Original Research Article

A radiological perspective of assessing neonatal respiratory distress syndrome

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Abstract

Background: The causes of respiratory distress in the neonatal period can be classified into abnormalities primarily affecting aeration, circulation or development of the thorax. Conditions of the lungs and cardiovascular system account for the majority but abnormalities of the tracheobronchial tree, chest wall, diaphragm, and a variety of neuromuscular diseases must also be considered in the differential diagnosis. Chest radiography is the most valuable imaging modality in the investigation of neonatal respiratory disorders. Within 48 – 72 hours, the most common disorder that occurs in neonate is respiratory distress. Post natal respiratory distress is the most important indication for chest X-ray.

Materials and methods: This was a prospective observational study that was conducted in rural tertiary care center. Anteroposterior chest radiograph in supine position of (59) neonates were taken, presented with a chief complaint of respiratory distress. Chest X-ray was taken with the help of portable X-ray machine in NICU department. Chest X-ray were taken on first day of admission and then follow up chest X-rays were taken.

Results: The commonest cause of respiratory distress in neonates which presented with respiratory distress was transient tachypnoea of new born, in my study 32.20% diagnosed with transient tachyponea; 20.3% diagnosed with hyaline membrane disease; 16.94% diagnosed with congenital neonatal pneumonia; 11.86% diagnosed with meconium aspiration syndrome; 1.96% diagnosed with aspiration syndrome; 5.08% diagnosed with cardiac causes; 3.38 % diagnosed with trachea-oesophageal fistula; 3.38% diagnosed with congenital diaphragmatic hernia; 1.69% diagnosed with idiopathic persistent pulmonary hypertension; 1.69% diagnosed with eventeration of diapghram; 1.69% diagnosed with pneumoperitoneum, presented to radiology department with respiratory distress.

Conclusion: Chest radiography is essential in neonates with acute respiratory distress to exclude structural abnormalities such as congenital diaphragmatic hernia or congenital lobar emphysema. One should remember that any sign of post–natal respiratory distress is an indication for roentgenogram of the chest which should be taken as early as possible. Finally chest radiograph should be read by an expert radiologist.

Key words

Neonates, Chest radiograph, Acute respiratory distress, Transient tachypnoea of newborn.

Introduction

The causes of respiratory distress in the neonatal period can be classified into abnormalities primarily affecting aeration, circulation or development of the thorax. Conditions of the lungs and cardiovascular system account for the majority but abnormalities of the tracheobronchial tree, chest wall, diaphragm, and a variety of neuromuscular diseases must also be considered in the differential diagnosis. Chest radiography is the most valuable imaging modality in the investigation of neonatal respiratory disorders [1].

Within 48 – 72 hours, the most common disorder that occurs in neonate is respiratory distress. Post natal respiratory distress is the most important indication for chest X-ray.

Respiratory distress is defined by presence of at least two of following three features:

- Tachypnea (respiratory rate >60 per minute)
- Retractions (intercostal, subcostal, sternal and suprasternal)
- Noisy respiration (grunt, stridor or wheeze)

Chest radiography is very essential in neonates with acute respiratory distress to exclude the surgical and medical causes of respiratory distress. It is the most important indication for neonatal respiratory distress. Clinically it is very difficult to distinguish the difference between pulmonary and extra pulmonary causes of respiratory distress as a neonate can develop respiratory distress in utero, during delivery or in post natal period.

Any signs of postnatal respiratory distress are an indication for roentgenogram of the chest. It has a wide range of causes, some of which are life threatening. Chest radiograph is considered the most reliable diagnostic tool to study the respiratory distress in new born [2, 3].

This paper reviews the common spectrum of disorders of the neonatal chest on evaluation using chest roentgenography.

Aim and objectives

- To present a brief overview of the various chest pathologies in neonate.
- To consider radiological appearances of various chest pathologies
- To discuss current approaches for radiologic analysis and diagnosis of these pathologies
- To study the various risk factors associated with development of severe respiratory distress in the new born.
- To assess the immediate clinical outcome of respiratory distress in new born.

Materials and methods

Study area

The study was carried out in the Department of Radiodiagnosis, S.B.K.S. Medical Institute and Research Centre, Waghodia, Vadodara.

Study design

Type of the study: An Observational, Descriptive Hospital Based Study.
Sample size: 59 patients.

Selection of subject

Inclusion criteria

- All the neonates who were admitted to NICU of Dhiraj General Hospital, Vadodara within 72 hours of birth having symptoms suggestive of respiratory distress were included in the study.
- All neonates delivered in the hospital and also those delivered outside the institution and then admitted in the institution for respiratory insufficiency complaints within the 72 hours of birth, were included in this study.

Exclusion criteria

- All New born admitted to NICU with onset of respiratory distress after 72 hours.
- Families unwilling to participate in the study were excluded.

Study protocol

- This was a prospective observational study of 59 neonates presented with respiratory distress. Neonates admitted in NICU department, within 72 hours of birth with respiratory distress were included in study.
- Chest X-ray was done on 1st day of admission and then follow up X-rays were taken from 2nd day of admission till date of discharge as required. Findings of chest X-ray on 1st day of admission along with clinical history, birth history, maternal history, APGAR score at 1 minute, liquor, history of immediate cry and gestational age were noted. Then treatment history along with follow up chest X-ray findings were taken, on the basis of which, final diagnosis was concluded.
- Compilation of all the observational data of Dhiraj General Hospital was done in the form of frequencies and percentage which has been depicted in the form of pie-charts and graphs.
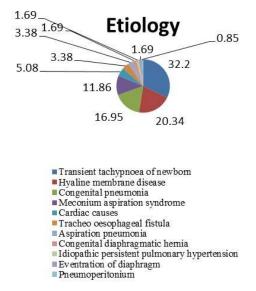
Results

Table – 1 and **Figure - 1** showed 32.20% diagnosed with transient tachyponea; 20.3% diagnosed with hyaline membrane disease; 16.94% diagnosed with congenital neonatal pneumonia; 11.86% diagnosed with meconium aspiration syndrome; 1.96% diagnosed with aspiration syndrome; 5.08% diagnosed with cardiac causes; 3.38 % diagnosed with trachea-oesophageal fistula; 3.38% diagnosed with congenital diaphragmatic hernia; 1.69% diagnosed with idiopathic persistent pulmonary hypertension; 1.69% diagnosed with eventeration of diapghram; 1.69% diagnosed with pneumoperitoneum, presented to radiology department with respiratory distress.

Table – 1: Etiology.

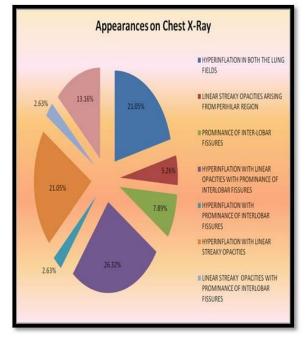| Etiology	Frequency (n = 59)	%
Transient tachypnoea of newborn	19	32.20%
Hyaline membrane disease	12	20.33%
Congenital pneumonia	10	16.94%
Meconium aspiration syndrome	7	11.86%
Aspiration pneumonia	1	1.69%
Cardiac causes	3	5.08%
Tracheooesophageal fistula	2	3.38%
Congenital diaphragmatic hernia	2	3.38%
Idiopathic persistent pulmonary hypertension	1	1.69%
Eventration of diaphragm	1	1.69%
Pneumoperitonium	1	1.69%
Total	59	100%

Figure – 2 showed varied appearances of transient tachypnoea of new born on chest X-ray: 21.05% presented with hyperinflation in both lung fields; 5.26% with linear streaky opacities arising from perihilar region; 7.88% with prominence of interlobar fissure; 26.33% with

hyperinflation with linear opacities with prominence of inter lobar fissure; 2.63% with hyperinflation with prominence of interlobar fissure; 21.05% with hyperinflation with linear streaky opacities; 2.63% with linear streaky opacities with prominence of interlobar fissure and 13.15% had normal chest X-ray.
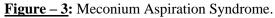
Figure – 1: Etiology.

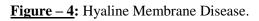**Figure – 2:** Appearances on chest X-ray.

Discussion

In this study commonest cause of respiratory distress in neonates which presented with respiratory distress was transient tachypnoea of

new born (**Figure – 5**), which was (32.20%), followed by hyaline membrane disease (20.33%) (**Figure – 4**), neonatal congenital pneumonia (16.94 %), meconium aspiration syndrome (11.86 %) (**Figure – 3**), cardiac causes (5.08 %), trachea-oesophageal fistula (3.38 %), congenital diaphragmatic hernia (3.38 %), aspiration pneumonia (1.69%), idiopathic persistent pulmonary hypertension (1.69%), eventration of diaphragm (1.69%) followed by pneumoperitonium (1.69%).

Figure – 3: Meconium Aspiration Syndrome.

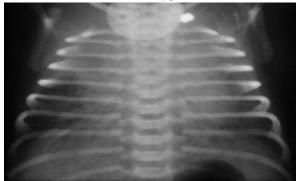**Figure – 4:** Hyaline Membrane Disease.

Chest radiographic finding in patients with transient tachypnea of new born in this study showed that hyperinflation with linear streaky perihilar opacities with prominence of interlobar fissure was most common finding of transient tachypnea of new born (26.32%), followed by

only hyperinflation noted as sole finding on chest x ray (21.05%), hyperinflation with linear streaky opacities (21.05%), prominence of interlobar fissures (7.88%), linear streaky perihilar opacities (5.26%), hyperinflation with prominence of interlobar fissures (2.63%), linear opacities with prominence of interlobar fissures(2.63%). Normal chest x rays were noted in 13.15% cases of transient tachypnea of new born.

Figure - 5: Transient Tachypnoea of New born.

One study found chest X–ray films were normal in 16% [1]. One study found that many newborn with transient tachypnea had clear chest films [2]. Marini, et al. [4] in 1997, found only reticulonodular shadowing in chest radiograph of patients with transient tachypnea of newborn. In present study 13.15% are normal. In this study most common presentation was combination of hyperinflation of lung fields with linear streaky perihilar opacities with prominence of interlobar fissures. No nodularity was noted in our study.

Standard chest radiography is the preferred radiologic examination. Initially, it may be difficult to distinguish transient tachypnea from other causes of respiratory distress of the newborn.

The differential diagnosis includes Hyaline membrane disease, Meconium Aspiration, and neonatal pneumonia. Other conditions to be considered include respiratory distress syndrome, congenital lymphangiectasia, congenital heart disease, polycythemia, cerebral hyperventilation, and anemia/ hypovolemia [2].

The incidence and severity of RDS are inversely related to gestational age. RDS is the most common cause of respiratory failure during the first days after birth [3]. In addition to prematurity, other factors contributing to the development of RDS are maternal diabetes, cesarean delivery without preceding labor, being the second born of twins, perinatal asphyxia, perinatal infection, and patent ductus arteriosus. A normal film at 6 hours of life excludes the diagnosis of RDS [4].

Conclusion

Respiratory distress is one of the most common disorders that occur within the first (48-72) hours of life. Neonate can have respiratory disturbance in utero, in delivery room or in nursery. There are wide varieties of causes that can cause respiratory distress in neonate. There are pulmonary and extrapulmonary causes. Pulmonary causes include transient tachypnea of newborn, hyaline membrane disease, congenital neonatal pneumonia and meconium aspiration syndrome. Extrapulmonary causes include surgical causes like congenital diaphragmatic hernia, tracheooesophageal fistula, eventration of diaphragm, cardiac causes and pneumo peritoneum can cause external pressure and cause respiratory distress. It is difficult to distinguish pulmonary and extrapulmonary causes of respiratory distress clinically.

Any sign of post natal respiratory distress is an indication for roentgenogram of chest. Chest radiography is most important tool to study the respiratory distress in neonates. In our present study chest x ray was done in neonates, presented with respiratory distress.

Chest radiography is essential in neonates with acute respiratory distress to exclude structural abnormalities such as congenital diaphragmatic hernia or congenital lobar emphysema. One should remember that any sign of post–natal respiratory distress is an indication for roentgenogram of the chest which should be taken as early as possible. Finally chest

radiograph should be read by an expert radiologist.

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