Original Article

Measurements of Rates and Parameters in Newborn Babies Fit for Discharge at a Tertiary Hospital in North-Western Nigeria

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Abstract

Introduction: The arrival of a newborn brings a mixture of excitement and anxiety, due to a wide variation in physical and physiologic findings. Neonatal morbidity and mortality remain alarmingly high in North-western Nigeria, and failure to recognize a sick neonate that needs medical attention contributes to these dire statistics. Therefore, an understanding of the variations of newborn parameters allows health-care personnel to address families' concerns and support parents. **Materials and Methods:** The study was a retrospective descriptive review of birth records, of live neonates delivered at a tertiary hospital who were referred for a pediatrician's assessment and subsequently certified stable and fit for discharge. Their parameters were described, and sub-groups were compared. **Results:** There were 224 newborns examined, with a male:female ratio of 1:1.1. Majority (99.1%) of the babies were examined within 24 h of life, and the mode of delivery was through cesarean section in 70.1% of the newborns. Their mean gestational age was 39.3 (±1.2 standard deviation [SD]) weeks, with 37 (16.5%) late preterm and 187 (83.5%) term babies. They had birth weight 3.1 kg (±0.6 SD) and 2.6 (±0.6 SD), $P = 0.0001$; length 49.2 cm (±2.9 SD) and 47.0 (±3.0 SD), $P = 0.017$; occipitofrontal circumference 34.6 cm (±1.7SD) and 33.6 (±1.3 SD), $P = 0.001$; respiratory rate 52 (±12 SD) and 54 (±14 SD), cycles (cpm) $P = 0.291$; heart rate 141 (±13SD) and 145 (±15SD) beats (bpm), $P = 0.129$; for the term and late preterm babies, respectively. **Conclusions:** Referred newborns who were assessed and certified stable and discharged, had comparable parameters, with average respiratory rate of 51 cycles, and heart rate of 140 beats. There were no statistical differences in the vital signs between late preterm and term newborns.

Keywords: Discharge, heart rate, newborns, respiratory rate, stable infant

Introduction

The delivery of a newborn brings a lot of excitement to families but can sometimes be a cause of extreme anxiety. This is due to the wide variations in the physical and physiological findings in a normal newborn. These variations result partly from the changes the newborn undergoes as it adapts to extra-uterine life and partly due to other factors such as mode of delivery, maternal medications during labor, and/or other premorbid factors. There is a very high neonatal morbidity and mortality, particularly in North-western Nigeria due to perinatal asphyxia, prematurity, and neonatal sepsis among the numerous causes.[1-4] Failure to recognize a sick neonate that needs medical attention can lead to catastrophic consequences, and many newborns have been shown to die within the first 24 h of life.[3] On the other hand, anxiety and apprehension over a newborn's condition can lead to unnecessary treatments and potential harm. Therefore, it is the understanding of variations in newborn parameters, that allows the pediatrician to institute interventions or re-assure families and help support them in their roles of taking care of the newborn.[5]

The assessment of a newborn by a pediatrician should take place within the first 24 h, but it is not uncommon for such examinations to occur up to 72 h after delivery, especially where there is limited access to health care.[5-7] Similarly, sick newborns have been shown to be admitted to hospital from the 1st h of life onward, depending on proximity to medical services and the underlying morbidities.[8,9] Therefore, it is not uncommon for newborns to be referred to a pediatrician

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for assessment, if such was not available after the delivery. Under research conditions, newborn measurements have been published from as early as 30 min, while the large multi-center fetal and newborn study, INTERGROWTH-21st project had measurements taken at 12 h of life.[10,11]

Literature abound on newborn anthropometry, comprising but not limited to weight, length,[6,7,12] chest circumference, head circumference;[13] abdominal circumference;[10] and various other proportions. A plethora of guidelines exist describing ranges considered to be normal for these newborn parameters, with some studies describing the normal newborn's vital signs parameters such as temperature, heart rate, or respiratory rate.[14]

Study objectives

The current study set out to document the parameters of stable newborn babies, born in a tertiary hospital of North-Western Nigeria that were referred and examined by a pediatrician and subsequently certified stable and fit for discharge to their mothers. The objectives of the study were to describe the anthropometry and vital signs of these newborn babies and to compare the parameters based on gender, gestational age, and modality of birth categories.

Materials and Methods

The study was a retrospective and descriptive review of birth records of neonates delivered and referred for a pediatrician's assessment at a tertiary hospital of North-western Nigeria. The records covering a period of 12 calendar months were manually retrieved. The search criteria were newborns who were examined by a pediatrician and did not require resuscitation or hospitalization after delivery, were certified stable, and fit to be discharged to their mothers for essential newborn care. All newborn chart records of babies referred to the pediatrician over a 12-month period were retrieved and those which met the study criteria were collated and subsequently reviewed. Information extracted from the charts was gestational age category of the infant, anthropometry, sex, vital signs, and age at the time of examination. The Ballard score was used to determine the babies gestational age based on maturity of the nervous system and physical appearance.[15]

Babies with an estimated gestational age (EGA) of 35–37.9 weeks were classified as late preterm, while those with EGA 38–41.9 weeks were classified as full term. All other babies with any morbidity necessitating observation in the newborn unit and/or treatment of any form were excluded from the study.

The study was conducted according to ethical principles as stated in the Helsinki declaration of 1975, as revised in 2000. Ethical approval was granted by the Health Research and Ethics Committee. There were 749 birth records during the study period, of which 224 fulfilled the inclusion and exclusion criteria for the study. The results were summarized in simple proportions, means and standard deviations (SDs). The comparisons of continuous variables were made using unpaired Student's *t*-test, whereas discrete variables were compared using the Chi-squared test. $P < 0.05$ was chosen as a significant difference between the variables.

Results

Out of the 224 newborn records analyzed, there were 108 (48.2%) males, and 116 (51.8%) females, with a male:female ratio of 1:1.1. Majority (99.1%) of the babies were examined in the first 24 h of life, with 126 (56.3%) examined within the 1st h of life and 96 (42.8%) were examined between the 2nd and 24th h of life. Only 2 (0.9%) were examined between 25th and 36th h of life.

Mode of delivery was through cesarean section (CS) in 157 (70.1%) of the newborns, instrumental vaginal delivery (IVD) in 4 (1.8%) and spontaneous vaginal delivery (SVD) in 63 (28.1%). For the CS and IVD combined, 113 (50.5%) were examined in the 1st h of life, whereas 48 (21.4%) where examined from the 2nd h of life onwards. On the other hand, 13 (5.8%) of the SVD were examined in the 1st h, whereas 50 (22.3%) were examined thereafter; Chi-square test 45.178, $P = 0.0001$.

The modal Apgar scores were 8, 9, and 10, at the 1st, 5th, and 10th min, respectively. The EGAs of the newborns ranged from 36.0 to 42.0 with a mean of 39.3 (±1.2 SD) and 37 (16.5%) were late preterm, whereas 187 (83.5%) were term babies. There were also 42 (18.8%) low birth weight babies with weights ranging between 2.0 and <2.5 kg while 166 (74.1%) weighed between 2.5 and <4.0 kg and 16 (7.1%) had weights of 4.0–4.55 kg.

Table 1 shows the averages of the parameters for all the newborns and compares the means between the two genders, gestational age categories, and modes of delivery.

The table shows that males in the study had a slightly higher mean weight, length, occipitofrontal circumference (OFC), and respiratory rate. However, only the differences in OFC was statistically significant, $P = 0.037$. Females, on the other hand, had a slightly higher mean anterior fontanelle. This difference was not of statistical significance.

The term babies had higher mean weights ($P = 0.0001$), lengths ($P = 0.017$), and OFC ($P = 0.001$) as compared to the late preterm groups. Conversely, the late preterms had higher mean respiratory rates ($P = 0.291$) and heart rates ($P = 0.139$), but these differences were not statistically significant.

The babies born through normal vaginal delivery had lower mean weight, length, OFC, posterior fontanelle, respiratory rate, and heart rate compared to other delivery methods. However, only the differences in weights and posterior fontanelles were statistically significant, $P = 0.003$ and 0.007, respectively.

None of the babies had cardiopulmonary, gastrointestinal, or neurological abnormalities observed. In addition, primitive

Table 1: Comparison of the parameters for stable and fit newborns according to gender, gestational age category and mode of delivery

Parameter	Mean (±SD) (*n*=224)	Male (*n*=108), mean (±SD)	*P*, male versus female	Female (*n*=116), mean (±SD)	Term (*n*=187), mean (±SD)	*P*, term versus late preterm	Late preterm (*n*=37), mean (±SD)	SVD (*n*=63), mean (±SD)	*P*, SVD versus CS/ID	CS/ID (*n*=161), mean (±SD)
Weight	3.1 (±0.6)	3.1 (±0.6)	0.076	3.0 (±0.6)	3.1 (±0.6)	0.0001	2.6 (±0.6)	2.8 (±0.6)	0.003	3.1 (±0.5)
Length	48.9 (±2.8)	49.1 (±2.9)	0.286	48.7 (±2.9)	49.2 (±2.9)	0.017	47.0 (±3.0)	48.1 (±3.5)	0.072	49.1 (±2.6)
OFC	34.5 (±1.7)	34.8 (±1.6)	0.037	34.3 (±1.7)	34.6 (±1.7)	0.001	33.6 (±1.3)	34.2 (±1.5)	0.071	34.7 (±2.0)
Anterior fontanelles	3.3 (±1.1)	3.2 (±1.2)	0.668	3.3 (±1.1)	3.1 (±1.0)	0.831	3.1 (±1.3)	3.5 (±1.2)	0.088	3.2 (±1.1)
Posterior fontanelles	0.8 (±0.7)	0.8 (±0.7)	0.903	0.8 (±0.7)	0.9 (±0.7)	0.341	0.6 (±0.7)	0.7 (±0.6)	0.007	0.9 (±0.7)
Respiratory rate	51 (±12)	52 (±13)	0.493	51 (±12)	52 (±12)	0.291	54 (±14)	49 (±11)	0.056	52 (±12)
Heart rate	140 (±13)	141 (±13)	0.931	141 (±14)	141 (±13)	0.139	145 (±15)	139 (±14)	0.174	149 (±13)

SVD: Spontaneous vaginal delivery, CS: Cesarean section, ID: Instrumental delivery, OFC: Occipito-frontal circumference. SD: Standard deviation

reflexes were assessed to be optimum in all babies. After the initial assessments, all the babies examined were diagnosed as stable and fit and subsequently discharged to their mothers' care.

Discussion

The study showed that a large proportion of the babies had their newborn examinations conducted within the first few hours of life, in keeping with best practices and standards of care for newborns.[5] This may be explained by the study finding that majority of the babies were delivered via CS, a mode of delivery commonly associated with high risk pregnancies which may also dictate the need for early newborn assessment and presence of a pediatrician at delivery. On the other hand, babies delivered via SVD are usually low risk and mostly normal deliveries. Hence, the timeliness for a pediatrician's assessment for the SVD may not be considered urgent as the case for the CS deliveries.

Majority (70%) of the deliveries were by CS, as the hospital, being a tertiary facility, was more likely to receive referrals and care for high risk and complicated pregnancies, as well as the care for normal uncomplicated pregnancies. It is not routine for normal vaginal delivery babies to be referred for assessment, unless there is a concern raised by the midwife or the parents, unlike the high-risk babies that routinely must be referred for assessment. This could explain the apparent skewness of the mode of delivery from the study, although it only reflects the proportion of babies referred to the pediatrician, not the entire deliveries conducted in the study site during the study period. Studies on babies delivered through CS have shown that a lot of these babies do not require active interventions or treatment after delivery, even though in another study, CS was an independent risk factor for neonatal distress and admission to intensive care.[8,16] Hence, it is not out of place that the babies in the present study were found to be stable, and did not require any interventions, and hence were discharged to their mothers.

A study using electrocardiography described the normal heart rate of newborns to be 120–160 bpm.[14] The documented heart rates in the present study were found to be within this range across all the comparison groups. In another study, newborns with respiratory rates above 60 cycles or below 30 cycles, and/or heart rates >160 beats or <120 beats usually required hospitalizations for underlying morbidities.[8] However, the average rates obtained in the present study do not correspond to these values. Thus, it can be assumed that the present study subjects had apparently normal heart rates and respiratory rates.

The vital signs for the late preterm and term neonates were quite similar, with no statistically significant difference, even though one might be tempted to expect a disparity between the two groups given the lower gestational age of the late preterms. However, at this age, lung maturity is expected to have been achieved and therefore such babies could have optimum respiratory functions. Indeed, studies have shown that late preterms have an equal likelihood of survival as term infants, in the absence of other comorbidities.[9]

Unsurprisingly, there were statistically significant differences in the anthropometry between the two groups. It is a well-established fact that babies born at term attain higher somatic growths compared to preterms, in the absence of other comorbidities.[17-19] Similarly, the study showed males to be heavier, longer and with larger heads compared to the females. These are in keeping with already established growth charts, although only the differences in head size were statistically significant.[17] However, there were no significant differences between the two gender groups or the different modes of delivery with regard to the vital signs obtained from the study.

The birth weights, lengths, and occipito-frontal circumferences of babies in this study are similar to the values reported from Sudan and Karachi.[7,12] All these studies including the present one showed males to have higher anthropometry compared to the females. This similarity is probably a reflection of the biologic differences between the groups given the consistency of this finding across different growth charts.

Conclusions

Newborns who were referred for pediatrician's assessment at the study site and certified to be stable and fit for discharge, had comparable parameters, with average respiratory rate of 51 cycles, and heart rate of 140 beats/min. There were no statistical differences in the vital signs between late preterm and term newborns. These data are important and can serve as a guide for health workers to triage newborns and develop red flag signs for referral of babies to secondary care.

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Conflicts of interest

There are no conflicts of interest.

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