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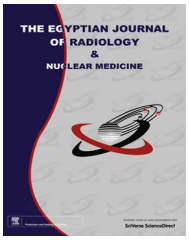

REVIEW

The value of bedside Lung Ultrasonography in diagnosis of neonatal pneumonia

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KEYWORDS

Lung ultrasonography;
Pneumonia;
Chest radiography;
Lung consolidation

Abstract *Purpose:* The aim of this prospective study was to assess lung ultrasonography as an alternative to bedside radiography for the diagnosis of neonatal pneumonia.
Patients & methods: The study was performed on 75 neonates admitted during the period from October 2011 to October 2012 in the NICU of Cairo University Pediatric Hospital presenting with clinical picture of pneumonia. Chest X-rays and lung US were done.
Results: Chest X-ray findings denoting lung infections were present in 64 cases (85.3%), and the remaining 11 cases (14.6%) had a free chest X-ray. Ultrasonography revealed pneumonic patches in 68 patients (90.6%), 7 (9.3%) had free US scans. US and chest X-rays detected pneumonic patches in 64 cases (85.3%), US detected pneumonic patches in 18 cases (24%) with chest X-rays having signs of chest infections other than pneumonic patches and in 4 cases (5.3%) with clear chest X-rays.
Conclusion: Bedside lung ultrasonography is highly sensitive, specific, and reproducible for ruling out underlying pneumonic process as well as in early detection and follow up of possible complications and can be considered an attractive alternative to bedside chest radiography and thoracic computed tomography with minimal radiation exposure.

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Contents

1. Introduction

Pneumonia contributes to between 750,000 and 1.2 million neonatal deaths each year worldwide (1). Diagnosis of pneumonia is sometimes difficult and lack of exact definitions for pneumonia (2) compounds this problem. It was reported that clinical picture and chest X-ray can miss the diagnosis of pneumonia in neonates in 15% cases (3). However, chest X-ray is still considered to be the first imaging step for diagnosing pneumonia in children (4).

In the neonatal intensive care unit (NICU), bedside lung auscultation and chest radiography are routinely performed on a daily basis for assessing lung status in infants with chest problems. Interpretation of the location and nature of an area of increased opacity on chest radiographs is sometimes problematic, particularly in young infants with varied configurations of the normal thymus, and differentiation between pulmonary, pleural, and mediastinal lesions is not always easy. Because of many advantages such as the absence of radiation exposure, non-invasiveness, low cost, safety, and ready availability, transthoracic ultrasonography (TUS) represents an emerging and useful technique in the management of pleural and pulmonary diseases (5).

TUS is helpful in the evaluation of persistent or unusual areas of increased opacity in the peripheral lung, pleural abnormalities, and mediastinal widening; ultrasonography (US) is particularly useful in patients with complete opacification of a hemithorax at radiography. In cases of pulmonary parenchymal lesions, identification of air or fluid bronchograms at US is useful for differentiating pulmonary consolidation or atelectasis from lung masses and pleural lesions (6,7).

The aim of this prospective study was to assess whether lung ultrasonography could be an alternative to bedside chest radiography for diagnosing neonatal pneumonia.

2. Materials and methods

The study was performed on 75 neonates admitted during the period from October 2011 to October 2012 in the NICU of Cairo University Pediatric Hospital. Neonates presenting with clinical picture of pneumonia were enrolled in the study. This included an acute onset of symptoms and signs of respiratory distress including tachypnea, retractions, grunting and cyanosis in addition to auscultatory findings including diminished air entry, fine crepitations and bronchial breath sounds. Only neonates presenting after 48 h of life were included as an attempt to exclude the possibility of Respiratory Distress Syndrome (RDS) and Transient Tachypnea of the Newborn (TTN). Neonates with congenital heart disease (CHD) were excluded from the study to rule out pulmonary edema secondary to congenital heart disease.

All included neonates were subjected to

- **History taking** including; sex, gestational age, postnatal age, mode of delivery, weight, presenting symptoms and their onset.
- **Full clinical examination** including general, cardiac, abdominal and chest examination was performed. Signs of respiratory distress (respiratory rate, presence of retractions, grunting or cyanosis) were observed and meticulous chest auscultation was done. Auscultation was performed by the same investigator immediately before performing the US scanning. Twelve lung regions were systematically examined: the upper and lower parts of the anterior, lateral, and posterior regions of the left and right chest walls with the patient in the supine position. Abnormal auscultatory findings included diminished breath sounds, presence of bronchial breath sounds and presence of fine crepitations. The extent of lung injury was assessed as the number of regions where auscultation was abnormal.
- **Laboratory investigations** including complete blood count with differential, C reactive protein, blood culture and endotracheal aspirate in ventilated cases were done.
- **Chest radiography** with the patient in the supine position, anterior portable radiographs were obtained using a Philips Mobile Medical X-ray system D-22335 Hamburg, Germany before US scanning that was read by the same radiologist. Exposure time, focus-film distance, and degree of exposure were standardized for each patient to obtain the best radiographic quality. Lung parenchyma was divided into 12 regions by a cephalocaudal mid-axillary line and a transversal hilar line. Upper lung regions were defined as lung regions delineated by the apex, mid-axillary line, mediastinal line, and hilar line. Upper and lower lateral lung regions were defined as lung regions delineated by the external limit of the chest wall, mid-axillary line, and apex (upper) or diaphragm (lower). Upper and lower posterior lung regions were defined as lung regions with radiologic signs erasing the mediastinum border (“silhouette sign”) and delineated by the mediastinum, mid-axillary line, hilar line, and apex (upper) or diaphragm (lower) (8).The extent of lung injury was assessed as the number of lung regions with radiologic signs suggestive of alveolar consolidation.
- **Lung ultrasonography** was performed immediately after the chest radiography, with a Toshiba Diagnostic Ultrasound System, Nemio XG SSA-580A, and a linear 7 MHz. The lung regions that were explored by auscultation were also