Community-acquired pneumonia (CAP) is a common, and often serious, illness. It is the sixth leading cause of death in the U.S. and Canada and about 600,000 people are hospitalized with CAP each year. The overall mortality rate for patients with CAP ranges from 6% to 15%.1,2 The key to the successful management of CAP is an accurate diagnosis of this illness.

What exactly is CAP?

CAP is an acute illness characterized by two or more of the symptoms and signs listed in Table 1. However, symptoms alone do not have a sufficient sensitivity and specificity to make a CAP diagnosis. Respiratory symptoms raise the possibility that a patient may have pneumonia and certain physical findings may heighten this suspicion. For example, a respiratory rate of ≥ 25 breaths per minute has a likelihood ratio of 1.5 to 3.4 for pneumonia, while the combination of heart rate <
100 beats per minute, temperature < 37.8°C, and a respiratory rate of < 20 breaths per minute reduces the probability of pneumonia.3

How is CAP diagnosed?

The chest radiograph is the gold standard for the diagnosis of CAP. When a lobar opacity is present in the setting of an acute respiratory illness, it is easy to arrive at a diagnosis of pneumonia. However, it is often not so easy to reach this conclusion in elderly persons who have radiographs of suboptimal quality. In this setting, inter- and intra-observer variability in the interpretation of chest radiographs of patients with possible pneumonia is well-documented.4 Young and Marrie studied 15 patients with pneumonia and found that a panel of three radiologists agreed with the original radiologist on the diagnosis of pneumonia 87% of the time; conversely, when 21 internists read the same set of radiographs they agreed with the original radiologist only 72% of the time.5 Thus, some patients with pneumonia don’t get properly diagnosed.

In a recent study, high resolution computed tomography (HRCT) scans of the chest and chest...
radiographs were simultaneously compared in 47 patients presenting with presumed CAP. The HRCT scans identified all 18 cases that were apparent on chest radiograph, as well as an additional eight cases. Thus, eight out of 26 cases of the pneumonias in this study were not identified by chest radiography. Table 2 gives the chest radiograph findings, as reported by a radiologist, in patients who had a clinical diagnosis of pneumonia and whose radiographs had been interpreted as positive for pneumonia.

If your clinical suspicion of pneumonia is high, and the chest radiograph is reported as normal or no pneumonia, the simplest thing to do is to repeat the chest radiograph in 48 hours. Followup chest radiographs to document complete clearing of pneumonia are important in those who are over 45 and in patients who are tobacco smokers. The reason for this is that in patients who require admission to hospital for treatment of pneumonia, 2% will have lung cancer and their pneumonia is thus due to obstruction of a bronchus. In 50% of these cases, the radiologist suggests the diagnosis of malignancy, but often the malignancy is only discovered because the pneumonia fails to clear, triggering investigations, such as bronchoscopy.

The rate of radiographic resolution of pneumonia is influenced by the age of the patient and underlying lung disease; patients with bacteremic

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Table 2

<table>
<thead>
<tr>
<th>Finding</th>
<th>Ambulatory patients</th>
<th>Admitted patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pneumonia</td>
<td>1,753 (41.2%)</td>
<td>1,845 (53.1%)</td>
</tr>
<tr>
<td>Query pneumonia</td>
<td>544 (12.8%)</td>
<td>615 (17.7%)</td>
</tr>
<tr>
<td>No pneumonia</td>
<td>1617 (38.0%)</td>
<td>928 (26.7%)</td>
</tr>
<tr>
<td>Pleural effusion</td>
<td>324 (7.6%)</td>
<td>752 (21.6%)</td>
</tr>
<tr>
<td>COPD</td>
<td>360 (8.5%)</td>
<td>618 (17.8%)</td>
</tr>
</tbody>
</table>

COPD: Chronic obstructive pulmonary disease

Table 3

Tests for confirmed/suspected CAP

- Complete blood count
- Blood urea nitrogen
- Creatinine, glucose
- O₂ saturation
- Blood gas analysis in those with COPD or in those with an O₂ saturation ≤ 90%

COPD: Chronic obstructive pulmonary disease
O₂: Oxygen
pneumococcal pneumonia who are over 60 and have chronic obstructive pulmonary disease (COPD) require up to 12 weeks for resolution of pneumonia. The dilemma, then, is to determine the optimal timing of the followup chest radiograph among patients who are clinically well. In elderly patients with COPD, it is reasonable to wait eight to 12 weeks before doing the followup chest radiograph.

How can diagnosis be confirmed?

For patients who are seen in an office practice and who are well enough to be treated at home, no blood work or etiologic investigations are necessary. However, for patients who are seen in the ED, and for those who are ill enough to be admitted to hospital, certain tests should be performed (Table 3). These tests are important in the risk stratification of patients with CAP.

Fine et al. assigned points to 20 different items to derive a pneumonia specific severity of illness score.5 This system allowed categorization of patients with pneumonia into five strata, with increasing risk for mortality from risk class I to V. This scoring system can be used to help with the site of treatment decision. Patients in risk classes I and II can usually be treated at home; those in risk class III may require a period of observation in the ED before a decision is made about optimal site of treatment.

How do you determine the cause of pneumonia?

A gram stain of a proper sputum specimen (more than 10 squamous epithelial cells per low power microscopic field and more than 25 white blood cells per low power microscopic field) can be very valuable in making a rapid etiologic diagnosis. If large numbers of gram positive diplococci are seen, it is likely that the patient has pneumococcal pneumonia. The
Community-Acquired Pneumonia

Table 4
Tests available to determine cause of pneumonia

<table>
<thead>
<tr>
<th>Test</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acid fast stain of sputum</td>
<td>• Important in the diagnosis of pulmonary tuberculosis</td>
</tr>
<tr>
<td></td>
<td>• Staining sputum with a fluorescein tagged monoclonal antibody directed against a pneumocystis antigen can be diagnostic for pneumocystis pneumonia</td>
</tr>
<tr>
<td></td>
<td>• Special stains for fungi can be important in the diagnosis of pneumonia due to blastomyces dermatitidis</td>
</tr>
<tr>
<td>Nasopharyngeal swabs</td>
<td>• For viral culture or as a method of obtaining material for amplification of deoxyribonucleic acid of a microorganism</td>
</tr>
<tr>
<td></td>
<td>• Recently, patients with severe acute respiratory syndrome had these tests done and from these specimens, as well as from pulmonary tissue, a coronavirus was isolated.</td>
</tr>
<tr>
<td>Enzyme immunoassay</td>
<td>• Recommended for patients with progressive pneumonia with risk factors for Legionnaires’ disease (such as exposure to an aquatic source for Legionella or recent travel)</td>
</tr>
<tr>
<td>Streptococcus pneumoniae (S. pneumoniae) urinary antigen test</td>
<td>• Enzyme immunoassay, with results available in 15 minutes</td>
</tr>
<tr>
<td></td>
<td>• Sensitivity of 80% and specificity of 97-100% when bacteremic pneumococcal pneumonia is used as the gold standard</td>
</tr>
<tr>
<td></td>
<td>• Antigen may be detected for up to 1 month following onset of pneumonia</td>
</tr>
<tr>
<td></td>
<td>• In children, nasopharyngeal carriage of S. pneumoniae can result in a positive urinary antigen test</td>
</tr>
<tr>
<td></td>
<td>• The role of pneumococcal urinary antigen in the etiologic diagnosis of CAP is not clear at present</td>
</tr>
</tbody>
</table>

What would I do?

Based on recent experience with almost 8,000 patients with pneumonia who presented to EDs in Edmonton, my recommendation is to perform blood cultures in all those with pneumonia who have a temperature < 36 C or > 38.5 C, in patients with diabetes, and in those with chronic renal failure who are receiving hemodialysis. In addition, all patients who are going to be admitted should have blood cultures.

gram stain may be the first clue to an unusual microorganism, such as Nocardia species or Actinomyces species, as the cause of the pneumonia. The gram stain is also important in the interpretation of sputum culture results. Growth of Escherichia coli (E. coli) or other aerobic gram negative bacilli from sputum, which on gram stain showed no gram negative bacilli, suggests that the E. coli is likely a contaminant.

Some other etiologic tests are listed in Table 4.

References
2. www.statcan.ca

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2. The Canadian Thoracic Society: www.lung.ca/cts
3. InfectNet (maintained by the Canadian Infectious Disease Society): www.infectnet.com
Community-Acquired Pneumonia

Take-home message

Diagnosis

- Chest radiograph is the gold standard for the diagnosis of CAP.
- Many pneumonias go undetected in a radiograph, therefore, if suspicion of pneumonia is high and the radiograph is normal, the best thing to do is to repeat the radiograph in 48 hours.
- Determining the time of followup radiographs is critical.
- It is important to determine the cause of pneumonia. The tests that can be used include: blood cultures, gram staining of proper sputum specimen, acid fast stain of sputum, nasopharyngeal swabs, enzyme immunoassay, and S. pneumoniae urinary antigen test.


For a quick-take on this article, go to our Frequently Asked Questions department on page 31.