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Pneumonia presenting with organ dysfunctions: Causative microorganisms, host factors and outcome

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Summary Community-acquired pneumonia (CAP) is a serious infection that may occasionally rapidly evolve provoking organ dysfunctions.

We aimed to characterize CAP presenting with organ dysfunctions at the emergency room, with regard to host factors and causative microorganisms, and its impact on 30-day mortality.

460 of 4070 (11.3%) CAP patients had ≥2 dysfunctions at diagnosis, with a 30-day mortality of 12.4% vs. 3.4% in those with one or no dysfunctions. Among them, the most frequent causative microorganisms were *Streptococcus pneumoniae*, gram-negatives and polymicrobial etiology. Independent host risk factors for presenting with ≥2 dysfunctions were: liver (OR 2.97) and renal diseases (OR 3.91), neurological disorders (OR 1.86), and COPD (OR 1.30). Methicillin-resistant *Staphylococcus aureus* (OR 6.41) and bacteraemic episodes (OR 1.68) had the higher independent risk among microorganisms. The number of organ dysfunctions vs. none increased at 30-day mortality: three organs (OR 11.73), two organs (OR 4.29), and one organ (OR 2.42) whereas *Enterobacteria* (OR 3.73) were also independently related to mortality.

The number of organ dysfunctions was the strongest 30-day mortality risk factor while *Enterobacteriaceae* was also associated with poorer outcome. The assessment of organ dysfunctions in CAP should be implemented for management, allocation and treatment decisions on initial evaluation.

Introduction

Community-acquired pneumonia has an incidence of 3—5 cases per 1000 adults-year and, mainly in the most severe episodes, causes a large number of deaths worldwide in older patients and in those with comorbidities.[1] From a local initial inflammatory response, microorganisms are able to trigger a cytokine cascade spill over that may eventually lead to distal organ failure. This response depends on host characteristics, comorbid conditions and causal microorganisms.[2] Currently, gram-positive bacteria are displacing gram-negative bacteria as the most frequent microorganisms causing organ dysfunction and sepsis.[3]

The assessment of respiratory and/or any other organ dysfunction has recently been recommended as the first step in CAP management, even before scoring prognostic scales.[4] This approach to CAP — *as an emergency* — has a practical interest for severity recognition, treatment decisions and allocation with the aim of improving survival.[5,6] This policy advocates considering that even mild dysfunctions may eventually progress, highlighting the need for rapid management. This perspective is in line with the global aims of the *Surviving Sepsis Campaign*[7] although its spread in CAP is far behind the scales. A crucial decision to improve outcome is the choice of adequate initial antibiotic regimen and initial management. The knowledge therefore of the main pathogens causing organ dysfunctions in CAP would be useful in the decision making process.

There is a scarce literature evaluating causal microorganisms in CAP with regard to the number and type of organ dysfunctions. It is plausible that host comorbidities and causal microorganisms are involved both in the rapid progression of provoking organ dysfunctions when presenting CAP, and in its outcome.

The aim of the study was to evaluate risk factors for presenting with organ dysfunctions — mainly with ≥2 dysfunctions — at CAP diagnosis in emergency rooms with regard to host factors (age and comorbid conditions) and causal microorganisms. An additional aim was to evaluate its impact on 30-day mortality.

Methods

Patients and data collection

This study is a secondary analysis from a prospective multicenter study from 13 Spanish hospitals.[8] Briefly, inclusion criteria were a new radiographic infiltrate compatible with pneumonia with at least two signs or symptoms. Nursing-home residents, HIV+ or immunosuppressed patients, and those with do not resuscitate orders were excluded. The ethics committees approved this study and patients signed informed consents.

We recorded data on age, gender, prior antibiotic treatment, current smoking status, alcohol abuse (>80 gr/day), comorbidities (diabetes mellitus, chronic obstructive pulmonary disease (COPD), heart, liver, neurological, solid tumor, renal diseases), Pneumonia Severity Index (PSI)[9] and CURB 65 score.[10] Comorbidities were defined as published in previous studies[11,12]: cardiac (involving treatment for coronary artery disease, congestive heart failure or valvular heart disease); pulmonary (treatment for asthma, chronic obstructive pulmonary disease or interstitial lung disorders); renal (pre-existing kidney disease with documented abnormal serum creatinine levels outside the pneumonia episode); hepatic (pre-existing viral or toxic liver disease); neurological disorders (presence of symptomatic acute or chronic vascular or nonvascular encephalopathy, with or without dementia); diabetes mellitus (diagnosis of glucose intolerance and treatment with oral antidiabetic drugs or insulin); and neoplastic disease (any solid tumor active at the time of presentation or requiring antineoplastic treatment within the preceding year).

Microbiological studies comprised blood cultures, urinary antigens for *Legionella pneumophila* and *Streptococcus pneumoniae*, sputum Gram stain, serological studies and invasive samples and nasopharyngeal swab for viral nucleic acids if requested by the attending physician. Initial antibiotic regimens and time until first dose (<6 h) were recorded as adhering or not to the Spanish guidelines.[8]