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Epidemiology of Neonatal Apnea in Sharqia Governorate, Egypt

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ABSTRACT
Background: Apnea is defined as the cessation of airflow. Apnea is pathologic when absent air flow is prolonged (usually 20 seconds or more) or accompanied with bradycardia. **Objective:** The aim of the current study is to describe the epidemiological characteristics of neonatal apnea and its association with other diseases.
Patients and methods: A descriptive study was conducted on 100 neonates admitted at Neonatal Intensive Care Unit (NICU) of Zagazig University Hospital. Participants were admitted at NICU between June 2021 and June of 2022. Study variables were age, sex, weight and primary disease group. **Results:** Regarding the associations between neonatal apnea and primary disease, it was found that 60% of the studied cases were premature. Hypoxic-ischemic encephalopathy was observed in 16% of the included neonates, and respiratory distress in 60% of them. Gastro-oesophageal reflux disease and neonatal sepsis were observed in 2% and 4% of the studied cases, respectively.
Conclusion: Our results show high association between neonatal apnea and prematurity and respiratory distress, and to lesser extent to hypoxic-ischemic encephalopathy and gastro-oesophageal reflux disease and neonatal sepsis.
Keywords: Neonatal Apnea, Prematurity, Gastro-oesophageal reflux disease, Neonatal sepsis Epidemiology.

INTRODUCTION

Apnea is defined as the cessation of airflow. Apnea is pathologic when absent air Flow is prolonged (usually 20 seconds or more) or accompanied by bradycardia (heart rate <100 beats per minute) or cyanosis. Bradycardia and cyanosis are usually present after 20 seconds of apnea, although they can occur more rapidly in the small premature infant [(1)]. Bradycardia is associated with apnea in more than 95% of cases [(2)].

An oxygen saturation level less than 85% is considered pathologic in this age group. In all cases, the decrease in saturation should persist for at least 5 seconds [(3)]. After 30 to 45 seconds, pallor and hypotonia are seen, and infants may be unresponsive to tactile stimulation. Apnea of infancy (AOI) occurs when apnea persists in a neonate older than 37 weeks after conception.The physiologic aspects of apnea of prematurity (AOP) and AOI coincide [(4)].

The aim of the current study is to describe the epidemiological characteristics of neonatal apnea and its association with other diseases.

PATIENTS AND METHODS

A descriptive study was conducted on 100 neonates admitted at Neonatal Intensive Care Unit (NICU) of Zagazig University Hospital. Participants were admitted at NICU between June 2021 and June of 2022.

Patients were selected on the basis of the following inclusion and exclusion criteria:

Inclusion criteria: All cases with proved diagnosis of neonatal apnea.

Exclusion criteria: Cases who not suffering from apneal attack.

Methodology:

All neonates incorporated in this study were subjected to the following: **A.** Careful **history taking:** regarding disease history and associated symptoms; all cases suffering from cessation of breathing for more than 20 second.

B. Thorough **clinical examination:** to search for CNS, Cardiac, respiratory, GIT, and hematological manifestations.

C. Laboratory investigations: CBC, CRP, ABG, etc.

D. Radiological investigations: Chest X-ray, Cranial U/S (suspected cases), and gastrgraphin (suspected cases).

Ethical Consideration:

The Ethical Institutional Review Board at Zagazig University approved the study. After explaining our research objectives, written informed consent was obtained from all study participants. This study was conducted in compliance with the code of ethics of the world medical association (Declaration of Helsinki) for human subjects.

Statistical Analysis

The collected data were introduced and statistically analyzed by utilizing the Statistical Package for Social Sciences (SPSS) version 20 for windows. Qualitative data were defined as numbers and percentages. Pearson Chi-Square test, Fisher's exact test and Chi-Square for Linear Trend were used for comparison between categorical variables as appropriate. Quantitative data were tested for normality by Kolmogorov-Smirnov test. Normal distribution of variables was described as mean and SD, and independent sample t-test was used for comparison between groups. P value ≤ 0.05 was considered to be statistically significant.

RESULTS

Table 1 shows the association between neonatal apnea and age where 74% of them were 1 day of age. The results shows increase frequency of neonatal apnea among newborn in early age.

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Table (1): Association between neonatal apnea and age

Apnea / Age/day	Frequency	Percent	Chi-square	P-value
1	74	74		
2	8	8		
3	2	2		
4	4	4		
5	6	6	23.04	0.001
6	2	2		
9	2	2		
29	2	2		
Total	100	100		

Table 2 shows the association between neonatal apnea and sex. The results show increase frequency of neonatal apnea among male newborn more than female newborn.

Table (2): Association between Neonatal apnea and sex

Apnea / Sex	Frequency	Percent	Chi-square	P-value
Female	36	36		
Male	64	64	7.84	0.005
Total	100	100		

Table 3 shows the association between neonatal apnea and weight where 6% of them were <1 kg and 48% of them were 1-1.5 kg. These results shows increase frequency of neonatal apnea among newborn with low birth weight (P =0.000).

Table (2): Association between neonatal apnea and weight

Apnea / Weight/kg	Frequency	Percent	Chi-square	P-value
0.60	2	2		
0.80	2	2		
0.90	2	2		
1.00	6	6		
1.10	10	10		
1.20	6	6		
1.25	2	2		
1.30	8	8		
1.40	2	2		
1.45	2	2		
1.50	12	12		
1.60	2	2		
1.70	8	8	36.64	0.001
1.80	2	2		
2.00	4	4		
2.20	4	4		
2.50	10	10		
2.90	4	4		
3.00	6	6		
3.50	4	4		
3.90	2	2		
Total	100	100		

Table 4 shows the association between neonatal apnea and prematurity (P =0.046).

Table (4): Relation between Neonatal apnea and prematurity.

Apnea / Prematurity	Frequency	Percent	Chi-square	P-value
Negative	40	40		
Positive	60	60	4.0	0.046
Total	100	100		

Table 5 shows the association between neonatal apnea and hypoxic-ischemic encephalopathy where 16% of them were suffering from hypoxic-ischemic encephalopathy (P =0.000)

Table (5): Association between neonatal apnea and hypoxic-ischemic encephalopathy (HIE).

Apnea / HIE	Frequency	Percent	Chi-square	P-value
Negative	84	84		
Positive	16	16	46.240	0.001
Total	100	100		

Table 6 shows the association between neonatal apnea and respiratory distress, where 60% of them were suffering from respiratory distress (P =0.046).

Table (6): Association between neonatal apnea and respiratory distress (RD).

Apnea / RD	Frequency	Percent	Chi-square	P-value
Negative	40	40		
Positive	60	60	4.000	0.046
Total	100	100		

Table 7 shows the association between neonatal apnea and gastro-oesophageal reflux disease where 2% of them were suffering from gastro-oesophageal reflux disease (P =0.000).

Table (7): Association between neonatal apnea and gastro-oesophageal reflux disease (GERD).

Apnea / GERD	Frequency	Percent	Chi-square	P-value
Negative	98	98.0		
Positive	2	2.0	92.16	0.001
Total	100	100.0		

Table 8 shows the association between neonatal apnea and neonatal sepsis where 4% of them were suffering from neonatal sepsis (P =0.000).

Table (8): Association between neonatal apnea and neonatal sepsis.

Apnea / Sepsis	Frequency	Percent	Chi-square	P-value
Negative	96	96		
Positive	4	4	84.640	0.001
Total	100	100		

DISCUSSION

Apnea can begin in many preterm infants in the first week of life and can last until the day of discharge or beyond [5]**.** We aimed at this work to review the incidence, association between neonatal apnea and other diseases.

In the present study, 100 newborns developed neonatal apnea, 64% of them were males while 36% females. These results show increase frequency of neonatal apnea among males (**P** =0.005). This was in agreement with **Mlay and Maitji** [6] who found that neonatal apnea is more in males than females.

In our study there were 74% of them were 1-day age. These results show increase frequency of neonatal apnea among newborn in early age (P =0.000), while **Sinha and Donn** [7] in their study concluded that there was no association between neonatal apnea and post-conceptional age (PCA) of the last apnea (against our study).

The American Academy of Pediatrics [8] in their study concluded that there was correlation between neonatal apnea and the neonatal age.

In our study, there were 6% of them were <1 kg while %48 of them were from 1-1.5 kg, 20% of them were from 1.5-2.5 kg, and 26% of them were ≥2.5 kg. These results show increase frequency of neonatal apnea among newborn with low birth weight (**P** =0.000).

Jacob *et al.* [9] in their study concluded that there was association between neonatal apnea and the birth weight which improved with treatment with caffeine.

Becker *et al.* [10] concluded that neonatal apnea is inversely proportional to the gestational age and birth weight.

In our study, there were 60% of them were suffering from prematurity which are positive, while 40% were negative cases. These results show increase frequency of neonatal apnea among premature neonates by (**P** =0.040).

Tauman and Sivan [11] in their study concluded that there was an association between neonatal apnea and prematurity**.** The same observation was reported by **Malviya *et al.*** [12].

Barrington *et al.* [13] in their study concluded that about 6-22% of babies with a very low birth weight had apnea at term. Approximately 91% of premature neonates had apnea of longer than 12 seconds at the time of hospital discharge. Of these babies, 31% also had bradycardia, and 6.5% required prolonged hospitalization because of the severity of their apnea and bradycardia.

In our study, there were 16% of them were suffering from hypoxic-ischemic encephalopathy which are positive, while 84% were negative cases. These results show increase frequency of neonatal apnea among neonate with hypoxic-ischemic encephalopathy (P =0.000).

John *et al.* [14] perinatal asphyxia is a cause of significant morbidity among full term infants, but breathing abnormalities after an asphyxic insult have not been studied.

In our study, there were 60% of them were suffering from respiratory distress which were positive, while 40% were negative cases. These results show increase frequency of neonatal apnea among neonate with respiratory distress (**P** =0.046).

Kurlak *et al.* [15] in their study concluded that there was association between neonatal apnea and respiratory distress.

In our study, there were 2% of them were suffering from gastro-oesophageal reflux disease which were positive, while 98% were negative cases. These results show decrease frequency of neonatal apnea among neonate with gastro-oesophageal reflux disease (P =0.000).

Arad-Cohen *et al.* [16] in their study concluded that there was association between neonatal apnea and gastro-oesophageal reflux disease.

In our study, there were 4% of them were suffering from neonatal sepsis which were positive, while 96% were negative cases. These results show decrease frequency of neonatal apnea among neonate with neonatal sepsis (**P** =0.000). **Halasa *et al.*** [17] in their study concluded that there was association between neonatal apnea and neonatal sepsis (against our study).

CONCLUSION

Our results show high association between neonatal apnea and prematurity and respiratory distress, and to lesser extent to hypoxic-ischemic encephalopathy and gastro-oesophageal reflux disease and neonatal sepsis.

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