Patterns of Chest Radiographic Findings in Neonates with Respiratory Distress Admitted to the Neonatal Intensive Care Unit in Tikur Anbesa Specialized Hospital

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ABSTRACT

Background: Neonatal respiratory distress accounts for most admissions to intensive care units in the immediate newborn period. Chest radiograph is the primary and most important imaging modality in the evaluation of causes of respiratory distress (RD) and its complications. **Methodology:** A cross-sectional study was conducted from October 2011 to August 2012 in Tikur Anbessa Specialized Hospital (TASH). A convenient sampling method was used and 150 neonates who had chest radiographs with different causes of RD from the neonatal ICU admissions were included in the study period. **Result:** Of the 150 neonates with RD, chest radiographs showed 66(44%) neonates had abnormal chest radiographic findings. Pneumonia 24(36.4%) and HMD 23(34.8%) accounting the majority of causes of RD. Neonates with congenital pneumonia presented with lobar or multi lobar asymmetric consolidation in 18(75%) neonates followed by fine diffuse, bilateral, symmetrical reticulogranular and reticulonodular infiltrates with normal lung volume in 6(25%) neonates. All 23 neonates with HMD presented with fine, diffuse, bilateral reticular or reticulogranular infiltrates with decreased lung volume. There is no significant association between independent variables like maturity of neonates, premature rupture of membrane (PROM), prolonged labor or route of delivery with either clinical or radiological diagnosis of causes of RD in neonates. all 23 neonates with HMD presented with fine diffuse bilateral reticular or reticulogranular infiltrates with decreased lung volumes. There is no significant association between independent variables like maturity of neonates, premature rupture of membrane (PROM), prolonged labor or route of delivery with either clinical or radiological diagnosis of causes of RD in neonates. **Conclusion:** The study showed HMD and infections (EONS, pneumonia) were the most common causes of RD in neonates and most other researches also show comparable results of causes and radiographic findings of RD in neonates.

Key words: Respiratory distress, Neonates, Chest radiograph

12/27/2014 **Source of Support:** Nil, **Conflict of Interest:** None Declared

How to Cite: Tadesse T, Hawaz Y and Zewdneh D. 2014. **Patterns of Chest Radiographic Findings in Neonates with Respiratory Distress Admitted to the Neonatal Intensive Care Unit in Tikur Anbesa Specialized Hospital** *Malaysian Journal of Medical and Biological Research*, 1, 73-78.

INTRODUCTION

Respiratory distress is one of the commonest disorders encountered within the first 48-72 hours of life. It occurs in 0.96 to 12 % of live births and is responsible for about 20% of neonatal mortality (Khatua etel, 1979; Thomas etel, 1981; Misra, 1987; Kumar etel, 1999). Respiratory pathology is the commonest (32-54%) autopsy finding among early neonatal deaths (Maheshwari etel, 1971; Tibrewala etel, 1975; Banerjee, 1975). Respiratory distress of the newborn is a common presentation for a wide variety of diseases. Lung parenchymal disorders, such as transient tachypnea of the new born, pneumonia, surfactant deficiency, and meconium aspiration are the most common causes of respiratory distress in the neonate. However, airway and chest wall deformities as well as abnormalities of the diaphragm and mediastinal structures also can cause respiratory distress. Additionally, neurologic, cardiac, and metabolic abnormalities must be considered. Neonates who have congenital heart diseases commonly present with respiratory distress. Common metabolic causes of respiratory distress include hypoglycemia and acidosis. Respiratory distress can be a presentation of hypothermia, sepsis, acidosis, polycythemia, or anemia (Aly, 2004). Respiratory distress due to either medical or surgical causes occurs commonly in neonates and it is the most common cause of admission to a neonatal ward in a tertiary care hospital (Kumar, 2005). The chest radiograph is the most valuable imaging modality in the assessment of neonate with respiratory distress (Appleton, 1984; Sutton, 1998). The main aim of this study was to describe the chest radiographic patterns of neonates with RD.

SUBJECT AND METHODS

Hospital-based prospective cross-sectional study was conducted from October 2011 to August 2012 at neonatal intensive care unit in TASH. TASH is a specialized, teaching and tertiary level referral hospital in Ethiopia. Source of population was all neonates who were admitted in TASH. The study population was neonates with respiratory distress who were admitted in the study period. Study subjects were neonates with respiratory distress who had chest x-ray at admission in the neonatal ICU. Both sexes were included. Each patient was studied only once on his or her first admission during the study period. Those who were already admitted with respiratory distress who had chest radiograph were included in the study. Patients without respiratory distress were excluded. A convenient sampling method was used. All consecutive neonates with respiratory distress during the study period were included. Questionnaire was prepared and demographic and clinical data was collected from the charts of neonates with RD who had chest radiograph. The chest radiographs were collected and the findings were documented. All the information was collected by the principal investigator. Chest radiograph reading was done by final year radiology residents after training on chest radiograph reading in neonatal chest radiograph and check list was also prepared to minimize variation of interpretation of the chest radiographs. The collected data were checked for completeness and cleaned. Statistical Package for Social Sciences for window (SPSS) version 16 was used to enter and analyze the data. Data after checked was analyzed using Odd's ratio with 95% confidence interval and multiple regression analysis to determine the effect of numerous factors on the outcome variable and to control confounding effect. Analysis was also made for determination of relationship between causes of respiratory distress and associated factors. Ethical clearance had been obtained from Radiology Department Research Committee and Institutional Review Board (IRB). The questions from the questionnaire were proved not to affect the moral and personality of study subjects. Confidentiality of information and anonymity of patients' identity had been ensured.

RESULTS

One hundred fifty neonatal charts who were admitted in neonatal ICU in TASH were analyzed. Of 150 mothers of the neonates who were admitted, 133(89%) mothers were between 20-34yrs of age, 3(2%) mothers were between 15-19 yers of age, and 14(9%) mothers were between 35-49yrs of age. 80(53%) mothers had only one child, 66(44%) mothers had 2-4 children and 4(3%) mothers had more than 4 children. Majority of mothers, 134(89%) were living in urban and only 16(11%) were living in rural areas. Among 150 mothers, 145(96.7%) had ANC follow up and only 5(3.3%) mothers had no ANC follow up during pregnancy. Among the mothers who had ANC follow up, 34(23.4%) mothers had associated illness during pregnancy and 23(15.9%) mothers had hypertension or preeclampsia, 1(0.7%) mother had asthma and 10(6.9%) had other different causes (table 1). Majority of neonates124 (82.7%) were delivered in the hospital followed by deliveries at health centre 21(14%) cases. Deliveries at higher clinics was 3(2%) and home 2(1.3%); of all the neonates, 79(52.7%) were spontaneous vaginal deliveries, 58(38.7%) were CS and 13(8.7%) were instrumental deliveries. In 98(65.3%) cases, the duration of labor was between 4-24hrs, 9(6%) cases deliveries occurred within 3hrs of labor and in 3(2%) cases labour took place for more than 24hrs. In 24(16%) cases, the mothers had PROM or fever before delivery. Of 150 neonates, 133(88.7%) were singleton pregnancies, 15(10%) were twins and 2(1.3%) were triplets where the ratio of male to female neonates was 1.16:1 and 1(0.7%) neonate had ambiguous genitalia. Weight of neonates at birth was known in 137 patients and 21(15.3%) were less than 1500gms, 49(35.7%) were 1500-2499gms, 63(46%) were 2500-4000gms, 4(3%) were more than 4000gms. Most of the neonates 129(86%) were admitted with in 24hrs after birth and only 21(14%) neonates were admitted between 25hrs-7days after birth. Majority of neonates were term pregnancy 79(52.7%), followed by preterm babies 66(44%) and 5(3.3%) were post term neonates (table 2).

Clinical evaluation in 150 neonates with RD showed HMD 44(29.3%), EONS 33(22%) and MAS 24(16%). These made up the majority of causes of neonatal RD and other less common causes include combined Meconium Aspiration Syndrome (MAS) and PNA 9(6%), combined HMD and EONS 6(4%), TTN 4(2.7%), combined pneumonia & proximal atresia with Tracheo-Esophageal Fistula (TEF) 4(2.7%), pneumonia 2(1.3%), Congenital Heart Disease(CHD) 2(1.3%), Perinatal Asphyxia (PNA) 2(1.3%), combined MAS & EONS 2(1.3%), combined (Transient Tachypnea of the Newborn) TTN & EONS 2(1.3%), combined PNA & EONS 2(1.3%) and combined pneumonia & EONS 2(1.3%) and 12(8%) cases constituting other single or combined cases (fig. 1). From 150 RD cases who had chest radiograph, 66(44%) neonates had abnormal chest radiograph findings; Pneumonia 24(36.4%), HMD 23(34.8%), CHD 6(9.1%), MAS 4(6.1%), TTN 3(4.5%), proximal EA with distal TEF 3(4.5%), combined pneumonia and proximal EA with distal TEF 2(3%) and chest deformity with rib fusion and scoliosis 1(1.5%) (fig.2). Concerning the radiological findings of each specific disease, HMD presented with bilateral, symmetrical and diffuse finely reticular or reticulogranular infiltrates with decreased lung volume in all the neonates (23 neonates). Neonates with congenital pneumonia presented with lobar or multi lobar asymmetric consolidation in 18(75%) neonates followed by bilateral, symmetrical and diffuse fine reticulogranular or reticulonodular infiltrates with normal lung volume was seen in 6(25%) neonates. TTN presented with bilateral perihilar streaky shadows in all 3 neonates and only one patient had associated right side pleural effusion. MAS presented with bilateral asymmetric course nodular infiltrates with hyper inflation in 2(50%) neonates, bilateral symmetrical and diffuse coarse reticulonodular infiltrates with hyperinflation in 1(25%) neonate and unilateral course nodular infiltrates with hyperinflation in 1(25%) neonate were seen. In neonates with CHD presented with increased cardiothoracic ratio in all 6 neonates with decreased pulmonary vasculature in 4(66.7%) neonates and increased pulmonary vasculature in 2(33.3%) neonates. In patients with proximal esophageal Atresia (EA) with distal TEF, the chest radiograph showed dilated proximal esophagus and blind ended mid esophagus with curling of nasogastric tube was seen in 5 neonates and there was also associated pneumonia presented with unilateral lower lung nodular infiltrates in 2(40%) neonates. Chest deformity with rib fusion and scoliosis was seen in only 1 neonate (fig 3).

DISCUSSION

This research was conducted to show the patterns of chest radiographic findings of RD in neonates in neonatal ICU in TASH but the study lacks the Gold Standard tests for confirming the diagnosis to show the definitive causes of respiratory distress in neonates. The study showed that the common causes of RD in neonates were HMD 44(29.3%), EONS 33(22%) and MAS 24(16%) on clinical diagnosis and Pneumonia 24(36.4%) and HMD 23(34.8%) account the majority of causes of RD based on the radiograph findings but other research showed the leading cause of neonatal RD was TTN (50-60% of RD cases) followed by infections (pneumonia, sepsis, or meningitis), MAS, and HMD(13). Preterm babies had the highest incidence (30.0%) followed by post-term (20.9%) and term babies (4.2%) but in our research the most common causes of RD occur in term babies 79(52.7%), followed by preterm babies in 66(44%) cases and 5(3.3%) cases of post term neonates. Other study showed the frequency of respiratory distress was 29.2% of all admissions (n = 569) and pneumonia accounting 68.7% of cases(14) where chest radiographs showed alveolar infiltrates in 44.6%, sub lobar consolidation in 17.4%, lobar consolidation in 9.7%, diffuse haziness in 11.6% and opacity with reticulogranular pattern in 1.9% but a research done here showed higher radiographic finding of lobar or multi lobar consolidation in 18(75%) cases followed by fine diffuse, bilateral, symmetrical reticulogranular and reticulonodular infiltrates with normal lung volume seen in 6(25%) neonates. There is no significant association between independent variables like maturity of neonates, PROM, prolonged labor or route of delivery with either clinical or radiological diagnosis of causes of RD in neonates. Statistical association using Pearson Chi-square was also done to assess the association between clinical and radiological diagnosis and there was no significant association between clinical and radiological diagnosis of any of the causes of neonatal distress.

CONCLUSION

Chest radiograph showed pneumonia 24(36.4%) and HMD 23(34.8%) account the majority of cases. HMD presented with bilateral, symmetrical and diffuse fine reticular or reticulogranular infiltrates with decreased lung volume. Neonates with congenital pneumonia presented with lobar or multi lobar asymmetric consolidation in 18(75%) neonates. There was no significant association between independent variables like maturity of neonates, PROM, prolonged labor or route of delivery with either clinical or radiological diagnosis of causes of RD in neonates.

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Table 1: Socio-demographic characteristics of mothers whose neonates were admitted with RD in neonatal ICU in TASH. (n=150)

Variable	Frequency	Percentage (%)
Mothers		
Age		
15-19 years	3	2
20-34 years	133	89
35-49 years	14	9
No. of children		
1 child	80	53
2-4 children	66	44
>4 children	4	3
Residence		
Urban	134	89
Rural	16	11

Table 2: Assessment of neonatal conditions during delivery in neonates with RD admitted in TASH in neonatal ICU. (n=150)

Variables	Frequency	Percentage (%)
Place of delivery		
Home	2	1.3
Health centre	21	14
Hospital	124	82.7
Higher clinic	3	2
Route of delivery		
SVD	79	52.6
Instrumental delivery	13	8.7
CS	58	38.7
Duration of labour		
Up to 3hrs	9	6
3-24hrs	98	65.3
>24hrs	3	2
Unknown/no labour	40	26.7
Multiplicity if birth		
Singleton	133	88.7
Twin	15	10
Triplet	2	1.3
Neonatal sex		
Male	80	53.3
Female	69	46
Ambiguous genitalia	1	0.7
Age at admission		
Within 24hrs	129	86
25hrs-7days	21	14
7-28days	0	0
Maturity of neonates		
Preterm	66	44
Term	79	52.7
Post term	5	3.3

Figure 1: clinical diagnosis in neonates with RD who are admitted in neonatal ICU in TASH. (n=150)

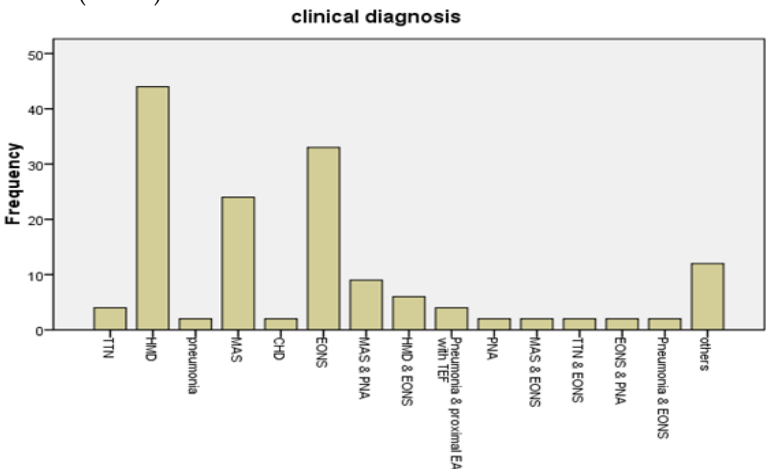

Figure 2: CXR diagnosis in neonates with RD who were admitted in neonatal ICU in TASH. (n=150)

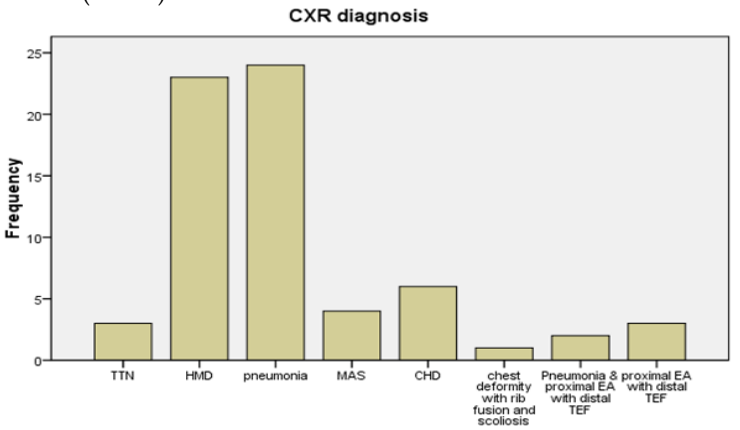

Figure 3: Radiographic findings of neonates with RD who were admitted in neonatal ICU in TASH. (n=150)