General and Radiological Investigations

Challenges

Clinicians face both diagnostic and prognostic challenges in the initial management of patients with suspected community-acquired pneumonia (CAP). Physical examination and radiological investigations play an important role in the diagnosis of CAP. The most useful signs and symptoms for the diagnosis of CAP include:

- Fever
- Dyspnea
- Tachypnea
- Positive signs on respiratory examination

Studies show that traditional chest physical examination alone is not sufficiently accurate to confirm or exclude the diagnosis of pneumonia. Diagnosis of CAP in elderly patients is a challenge, because of lesser severity of symptoms as compared to younger patients. In elderly patient group, the symptoms are less severe and at times are replaced with nonspecific symptoms, such as functional failure, falls or confusion. They also have a lesser tendency to have fever compared to younger patients.

Clinical Features, History and Physical Examination

It is often difficult to correlate clinical features with the presence of a particular organism, but some studies have identified typical presenting features, which are summarized as follows:

- **Streptococcus pneumoniae**: Increasing age, comorbidity, acute onset, high fever and pleuritic chest pain.
- **Bacteremic pneumonia**: Female sex, excess alcohol, diabetes mellitus, chronic obstructive pulmonary disease.
- **Legionella pneumophila**: Younger patients, smokers, absence of comorbidity, diarrhea, neurological symptoms, more severe infection and evidence of multisystem involvement (e.g. abnormal liver function tests, elevated serum creatine kinase).
- **Mycoplasma pneumoniae**: Younger patients, prior antibiotics, less multisystem involvement.
- **Chlamydia pneumoniae**: Longer duration of symptoms before hospital admission, headache.
- **Coxiella burnetii**: Males, dry cough, high fever.

A review was conducted to test characteristics of the history, physical examination and laboratory findings, individually and in combination, in diagnosing CAP and predicting short-term risk for death from the infection.

It was found that history and physical examination could not provide a high level of certainty in the diagnosis of CAP. Absence of vital sign abnormalities substantially reduced the probability of the infection.

The gold standard for the diagnosis of pneumonia is chest radiography. Sensitivity and specificity of chest radiograph are not well-known and also limited data is available on costs of false-positive and false-negative results. The decision to advice for chest radiograph is based on expert opinion in strategies, which help in optimizing the balance between harms and benefits.

Role of Clinical Presentaions and Vital-Sign Abnormalities

Role of Clinical Presentation

Wipf et al. conducted a study to determine the accuracy of various physical examination maneuvers in diagnosing pneumonia and to compare the inter-observer reliability of maneuvers among three examiners.

Male patients with symptoms of lower respiratory tract infection (cough and change in sputum) were enrolled in this prospective study (n=52).

A comprehensive lung physical examination was performed sequentially by three physicians who were blind to clinical history, laboratory findings and radiography results.

A standard form was used to record the examination findings by lung site and whether the examiner diagnosed pneumonia. Radiologists read the chest radiography films.

It was found that abnormal lung sounds were common in both groups. Rales in the upright seated position and bronchial breath sounds were most frequently detected. The three examiners’ clinical diagnosis of pneumonia had a sensitivity of 47–69% and specificity of 58–75%.

The study concluded that the degree of inter-observer agreement was highly variable for different physical examination findings.

The most valuable examination maneuvers in detecting pneumonia were unilateral rales and rales in the lateral decubitus position.

Vital Sign Abnormalities

Nolt et al. conducted a study which examined the strength of the association among vital sign abnormalities, advanced age and the diagnosis of CAP in the evaluation of adults with acute cough illness.

A random sample of adult visits for acute cough to 15 emergency departments during the winter period of 2 consecutive years was selected for medical record abstraction. Visits were initially sampled based on discharge diagnoses for a broad range of acute respiratory tract infection diagnoses.

It was found that vital sign abnormality (including fever, hypoxemia, tachycardia or tachypnea) and age greater than 50 years were the only significant predictors of CAP. A strong association was found between hypoxemia and CAP diagnosis. The prevalence of CAP was associated with a greater number of abnormalities which ranged from 12% with 1 abnormality to 69% with four vital sign abnormalities.

This study demonstrated an increase in probability of CAP with increases in vital sign abnormalities. However, this association does not vary substantially with age.

Mayaud et al. carried out an evaluation study on data related to age and clinical and radiological findings. The data showed that absolute lack of ‘vital signs’ has a good negative predictive value in CAP. The presence of unilateral crackles has a good positive predictive value.

Wide range of radiography abnormalities such as localized alveolar opacities and interstitial opacities are noted. Profound radiological difficulties are observed particularly in elderly individuals with numerous disorders including chronic respiratory or cardiac opacities.

Role of Chest Radiograph

Lieberman et al. conducted a prospective, clinical study with the aim to determine the reliability of physicians’ judgements in respiratory tract infections (RTIs) patients by clinical assessment alone compared with chest radiography.

Ambulatory patients with febrile RTI were enrolled (n=250). Physicians were asked to judge based on the medical interview and physical examination alone. Physicians gave their clinical judgements related to study questions. These judgements were then compared with results of chest radiography.

Compared to the results of chest radiography, physicians’ judgements of pneumonia had a sensitivity of 74%, a specificity of 84%, a negative predictive value of 97% and a positive predictive value of only 27%. Physicians had good ability to
negate radiography-confirmed pneumonia by clinical assessment in febrile adult RTI patients. However, they had poor ability to successfully predict the condition. O’Brien et al.9 carried out a study to develop a prediction rule for the use of chest radiographs in evaluating CAP based on presenting signs and symptoms.

The study included 350 adult patients with acute respiratory symptoms and positive chest radiographic results from October 2004 through April 2005. The study included an equal number of age-matched controls with acute respiratory symptoms but negative radiographic results.

Six most common individual clinical indicators, namely cough, sputum production, fever, tachycardia, tachypnea and abnormal physical examination results, were analyzed. An analysis was also carried out for any vital sign abnormality and for the presence of vital sign or physical examination abnormalities.

It was found that vital sign and physical examination findings are useful screening parameters for CAP, demonstrating a sensitivity of 95%, and a specificity of 56% in the presence of vital sign or physical examination abnormalities.

The study findings were suggestive of non-requirement of chest radiographs in the absence of vital signs abnormalities or physical findings. However, this criteria can be considered if patient is on regular follow-up and there is low likelihood of morbidity with CAP.

Chest X-ray is Considered as Gold Standard for Diagnosis of Pneumonia: The Netherlands Study Findings

In a study conducted in three hospitals in the Netherlands, it was found

• Pneumonia cannot be treated based on clinical findings alone. Manifestation of pneumonia on chest X-ray varies considerably depending upon the degree of inflammation and stage of the disease process.

• Radiographic findings may lag behind clinical findings and are poor indicators of etiological diagnosis.

• Pneumonia was frequently overdiagnosed clinically by general practitioners.

This study concluded that chest radiography is a valuable tool to substantially reduce the number of patients misdiagnosed and is particularly important for the exclusion of pneumonia in general practice. Chest X-ray is considered as gold standard for the diagnosis of pneumonia. This study concluded that chest X-ray can reduce the overdiagnosis of pneumonia in general practice.

Synopsis from the Guidelines

British Thoracic Society Guidelines

British Thoracic Society guidelines do not recommend chest radiography in patients with suspected CAP unless the diagnosis is not clear and chest radiograph would help in differential diagnosis and management of acute illness. Chest X-ray is considered when

• there is no satisfactory treatment progress at the time of review or

• the patient is at risk of underlying lung pathology

The guidelines also recommend routine chest radiograph 6 weeks after discharge.

Infectious Disease Society of America (IDSA)/American Thoracic Society (ATS) Consensus Guidelines on the Management of Community-Acquired Pneumonia in Adults

• Clinical features (cough, fever, sputum production, and pleuritic chest pain) and physical examination (detection of rales or bronchial sounds) are the basis for the diagnosis of CAP. However, these are less sensitive and specific than chest radiographs.

• The clinical and physical examination findings may be altered in elderly patients. All patients need to be screened through pulse oximetry, which would help identify pneumonia without signs of pneumonia and unsuspected hypoxemia in patients with diagnosed pneumonia.

• For the routine evaluation of CAP to differentiate it from other common causes of cough and fever, such as acute bronchitis, a chest radiograph is required.

• The radiograph may also help in suggesting the etiologic agent, prognosis, alternative diagnosis and associated conditions.

The IDSA/ATS consensus guidelines recommend the use of chest radiograph or other technique with or without microbiological data for the diagnosis of pneumonia.

Identification of causative microorganism through microbiological studies may support the diagnosis of pneumonia.

Recommendations

• Chest radiographs is considered for the diagnosis of pneumonia when the clinical signs suspect the diagnosis of pneumonia or in case of presence of atypical symptoms.

• The need of chest radiograph is to

  • Confirm the diagnosis
  • Detect associated lung disease
  • Assess severity and associated complications
  • Obtain baseline to assess the response to treatment

References


