Accelerated time-to-diagnosis by automated processing of positive blood cultures on COPAN WASPLab

Marion Jetter, Martina Marchesi, Peter M. Keller, Michael Hombach

Institute of Medical Microbiology, University of Zurich, Zurich, Switzerland

Fast identification of pathogens causing sepsis and rapid antimicrobial susceptibility testing are crucial for ensuring an adequate therapy and the survival of patients. Manual growth monitoring of incubated plates from positive blood cultures in short time intervals after primary plate inoculation is very time consuming and can hardly be integrated in a regular routine workflow. The present study demonstrates that the fully automated WASP/WASPLab™ enables microbiological laboratories to follow a distinctive accelerated time-to-diagnosis algorithm based on early automated plate reading and therefore poses an essential contribution to decrease mortality rates of sepsis patients.

Figure 1: Fully automated WASP/WaspLAB™ unit from Copan (Brescia, Italy).

BACKGROUND

Time-to-diagnosis is critical in sepsis patients as an early targeted treatment significantly decreases morbidity and mortality (Kumar A. et al. Crit Care Med. 2006;34[6]:1589-96.). The aim of this study was to speed-up pathogen identification and antimicrobial susceptibility testing (AST) from positive blood culture samples. We validated a novel diagnostic algorithm integrating fully automated WASP/WASPLabTM (Copan, Brescia, Italy) sample processing and early MALDI-TOF-MS identification.

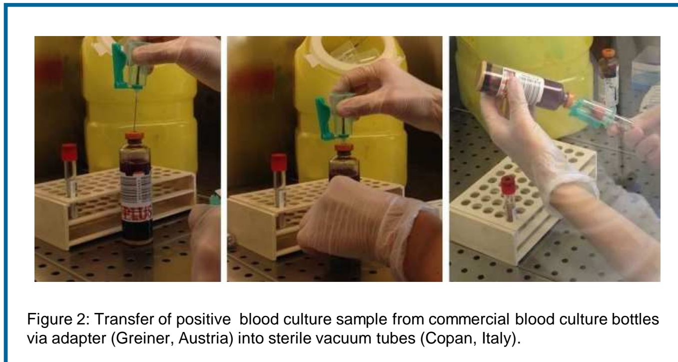


Figure 2: Transfer of positive blood culture sample from commercial blood culture bottles via adapter (Greiner, Austria) into sterile vacuum tubes (Copan, Italy).

METHODS

For this study broths of 63 individual positive blood cultures from 54 patients consecutively collected from September to November 2015 in our clinical laboratory were analyzed. Broth from blood culture bottles that were reported as positive by the BacT/ALERT ® system (bioMérieux, Marcy LÉtoile, France) were immediately transferred into vacuum tubes (Copan, Italy) using an adapter (Greiner, Austria) and processed in the WASP/WASPLab™ automation system, which comprised automated streaking by WASP™ (Copan) on appropriate agar plates, incubation of plates in automated WASPLab™ incubators, and automated image taking of the plates by WASPLab™ after 3h, 6h, 18h, 24h, and 40h of incubation. Images were subsequently checked for growth by a technician on-screen. If growth was detected, MALDI-TOF-MS using a Bruker Biotyper (Bruker Daltonics, Bremen, Germany) and AST was performed from the colonies detected on the plates. If MALDI-TOF MS and/or AST were not possible or did not yield appropriate results due to lack of colony material, plates were re-incubated and the next scheduled imaging-time-points were waited for. Results were compared to those of the routine work-up of our clinical laboratory, i.e. a classical manual workup including an overnight incubation of subcultures from blood culture broth.

1. Kumar A. et al. Crit Care Med. 2006;34[6]:1589-96.

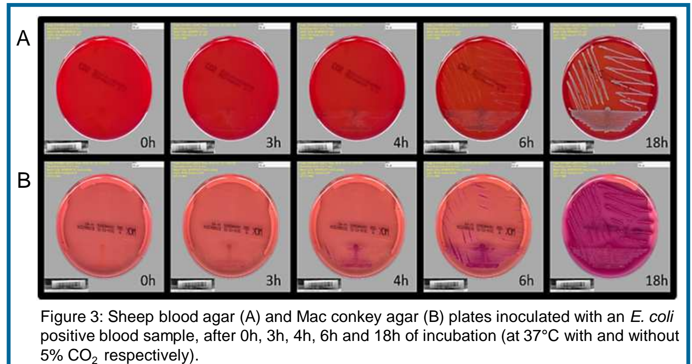
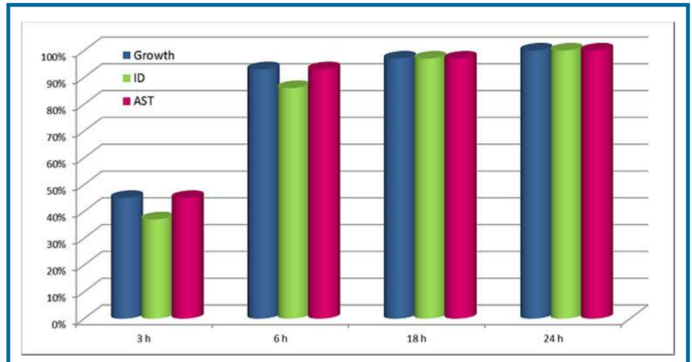


Figure 3: Sheep blood agar (A) and Mac conkey agar (B) plates inoculated with an *E. coli* positive blood sample, after 0h, 3h, 4h, 6h and 18h of incubation (at 37°C with and without 5% CO_2 respectively).

RESULTS

After 3h of incubation the overall growth rate was 45% for all samples, and MALDI-TOF MS identification and disk diffusion AST were possible for 37% and 45% of samples, respectively. After 6h of incubation MALDI identification and AST rates both increased to 93%. At 18h and 24h of incubation MALDI-TOF MS identification and AST-rates of 97% and 100% were yielded. Discrepancies in successful MALDI-TOF MS identification and AST rates were observed mainly for coagulase-negative staphylococci and streptococci at early time-points of incubation.



Incubation time	Growth	ID	AST
3 h	45%	37%	45%
6 h	93%	86%	93%
18 h	97%	97%	97%
24 h	100%	100%	100%

Figure 4: Overall growth-, identification- and susceptibility-rate after 3h, 6h, 18h and 24h of incubation.

CONCLUSIONS

Automated periodic plate-screening can accelerate time-to-diagnosis of blood cultures providing same-day results in contrast to the classical manual work-up that uses an 18-24h incubation period before identification and AST will be done. The accelerated work-up facilitates bacterial identification by MALDI-TOF MS superseding additional extraction procedures and, in addition, enabling species specific AST at the same time. Copan WASPLab™ automation facilitated the implementation of same-day MALDI-TOF MS identification and AST for blood cultures with a potentially significant impact on expected patient morbidity and mortality.