



Case Report

Usefulness of broad-range PCR plus sequencing for the diagnosis of bacteremia due to a lung abscess

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SUMMARY

The early detection and treatment of sepsis in patients is essential for a positive outcome. Microbiological analysis of blood cultures, as the gold standard for diagnosis, is rather slow. However, more rapid methods like PCR have become available recently and are being evaluated clinically. We present data from the monitoring of a patient with sepsis who was on anti-infective treatment. The patient was positive for *Streptococcus pneumoniae* by broad-range PCR and sequence analysis in a blood sample and resected lung tissue specimen, the latter embedded in paraffin, while blood culture diagnostics remained negative.

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1. Introduction

The early detection and treatment of sepsis in patients is essential for a positive outcome.¹ Microbiological analysis of blood cultures, as the gold standard for diagnosis, is rather slow.² More rapid methods like PCR have become available recently and are being evaluated clinically.³ Because of observed false-negative results and also the identification of additional, non-growing pathogens, there is general agreement that PCR is a valuable tool that can complement but not replace blood culture.^{3,4} Here, we present data from the monitoring of a patient with sepsis who was on anti-infective treatment. The patient was positive for *Streptococcus pneumoniae* by broad-range PCR and sequence analysis in a blood sample and resected lung tissue specimen, the latter embedded in paraffin, while blood culture diagnostics remained negative.

2. Case report

A 65-year-old male hunter was admitted to our hospital with a chest trauma following a fall from a high chair. In the emergency department, the patient was awake, but very dyspnoeic, and

oxygen saturation was 70% on a non-rebreather mask. Chest X-ray and computed tomography (CT) revealed a right-sided tension haemopneumothorax with an incompletely collapsed right lung and bilateral lung contusions (Figure 1, A and B). After placement of an intercostal chest drain, the patient's trachea was intubated due to hypoxia. In the intensive care unit (ICU), a chest X-ray on day 1 showed worsening of the left-sided atelectasis leading to the initiation of kinetic therapy with a rotation bed. On day 3, the patient developed fever (39 °C) and high levels of C-reactive protein (303.1 mg/l) and procalcitonin (10.39 ng/ml) (Figure 2). The patient received piperacillin/tazobactam and ciprofloxacin leading to rapid clinical and laboratory improvement. While blood cultures were negative throughout the monitoring phase (except for *Staphylococcus epidermidis* on day 11, which was regarded as a contaminant), PCR plus sequencing diagnosis (universal 16S rDNA PCR, Sepsitest; Molzym, Bremen, Germany) identified *S. pneumoniae* in a blood sample drawn on day 2. Microbiological results from tracheal secretions on day 4 revealed *Staphylococcus aureus* and *S. pneumoniae*, and both tested sensitive to the administered antibiotics. Over the next days, daily bronchoscopy revealed inflammatory changes and abscess-like purulent secretions in the bronchial tree. Due to clinical signs of infection, the antibiotic treatment was changed to meropenem and vancomycin on day 4. However, microbiological results for the bronchial secretions under the anti-infective treatment were negative.

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Figure 1. (A) Chest X-ray on hospital admission before insertion of a chest drain for right-sided haemopneumothorax. (B) Chest computed tomography scan on hospital admission showing left-sided pneumothorax and lung contusions. (C) Chest computed tomography scan after intravenous contrast medium, revealing left-sided lower lobe atelectasis with a lung abscess ruptured in the pleural space (white arrow) on day 12. With permission from the Department of Radiology, Medical Centre Cologne-Merheim.

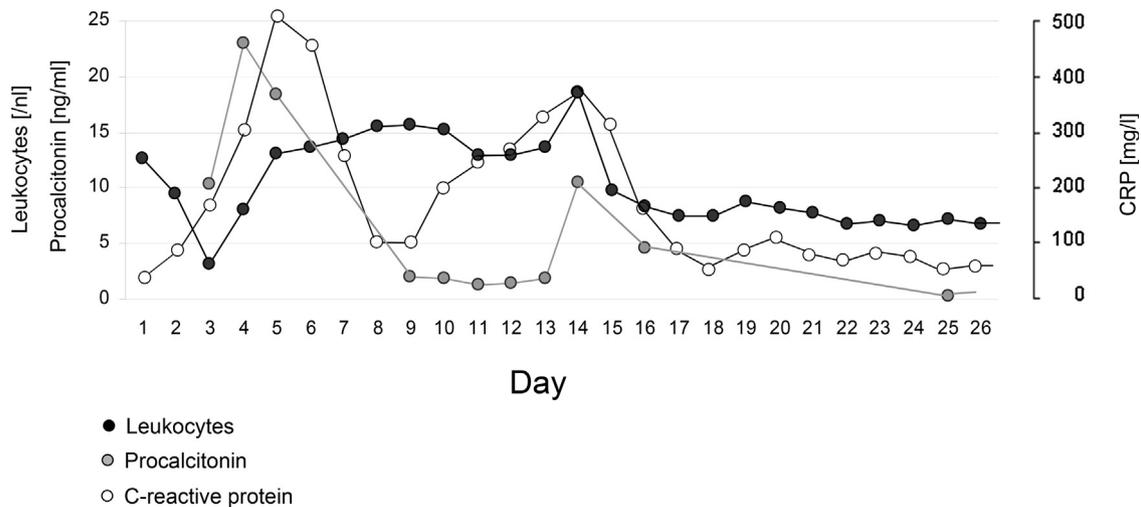


Figure 2. Infection parameters during the ICU stay. CRP, C-reactive protein.

Unfortunately, the patient remained febrile (38.7 °C) with high infection parameters, i.e., leukocytosis, elevated C-reactive protein (CRP), and procalcitonin (PCT) (Figure 2). For adequate oxygenation, high fraction of inspired oxygen (FiO₂; 0.80) and positive end-expiratory pressure (PEEP; 15 mbar) were required, while breath sounds in the left lower lobe were reduced. CT on day 14 showed a ruptured lung abscess of the left lower lobe (Figure 1C). The patient immediately underwent surgical evacuation of the abscess and resection of the left lower lobe. The next day, the patient improved immediately and dramatically, with a drop in leukocyte count, CRP, and PCT. He became haemodynamically stable and afebrile. Kinetic therapy was finished and the patient was successfully weaned from the ventilator on day 23. The patient was transferred to a rehabilitation centre on day 35.

The pathologist received a 20 × 9.5 × 9.5-cm resected lung tissue specimen showing chronic pneumonia with carnification and an acute fibrinous-purulent pleuritis. PCR performed from the lung specimen – unfortunately after fixation in paraffin – confirmed *S. pneumoniae* associated with *Haemophilus influenzae*.

3. Discussion

Our patient suffered from lung contusions as a complication of a lung abscess that ruptured into the pleural space. Despite anti-infective therapy, the patient did not improve clinically and surgical removal of the septic focus was required for survival.⁵ Our case emphasizes the value of PCR plus sequencing diagnosis in two ways: (1) PCR was already positive on day 2 (results available the

next day), i.e., 3 days earlier than microbiological results from the tracheal secretion (taken on day 4, identification results available 2 days later), and (2) PCR was the only method identifying the source of the infection (lung abscess) of the blood stream. Of note, follow-up blood cultures and PCRs (from days 11, 14, and 26 after admission) were negative (except for *S. epidermidis* in blood cultures on day 11). The relevance of *H. influenzae* remains unclear. However, therapy consisted of two drugs (piperacillin/tazobactam and ciprofloxacin) active against Gram-negative organisms and thus *H. influenzae* was probably not found in the blood.

In conclusion, PCR technology may be useful as a rapid and helpful diagnostic tool in the management of critically ill patients.

Conflict of interest: None declared.

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