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Original Research Article

Predictors of morbidity and mortality of extramural neonates with respect to TOPS score: prospective experience from a tertiary care centre of western India

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ABSTRACT

Background: The transport of sick newborns in India is still at a premature stage. Many of these newborns thus transported are cold, blue, and hypoglycaemic, and 75% of the babies transferred this way have serious clinical implications. The aim of this study was to study the clinical status of neonates transported to our hospital and predict the outcome in terms of morbidity and mortality, based on the TOPS score.
Methods: This prospective, observational, longitudinal, simple randomized study was carried out over 12 months in the Department of Paediatrics, Civil Hospital Ahmedabad, Gujarat, and a total of 750 patients were enrolled. A detailed history and clinical examination were carried out through a preformed proforma.
Results: The parameter that was found to be most altered was temperature (70.6%), 52% had hypoxia, 48.6% had poor perfusion and 20% patients had hypoglycemia. Hypoxia was the strongest predictor of mortality. 74.8% of the neonates referred to our hospital had TOPS score of 4-6, and had the highest mortality (41.3%). 25.2% of the newborns were having a TOPS score of 7-8.
Conclusions: TOPS is a simple, reliable score which can help in the quick assessment of neonates on arrival. Hypothermia was the most common altered parameter at the time of presentation followed by hypoxia and hypoperfusion. Mortality was found to be statistically significant in those sick newborns, who presented with more than one altered parameter of TOPS.

Keywords: Perfusion, Hypoxia, TOPS score, Morbidity, Mortality

INTRODUCTION

The transport of sick newborns in India is still at a premature stage. "Most neonatal transports are self-transports without any pre-treatment stabilization or care during transport. Many of these newborns thus transported are cold, blue and hypoglycaemic, and 75 % of the babies transferred this way have serious clinical implications.[1] Neonatal physiology is adversely affected based on temperature, oxygen saturation, skin perfusion and blood sugar, which have shown to predict the mortality in transported neonates.[2] A simple scoring system- TOPS score can be used as a useful method of predicting mortality outcomes that can be assessed immediately, at admission. Hence, the present study was undertaken to evaluate the clinical profile of transferred neonates, and the role of the TOPS score in predicting the immediate outcome of such neonates.

Aims and objectives

Aims and objectives were to study the clinical status of neonates transported to our hospital, to evaluate the complications, present in such neonates if any, to predict

the outcome of transported neonates in terms of morbidity and mortality, based on the TOPS score, and to study the applicability of the TOPS score in a clinical setting.

METHODS

This was a prospective, observational, longitudinal, simple randomized study carried out in the NICU of 1200 bedded new Civil Hospital, Ahmedabad, Gujarat, after approval by the institutional ethical committee (IEC), for one year from August 2018 to August 2019.

Inclusion criteria

Extramural neonates who were transferred to our institute and admitted to NICU within the 1st 28 days of life were enrolled in the present study. The neonates enrolled were randomised by systematic randomization method, thus using a multiple of 5, who satisfied the criteria.

Exclusion criteria

Major and/or life-threatening congenital malformation, all neonatal surgical emergencies, and patients unwilling to participate in the study were excluded.

Methods of data collection

A total of 750 patients were enrolled by simple randomization technique and every 5th newborn referred to our NICU, who met the eligibility criteria, was included. Detailed history and clinical examination were carried out through a preformed proforma, and gestational age assessment was done by modified Ballard score in neonates within 7 days of life and thereafter it was done based on LMP-EDD date and/or USG report (earliest trimester) whichever was available. Written and informed consent was obtained from parents/guardians of enrolled neonates before inclusion in the study. TOPS (T-Temperature, O-Oxygen saturation, P-perfusion, S-Sugar) score was recorded.

Sample size estimation

Assuming that 50% of patients will have all parameters altered and confidence level 95% and margin of error 5%; applying the formula for sample size estimation for an observational study, a statistically significant number of the cohort was determined as 347. So, we enrolled double the required study population in our study to improve the statistical significance of outcome analysis.

Statistical methods

Data of this study was recorded in Microsoft excel and analysed using appropriate statistical tests (Chi-square test, odds ratio). The primary outcome (or immediate outcome) was studied on all enrolled patients as it involved assessment of TOPS on arrival at our unit. Secondary outcome (or outcome) was studied on 736 patients as 14 patients left against medical advice and hence were not followed up till the end.

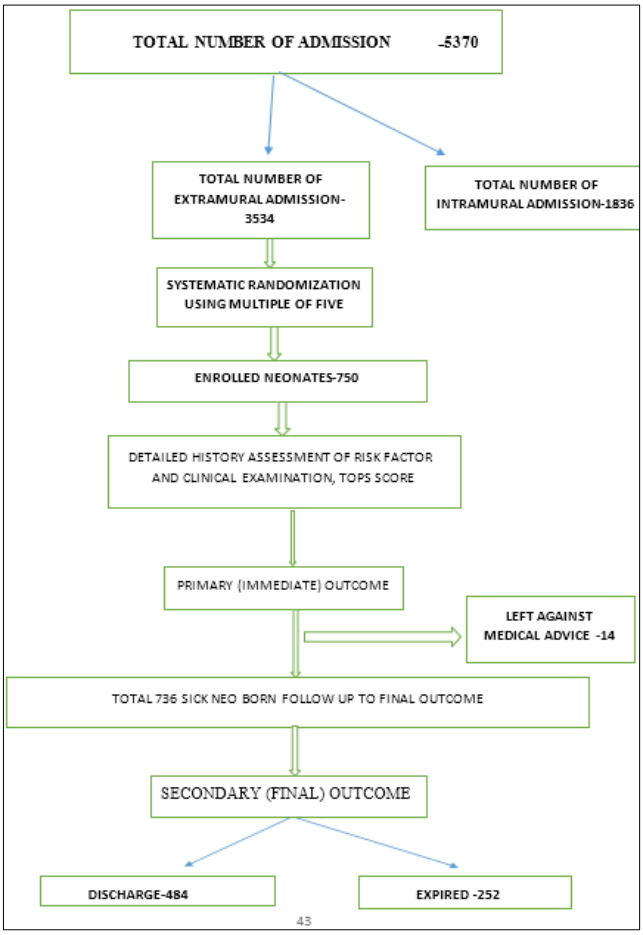

Figure 1: Flow diagram.

RESULTS

In the present study out of 3534 extramural babies received at our institute, 750 patients were enrolled. The male to female ratio in this study was 1.8:1; male newborns were 484 (65.5%) and female newborns were 266 (35.4%). 70.7% of referrals were in the early neonatal period of which 60% were in 1st 3 days of life, with nearly equal distribution on 1st, 2nd and third day of life, in my study, 60% of the newborns were admitted having weight <2.5 kg and 40% of the newborns had weight >2.5 kg with mean admission weight 2.2 kg.

Among newborns who were enrolled in my study, 57.9% were preterm and 42.1% of the newborns were term. Out of 750 newborns, 165 (22%) newborns were home delivered. Amongst those home delivered, 102 (13.6%) newborns belonged to the rural area, whereas 63 (8.4%) were from urban areas.

The most common high-risk factor associated was amniotic fluid abnormalities either oligohydramnios or polyhydramnios (21%) followed by malpresentation (17.2%) and preeclampsia (16.4%). 587 (78%) newborns

were hospital delivered; out of that, 153 (20.4%) belonged to rural areas and 432 (57.6%) belonged to urban areas. Out of the 750 patients enrolled, 337 (45 %) patients took >60 minutes to reach the civil hospital, whereas 173 (23%) patients reached within 30 minutes. Low birth weight was one of the major reasons for referral amounting to 450 (60%) closely followed by prematurity 434 (57.8%). Other reasons for referral were respiratory distress syndrome, birth asphyxia, septicaemia, meconium-stained liquor, hyperbilirubinemia and congenital heart disease. It was observed in my study that a referral radius of more than 10 km resulted in marginally higher mortality compared to those referred within a radius of 10 km. 74% of the newborns who were referred did not receive any prior stabilization; out of which, 39.2% expired. 59.3% of the newborns were transferred via ambulance and few utilized other modes of transport like a private vehicle, auto-rickshaw, and others. 85.4% of the patients were not accompanied by health personnel.

Table 1: Demographic distribution of the newborns.

Demographics	Number	Percentage
Gender (n=750)		
Male	484	65.5
Female	266	35.4
Ratio		1.8:1
Age at admission (days) (mean age=49 hours)		
<24 hour	200	26.6
1-3	250	33.3
4-7	81	10.8
7-14	87	11.6
14-21	69	9.2
21-28	63	8.4
Age at admission (days) (n=750)		
<7	531	70.8
>7	219	29.2
Birth weight (gm) (n=750)		
<1000	36	4.8
1000-1499	118	15.7
1500-2499	297	39.6
2500-3900	279	37.2
>4000	20	2.8
Weight of the newborn	Mean weight=2.2 kg	

In the present study, the parameter that was found to be most altered was temperature, contributing to 70.6% of the cases; 52% had hypoxia, 48.6% had poor perfusion and 20% had hypoglycemia. Altered oxygen saturation, seen as hypoxia was the strongest predictor of mortality with the highest odds ratio. Prolonged capillary refill time (CRT) indicating poor perfusion was the next strongest predictor of mortality.

When individual parameters of the TOPS score were correlated with the outcome, hypoxia had the highest specificity of 91.2% and hypothermia was found to be the most sensitive parameter for predicting the mortality.

Table 2: Risk factors affecting the outcome.

High-risk factors	Number	Percentage
High-risk factors in mothers		
Oligohydramnios or polyhydramnios	53	21
Malpresentation	42	17.2
Twins	14	5.7
Preeclampsia	40	16.4
Antepartum haemorrhage	33	13.5
Grand multipara	26	10.6
Bad obstetric history	18	7.4
Maternal illness	11	4.5
Eclampsia	18	7.4
Elderly pregnancy	16	6.5
Reason for referral		
LBW baby	450	60
Preterm	434	57.8
RDS	238	31.7
MSL	124	16.5
Birth asphyxia	114	15.2
Septicemia	96	12.8
Hyperbilirubinemia	48	6.4
CHD	37	4.9
Distance from referring (km)*	**Number n=750**	**Mortality n=252**
<10	322 (43)	98 (30.4)
>10	428 (57)	154 (35.9)
Mode of transport**		
Ambulance	445 (59.3)	112 (25.1)
Auto-rickshaw	108 (14.4)	48 (44.4)
Private vehicle	127 (16.9)	58 (45.6)
Others	70 (9.3)	34 (48.5)
Duration of hospitalization (days)	**Number n=750**	**Percentage**
<7	135	18
7-14	419	55.8
14-21	121	16.1
21-28	75	10

*Distance from referring unit p=0.26, **mode of transport p value=0.000968

A majority (55.9%) of the patients required hospitalization for 7-14 days, with an average length of stay for 10 days. Major causes of morbidity in order of frequency were prematurity in 424 (56.6%), respiratory distress syndrome and hyperbilirubinemia in 256 (34.1%) and 256 (34%) patients respectively, and CHD contributed to 11.8% of the total making it a less likely cause. 74.8% of the neonates referred to our hospital had a TOPS score of 4-6, and had the highest mortality (41.3%). 25.2% of the newborns were having a TOPS score of 7-8.

Table 3: TOPS parameters.

Parameters*	At admission (%)	Mortality (%)
Temperature (<36.5 C)	530 (70.6)	192 (36.2)
Oxygen (SpO_2 <90%)	365 (48.6)	164 (45.7)
Perfusion (CRT >3 sec)	390 (52)	165 (42.3)
Sugar (RBS <40 mg/dl)	150 (20)	50 (33.3)
Predictor variable**	**Univariate odds ratio (95%)**	**P value**
Skin temperature <36.5^{0}C (T)	1.51 (1.07-2.14)	0.0087
Saturation <90% (O)	2.75 (2.01-3.77)	<0.0001
Perfusion CRT >3 sec (P)	2.30 (1.68-3.15)	<0.00001
Blood sugar <45 mg/dl (S)	0.98 (0.67-1.43)	0.47

*Altered TOPS parameters of transported neonates, **odds ratio of TOPS variable for predicting mortality

Table 4: Test characteristics of individual parameters with respect to mortality.

Parameter	Hypothermia (%)	Hypoxia (%)	Hypoperfusion (%)	Hypoglycemia (%)
Sensitivity	76.1	65.3	65.4	19.2
Specificity	32.1	91.2	54.8	79.9
Positive predictive value	36.2	44.9	22.4	33.3
Negative predictive value	72.7	77.1	75	66.3

In the present study, highest mortality was attributed to septicaemia (34.4%), followed by 21.4% due to severe birth asphyxia, 16.6% due to meconium aspiration syndrome and 15.8%, 11.9% due to respiratory distress syndrome and extreme prematurity respectively.

DISCUSSION

A present study suggestive of a male: female ratio of 1.8:1, which is comparable to other studies like Hapani et al, Begum et al, and Mathur et al probably shows health-seeking behaviour of community with treatment preference to a select child.

This study shows that 60% of newborns enrolled were having weight <2.5 kg which is comparable to the study done by Dalal et al (55%) and Thwala et al (67.8%).[3]

Out of 750 newborns, 57.9% were preterm and 42.1% were term which is comparable to Hapani et al study (term were 45% and preterm were 55%) and Thwala et al study (term were 66.6 % and preterm 33.4%).[4]

In the present study, maximum number of referrals were done for low-birth-weight care (60%) and prematurity (57.8%) which is comparable to Begum et al and Sehgal et al study.[5,6]

In the present study, maximum number of patients, 74% of newborns were referred without prior stabilization, out of which 39.2% expired, which is statistically significant (p=0.000043 Chi-square test) which is comparable to Buch et al study.[7] The maximum number of patients were transported by ambulance (59.3%). In the present scenario, after the introduction of 108 ambulance services in India, there is a remarkable improvement in the transportation system, hence having a positive impact on reducing the neonatal mortality rate. Similar results were seen in Dalal et al (47.3%) and Hapani et al (34%) study.[4,8]

In the present study, only 14.6% of patients were accompanied by health personnel. Similarly, in Hapani et al (39.4%), Dalal et al (44.3%) and Shah et al (28%) patients were accompanied by health personnel. Out of the total expired patients, 36.2% had hypothermia which was comparable to Hapani et al (29.8%) and Dalal et al (31.4%).

365 patients had hypoxia at the time of admission, out of which 45.7% of patients expired, similar results were found in other studies, Hapani et al (54.8%), Begum et al (69%) and Dalal et al (56%). Hypoperfusion was found in 390 patients, out of that 42.3% expired, which was comparable to the result of Begum et al (40.3%).

Prematurity, respiratory distress syndrome, birth asphyxia, sepsis and meconium aspiration syndrome were the most common causes of morbidity among the multiple co-morbidities, which is similar to the study done previously by Buch et al and Dalal et al.

"Incidences of sepsis and HMD among preterm and LBW babies are the major causes of immediate adverse outcomes in other studies from developing countries of Asia and Africa".[9-13]

Limitations

Confounding factors like birth weight, gestational age and associated illnesses were not assessed while comparing TOPS score and neonatal mortality.

CONCLUSION

Low birth weight and prematurity were the most common causes of referral. Hypothermia was the most common altered parameter at the time of presentation followed by hypoxia and hypoperfusion. Simple measures like kangaroo mother care, polythene bag, embrace, incubator and the safest being in-utero transportation can decrease the incidence of hypothermia during transport. Various modes of oxygen therapy (nasal prongs, and transport ventilator) also should be taken care of during transport. The majority of patients who were referred did not receive any pre-referral treatment or stabilization which had a huge impact on their outcome in relation to mortality. This indicates the need for pre-referral stabilization before arranging for the transport of such sick neonates. Mortality was found to be statistically significant in those sick newborns, who presented with more than one altered parameter of TOPS.

TOPS is a simple, reliable score which can help in the quick assessment of neonates on arrival. Alteration in parameters can guide the overall management of these neonates. Also, it can be used before and during transport so that such neonates are in better condition to be managed at the referral institute. Thus, has a positive influence on reducing the neonatal mortality rate.

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REFERENCES

1. Bang AT, Bang RA, Baitule SB, Reddy MH, Deshmukh MD. Effects of home based neonatal care and management of sepsis on neonatal mortality: field trial in rural India. Lancet. 1999;354(9194):1955-61.
2. Mathur NB Arora D. Role of TOPS (a simplified assessment of neonatal acute physiology) in predicting mortality in transported neonates. Acta Paediatr. 2007;96(2):172-5.
3. Thwala M. The Quality of Neonatal inter-facility transport system within the Johannesburg Metropolitan region. 2012.
4. Hapani PT, Berwal A, Dave H. Application of tops score in sick neonates received at level 3 nicu and its impact on the outcome of the neonate. IOSR J Dent Med Sci. 2019;18(3):11-5.
5. Begum A, Ashwani N, Kumar CS. TOPS: a reliable and simplified tool for predicting mortality in transported neonates. IOSR J Dent Med Sci. 2016;15:53-8.
6. Sehgal A, Roy MS, Dubey NK, Jyothi MC. Factors contributing to outcome in newborns delivered out of hospital and referred to a teaching institution. Indian Pediatrics. 2001;38(11):1289-94.
7. Buch PM, Makwana AM, Chudasama RK, Doshi SK. Status of newborn transport in periphery and risk factors of neonatal mortality among referred newborns. J Pharma Biomed Sci. 2012;16(9):1-6.
8. Dalal E, Vishal G, Solanki D. Study on neonatal transport at tertiary care centre. Int J Sci Res. 2013;2(12):289-92.
9. Wardhani DM, Haksari SW. Risk factors of neonatal mortality of referred babies with birth weight of 1000-< 2500 grams. J Med Sci (Berkala ilmu Kedokteran). 2009;41(3):143-51.
10. Cornblath M, Howdon JM, Williams AF. Contraversies regarding definition of neonatal Hypoglycaemia: Suggested operational threshold. Paediatrics. 2000;105(5):1141-5.
11. Hoque M, Haaq S, Islam R. Causes of neonatal admissions and death at rural hospital in Kwazulunatal, South Africa. South Afr J Epidemiol Infect. 2011;26(1):27-9.
12. Njokanma OF, Olanrewaju DM. A study of neonatal deaths at the Ogun State University Teaching Hospital, Sagamu, Nigeria. J Trop Med Hyg. 1995;98(3):155-60.
13. Okechukwu AA, Achonwa A. Morbidity and mortality patterns of admissions into the Special Care Baby Unit of University of Abuja Teaching Hospital, Gwagwalada, Nigeria. Niger J Clin Pract. 2009;12(4):389-945.

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