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Original Research Article

To assess the applicability of Whitt's neonatal trigger score (W-NTS) for early detection of at- risk neonates in Indian setup.

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ABSTRACT: Background- Neonates show clinical signs prior to acute deterioration which are usually unrecognized. Whitt's neonatal trigger score (W-NTS) with high sensitivity(77%) and specificity(97%) was developed in 2010 for early detection of neonates who are at risk of deterioration. The aim of our study was to assess the applicability of W-NTS for early detection of at risk neonates in Indian population. **Method-** A Prospective Observational study was conducted over a period of 24 months on stable neonates with predefined risk factors in the postnatal ward. The scores were calculated using 6 clinical parameters Heart rate, Respiratory rate, Temperature, Respiratory distress, Level of activity, and RBS readings and were recorded on W-NTS chart. Each parameter score minimum of 0, and maximum ranging from 1 to 3. The score from each separate parameter was then combined to generate a cumulative score (minimum 0, maximum 15). Neonates were divided into 3 groups Group 1 (score 0): who remained well in the PNW, Group 2 (score 1): neonates requiring septic screen and antibiotics therapy, Group 3(score ≥2): required admission to the NICU. **Results-** Out of 853 neonates ,683(80.07%) belonged to group 1, 23(2.7%) belonged to group 2, whereas 136(17.23%) belonged to group 3($P<0.001$). Septic screen was done for all neonates in group 2 and 3. Neonates who belonged to group 2 had negative results were successfully discharged, whereas in group 3 ,62 out of 143 had positive septic screening results, out of which 11 died and 136 were successfully discharged. **Conclusion-**This W-NTS score is highly usefull for early detection of deterioration in neonates with high risk factors. The score is highly reliable and easy to perform.

Keywords- Whitt's neonatal trigger score, septic screen, neonate

1. INTRODUCTION

Trigger scores have been validated as the useful ways of detecting clinical deterioration at an early stage and planning early intervention to reduce morbidity (1). Although there are many scoring systems in pediatric and adult group, only few standardised clinical scoring systems for neonates (2). Most of the scores were very difficult to be performed and other scores were condition specific, for example, cardiac children's hospital early warning score(C-CHEWS) (3) (4). Therefore, a neonatal specific score Whitt's Neonatal Trigger Score (W-NTS) was developed in 2010 to provide an objective measure of clinical status using routine bedside observations (5).

The W-NTS was designed for babies at risk of deterioration in non-specialist areas, such as postnatal or labor wards, and can be performed and interpreted by any member of the

multidisciplinary team (5). It also helps to identify early signs of de-compensation, allowing time for transfer from the non-specialist postnatal ward (PNW) to a more appropriate neonatal-specific intensive care environment (5).
Globally, 130 million babies are born every year and of these, 4 million die during newborn period. In 2018, approximately 2.5 million children died in the first month of life, which calculates to approximately 7000 newborns every day. Most of these newborns died in first week of life with approximately 1 million dying in first day of life (6). This makes focus on the newborn care more, critical than ever before. India accounts for the highest number of annual births (25.6 million) and neonatal deaths (0.7 million or 30% of global burden) (7). The main direct causes of neonatal deaths include preterm births (29%), severe infections (29%) etc. (7)
Only few studies (1) (8) (9) (10) have been conducted in the developed countries but no such study has been conducted in developing countries therefore, this study was planned to assess the applicability of Whitt's neonatal trigger score for early detection of at- risk neonates in Indian setup.

2. METHODOLOGY

This was a Prospective Observational study conducted between Jan 2017 to July 2019 in Department of Pediatrics and Department of Obstetrics and Gynaecology, Gandhi Medical College, Bhopal. Inclusion criteria-All neonates delivered in our hospital who stayed with their mothers in the post-natal wards were eligible for the recruitment. Out of these, neonates having one or more of the following risk factors were included in the study: 1.Prolonged rupture of membranes (>18h) 2.Maternal fever (>38C) 3.Meconium stained amniotic fluid without Respiratory distress.4.Gestation 35–37 weeks 5.Maternal diabetes mellitus**.** Exclusion criteria 1.Neonates requiring any kind of neonatal resuscitation at birth. 2.Neonates who were started with prophylactic antibiotics at birth due to maternal sepsis concerns (i.e. without any signs of clinical deterioration)3.All the neonates admitted in NICU before recruitment for any maternal or neonatal complications. 4.Neonates whose parents were unwilling to participate in this study.Sample size was 840 (Formula = 4PQ/L2, Prevalence - 30%,Q = 100 – P,L = precision or acceptable level of error 10% of prevalence i.e. 3). After obtaining written consent the antenatal, natal and postnatal history details were recorded in a predesigned and pretested proforma. The WNTS scores were calculated using clinical parameters such as Heart rate, Respiratory rate, Temperature, Respiratory distress, Level of activity, Oxygen saturation and RBS readings and were recorded at 0 hour, 1 hour, 2 hour, 4 hour, 8 hour, 12 hr and 24 hour. Each parameter could score a minimum of 0, with maximum scores ranging from 1 to 3. The score from each separate parameter was then combined to generate a cumulative score (minimum 0, maximum 15) with a higher score reflecting greater deviation from normal. Participants were divided into 3 groups and intervention was done according to the group - Group 1 (well): consecutive neonates born during the same period with any of the risk factors but remained well in the PNW, requiring neither NICU admission nor any antibiotics. Group 2 (intervention): all neonates requiring septic screen and antibiotics therapy during the same time period but not requiring NICU admission and Group 3: all neonates born in this period who required admission to the NICU from the labor or postnatal wards. The decision to admit was purely clinical, based on the baby's condition. If baby comes in group 2 then relevant investigations were performed. If they needed greater levels of care, such as oxygen or intravenous fluids, they were admitted to NICU and outcomes were recorded in all cases. The data was collected and tabulated in Microsoft excel spreadsheet of Microsoft office 2010.The qualitative data of non parametric type was

represented as frequencies and analyzed using Chi square analysis and Fisher's exact test for differences in proportion. Kruskal-wallis test posthoc Dunn's multiple test was applied to compare mean of WNTS score in three groups. The Receiver Operating characteristics curve (ROC) was used to find out diagnostic ability as cutoff point and sensitivity and specificity of WNTS score. All the statistical analysis was performed using SPSS 16.0 for windows.

3. RESULTS

TABLES-Table 1- Showing demographic profile

Parameter		Number	Percentage (%)
Gender	Male	483	56.62
	Female	370	43.38
Gestation(in weeks)	35-37	243	28.48
	37-42	610	71.52
	>42	0	0.00
Birthweight(in kilograms)	1.5-2.5	420	49.23
	>2.5	433	50.76

Table 02 - Showing association between mean W-NTS in each group and its final outcome

	Group 1 (well)	**Group 2 (intervention)**	**Group 3 (admission)**	**Total**	**Statistical inference**
Numbers (%)	683 (80.07%)	23 (2.70%)	147 (17.23%)	853 (100 %)	---
Mean W-NTS Score	0 ± 0	1 ± 0	2.44 ± 0.78[#]	0.45 ± 0.41	p<0.0001
Discharged	683	23	136	842 (98.71%)	
Death	0	0	11	11 (1.29%)	

Kruskal-Wallis test post hoc Dunn's multiple comparisons test was applied to compare means of W-NTS in three groups.

Table 03 - Showing septic screen results and outcome

	Group 1 (well)	**Group 2 (intervention)**	**Group 3 (admission)**	**Total**	**Statistical inference**
Numbers (%)	683 (80.07%)	23 (2.70%)	147 (17.23%)	853 (100 %)	
Septic screen	**Positive**	0	0	62	62
	Negative	0	23	85	109
Discharged	683	23	136	842 (98.71%)	p<0.005
Death	0	0	11	11 (1.29%)	

Fisher's exact test was applied to know the difference in proportion of positive and outcome.

In this study, total number of participants were 853 among which 56.62% (n=483) were males and 43.38% (n= 370) were females. The male to female ratio neonates was 1.53:1 with slight male predominance. All subjects were between 35-42 weeks of gestation. Majority of the subject belonged to 37-42 weeks with 71.52 % (n=610) neonates followed by gestational age of 35-37 weeks which contributed to 28.48% (n=243) cases. All neonates had birth weight between 1.5-2.5kg with 50.76% (n=433) of the neonates were having birth weight >2.5 kg and 49.23% (n=420) neonates were having birth weight between 1.5-2.5kg.(Table 1)
In our study, majority of the neonates remained well in the post natal ward constituted 80.07%(n=683) were included in group 1 and no interventions were done. They were kept along with mother and breast feeding was ensured. Group 3 constituted the next most common group which included 17.23 % (n=147) neonates. They were immediately admitted to NICU and interventions were made accordingly followed by group 2 which included 2.7% (n=23) neonates who remained in the post natal wards and underwent septic screening but do not require NICU admission..(Table 2)
Septic screen was done in all neonates who were included in group 2 and 3. All neonates who belonged to group 2 had negative results and were successfully discharged, whereas in group 3, 62 out of 143 neonates had positive septic screening results, out of which 11 neonates died and 136 were successfully discharged.(Table 3)

4. DISCUSSION

In our study, all subjects were between 35-42 weeks of gestation. As prematurity is itself a risk factor and is an indication of admission in NICU at birth, such babies were already excluded from our study. In a study conducted by Holme et al (1) in 2017 on retrospective evaluation of new neonatal trigger score, all neonates >35weeks gestation were included in the study with mean gestational age 39.02± 1.73 in group 1 (unwell) and 38.68±SD 1.62 in group 2 (well). Similar results were obtained in a study conducted by Robinson et al (5) .Roland et al (9) in 2010 conducted a study in which they have included neonates who had gestational age >37 week.
In our study, neonates with birth weight more than 2.5kg constituted the most common cohort group as far as birth weight is concerned. In studies conducted by Robisnson et al (5) in 2017 and Holme et al (1) in 2013, they have included low birth weight and IUGR babies in their study groups whereas Roland et al conducted a study in 2010 on development of at-risk infant intervention system in which they included neonates who had birth weight more than 2.5kg.
As far as risk category is concerned, 26.6% (n=227) neonates had PROM as the most common risk factor followed by MSL without respiratory distress as the next common risk factor including 21.4% (n=183) neonates. Prematurity was present in 147 (17.2%) patients and PROM was again the most common risk factor in the group of premature infants, followed by same of MSL, in 44 and 25 preterm neonates, respectively.
Majority of the neonates with any risk factor were asympyomatic and remained well in the post natal wards. The most common clinical presentation was respiratory distress which contributed to 8.3% (n=71) followed by dullness as the next common presentation which included 4.69% neonates (n=40).Similar results were obtained in a study conducted by Holme et al (1) ,Whereas in study conducted by Ahmed et al (11) in 2013, 79% (19/24) neonates had sepsis as the most common presentation at the time of admission.
In the study conducted by Robinson et al in 2013 on prospective evaluation of Whitt neonatal trigger score out of 455 neonates, 70%(n=319) remained well in the post natal ward requiring no intervention, followed by group 3 (n=83) who required septic screen and

antibiotics but do not require NICU admission. In study conducted by Holme et al in 2013 on retrospective evaluation of new neonatal trigger score, the maximum number (n=292) of neonates belonged to well cohort and required no intervention whereas 193 neonates belonged to unwell cohort.

In our study, a total of 1075 scores were recorded over a period of one year. In our study 683 (80.07%) neonates belonged to group 1 with mean WNTS of 0 ±0, 23(2.7%) neonates belonged to group 2 with mean WNTS of 1 ± 0 whereas 136 (17.23%) neonates belonged to group 3 with mean WNTS of 2.44 ± 0.78. The mean W-NTS was significantly higher in neonates requiring admission in NICU (group 3) and intervention (group 2) as compared to well cohort (group1). All neonates admitted in group 1 and group 2, were discharged. The death rate in study period was 1.29% and all of the expired neonates belonged to group 3. Similar results were obtained by study conducted by Robinson et al (5) with significantly higher scores in neonates requiring admission in NICU (group 1) or intervention (group 3) compared to the well cohort (group 2) (2.2, 2.0 and 0.3, respectively) ($p<0.001$).Whereas in study conducted by Holme et al (1) in 2013 mean NTS was significantly higher for neonates in group 1 (unwell) as compared to group 2 (well) (2.8 and 0.35, respectively).

In our study, septic screen was done in all neonates who were included in group 2 and 3. Out of 62 neonates, 50 neonates had high DLC count and high CRP levels whereas 12 newborns had blood culture proven sepsis. Death rate in our study was 1.29% which was significantly higher in newborns who were included in group 3. Most common cause of death in all these neonates was septic shock.

In our study, we also evaluated cut off scores by ROC analysis and compared them with original Whitts neonatal score. For predicting intervention an overall cumulative cutoff scores of W-NTS was >0.5 was calculated from ROC analysis where area under curve was 0.827±0.013. The cutoff score had a sensitivity 100% and specificity of 82.7% (WNTS cutoff score for intervention had 100% sensitivity and 86.1% specificity). The ROC analysis for predicting intervention with overall W-NTS was statistically highly significant ($p<0.0001$). For predicting admission an overall cumulative cutoff scores of W-NTS was >1.5 was calculated from ROC analysis where area under curve was 0.980±0.012. The cutoff score had a sensitivity 98% and specificity of 100%. (WNTS cutoff score for admission had 82.5% sensitivity and 95.01% specificity). The ROC analysis for predicting intervention with overall W-NTS was statistically highly significant ($p<0.0001$).

This score was designed for early detection of neonates who are at risk of deterioration in post natal ward. We applied this score in our neonatal population and found that this score was very useful to detect sick neonates at an early stage. This score contains 6 parameters which are easy to monitor and can be performed by nurses and paramedical staff.

Limitations

We could not assess the reliability on paramedical staff as they were not included in our study. Further such studies can be performed to monitor such neonates by the paramedical staff. One of the limitations of this score could be the invasive nature of the RBS monitoring and many times, parents are unwilling to participate in the study considering their babies as healthy. Hence, studies can be done in which RBS can be replaced by an alternate parameter such as Spo2 monitoring which is a non invasive method and is easy to perform.

5. CONCLUSION

This study was done to assess the applicability of WNTS score for an early detection of neonates at risk of deterioration in post natal wards. This score has been shown to be highly reliable and easy to perform with a high sensitivity and specificity for an early detection of neonates who are at risk of deterioration.

6. REFERENCES

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