

Chest ultrasound for respiratory distress in preterm newborn

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Abstract

Study was carried out to assess benefits of chest ultrasound in preterm neonates having respiratory distress. This was done for better and more reliable assessment of treatment and to reduce the radiation dose.


Key Words: USG, X-ray, RDS.

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Received Date: 16/11/2016 Revised Date: 20/12/2016 Accepted Date: 13/01/2017

Access this article online	
Quick Response Code:	Website: www.medpulse.in
	DOI: 18 January 2017

INTRODUCTION

Although respiratory distress syndrome of newborn infant has been the object of increased clinical and research interest in past 10 years little attention has been paid to its possible sequelae. It is stated that most of these infants who survive the first three days of life will recover completely and by 7 to 10 days of life will have normal lungs radiographically.¹ Respiratory distress in preterm neonate can be due to following causes

1. Surfactant deficiency disorder
2. Meconium Aspiration Syndrome
3. Transient tachypnea of newborn
4. Pneumonia-congenital or aspiration
5. Sepsis, Hypoxia
6. Pleural effusion
7. Pneumothorax²

Clinical assessment varies depending upon observer's experience, variable presentation in extreme preterm and extremely low birth weight. Interpretation of the location and nature of pathology on chest x-ray is sometimes difficult. Differentiation between pulmonary and pleural lesions may not be possible. X rays involve exposure to ionizing radiation so either very high radiation dose is required or to avoid radiation dose X-rays cannot be repeated as and when required.³ Progressive respiratory distress occurring shortly after birth showing symptoms like tachypnea, grunting, nasal flaring, subcostal or intercostals retraction, reduced breath sounds- need very frequent monitoring by imaging.

Role of Ultrasonography (USG) of Chest

USG chest been found to be sensitive in diagnosing respiratory pathologies in preterm neonate which shows following patterns

1. Generalized consolidation with air bronchogram
2. Bilateral white lung
3. Pleural line abnormalities
4. A line disappearance, pleural effusion, etc.

Advantages of USG

- Its non ionizing.
- Can be performed bed side with infant in the incubator.
- Easy to operate.
- Can be repeated several times a day without hazard to operator and patient.
- Cost effective and requires only some basic skill training.⁴

MATERIAL AND METHODS

Setting

Tertiary level Neonatal Intensive Care Unit. Bharati Vidyapeeth Deemed University Medical College and Hospital, Sangli.

Study design

Prospective analytical study.

Study period

From 1st Sept 2014 to 31th august 2015

Sample size

100 N.I.C.U. preterm children with respiratory signs.

Inclusion criteria

All preterm neonates admitted in neonatal intensive care unit with respiratory distress.

Exclusion Criteria

- Neonates with major congenital malformations
- Refusal of consent from Parents / Guardian
- Failure to do USG chest in first 24 hrs of admission.

Control

Pre term babies without Respiratory distress.

Clinical Protocol

X-ray chest

1. At the time of admission
2. 24 hours
3. 48 hours
4. 72 hours

If clinical situation needs x-ray, additional x-rays were taken as per neonatologist's advice.

USG Chest

1. < 24 hours of admission
2. 48 hours
3. 72 hours

If USG chest was done in 24 hrs of admission, comparative X-ray was first X-ray and if USG chest done after 24hrs then it was compared with 24hrs X-ray. If

REPRESENTATIVE CASES

required, for management of patients x rays and chest USG was done more often. USG findings were taken into account only when pertinent. Clinical protocol for management respiratory distress was same as before trials. Sonologist was blinded about x-ray findings.

OBSERVATIONS AND RESULTS

Table 1: X-ray chest correlation

X ray findings	Positive for RDS	Negative for RDS	Other pathologies
n=100	41	54	05
Percentage %	41%	54%	05%

Table 2: USG chest correlation

USG findings	Positive for RDS/interstitial fluid	Negative for RDS	Other pathologies
n=100	64	31	05
Percentage %	64%	31%	05%

Table 3: USG and x-ray chest correlation

Finding	USG Positive for Meconium aspiration	Xray positive for Meconium aspiration
n=100	03	03

Table 4: USG and x-ray correlation

Findings	USG positive for pneumonia	Chest Xray positive for pneumonia
N=100	02	02

Statistical Analysis: Percentage and proportion was taken and analyzed with Z- test (Standard Error of difference of two proportion). SPSS software and Microsoft Excel was used.



Figure 1: Images showing normal chest x-rays and positive USG findings for RDS



Figure 2: X-ray and USG Images showing positive case of Meconium aspiration



Figure 3: X-ray and USG Images showing two positive cases of Pneumonia

DISCUSSION

In neonate with normal chest, chest sonography demonstrated a bright echo reflective line at pleural lung interface with shadowing beyond. This was appearance of normal aerated lungs. In some neonate few thin white lines (B lines) perpendicular to lung pleura interface were seen, which we realized was a normal appearance as these neonates were clinically and radiographically normal. These lines were described earlier by researchers as representing sub pleural interstitial edema. When these lines were thick and numerous neonates were found to be mildly affected clinically.⁴⁻⁵ B lines represents interstitial fluid. When this fluid was in sub pleural location it cause break in echo reflective surface as well as an artefactual line because of reverberation. Segmental white lung appearance – Thick white columns extending from pleural surface. This represented neonates with moderate changes of RDS clinically and radiologically. Total white lung corresponded with severely affected neonates clinically and radiologically. Segmental white lung and total white lung was most likely produced by collapsed alveoli, which allow the sound waves to pass though and because of too many interface of collapsed alveolar walls cause bright appearance.⁶ The appearances were overlapping and rapidly changing. We found them to correlate very well with clinical picture. In some cases

they correlated with clinical picture much better than the radiographs. In meconium aspiration chest USG changes were irregular and thickened pleural lines, multiple B lines and multiple consolidation with bronchograms. In pneumonia chest USG findings were gray appearance of lung with air bronchogram noted within. Sometimes fluid bronchograms were seen in the consolidated lung.⁷⁻⁸

SUMMARY AND CONCLUSION

We have studied 100 patients. It was found that

- On X-ray positive RDS patients were 41 while no RDS or normal x-ray seen in 54 patients and 5 showed other pathologies like meconium aspiration and pneumonia.
- While sonographic findings of 100 patients showing positive RDS cases in 64. Advanced changes seen in 35 while mild quantity of interstitial edema noted in 29 patients corresponding to mild RDS changes in which x ray was normal. Other pathologies noted in 5 patients corresponding to chest x rays
- USG was found to be more sensitive in milder form of RDS to an X-ray.
- It was found that 3 positive cases of meconium aspiration found on sonography having corresponding chest X-ray findings.

- Two positive cases of pneumonia found on X-ray, USG showed pneumonia.
- The rapid changes in condition was better reflected in USG.
- The chest USG correlated more accurately with change in clinical condition than chest X-ray.

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Source of Support: None Declared
Conflict of Interest: None Declared