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ORIGINAL RESEARCH

Assessment of usefulness of lung ultrasound in the diagnosis of community-acquired pneumonia in children

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Abstract

Background: Pneumonia is a major health threat worldwide and causes more deaths in children than AIDS, malaria, and measles. The present study was conducted to assess usefulness of lung ultrasound in the diagnosis of community-acquired pneumonia in children.

Materials & Methods: 48 child patients with community-acquired pneumonia of both genders were enrolled and all were subjected to chest radiography and lung ultrasound (LUS).

Results: Out of 48, boys were 28 and girls were 20. The mean weight was 24.6 kgs, height was 114.2 cm, length of stay was 7.5 days, positive PICU stay was 25.4 days, location was right lung in 22, left lung in 15 and both lungs in 11 cases. Comet sign was positive in 25 and negative in 23, air bronchogram positive in 42 and negative in 6, fluid bronchogram positive in 5 and negative in 43, vascular pattern positive in 9 and negative in 39 and pleural effusion positive in 7 and negative in 41.

Conclusion: A high detection rate for LUS in identifying pneumonia in children was found. It also proved to be a prromising tool for the follow up of patients with pneumonia.

Key words: Children, Pneumonia, USG

Introduction

Pneumonia is a major health threat worldwide and causes more deaths in children than AIDS, malaria, and measles. In India, pneumonia is the 5th leading cause of death with a mortality rate of 24.8/10,000 people and accounts for more than 0.65 million outpatient visits in medical settings each year; 50% of these patients are children.[1]

The diagnosis of pneumonia is usually a new infiltrate seen on a chest radiograph.[1] However, ionizing radiation may expose children to an increased risk of gene mutations and the development of cancer. Lung ultrasound (LUS) has increasingly been used to detect pneumonia in children.[3] In many clinical settings, especially emergency departments and intensive care units, LUS has been widely used as the primary diagnostic tool to detect pneumothorax, pulmonary consolidations, pleural effusion, acute respiratory distress syndrome, and pulmonary edema due to its ease of operation, provision of real-time images, and no risk of exposure to ionizing radiation.[4] Multiple studies have shown LUS imaging to be more accurate than chest radiography in some respiratory diseases in adults, such as pneumothorax, alveolar interstitial syndrome, pleural effusion, and pneumonia.[5,6] The present

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study was conducted to assess usefulness of lung ultrasound in the diagnosis of community-acquired pneumonia in children.

Materials & Methods

The present study consisted of 48 child patients with community-acquired pneumonia of both genders. Parental consent was obtained to participate in the study.

Data such as name, age etc. was recorded. The presence of signs and symptoms of pneumonia such as fever, tachypnea, breathlessness, cough, wheeze, or chest pain was recorded. History-taking, physical examination, laboratory tests such as complete blood count and level of C reactive protein was done. All were subjected to chest radiography and lung ultrasound (LUS). Results thus obtained were subjected to statistical analysis. P value less than 0.05 was considered significant.

Results

Table I Distribution of patients

Total- 48		
Gender	**Boys**	**Girls**
Number	28	20

Table I shows that out of 48, boys were 28 and girls were 20.

Table II Baseline characteristics

Parameters	Mean	SD
Weight (Kgs)	24.6	3.7
Height (cm)	114.2	12.5
Length of stay (days)	7.5	3.4
Positive PICU stay (Days)	25.4	8.6
Location right	22	1.3
Left	15	1.1
Both	11	1.5

Table II, graph I shows that mean weight was 24.6 kgs, height was 114.2 cm, length of stay was 7.5 days, positive PICU stay was 25.4 days, location was right lung in 22, left lung in 15 and both lungs in 11 cases.

Graph I Baseline characteristics

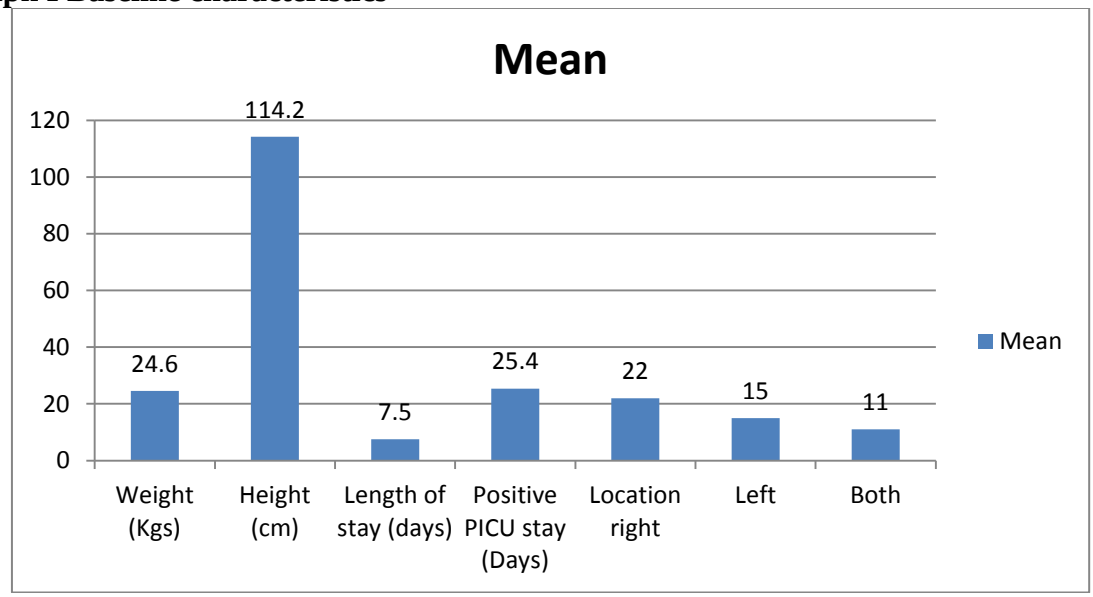

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Table III USG findings

Findings	Positive	Negative	P value
Comet sign	25	23	0.17
Air bronchogram	42	6	0.01
Fluid bronchogram	5	43	0.02
Vascular pattern	9	39	0.04
Pleural effusion	7	41	0.02

Table III shows that comet sign was positive in 25 and negative in 23, air bronchogram positive in 42 and negative in 6, fluid bronchogram positive in 5 and negative in 43, vascular pattern positive in 9 and negative in 39 and pleural effusion positive in 7 and negative in 41. The difference was significant (P< 0.05).

Discussion

Community-acquired pneumonia (CAP) is a lower respiratory tract infection occurring in a child who has not resided in a hospital or health care facility in the preceding 14 days. Vertical transmission of organisms from the maternal genital tract is the main route of entry of pathogens in the neonatal and early infancy period.[7] The primary organisms responsible for pneumonia in the first three months of life are group B streptococci, gram-negative bacilli and occasionally Listeria monocytogenes. Overall, viruses are the most common causes of pneumonia in the first two years of life, accounting for up to 90% of pneumonias.[8] The most commonly implicated viruses are respiratory syncytial virus, parainfluenza virus types 1, 2, and 3, influenza virus types A and B, adenovirus, rhinoviruses, and less commonly, herpes simplex virus and enteroviruses.[9] With increasing age, the incidence of pneumonia decreases, but bacterial pathogens including Streptococcus pneumoniae, Mycoplasma pneumoniae, and Chlamydia pneumoniae become more frequent. In children up to 15 years of age, S pneumoniae accounts for between 17% and 28% of all community-acquired pneumonia cases.[10] The present study was conducted to assess usefulness of lung ultrasound in the diagnosis of community-acquired pneumonia in children.

We found that out of 48, boys were 28 and girls were 20. Ho M-C et al[11] determined the power of lung ultrasonography (LUS) for the diagnosis of pneumonia in children. A total of 163 patients was enrolled. Chest radiography was able to detect pneumonia in 152 patients, whereas LUS detected pneumonia in 159 patients. In LUS, the positive rates of the comet-tail sign, air bronchograms, fluid bronchograms, vascular pattern within the consolidation, and pleural effusion were 50.9%, 93.7%, 20.1%, and 28.9%, respectively. During follow up, the average size of the pneumonia patch in 23 patients decreased from 10.9 to 8.7 cm2 to 5.5 8.2 cm2 and finally to 2 1.9 cm2 on day 1, days 3-5 and days 7-14, respectively.

We found that mean weight was 24.6 kgs, height was 114.2 cm, length of stay was 7.5 days, positive PICU stay was 25.4 days, location was right lung in 22, left lung in 15 and both lungs in 11 cases. Reissig et al[12] reported the first prospective study in adults of the diagnosis of community-acquired pneumonia using LUS with an excellent sensitivity of 94% and specificity of 98%.

We found that comet sign was positive in 25 and negative in 23, air bronchogram positive in 42 and negative in 6, fluid bronchogram positive in 5 and negative in 43, vascular pattern positive in 9 and negative in 39 and pleural effusion positive in 7 and negative in 41. The thoracic wall consists of skin, subcutaneous tissue, muscles, and the ribs. On longitudinal scans the pleura appear as a horizontal line (the pleural line), which moves during breathing.[13] Beyond the pleural line, the air in the lung further impedes visualization of the normal lung parenchyma. However, the large change in echogenicity results in horizontal artifacts called A-lines. A-lines are parallel lines and can be seen below the pleural line in an ultrasound scan of a normal lung. When the fluid content in the lung increases, B-lines are

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generated. B-lines are vertical, hyperechoic artifacts originating from pleural line and extending to the edge of the image. B-lines are also called the comet-tail sign and are commonly seen in lung edema.[14]
The limitation of the study is small sample size.

Conclusion

Authors found that a high detection rate for LUS in identifying pneumonia in children was found. It also proved to be a prromising tool for the follow up of patients with pneumonia.

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