Rapid Diagnostic Testing of Bronchoalveolar Lavage to Detect Non-Fermenting Gram-Negative Bacteria and Antibiotic Resistance Genes

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Rationale

- Non-fermenting Gram-negative bacteria, especially *Pseudomonas* and *Acinetobacter*, are a major cause of pneumonia but can difficult to treat due to their highly resistant phenotypes.
- Carbapenem resistance is one of the most clinically important resistance patterns, with various causative genes including *kpc*, *vim*, *oxa*-24 and *ndm*.
- Multiplex polymerase chain reaction (mPCR) offers the potential for early detection of pathogens and antibiotic resistance but clinical implications of results are poorly understood.
- We reviewed clinical data to determine the rate of detection of important resistance genes and to observe clinical outcomes in patients with discrepant results between culture and a rapid sample-to-answer mPCR platform.

Methods

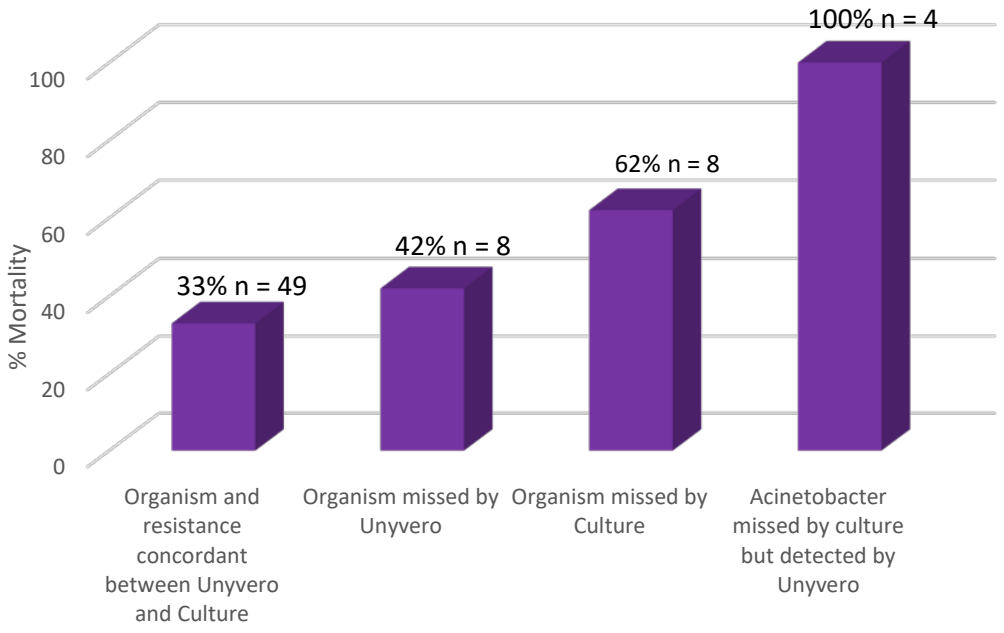
- The Unyvero lower respiratory tract (LRT) Panel was used for this study.
- This platform detects 20 microorganisms and 19 antibiotic resistance markers in bronchoalveolar lavage (BAL) samples, with a turnaround time of less than 5 hours.
- A validation study of the Unyvero system compared to culture was performed prospectively on BAL samples from patients with suspected pneumonia.
- Discrepant results were resolved by performing two independent PCRs and sequencing for the organisms on the Unyvero panel.

Results

Total BAL samples reviewed	64
Concordance between BAL culture and Unyvero	49 (77%)
Discrepant organism (missed by culture)	8 (13%)
Discrepant organism (missed by Unyvero)	8 (13%)
Concordant organism, discrepant resistance	12 (18%)

Table 1. Results of the BAL samples reviewed. Concordance is defined as agreement between culture and a bacterial species that LRT can detect. The concordant cultures may include some organisms that the LRT panel does not detect.

% Mortality in patients with discordant culture vs Unyvero results



Resistance Gene	Unyvero	Culture
kpc, *vim* or *oxa*-24	8	11 carbapenemase resistance
New Delhi Metalloproteinase (*ndm*)	1	1
*mec*A	6	7 oxacillin resistance

Table 2. Unyvero vs culture detection of resistance genes.

- The 8 organisms missed by culture included 1 *Pseudomonas, Staph, Klebsiella, Haemophilus* and 4 *Acinetobacter sp.*
- All 4 missed *Acinetobacter* cases had a subsequent culture grow *Acinetobacter*, with antibiotic treatment initiated at that time.

Conclusions

- **75% of carbapenem resistance was detected by the LRT platform within 5 hours of testing, potentially minimizing inappropriate antibiotic duration.**
- **Non-fermenters detected by LRT but not grown on culture may be causative and are associated with high mortality.**
- **The LRT panel appears to complement standard culture for detection of important pathogens and resistance genes.**