Newborn Observation Track and Trigger (NOTT) Chart

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ABSTRACT

Use of early warning system scores and track-and-trigger charts is widespread in adult and paediatric hospitalized patients; but its use in neonatal group is not well recognized. The authors aimed to develop and implement neonatal observation track-and-trigger chart for use in babies on postnatal wards and to assess its efficacy in identifying neonates in need of urgent medical assessment and intervention. Core group developed Newborn Observation Track and Trigger (NOTT) chart for "At-Risk" and "At-High-Risk" Infants. A decision tree was devised based on 'low', 'medium' and 'high' scores. Sensitivity and specificity of NOTT chart's 'medium' and 'high' score was 96% and 90%, respectively. Positive and negative predictive value was 43% and 100%, respectively. NOTT chart is a valuable tool for assessment of neonates on postnatal wards. A prospective study, using large number of participants, would be beneficial to further corroborate this useful tool.

Key Words: *Newborn.   Trigger chart.   Early warning scores.*

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 hospitalized patient's medical condition. In adult and paediatric population, numerous scoring systems or parameters are in widespread use.[1-6] Two approaches to the timely identification of patients at risk are in common use. First is the use of calling criteria, where patients, meeting one or more specific triggering criteria, are referred (track-and-trigger system). Alternatively, early warning scores, where severity of illness scores combine clinical parameters into a single score and patients with scores greater than a threshold, are identified and referred (early warning observation scores).

In recent years, there has been a growing interest in the development of similar structured scoring system for newborn babies to identify a deteriorating neonate, thus initiating prompt and early medical intervention. Lack of unified normal ranges, for biophysical variables in preterm/term neonates, elucidate problems in formulating a robust scoring system that can be used on the neonatal units (NNU) and postnatal wards (PNW).

We would like to share our experience of developing and implementing Newborn Observation Track and Trigger (NOTT) chart. A consultation process was launched with key stakeholders from NNU and maternity unit. Help was also sought from adult critical care team as well as acute

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care delivery group. A core group, involving local paediatrician, neonatologist, neonatal nurses and midwifery sister, was established to lead the project. The group contacted various neonatal units in different newborn networks in England seeking information if early warning scores or track and trigger system was being developed or already in use. This study was approved by the hospital clinical effectiveness and audit department, thus was judged to be exempt from requiring ethical approval.

In order to assess the effectiveness of the NOTT chart and to determine its efficacy, a service evaluation was carried out from February to August 2013. All admissions to the NNU from PNW during this time period were evaluated. A second set of control data was also collected from all newborn babies on the PNW over a random two-week period, during the first and third week of November 2013.

None of the neonatal units, contacted in Central Newborn Network region, had an established early warning neonatal scoring system. Only two relevant published studies and one abstract were retrieved from Medline search.[7-9] Using available evidence and newborn life support guidelines, the core group reached consensus in developing NOTT chart for newborn babies (Figure 1). Prior to implementing NOTT charts, a comprehensive training program was rolled out which involved neonatal medical/nursing staff and midwives. After a successful pilot project, NOTT chart was formally launched locally on labour ward and PNW, in February 2013.

NOTT chart is used only for babies on postnatal wards who fulfil the risk criteria (Figure 1), which further stratifies the newborns into 'at-risk' and 'at-high-risk' groups. For newborns fulfilling the at-risk criteria, midwifery staff document heart rate, respiratory rate, temperature, colour of the neonate, neurological abnormalities, abnormal noises and staff concern every

Figure 1: Newborn observation track and trigger (NOTT) chart.

Table 1a: Admission to neonatal unit from postnatal ward between February - August 2013.

	Admission to NNU	
	Yes	No
NOTT medium / high score		
Yes	a = 22	b = 0
No	c = 1	d = 0
Sensitivity $\dfrac{a}{a+c}$ = 96%	(95% CI = 78% - 99%)	

Table 1b: Two weeks analysis (42/93 babies qualifying for NOTT chart observation) on postnatal ward in November 2013.

	Admission to NNU	
	Yes	No
NOTT medium/high score		
Yes	a = 3	b = 4
No	c = 0	d = 35
Sensitivity $\dfrac{a}{a+c}$ = 100%	(95% CI = 30%-100%)	
Specificity $\dfrac{d}{b+d}$ = 90%	(95% CI = 76%-97%)	
Positive predictive value $\dfrac{a}{a+b}$ = 43%	(95% CI = 10%-81%)	
Negative predictive value $\dfrac{d}{c+d}$ = 100%	(95% CI = 90%-100%)	

4 hours. Moreover, babies fulfilling at-high-risk criteria also have their blood glucose and saturation monitoring checked in addition to documentation of grunting and recessions. The observations are recorded on colour coded areas which highlight normal parameters (white colour), values just outside the normal range (yellow colour) and significantly outside the normal range (red colour). Four-hourly assessments are continued if all the observations remain normal. Even one observation falling outside the normal range into a yellow box triggers a liaison with the neonatal team or senior midwife for advice. If two observations fall into yellow boxes or one in a red box, neonatal team is urgently summoned to review the baby with a view to low threshold for admission to the NNU.

All admissions to NNU from PNW from February to August 2013 were evaluated. Babies directly admitted to NNU from delivery suite were excluded. There were 24 NNU admissions from PNW during this time period. Most common provisional diagnosis on admission to the NNU was presumed sepsis and 19/24 (79%) babies were commenced on antibiotics. In 23/24 cases, NOTT chart was filled. All but one were in 'medium' or 'high' score category. Based on the need for admission to NNU, sensitivity (Table 1a) of NOTT chart's 'medium' and 'high' score was 96% (22/23).

During the 2 weeks in November 2013, out of 93 babies on PNW, only 42 required NOTT chart observations thus fulfilling at-risk and at-high-risk criteria. Charts and hospital notes of these 42 babies were examined in detail. 7/42 babies scored 'medium' or 'high', out of

which 3 were admitted to NNU. None of the babies who were not on NOTT charts or who scored 'low' on NOTT chart required an admission to NNU. Specificity of NOTT chart's 'medium' and 'high' score was 90%. Similarly, positive and negative predictive values were 43% and 100%, respectively (Table 1b).

This data supports the usefulness of NOTT chart as a valuable tool for assessment of neonates on PNW. It provides a comprehensive assessment check list; and empowers novice trainees, healthcare assistants and midwives by offering clear guidance on when to seek seniors' assistance. It is also a useful tool for information sharing and provides a one-stop solution for unifying all neonatal observations; using objective clinical parameter limits the potential for variability when used by different professionals. However, it is important that all the staff members involved in undertaking assessments using NOTT chart are appropriately trained, capable to understand its clinical relevance, and are able to escalate care appropriately.

Early appropriate interventions are likely to translate into reduced morbidity and mortality, which will improve the quality of care and reduce costs to National Health Service by allowing timely beneficial interventions. A reduction in NNU admissions reduces separation from mothers, encourages breast feeding and improves bonding. At the same time, it allays parental anxiety as they can see that their babies are being regularly monitored in a systematic way. High sensitivity, specificity and negative predictive values validate newly designed NOTT chart's efficacy and potential to detect unwell neonates on PNW and labour ward.

Compared to neonatal trigger score,[8] NOTT chart is only used in at-risk and at-high-risk babies with clearly defined parameters on PNW. Hence, it not only targets neonates with potential risk for deterioration on PNW but also decreases the burden on clinical staff of scoring each and every neonate on labour ward or PNW. In comparison to neonatal trigger score, NOTT chart has much higher sensitivity (79% vs. 96%) and almost similar specificity (93% vs. 90%).

Given its efficacy, the authors believe that NOTT chart has the ability to detect unwell neonates during the early stages of their illness or decompensation. This initial evaluation data recommend its wider use on PNW and labour wards. However, it is acknowledged that this data is limited by a relatively small sample size. Hence, a prospective study, using a large sample size, would be useful to further corroborate our evidence.

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