Evaluation of the Accelerate Arc module and BC kit for isolation of microorganisms from positive blood culture broths and suitability for MALDI-ToF analysis

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Background

Bloodstream infections carry a high morbidity and mortality. The outcome of these infections is positively impacted by rapid identification of the infecting organism, thereby enabling appropriate antibiotic selection. Matrix-assisted laser desorption ionization time-of-flight (MALDI-ToF) provides rapid identification of bacterial and fungal isolates; however, this method requires purification of microorganisms from positive blood culture broths (PBCs) prior to analysis. We evaluated the performance of the Accelerate Arc™ module and BC kit (under development; Accelerate Diagnostics, USA) for automated sample preparation from PBCs for subsequent MALDI-ToF analysis.

Methods

Fifty PBCs (VersaTREK) were prospectively enrolled to this study. This included 30 aerobic and 20 anaerobic cultures. The Gram stain result and time from positive signal to analysis was recorded. A 1.5-2.0 mL portion of broth was loaded to the Arc capsule and inserted with the reagent cartridge into the Arc module for automated processing. Following processing, 1 µL of processed sample was spotted in triplicate for MALDI-ToF (Bruker, RUO library) analysis. In parallel, each broth was plated to solid culture medium and incubated overnight. Resulting colonies were spotted in triplicate for MALDI-ToF analysis. The final identification, mean scores, and standard deviation were compared between methods.

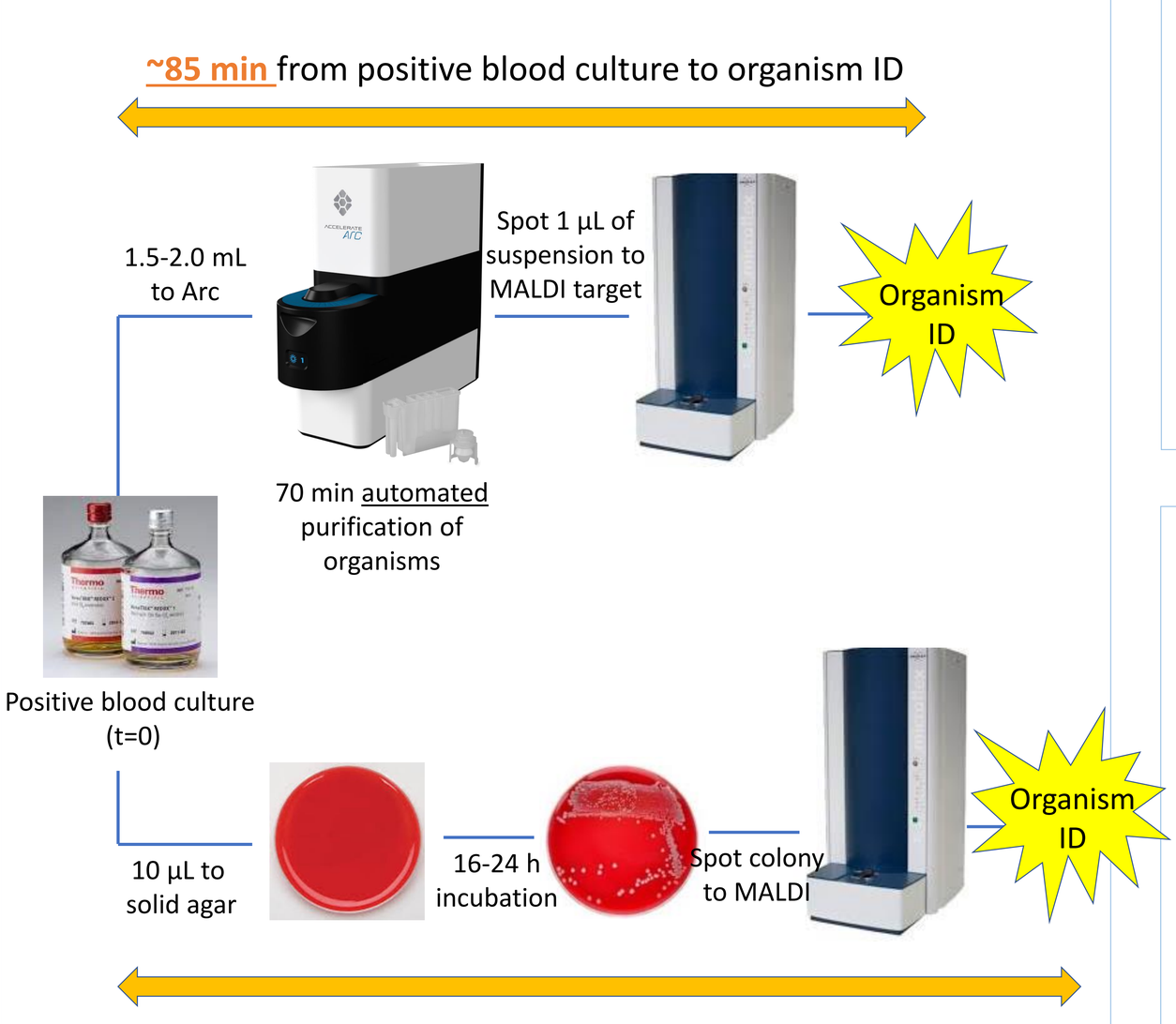


Figure 1. Identification rate based on MALDI-ToF Score*

- Direct MALDI-ToF analysis of Arc isolated organisms provided an identification for **90% of PBCs**, including 70% with high confidence scores (≥ 2.0).
- There was **100% agreement** between Arc and colony identification for the 44 PBCs with a definitive organism ID from both methods (MALDI score ≥ 1.7).
- Arc **enabled identification** of *Prevotella oulorum* in a PBC that **failed to grow** on solid medium.

* Score is average of 3 replicate MALDI spots

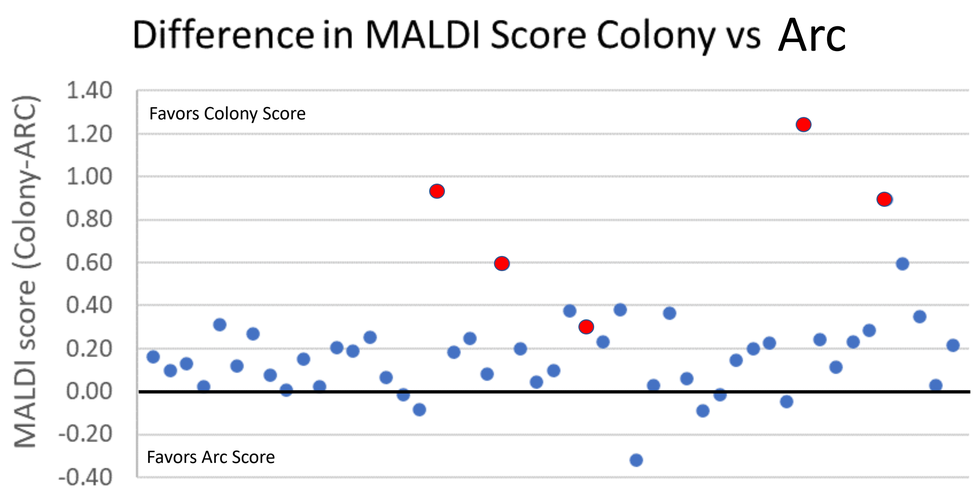
Table 2. PBCs with discrepant identification

Arc		Colony	
Identification	**Score**	**Identification**	**Score**
No ID	1.29	*S. epidermidis*[a]	2.22
No ID	1.27	*C. jeikeium*	1.86
No ID	1.22	*E. faecium*	2.46
No ID	1.30	Polymicrobial[b]	-
No ID	1.66	*S. dysgalactiae/canis*	2.01
Prevotella oulorum	2.05	Failed to grow on agar	NA

[a]Arc suspension was pink in color, suggesting residual red blood cells in specimen

[b]Culture contained *Acinetobacter spp.*, *A. viridans*, and *S. haemolyticus*

Figure 2. Comparison of Colony and Arc confidence scores



The average difference in MALDI score between Arc and colony identification was 0.21. The standard deviation based on replicate testing was 0.05 for both methods. Red dots indicate the 5 cultures with failed Arc identification.

Table 1. List of organisms in positive cultures

E. coli (n=12)	*C. jeikeium* (n=1)
S. epidermidis (n=6) other CoNS (n=5)	*E. faecium* (n=1)
S. aureus (n=5)	*B. cereus* (n=1)
K. pneumoniae (n=4)	*E. cloacae* (n=1)
S. anginosus (n=2)	*C. koseri* (n=1)
Streptococcus viridians gr. (n=2)	*S. marcescens* (n=1)
S. agalactiae (n=2)	*C. albicans* (n=1)
P. septica (n=2)	*P. oulorum* (n=1)
S. dysgalacties/canis (n=1)	*A. viridans* (n=1)

Conclusions

- Arc **enabled direct identification** of microorganisms in **90% of blood cultures**
- There was **100% agreement** between Arc and colony identification
- Arc enables identification in **<90 min. with <5 min** of hands-on time
- Arc **enables identification** of organisms that **fail to grow** on solid medium

Accelerate Arc™ module is US-IVD and the BC kit is currently US-RUO