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Original Research Article

A clinical study of incidence and etiology of apnea in newborn

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ABSTRACT

Background: Apnea, defined as cessation of breathing resulting in pathological changes in heart rate and oxygen saturation, is a common occurrence especially in preterm neonates, apnea is not a disease and is a symptom of various diseases that affect neonates. Aim was to know the incidence and etiology of apnea in newborn in Indian setup.
Methods: All admitted neonates who developed apnea is documented to know the incidence and selected cases were retrospectively studied to know the etiology.
Results: Incidence of apnea was 19.92%, hypoxic ischaemic encephalopathy and sepsis 25.67% each were the common etiologies.
Conclusions: Occurrence of apnea definitely reflects the mortality rate in newborns. Incidence of apnea in general and apnea in term newborns in particular are significantly more in comparison with western data. The association of HIE and Sepsis, the potentially preventable causes, perpetuates the incidence of term apnea reflecting the bad obstetric care, poor infrastructure, illiteracy, poor health seeking behavior affecting the child health antenataly, nataly and post nataly. Incidence of apnea in premature newborns is almost comparable to western studies. The primary apnea which is the most common cause, is an uncontrollable entity affecting similarly the newborn community of developed and developing world. India's taboo of having high infant mortality is once again reflected in the study.

Keywords: Apnea, Hypoxic ischaemic encephalopathy, Newborn, Sepsis

INTRODUCTION

Apnea, defined as cessation of breathing resulting in pathological changes in heart rate and oxygen saturation[1], is a common occurrence especially in preterm neonates, apnea is not a disease and is a symptom of various diseases that affect neonates. This is an important cause of mortality and brain damage in immature babies especially those with a gestation of less than 32 weeks.[1,2] It occurs either due to immaturity of the central nervous system (apnea of prematurity) or secondary to other causes such as metabolic disturbances etc. In term infants, apnea is always worrisome and demands immediate diagnostic evaluation.

Disorders produce apnea by direct depression of the central nervous system's control of respiration (hypoglycemia, meningitis, drugs, hemorrhage, seizures), Disturbances in oxygen delivery (shock, sepsis, anemia) and Ventilation defects (obstruction of the airway, pneumonia, muscle weakness). Apnea is categorized into 3 types. Centralapnea, centralapnea is characterized by total cessation of inspiratory efforts with no evidence of obstruction (absence of both chest wall movement and nasal air flow), obstructive apnea (10%). In obstructive apnea, the infant tries to breath against an obstructed upper airway, resulting in chest wall motion without airflow throughout the entire apneic episode (chest wall movements without nasal air flow). Mixed apnea (50%):

Mixedapnea consists of obstructed respiratory efforts usually following central pauses (have both obstructive and central components). Purely obstructive apnea in the absence of a positional problem is probably uncommon.

As there are many different causes of apnea, the treatment of the condition depends on the results of investigation, examination and diagnosis of the underlying etiology. Most of the studies on apnea are Western studies of developed countries, showing their data and their trend in the disease. India being a developing country with contribution of more than 30% of global neonatal mortality[3] has different environmental, socio economic, health care factors, so their results cannot be applied here. Also, there is paucity of studies and sufficient data to establish relationship between apnea and maturity status of the neonates, in our country in general and this part of India in particular.

The purpose of this study is to find out the incidence and the different etiologies, in our setup, of this very important problem in new born care with an objective of an early diagnosis and timely management.

METHODS

This study was conducted in Sardar Vallabhai Patel Postgraduate Institute of Pediatrics, Cuttack, India for a period of eighteen months from January 2010 to June 2011. All the admitted neonates in Newborn ward, NICU who developed apnea according to the definition, were included in the study. The study group consisted of 148 cases which were randomly selected and were retrospectively studied for risk factors and prospectively studied about the event. A detailed history including age, gestational age, sex and obstetrics history was taken in each case and a thorough clinical examination and investigations were carried out according to the preformed proforma to find out the etiology (most explainable contributing factor) of the disease. The neonates with primary apnea in the labor room were not included in the study.

RESULTS

The newborn admissions in the hospital constituted 9216 cases. Of these babies 3688 (39.56%) babies were normal and 5528 (60.44%) babies were low birth weight. Out of 9216 admissions 6000 (65.1%), 2880 (39.56%) and 336 (3.6%) were term, pre-term and post term babies respectively. In this study period,1836 hospitalized newborns developed apnea with an incidence of 19.92%. Out of 5528 low birth weight newborns 23% cases (1260) developed apnea (Table 1). Incidence of apnea in term was 16.48% and in preterm was 27.5% (Table 2). Out of 13,628 hospital inborns 498 newborns developed apnea with the incidence of 3.65% (term-1.7%, preterm-15.15%) (Table 3).

Table 1: Incidence of APNEA in hospital neonatal admissions according to birth weight.

	Admissions	APNEA	Percentage
Normal birth weight	3688	576	15.61
Low birth weight	5528	1260	23
Total	9216	1836	19.92

Table 2: Incidence of apnea in hospital neonatal admissions according to maturity.

	No. of admissions	APNEA	Incidence
Term	6336	1044	16.48
Preterm	2880	792	27.5
Total	9216	1836	19.92

Table 3: Incidence of APNEA in hospital inborn.

	Live births	APNEA	Percentage
Term	11,648	198	1.7
Preterm	1,980	300	15.15
Total	13,628	498	3.65

Table 4: Contributory factors of APNEA in neonates of study group (n=148).

Cause	Number	Percentage
HIE	38	25.67
Sepsis	38	25.67
Obstruction	18	12.16
Apnea of prematurity	18	12.16
MAS	14	9.4
ARDS	6	4.05
Meningitis	6	4.05
Hypoglycemia	6	4.05
Hyponatremia	2	1.35
Bilirubin encephalopathy	4	2.7
TEF	4	2.7
Anemia	4	2.7
Polycythemia	4	2.7
Pulmonary hemorrhage	4	2.7
Resp distress	2	1.35
Hyperthermia	2	1.35
Hyperkalemia	2	1.35
Pulmonary hypoplasia	2	1.35
Procedure	2	1.35
Pneumonia	2	1.35
Congenital anamolies	2	1.35
Maternal magnesium	2	1.35
Sedation	2	1.35
Uremia	2	1.35

Majority (73 %) of the babies had central (97), 12 % had Obstructive and 15 % had mixed apnoea.

HIE, and sepsis were the commonest pathological causes (25.67% each) of apnea in newborn in our study, followed by apnea of prematurity and obstructive apnea 18 (12.16% each), meconium aspiration syndrome 14 (9.4%); ARDS, meningitis, hypoglycemia 6 (4% each), bilirubin encephalopathy, TEF, anemia, polycythemia, pulmonary hemorrhage 4 (2.7% each), hyponatremia, respiratory distress, hyperthermia, hyperkalemia, pulmonary hypoplasia, during procedure, pneumonia, congenital anomalies, maternal magnesium, sedation 2 (1.35% each) (Table 4).

Table 5: Causes of APNEA in preterms of study group.

Etiology	Number	Percentage
Primary	18	30.5
Sepsis	12	20.33
HIE	8	13.55
ARDS	6	10.17
Obstruction	2	3.4
Polycythemia	2	3.4

Table 6: Causes of APNEA in terms of study group.

Cause	Number	Percentage
HIE	30	20
Sepsis	26	17.56
Obstruction	18	12.16
MAS	14	9.4
Meningitis	4	4.05
Hypoglycemia	6	4.05
Hyponatremia	2	1.35
Bilirubin encephalopathy	4	2.7
TEF	4	2.7
Anemia	4	2.7
Polycythemia	2	2.7
Pulmonary hemorrhage	2	2.7
Resp distress	2	1.35
Hyperthermia	2	1.35
Hyperkalemia	2	1.35
Pulmonary hypoplasia	2	1.35
Procedure	2	1.35
Pneumonia	2	1.35
Congenital anamolies	2	1.35
Maternal magnesium	2	1.35
Sedation	2	1.35
Uremia	2	1.35

Primary apnea constituted 30.5% (18) cases of apnea in preterms, sepsis constituted 20.33% (12), HIE 13.55% (8), ARDS 10.17% (6), polycythemia and obstruction constituted 3.4% (2) cases each (Table 5). Apnea in term neonates were contributed by Hypoxic ischaemic encephalopathy (25.67%), sepsis (17.56%), obstructive apnea 18 (12.16%), meconium aspiration syndrome 14 (9.4%), ARDS, meningitis, hypoglycemia (4% each); bilirubin encephalopathy, tef, anemia, polycythemia, pulmonary hemorrhage (2.7% each), hyponatremia, resp distress, hyperthermia, hyperkalemia, pulmonary hypoplasia, during procedure, pneumonia, congenital anomalies, maternal magnesium, sedation (1.35% each) (Table 6).

DISCUSSION

Over the period of present study, 1836 hospitalized newborn developed apnea with an incidence of 19.92%. Yi Ke et al a hospital study reported 9.85% incidence of neonatal apnea.[4] Although hospital wise data are less available to compare, with available studies like above mentioned study, incidence of apnea is significantly higher in our hospital. As ours is a tertiary care hospital with out-born neonatal admissions consisting more than 75% by either home born neonates or neonates delivered by unskilled workers and from a poor antenatal care deliveries with many birth complications, incidence of apnea is more.

Out of 5528 low birth weight newborns, 23% cases (1260) developed apnea Raul C, et al in their study reported approximately 25% apnea incidence in neonates <1800g birth weight.[5] An US study by Barrington KJ et al, reported 6-22% incidence of apnea in VLBW neonates.[6] Nimavat DJ et al**,** from US also reported the incidence of apnea to be 25% in neonates <2500g birth weight, 50% in neonates with <1500g and 84% in neonates with <1000g.[7] Guruprasad et al reported 25% incidence of apnea in VLBW neonates. The data in our study are almost at par with results of other western studies and better than the one Indian study reported Prasad G et al.[8]

Incidence of apnea in term and preterm babies are 16.48% (1044) and 27.5% (792) respectively. D.J Henderson-smart et al [9], in their study in US showed incidence of recurrent apnea increased with decreased gestational age (7% at 34-35 weeks gestation to 54% at 30-31 weeks gestation). Banagalub et al, an US study reported 25% incidence of apnea in infants below 34 weeks of gestational age.[5] According to Madhava et al, 92% (at 23 weeks), 94% (at 28weeks), >80% (at <30 weeks), 10% (at 35 weeks), 2.5% (at 36 weeks), 0.6% (at 37 weeks) <0.2% (at >38 weeks) babies developed apnea in their series.[10] Darnall RA, et al reported 10% incidence in late preterm infants.[11] Although gestational week wise data is unavailable in our study, the incidence of preterm apnea in our study is almost comparable with western studies. But term apnea was significantly higher in our study, out of which about 20% cases were caused by HIE and 17.56 % constituted by neonatal sepsis. This again may be due to bad obstetric practices leading to very high number of complicated births. And heterogeneous groups of neonatal hospitalization and random case selections

have also contributed for the difference. In hospital inborn, 1.7% (198) of term live births (11,648) and 15.15% (300) of preterm live births (1,980) developed apnea. Smart DJ et al, an US study reported apnea in 1% (249) of 25,154 live born babies during 6 year of their study period and only 18 of them were term, an US study reported a bit higher incidence than the previous study and substantiated by saying improved patient monitoring has resulted in increased apnea and/or its recognition reported 0.5-0.6% incidence of all newborns. Genizi J et al**,** reported 0.35 cases per 1,000 populations in Sweden.[9,13] Incidence of apnea and apnea in term in particular is significantly higher in our hospital compared to above mentioned western studies. Poor maternal nutrition, poor antenatal care due to illiteracy, poverty, insufficient health care facilities leading to many pregnancy complications and sepsis are the causes of this increased incidence. As our India is a developing country with a high rate of poverty and poor health infrastructure particularly in eastern India with high infant mortality rate will explain this finding.

From among the above hospitalized (out-born and inborn) cases developing apnea, 148 cases were randomly selected and were put under study group and were retrospectively studied for risk factors and prospectively studied about the event and outcome of each case. 35% of neonates developed apnea between 24-72 hrs and 26% cases developed within 24 hours, which showed decreasing trend further 16% (25), 15% (23), 8% (13) within 3-7 days, 7-14 days and > 14 days, respectively. Barrington KJ et al, reported that apnea frequently start on first day of life (frequency was highest in first 24 hours after birth with a mean frequency of 0.9 per hour and gradually reduced thereafter, falling to 0.2/Hr by 5 days of age).[6] Smart H et al, reported that apnea commences in first two days of life in 77% of cases and was unlikely to commence after 7 days.[9] HIE being a more contributing factor (25.67%) for apnea in our study, may be the cause of more number of cases developing apnea between 24 to 72 hrs of life in our study as HIE leads to respiratory failure mostly between 24 to 72 hrs. 67% (99) of apnea events developed in male neonates and 33% (49) developed in female infants in our study, with a ratio of M: F 2:1. Rocker JA et al, reported no gender difference in incidence of apnea of prematurity. Also they reported male to female ratio to be 2:1 in ALTE and male predilection in sleep disordered breathing. As M: F is 2.1:1 for hospitalization (because of male preferential hospitalization in our part of country), this might have affected the increased male incidence in our study compared to other studies of neonatal apnea.[14] Among the apnoeic babies in our study, 60% (89) were term and rest 40% (59) were preterm. This majority of term apnoeic infants in our study might be the reflection of majority of term neonates being admitted in our hospital. Septicemia was associated with 36.59% (54) of cases in the study group. Ralston S et al, reported the incidences of 23.8% to as low as 1.2% of apnea among 5575 hospitalized patients with RSV.[15] Fanaroff AA et al reported 55% incidence of apnea with infection.[16] Sepsis is a major cause of morbidity and mortality in Indian health care setup. This explains the increased incidence of sepsis causing apnea in our study in comparison to western studies.

HIE, and Sepsis were the commonest pathological causes (25.67% each) of apnea in newborn in our study followed by apnea of prematurity and obstructive apnea 18 (12.16% each), meconium aspiration syndrome 14 (9.4%), ARDS, meningitis, hypoglycemia 6 (4% each), bilirubin encephalopathy, TEF, anemia, polycythemia, pulmonary hemorrhage 4 (2.7% each), hyponatremia, resp distress, hyperthermia, hyperkalemia, pulmonary hypoplasia, during procedure, pneumonia, congenital anomalies, maternal magnesium, sedation 2 (1.35% each) according. Our study result is comparable to studies done by Zanelli SA et al which reported that Birth asphyxia is the cause of 23% of all serious neonatal morbidities like apnea worldwide.[17] Juma A et al reported 27.2%. Dongol S reported (23%), Buchmann EJ et al reported 14% contribution of HIE to apnea.[17-20] Arakhita Set al reported 17.5% incidence of apnea with sepsis, similar observations were made by other workers Some et al, Saxena et al, and Khatua et al, Fajardo C et al reported incidence of obstructive apnea ranging from 4%-13% in neonates.[19-22] Apnea of prematurity constitutes 30.5% (18) cases in the present study. It is followed by sepsis 20.33% (12), HIE 13.55% (8), ARDS 10.17% (6), polycythemia and obstruction 3.4 % (2) cases each. Apnea in term neonates is caused by hypoxic ischaemic encephalopathy (25.67%) sepsis (17.56%), obstructive apnea (12.16%), meconium aspiration syndrome (9.4%), ARDS, meningitis, hypoglycemia (4% each), bilirubin encephalopathy, TEF, anemia, polycythemia, pulmonary hemorrhage (2.7% each), hyponatremia, resp distress, hyperthermia, hyperkalemia, pulmonary hypoplasia, during procedure, pneumonia, congenital anomalies, maternal magnesium, sedation (1.35% each).

Table 7: Comparison of types of APNEA with other studies.

APNEA	Central (%)	Obstructive (%)	Mixed (%)
Gerbeck T et al	50	10	0
Barrinington KJ et al	40	10	50
Dharmendra J et al	40	10	50
Butcher et al	69	11	20
Our study	65.54	16.22	18.24

CONCLUSION

Occurrence of apnea definitely reflects the mortality rate in newborns. Incidence of apnea in general and apnea in term newborns in particular are significantly more in comparison with western data. The association of HIE and Sepsis, the potentially preventable causes, perpetuates the incidence of term apnea reflecting the bad

obstetric care, poor infrastructure, illiteracy, poor health seeking behavior affecting the child health antenataly, nataly and post nataly. Incidence of apnea in premature newborns is almost comparable to western studies. The primary apnea which is the most common cause, is an uncontrollable entity affecting similarly the newborn community of developed and developing world. India's taboo of having high infant mortality is once again reflected in the study. So many programmes on neonatal welfare are falling short of high demands. Illiteracy and traditional malpractices are of great concern and need immediate intervention.

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REFERENCES

1. Dudell G, Barbara J, Apnea. Nelson textbook of Pediatrics;20thth Edition 2016:729.
2. Agarwal R. Apnea in newborn.AIIMS NICU Protocols.2nd ed. New Delhi;2005:113-8 .
3. Kumar A. Apnea in newborn. IAP textbook of pediatrics. 6th ed. New Delhi: Jaypee publications; 2016:52-5.
4. Fang N, Ke Y, Xue D, Bao X. Incidence and risk factors analysis of neonatal apnea in the representative regions of Guangdong province. 2007;27(11):1688-91.
5. Raul C, Banagaleb D, Dietrich W, William F. Apnea in newborn infants: Approach to management. Resuscitation, Elsevier Scientific Publishers Ireland Ltd. 1984;11:9-20.
6. Barrington KJ, Finer N, Li D. Predischarge respiratory recordings in very low birth weight newborn infants. J Pediatrics. 1996;129(6):934-40.
7. Nimavat DJ, Krantz R. Apnea of prematurity, 2008. Available from: http://www.pubmed.emedicine.medscape.com/article/974971. Accessed on 9 December 2016.
8. Guruprasad G. Immediate mortality and morbidity pattern of newborn <1500gm. NNF Protocol Handbook of Pedican.1st ed. New Delhi: Jaypee publications;2011:99-100.
9. Smart DJ. The effect of gestational age on the incidence and duration of recurrent apnea in newborn babies. 1981;4:273-6.
10. Beeram, Madhava R, Krauss, David. Incidence of apnea and bradycardia in newborn population during post surfactant era (1990-1996), 1996. Available from: http://www.ncbi.nlm.nih.gov/pubmed/3601711. Accessed 9 January 2017.
11. Darnall RA, Ariango RL, Kinney HC. The late preterm infant and the control of breathing, sleep and brainstem development a review. Clini Perinatol. 2006;33(4):883-914.
12. Brooks JG. Apparent life threatening events and apnea of infancy. Clini Perinatol. 1992;19(4):809-38.
13. Genizi J, Pillar G, Ravid S, Shahar E. Apparent life threatening events. Neurological correlates and the mandatory work-up. J Child Neurol. 2008;23(11);1305-7.
14. Rocker JA.Pediatric apnea,2016.Available at http://www.emedicine.medscape.com/article/800032. Accessed 15 January 2017.
15. Ralston S, Hill V. Incidence of apnea in infants hospitalized with respiratory syncytial virus bronchiolitis, a systematic review. J Pediatr. 2009;155(5):728-33.
16. Fanaroff AA, Korones SB, Wright LL, Verter J, Poland RL, Bauer CR, et al. Incidence, presenting features, risk factors and significance of late onset septicemia in very low birth weight infants. The national institute of child health and human development neonatal research network. Pediatr Infect Dis J. 1998;17(7);593-8.
17. Zanelli SA, Rosenkrantz T. Hypoxic-Ischemic Encephalopathy, 2016. Available from: http://www.emedicine,2016medscape.com/article/973501. Accessed 20 January 2017.
18. Juma A. Prevalence and immediate outcomes of hypoxic ischaemic encephalopathy (HIE) among infants with birth asphyxia admitted at the neonatal ward of muhimbili national hospital in dares salaam, Tanzania. Official Publication Tanzania Medical Students' Association. 2006;07:17-9.
19. Dongol S, Singh J, Shrestha S, Shakya A. Clinical profile of birth asphyxia in dhulikhel hospital: a retrospective study. J Nep Paedtr Soc. 2010;30(3):141-6.
20. Buchmann EJ, Pallinson RC, Myathikazi N. Intrapartum related birth asphyxia in South Africa lessons from the first national perinatal care survey. SAF Med J. 2002;92:897-901.
21. Fajardo C, Alvarez J, Wong A, Kwiatkowski K, Rigatto H. The incidence of obstructive apneas in preterm infants with and without bronchopulmonary dysplasia. Early Hum Dev. 1993;32(2):197-206.

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