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Research Article

A simple clinical score to predict outcome in hospitalized extramural neonates

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ABSTRACT

Background: Illness severity scores can guide to optimize the limited health care resources in developing nations. The aim of this study was to develop a clinical score for severity of illness to help prioritize care and predict outcome of neonates admitted in emergency department.
Methods: Prospective hospital based observational study. Out of total 419 neonates who attended Emergency Department, 341 were included in the study. The neonates were screened for 20 clinical parameters at admission and a score of 0, 1 & 2 was assigned for each parameter depending upon severity. The outcome (death/discharge) was correlated with the study variables and total score. The predictive ability of score was calculated using Receiver Operating Characteristic curve (ROC) analysis. Every 10th case was also evaluated with Score for Neonatal Acute Physiology (SNAP) score and served as controls.
Results: Of the 20 variables, 13 variables were found to be significantly associated with mortality. Mortality increased with the increase in the total score. The predictive ability of score calculated using ROC curve was 85.2. Maximum discrimination was observed at score of 17. The 36 control cases which were evaluated with SNAP score also had predictive value of 92.2. There was no statistically significant difference in the predictive values of Clinical Score and SNAP (P value >0.05).
Conclusions: In emergency department, any sick neonate with clinical score 17 or more should be closely monitored and evaluated. These patients require admission as they have a potential risk of death.

Keywords: Clinical score, Neonate, Outcome

INTRODUCTION

Each year nearly 3.6 million neonates die globally with about 1 million in India alone.[1] The current neonatal mortality rate of India is 31 per 1000 live births. Assessment of risk of mortality of a neonate at admission in a hospital is thus, important as it can guide us to optimize the limited health-care resources available in any developing nation. There are a number of illness severity scoring systems available for predicting neonatal outcome like Score for Neonatal Acute Physiology (SNAP),[2] the SNAP perinatal extension (SNAP-PE)[3] and the Clinical Risk Index for Babies (CRIB)[4] but most of them take into account an exhaustive number of parameters including laboratory investigations and are expensive and time consuming.[5]

This study was designed to evaluate role of simple clinical findings in predicting mortality by developing a simple clinical score and to compare its predictive ability with SNAP.

METHODS

The present study was a prospective observational study conducted in the pediatric emergency department of our tertiary care hospital in Northern India from January 2009 to June 2010. Ethical clearance from the institutional review board was obtained prior to initation of this study. A total of 419 neonates were admitted during the study period, 78 of these left against medical advice which were excluded. Remaining 341 cases formed the study sample (Figure 1).

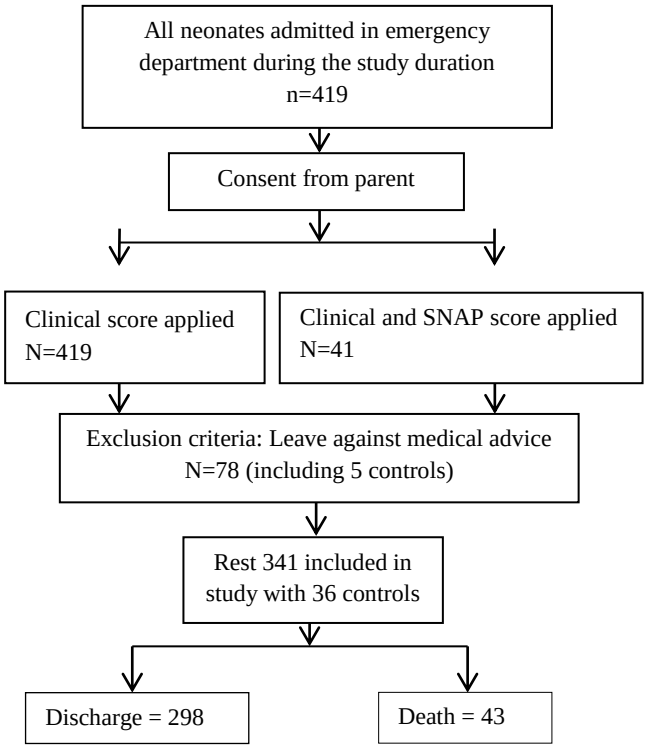

Figure 1: Study design.

These cases were screened for 20 clinical parameters (Table 1) at the time of admission and a score of 0, 1 & 2 was assigned to each in order of increasing severity. Every 10th case was assessed with 26 parameters of SNAP score also.[2]

Consultant on duty (HSB) verified the physical findings recorded by the investigator (JS). Axillary temperature was recorded using a mercury thermometer for 3 minutes. Oxygen saturation was measured using a pulse oximeter. Score was computed as arithmetic mean of the points assigned for each criterion. This data was kept in a sealed envelope and numbered. Patients were then transferred to neonatal intensive care unit and managed by attending doctors and nursing staff as per protocol. Sealed data was kept confidential from attending staff. Outcome (death/discharge) was documented and correlated with the study variables and total score.

Statistical analysis was carried out using SPSS version 16.0. Odd's ratio with 95% confidence interval was calculated for each variable. Logistic regression analysis was used to correlate magnitude of association of each variable with mortality. Predictive ability of both scores was calculated using Receiver Operating Characteristic (ROC) curve analysis. Sensitivity, specificity, positive and negative predictive values and p-value for goodness of fit were calculated.[6] A comparison was made at end of study between predictive value of clinical score as well as SNAP score in relation to final neonatal outcome.

Table 1: Parameters included in the simple clinical score.

Parameter	0	1	2
Cry/activity	Active/crying	Weak cry/poor activity	Shrill cry/no cry/very lethargic
Heart rate	100-160	60-99 161-200	<60 >200
Respiratory rate	30-60	61-100 <30	>100 Gasping or apnea
Temperature (°C)	36-37	32-36	<32
Capillary filling time	<3 sec	3-5 sec	> 5 Sec
SpO_2	Maintaining saturation without oxygen	Maintaining saturation with oxygen	Not maintaining saturation with oxygen
Pallor	Absent/mild	Moderate	Severe
Icterus	Absent/sparing palms and soles	Upto palms & soles	Kernicterus/ encephalopathy
Cyanosis	Nil	Disappears with oxygen	Persistent with oxygen
Sclerema	Absent	Localized	Generalized
Bleeding	Absent	Skin bleed	Mucosal bleed
Anterior fontanella	Normal	Depressed/full (not tense)	Tense, bulging
Tone	Normal	Hypotonia/ hypertonia	Flaccid
Moro's reflex	Normal	Sluggish	Absent
Seizures	Absent	Single	Multiple
Grunting	Absent	Heard with Stethoscope	Heard without Stethoscope
Retractions	Absent	Subcostal & intercostal	Subcostal, intercostal & suprasternal
Abdominal distension	Absent	Soft distended	Tense shiny distended
Birth weight (g)	>2000	1500-2000	<1500
Gestation (weeks)	>34	28-34	<28

RESULTS

Out of 341 neonates included in the study, 298 (87.4%) were discharged and remaining 43 (12.6%) died in hospital. It was observed that as the clinical score increased, the risk of mortality increased (Table 2).

Table 2: Outcome in relation to clinical score.

Clinical score	Outcome				Total	Odd's	P value
	Discharged		Death				
	No.	%age	No.	%age			
Upto 5	180	98.90	2	1.10	182	0.32	0.0001
6-10	90	84.91	16	15.09	106	1.34	0.0001
11-15	20	57.14	15	42.86	35	7.45	0.0001
>15	8	44.44	10	55.56	18	10.99	0.0001
Total	298	87.39	43	12.61	341		
P value							0.00053

Table 3: Association of study variables with mortality based on logistic regression analysis.

Variable	Score	Discharged		Death		Total	Odd's ratio	Weight	P value
		No.	%age	No.	%age				
Cry/activity	0	158	96.93	5	3.07	163	8.58	-0.31	0.0001
	1-2	140	78.65	38	21.35	178			
HR	0	244	88.09	33	11.91	277	1.37	-0.33	0.4200
	1-2	54	84.38	10	15.63	64			
RR	0	182	95.29	9	4.71	191	5.93	0.53	0.0001
	1-2	116	77.33	34	22.67	150			
Temp	0	214	87.70	30	12.30	244	1.10	-1.42	0.781
	1-2	84	86.60	13	13.40	97			
CFT	0	215	94.30	13	5.70	228	5.98	0.77	0.0001
	1-2	83	73.45	30	26.55	113			
SpO2	0	137	98.56	2	1.44	139	17.44	1.44	0.0001
	1-2	161	79.70	41	20.30	202			
Pallor	0	290	89.51	34	10.49	324	9.60	0.42	0.0001
	1-2	8	47.06	9	52.94	17			
Icterus	0	221	85.66	37	14.34	258	0.47	0.88	0.090
	1-2	77	92.77	6	7.23	83			
Cyanosis	0	265	90.14	29	9.86	294	3.88	-0.95	0.0001
	1-2	33	66.00	17	34.00	50			
Sclerema	0	298	88.17	40	11.83	338	Infinity	17.51	0.0001
	1-2	0	0.00	3	100.00	3			
Bleeding	0	293	88.52	38	11.48	331	7.71	0.89	0.0001
	1-2	5	50.00	5	50.00	10			
AF	0	283	87.89	39	12.11	322	1.94	0.28	0.254
	1-2	15	78.95	4	21.05	19			
Tone	0	219	96.90	7	3.10	226	14.26	0.89	0.0001
	1-2	79	68.70	36	31.30	115			
Moro's	0	189	97.93	4	2.07	193	16.91	0.94	0.0001
	1-2	109	73.65	39	26.35	148			
Seizure	0	280	87.77	39	12.23	319	1.60	0.42	0.416
	1-2	18	81.82	4	18.18	22			
Grunting	0	264	87.42	38	12.58	302	1.02	-0.09	0.966
	1-2	34	87.18	5	12.82	39			
Retraction	0	157	95.73	7	4.27	164	5.73	0.30	0.0001
	1-2	141	79.66	36	20.34	177			
Abdominal distension	0	280	88.61	36	11.39	316	3.03	0.20	0.016
	1-2	18	72.00	7	28.00	25			
Birth weight	0	215	89.21	26	10.79	241	1.69	0.24	0.116
	1-2	83	83.00	17	17.00	100			
Gestation	0	262	88.81	33	11.19	295	2.21	0.99	0.045
	1-2	36	78.26	10	21.74	46			

There was 10.99 times more risk of mortality when the Clinical score was >15. The Clinical Score was significant in relation to final outcome (P = 0.00053). The association of each of the variables with the outcome was done with logistic regression analysis (Table 3).

The 36 control cases were evaluated with both clinical score and SNAP score. There was a similar trend observed indicating that increase in SNAP score was directly proportional to the risk of mortality (Table 4).

Table 4: Outcome in relation to snap score.

SNAP score	Outcome				Total	Odd's ratio	P value
	Discharged		Death				
	No.	%age	No.	%age			
Upto 5	27	100.00	0	0.00	27	0.00	0.0001
6-10	2	66.67	1	33.33	3	5.00	0.0001
>11	3	50.00	3	50.00	6	29.00	0.001
Total	32	88.89	4	11.11	36		
Mean ± SD	3.72 ± 5.14		12.50 ± 4.20		12.40 ± 6.35		
P value							0.00789

ROC analysis of clinical score (Figure 2) showed a predictive ability of 85.2 (P = 0.00053). Maximum discrimination was observed for a score of 17. ROC analysis of SNAP (Figure 3) showed a predictive ability of 92.2 (P = 0.0078). Maximum discrimination was observed for a score of 19.

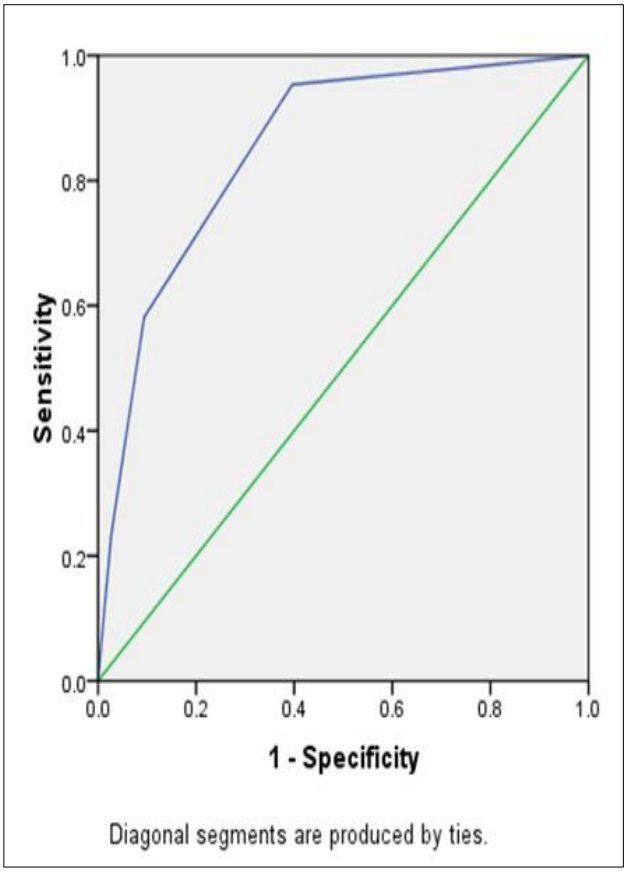

Figure 2: ROC of simple clinical score.

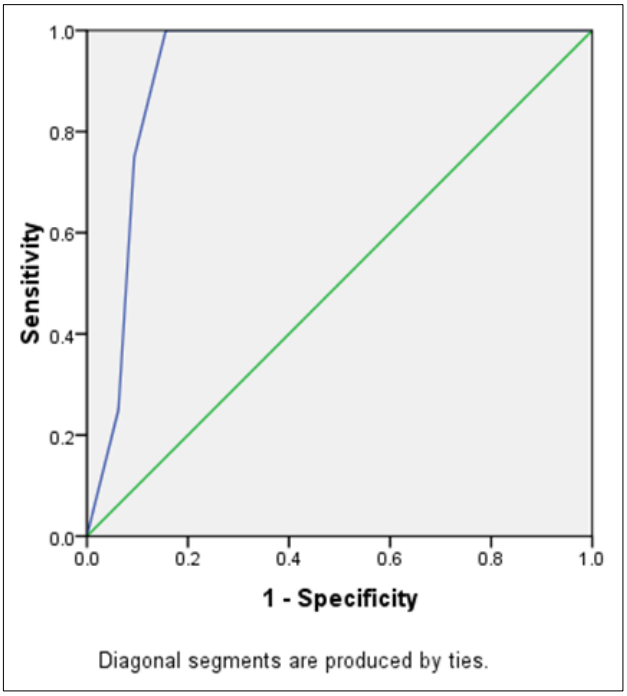

Figure 3: ROC of SNAP score.

Cut off values of clinical score and SNAP, calculated using regression analysis, were 11 and 5 respectively. The positive and negative predictive value of clinical score >11 in predicting mortality was 50% and 92.72% respectively (Table 5). The positive and negative predictive value of SNAP score >5 in predicting mortality was 44% and 100% respectively. Both scores were well calibrated (P value for clinical score was 0.00053 and for SNAP score was 0.00789). Table 5 shows that there is no statistically significant difference in the predictive values of Clinical Score and SNAP (P value >0.05).

Table 5: Comparison of clinical score and snap score.

	Clinical score	SNAP	P value
Positive predictive value	50.00	44.44	0.54775
Negative predictive value	92.72	100.00	0.11365
Overall predictive value	87.72	86.11	0.59320
P value for goodness of fit	0.00053	0.00789	
Area under ROC curve	85.2	92.2	

DISCUSSION

We found that SNAP has a good predictive value for neonatal mortality. This was consistent with the findings done by Vasudevan et al.[7] But it is a complex 26 item score as well as time consuming. It uses 24 hour data collection and thus it can be affected with the response to treatment. Also, it cannot be used for infants who die during the initial 24 hours of admission.

In the present study, we hypothesized that physical variables alone can be helpful in predicting outcome. The clinical score was applied immediately at admission with no waiting period of 24 hours. This clinical score differs from most of the existing illness severity scores as it took into account only clinical parameters. This may be of use in situations where laboratory help is either not available or not affordable. Also as this score assesses the condition of the patient at admission, it may guide the appropriate level of care for the patient and also prognosticate the attendants of the patient. But, this clinical score needs to be validated in other study populations before being considered valid.

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