

## Uncovering Pneumonia: Comparing Chest Radiograph to Computed Tomography: An Analysis

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### Abstract

**Background:** Pneumonia is a disease frequently encountered during daily clinical practice. Symptoms and signs may sometimes be difficult to elicit and the chest radiograph misleading.

**Methods:** We discuss three cases of pneumonia where the chest radiograph results were of limited value. In these cases, computed tomography provided an accurate diagnosis and ensured adequate antibiotic treatment in keeping with the severity of the disease.

**Conclusion:** In addition to the standard chest radiograph, we should consider training of medical officers in the use of lung ultrasound to aid in the diagnosis and management of pneumonia. There should be a low threshold for the use of computed tomography in patients with a diagnosis of pneumonia.

**Keywords:** Pneumonia; Chest Radiograph; Computed Tomography; Lung Ultrasound

### Background

Pneumonia is a frequent disease mainly affecting older and multimorbid patients. Symptoms and signs lack sensitivity and specificity, and chest X-ray has poor accuracy [1]. Pneumonia is an important cause of morbidity and mortality in the elderly. However, if treated correctly and in a timely manner the prognosis is good. Therefore, a prompt diagnosis of pneumonia is imperative [2]. In patients admitted with a clinical diagnosis of community acquired pneumonia, the initial chest radiograph lacked sensitivity and did not demonstrate parenchymal opacifications in 21% of patients [3].

Pneumonia is diagnosed based on symptoms, physical exam, and chest radiograph and laboratory results. In our literature review the sensitivity of the chest radiograph to diagnose pneumonia has been found to be low and alternative imaging modalities need to be considered. Below are case studies of three patients diagnosed with pneumonia based on chest computed tomography findings despite having normal chest radiographs.

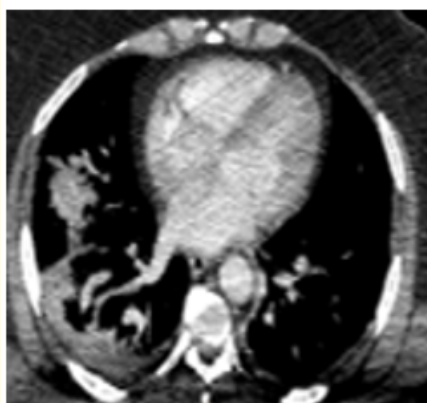
### Case Study-1

57-year-old male with type 2 diabetes mellitus and hypertension, presented with fever, chills, difficulty breathing and cough. Oxygen saturation on room air was 80%, temperatures of 41 degree Celsius, blood pressure 125/54mmHg and heart rate of 120 beat per minute.

On physical examination he had tachypnea and bilateral basal crepitations. Laboratory evaluation revealed an elevated white cell count of 19,500 per mcl with neutrophilia of 85% and elevated procalcitonin of 1.047 ( $< 0.5$  ng/ml). Chest radiograph showed no evidence of consolidation. Chest computed tomography showed bilateral basal consolidation.



*Figure 1: Chest radiograph.*



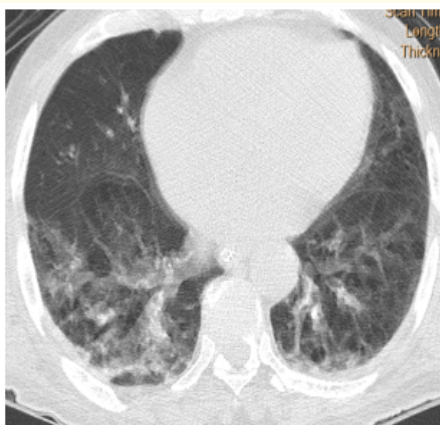
*Figure 2: Chest computed tomography.*

### Case Study-2

83-year-old male with prostate cancer on chemotherapy presented with confusion and aggressive behavior. Physical examination showed low blood pressure of 82/45 and oxygen saturation on room air of 78%. He was transferred to the intensive care unit, supplemental oxygen via non-rebreather mask and started on inotropic support. Laboratory evaluation showed reduced sodium level at 123 mmol/L, white blood cell count of 10,650 per mcl with neutrophilia of 89.1% and procalcitonin level elevated at 6.48 ng/ml. Chest radiograph was negative for pneumonia. Chest computed tomography showed features of bilateral basal pneumonia and emphysematous changes with apical predominance in keeping with centrilobular emphysema.



**Figure 3:** Chest radiograph.



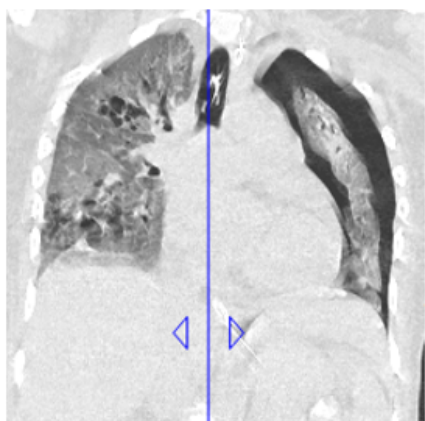
**Figure 4:** Chest computed tomography.

### Case Study-3

35-year-old female with Human Immunodeficiency Virus on HAART presented to the emergency department with difficulty breathing. Physical examination revealed borderline low blood pressure of 92/75, tachycardia of 112, SPO<sub>2</sub> of 88% on 15 L/min, labored breathing with bilateral chest crepitations and reduced breathe sounds on the left side. She was electively intubated. Chest radiograph showed cystic lucencies in the right lower zone and left mid and lower zone. Computed tomography of her chest showed numerous pulmonary cysts of varying sizes in a background of diffuse bilateral ground glass opacification, cystic bronchiectasis in the superior segments of both lower lobes and left pneumothorax with left lung collapse but no shift of mediastinal structures. She was managed for *Pneumocystic jiroveci* Pneumonia and Influenza with high dose trimethoprim- sulfamethoxazole and oseltamivir. Left sided chest drain was inserted. She progressed well.



*Figure 5: Chest radiograph.*



*Figure 6: Chest computed tomography.*

## Discussion

Alternative imaging strategies including computed tomography (CT)-scan may improve the diagnosis of pneumonia [1]. In the above three cases it was especially useful in delineating the severity of the disease. CT chest also reduces overdiagnosis of pneumonia and allows a better identification of alternative diagnoses [1].

In community acquired pneumonia, suspected patients visiting the emergency unit, early CT scan findings complementary to chest radiograph markedly affect both diagnosis and clinical management [4]. This may lead to earlier institution of broad-spectrum antibiotics, appropriate admission to high dependency units and earlier consultation with pulmonologist and infectious disease specialists. The impact on clinical outcomes of a strategy incorporating computed tomography for patients suspected of pneumonia should be evaluated [1].

Thoracic computed tomography scan although being considered the “gold standard” for detection of pneumonia and other pulmonary lesions, cannot be used as a first-line radiological examination in all patients with suspected pneumonia. This is mainly because it is costly, not available and involves a high radiation dose [5]. Low-dose computed tomography of the chest can potentially be helpful, especially in cases with an intermediate probability of pneumonia on chest radiography [2]. This may serve as a cost-effective way of assisting in diagnosis with a lower radiation dose.

Chest radiography has certain advantages: it is readily available, relatively inexpensive compared to other radiological studies, has a low radiation burden, and in the majority of cases is also interpretable by non-radiologists in the acute setting [2]. This is why it is the first line diagnostic tool.

However, lung ultrasound can help recognize adult community acquired pneumonia. Using chest computed tomography scan as a reference, the diagnostic accuracy of lung ultrasound is better than that of chest radiography in adult patients with clinically suspected community-acquired pneumonia [5]. Therefore, considering characteristics such as safety, low cost, being portable, and being available, ultrasonography seems to be a reasonable tool for screening and diagnosis of patients with pneumonia [6].

### Conclusion

In addition to the standard chest radiograph, we should consider training of medical officers in the use of lung ultrasound to aid in the diagnosis and management of pneumonia. There should be a low threshold for the use of computed tomography in patients with a diagnosis of pneumonia.

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