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Original Research Article

TOPS score (T-temperature, O-Oxygen saturation, P- Perfusion, S- Sugar) on admission in transported neonates to tertiary care hospital

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ABSTRACT

Background: In India, 70% of deliveries take place in rural areas and the transport of the preterm babies to a tertiary care centre are referred only after the birth Babies must be transported to a higher level neonatal intensive care unit (NICU) to overcome the negative effects of critical illness such as respiratory distress and asphyxia in newborns. Most of the neonates are transported without any pre-transport stabilization or care during transport, which can have serious clinical implications on the ultimate outcome of babies.

Aims & Objectives: To assess the clinical condition and presence of complications among neonates transported to NICU. To predict outcome of transported neonates in terms of morbidity and mortality based on TOPS score.

Materials and Methods: A cross-sectional observational study was conducted among 500 newborns admitted in NICU, at New Civil Hospital, Surat.

Results: Out of total, 258(51.3%) and 245(48.7%) patients were respectively males and females in the study. Out of the 503referred neonates 258 (51.3%) were referred for respiratory distress and ventillatory support, 138(27.4%) were referred for LBW / prematurity. The hypothermia was present post transport approximately among 64% neonates. Hypoglycaemia was found in only 18% of transported neonates. 33% of the studies neonates were hypoxic on reaching the referral centre and the remaining maintained spo2 above 90%.

Conclusion: The high sensitivity (81%) and high negative predictive value (87.4%) with a specificity of 61.5% and positive predictive value of 59.7% suggest that TOPS score a very strong screening test to predict the outcome of babies admitted.

1. Introduction

Newborn (NB) health is of fundamental importance to the reduction of child mortality, the promotion of abetter quality of life, and the reduction of inequality in health.[1] In India, 70% of deliveries take place in rural areas and the transport of the preterm babies to a tertiary care centre are referred only after the birth Babies must be transported to a higher level neonatal intensive care unit (NICU) to overcome the negative effects of critical illness such as respiratory distress and asphyxia in newborns.[2]

A tool for monitoring the acute physiological parameters of such babies can be very useful. The development of Disease Severity Scores has several goals, including improving the validity of comparability of results across hospitals, departments, and individual physicians. Improving efficiency in prospective or randomized treatment trials; streamlining reward systems.[3] Scoring systems that quantify initial risk have an important role in health services research planning and clinical audit. By

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facilitating more reliable comparisons of outcome, they allow better monitoring of quality of care between and within hospitals. However for a clinical score to achieve widespread acceptance by busy clinicians it must be simple &accurate and use routine data.[4]

India contributes about one fifth of global neonatal death burden. The NMR in India had declined significantly from 22/1000 live in 2019 to 20/1000 live births in 2020.[5] The Sustainable Development Goal 2030 to achieve a NMR of < 12 still seems out of reach. Figure 1 Newborn in NICU In Gujarat, the total Neonatal mortality rate was 24 per 1000 live birth as per SRS 2020.[6] Neonatal intensive care in India has now acquired considerable sophistication with the introduction of neonatal ventilators, onsite blood gas analysis, in-house facility for cranial ultrasound etc.[7]

Though institutional delivery and in-utero transport of newborn is safest, unfortunately preterm delivery and perinatal illness cannot be always anticipated resulting in continued need of transfer of these babies after delivery. Neonatal transport has been found to be associated with increased infant mortality in the developing countries.[8] These babies are often critically ill and outcome is also dependent on effectiveness of transport system. Transportation to higher referral centre is one of the important factors to decide survival of sick neonates. Most of the neonates are transported without any pre-transport stabilization or care during transport, which can have serious clinical implications on the ultimate outcome of babies.[4] Many of these newborns thus transported are cold, blue and hypoglycaemic and most of these babies transferred this way have serious 4 clinical implications.[9]

Navjat Shishu Suraksha Karyakram launched by the Government of India also highlights the role of safe neonatal transport.[7] A simple scoring system-TOPS score (Temperature, Oxygen saturation, Perfusion, Sugar) can be used as a useful method of predicting mortality outcome that can be assessed immediately, at admission.[9] However, before applying a prognostic score clinically in a local population, its validity must be checked because differences have been reported in different populations. These differences can be explained by local mortality rate and it's contributing factors.

Moreover, with advancement in NICUs and treatment like surfactant therapy has decreased the overall mortality rate in NICUs over time and hence the predicting ability of a prognostic score may be changed with change of mortality rate. So, it is logical to test the validity of prognostic score over time especially when new treatment modalities have been adopted that may alter the mortality rate.[10] So, the present research was undertaken to evaluate the clinical profile of transferred neonates, and the role of TOPS score in predicting the immediate outcome of such neonates in our area.

2. Aims & Objectives

To assess the clinical condition and complications among neonates transported to NICU of our hospital. To predict outcome of transported neonates in terms of morbidity and mortality based on TOPS score. To study of applicability of TOPS score in transported neonates

3. Materials and Methods

A cross-sectional observational study was conducted among 500 newborns admitted at NICU, New Civil Hospital, Surat. Out born neonates who were transported and admitted in NICU of our hospital within first 28 days of life were included. Neonates having major lethal congenital malformations like anencphaly, severe meningomyelocele, hypoplastic left heart syndrome encephalocele and neonates with birth weight less than 1.500kg were excluded.

Sample Size: As it was a hospital based study, sample size has been calculated based on law of averages. Total number of out born neonates in our NICU with weight greater than 1.5kg and with no lethal congenital malformation for the last 3 years are respectively 560,562 and 444 (sudden drop in 2020 due to COVID19 pandemic). Taking the average of these 3 years, we could come to the conclusion of 500.

Every child who satisfies the inclusion criteria were studied. Among enrolled neonates T-Temperature, O-Oxygen saturation, P-Perfusion, S-Sugar was taken. A score of 133 was assigned to each abnormal parameters of TOPS and 2 to each normal parameters thus every neonates was got minimum 4 score and maximum 8. Temperature (axillary) was recorded by thermometer at the time of admission. Oxygenation was checked by pulse oxymeter before initial stabilization. Perfusion was checked by capillary refill time and sugar was assessed by random blood sugar by glucometer. A specific TOPS score were assigned to the baby at the time of admission itself. Complete history including birth history, examination, clinical and physiological parameters was taken. Pre transferred treatment and transportation details were taken. Complete maternal history was taken. All neonates enrolled in the study had given standardised treatment as per aims protocol by equally trained staff. Course during hospitalization (morbidity) and outcome in the form of expiry or discharge was noted.

This study was approved by Institutional Ethical Committee of this institute. Written informed consent was taken prior to the study of each participants.

Data collection and analysis: Data was collected by case record form and entered into MS excel 2016. Data analysis was done in SPSS Software version 26. Qualitative data were represented as frequency and percentages and analyzed by chi-square test, while Quantitative data were described as a Mean and Standard deviation and analyzed

by unpaired t test. P-value less than 0.05 was considered as a statistical significance.

4. Results

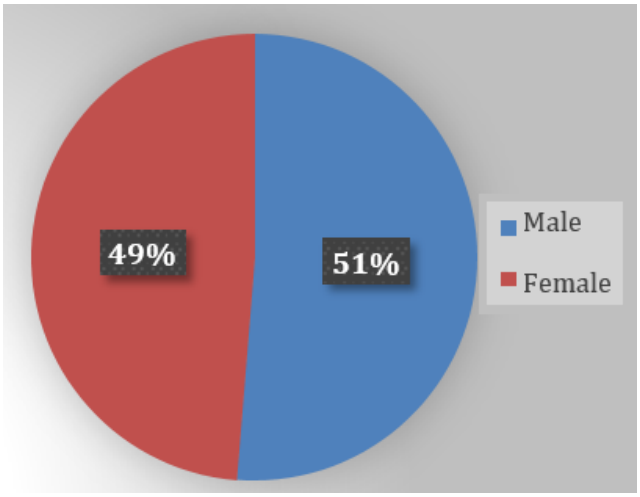

Figure 1: Gender wise disribution of study participants

Out of total, 258(51.3%) and 245(48.7%) patients were respectively males and females in the study. [Figure 1]

Table 1: Reasons for neonatal transport

Reasons	Frequency (%)
Respiratory distress/ Ventilatory supports	258 (51.3%)
LBW/ Prematurity	138 (27.4%)
Sepsis	86 (17.1%)
Neonatal jaundice	16 (3.2%)
Others	5(1%)

Out of the 503referred neonates 258 (51.3%) were referred for respiratory distress and ventilatory support,138(27.4%) were referred for LBW / prematurity. 86 of them were referred for sepsis related complications , 16 for neonatal jaundice and 5 were referred for other causes like seizures, vaccine related complications, feeding issues etc. [Table 1]

Among the study participants, 260(51.6%) cases had birth weight in between 1.5-2 kg category followed by 24.05% with weight in the range of 2.1- 2.5 kg. while in 122 babies (24.2%) birth weight was above 2.5kg. [Figure 2]

In 57% of the neonates we found prolonged CRT indicating poor perfusion.

Our study revealed that a major chunk of the study population has developed hypothermia post transport approximately 64%, only leaving 36% with a normal temperature. Hypoglycaemia was found in only 18% of transported neonates while 82% succeeded to maintain euglycemia post transport.33 % of the studies neonates were hypoxic on reaching the referral centre and the remaining maintained spo2 above 90%.[Table 2]

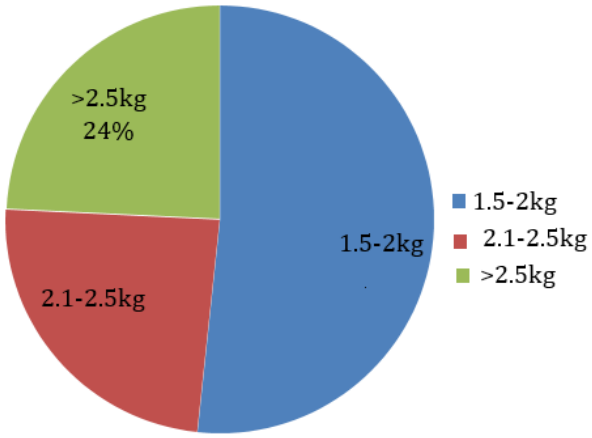

Figure 2: Birth weight distribution

Table 2: Parameters of TOPS score

Parameters		Frequency (%)
Temperature	Normal	179(35.5%)
	Hypothermia (<36.5^{0}C)	324(64.4%)
Oxygenation	Normal	337(66.9%)
	Hypoxia (90%)	166(33%)
Perfusion	CRT <3sec	289(57.4%)
	CRT>3sec	214(42.4%)
Sugar	>45mg/dl	414(82%)
	<45mg/dl	89(17.6%)

Table 3: TOPS score distribution

Score	Frequency (%)
0	133(26%)
1	102(20.2%)
2	177(35.1%)
3	97(19.2%)
4	14(2.7%)

In our study, out of 503 neonates studied, maximum number of neonates 177 (35.1%) had TOPS score 2 followed by 133 (26%) had TOPS Score 0. TOPS score 4 was found only in 14(2.7%) patients. [Table 3]

Table 4: Validity of TOPS score

Validity	Percentages
Sensitivity	81.3%
Specificity	61.5%
Positive predictive value	59.7%
Negative predictive value	87.4%
Area Under ROC Curve	0.723

The sensitivity was 81.3%, specificity was 61.5%, Positive predictive value was 59.7% and Negative predictive value was 87.4%. TOPS score can be safely established as an effective screening tool, to predict mortality in transported neonates. The very high sensitivity of 81.3% along with a high negative predictive value suggest this fact. The specificity is not very high; hence it can't be used as a diagnostic test. As area under the curve in an ROC curve is a measure of usefulness of a test in general. [Table 4, Figure 3]

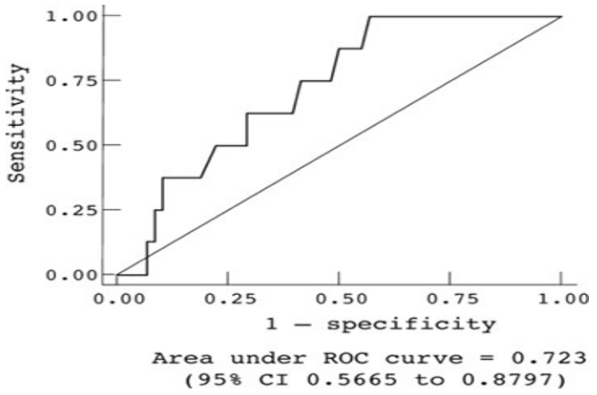

Figure 3: ROC curve analysis of TOPS score

Table 5: Odd's ratio of TOPS variable in predicting mortality

Variable		Univariate Odd's Ratio (95% CI)	P - value
Temperature	Normal Hypothermia	2.81 (1.7 – 3.4)	0.712
SPO2	< 90% >90%	9.89 (7.4 - 12.9)	0.0024
CRT	> 3sec < 3sec	33.7 (27.8 – 35.4)	0.006
Blood Sugar Level	< /=45mg/dl > 45mg/dl	7.56 (2.7 – 9.10)	0.00001

The odds ratio was calculated for each parameter in TOPS score by univariate analysis. It revealed that all the parameters except temperature had significant association with the outcome.CRT with the maximum odds ratio of 33.7 was found to be the strongest predictor of outcome. [Table 5]

5. Discussion

India is a vast country with unequal distribution of hospitals, which makes it difficult to transport a sick newborn to a well facilitated hospital. There are various factors that contribute to the neonatal morbidity, like prematurity, sepsis, respiratory distress syndrome, meconium aspiration, asphyxia etc., all of which can be prevented and treated once the baby reaches a tertiary centre. However transport of the neonates to such a higher center plays an important role in reducing the morbidity and mortality. In our study the gender distribution was found to be almost even, consisting of 48.7% males and 51.3% females, compared to other studies shows male preponderance.[11,12]

The maximum number of referrals have been made for the single cause of respiratory distress & ventilator support (51.3%) in our study group, which exactly matched with the results of study by Baghel et al[8] in M.P. This was followed by LBW/ Preterm babies (27.4%) who were less predominant in Baghel et al[8] study. This was followed by sepsis (17.1%) compared to a 12.4% in the referred study. We had only 3.2% cases referred for jaundice compared to a7.3% in the other study, might be showing the self sufficiency of our referring hospitals with respect to phototherapy. Other casuses like dehydration seizures necrotizing entero collitis etc accounted only 1% in our study.

In most of the studies conducted on TOPS score, the leading parameter to be deranged is temperature. Hypothermia was found in all the studies as shown above. In our study too hypothermia was seen in 64.6% of study population. Only 33% of our neonates were found to be hypoxic which closely matches studies conducted by Pathak et al[9] (27.8%), Begum et al(28.2%),[13] Sheth M.N. et al(29.5%)[14] while 51.6% were hypoxic in the study by Bagel et al.[8] Perfusion as per prolonged CRT was found deranged in 43% of our study population and it matches with Pathak et al[9] 33.9%, while rest of the studies reflect a much better state of perfusion of the babies on arrival. The issue of hypoglycaemia again is higher in our neonates(17.6%) almost matching the 22% in Pathak et al[9] study, while remain a long way from the single digit proportions of our other compared studies. The need for inotropes to maintain perfusion and proper IV fluids to maintain euglycaemia even after an improved pre referral stabilization is pointing towards the need focus more in pre referral treatment to address these very 82 important issues. The greater proportion of preterms in our study who are at risk for developing these both states can also be the reason for this disparity.

Derangements in TOPS variables had good correlation with neonatal mortality as depicted by univariate odds ratio analysis except for temperature in our study. Prolonged capillary refill time (CRT) indicating poor perfusion was the strongest predictor of mortality with highest odds ratio of 33.7 which is higher than that found in both the above compared studies. .Hypoxia was observed as a significant predictor of mortality with an odds ratio of 9.89 which is less compared to the other studies.[15]

From our study we can confidently conclude that TOPS score is an effective screening tool to predict the outcome of mortality in transported neonates as it has a sensitivity of 81.3% much higher than the 71.9% of Begum et al[13]

and is comparable to the 81.6% of Mathur et al.[15] Positive and negative predictive values also (59.7% and 87.4%) is comparable to both the studies as shown in the table. And most importantly the area under the roc curve is 0.723, 0.76, and 0.89 in the 3 studies which is again comparable.

6. Conclusion

The Various parameters, which has strong association with TOPS score on admission were Pre referral treatment, Referral note availability, Accompanying person, Mode of transport, and Duration of transport. TOPS score is a reliable and simplified scoring system which can be done by any health care worker in a peripheral set up also. The high sensitivity (81%) and high negative predictive value (87.4%) with a specificity of 61.5% and positive predictive value of 59.7% suggest that TOPS score a very strong screening test to predict the outcome of babies admitted. Therefore it can be concluded that TOPS score can be used to screen neonates transported to tertiary care centers.

7. Source of Funding

None.

8. Conflict of Interest

None.

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