







# Symptoms and signs plus erythrocyte sedimentation rate or C-reactive protein predicted pneumonia in lower respiratory tract infection

Hopstaken RM, Muris JW, Knottnerus JA, *et al.* Contributions of symptoms, signs, erythrocyte sedimentation rate, and C-reactive protein to a diagnosis of pneumonia in acute lower respiratory tract infection. *Br J Gen Pract* 2003;**53**:358–64.

Clinical impact ratings GP/FP/Primary care ★★★★★☆☆ Emergency medicine ★★★★★☆☆ Internal medicine ★★★★★☆☆ Respiriology ★★★★★☆☆ Infectious disease ★★★★★☆☆

## Q In adults with a lower respiratory tract infection (LRTI), which symptoms, signs, and tests best inform the diagnosis of pneumonia?

### METHODS

-  **Design:** blinded comparison of chest radiographs with general practitioner (GP) assessed diagnosis.
-  **Setting:** 15 general practices (25 GPs) in the Netherlands.
-  **Patients:** 246 patients aged ≥18 years (mean age 52 y) presenting to a GP with an LRTI. Exclusion criteria included severe clinical disease, recent antibiotic treatment, or hospital admission for respiratory disease.
-  **Description of tests:** the clinical status of patients (classified as either pneumonia or other LRTI) was based on clinical symptoms and signs, and C-reactive protein (CRP) and erythrocyte sedimentation rate (ESR) blood tests.
-  **Diagnostic standard:** chest radiography (lateral and postero anterior) was used as the diagnostic standard for identifying pneumonia.
-  **Outcomes:** diagnostic characteristics for the performances of the CRP and ESR blood tests, and the final multivariate models.

### MAIN RESULTS

32 (13%) patients were diagnosed with pneumonia by chest radiography. The classical symptoms and signs of pneumonia (dyspnoea, thoracic pain, self reported fever, respiratory rate >20/min, percussion dullness, crackles, and the clinical diagnosis of pneumonia) were not predictive of pneumonia. The final “symptoms and signs” (SS) model used to predict pneumonia included the variables dry cough, diarrhoea, and temperature ≥38°C. The areas under the ROC curves were 0.87 for the CRP test, 0.77 for the ESR test, 0.70 for the SS model, 0.90 for the SS plus CRP model, and 0.81 for the SS plus ESR model. The table shows the diagnostic characteristics for various cutoffs for the CRP and ESR tests. Applying a prediction rule for patients at low risk of pneumonia (maximum of 1 positive score on the 3 items dry cough, diarrhoea, and temperature ≥38°C; and a CRP value <20 mg/l), 80 of the 193 antibiotic prescriptions could have been prevented.

### CONCLUSIONS

In adults with a lower respiratory tract infection, classical symptoms and signs of pneumonia were not predictive of pneumonia. A model consisting of dry cough, diarrhoea, and temperature ≥38°C plus erythrocyte sedimentation rate or C reactive protein (CRP) best predicted pneumonia. The prediction rule for patients at low risk of pneumonia, including a CRP value <20 mg/l, can reduce antibiotic overprescribing in general practice.

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Source of funding: Care and Public Health Research Institute, Maastricht, the Netherlands.

### Commentary

Making a diagnosis of community acquired pneumonia in office practice is problematic. The study by Hopstaken *et al* shows that symptoms and signs commonly attributed to pneumonia are neither sensitive nor specific enough to distinguish pneumonia from bronchitis, bronchiolitis, or an acute exacerbation of chronic obstructive pulmonary disease in patients who present with LRTI. Chest radiography was used as the gold standard (although it is not an ideal test and not practical for all patients who present with LRTI). In searching for the best fast method of diagnosing pneumonia, the investigators found that an SS model (including dry cough, diarrhoea, and temperature ≥38°C plus ESR >10 mm/h or CRP >10 mg/l) best predicted pneumonia. However, the finding of a CRP <20 mg/l in patients at low risk of pneumonia is likely to be more useful as a negative predictor of pneumonia. 97% of the patients with radiographically confirmed pneumonia had CRP and ESR >10. The authors show that with a point of care CRP test, results can be available in minutes.

CRP is an acute phase reactant synthesised in the liver in response to any infection and inflammation.<sup>1–5</sup> Can we now use CRP as a diagnostic test for pneumonia? Firstly, we need to repeat the study using a point of care test to determine CRP levels. The CRP should be correlated with the number of days from onset of symptoms prior to starting therapy. On average, patients with pneumonia are symptomatic for 5 days before presentation to their physicians. Secondly, chest radiography has to be done at the time of presentation and not on day 3, as in the current study, if decisions about antibiotic therapy are to be made on the basis of the results and in a timely fashion.

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#### Diagnostic characteristics of C reactive protein (CRP) (mg/l) and erythrocyte sedimentation rate (ESR) (mm/h) tests for diagnosing pneumonia in lower respiratory tract infection\*

Tests	Sensitivity (95% CI)	Specificity (CI)	+LR	–LR
CRP ≥10	97% (84 to 100)	31% (25 to 38)	1.4	0.10
CRP ≥20	91% (75 to 98)	51% (44 to 57)	1.8	0.19
CRP ≥50	88% (71 to 97)	75% (70 to 81)	3.6	0.17
ESR ≥10	97% (84 to 100)	29% (23 to 35)	1.4	0.11
ESR ≥20	78% (60 to 91)	57% (51 to 63)	1.8	0.38
ESR ≥40	59% (41 to 76)	85% (80 to 90)	3.9	0.48

\*Diagnostic terms defined in glossary. Sensitivity, specificity, and CIs provided by author; LRs calculated from data provided by author.