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A Prospective Observational Study of Evaluation of Neonatal Trigger Score (NTS) as an Early Warning System (EWS) in Postnatal Wards

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Abstract: ***The early identification of neonates at risk of medical deterioration is crucial, particularly in postnatal wards where specialized neonatal care may not always be immediately accessible. This prospective observational study, carried out at ACS Medical College from March 2023 to March 2024, explores the effectiveness of the Neonatal Trigger Score (NTS) as a practical tool for non-specialist staff to recognize subtle signs of illness in newborns. It is evident that out of 750 neonates, 18.1% triggered the NTS, with a significant proportion requiring medical intervention. Notably, a score of 1 demonstrated high sensitivity (99.14%) for initiating medical reviews, while a score of 2 showed a strong association with NICU admissions. This suggests that the NTS, when used consistently, enables timely escalation of care, potentially reducing neonatal morbidity and mortality. The study not only validates previous findings from Western contexts but also highlights the relevance of such scoring systems in Indian healthcare settings. That said, the findings underline a pressing need for broader research and adoption of neonatal early warning tools to safeguard newborn health, particularly in resource-constrained environments.***

Keywords: neonatal care, early warning score, neonatal trigger score, NICU admission, newborn health

1. Introduction

- The early postnatal period is a critical phase in the lives of newborn babies. Major changes occur during the neonatal period because of adjustments to extra-uterine life, physiological immaturity or exposure to intra-partum risks such as infections. Following birth, the majority of apparently "healthy" neonates are cared for in the postnatal or maternity wards.
- In the majority of hospitals, post-natal wards are not designed to take care of the unwell neonates.
- Before acute deterioration and subsequent transfer to the neonatal intensive care unit (NICU), neonates often show signs of illness that are often subtle and are not recognised.
- Early identification and management of these potentially "at-risk" neonates are of paramount importance.
- Based on physiological observations such as heart rate, respiratory rate, etc., early warning score (EWS) systems have been validated in adult and pediatric populations to detect deterioration with prompt interventions to reduce morbidity and mortality.[1, 2]
- Despite a national recommendation that all adult patients outside intensive care be monitored on a track and trigger score,[3] there has been no standardised clinical scoring system for neonates.
- Although a couple have been proposed previously,[4,5] none had been validated or extensively studied, with no statistical analysis of score sensitivities or specificities, and the established Paediatric Early Warning System (PEWS) scores[6-8] either demonstrated poor sensitivity in detecting unwell neonates or were overly complicated for a non-specialist environment.
- In a recent prospective evaluation of Neonatal Trigger Score (NTS) in neonates, it has been shown that NTS can be successfully used as an adjunct to clinical assessment by non-specialists, in early identification of neonates requiring extra care [7]

2. Methods and Methodology

- A prospective observational study was conducted at ACS Medical College from March 2023 to March 2024
- All neonates admitted in the postnatal wards of the ACS hospital during the study period were included in the study.

Exclusion Criteria:

- Neonates weighing <2kg at birth.
- Neonates with a gestational age of < 35 weeks.
- Babies are admitted directly to the NICU from the labour ward.
- All the postgraduates and interns of the Department of Paediatrics, and nurses posted in Labour and Postnatal wards were sensitised regarding the use of the NTS observation chart.
- Sensitisation was done at repeated intervals for interns and nurses who were posted in labour and postnatal wards according to their rotation postings.
- Data was collected by the postgraduates, interns and nurses posted in labour and postnatal wards.
- All neonates fulfilling the inclusion criteria were included in the study.
- At the time of enrolment, informed written consent was obtained from the parents.
- The parameters included in our study were respiratory rate, respiratory distress and level of consciousness.
- Scores were obtained at 1, 2, 4, 6, 8, 10 and 12 hours after birth and then every 4th hourly until 48 hours old.

- Those neonates requiring medical intervention were followed up till discharge to observe for the following outcomes: medical intervention, length of NICU/hospital stay, mortality.

Name:

Hospital Number:

DOB:

Birth Weight: Kg Gestation: / 40

Score
0
1
2
3

Neonatal Trigger Score (NTS)

Date									
Time									
Hours From time of birth		Birth	1 Hour	2 Hours	4 Hours	6 Hours	8 Hours	10 Hours	12 Hours
Temperature (°C)	> 38.0								
	37.5-38.0								
	36.5-37.4								
	36.0-36.4								
	<36.0								
Heart rate (Beats per minute)	>220								
	180-219								
	160-179								
	100-159								
	80-99								
	<80								
Respiratory Rate (Breaths per minute)	> 70								
	51-70								
	31-50								
	20-30								
	<20								
Respiratory distress	Present								
	Absent								
Conscious level	Alert / sleeping								
	Irritable / lethargic / jittery								
	Unresponsive								
Pre-feed blood sugar (mmol) [] Tick if indicated	Time (pre-feed only)								
	> 6.0								
	2.0 – 5.9								
	1.1-1.9								
	<1.0								
☑ If passed urine									
☑ If passed meconium									
Total NTS Score									
Patient Reviewed ☑									

Total NTS Score	Action
	Warm baby / skin-to-skin contact – repeat temperature measurement in 1 hour
0	Continue
1	Medical review: consider partial septic screen and antibiotics
2	Urgent medical review: consider admission to NICU
Any observation in red zone	Strongly consider cardiac arrest call (x2222)

Figure 1: Neonatal Trigger Score (NTS) observation and scoring chart designed and developed by Holme H et al.

Calculation of score:

- Individual parameter scores were entered according to the colour coding by putting a cross (X) in the appropriate colored box.
- The total NTS score was obtained by adding the scores for each core parameter and was entered.
- All the postgraduates, interns and nursing staff who recorded the observations were given the following instructions:
- If a neonate scores 0, to continue the same and to observe the baby for the next 48 hours as per the NTS chart.
- If a neonate scores >1, to inform the consultant / PG on call immediately for review.

Participants were divided into three groups:

- Group 1 (unwell): all requiring admission to NICU, excluding well neonates admitted for social reasons (such as observation for neonatal abstinence syndrome) or management of isolated jaundice or polycythaemia.
- Group 2 (well): who remained on the PNW receiving standard care
- Group 3 (intervention): those who received antibiotics but did not require admission to NICU.
- A decision to admit was purely clinical, based on the baby's condition.

3. Results

- Out of 750 neonates for whom NTS was applied, 136 (18.1%) triggered the NTS while the remaining 614 (81.9%) neonates did not trigger the NTS.

- The majority, 500(66.7%) of neonates had normal respiratory rates (31-50 cycles per minute), while 246 (32.8%) neonates had tachypnea (>50 cycles per minute) and 4(0.5%) neonates had a respiratory rate of > 70 cycles per minute. None of the neonates were in the red zone (<20).
- But among those, it was observed that respiratory distress was present in 63/136 (8.4%) neonates who triggered the NTS chart, whereas it was absent in all neonates who did not trigger the NTS chart (100%), which was statistically significant (P < 0.05).
- The Level of Consciousness was normal in all the neonates who did not trigger the NTS (100%), whereas it was abnormal in 19/136 neonates (2.5%) who triggered the NTS chart, which was statistically significant (P<0.05).
- Out of 750 neonates, 614 neonates who did not trigger the NTS chart had a score of 0. Among neonates who triggered the NTS chart, 28/136 (20.6%) neonates had a score of 1, 99/136 (72.8%) neonates had a score of 2, 9/136 (6.6%) neonates had a score of 3 and none had a score of 0 which was found to be highly significant statistically (P<0.05).
- It was observed that among NTS-triggered neonates, 21/136 (15.4%) did not require any medical intervention and were "well" neonates, 115/136 (84.6%) required medical intervention.
- Among 614 neonates who did not trigger NTS, none required any medical intervention (100%). It was found that among neonates who triggered NTS and required medical intervention, 90(66.2%) were treated in NICU while 46(33.8%) were managed in PNW. Both observations were found to be highly significant statistically (P<0.05).

Characteristics of study participants who triggered NTS and required intervention in PNW are as follows:
- Asymptomatic hypoglycemia (n-13)
- Dehydration fever (n-04)
- Fever following immunisation (n-04)
- Probable sepsis (n-04)

The following are the characteristics of neonates requiring intervention in the NICU:
- Transient tachypnea of newborn (n-44)
- Meconium aspiration syndrome (n-21)
- Probable sepsis (n-10)
- Dehydration fever (n-15)
- In our study, score 1 had 99.14% sensitivity and 96.69% specificity, while score 2 had 73.28% sensitivity and 99.37% specificity, and score 3 had 7.76% sensitivity and 100% specificity for predicting the requirement of medical intervention (ward or NICU).

4. Statistical Analysis

- Data were entered into Microsoft Excel, and statistical analysis was carried out in SPSS software version 17.0. Qualitative variables were presented as frequencies and percentages. Quantitative variables were presented as mean (standard deviation) or median(range), depending on the distribution of data.
- Association between categorical variables were assessed using chi chi-squared test. A P -P-value of less than 0.05 was considered statistically significant.
- ROC analysis was performed using the NTS score to predict the admission of the baby to the ward or NICU.
- Sensitivity, specificity and diagnostic accuracy were calculated for different cut-off values of the NTS score.

5. Discussion

- Patients, families and carers have a right to expect and receive the best possible medical care.
- An important component of this expectation is early recognition of any deterioration in a hospitalised patient's medical condition.
- Significant morbidity and mortality might occur in neonates due to the absence of an early warning system.
- The W-NTS is one such scoring system that has been successfully used in the UK as an adjunct to clinical assessment by non-specialists, in the early identification of neonates requiring extra care.

NTS Score cutoff for Medical Review:
- In our study, it was observed that an NTS score of 1 was a cutoff score at which a neonatal doctor should be informed for a medical review (Sensitivity 99.14%, Specificity 96.69%). The observations were found similar when compared to the recommendations postulated from a retrospective study conducted by **Holme et al.,**[9](Sensitivity 92.7%, Specificity 71.6%) and a prospective study conducted by **Robinson A et al.,**[10] (Sensitivity 100%, Specificity 86.1%).

Score cutoff for admission to NICU:
- In our study, it was observed that a score of 2 (Sensitivity 73.28%, Specificity 99.37%) was strongly associated with increased need for intensive care admission (p <0.001), whereas a score of 0 was highly predictive of being well enough to remain in PNW (p<0.001). These observations are similar when compared to the recommendations postulated by a retrospective study conducted by **Holme H et al.,**[9] (Sensitivity 79.3%, Specificity 93.5%) and a prospective study conducted by **Robinson A et al.,**[10] (Sensitivity 82.5%, Specificity 95%).
- The present prospective evaluation supported the postulated score cutoffs from retrospective research by **Holme H et al.,**[9] and **Robinson A et al.,**[10] that a neonate scoring ≥1 was more likely to require a medical review and a score of ≥2 was more likely to require NICU admission.
- When using a score to determine which babies potentially need septic screen/antibiotics, sensitivity is important than specificity, showing that an optimum score of 2 is required for intervention. When choosing a, consider admission" trigger score, a higher specificity is desirable to avoid unnecessary admissions and neonate-mother separations.

6. Conclusion

- Identifying deteriorating healthy babies promptly is our priority, and it can be prevented by using an appropriate escalation system. This study has provided evidence that

NEWS is an effective tool to ensure that newborn safety is met.

- This prospective evaluation supports previous retrospective research and the following recommendations in institutions similar to ours:
- If a neonate scores 1, the paediatrician should be requested to review and strongly consider performing a septic screen and commencing intravenous antibiotic therapy.
- If a neonate scores 2 or more, they should be reviewed urgently as there is a high chance they will need to be moved to intensive care for ongoing management.
- If any of the individual categories score 3 (red column on the chart), then they need very urgent attention.
- NTS can be successfully used as an adjunct to clinical assessment by non-specialists to identify babies that may require an escalation in their care, and by enabling earlier detection of the sick neonate, NTS has proven to be of clinical value.
- Further research on the early warning systems in the neonatal population is required in India, as this is a new concept that needs to be explored.

References

[1] Stubbe CP, Kruger M, Rutherford P, Gemmell L. Validation of a modified Early Warning Score in medical admissions. Q J Med.2001; 94:521-6.
[2] Duncan H, Hutchison J, Parshuram C. The pediatric early warning system score: A severity of illness score to predict urgent medical need in hospitalised children. J Crit Care.2006; 2:271-8.
[3] National Institute for Health and Clinical Excellence. Acutely Ill Patients in Hospital. London: The Institute, 2007. NICE Clinical Guideline No.: CG50. Journal of Paediatrics and Child Health 53 (2017) 950–956 © 2017 Paediatrics and Child Health Division (The Royal Australasian College of Physicians) 955 A Robinson et al. Neonatal Trigger Score
[4] Roland D, Madar J, Connolly G. The Newborn Early Warning (NEW) system: Development of an at-risk infant intervention system. Infant 2010; 6: 116–20.
[5] Nowlan K, Soliman M, Mathur R, Jaiswal S. A pilot study validating the use of a neonatal early warning score. Pediatr. Res. 2011; 70: 701.
[6] Haines C, Perrott M, Weir P. Promoting care for acutely ill children— Development and evaluation of a Paediatric Early Warning Tool. Intensive Crit. Care Nurs. 2006; 22: 73–81.
[7] Edwards ED, Powell CVE, Mason BW, Oliver A. Prospective cohort study to test the predictability of the Cardiff and Vale paediatric early warning system. Arch. Dis. Child. 2009; 94: 602–6.
[8] Monaghan A. Detecting and managing deterioration in children. Paediatr. Nurs. 2005; 17: 32–5.
[9] Holme H, Bhatt R, Koumettou M, Griffin MAS, Winckworth LC. Retrospective evaluation of a new neonatal trigger score. Pediatrics 2013; 131: e837–42.
[10] Robinson A, Winckworth LC, Eleftheriou G, Hewitson R, Holme H. Prospective evaluation of the Whitt Neonatal Trigger Score in an ‘at-risk’ neonatal population. J Paediatr Child Health.2017; 53:950-6.