Dansk Tidsskrift for Akutmedicin
Vol. 8, No. 1
Accepted: 24 April 2025 | Published: 18 July 2025
DOI: 10.7146/akut.v8i1.156800

Dissertation Abstract

Diagnosis and Treatment of Acutely Hospitalised Patients with Suspected Community-Acquired Pneumonia – Clinical and Microbiological Perspectives

Defended:
November 30, 2023

Author:
Mariana Bichuette Cartuliares [1,2,3]

Principal supervisor:
Helene Skjøt-Arkil [1,2]

Co-supervisors:
Christian Backer Mogensen[1,2], Flemming Schønning Rosenvinge[3,4], Thor Aage Skovsted[5]

[1] Department of Emergency Medicine, University Hospital of Southern Denmark, Hospital Sønderjylland
[2] Department of Regional Health Research, University of Southern Denmark
[3] Department of Clinical Microbiology, Odense University Hospital
[4] Research Unit of Clinical Microbiology, University of Southern Denmark
[5] Department of Biochemistry and Immunology, University Hospital of Southern Denmark

Correspondence:
mbc@rsyd.dk

Introduction

Community-acquired pneumonia (CAP) is a leading cause of mortality worldwide, associated with high morbidity and hospital costs. CAP is one of the most common infections diagnosed in emergency departments (EDs), requiring timely antibiotic treatment within a few hours from patient admission. The CAP diagnosis is often based on uncertain history, questionable diagnostic methods, and non-specific blood tests. This challenges clinicians to make correct early diagnoses, with misdiagnosis risking adverse events, poorer patient outcomes, increased healthcare costs, and the overuse of broad-spectrum antibiotics. This, in turn, contributes to the increased development of resistant bacteria, thereby threatening future treatment possibilities.

Aims and objectives

This PhD thesis aimed to investigate potential improvements to the CAP diagnostic process within the first hours of acute admission. An improved diagnostic process would use rapid and precise diagnostic methods to support rational, targeted antibiotic prescriptions, preventing poor patient outcomes and antimicrobial resistance (AMR).

WHAT DO WE KNOW?

Community-acquired pneumonia (CAP) is a growing cause of hospitalization and death, particularly among elderly patients, where diagnosis is often difficult due to vague symptoms.

Fact box (in Danish)

Summary of studies

Study I

It was hypothesised that well-defined clinical characteristics could assist ED physicians in making an earlier, more accurate CAP diagnosis. The study design was a cross-sectional diagnostic, predictive study. The study identified the clinical characteristics of patients with CAP, developed a diagnostic model, and compared the model's performance to the ED physician's initial assessment. The model yielded 13 predictors, all recognised and supported by published literature. The performance and calibration of the model were good but did not outperform the initial tentative diagnosis made by the ED physicians. The addition of new diagnostic tools will be essential in future diagnostic models.

Study II

It was hypothesised that expiratory techniques (forced expiratory technique and sputum induction) were non-inferior to tracheal suction for collecting good-quality sputum samples from patients with suspected lower respiratory tract (LRT) infection in the ED. The number of adverse events between groups was compared, and patient experiences of sampling methods were investigated. For this thesis, additional microbiological results of good-quality LRT specimens are described. The study was an open-label, parallel-armed, non-inferiority randomised controlled trial (RCT). Results showed that tracheal suction had approximately a twofold likelihood of ensuring a good-quality specimen compared with expiratory techniques. However, often good-quality samples had low microbiological yields. Although there were no differences in adverse events between the two sampling methods when pooled and compared, patients allocated to the expiratory technique reported a more positive experience than patients allocated to tracheal suction.

WHAT IS NEW?

This thesis contributes new insights into the value of good-quality respiratory samples and point-of-care PCR testing, showing their potential to improve diagnosis and enable more targeted antibiotic treatment.

Fact box (in Danish)

Study III

It was hypothesised that point-of-care polymerase chain reaction (POC-PCR) testing of LRT samples from suspected CAP patients would increase the proportion of patients treated with no or narrow-spectrum antibiotics compared with standard care only (SCO), which included routine culture and targeted-specific PCR if requested by the ED physician. The study compared the length of stay (LOS), intensive care unit (ICU) admission, mortality, and readmissions between groups. Additional descriptive analysis was completed on bacteria and viruses from the microbiological analyses of the LRT specimens. The study was a multicentre, open-label, parallel-armed superiority RCT. Adding POC-PCR to the diagnostic setup did not increase the number of patients treated with narrow-spectrum or without antibiotics, but the results indicated that patients in the POC-PCR group received earlier and more targeted antibiotic treatments. Compared with culture, POC-PCR identified more bacteria and viruses, including common CAP pathogens. No

statistical differences between POC-PCR and SCO groups were observed for mortality, readmissions, ICU admissions, or LOS.

In conclusion, this thesis reflects the challenges of diagnosing CAP and provides new insight into optimising the diagnostic process. These three studies contribute vital information and knowledge to future research and implementation strategies targeting the improvement of CAP diagnosis.

HOW CAN IT BE APPLIED IN DANISH EMERGENCY DEPARTMENTS?

The findings can support the development of diagnostic algorithms combining standard tests, clinical evaluation, and new testing methods to improve timely and accurate diagnosis of common infections—including CAP—in Danish emergency departments.