

Strain typing of hospital outbreaks with multi-resistant Gram-negatives using MS

Stefan Zimmermann, Jessica Panitz and Irene Burckhardt

Department of Infectious Diseases, Medical Microbiology and Hygiene, University Hospital Heidelberg

Introduction

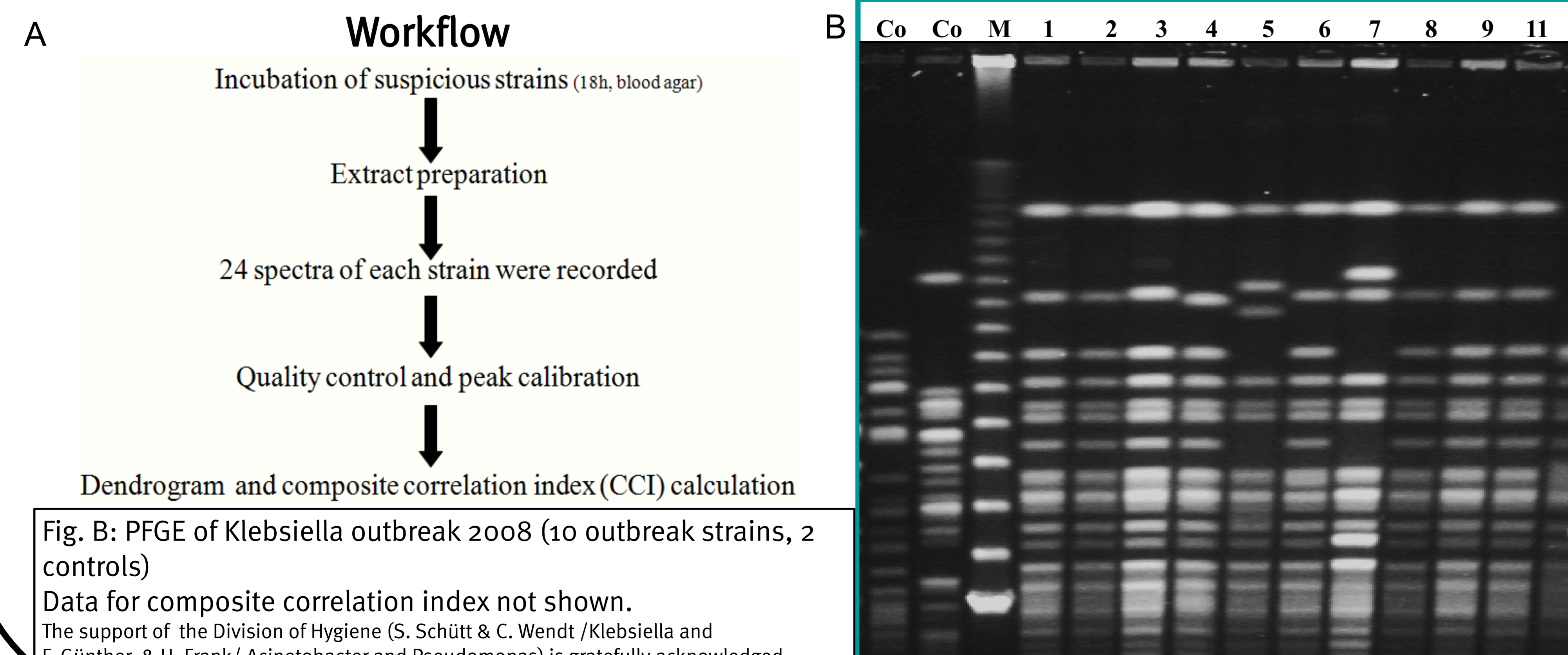
For the time being patient to patient transmission of infectious agents in the hospital setting is an undeniable fact. Even with all known preventive measures strictly adhered to it cannot be avoided completely. However, one should not hesitate to use all known techniques to at least identify the source and chain of transmission. MALDI-TOF, the latest method for species identification of bacteria might be a valuable tool for outbreak investigations.

Aim

We aimed to develop a rapid, accurate and reliable system for investigation of hospital outbreaks with multi-resistant gram-negative rods by using mass spectrometry.

Methods

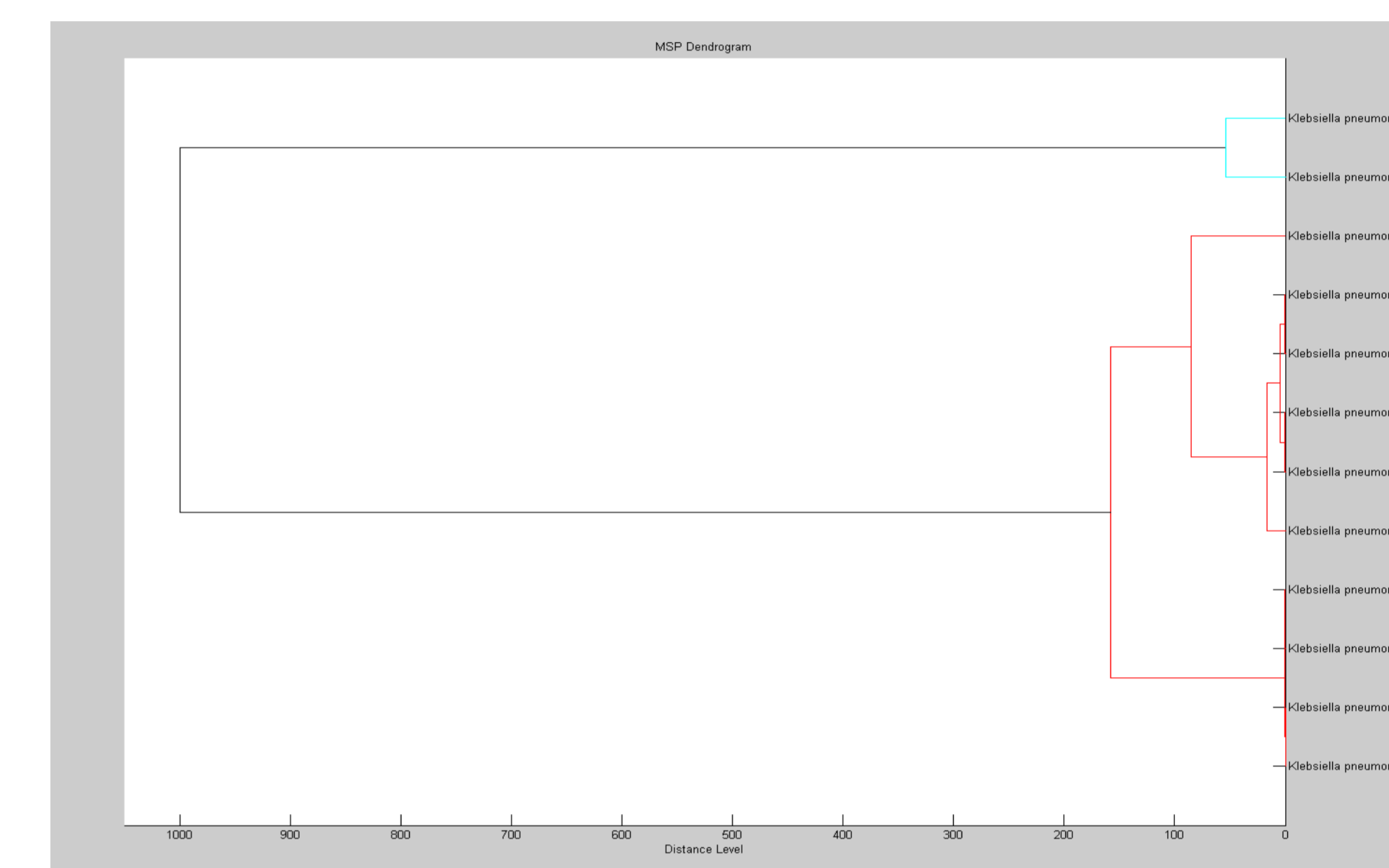
Three different outbreaks with *K. pneumoniae*, *P. aeruginosa* and *A. baumannii* were investigated using MALDI-TOF (Bruker, microflex). Suspicious isolates were collected, grown on blood agar, extracts were prepared from each strain and 24 spectra of each strain were recorded. Spectra were quality controlled, calibrated and a dendrogram as well as a composite correlation index (CCI) were calculated using software provided by the manufacturer. Results were compared to pulsed field gel electrophoresis. Additionally the MALDI-TOF technique was evaluated in terms of reliability, handling and cost.



Results

In all three outbreaks results were in good accordance with the pulsed-field electrophoresis results. However, it is mandatory that all strains are grown under the exact same conditions (i.e. together). This precludes to create a reference dendrogram or CCI and adding data of suspicious strains later. Due to the mathematical algorithms the dendrogram as well as the CCI can change after addition of new data to the dendrogram or CCI file.

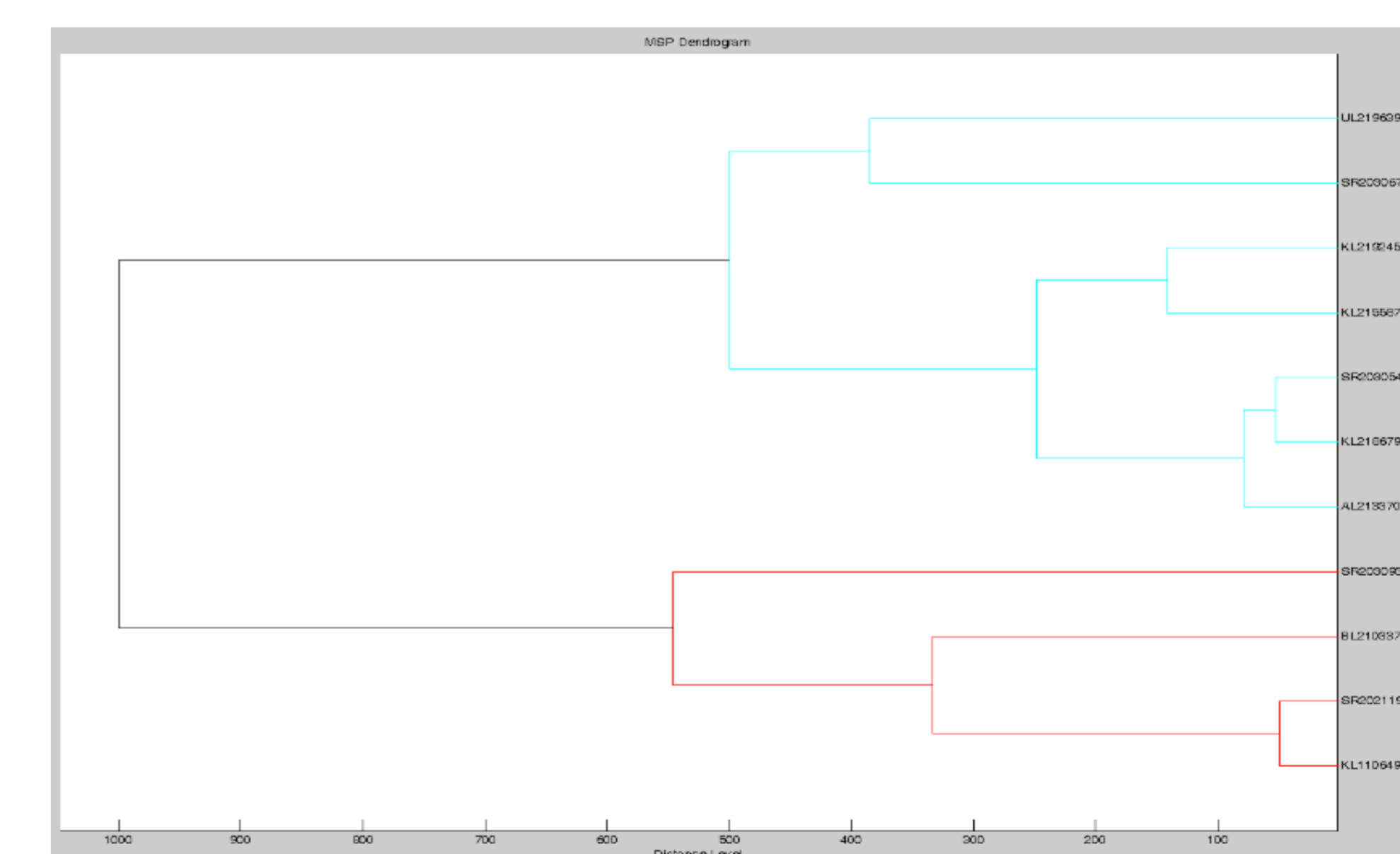
A *Klebsiella pneumoniae* KPC⁺ outbreak 2008 (10 strains [red], 2 controls [blue])



B *Acinetob. baumannii* OXA23⁺ outbreak 2012 (8 strains [red], 2 controls [blue])



C Panresistant *P. aeruginosa* outbreak 2012 (7 strains surgical ward [red], 4 internal ward [blue])



Conclusions

MALDI-TOF is a promising technique for the investigation of minor outbreaks.

Pros:

It is fast, cost effective and reliable. No special hardware is necessary (e.g. a pulsed-field gel electrophoresis chamber), if MALDI-ToF is used for microbe identification in the lab.

Cons:

Spectra of all strains have to be grown simultaneously to give reliable results. Improved software tools must be developed to establish MALDI-TOF as an outbreak investigation tool. The discriminatory power is still inferior to PFGE.

The new technology of labeling bacteria with heavy isotopes for MS investigations gives an exciting outlook to overcome the current limitations. [K. Sparbier et al., JCM 51 (11): 3741-8, 2013]