

# Diagnosing Pneumonia by Medical History and Physical Examination

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0196-0644/\$-see front matter

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doi:10.1016/j.annemergmed.2005.08.011

[Ann Emerg Med. 2005;46:465-467.]

## SYSTEMATIC REVIEW SOURCE

This is a rational clinical examination abstract, a regular feature of the *Annals'* Evidence-Based Emergency Medicine (EBEM) series. Each features an abstract of a rational clinical examination review from the *Journal of the American Medical Association* and a commentary by an emergency physician knowledgeable in the subject area.

The source for this rational clinical examination review abstract is: Metlay JP, Kapoor WN, Fine MJ. Does this patient have community-acquired pneumonia? Diagnosing pneumonia by history and physical examination. *JAMA*. 1997;278:1440-1445.

The *Annals'* EBEM editors assisted in the preparation of the abstract of this rational clinical examination review, as well as selection of the Evidence-Based Medicine Teaching Points.

## OBJECTIVE

To evaluate the validity of diagnosing pneumonia using various aspects of the history and physical examination.

## DATA SOURCES

The authors searched English-language medical literature using MEDLINE from 1966 through October 1995. They cite a specific MEDLINE search strategy that is not detailed in the article but is available on request from the authors.

## STUDY SELECTION

The authors used a 3-step approach to select studies. After the initial retrieval (MEDLINE search and potentially eligible articles recognized through review of the article reference lists), the authors excluded articles that focused on hospital-acquired pneumonia, pediatric pneumonia, or AIDS-related pneumonia. They then excluded nonoriginal data and studies of patients younger than 16 years, with known immunosuppression, or with nosocomial infections. Last, the remaining eligible articles were evaluated by an author using a methodologic filter assigning a level of evidence ranging from I to V. Only articles qualified as level I (primary, prospective study of the accuracy or precision of the clinical examination in community-acquired

pneumonia enrolling >50 consecutive subjects) were used in the main analyses.

## DATA EXTRACTION AND ANALYSIS

The authors calculated likelihood ratios (LRs) for the presence or absence of distinct clinical findings and included in the results only findings associated with pneumonia in at least 1 study, using a 2-tailed  $\chi$  or Fischer exact test with  $P < .05$ .

## MAIN RESULTS

There were no studies that examined interobserver variability for the precision of the symptoms and signs of community-acquired pneumonia. Analogous work cited by the authors revealed considerable interobserver variation in the recording of symptoms.<sup>1,2</sup> One study examined interobserver agreement for physical examination findings in patients with a variety of respiratory conditions. The 3 most reliable findings, dullness to percussion, wheezes, and crackles, had agreement values ranging from 72% to 79%, with  $\kappa$  values from 0.41 to 0.52.<sup>3</sup>

The accuracy of the clinical history in the diagnosis of community-acquired pneumonia is addressed by 4 studies. The symptoms (Table 1) with the highest positive LR (LR(+)) include a history of fever (LR(+)=2.1),<sup>4</sup> cough (LR(+)=1.8),<sup>5</sup> chills (LR(+)=1.7),<sup>6</sup> and night sweats (LR(+)=1.7),<sup>4</sup> whereas rhinorrhea and sore throat had negative LRs of (LR(-)=2.4 and 1.5), respectively.<sup>4</sup> One study demonstrated a reduction in the odds of pneumonia if the patient had a history of asthma (LR(-)=3.8 [see teaching point]).<sup>6</sup> The pooled and individual results for accuracy of the physical examination are shown in Table 2.

The prediction rule described by Diehr et al<sup>4</sup> yields an LR(+) 1.5 to 14.0 and an LR(-) 0.22 to 0.82 for the diagnosis of pneumonia. Singal et al<sup>5</sup> demonstrate probabilities of pneumonia ranging from 4% to 49%, depending on the number of findings present. Heckerling et al<sup>6</sup> showed a maximum probability of pneumonia of 50% if all 5 of their clinical predictors were fulfilled.

## CONCLUSIONS

There is significant interobserver variability in elucidating the presence or absence of individual findings on chest

**Table 1.** LRs for pneumonia based on individual medical history findings.

Symptoms	Positive LR (LR+)	Negative LR (LR-)
Fever <sup>4</sup>	2.1	0.7
Cough <sup>5</sup>	1.8	0.31
Chills <sup>6</sup>	1.7	0.85
Night sweats <sup>4</sup>	1.7	0.83
Asthma <sup>6</sup>	0.1	3.8
Rhinorrhea <sup>4</sup>	0.78	2.4
Sore throat <sup>4</sup>	0.76	1.5

examination of patients with respiratory illness. The use of any individual symptom or sign to guide the diagnosis of community-acquired pneumonia is lacking suitable test characteristics. There is not enough evidence to rule in or out the diagnosis of community-acquired pneumonia based on any individual symptom or sign of the patient. Decision rules exist for community-acquired pneumonia that take into account the signs and symptoms of the patient and render a lesser or greater likelihood of pneumonia. However, there is again no combination of symptoms or signs, whether present or absent, that reliably confirms or rules out the diagnosis of pneumonia.

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#### COMMENTARY: CLINICAL IMPLICATION

Pneumonia is the leading infectious cause of death and seventh leading cause of all deaths in the United States.<sup>7</sup> Mortality rates of hospitalized and outpatients with pneumonia exceed 5%, whereas patients requiring admission to the ICU have rates as high as 37%.<sup>8</sup> With a prevalence of approximately 4 million cases per year, emergency physicians diagnose and treat community-acquired pneumonia regularly.<sup>9</sup> As the authors of the rational clinical examination explain, the importance of accurately diagnosing pneumonia is paramount in choosing the appropriate treatment regimens, reducing health care costs, and, more important, decreasing the morbidity and mortality from pneumonia in our population.

In their rational clinical examination series, Metlay et al<sup>10</sup> present results of numerous studies to evaluate the utility of the clinical examination in diagnosing pneumonia, including elements from the patient's medical history, signs from the physical examination, and prediction decision rules. The authors concluded that there were no single items in the clinical examination whose presence or absence would reliably rule in or rule out the diagnosis of pneumonia without the use of radiography.

The decision to proceed to radiography in a patient suspected of having pneumonia should be driven by the probability of the disease, the sensitivity and specificity of the

**Table 2.** LRs for pneumonia based on physical examination findings.

Signs	Positive LR (LR+)	Negative LR (LR-)
Any vital sign abnormality <sup>13</sup>	1.2–4.4	0.5–0.8
Any chest finding <sup>13</sup>	1.3	0.57
Crackles <sup>4,6,13</sup>	1.6–2.7	0.9
Egophony <sup>4,13</sup>	8.6	0.96
Dullness to percussion <sup>6,13</sup>	4.3	0.93
Decreased breath sounds <sup>6</sup>	2.6	0.64
Asymmetric respirations <sup>4</sup>	Infinity	0.95

diagnostic test, the costs and dangers of the test, and the threshold to treat. The inaccuracy of the clinical examination suggests that emergency physicians should maintain a low threshold to obtain chest radiography in patients with possible pneumonia. Although chest radiography is not 100% sensitive and interpretation may exhibit variable interobserver agreement, it is an inexpensive and safe test.<sup>11</sup> Moreover, it may be the closest modality physicians have to a convenient and accessible reference standard in the current diagnosis of pneumonia.

#### TAKE HOME MESSAGE

Although a few select history and physical examination factors appear to be contributory in a patient suspected of having pneumonia, no single finding or combination of findings is able to rule in or rule out the diagnosis. Therefore, physicians should maintain a low threshold for chest radiography to aid in the diagnosis of pneumonia when clinical suspicion indicates it.

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#### EBEM TEACHING POINT

*Inverted LRs.* The LR of a positive test represents the ratio of the proportion of true positives to the proportion of false positives. By convention, we think of these “positive LRs” as being greater than 1.0, and we think of a potentially useful diagnostic test as having a positive LR of greater than or equal to 10.<sup>12</sup> In other words, it is roughly 10 times more likely that a positive test represents a true (correct) result than a false (incorrect) result. It is also possible, however, that the proportion of false positives will be greater than the corresponding proportion of true positives. Although this will not yield the result we expect to see because the number will be less than 1.0, it offers valuable information.

In this rational clinical examination, for instance, in the setting of possible pneumonia a history of asthma is associated with a positive LR of 0.1, which informs clinicians that patients with a history of asthma are one tenth as likely to demonstrate

pneumonia on a chest radiograph (a true positive) than not (a false positive). Stated in its inverse, patients with asthma are 10 times more likely to have a normal chest radiograph result than one that demonstrates pneumonia. Although this is not the information expected from a positive LR, it is clearly valuable information. Therefore, understanding the underlying meaning of the LR allows us to infer important information from the statistic, regardless of whether it is above or below 1.0.

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## New Resident Fellow Announced

Each year, *Annals of Emergency Medicine* selects a Resident Fellow (formerly the Resident Editor) to serve on the Editorial Board. We are pleased to announce that Troy Madsen, MD, of the Ohio State University, Columbus, Ohio, has been selected to serve as the new Editorial Board Resident Fellow for the coming year. He graduated from medical school at the Johns Hopkins University School of Medicine in 2003 and earned his bachelor of arts in history from Brigham Young University in 1999.

Truman J. Milling, Jr., MD, of Brackenridge Hospital, Austin, Texas, and Troy P. Coon, MD, of the Eisenhower Army Medical Center, Ft. Gordon, Georgia, are the immediate past Resident Fellows for the journal. Dr. Madsen began his term in September 2005; his service will continue through October 2006.

If you have an idea, an issue, or an experience about which you would like to write, submit an abstract (limit 250 words, double-spaced) outlining your idea. Give the names of your coauthors, if any. If your idea is chosen,



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