University Hospital Basel

Matrix-assisted laser desorption/ionization-time of flight mass-spectrometry (MALDI-TOF) based typing of an ESBL *Escherichia coli* outbreak in a hospital setting

A. Egli[1], S. Tschudin-Sutter[2], D. Goldenberger[1], A. Widmer[2], R. Frei[1]

[1] Clinical Microbiology, University Hospital of Basel, Switzerland; [2] Division of Infectious Diseases and Hospital Epidemiology, University Hospital of Basel, Switzerland

Purpose

- Rapid and specific identification to subspecies level and determination of strain identity are integral components of outbreak investigation and control.
- Conventional methods such as pulsed-field gel electrophoresis (PFGE) are labour intensive and require up to one week from sample collection to result.
- MALDI-TOF is able to identify bacterial species and subspecies rapidly.
- We aimed to assess the validity of MALDI-TOF for detection of stain identity as compared to PFGE.

MALDI-TOF technology

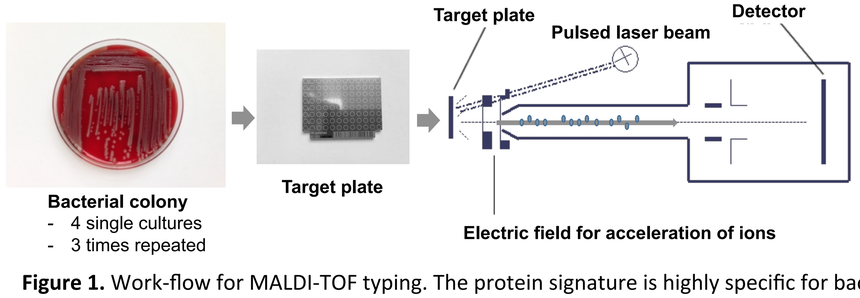

Figure 1. Work-flow for MALDI-TOF typing. The protein signature is highly specific for bacterial species

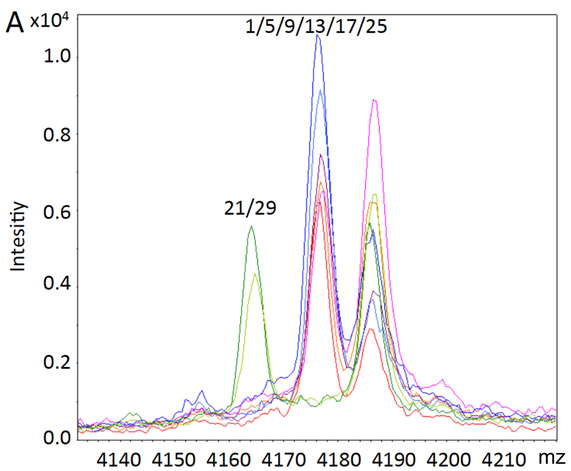

Figure 2. Frameshift analysis. Spectra were magnified and strain specific protein peaks were identified.

Methods

- ESBL-producing *E.coli* isolates from a previously investigated and published report from our institution were analysed using MALDI-TOF after a full protein extraction protocol.
- The spectra profiling was done in quadruplicates and repeated three times and analyzed using principal component analysis (PCA) to generate a dendrogram.
- Analysis was performed with Biotyper 3.0 software (Bruker Daltonic, Leipzig, Germany).

Results

- Outbreak on neonatal intensive care unit (Tschudin-Sutter S et al. Emerging Infect Dis 2010)

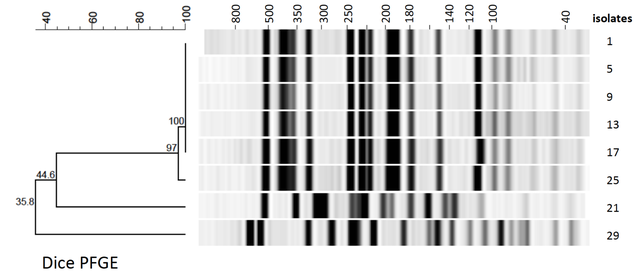

Figure 3. PFGE of ESBL-producing *E.coli* outbreak

- Eight isolates collected during an outbreak investigation in the neonatal care unit, identifying transmission of ESBL-producing *E.coli* from a mother to her newborn twins and subsequent spread to two other neonates and one healthcare worker, were analyzed by PFGE and MALDI-TOF.
- In comparison to PFGE, PCA-based typing with MALDI-TOF spectra reproduced a very similar dendrogram with identical clustering of six outbreak isolates. Two isolates of ESBL-producing *E. coli* not associated with the outbreak were correctly separated.

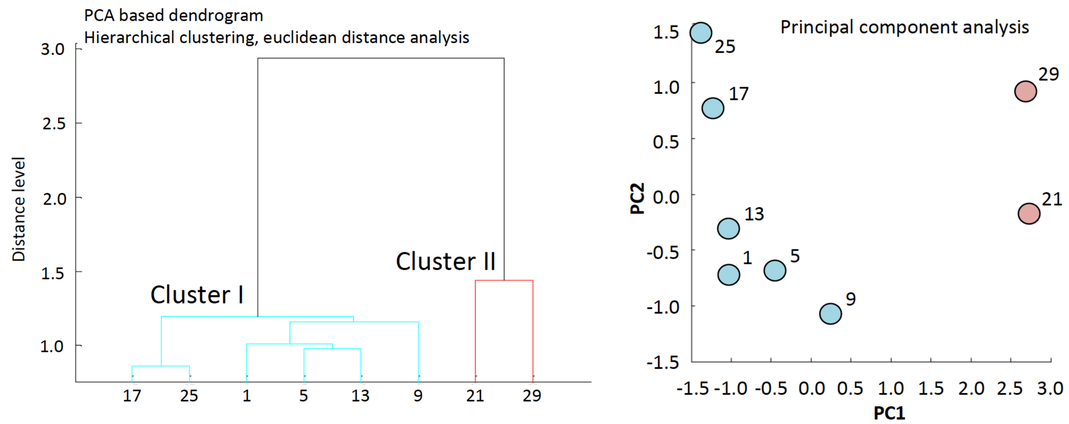

Figure 4. Principal component analysis of ESBL-producing *E.coli* isolates.

- PCA-based dendrogram and frameshift analysis of quadruplicates at three independent experiments showed a high reproducibility of the results.

Summary and Conclusions

- These results demonstrate that MALDI-TOF can provide a rapid means of typing of ESBL-producing *E. coli* isolates reliably separating outbreak-related from unrelated isolates.
- Our findings have important implications for outbreak investigations, which are hampered by the slow turnaround time of conventional typing techniques.

Corresponding author

Adrian Egli MD PhD, Clinical Microbiology, University Hospital Basel, Petersgraben 4, 4031 Basel, Switzerland, E-mail: a.egli@usb.ch