambulance service over the last few years.

Gravida[OR 0.85(0.62,1.17)] Mode of delivery[OR 0.78(0.56,1.09)] distance travelled [OR 1.0(1.0,1.01) ] and duration of transport [OR 1.6(1.15,2.3)] did not correlate with outcome whereas increasing gestational age [OR 0.82(0.78,0.86) ] was associated with a favourable outcome.

The mortality rate in different gestational ages in our study group was as follows: 55.36% ( $\leq 30$  weeks), 24.77%(31-34 weeks), 16.92% (35-37weeks) and 11.95%(>37 weeks). The overall mortality rate was 16.97% during the study period which may be high, as this unit is the tertiary referral center in the state.

The need for immediate cardiorespiratory support post transport was associated with very poor outcome [OR 26.06 (15.69,43.28) ]. This will alert us in prognosticating the outcome.

Since the SNS < 12 predicted mortality, subgroup analysis was done for neonates with SNS < 12. Among 299 neonates with SNS < 12, only 81 had prior stabilisation before transport and among them 30 (37.03%) expired whereas in 218 neonates without prior stabilisation, 128 neonates(58.7%) expired. Prior stabilization pre-transport was associated with favourable outcome(p<0.001). In a study by Kumar et al. stabilisation of the neonate before and during transport has been shown to improve the condition of the neonate in terms of temperature, oxygenation, blood glucose and blood pressure.<sup>8</sup> This reemphasises the importance of stabilization of sick neonates before transport.

### Conclusion

SNS can be a useful & simple scoring system to predict outcome of sick neonates admitted and sick neonates transported with prior stabilization had a favourable outcome. This being a retrospective study, a prospective study conducted in this regard will be able to validate SNS better.

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