Clinical and laboratory findings in the diagnosis of bacterial pneumonia in children

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To the Editor:

Stolz et al. recently presented their findings on the diagnostic value of symptoms, clinical signs and laboratory findings in lower respiratory tract infection (LRTI) in adults [1]. On admission, 243 patients with suspected LRTI were treated either as procalcitonin (PCT)-guided or by the clinical practice of the hospital, in both cases independently of the authors. After treatment two clinical subgroups were formed: bacterial LRTI (antibiotic treatment, bacterial culture positive in blood, sputum or bronchial samples, n = 32) and self-limiting LRTI (spontaneous improvement, no antibiotics, n = 86). Clinical signs and blood leukocytes (WBC) were not helpful in distinguishing between bacterial and self-limiting LRTI cases. The sensitivity of the presence of infiltrates in chest radiographs, C-reactive protein (CRP) >50 mg/l and PCT >0.1 ng/ml was 97%, 94% and 94% respectively. The likelihood ratios (LR+) were not expressed but were possible to calculate, and were 6.90 (infiltrates), 3.35 (CRP) and 3.35 (PCT). Thus, the presence of infiltrates had a significant effect (LR+ >5.0), whereas CRP >50 mg/l and PCT >0.1 ng/ml had a moderate effect (LR+ >3.0) on the pre-test probability of bacterial LRTI [2]. The authors did not investigate whether any combination of the markers managed better than single parameters.

In our recent study in 101 children with community-acquired pneumonia (CAP), bacterial aetiology of infection was assessed by serological methods [3]. In accordance with the results of Stolz et al. [1], clinical symptoms and signs, such as tachypnoea defined as respiratory rate >50 breaths/min in children aged <12 months, >40 breaths/min in children aged 1–5 years and >30 breaths/min in children aged >6 years (32/81, 39%), crackles on auscultation (48/99, 48%), or fever >38 °C (72/101, 71%), >38.5 °C (58/101, 57%) or >39 °C (38/101, 38%) were not associated with bacterial aetiology. PCT, which was used to select patients for antibiotic therapy in the adult study [1], was associated with the severity of CAP like the need for hospital care and with the presence of alveolar infiltrates in the chest radiograph, but was not associated with bacterial findings in children [3, 4]. None of the non-specific laboratory parameters by any cut-off point was able to screen pneumococcal, atypical bacterial and viral aetiology of infection. By the combination of CRP >100 mg/L, WBC >15000/ul, PCT >1.0 ng/ml and ESR >65 mm/h, LR+ was 3.0 (sensitivity 36%, specificity 88%) in the distinction between pneumococcal and viral CAP, and 3.6 (sensitivity 43%, specificity 88%) between atypical and viral CAP. If there was a very high value in one of these four parameters (CRP >200 mg/L, WBC >22000/uL, PCT >1.8 ng/ml or ESR >90 mm/h), LR+ for bacterial *vs* viral pneumonia rose to 4.8 or more, which means a significant increase from pre-test to post-test disease probability. The finding of an alveolar infiltration was associated with higher values in non-specific inflammatory markers when compared with interstitial infiltrates, but offered no additional value in the combinations.

In children the aetiological diagnosis of bacterial LRTI is even more difficult than in adults. For example, blood cultures are nearly always negative, as was also seen in our study [3], the children cannot produce adequate sputum samples and invasive methods such as bronchoalveolar lavage, as used in the study of Stolz et al. [1], are justified in the most severe cases only. In our experience non-specific laboratory markers, when used as combinations, have some though a limited role in screening between bacterial and viral LRTI in children.

Key words: Streptococcus pneumoniae; lower respiratory tract infection; community-acquired pneumonia; procalcitonin

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References

1 Stolz D, Christ-Crain M, Gencay MM, Bingisser R, Huber PR, Muller B, et al. Diagnostic value of signs, symptoms and laboratory values in lower respiratory tract infection. Swiss Med Wkly. 2006;136:434–40.
2 Sackett D, Straus S, Richardsson W, Rosenberg W, Haynes B. Diagnosis and screening. In: Sackett et al. (Eds). Evidence-based medicine: How to practice and teach EBM. Churchill Livingstone, London 2000 (2nd Edition).
3 Don M, Fasoli L, Paldanius M, Vainionpää R, Kleemola M, Räty R, et al. Aetiology of community-acquired pneumonia: serologic results of a paediatric survey. Scand J Infect Dis. 2005;37:806–12.
4 Don M, Valent F, Korppi M, Falleti E, De Candia A, Fasoli L, et al. Efficacy of serum procalcitonin in evaluating severity of community-acquired pneumonia in childhood. Scand J Infect Dis. 2007;39:129–37.

Authors' reply:

We appreciate the comments of Don et al. on our study analysing the diagnostic value of signs, symptoms and laboratory parameters in an adult population admitted to hospital with lower respiratory tract infection [1]. The findings reported on community-acquired pneumonia (CAP) in children fit well with some of our results [2]. Interestingly, children requiring hospital admission due to CAP showed higher circulating procalcitonin values than adult patients admitted with CAP or severe exacerbations of COPD [3, 4]. In the study by Don et al., procalcitonin was shown to adequately assess the severity of pneumonia in children, although not capable of differentiating between bacterial and non-bacterial causes of pneumonia [5]. In this particular study, the aetiological diagnosis of pneumonia was based solely on serology in the majority of cases, reflecting the challenge of obtaining sputum and bronchoalveolar lavage samples for microbiological studies in paediatric patients. Thus, a possible explanation for the similar procalcitonin levels in patients with positive pneumococcal, atypical bacterial, viral and unknown serology groups may be related to the methodology employed. We have proposed that even patients with microbiologically proven bacterial CAP, including those with positive blood cultures, may present previous or concomitant viral infection [6]. Hence a positive virus serology alone does not preclude concomitant bacterial infection. Procalcitonin proved effective and safe in guiding antibiotic therapy in lower respiratory tract infection thus underlying the fact that procalcitonin reliably identifies patients with bacterial infection requiring antibiotic therapy [3, 4, 7].

We believe that in the research setting direct examination of microbiological samples may prove to be more reliable in establishing an aetiological diagnosis than serology only. Nevertheless, we agree with Don et al. that a combination of a serum biomarker and a further parameter may be clinically helpful in deciding which patients have a bacterial infection. Thus, we have recently shown that serum procalcitonin or C-reactive protein levels combined with neutrophil counts in bronchoalveolar lavage are consistently increased in immunocompromised patients with pulmonary infections of bacterial origin [8].

PD Dr. Daiana Stolz
Prof. Michael Tamm

References

1 Stolz D, Christ-Crain M, Gencay MM, et al. Diagnostic value of signs, symptoms and laboratory values in lower respiratory tract infection. Swiss Med Wkly. 2006;136:434–40.
2 Don M, Fasoli L, Paldanius M, et al. Aetiology of community-acquired pneumonia: serological results of a paediatric survey. Scand J Infect Dis. 2005;37:806–12.
3 Christ-Crain M, Stolz D, Bingisser R, et al. Procalcitonin guidance of antibiotic therapy in community-acquired pneumonia: a randomized trial. Am J Respir Crit Care Med. 2006;174:84–93.
4 Stolz D, Christ-Crain M, Bingisser R, et al. Antibiotic treatment of exacerbations of COPD: a randomized, controlled trial comparing procalcitonin-guidance with standard therapy. Chest. 2007;131:9–19.
5 Don M, Valent F, Korppi M, et al. Efficacy of serum procalcitonin in evaluating severity of community-acquired pneumonia in childhood. Scand J Infect Dis. 2007;39:129–37.
6 Gencay M, Stolz D, Christ-Crain M, et al. Viral serology in patients presenting with lower respiratory tract infections (LRTI). Am J Respir Crit Care Med. 2004;169:A654.
7 Christ-Crain M, Jaccard-Stolz D, Bingisser R, et al. Effect of procalcitonin-guided treatment on antibiotic use and outcome in lower respiratory tract infections: cluster-randomised, single-blinded intervention trial. Lancet. 2004;363:600–7.
8 Stolz D, Stulz A, Muller B, et al. BAL neutrophils, serum procalcitonin, and C-reactive protein to predict bacterial infection in the immunocompromised host. Chest. 2007;132:504–14.

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