

## Original Article

# Study of TOPS Score as a Predictor of Survival in Transported Neonates in a Tertiary Care Centre

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Safe Neonatal Transport act as a bridge between referring and receiving units. Simple, timely and efficient approach is required to reach sustainable development goal-3. Reliable and easily applicable score is required to predict mortality in this sick neonates in resource limited setups. Present study is aimed to evaluate TOPS score as a predictor of survival in this transported neonates also intend to find strength and lacunae of referral systems. A prospective observational study was done in a Tertiary Care SNCU enrolling 430 Transported Neonates. All clinical and demographic data were noted. All transport details were recorded. Clinical physiological parameter of TOPS Score was applied at time of admission and was related with outcome, expired, or survived (temperature by digital Thermometer in axilla, saturation by Pulse Oximeter, capillary refill time in mid sternum region, Blood Sugar by reagent strip). Pre-stabilisation of transported neonates were strongly associated to reduce mortality in referring systems (p=0.001). All parameters of TOPS score were strongly associated with mortality.

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**Key words :** TOPS Score, Neonatal Transport, High Risk Neonate, Neonatal Mortality.

Neonatal Mortality is a major concern globally, around four million neonates die every year primarily in underdeveloped countries with limited resources. During the last two decades, India has significant reduction in child death with immense effort from the government and improvement of health care facility. The NMR is not uniform across India. The NMR in rural areas is twice the NMR in urban areas. Though institutional delivery and in-utero transport of new born is safest but unfortunately preterm delivery and perinatal illness cannot always be anticipated resulting in continued need of transfer of these neonates after delivery<sup>1</sup>. These neonates are often critically ill, and their outcome is dependent on effectiveness of transport system. There is expansion of Special Care Newborn Unit, still sick neonates do not arrive in time and once irreversible patho-physiology has set in before reach to health facility, the probability of mortality is increased. The assessment of illness severity in neonates at admission is central to assessing the risk of fatality. For this purpose various survival score like SNAPPE, CRIB, TRIPS etc. have been devised and are used in developed countries, but most of them are

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### Editor's Comment :

- Assessment of Transported Neonated at the time of admission by using TOPS Score will help as a Prognostic tool in countries where advanced Diagnostic and Therapeutic resources are limited and it will also help to asses quality improvement in health care facility.

time consuming and required sophisticated equipment also. One of the score devised by Mathur et al<sup>2</sup>, and was given the acronym TOPS is a simple and rapid score.

Present study was aimed to evaluate TOPS score as survival score in all transferred sick neonates. Being a Tertiary Care Neonatal Institute there are ample of references from home, PHC, CHC, private sector for further management. So, this study was undertaken to know the condition of neonate at the time of presentation by TOPS score and final outcome in form of morbidity and mortality. This study was intended to find strengths and lacunae of referral system and emphasize a clinical score (TOPS) to identify high risk neonates for prompt action (triage) for intact survival of these tiny babies.

### MATERIAL AND METHOD

Present study was prospective observational study done in a Tertiary Care Hospital over period of two years over 430 out born neonates, who were transported either from home, PHC, CHC or any other hospital. Extreme low birth weight <1000 gms and neonates having severe congenital malformation were excluded from study.

All the Details of birth history including mode of delivery, place of delivery, antenatal maternal history (TT inj, antenatal visits, major/minor medical illness) Gestational age (PT/FT), Birth weight and Resuscitation detail were documented. Transport detail including referring centre, mode of transport used, accompanying trained person, transportation time, details of pre-transport stabilization were recorded. The referral documents were recorded and categorized as no document or detail document.

Clinical physiological parameter of TOPS score on admission were observed and recorded in data capturing sheet by on duty clinician.

TOPS scoring on admission.

Included 4 variables —

- I) Temperature by digital thermometer in axilla,
- II) Oxygenation by spo2 monitor (Nelcor Pulse Oximeter)
- III) Perfusion by capillary refilling time on mid sternum,
- IV) Sugar by reagent strip (one touch glucometer strip)

Abnormality of each parameter defined as —

- Hypothermia - <36.5°C  
 Hypoxia - < 90%  
 Hypo-Perfusion -  $\geq$  3 second  
 Hypoglycemia - < 40 mg/dl

Each parameter was assigned as score 1 if abnormal and 0 if normal (Lowest Score 0 and highest Score is 4). Patient were managed according to standard NICU protocol by on duty clinician. Cases were followed up till outcome. Outcome was observed and recorded in form of discharge, DAMA and expiry. In case of mortality cause of death were recorded.

Computerised analysis of data was done with the help of MedCalc Version 19.1. The study variable were analysed for their association with immediate outcome by applying Chi-square test or fisher exact test as applicable. All P value were too tallied and  $p < 0.05$  was considered statistically significant. Variable that was found significant on Chi-square test were further analysed using logistic regression analysis for their possible independent association with mortality. Univariate analysis of TOPS parameter was done, after that cumulatively TOPS Score was analysed. ROC curve analysis was done.

## RESULTS

Total 430 neonates were enrolled in study out of them 253 (58.8%) were male and 177 (41.1%) were female. Out of 430 neonate Majority of neonate were low birth weight 228 (53%), very low birth weight was 45(10%) and rest 157 (37%) were normal birth weight.

With mean birth weight was 2250 grams (Table 1).

Out of 430 neonate 346(80%) were discharged, 25(6%) were taken DAMA and 59(14%) expired (Table 2).

TOPS score was measured in all referred neonates and outcome according to score and according to all variables of score was observed and analyzed (Table 3).

At admission Hypothermia was present in 217(50.4%) neonates, 150(34.8%) were Hypoxic, 86(20%) had poor perfusion and 107(24.9%) were hypoglycaemic. All abnormal parameters were significantly associated with increase mortality. Highest mortality was found in poor perfusion group (53.4%) whereas Hypothermic group had least mortality (18.4%). On univariate statistical analysis of TOPS variable in form of sensitivity, specificity, predictive value, and likelihood ratio was analysed in Table 4.

Table 1 — Demographic Profile

Character	Frequency (430)	
Postnatal age at time of admission	<1 Week	301(70%)
	1-2 Weeks	92 (21%)
	>2 Weeks	37 (8%)
Gestational age	Preterm <37 weeks)	125 (29%)
	Full term (>37 weeks)	305 (71%)
Dwelling area	Rural	300 (69.7%)
	Urban	130 (30.2%)
Maternal risk factor	Absent	379 (88.13%)
	Present	51 (11.8%)
Place of delivery	Hospital	408 (94.5%)
	Home	22(5%)
Mode of delivery	ND	352 (82%)
	LSCS	78 (18%)

Table 2 — Referral Data

Data	Variables	No (n=430)	Outcome (n=59) (Mortality)
<b>Referring unit :</b>	Private	192(44.6%)	19 (9.8%)
	Government	160(36.2%)	18(11.25%)
	Self	78(18%)	22(28.8%)
<b>Transport Vehicle :</b>	Private	41(9%)	7(17.07%)
	Government (108)	286(66.5%)	40(13.98%)
	Self	93(21.6%)	12(12.9%)
<b>Prestabilisation :</b>	Yes	103(24%)	5(4.2%)( $p < 0.008$ )
	No	335(76%)	54 (17.07%)
<b>Transportation Time :</b>	<30 minutes	106(24.6%)	10(9.4%)( $p=0.2$ )
	30-60 minutes	290(67.4%)	42(14.4%)
	>60 minutes	34(7.9%)	7(20.8%)
<b>Accompanied by Trained Person :</b>	Yes	19(4.4%)	1(1.6%)( $p=0.01$ )
	No	411(95.6%)	58(98.3%)
<b>Availability of Documentation :</b>	Yes	36 (8%)	4(11.11%)
	No	394(91.6%)	55(13.9%)

For prediction of mortality, Hypothermia and Hypoxia were most sensitive (68.2 and 76.6%) with the best negative predictive value (91.08 and 95.02%) Hypoperfusion had highest specificity (86.7%) and maximum positive predictive value (38.64%)(Table 5).

Out of 430 neonates, 138(32.1%) babies had normal TOPS score and only 1(0.72%)

baby expired, 292 (67.9%) presented with abnormal TOPS score among which 58 (19.8%) expired.. Amongst which higher the score more the mortality was observed (Table 6) (Fig 1).

A score of =2 had the best discrimination (AUC-0.816) on ROC curve plotted between TOPS score and mortality (P<0.0001).

**DISCUSSION**

Infant Mortality Rate (IMR) is an indicator of health as well as accessibility of health services by the people in a developing country like India. NMR contributes to about two third of all infant deaths<sup>3</sup>. India contributes about a quarter of all neonatal death in the world Delivery of sick neonates needing special care still take place at places with extremely limited resources, necessitating need for transport. Percentage of hospital deliveries in our study was 408(94.5%) comparable to recent data of Gujarat as per SRS was 85.7% probably due to JSSK and lakshya programe<sup>4,5</sup>. With the initiative of state governments in developing Special Care New born Units (SNCU) at District Hospitals and introduction of 108 ambulance services the transport and survival of sick neonate to higher centers has revolutionized.

Prematurity125 (29%) was the most common cause of referral followed by Sepsis 111 (25.8%) followed by pathological Jaundice 66(15.3%) followed by respiratory distress 58 (11.3%) followed by birth Asphyxia 32 (7%) followed by convulsion 21 (4.8%) followed by meconium aspiration syndrome 17 (3.9%). In our study higher number of neonates transported by 108 (286) or private ambulance (41) which was comparable to similar study done in Tamil Nadu 2019.

There is currently no dedicated neonatal transport service by Government in India. Prior stabilisation, trained attendant, proper documentation was still lacking in most of transported neonates in our study leads to deranged TOPS score of neonates at time of admission and leads to increase mortality. Similar phenomenon was observed in Mathur, *et al*<sup>6</sup>.

Table 3 — Different variables of TOPS score with outcome in form of mortality

Variables of TOPS score	score	Affected (n=430)	survived	expired	P value	Odds ratio for fatality
Temperature	0	213 (49.5%)	194 (91.1%)	19 (8.9%)	<0.001 significant	2.3
	1	217 (50.4%)	177 (81.6%)	40 (18.4%)		
Oxygenation	0	280 (65.11%)	267 (95.4%)	13 (4.6%)	<0.001 significant	9
	1	150 (34.8%)	104 (69.4%)	46 (30.6%)		
Perfusion score	0	344 (80%)	325(94.4%)	19 (5.5%)	<0.001 significant	14.8
	1	86 (20%)	46 (46.6%)	40 (53.4%)		
Blood sugar	0	323 (75.1%)	290 (89.8%)	33 (10.2%)	<0.001 significant	2.8
	1	107 (24.9%)	81 (75.8%)	26 (24.2%)		

Table 4 — Accuracy of individual parameter

	Individual parameter of TOPS score			
	Hypothermia T	Hypoxia o	Hypoperfusion p	Hypoglycaemia s
Sensitivity (%)	68.21	76.67	67.80	44.07
Specificity (%)	52.29	71.97	87.60	78.17
Positive predictive value (%)	18.43	30.67	38.64	24.30
Negative predictive value (%)	91.08	95.02	92.18	87.44
Positive likelihood ratio	1.42	2.73	3.96	2.02
Negative likelihood ratio	0.62	0.32	0.37	0.72

Table 5 — Tops Score of Neonate and Relation with Mortality

TOPS Score	Affected Neonate (N=430)	Mortality (N=59)
0	138(32.09%)	1 (0.72%)
1	109(25.34%)	10 (9%)
2	117(27.2%)	17 (14%)
3	53(12.32%)	19 (35.8%)
4	13(3.02%)	12 (92.3%)

Table 6 — Comparison of Accuracy of TOPS Score in Predicting Mortality

Present study (95% CI)	
Sensitivity	77.32%
Specificity	65.48%
Positive predictive value	26.55%
Negative predictive value	94.54%
Area under curve	0.81

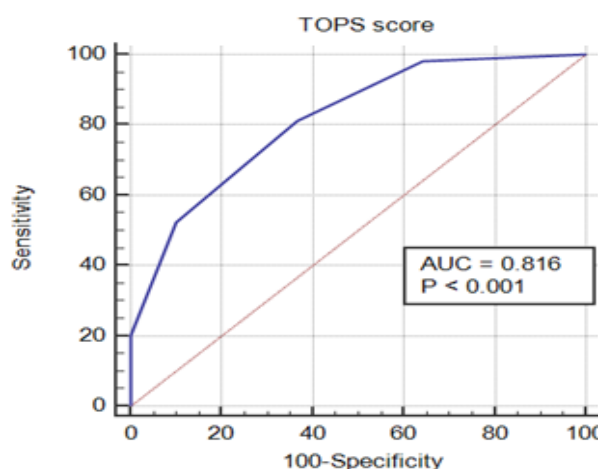


Fig 1 — Sensitivity and Specificity

In our study Hypothermia was commonest physiologic derangement at time of presentation followed by Hypoxia, Hypoglycaemia and Hypoperfusion. Which was comparable to Dalal, *et al*; Mathur, *et al* and Suresh Kumar, *et al*<sup>2,6,7</sup> odds ratio for fatality was high with hypoperfusion which was comparable to all other studies. this parameters can be easily manged before and during transportation by very simple means including Kangaroo mother care. In our study, out of all parameter Hypothermia, Hypoperfusion was most specific predictive parameters.

Neonatal mortality rate among our neonates was 20.76% which is in line with the findings of a recent study done by Begum, *et al*, in Telangana (22.8%)<sup>8</sup> but is lower than older studies done by Buch, *et al*, and Mathur, *et al*, and Narang, *et al*<sup>2,9,10</sup> (32.2% in Gujarat and 34.25% in New-Delhi, 46.3% in New-Delhi respectively).

In the present study among TOPS parameters, odds ratio for mortality was maximum for hypoperfusion, followed by Hypoxia, Hypoglycaemia and Hypothermia, these findings are comparable to Dalal, *et al*; Verma, *et al*; Mathur, *et al*<sup>2,6,7</sup>.

The present study showed increase in mortality with increase in TOPS score, these findings are in concordance with the previous studies (Table/Fig 4). ROC curve analysis showed that the score of =2 has got the maximum discrimination for prediction of mortality as noted in previous studies also (AUC: present study 0.816, Verma, *et al* 0.83, Mathur NB, *et al*, 0.89, Begum A, *et al*, 0.76) (Table/Fig 6)<sup>2,6-8</sup>.

In today's era intrauterine transport or sick neonate by special neonatal transport vehicle as best transport to get minimum mortality. India had got wide network of peripheral health centre in rural area where most population resides. There is need of special SNCU is needed in this centre to minimised neonatal refer to higher centre. A neonate should be referred always with Prestabilisation, proper documentation, accompany by trained person, and minimum transport time to reduced mortality further at higher centre. The presence study showed that TOPS Score is a reliable predictor of mortality among transported neonate.

**Limitations :** Limitations of our study include no head to head comparison between out-born and in-born data and lack of long term follow-up.

### CONCLUSION

Though, institutional delivery and transport facilities are gradually improving in the country but faster reduction of NMR requires a well-developed transport system for sick neonates, which include Prestabilisation, good documentation, expert medical accompanying staff, well equipped and quickly

available ambulances, road traffic guidelines for faster clear road during transportations, and well equipped SNCU with enough trained staff for neonatal care. Safe neonatal transport act as a bridge between referring and receiving centres. TOPS seems to be score of choice for assessment of neonatal unit, especially in countries where advanced diagnostic and therapeutic resources are limited. TOPS score is practical, since it uses variables that are part of the routine care of new-borns, and they are quickly obtained. TOPS score can be easily reproduced, avoiding interpretation error due to individual subjectivity. The present study revealed that derangements of TOPS variables had good sensitivity, specificity, positive and negative predictive values. TOPS score can be used to assess severity of illness and help to give prognostic information to parents about their baby, and to identify high risk neonates for prompt action (TRIAGE).

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