Epidemiology of Apnea in Preterm Neonates Admitted to the Neonatal Intensive Care Unit of French Medical Institute for Mothers and Children Hospital in Kabul City: An Analytic Cross-Sectional Study.

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Abstract

Background: Prematurity is one of the leading causes of neonatal death in Afghanistan and complicates a lot of serious problems including apnea. Although recurrent and prolong apnea may be directly or indirectly associated with significant adverse outcomes, there isn't enough scientific information regarding the incidence and pattern of this problem in Afghanistan, therefore, this study is performed to obtain such information.

Objective: To find the incidence rate and pattern of apnea in premature neonates admitted to the Neonatal Intensive Care Unit of the French Medical Institute for Mothers and Children Hospital, Kabul City.

Method: This analytic cross-sectional study was conducted at the Neonatal Intensive Care Unit of the French Medical Institute for Mothers and Children Hospital in Kabul city, Afghanistan. All the preterm babies admitted during the study period were included in this research. Statistical analysis was performed by SPSS 20.

Results: A total of 75 preterm newborns were enrolled in this study and the apnea attacks were developed in 48% of them. Extremely low birth weight preterm neonates had a 71.4% incidence rate of apnea, while in very low birth weight and low birth weight the rates were 47.4% and 36.4% respectively. Based on gestational age, the incidence rates of apnea in the early and moderate preterm neonates were 55.6% and 52.8% respectively, whilst also in late preterm neonates it was 42.8%. The apnea appeared more prevalent in boys (54.3%) than girls (45.7%). The median ages for the onset and duration of apnea were 2 and 6 days respectively. The preterm neonates in the apnea group versus the non-apnea group had the mean birth weight of (1233.33 ± 235.25 g vs 1333.46 ± 274.44 g, 90%CI= -198 _ -1.4) and mean maternal age of (24.78 ± 3.68 y vs 26.62 ± 4.58 y ,90%CI= -3.44_-0.23).

Conclusion: The overall incidence rate of apnea in preterm neonates was 48% and the highest rates were seen within extremely low birth weight and early preterm neonates. In most cases, the apnea has commenced on the second day of life and has lasted for six days. The lower neonatal birth weight and young maternal age were found to be the risk factors of apnea in preterm neonates.

Background

Globally, about 2.4–2.8 million neonates died in 2017 and during this period south Asia and Africa had the highest neonatal mortality rate.^{1, 2} The neonatal mortality rate in Afghanistan is one of the highest in the world and it reported by UNICEF in 2019, 37 deaths per 1000 live births.^{3, 4} Prematurity, defined as neonate delivered before 37 weeks of gestation, is one of the major causes (35%) of early neonatal mortality in Afghanistan.^{5, 6} Apart from high mortality, Prematurity is also an important cause of neuromotor disability. It has been estimated that 15 million preterm babies are born worldwide every year.^{2, 6} Birth weight less than 1500g is classified as low birth weight.⁶

Apnea is defined as a cessation of breathing for 20 seconds or longer or a shorter pause accompanied by bradycardia (< 100 beats per minute), cyanosis, or pallor. In practice, many apneic events in preterm infants are shorter than 20 seconds. Approximately, all infants born at ≤ 28 weeks gestation have apnea; beyond 28 weeks gestation, the proportion of apnea decreased, from 85% at 30 weeks gestation to 20% at 34 weeks gestation.^{7, 8}

Apnea or cessation of respiration is an important cause of mortality and brain damage in immature babies especially those with a gestation of fewer than 34 weeks or weight less than 1500g.⁹ It is due to the immaturity of the central nervous system (apnea of prematurity) or secondary to other causes such as metabolic disturbances.^{10, 11} The prevalence of apnea in neonates with very low birth weight who admitted to NICU of the Aditya Hospital of India was 44%.¹² In the NICU of Enugu State University Teaching Hospital, South-East Nigeria, the prevalence of recurrent apnea was reported 84%, 47%, and 15% in ELBW, VLBW, and LBW neonates respectively.¹³ The incidence of apnea in preterm infants increase with low gestational age and birth weight of the newborn infants.^{14, 15}

Despite high neonatal mortality due to prematurity and its complications, there is not enough scientific information regarding the epidemiology of apnea in preterm newborns of Afghanistan.

The present study was carried out to find the incidence rate and pattern of apnea in preterm neonates who were admitted to the Neonatal Intensive Care Unit (NICU), French Medical Institute for Mothers and Children (FMIC) Hospital, Kabul City. Such information is highly required for better neonatal care, generation of hypotheses, further researches, and health policymaking.

Method And Material

Study Design, Setting, and Population:

We conducted an analytic cross-sectional study in the Neonatal Intensive Care Unit (NICU), French Medical Institute for Mothers and Children (FMIC) Hospital, Kabul City during July-December 2019. The study population comprised of preterm neonates (infants up to 28day old) with weights less than 2500g.

Inclusion criteria and Exclusion criteria:

The neonates with a gestational age of fewer than 37 weeks and birth weight less than 2500g were enrolled in this study. As we studied apnea due to primary and secondary causes in preterm neonates, therefore, no cases were excluded.

Sample size and sampling strategy:

All preterm neonates (75) admitted to the NICU of the FMIC hospital during the last six months of 2019 were studied by the census sampling method.

Variables:

Main variables are:

- The birth weight of neonates in gram was determined by accurate balance during the first 24hr of life. According to the birth weight the neonates were classified as low birth weight (1500-2500g), very low birth weight (1000-1500g), and extremely low birth weight (less than 1000g)
- The gestational age of neonates in weeks was determined by Last Menstrual Period (LMP) or antenatal maternal ultrasound or neonatal heel-toe distance. Prematurity was defined as birth occurring at less than 37 weeks of gestational age and was classified as early (less than 32 weeks of gestation), moderate (32-34 weeks of gestation) and late (34-37 weeks of gestation).
- The apnea was defined as a cessation of breathing for 20 seconds or longer or a shorter pause accompanied by bradycardia (<100 beats per minute), cyanosis, or pallor. The attacks of apnea were detected by continuous cardio-respiratory monitor and clinical examination.
- The maternal age in year, type of delivery (vaginal or cesarean), and parity was defined as the number of birth with the gestational age of more than 20 weeks.

Data collection tools & Statistical analysis:

Initially, raw data were collected in data collection sheets and then entered in SPSS 20 software for statistical analysis. For detecting the significance level and comparing the mean of normally distributed data, independent t-test and for non-normally distributed data Mann-Whitney test were used. Chi-square test and Binary Logistic Regression were performed for dichotomous independent variables. We accepted a power of 80% and an alpha error of 0.1 so the p-value less than 0.1 is significant.

Results

Seventy-five preterm newborn babies were evaluated for the incidence and pattern of apnea at the Neonatal Intensive Care Unit (NICU) of French Medical Institute for Mothers and Children (FMIC) Hospital, Kabul City. The baseline characteristics of the mentioned preterm neonates are described in Table-1. As shown in Table-2 the overall incidence rate of apnea in premature newborn babies was 48% and the highest incidence rates were seen within groups of ELBW and early preterm infants. The mentioned data also describes, such apnea usually appeared on the second day of life and continued for one week.

After the comparison of data between apnea and non-apnea groups, as shown in [Table-3], the lower mean neonatal birth weight and mean maternal age had a significant association with the development

of apnea in preterm neonates. The neonatal age, sex, gestational age, number of delivery, and mode of delivery had no statistically significant relationship with the occurrence of apnea in such infants. However, the risk of mortality was higher in the non-apnea group but such finding wasn't statistically significant.

Discussion

The current analytic cross-sectional study revealed the incidence and figures of apnea in preterm neonates admitted to the NICU of the French Medical Institute for Mothers and Children Hospital, Kabul City. Based on the results, the overall incidence rate of apnea in preterm neonates was 48% and the highest rates were demonstrated within groups of ELBW and early preterm neonates, 71.4% and 55.6% respectively. The apnea was more prevalent in boys than girls. The attacks of apnea usually commenced during the second day of life and sustained for a median age of six days. [Table-2]. The current study also found a relationship of neonatal birth weight and maternal age with the occurrence of apnea in preterm neonates [Table-3]. It means a lower neonatal birth weight and younger maternal age increase the chance of apnea in such newborn babies.

Shinde R et al conducted a retrospective observational study on VLBW neonates admitted to NICU of Aditya Hospital, Hyderabad of India. According to the result of this study, the prevalence of apnea in very low birth weight was 44%.¹² Chidiebere et al were carried out a prospective study at the Neonatal Intensive Care Unit (NICU) of Enugu State University Teaching Hospital, South-East Nigeria. The prevalence of recurrent apnea was demonstrated 20% and 14% in VLBW and LBW neonates respectively.¹³ Henderson-Smart reported an incidence of 85% in premature infants born at 30 weeks, with a subsequent decrease to 20% in those born at 34 weeks.¹⁵ Compared to the studies of Shinde R et al, Chidiebere et al and Henderson-Smart et al, the current study found higher incidence rates of apnea within groups of LBW and VLBW premature infants [Table-2]. This difference may be attributed to the higher prevalence rate of prematurity and associated factors of apnea in preterm neonates of our country.

The study of Henderson-Smart concluded, the attacks of apnea usually initiated in the first 2 days of life¹⁵ which is the same as the finding of the index study [Table-2]. Ogunlesi et al conducted a retrospective study at the Olabisi Onabanjo University Teaching Hospital of Nigeria. This research found a significant relationship between neonatal birth weight and incidence of apnea in newborn infants.¹⁶ The association of fewer birth weight with apnea in preterm neonates was also detected in our study. Therefore, the findings of both studies are similar. The current study also uncovered an association of young maternal age with apnea in preterm neonates [Table-3]. Fuchs et al performed a large cohort study and revealed that younger women (20–24 years) had an increased risk of premature deliveries (aOR = 1.08, 95% CI 1.01–1.15).¹⁷ As the younger maternal age is a risk factor of preterm birth, it may also explain the increased risk of apnea in such an infant group.

Conclusion

The current study demonstrated, the overall incidence rate of apnea in preterm neonates was 48% and the highest rates appeared within groups of extremely low birth weight and early preterm newborns babies. Usually, the apnea has been initiated on the second day of life and has continued for one week. The lower neonatal birth weight and maternal age were the risk factors of apnea in preterm neonates. However, the incidence of mortality was higher in the non-apnea group, such finding wasn't statistically significant. These findings are most useful for better neonatal care, the generation of hypotheses, further researches, and health policymaking.

Abbreviations

ELBW: Extremely Low Birth Weight

FMIC: French Medical Institute for Children and Mother

LBW: Low Birth Weight

LMP: Last Menstrual Period

NICU: Neonatal Intensive Care Unit

VLBW: Very Low birth weight

Declarations

Ethics approval and consent to participate:

This study was approved by the Department of Neonatology (Protocol no 5 dates 3/2/2021), Kabul University Medical Science, and the Ethical Board of FMIC hospital. Although, this was an observational study and the data were obtained from the patient documents, verbal consents was taken from patients' guardians for participating in this study. The Helsinki Declaration was taken into consideration and all the personal information remained anonymous.

Consent for publication:

Not applicable.

Availability of data and materials:

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Competing interests:

The authors declare they have no interest of conflict.

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We performed this study without any fund.

Authors' contribution:

Conceptualization, design, data analysis, manuscript drafting, editing and reviewing was performed by the first author. The second author designed the data collection instruments, collected the data and revised the manuscript. The third author coordinated and supervised data collection. The final report was approved by all authors.

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Accordance:

All methods were performed in accordance with the relevant guidelines and regulations.

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Tables

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