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Clinical outcomes of the nicu graduates weighing less than 2500 grams in Bihar region

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Abstract
Birth weight is considered the major determinant of neonatal deaths in technologically developed countries. There is a relationship between low birth weight and infant morbidity and mortality. The lower the birth weight, the higher the mortality. The relatively high incidents in the US are considered as a key factor in its higher neonatal mortality rates when compared with other countries. Hence based on above findings the present study was planned for Clinical Outcomes of the NICU Graduates Weighing Less than 2500 Grams in Bihar region.
The Present study was planned in Department of Pediatrics, Darbhanga Medical College & Hospital, Laheriasarai, Bihar. The 25 cases of the NICU graduate weighing less than 2500 gms were enrolled in the present study.
The various antenatal and perinatal risk factors had not shown significant correlation with developmental outcome at one year of age. This could be due to the small sample size and short term follow up of low birth weight babies. Perhaps a larger sample size and long term follow up will yield more conclusive data.

Keywords: NICU graduates, weighing less than 2500 grams, low weight babies, Bihar, etc

Introduction
The birth of a baby is one of the most awe-inspiring and emotional events that can occur in one's lifetime. After nine months of anticipation and preparation, the neonate arrives amid of flurry of excitement. Immediately after birth, the new born make rapid adjustment to successfully adapt to life outside the womb [1].
Newborn period comprises of the first four weeks of extra uterine life. It is an important link in the chain of events from conception to adulthood. The physical and mental well-being of an individual depends on the correct managements of events in the perinatal period. In India almost 7 out of 100 babies do not see their first birthday and nearly 65 % of these infant deaths occur in the neonatal period, namely, the first four weeks of life. The current neonatal mortality rate in India is 45 per 1000 births [2].
In 2007 neonatal mortality rate was 44 per 1000 live births, which accounts for nearly 30 % of total 39 million neonatal deaths world-wide and it accounts for 2/3rd of Infant mortality rate and half of Under 5 Mortality Rate. Two newborns' death occurs every minute in this vast country. India contributes to 25% of the over 10 million Under 5 deaths occurring world-wide each year [3].
Low birth weight may either be due to prematurity or Intra Uterine Growth Retardation (IUGR). Low birth weight and very low birth weight babies require intensive neonatal nursing care from limited resources at a vast expense. Low birth weight is the single most important determinant of neonatal deaths. According to the WHO, babies with a birth weight of 2500g or less should be designated as low birth weight babies. The term – Very low birth weight refers to a birth weight between 1000g and 1500g and extremely low birth weight to a birth weight less than 1000g [4].
According to WHO, some 20 million low birth weight babies are born each year, because of their preterm birth or impaired prenatal growth, mostly in less developed countries. Low birth weight and preterm birth are thus associated with high neonatal and infant mortality and morbidity. Therefore, care of such infants becomes a burden for health and social system elsewhere. In affluent societies, the contributor to low birth weight is preterm birth. The rate has been decreasing due to better Socio-Economic conditions, life style and nutrition. But in less developed countries it is prevailing due to lack of modern technology and shortage of skilled staff. For many preterm infants prolonged medical care is important but, due to lack of technology and shortage of skilled staff, it is not possible.
Birth weight is considered the major determinant of neonatal deaths in technologically developed countries. There is a relationship between low birth weight and infant morbidity and mortality. The lower the birth weight, the higher the mortality. The relatively high incidents in the US are considered as a key factor in its higher neonatal mortality rates when compared with other countries [5].
The magnitude of low birth weight infants in developing world is enormous. Out of a total of 22 million such infants in the world, 21 million belong to the developing countries and India's share is quite substantial: 7 – 10 million. Low birth weight constitutes 30 % of live births in India [6].
A neonate with a birth weight of less than 2500g irrespective of the gestational age are termed as low birth weight babies. High incidents of low birth weight babies in our country are due to higher number of babies with intra uterine growth retardation rather than preterm babies. It is not possible to provide special care to all low birth weight babies, especially in India [7].
Any neonate whose life or quality of existence is threatened is considered to be in a high risk category and requires close

professional supervision. Pre maturity and low birth weight often occur together and both of these factors are associated with increased neonatal morbidity and mortality. The less a baby weighs at birth, the greater are the risk of life during delivery and immediately thereafter [8].

Among the various anthropometric measurements, Birth weight, the weight of the baby within 24 hours of birth, is an important indicator of infant's survival. In India a birth weight of 2500 grams is considered as normal expected weight, a baby weight below 2500 grams is considered as low birth weight¹. Mean birth weight in India is 2800 grams [9].

The recording of the weight at birth is a useful indicator of intrauterine environment and also reflection of health and nutrition, socioeconomic indicator of the mother and also indicator of health status of the nation. Birth weight can also predict regarding survival and useful parameter in predicting the future growth and development of the child. It can be used identifying at risk infants and help in decision making during implementation of the intervention programs. It's useful parameter in measurement of health during the vulnerable periods of life and can serve as useful parameter in measurement of health of the community because it depends on environment and socioeconomic influences.

Many factors influences the birth weight and other anthropometric measurements like, head circumference, chest circumference, mid arm circumference, etc, namely maternal characteristics like age, weight, height, obstretical factors like parity, multiple pregnancy, gestational age, birth spacing, illness during the pregnancy and placental factors. The economic factors, educational status, religion play an important role in determining the birth weight and other anthropometric measurements of the new born.

Low birth weight is defined as birth weight less than 2500 grams irrespective of the gestational age1. Low birth weight is an important determintant of infant mortality. The prevalence of low birth weight in India is around 30 to 40%. The infant mortality rate in low birth weight is higher compared to infant with birth weight more than 2500 grams.

Expected weight of the new born infants born at a given gestational age is estimated from the intrauterine growth charts on observations in live births of mothers delivering at different gestations. Babies with birth weight ranging from 10th to 90th percentile on intrauterine weight for both sexes chart are considered appropriate for gestational age. New born babies with birth weight less than 10th percentile are categorized as small for date. Newborn babies with birth weight more than 90th percentile are categorised as Large for date [9].

Precise estimation of gestational age can be done by assessment of new born's physical and neurological parameters by New Ballard Scoring System [10] Pre term is defined as a baby with gestation of less than 37 weeks, term baby is defined as gestational age between 37weeks to 42 weeks and babies born more than 42 weeks are termed as post term [11].

In developed countries, follow-up for neonatal intensive care unit (NICU) patients is commonly performed at designated clinics [12, 13]. From their inception, NICU-related follow-up clinics have focused on outcomes of premature infants. Some clinics perform follow-up for medical conditions (eg, bronchopulmonary dysplasia, posthemorrhagic hydrocephalus); however, the intent in all NICU-related clinics is to determine neurodevelopmental outcomes. Many clinics do both, especially if the institution is part of a research network [14, 15].

The intent of the NICU-related follow-up should be several-fold. Less-than-acceptable outcomes may result in practice changes within individual NICUs. Most importantly, professionals in the clinic should direct "NICU graduates" to appropriate rehabilitative or social services if they are not aligned with optimal care in their community [16].

The growth of NICU-related follow-up clinics reflects the increase in a population of infants with complex needs. Currently, many neonates born prematurely or with major malformations survive, whereas just a few decades ago, neonates born with these birth defects died.

At the same time, pediatricians and family practitioners have less experience with the advances in NICU care than they did 2-3 decades ago. In addition, current clinical training schedules give pediatric and family practice house staff only limited time to spend in the follow-up care of NICU graduates. The evaluation of preterm and term infants with complex conditions requires the involvement of professionals from multiple medical, rehabilitative, psychological, and social-service subspecialties [17].

Follow-up of extremely low-birth-weight infants (ELBW), who have a birth weight of less than 1000 g, from infancy to adulthood has revealed subtle neurodevelopmental problems that require evaluations and interventions that are more complex than previously appreciated. A retrospective analysis of information on ELBW infants from the National Institutes of Child Health and Human Development revealed that these patients have high use of special outpatient services, and efforts to improve these services are needed [18].

A structured teaching plan must be individualized for the primary caregivers to educate them in the infant's care. Each infant has unique needs, and the education program should be directed at those needs. A checklist is essential to accomplish all of the required teaching needs (e.g., cardiopulmonary resuscitation, gastrostomy feedings, total parenteral nutrition administration, monitor use). The appropriate educators must be identified to provide the training. Research shows that training educators for this activity results in better training of the primary caregivers at home [19].

The goal of this education is to ensure that the parents are capable and confident in caring for their infant at home. It may be appropriate for caregivers to stay overnight and provide care with minimal staff interventions. The staff providing care should not appear overprotective.

Two or more caregivers in the home must receive this training. Having an additional caregiver allows respite for the primary caregiver. A young mother with other small children and no grandmother or husband can be particularly stressed. The role of confounding factors associated with siblings in the home must be considered in the teaching.

For extremely complicated care situations (eg, infants with a tracheostomy), parents should have a rooming-in experience before discharge occurs. This is probably a good practice for all families before they go home with their infant but is especially important for infants who have ongoing, complex problems. Home visits by experienced home health care professionals and/or follow-up telephone calls are essential for the success of the transition process.

Hence based on above findings the present study was planned for Clinical Outcomes of the NICU Graduates

Weighing Less than 2500 Grams in Bihar region.

Methodology

The Present study was planned in Department of Pediatrics, Darbhanga Medical College & Hospital, Laheriasarai, Bihar. The 25 cases of the NICU graduate weighing less than 2500 gms were enrolled in the present study.

All the patients were informed consents. The aim and the objective of the present study were conveyed to them. Approval of the institutional ethical committee was taken prior to conduct of this study.

Following was the inclusion and exclusion criteria for the present study.

Inclusion Criteria: Mothers of Low Birth Weight babies admitted in NICU and Post natal ward, Mothers of Low Birth Weight babies willing to participate in the study.

Exclusion Criteria: Mothers of babies with congenital abnormality, Respiratory Distress Syndrome, Meconium, Aspiration Syndrome and Infection, Mothers of normal neonates, Mothers with post-partum complications.

Results & Discussion

A preterm born infant differ in its needs from the full term born infant even though if he is born without any neurological deficits, and require special care nursery [20]. The extent of the premature infant's adjustment to an environment depends largely on the gestational age and weight of the infant. The neurodevelopmental outcome for infants born prematurely; or for term infants with prenatal or birth complications, depends on the timing of the brain injury as well as on the nature of an insult to the developing brain.

Table 1: Basic Characteristics

Parameters	No. of Cases
Sex	
Males	13
Females	12
Birth Weight	
Less than 1 kg	6
1 to 1.5 kg	9
1.5 to 2.5 kg	10
Gestational Age	
Less than 28 weeks	3
28 – 32 weeks	9
32 – 36 weeks	13
Maternal education	
Literate	19
Illiterate	6

Table 2: Intrapartum/postpartum risk factors

Parameters	No. of Cases
Fetal Heart Rate	
Bradycardia	7
Tachycardia	10
Normal	8
APGAR in 5 mins	
3 – 6	7
More than 6	18

Table 3: Intervention Done

Parameters	No. of Cases
Partial parenteral nutrition	17
Antibiotics	19
Oxygen therapy Fio2>30%	18
Ventilation	7
Phototherapy	2
Exchange transfusion	0

Table 4: Developmental outcome

Parameters	No. of Cases
Gross motor delay	4
Fine motor delay	4
Language delay	6
Social delay	2
Vision impairment	8
Hearing impairment	7
Developmental Quotient(DQ)	9

Birth LBW babies was higher in mothers having weight <45kg. Normal (>2500 Grams) baby were born to mothers having weight < 45kg. This association is found to be statistically significant. This is in agreement with study of Fairley *et al*. [21] Shamsum *et al*. [22] documented that maternal anthropometric parameters such as weight, height, body mass index (BMI), weight gain during pregnancy, nutritional status and socioeconomic status, are some well-established determinants of birth weight of the neonate. Nahar S, *et al*. [23] conducted a study to determine whether maternal anthropometry can predict birth weight, and if so, to identify which cut-off values provided the best prediction of low birth weight in a field situations.

Periodic, sequential examinations over time are the most useful method of determining the developmental outcome of an individual infant [24]. Also gestational age assessment help to predict possible insult and later developmental outcome. Prenatal brain damage may be roughly separated into events during the first half of gestation versus later events as according to Evrard P *et al*. [25].

Neonatal mortality is directly related to birth weight and gestational maturity of the infant. In India it varies from 0.5% in healthy term infants to about 30% in preterm and in infants with a birth weight of less than 2000 g [26].

In 1980, OP GHAI reported in his study found that primi para will have low birth weight babies [27].

In 1981 Leela Raman did a study on influence of maternal nutritional factors affecting birth weight involving 3000 pregnant women. In her study she concluded that 50% of women (Hb <11gms) have anemia and folate defieciency is a greater contributory factor for anemia, mean birth weight is directly related to economic status, maternal weight and maternal height [28].

In 1985, Bhargava SK, Ramji S, Kumar A, Mohan M, Marwah J, Sachdev HP. Conducted a study in 520 neonates to detemine the Mid-arm and chest circumferences at birth as predictors of low birth weight and neonatal mortality in the community. They concluded that Mid-arm and chest circumferences are simple, practicable, quick, and reliable indicators for predicting low birth weight and neonatal

outcome in the community and can be easily measured by paramedical workers in developing nations [29].

In 1987 M.S. Kramer, WHO Study was done in detail about determinants of low birth weight and finally concluded that multiple factors are associated with Low Birth Weight like age, parity, Socio economic Status, Literacy, infant sex, toxic exposure, pregnancy weight gain etc [30].

In 1995 Catalano *et al.* did a study at Department of Obstetrics and Gynecology, University of Vermont College of Medicine, Burlington, USA on 183 Single ton new borns and found that Compared with females, males had greater birth weight ($p = 0.009$) and fat-free mass ($p = 0.0001$) but not fat mass [31].

In 2004 D Acharya, K Nagaraj, N S Nair, H V Bhat did a a case control study on 303 singleton infants in udupi district Karnataka to determine the maternal determinants of intrauterine growth retardation. In their study they found that maternal height (less than 145 cms), maternal weight (less than 45 kilo grams), body mass index less than 18.5, and anemia in pregnancy were significant risk factors of intrauterine growth retardation [32].

Perfusion failures caused by placental, embolic, and other factors are more common in the second half of gestation and lead to conditions such as; Hydranencephaly, Destructive microcephalies and Periventricular leukomalacia. Cerebral convolutions first appear in the fetal human brain during the fifth month of gestation and continue to develop into the first postnatal year. During the sixth and seventh months of gestation, the cerebral cortex remains largely underdeveloped with smooth surfaces quite uncharacteristic of the full term brain with its many cerebral cortical convolutions.

Nurses should actively involve in early identifying the anxiety among the mothers and support the mothers to prevent further complications. They should also encourage the family members to support the mothers during the stay of their neonates in NICU. Early identification of anxious mothers of neonates is indicated to promote optimal developmental outcomes.

The birth and subsequent hospitalization of a neonate evokes considerable psychological distress in mothers. The study findings conclude that mothers whose neonates are admitted in NICU exhibit high levels of anxiety during their neonate's hospitalization. Maternal anxiety in the NICU predicted to have adverse interactive behaviors when the children are 24 months corrected age [33]. Early identification of anxious mothers in the NICU is needed in order to initiate preventive intervention to support the mother–infant relationship Also early identification of anxiety level in the mothers has implications for the support of mothers during hospitalization of their newborns. These results have implications for policy development in order to enhance family centered care and family support groups in the neonatal intensive care.

Conclusion

The various antenatal and perinatal risk factors had not shown significant correlation with developmental outcome at one year of age. This could be due to the small sample size and short term follow up of low birth weight babies. Perhaps a larger sample size and long term follow up will yield more conclusive data.

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