Original Research Article

Will outlining neonatal near miss events make a change? A hospital based case control study

Nittal H. Ninama[1], Bhavesh D. Shroff[2]*

[1]Department of Community Medicine, Gujarat Medical Education and Research Society Medical College, Himmatnagar, Gujarat, India
[2]Department of Community Medicine, Medical College Baroda, Vadodara, Gujarat, India

*Correspondence:
Dr. Bhavesh D. Shroff,
E-mail: drbhavesh_psm@yahoo.com

ABSTRACT

Background: In paediatrics and neonatology, the term ''near miss'' is mostly used in the situation of adverse events during patient care. Another common use of the term is in the perspective of Sudden infant death syndrome (SIDS). No accepted definition of NNM in this setting currently exists. The definition of Neonatal near miss (NNM) used differently, can aid in assessing and improving obstetric and paediatrics practice in different settings. By identifying those neonates that escaped being apprehended as a death statistic, deficiencies in the services rendered to pregnant women may be addressed and this may lead to further improvement in care.[1]
Methods: The unmatched case control study was conceded in Neonatal intensive care unit (NICU) at Rukamani Chainani Hospital Vadodara. Newborns admitted in NICU, having any one of criteria like birth weight less than 1500, gestational age less than 30 weeks and Apgar score less than 7 at 5 minutes, were defined as Near miss in this study.
Results: Neonatal mortality rate was 22 per 1000 live births during study period, whereas neonatal near-miss rate was 87.6 per 1000 live births. In study groups average duration of stay in NICU was 10 days for neonates.
Conclusions: There must be a scoring system or calculation of infant mortality index events into the system to identify near miss events which help for the restructuring and improvement of care for pregnant women and newborns.

Keywords: Neonatal near miss events, Apgar score, Low birth weight

INTRODUCTION

Mortality in the neonatal period is an important indicator of maternal and child health, reflecting the socioeconomic and reproductive status, especially those related to prenatal care, child birth and new-born care. In recent years, death in the neonatal period have constituted the main component of infant mortality in many regions of the world due to the accelerated decrease in the postnatal component.[2] These deaths are almost entirely preventable, but they still present high rates, with a slow decline.[2,3]

Many systems that score neonatal morbidity exist. The question is whether we can use any of these existing assessments of morbidity to define NNM. Neonatal scoring systems were developed for a variety of uses and some are fairly complicated and cumbersome to use. In the setting of health services in developing countries where improvement in obstetric services are of the utmost importance, they are in most instances neither suitable nor applicable but this practice is fraught with difficulty and the use of scoring systems in this scenario has been limited.[4]

The ideal neonatal scoring system should have the following properties as ease of use, applicability early in the course of hospitalisation, ability to reproducibly predict mortality, specific morbidities, or cost for various categories of neonates and usefulness for all groups of neonates to be described.[5]

Including the near miss cases will have several advantages compared with looking at the mortality only. As the number of ill survivors identified most likely will be approximately four times the number of deaths, conclusions and reporting on maternal care issues will be more rapid. This is true especially where the number of neonatal deaths is low.[6]

The identification of risk factors associated with neonatal near miss may assist planning for the restructuring and improvement of care for pregnant women and newborns, in order to reduce neonatal mortality and there by infant mortality. The reduction of these deaths does not depend on new knowledge, as is the case with other health problems, but on the availability and more effective use of existing scientific and technological knowledge.[7]

This study aimed to identify "Neonatal near miss events" by associated factors, with special attention to assistance care during the prenatal, childbirth and neonatal period.

METHODS

The unmatched case control study was conceded in Neonatal intensive care unit (NICU) at Rukamani Chainani Hospital of Sir Sayaji General (SSG) Hospital, Vadodara for the period of February 2015 to March 2016. Newborns admitted in NICU, having any one of following criteria; birth weight less than 1500, gestational age less than 30 weeks and Apgar score less than 7 at 5 minutes, were defined as Near miss in this study. Mothers of these new-borns were interviewed only after their discharge from NICU and their (newborns) survival from critical condition. Newborns those were not meeting above criteria and delivered at Rukamani Chainani Hospital were taken as controls. Mothers of these newborns were interviewed same as in cases.

The data set of the WHO Multicountry Survey on Maternal and Newborn Health (2010-2011), where the 21% newborn with Apgar score <7 at 5 minute were survived with odd's 0.1667 were used for sampling.[7] As 95% CI and 80% power, sample size was calculated to be 154 including both cases and controls, as per Fleiss with continuity correction factor formula.[8]

The data was collected with the help of a structured questionnaire by only researcher as well as checked for its completeness, quality and internal consistency then entered in Microsoft excel 2010 and analysed using the MedCalc software.

Bias in the study

Possible bias in this study might be recall bias. It may not be possible remove bias completely, but due care was taken to minimise bias.

RESULTS

This study was carried out with objective of calculation of near miss rate and find out factor associated with near miss events in Neonatal intensive care unit (NICU) at Rukamani Chainani Hospital of SSG Hospital, Vadodara. Newborns with one of the following criteria were selected as cases with near miss events that had birth weight less than 1500, gestational age less than 30 weeks and Apgar score less than 7 at 5 minutes

Knowing the sensitivity, specificity and positive likelihood ratio of near miss criteria from the reference studies we accepted these criteria (very low birth weight (<1,500 g), gestational age of less than 30 weeks and an Apgar score of less than 7 in the 5th minute of life) as near miss indicator to calculate near miss rate to identify number of vulnerable neonate which can be saved if appropriate care were given in times and to study factor associated with near miss event. We had collected data from August 2015 to November 2015 at Rukmani Chainani Hospital, Vadodara.

Table 1: Distribution of newborns admitted in NICU according to near miss criteria.

Total live births	2737
Total admitted in NICU	399
<30 weeks	13
No. of babies Apgar <7 at 5 minutes admitted in NICU	169
No. of babies very low birth weight admitted	109
Total near miss events in newborns admitted in NICU during study period	291
Total near miss newborns admitted in NICU during study period	240
Neonatal near miss rate during study period	87.6 per 1000 live births (4 times higher than deaths)
Total no. of deaths during study period	60
Neonatal mortality rate (NMR) during study period	22 per 1000 live births

From near miss events, 80 newborns and their mother were taken as near miss cases and 74 healthy newborns and their mother matched in respect to age and parity were taken as control for them. 6 controls were not found for 6 near miss cases.

Table 1 shows that 291 near miss events occurred in a tertiary care hospital during study period which included 109 newborns had birth weight less than 1500 grams, 169 newborns had Apgar score <7 at 5 minutes and 13 newborns had gestational age <30 weeks at birth which were our neonatal near miss criteria. One neonate might have all three or any two of these criteria present.

Neonatal near miss rate for hospital per 1000 live birth was 87.6, while neonatal mortality rate was 22 per 1000 live birth during study period. Neonatal mortality rate was quite similar to state NMR.

Table 2 and 3 shows that out of the total 80 neonates, 52 had birth weight less than 1500, two had gestational age less than 30 weeks and 34 had Apgar score less than 7 at 5 minutes. It was observed that only 6 cases had following combination of two near miss criteria (birth weight less than 1500 and Apgar score less than 7 at 5 minutes). No neonates had all three criteria together.

Table 2: Distribution of newborns according to near miss criteria in study group.

Criteria	No. of neonates	%
Birth weight less than 1500	52	65
Gestational age less than 30 weeks	2	2.5
Apgar score less than 7 at 5 minutes	34	42.5

Table 3: Combination of near miss criteria in study group.

Combination of criteria	No. of neonates
All three	0
Birth weight less than 1500 and Apgar score less than 7 at 5 minutes	6
Birth weight less than 1500 and gestational age less than 30 weeks	2
Gestational age less than 30 weeks and Apgar score less than 7 at 5 minutes	0

Table 4: Duration of admission in NICU in near miss group.

Duration (in days)	No. of neonates	%
1-7	25	31
7-14	37	46
>14	18	23

Table 4 shows that average duration of stay in NICU was 10 days (SD 5.01) for neonates (median stay was 9 days). 46% neonates admitted in NICU for 7 to 14 days. 18 neonates had duration of stay more than 14 days.

Table 5: Indication of admission in NICU in near miss group.

Indication for NICU admission	No. of neonates	%
Respiratory distress	35	43.7
Very low birth weight and prematurity	28	35
Severe to moderate birth asphyxia	18	22.5
Sepsis	13	16.2
Meconium aspiration syndrome	9	11.2
Jaundice	6	5
Congenital malformation	3	3.7

DISCUSSION

We found that neonatal mortality rate at study hospital was 31 deaths per 1000 live birth and neonatal near miss rate was 86.7 per 1000 live birth during study period.

Out of 80 cases, 70 neonates had birth weight less than 2500 grams. As we took birth-weight less than 1500 grams as near miss criteria, rests were having also birth-weight less than normal. So those neonates with Apgar score <7 at 5 minutes were associated low birth weight.

Out of 80 neonates, 66 had gestational age less than 37 week at birth which is known as pre-term. But out of 66 only 2 neonates had gestational age less than 30 weeks.

Out of the total studied neonates 34 had Apgar score less than 7 at 5 minutes. Among these 19 neonate associated with preterm (gestational age less than 37 weeks) and low birth weight (birth weight less than 2500).

A study carried out by Pileggi et al had used very low birth weight (<1,500 g), gestational age of less than 30 weeks and an Apgar score of less than 7 in the 5th minute of life as neonatal near miss indicators. They found over all neonatal near miss rate was 21.4 neonatal near miss cases per 1,000 live births, ranging from 4.5 to 42.3 cases per 1,000 live births in all health facility.[9] Similarly study done by da Silva et al found NMR and neonatal near miss rate was 11.1 deaths per 1000 births and 39.2 per 1000 live birth respectively.[10]

Neonatal near miss rate found in current study and reference study was about three to four times higher the NMR.

A study done by da Silva et al used birth weight of less than 1,500 g, Apgar score of less than 7 in the 5th minute

of life, use of mechanical ventilation, gestational age of less than 32 weeks and congenital malformations as near miss indicator. With respect to the neonatal near miss indicators, the results yielded 92.5% sensitivity, 97.1% specificity and 97% accuracy, and the positive likelihood ratio was 31.7. The greatest contributing factor for neonatal near miss was the use of mechanical ventilation, since 55.4% of all neonatal near miss cases underwent this procedure. The second most important contributing factor for neonatal near miss was gestational age of less than 32 weeks, while the least important factor was congenital malformation, which was present in only 18% of neonatal near miss cases. The factors as birth weight, Apgar score and gestational age made an additional contribution in 70.1% of the cases that fulfilled the neonatal near miss criteria, while the factors mechanical ventilation and congenital malformation made an additional contribution in 18.6% and 11.2% of cases, respectively.[10]

Another study done by Oliveira et al also shows that the predictive value of death with Apgar <4 varied, according to weight, from 62.74% in the <1,000 g group to 5.5%, in the >3,000 g group.[11]

Hospital based study done by Ike Elizabeth, et al at the SCBU of the UCH, Ibadan Nigeria, which shows that the newborns who weighed less than 1.5 kg died most while there was better survival with increasing weight beyond 1.5 kg. This is evidence that birth weight of the neonate's has an influence on the care outcomes.[12] Similarly Zanini et al also found that low birth weight, 1-and 5-minute Apgar score below eight, congenital malformation were associated with neonatal death in the traditional model in their study.[13]

Study conducted by Basu et al at Banaras Hindu university India, shows APGAR score was found to be a significant variable to predict neonatal mortality.[14] Study done by Lansky et al, was also found consistent result that NMR was high in among children weighing less than 1,500 g born in hospitals without neonatal ICU, those with very low birth weight (<1,500g), extreme prematures (<32 weeks), those with APGAR<7 at the 5th minute of life.[15] Study done by Kadivar, et al concluded that SNAP-PE II and Apgar score at 5 minutes can be used to predict mortality among the NICU patients.[16]

In our study total 399 inborn neonate needed NICU admission during study period out of these 13 (3.2%) neonate were having gestational age <30 weeks, 169 (42.35%) neonates have Apgar score <7 at 5 minutes of life and 109 (27.31%) neonate have birth weight <1500 grams.

In current study main indication for admission in NICU was prematurity and very low birth weight. Other being respiratory distress, birth asphyxia, meconium aspiration syndrome, sepsis, jaundices requiring phototherapy and congenital malformations.

Similar indication for NICU admission was found in studies done by Elizabeth et al, Ahmed et al and Nakimuli et al where prematurity low birth weight, birth asphyxia, grunting respiration were most common.[12,17,18]

However studies done by Iyer et al, Rajab et al and Mmbaga et al most common indication being sepsis, birth asphyxia, prematurity and low birth weight care, respiratory problems and hyperbilirubinemia, congenital anomalies.[19-21]

Looking critically at these studies, it is obvious that prematurity, birth asphyxia and sepsis are among the leading cause of neonatal admission which were largely consistent with the global pattern of neonatal mortality.[6]

Prematurity topping the list of diagnosis on admission in this study confirms Rukamani Chainani Hospital of SSGH as a referral centre both for pregnant mothers and neonates. Neonatal care facilities around and within the town are few, most of them have inadequate facilities and resources for neonatal intensive care in terms of incubators, equipment and staff. Hence most preterm babies are referred to SSGH. Care of premature babies requires specialized equipment, highly trained personnel and financial support. Another reason being was that most of the patients cater to SSGH were belong to low socioeconomic class so they can't afford cost of NICU admission in privet sector.

CONCLUSION

Neonatal mortality rate was 22 per 1000 live births whereas neonatal near-miss rate was 87.6 per 1000 live during study period. We found neonatal near miss rate was four times higher than neonatal mortality. In study groups average duration of stay in NICU was 10 days for neonates. The most common indication for admission at NICU is very low birth weight and prematurity (65%) in the neonates. Other indications were respiratory distress (43.7%), birth asphyxia (22.5%), sepsis (16.2%), jaundice (7.5%), meconium aspiration syndrome (11.2%) and congenital malformation (3.7%).

Recommendations

We recommended that there must be scoring systems or calculation of infant mortality index events into the enquiry system to identify near miss events. Reasons for developing these scoring systems include adjusting mortality in a particular hospital or population to identify high-risk infants who need specific interventions. At the same time identification of risk factors associated with neonatal near miss may assist planning for the restructuring and improvement of care for pregnant women and newborns, integration of near miss events into the confidential enquiry system is advisable for interventions like quality antenatal care, timely screening and referral of pregnant women in to the primary health care system.

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