Original Article

Indian Journal of Trauma and Emergency Pediatrics
Volume 9 Number 4, October - December 2017
DOI: http://dx.doi.org/10.21088/ijtep.2348.9987.9417.2

Clinical Profile of Cases of Neonatal Pneumonia

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Abstract

Introduction: Respiratory distress (RD) in neonates is one of the important clinical manifestations of a variety of disorders of the respiratory system and non-respiratory disorders. The high percentage of babies with respiratory distress is because babies have minimal respiratory reserve and they can encounter numerous problems in transition from intrauterine to extra-uterine life. *Methodology:* All the babies born at or referred to NICU of Hospital during the neonatal period of (0-28) days of birth and meeting the criteria for case definition were included in the study. Sample size 150 consecutive newborns with respiratory distress were considered as cases for this study. *Results:* None of the clinical features were significantly associated with outcome in neonates with pneumonia except respiratory rate ≥ 60/min. *Conclusion:* Chest retraction and tachypnea had high sensitivity. Grunting, lethargy, poor feeding & hypothermia had high specificity.

Keywords: Respiratory Distress; Neonatal Pneumonia; Poor Feeding & Hypothermia.

Introduction

The perinatal period is most often defined as the period from the 28th wk of gestation through the 7th day after birth. The neonatal period is defined as the 1st 28 days after birth and may be further subdivided into the very early (birth to less than 24 hr), early (birth to <7 days), and late neonatal periods (7 days to <28 days) [1]. Over 1 million newborn infants die every year before completing first four weeks of life, amounting to the highest burden of newborn deaths for any country in the world. The current neonatal mortality rate of 44 per 1000 live births accounts for two thirds of the infant mortality in India [2]. In a report from the year 2002-2003: NNPD - Data from a total of 151,436 deliveries were included in this report from 18 centres over a period of two years. There were 145,623 live births, 5,813 stillbirths, and 3,680 neonatal deaths. The Neonatal Mortality Rate (NMR) was 25.3 per 1000 live births [3].

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Received on 05.12.2017, **Accepted on** 19.12.2017

In a study [4] based on systemic review of literature done on causes of child death which included 28 published/unpublished studies and reports (6 multi-centric and 22 single sites) the median percentage of causes of deaths in neonatal period was sepsis/pneumonia: 24.9%, asphyxia: 18.5% and prematurity/LBW: 16.8%. The median proportional contribution of neonatal deaths to total infant deaths was 48.5%. In a report from the year 2002-2003: NNPD, the commonest primary cause of neonatal death was perinatal asphyxia (28.8%). Other major causes were Septicemia/meningitis (18.6%), Extreme prematurity (26.3%) and congenital malformations (9.2%)

In a report [5] of South East Asia Regional Neonatal- Perinatal Database (SEARNPD: 2007-08), the commonest primary cause of neonatal death was found to be prematurity (34.4%); infections and malformations (21.9% each) were the next most common causes. Perinatal asphyxia was responsible for only 9.4% of neonatal deaths. In a nationally representative mortality survey [6], three causes accounted for 78% (0.79 million of 1.01 million) of all neonatal deaths: prematurity and low birthweight (0.33 million, 99% CI 0·31 million to 0.35 million), neonatal infections (0.27 million, 0.25 million to 0.29 million), and birth asphyxia and birth trauma (0.19 million, 0.18 million to 0.21 million).

Respiratory distress (RD) in neonates is one of the

important clinical manifestations of a variety of disorders of the respiratory system and non-respiratory disorders. The high percentage of babies with respiratory distress is because babies have minimal respiratory reserve and they can encounter numerous problems in transition from intrauterine to extra-uterine life [7].

According to pooled hospital data based on NNPD survey ,the incidence of neonatal respiratory distress is around 5.8% [14,19].

In a prospective study of respiratory distress in 2400 consecutively delivered neonates, incidence of respiratory distress neonates was 4%. A higher incidence of respiratory distress was found in LBW (10.1%) & preterm (21.1%) as compared to normal weight (1.9%).

Generally 40% of lung fluids get squeezed out during passage through birth canal and the remainder gets absorbed into venous channels and lymphatic. TTNB represents a transient pulmonary edema that results from delayed resorption of fetal lung fluid by the pulmonary lymphatic system [8]. In addition, it may result from any condition that elevates the central venous pressure with resultant delayed clearance of lung fluid via the thoracic duct the increased fluid accumulates in the peribronchiolar lymphatic and bronchovascular spaces, interferes with forces promoting bronchiolar patency, and results in bronchiolar collapse and subsequent air trapping or hyperinflation. Hypoxemia results from continued perfusion of poorly ventilated alveoli, and hypercarbia results from mechanical interference with alveolar ventilation. The main effect of excess lung fluid is decreased compliance.

This may result from rapid delivery (precipitate or caesarian section) or poor respiratory effort resulting from perinatal asphyxia, respiratory depression from drugs and prematurity. The diagnosis is usually done by exclusion of other causes.

Methodology

It is a prospective descriptive study. All the babies born at or referred to NICU of Hospital during the neonatal period of (0-28) days of birth and meeting the criteria for case definition were included in the study. Sample size 150 consecutive newborns with respiratory distress were considered as cases for this study.

Minimum incidence of respiratory distresses in newborn, based on previous such studies, is around 9.6%. In total, screening of 1646 newborns over a period of 14 months provided 150 cases of respiratory distress. These 150 cases were sufficient for the study with a power of 80% and alpha error of 0.05.

Inclusion Criteria

All the babies of age group ≤ 28 days showing respiratory distress irrespective of the mode and place of delivery were included as cases. All neonates (preterm and term within 28 days of birth) presenting with respiratory symptoms characterized by any one of the following were included as cases.

1. Rapid, noisy or difficult breathing
2. Respiratory rate > 60/min
3. Chest retraction
4. Cough
5. Grunting

Exclusion Criteria

Surgical problems causing respiratory distress were excluded from the study such as

1. Congenital malformations affecting respiratory tract
2. Congenital heart disease
3. Persistent pulmonary hypertension
4. Esophageal Artesia
5. Congenital diaphragmatic hernia etc.

Results

Mortality In male neonates with pneumonia was 4% as compared to 17.5% in females. No significant association was noted between mortality and gender in pneumonia.

In neonates with respiratory distress significant clinical features were evaluated for diagnosing pneumonia. Chest retraction and tachypnea had high sensitivity. Grunting, lethargy, poor feeding & hypothermia had high specificity.

Chest retraction adventitious sound, lethargy, poor feeding & hypothermia had high negative predictive value. Poor feeding & hypothermia had high positive predictive value.

None of the clinical features were significantly associated with outcome in neonates with pneumonia except respiratory rate ≥ 60/min.

Table 1: Comparison of mortality in pneumonia with gender

Sex	Pneumonia Cases No	Expired (%)	P value	ODDS Ratio
M (n=96)	(n=42) (%)	1(4)	0.961	0.944 (0.094 – 9.520)
F (n=54	25(59.5)	3(17.5)	0.149	3.750 (0.564 – 24.911)

Table 2: Sensitivity, specificity and predictive value of clinical signs and symptoms in diagnosis of neonatal pneumonia

Signs and symptoms	Sensitivity (%)	Specificity (%)	Positive predictive Value (%)	Negative predictive Value (%)
Chest retraction	80.9%	52.8%	40.0%	87.7%
Respiratory rate≥60	78.1%	5.7%	24.4%	40.0%
Grunting	23.8%	86.1%	40.0%	74.4%
Adventitious sounds	59.5%	69.4%	43.1%	81.5%
Lethargy	14.3%	97.2%	66.7%	74.5%
Poor feeding	16.7%	99.1%	87.5%	75.4%
Hypothermia	11.9%	100%	100%	74.5%
Rapid breathing	76.2%	7.4%	24.2%	44.4%

Table 3: Correlation between mortality and pneumonia in presence of various signs and symptoms

Signs and Symptoms	Pneumonia (n=42) (%)	Expired (n=9) No of cases	(%)	P value	Odds ratio
Lethargy	6	1	1.000	1.909	1.909 (0.059– 61.347)
Poor feeding	7	0		(0.059–61.347)	-
Chest retraction	34	4	0.774	-	1.227 (0.305– 4.939)
Rapid breathing	32	1	0.971	1.227	1.043 (0.105-10.393)
(RR≥60)	9	2	0.024	(0.305–4.939)	1.429 (0.099–20.438)
Grunting	10	0	-	1.043 (0.105-10.393)	-
Hypothermia (temp<36.5)	5	1	-	1.429 (0.099–20.438)	-
Fever	0	0	-	-	-
(temp>37.5)	2	0	-	-	-
Shock	1	1	-	-	-
Hypoglycaemia	3	1	1.000	-	1.000 (0.335–29.809)
Adventitious sounds	25	4	0.930	-	1.07 (0.255–4.463)
Absent NNR	6	2	0.361	1.000 (0.335–29.809)	2.500 (0.335–18.623)

Discussion

In the present study, clinical features were evaluated for their value in diagnosing pneumonia in neonates. Chest retraction, RR>60/min had high sensitivity. Grunting lethargy, poor feeding hypothermia had high specificity. Chest retraction and adventitious sounds had high negative predictive value. Poor feeding and hypothermia had high positive predictive value. Our results were different from N.B. Mathur et al [8].

He showed high specificity for cough, adventitious sounds and flaring of nasal alae, high sensitivity for poor feeding chest retraction and RR>60/min. High positive predictive value for cough, adventitious sounds, chest retraction, flaring of nasal alae and cyanosis.

In our study, blood culture was sent in all 150 neonates to find the bacterial aetiology. One neonate with pneumonia had positive blood culture. This shows that blood culture have low sensitivity & could not be used alone in diagnosing pneumonia although it is specific.

In our study sepsis screen was positive in 57% in neonatal pneumonia. N.B. Mathur et al [8] had sepsis screen positive in 55% of neonates with pneumonia. The specificity and negative predictive value of sepsis screen parameters was found to be high and sensitivity & positive predictive were low in neonates with pneumonia. N.B. Mathur et al had high specificity and high positive predictive value for sepsis screen parameters. Namadeoet al [9] had high sensitivity and low positive predictive value. PS for bandemia, elevated micro ESR and CRP showed significant association in diagnosing neonatal pneumonia.

Chest X ray in neonates with pneumonia showed alveolar infiltrates in 59.5%, diffuse haziness in 9.5%, and opacification with reticulogranular pattern in

4.7%, sub lobar/lobar consolidation in 2.3%. It was noted that 7.1% of babies diagnosed to have pneumonia were having clear X- ray. N.B. Mathur et al had similar findings in which he showed 14.5%of neonatal pneumonia with clear chest x ray. Haney et alshowed normal chest X-ray in 10% of autopsy proven pneumonia. In 1 neonate in the present study the reticulogranular pattern typical of hyaline membrane disease was modified by presence of consolidation, N.B. Mathur et al had shown 2 such cases in his study. This shows that pneumonia may present with normal chest X- ray and also co-exist with other conditions like hyaline membrane disease.

In the present study, out of 42 cases of neonatal pneumonia, 93% of pneumonia cases had positive chest X-ray, 90.5% had positive chest X-ray and clinical signs of pneumonia, 57% had sepsis screen positive with clinical signs of pneumonia, 54% had positive chest x ray and positive sepsis screen. 2.3% cases had blood culture and chest X-ray positive. Earlier studies [10,11] on neonatal pneumonia have included neonates with only radiological evidence of pneumonia or have diagnosed pneumonia based on radiological findings and have not considered blood culture positivity in diagnosis of neonatal pneumonia. Webber et al and N.B. Mathur et al had included blood culture and sepsis screen along with radiological findings to diagnose pneumonia. Our study findings are differentfrom these studies (38% of pneumonia cases with blood culture and chest X-ray) as we had low blood culture positivity (2.3% cases only), and around 93% cases showed chest X-ray positivity. No other study has stated detailed diagnostic criteria for pneumonia in neonates utilizing blood culture or sepsis screen positivity.

Clinical signs & symptoms, chest X- ray and sepsis screen –combined of these parameters the sensitivity is 54% & specificity is 100%.

Chest X ray & sepsis screen combined – sensitivity is 56% & specificity 78%. FiO_2 requirement.

In babies with pneumonia who required a higher FiO_2 requirement to maintain O_2 saturations between normal limits (92-95%) an increasing trend in mortality was noted. Various studies have graded the severity of respiratory distress by taking FiO_2 as one of the parameters. In our study mortality in neonatal pneumonia with FiO_2 requirement >40% was significantly more as compared to those requiring FiO_2 < 40% which is consistent with the findings of N.B. Mathur et al.

In present study we evaluated alveolar-arterial oxygen gradient ($AaDO_2$) and arterial alveolar oxygen tension ratio (a/A) as indicators of mortality in pneumonia. It was found that mean AaDO2 in neonates with pneumonia (145) and in neonates with respiratory distress due to other causes (108) was not significantly different. Similarly mean a/A ratio in neonates with pneumonia (0.49) and in neonates with respiratory distress due to other causes (0.57) was also not significantly different. In the present study we found that mean $AaDO_2$ in pneumonia was higher (145) than nonpneumonia causes (108) and a/A ratio was lower in pneumonia (0.49) as compared to non pneumonia cases (0.57). But the association was not statistically significant. Our findings were similar to N.B. Mathur et al .

Mortality in neonates with pneumonia having $AaDO_2$ >250 mmHg was 80% as compared to 0% in those with $AaDO_2$ <250 mmHg. However the association was not statistically significant. Although $AaDO_2$>250mmHg had strong association with mortality in neonates with respiratory distress in general, no significant association was found in neonates with pneumonia. According to Harris et al value of $AaDO_2$ > 250 mmHg is an indicator of severe respiratory failure which is consistent with findings of our study. Similarly kumar et al also found that the $AaDO_2$ values were higher in those who expired which are consistent with our study.

In the present study an increase in mortality was seen with decrease in a/A ratio. The mortality was significantly higher in neonates with respiratory distress with a/A ratio <0.25. But no association was noted in case of pneumonia. Severe hypoxemia is indicated by a/A ratio <0.25 [9]. Kumar et al [9] &N.B. Mathur et al [8] also had showed significant association of mortality with neonatal pneumonia whose a/A was <0.25.

The median value of $AaDO_2$ in neonates with pneumonia was 495(399-542) mmHg as compared to 84(45-133) mmHg in those neonates who survived. The difference was significant. The median a/A ratio values was significantly less 0.12(0.09-0.31) in neonates with pneumonia who expired as compared to those neonates who survived 0.57 (0.39-0.74).

The findings are consistent with earlier observations that high $AaDO_2$ and low a/A ratio were significant indicators of mortality in neonates with respiratory distress.

Conclusion

Chest retraction and tachypnea (RR>60/min) have high sensitivity. Poor feeding and hypothermia which have high positive predictive value in diagnosing

neonatal pneumonia. Although other clinical features like lethargy and adventitious sounds are significantly associated with pneumonia, they have low sensitivity and positive predictive value in diagnosing pneumonia.

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