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Original Research Article

Determinants of outcome in newborns with respiratory distress in Osogbo, Nigeria

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ABSTRACT

Background: Respiratory distress is one of the commonest presentations necessitating hospital admission in newborn unit. Regardless of the cause, if not recognized and managed quickly, respiratory distress can escalate to apnoea, respiratory failure, cardiopulmonary arrest and death.
Methods: A cross-sectional and descriptive study of newborns with respiratory distress admitted into the SCBU of LAUTECH Teaching Hospital, Osogbo, Nigeria. Respiratory distress was diagnosed by grunting, inspiratory stridor, nasal flaring and tachypnea (more than 60 breaths per minute), retractions in the intercostal, subcostal, or supracostal spaces and cyanosis. At admission, every neonate had a complete physical examination.
Results: Of 625 babies admitted, 384 (61.4%) were males while 241 (38.6%) were females and 164 (26.2%) had respiratory distress. Respiratory distress was commoner among the preterms than term newborns. χ^2 = 44.7, p = 0.001. Leading causes of respiratory distress among the preterms were hyaline membrane disease, septicaemia, while among the term babies were perinatal asphyxia, transient tachypnoea of newborn and meconium aspiration. Sixty (36.6%) of the 164 babies with respiratory distress died. While 40.2% of the preterms died mainly from causes like hyaline membrane disease and septicaemia, 31.3% of term babies died from causes like perinatal asphyxia and meconium aspiration. Mortality from hyaline membrane disease was 46.9%, while perinatal asphyxia and meconium aspiration accounted for 38.9% and 40.0% respectively.
Conclusions: Respiratory distress is therefore, a very common neonatal problem and it causes death of more than third of those affected. Emphasis should be geared towards reduction of preterm delivery, control of asphyxia and neonatal sepsis in order to reduce neonatal mortality in our environment.

Keywords: Hyaline membrane disease, Neonatal respiratory distress, Nigeria, Perinatal asphyxia

INTRODUCTION

Respiratory distress is one of the commonest presentations necessitating hospital admission of newborns.[1] About 15% of term infants and 29% of late preterm infants admitted to the neonatal intensive care unit develop have significant respiratory symptoms; this is even higher for infants born before 34 weeks' gestation.[2,3] The clinical presentations of respiratory distress in the newborn include difficulty with breathing (nasal flaring, recessions or retractions in the intercostal, subcostal, or supracostal spaces, grunting, head nodding); too fast breathing (tachypnoea – respiratory rate more than 60 breaths per minute); too slow or shallow breathing (bradypnoea – respiratory rate less than 30 per minute, apnea); noisy breathing (stertor, expiratory

wheezes, inspiratory stridor, grunting) or hypoxaemia (cyanosis); with or without associated disorders like poor feeding, poor colour, poor activities, vomiting. Regardless of the cause, if not recognized and managed quickly, respiratory distress can escalate to apnoea, respiratory failure, cardiopulmonary arrest and death.[3]

Even though respiratory distress in newborn is not limited to any part of the world, predominant causes differ from region to region. Racial and gender predilection to neonatal respiratory distress are unknown.[1] Causes may differ based on factors like sepsis rate, preterm rate, small for gestational age rate. However, in many developing countries where there are no facilities for mechanical ventilatory support, management of respiratory distress can be a herculean task. Though, respiratory distress is a common presentation in the newborn unit in developing countries yet there is no known study on the determinants of outcome in newborns with of respiratory distress. Also, to the best of information, there is no recent published data on the subject of neonatal respiratory distress in Nigeria. This was a prospective study to determine the aetiology, pattern and outcome of neonatal respiratory distress and its role in neonatal mortality among babies admitted between June 2012 and May 2014 into the Special Care Baby Unit of Ladoke Akintola University of Technology (LAUTECH) Teaching Hospital, Osogbo, Southwestern Nigeria. The hospital has neonatal unit (SCBU) which has capacity to admit total of 30 babies with separate inborns and outborns units. The newborn unit has 2 neonatologists, senior registrars in Paediatrics, 2 junior registrars, incubators, baby cots, facilities for oxygen administration, pulse oximeters, 2 Bubble CPAP machine to give some respiratory support to newborn with respiratory distress but no facility for mechanical ventilatory support and for blood gas analysis.

METHODS

This was a prospectively, consecutive, cross-sectional and descriptive study of all newborns with respiratory distress admitted into the special care baby's unit. The diagnosis of respiratory distress was based clinically on the observation of, grunting, inspiratory stridor, nasal flaring, poor feeding, and tachypnea (more than 60 breaths per minute), retractions in the intercostal, subcostal, or supracostal spaces and cyanosis. Patients with apneic attacks were excluded since apnoea is a common terminal presentation for all deceased babies. The collected data were entered into a research proforma designed for the study. Maternal and neonatal data such as maternal age, antenatal check up, place of delivery, parity, type of delivery, presence of meconeum whether labour was induced or spontaneous, pregnancy complications, gestational age, Apgar score, birth weight, sex, clinical features, severity of birth asphyxia based on Apgar Score and temperature at admission were documented. Referral notes were also considered. At admission into the SCBU every neonate had a complete physical examination noting the activity, presence of congenital anomaly and stigmata of chromosomal disorders. Each baby was observed for presence of respiratory distress at presentation and subsequently during the course of hospitalization. Other abnormal signs like seizures, pallor or cyanosis were also noted.

The gestational age (GA) in weeks was determined using the mother's dates and Ballard's gestational assessment chart. The birth weight of each baby was recorded and in the case of outborn babies with no recorded birthweights the weight at presentation was recorded as admission weight.

Investigations like pulse oximetry, chest radiograph, full blood count, electrolytes and urea, blood glucose, blood glucose and cultures were done. There was no facility for blood pH and blood gases hence these were not done.

Hypoglycemia was taken as blood glucose less than 2.50mmol/litre (45mg%).[4] Babies with birth asphyxia were those with APGAR score of $\leq$7 at five minutes[2,5] and/or did not cry immediately after delivery in the presence of neurologic symptoms. For babies delivered outside the health facility, birth asphyxia was presumed in baby whom there was history that the baby had failed to cry or breathe at birth or had gasped for a long time or had to be stimulated for a prolonged period of time or was unable to suck in the first 24 hours with or without associated pallor, cyanosis, neurologic dysfunction and multisystemic affectation like respiratory distress, abdominal distension, coma or seizures.[5]

Patients were treated with oxygen therapy administered by nasal prongs or nasal bubble CPAP; SPO2 were monitored with pulse oximetry. Other definitive treatments were given as dictated by the primary cause of the respiratory distress. These include antibiotics for bacterial infections, transfusion for anaemia, management of cardiac failure and correction of metabolic abnormalities. Autopsy was not done in the majority of dead babies because of refusal of consent from the parents.

The data generated was entered into HP personal computer. Analysis of the data was undertaken with the statistical package for the social sciences (SPSS version 20). Means and standard deviations were determined for continuous variables and were compared between babies with respiratory distress and those without using analysis of variance and Students't' test. Proportions and percentages were compared using chi-square (χ^2) test. P values, <0.05 was taken as statistically significant.

RESULTS

Six hundred and twenty five babies admitted into special care baby unit over 2 year period, between June 2012 and May 2014 were prospectively studied. Three hundred and eighty four babies (61.4%) were males while 241 (38.6%)

were females, M:F ratio was 1.6:1. Of the 625 babies, 164 (26.2%) had respiratory distress; there is no significant difference in the gender of the babies with respiratory distress. For example, 101 (61.6%) were males and 63 (38.4%) females (χ^2= 0.02, p=1.00). Place of birth is shown in Table 1. Three hundred and twenty-four (51.8%) were Inborns while 301(48.2%) were Outborns. There was similar prevalence of respiratory distress irrespective of place of birth. For example, 78 (24.1%) of the inborns and 86 (28.6%) of the outborns were admitted with respiratory distress. χ^2 = 1.6, p = 0.2. Though, higher proportion of the babies with respiratory distress were outborns, but not at a statistical significant level P>0.3. Table 2 shows the distribution of respiratory distress in relation to gestational age of babies. Respiratory distress was commoner at the extremes of gestational ages; below 34 weeks and above 41 weeks. Respiratory distress was significantly commoner among the preterms than term newborns. χ^2 = 44.7, p = 0.001.

Table 1: Admissions in relationship with place of delivery among babies with respiratory distress.

Place of delivery	No admitted (N)	No with respiratory distress (% of N)
LTH	324	78 (24.1)
Government hospital	64	20 (31.3)
Home/TBA/inside car	30	11 (36.7)
Maternity centers	44	12 (27.3)
Mission hospital	47	14 (29.8)
Mission house	18	6 (33.3)
Private hospital	98	23 (23.5)
Total	625	104 (16.6)
Inborns	324 (51.8)	78 (47.6 of 164)
Outborns	301 (48.2)	86 (52.4 of 164)

LTH- LAUTECH Teaching Hospital. χ^2= 1.1, p = 0.3 (Comparing outborn to inborn).

Table 2: Distribution of respiratory distress in relation to gestational age.

Gestational age (weeks)	N	No (%) without respiratory distress	No (%) with respiratory distress
< 28	10 (1.6)	2 (20.0)	8 (80.0)
28 – 34	52 (8.3)	13 (25.0)	39 (75.0)
34 - <37	172 (27.5)	122 (70.9)	50 (29.1)
37 – 41	368 (58.9)	314 (85.3)	54 (14.7)
> 41	23 (3.7)	10 (43.5)	13 (56.5)
Total	625 (100.0)	461 (73.8)	164 (26.2)
Preterms: <28 - <37 weeks	234 (37.4)	137 (58.5)	97 (41.5)
Terms 37 - 42 weeks	391 (62.6)	324 (82.9)	67 (17.1)

χ^2 = 44.7, p = 0.001 (Comparing Preterms <37 weeks to Terms 37 to 42 weeks).

Similarly, Table 3 shows the relationship between birthweight or weight on admission and occurrence of respiratory distress. Respiratory distress was commoner at the extremes of birthweight; below 1.50kg and above 4.01kg. Comparing birthweight <2.50kg to ≥2.50kg, significant higher proportion of low birthweight babies had respiratory distress χ^2 = 49.8, p = 0.001. Generally, leading causes of neonatal respiratory distress were septicaemia, respiratory distress syndrome, pneumonia, unclassified aspirations, congenital anomalies of respiratory tract and cardiovascular cardiovascular causes. Table IV shows comparison of causes and associated factors of respiratory distress between preterm and term babies. Commoner causes of respiratory distress among the preterms were respiratory distress syndrome, septicaemia, anaemia, congenital anomalies of respiratory tract and cardiovascular cardiovascular causes, while among the term babies were birth asphyxia, transient tachypnoea of newborn, meconium aspiration, poycythaemia, pneumonia and hypoglycaemia.

However, while respiratory distress was significantly commoner among the preterms, birth asphyxia, transient tachpnoea of newborn (TTN) and meconium aspiration were statistically significant among the term babies (p at least 0.02). However, there was no significant difference

in the proportion of babies with respiratory distress who had septicaemia, pneumonia, haematologic or metabolic problems (p at least >0.6).

Table 5 shows the comparison of some characteristics and clinical profile between babies who survived and died from respiratory distress. Sixty (36.6%) of 164 babies with respiratory distress died. Though higher proportion of males, babies delivered by sponteous vertex delivery (SVD), low birth weight and preterms died, this was not statistically significant level (p>0.1). However, significantly higher proportion of outborns died. (p = 0.002). While 40.2% of preterms died mainly from hyaline membrane disease, 31.3% of term babies died mainly from perinatal asphyxia and meconium aspiration. Mortality from hyaline membrane disease was 46.9%, perinatal asphyxia 38.9% and meconium aspiration 40.0%.

Table 3: Showing the relationship between birth-weight or weight on admission and occurrence of respiratory distress.

Admission weight/ birthweight	No (%)$^{+}$ without respiratory distress	No (%)$^{+}$ with respiratory distress	Total N(%)* N=625
<1.00kg	3 (23.1)	10 (76.9)	13 (1.8)
1.00 – 1.49	18 (32.1)	38 (67.9)	56 (9.0)
1.50 – 2.49	121 (69.5)	53 (30.5)	174 (27.8)
2.50 - 4.00	303 (82.6)	64 (17.4)	367 (58.7)
≥4.01	10 (66.7)	05 (33.3)	15 (4.4)
Total	461 (73.8)	164 (26.2)	625 (100.0)
Low birth weight <2.50kg	142 (58.4)	101 (41.6)	243 (38.9)
Birthweight ≥2.50kg	319 (83.5)	63 (16.5)	382 (61.1)

Key: $^{+}$ = Percentage of total in row; * = Percentage of total in column; Percentages are in parenthesis. $\chi^2 = 49.8$, p = 0.001 (Comparing birthweight <2.50kg to ≥2.50kg).

Table 4: Comparison of causes and associated factors of respiratory distress between preterm and term babies.

Variables/Causes	Preterm N=97(%)$^{\#}$	Term N =67(%)$^{\#}$	Total N (% of 164)$^{+}$	χ^2	P**
Neonatal septicaemia	25 (56.8)	19 (43.2)	44 (26.8)	0.1	0.7
Birth Asphyxia	09 (25.0)	27 (75.0)	36 (22.0)	22.3	0.001**S**
Respiratory distress syndrome	29 (90.6)	3 (9.4)	32 (19.5)	14.7	0.001**S**
Transient tachpnoea of newborn (TTN)	2 (11.8)	15 (88.2)	17 (10.4)	15.5	0.001**S**
Pneumonia	5 (33.3)	10 (66.7)	15 (9.1)	3.4	0.06
Meconium aspiration	2 (20.0)	8 (80.0)	10 (6.1)	5.1	0.02**S**
Unclassified aspiration	5 (50.0)	5 (50.0)	10 (6.1)	0.08	0.8
Congenital respiratory system anomalies	4 (66.7)	2 (33.3)	6 (3.7)	0.00	1.00
Haematologic					
➢ Anaemia	4 (57.1)	3 (42.9)	7 (4.3)	0.00	1.00
➢ Polycythaemia	0 (0.0)	3 (100.0)	3 (1.8)	2.3	0.1
Cardiovascular causes including CHD	7 (70.0)	3 (30.0)	10 (6.1)	0.2	0.7
Metabolic causes including hypoglycaemia	3 (42.9)	4 (57.1)	7 (4.3)	0.3	0.6
Unknown including Other system involvement	15 (71.4)	6 (28.6)	21 (12.8)	1.0	0.3
Total$^{\#}$	97 (51.1)$^{++}$	67 (40.9) $^{++}$	164 (100.0) $^{++}$		

Key= $^{+}$ Pecentages of each column; $^{\#}$Percentage of each row; S- Significant **Yates's criteria applied. $^{++}$ Multiple diagnoses occurred in some.

DISCUSSION

Respiratory distress remains a common problem in the newborn unit and a major cause of neonatal admissions. In the present study, 26.2% of the admissions in the newborn unit at the centre of this study had respiratory distress. This is lower than findings of Bajad et al in India who reported 32% of all neonatal admissions; but higher than many other previous studies.[6-9] Abdelrahman et al in Sudan recorded neonatal respiratory distress (NRD)

frequency rate of 4.83% among newborn delivered in the hospital but 56.5% among newborn admitted to NICU, Fedakar et al also reported 7% of neonatal admissions in Turkey, Kumar et al in India found overall incidence of 6.7%.[7-9] There is therefore, variation in the incidence of respiratory distress at different centres. This is probably dependent on the prevalence of factors that caused it. Such factors may include preterm rate, birth asphyxia rate or neonatal infection rate. The higher are these factors, the higher is neonatal respiratory distress. Hence, many developing countries with high sepsis or birth asphyxia rate may have very high NRD rate as in the present study, while centres with NICU facilities that support very low birth weight and extreme preterm babies are likely to have high incidence of respiratory distress from respiratory distress syndrome.

Table 5: Comparison of some characteristics and clinical profile between babies who survived and died from respiratory distress.

Variable	No of babies affected n (%) N=164^{+}	Babies who survived n = 104*	Babies who died n = 60*	χ^2	p value
Gender					
Male	101 (61.6)	60 (59.4)	41 (40.6)	1.81	0.18
Female	63 (38.4)	44 (69.8)	19 (30.2)		
Mode of delivery					
SVD	97 (59.1)	58 (59.8)	39 (40.2)	1.33	0.25
C/S	67 (40.9)	46 (68.7)	21(31.3)		
Place of birth					
Inborn	78(47.6)	59 (75.6)	19 (24.3)	9.53	0.002**S**
Outborn	86 (52.4)	45 (52.3)	41 (47.7)		
Birthweight					
<2.50kg	101 (61.6)	61 (60.4)	40 (39.6)	1.03	0.31
≥2.50kg	63 (38.4)	43(68.3)	20 (31.7)		
Gestational age					
Preterm	97 (59.1)	58 (59.8)	39 (40.2)	1.33	0.25
Term	67(40.9)	46 (68.7)	21(31.3)		
Respiratory distress syndrome	32 (23.2)	17 (53.1)	15 (46.9)	0.31	0.58
Birth Asphyxia	36 (21.3)	22 (61.1)	14 (38.9)	0.11	0.75
Meconium aspiration	10 (6.1)	6 (60.0)	4 (40.0)	0.00	1.00**
Transient tachpnoea of newborn (TTN)	17 (6.7)	17 (100.0)	0(0.0)	9.25	0.002**S****
Unclassified aspiration	7 (4.3)	5 (71.4)	2 (28.6)	0.002	0.96**
Neonatal septicaemia	44 (23.2)	27 (61.3)	17 (38.6)	0.11	0.74
Pneumonia	15 (9.1)	11(73.3)	4 (26.7)	0.31	0.58**
Cardiovascular causes including CHD	10 (4.3)	7 (70.0)	3 (30.0)	0.01	0.91
Metabolic causes including hypoglycaemia	7 (42.9)	7 (100.0)	0 (0.0)	2.73	0.10
Unknown including Other system involvement	20 (71.4)	13 (65.0)	7 (35.0)	0.00	1.00

Key: $^{+}$ = Percentage of total in column; * = Percentage of total in row; SVD= Spontaneous vertex delivery; C/S= Caesaream section; S-Significant **Yates's criteria applied.

The found causes of respiratory distress in a newborn are diverse and multisystemic in the present study. This finding is supported by previous studies.[6-9] The leading causes of neonatal respiratory distress were neonatal septicaemia, birth asphyxia, respiratory distress syndrome (hyaline membrane diseases) and transient tachypnoea of newborn in descending order. These findings have similarities with the Bajad et al in India who observed leading causes of respiratory distress to be hyaline membrane disease, birth asphyxia, septicemia/pneumonia, meconium aspiration syndrome, transient tachypnoea of newborn, in descending order.[6] However, while respiratory distress syndrome was significantly commoner among the preterms (p=0.001); birth asphyxia, transient tachpnoea of newborn (TTN) and meconium aspiration were statistically significant among the term babies (p at least 0.02). Therefore, the specific causes of NRD in the present study vary

depending on the gestational age as also reported by previous authors.[8,9] Also, associated factors to occurrence of NRD in the present study were male gender, outborns and low birthweight.

Neonatal infections (septiacemia) is the overall leading cause of respiratory distress, occurred in 26.8% of the patients and accounted for 38.6% of the mortality. Neonatal septicaemia is very high in developing countries including Nigeria because many deliveries are unsupervised and occur in unhygienic environment. Newborn babies especially the preterms are physiologically immunocompromised.[10] Risk factors for pneumonia like prolonged rupture of membranes, prematurity, and maternal fever were not separately investigated in respect of pneumonia in this study. Most neonates with early-onset group B streptococcus (and many with *L. monocytogenes*) infection present with respiratory distress that is difficult to distinguish from respiratory distress syndrome. Infants may acquire pneumonia transplacentally, through infected amniotic fluid, via colonization at the time of birth, or nosocomially.[11,12] Sepsis in newborn result in multisystemic affectations, poor suck, respiratory distress from congestion of respiratory tract and resultant acidosis. Other factors like dehydration, release of heamolyzins with resultant haemolysis and anaemia can also occur.[13]

Perinatal asphyxia is the leading cause of respiratory distress among term babies in the present study. Bajad et al also found perinatal asphyxia as a major cause of respiratory distress among Indian population, after hyaline membrane disease.[6] This is possibly a reflection of high prevalence of perinatal asphyxia in the developing countries.[14,15] Perinatal asphyxia is a major cause of morbidity and mortality in the newborn period especially in developing countries Nigeria inclusive.[14-16] Globally, about one quarter of all neonatal deaths are caused by birth asphyxia.[13] Perinatal asphyxia readily cause respiratory distress through multiorgan dysfunction, theorized to be secondary to the "diving reflex," hypoxia, acidosis and its attendant complications.[18]

Expectedly, respiratory distress syndrome (hyaline membrane diseases is a disease of preterms below 34 week gestation, rarely seen after 36 weeks.[6] Its prevalence decreases with increase maturity. It presents with tachypnoea, grunting and recession with or without cyanosis usually before 4 to 6 hours of life. Diagnostic radiological features include reticulogranular pattern, ground glass opacity, low lung volume, atelectasis and white out lungs in severe diseases. It also show findings of respiratory acidosis, metabolic acidosis and mixed acidosis as laboratory findings.[6,14] The main stay of management is sulfactant administration, respiratory support and management of systemic complications or associated findings. Prognosis is determined based on severity of diseases, management viz a vis immediate sulfactant administration and respiratory support available; associated systemic complications.

In the present study, sixty (36.6%) of the 164 babies with respiratory distress died. This was very high. This result of the present study was quite higher than other studies.[7,9] Kumar et al reported 19% in India with sulfactant administration and effective respiratory support. Bajad et al also reported mortality of 22.33% in India, Abdelrahman et al reported 36.0% in Sudan.[6,7,9] Also, the causes of death followed the variation in the aetiology. While 40.2% of preterms died mainly from hyaline membrane disease, 31.3% of term babies died mainly from perinatal asphyxia and meconium aspiration. Mortality from hyaline membrane disease was 46.9%, perinatal asphyxia 38.9% and meconium aspiration 40.0%. This is similar to Kumar et al who reported mortality from hyaline membrane disease to be 57.1%, meconium aspiration 21.8% and infections 15.6%.[9] Unfortunately, in the centre of study, sulfactant administration was not available because of its very high cost but Bubble CPAP machines were available for respiratory support. No mechanical ventilation was given to any of the babies. This probably accounted for very high mortality recorded among the babies especially preterms with RDS.

The present study has shown that respiratory distress is a very common neonatal problem and causes death of more than third of those affected. Emphasis should be geared towards the prevention and reduction especially of preterm delivery, control of asphyxia and neonatal sepsis to reduce neonatal mortality in our environment.

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