

Original Research Article

Role of TOPS score in predicting the prognosis of acutely ill children presenting to paediatric emergency department

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ABSTRACT

Background: In paediatric intensive care units (PICU), assessing the severity of illness in children is crucial for effective resource allocation. There is critical need for reliable, easy to use tools in Emergency department to assess disease severity and predict outcome in paediatric patient. By using the TOPS (T-temperature, O-oxygen saturation, P-perfusion, S-sugar) score, we aim to identify a simple and effective tool for early risk stratification in critically ill paediatric patients.

Methods: A hospital-based prospective observational study was conducted in the ED Navodaya Medical College, Raichur, over three months. A total of 140 children aged 1 month to 18 years presenting to ED were included. TOPS Score were calculated with score of 0 for normal value and 1 for abnormal value for each parameter.

Results: Out of 140 children presenting to Emergency Department, TOPS score of 4 is associated with maximum risk of mortality 30%, while score of 2 and 3 has less mortality of 11.5% and 25% respectively. TOPS Score ≥ 2 shows poor outcome with sensitivity of TOPS Score 83% and specificity 34%. CRT is factor associated with maximum risk of mortality with Odds ratio of 5.762 ($p < 0.05$).

Conclusions: The TOPS score, which includes critical parameters such as temperature, oxygen saturation, perfusion, and blood sugar, presents a promising tool for assessing disease severity and predicting outcomes in paediatric emergency care. Its simplicity and practicality make it an attractive option for clinicians, allowing for quick and efficient evaluation of patients.

Keywords: TOPS score, Emergency Department, Triage, Mortality

INTRODUCTION

Paediatric emergencies are a critical aspect of healthcare, requiring rapid and accurate assessment to ensure timely intervention and improve outcomes. The main aim of triage is to ensure priority treatment for patients requiring urgent emergency care and accurately predict the type of care they need.^{1,2} A patient's clinical urgency does not clearly define the complexity or severity of their condition. Nevertheless, triage serves as an important measure of the critical time for medical intervention.³ Early recognition of serious illness might reduce the

morbidity and mortality in sick patients.⁴ Most of the existing scoring systems developed for intensive care unit (ICU) patients and neonates, are not executed at admission, hence these are not useful for triage.⁵⁻⁹ Measurement of vital signs is routine practice for children attending emergency department.¹⁰ In paediatric intensive care units (PICU), the ability to assess the severity of illness quickly and accurately is crucial for effective resource allocation and patient management. However, existing paediatric scoring systems, such as the paediatric early warning score (PEWS) and the paediatric risk of mortality (PRISM) score, are often complex, time-

consuming, and require extensive training, limiting their utility in busy emergency settings, particularly in resource-limited environments.^{11,12} The T-Temperature, O-Oxygen saturation, P-perfusion, S-Sugar (TOPS) score (temperature, oxygen saturation, perfusion, and sugar) is a novel, simplified scoring system designed to address these limitations. It focuses on four key physiological parameters that are easily measurable and provide immediate insights into a child's clinical stability.

The TOPS score assigns a numerical value to each parameter, with higher scores indicating greater clinical severity. This simple, objective scoring system can be rapidly applied by healthcare providers, even in high-volume emergency settings. The TOPS score offers several advantages over existing scoring systems. Its simplicity and ease of use make it particularly suitable for resource-limited settings, where time and resources are often constrained. By focusing on four key parameters, the TOPS score provides a rapid assessment of a child's clinical status, enabling healthcare providers to prioritize care and allocate resources effectively.

Objective

To evaluate the effectiveness of TOPS score in predicting mortality in pediatric ICU patient.

METHODS

Hospital-based cross-sectional study was conducted in the PICU at Navodaya Medical College, Raichur, over three months from January 2024 to April 2024. A total of 140 children aged 1 month to 18 years presenting to emergency department were included by employing convenient sampling technique. Axillary temperature was recorded by digital thermometer, Oxygen saturation was recorded by digital Pulse oximeter, blood sugar recorded by glucometer with Strips. TOPS Score values were calculated and analysed for their association mortality and outcomes.

Inclusion criteria

Children of age group 1 month-18 years presenting to Emergency Department were included in inclusion criteria.

Exclusion criteria

It excludes neonates, children that were treated on OPD basis.

Statistical analysis

All statistical analysis was performed according to intention to treat principle by statistical package for the social sciences (SPSS) software version 27 for Windows (SPSS Inc., Chicago, IL, USA).

Data was entered into Microsoft excel data sheet and was analyzed using SPSS 27 version software. Categorical data was represented in the form of frequencies and percentage. Chi-square test/pooled Chi square was used as test of significance for qualitative data. The ethical clearance and permission from the Institutional Review Board was obtained prior to initiation of the study

RESULTS

Demographic data

Gender distribution

Out of total number 140 sample size 71 (51%) are female and 69 (49%) are male (Table 1).

Age distribution

The age distribution of the 140 participants reveals that the 3–5 years age group constituted the largest proportion (25.7%, 36 children), while the 1 month–1 year group was the smallest (15%, 21 children) (Table 2).

Distribution of TOPS score

A total of 140 children presenting to emergency department were included in this study. Among them, highest mortality is associated with TOPS score of 4, followed by score of 3 (25%) and 2 (11.5). Elevated TOPS Score ≥ 2 was significantly associated with adverse outcomes and mortality as score increases (Table 3). The study population included children aged 1 month to 18 years, with a slight female preponderance (51% female vs. 49% male).

Distribution of TOPS score and its outcome

This figure shows the distribution of TOPS Score and its association with mortality and outcome (Table 3).

Table 1: Male and female distribution show female dominance.

Gender	Member	%
Female	71	51
Male	69	49
Total	140	100

Table 2: Age distribution among children's.

Age group	Member	%
1 month-1 year	21	15
1-3 year	26	18.6
3-5 year	36	25.7
5-12 year	33	23.5
12-18 year	24	17.1
Total	140	100

Parameter of TOPS score

Parameter include T-Temperature, O-Oxygen saturation, P-Perfusion (CRT), S-Sugar (Table 4). Each parameter give score of 0 for normal value, score 1 for abnormal value.

This parameter is easy to use and can be apply at first contact with patient even by nonprofessional medical staff also this parameter does not require any laboratory investigations with make it easy to use.

Parameters of TOPS score

This table highlights the parameter of TOPS scores with their normal and abnormal values and their frequency in percentage.

Table 3: Distribution of TOPS score and its outcome.

Tops score	Frequency	%	Outcome
1	83	59.3	Survive-81 (97.59%) Death-2 (2.41%)
2	35	25	Survived-31 (88.5%) Death-4 (11.5%)
3	12	8.6	Survived -9 (75%) Death-3 (25%)
4	10	7.1	Survived-7 (70%) Death-3 (30%)
Total	140	100	

Duration of PICU stay

The average PICU stay for children with elevated SI was 5 ± 1 days compared to 2 ± 1 days for those with normal score. Prolonged PICU stays (>7 days) were observed in 35.7 % of the children with high score (Figure 1).

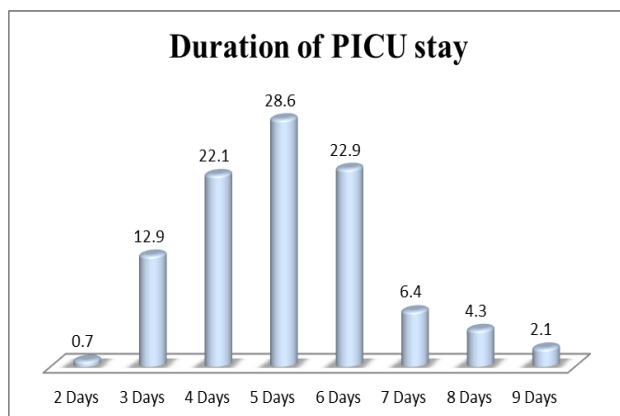


Figure 1: Duration of PICU stay.

Validity of TOPS Score. In our study we found the TOPS score ≥ 2 shows poor outcome with sensitivity of TOPS Score 83% and specificity 34 % (Table 5).

Table 4: Parameter of TOPS score.

Parameters	Frequency (%)
Temperature	Normal 36° - 38°
	$>38^{\circ}$
	Hyperthermia
Oxygenation	$<36^{\circ}$ Hypothermia
	Normal $>92\%$
	Hypoxia $<92\%$
Perfusion	crt ≤ 2 sec
	crt ≥ 3 sec
	normal
Sugar	<54 mg/dl
	>200 mg/dl

Table 5: Validity Of TOPS score.

Validity	%
Sensitivity	83
Specificity	34
Positive predictive value	14.30
Negative predictive value	7.20

DISCUSSION

Scoring system can used in emergency department aim to early prediction of severity of illness with early stratification and resource allocation. In our study we use 4 parameter TOPS in predicting the outcome of patient. TOPS Score helps to ensure that the patient is treated in Order of their severity of illness. This scoring system is easy to use so it can be applied at first contact with patient.

In our study physical variable alone helpful in predicting the outcome of patient and there is no need for laboratory evaluation which make it easier to use. No specific training is required for implementation and can applied immediately patient come to emergency department.

In this study we found that 49% male and 51% female children with age group of 1 month to 1year are 15%, 1 year to 3 year are 18.6%, 3 year to 5 year are 25.7%, 5 year to 12 year are 23.5%, 12 year to 18 year are 17.1% The reason for admission in PICU are respiratory related problems (35.7%), sepsis (17.8%), shock (14.8%), DKA or hypoglycaemia (8.9%), Others (22.6%). A study conducted by Reddy et al show Mortality was highest with respiratory diseases followed by septic shock, neurological disorders and cardiac diseases.¹⁶

A study conducted by Bains et al and Soni et al TOPRS score which includes additional parameters like pulse rate, respiratory rate, and sensorium was used. A score ≥ 2 was associated with high mortality, with a sensitivity of 79.6% and specificity of 74.43%. The specificity in their study (74.43%) was much higher than in our study (34%), indicating that the TOPRS score may be more effective in reducing over-triage.⁴

In our study we found that the highest mortality is associated with score of 4 which 30% while score of 2 and 3 has less mortality of 11.5 % And 25% respectively. A Study conducted by Roy A, Patel P, et al on 'TOPS' Score (Temperature, Oxygen saturation, Perfusion, Sugar) on admission of neonate in tertiary care hospital show highest mortality is associated with score of 4 with sensitivity of 81.3% and specificity of 61.5 %

Compared to this study we found that sensitivity of 83% And specificity 34% which more than the study conducted by Roy et al.¹³

the earliest physiological scoring systems for children was physiology stability index (PSI) in which score was calculated from the worst of 34 values from routinely measured variables over first day of PICU stay. To make it less tedious, PRISM scoring system was evolved from it with variables.^{14,15}

In this study it found that at least derangement in any 2 components of TOPS score was able to identification of sick children who need immediate treatment (sensitivity 83%), who would benefit from early resource allocation. Low specificity (34%) implies a high proportion of children with low mortality risk who received unnecessary attention, hence reducing optimization of resource allocation. Hence, TOPS Score can be used in Paediatric emergency department for early reorganization of sick children their stratification based on severity and early resource allocation.

It is a single-centre design with a modest sample size. Future multi-centre studies with larger populations are essential to validate these findings. the study was conducted in a single institution, which may limit the generalizability of the findings. Including multiple centers with varying patient demographics would enhance the results.

The TOPS score relies solely on physical parameters and does not incorporate laboratory findings or advanced diagnostic tools. While this makes the score easy to use, it may also limit its predictive accuracy.

CONCLUSION

TOPS score is a reliable and simplified scoring system which can be done in pediatric emergency department at first point of contact with patient. The high sensitivity (83%) and with a specificity of (34%) and suggest that TOPS score a very strong screening test to predict Mortality in pediatric ICU particularly in resource-limited settings where quick and efficient decision-making is crucial. Therefore, it can be concluded that TOPS score can be used in pediatric emergency department to predict severity of illness in pediatric patients.

The TOPS score's simplicity is one of its most significant advantages. It requires no specific training and can be

applied immediately upon the patient's arrival in the emergency department This straightforward scoring system allows healthcare providers to quickly assess the severity of a child's condition and prioritize treatment accordingly. The score's reliance on physical parameters alone, without the need for laboratory evaluations, makes it particularly useful in resource limited centers.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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