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Clinical Impact of Rapid Identification and Phenotypic Antimicrobial Susceptibility Testing by Accelerate Pheno™ System for Gram-negative Bloodstream Infections

N. Matic[1]*, B. Willey[2], B. Gascon[2], S. Lee[2], V. Koren[2], S. Surangiwala[2], P. Lo[2], T. Mazzulli[1,2,3], S. M. Poutanen[1,2,3]

[1]Department of Laboratory Medicine and Pathobiology, University of Toronto, ON, Canada [2]Department of Microbiology, University Health Network/Sinai Health System, Toronto, ON, Canada [3]Department of Medicine, University of Toronto – all in Toronto, Canada

Nancy.Matic@medportal.ca
Susan.Poutanen@sinaihealthsystem.ca
Mount Sinai Hospital
600 University Avenue, Rm 1485
Toronto, ON, Canada M5G 1X5
Tel: 416-586-3139, Fax: 416-586-8746

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Abstract

Background

- Laboratory turn-around-times (TATs) for identification (ID) and antimicrobial susceptibilities (AST) can delay prescription of adequate/optimal antimicrobial therapy (ABX) in septic patients, leading to poor outcomes.
- The Accelerate Pheno™ system (Accelerate Diagnostics, USA) (AXDX) is a rapid ID and AST system with potential to improve TATs.

Methods

- 70 prospective non-duplicate blood cultures with Gram-negative bacilli were tested by AXDX.
- AXDX TATs were compared to TATs of **current methods** (MALDI-TOF with short-incubation subcultures & VITEK® 2), **modified current methods** (foregoing purity plate review or calling ID & AST results), and **former methods** (VITEK® 2).

Results

- Using current methods: Gram stain, ID and AST results led to tailoring of ABX in **88.6%** of patients, impacting **22.9%**, **31.4%**, and **64.3%** of patients at **2.5h**, **19.0h**, and **62.1h**, respectively.
- AXDX generated the shortest ID and AST TATs with the potential to shorten time to ABX tailoring in response to ID and AST to **1.3h** and **6.7h**, respectively.

Conclusions

- Among the methods compared, AXDX has the greatest potential impact on time to appropriate ABX in Gram-negative bloodstream infections.
- Prospective studies evaluating the impact on patient outcomes are needed.

Introduction

- For every hour delay in the initiation of appropriate antimicrobial therapy (ABX) in septic patients, there is an average 7.6% decrease in survival.
- Laboratory methods for identification (ID) and antimicrobial susceptibility testing (AST) of organisms from positive blood cultures have traditionally relied on culture, which can have turn-around-times (TATs) up to >80 hours.
- Rapid ID and AST systems have the potential to improve laboratory TATs, with subsequent improvements in clinical outcomes such as mortality and hospital length of stay.
- Furthermore, rapid microbiology results have been shown to lead to earlier de-escalation of ABX in conjunction with an antimicrobial stewardship program (ASP).
- The **Accelerate Pheno™ system** (Accelerate Diagnostics, USA) (AXDX) is a fully-automated, rapid diagnostic system that is used directly on positive blood cultures. It performs:
  - Gel electro-filtration and fluorescence in situ hybridization for **ID**
  - Automated microscopy for observation of bacterial growth and extrapolation of MICs for **AST**

Objective: Our laboratory evaluated the potential clinical impact of AXDX by reviewing ABX changes made by physicians as Gram stain, ID, and AST results are released.

Methods

- 70 prospective non-duplicate blood cultures with Gram-negative bacilli from 3 Toronto tertiary care hospitals from Jun-Sep 2016 were tested by AXDX as part of a concurrent study assessing AXDX accuracy (IDWeek Poster 2031).
- AXDX ID and AST TATs were compared to the TATs of:

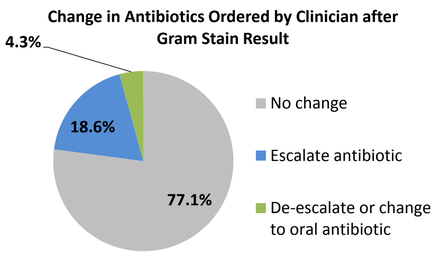
Current Methods
- ID by MALDI-TOF using VITEK® MS (bioMérieux) from short-incubation subcultures and AST by VITEK® 2 (bioMérieux)

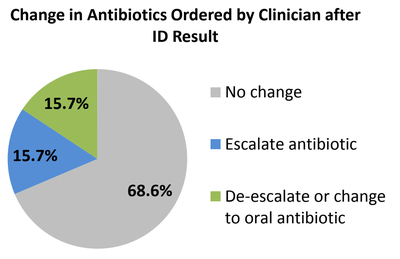
Modified Methods
- Releasing VITEK® 2 AST results prior to purity plate review
- Calling ID and AST results to ward

Former Methods
- ID and AST by VITEK® 2 from data review of 134 retrospective blood cultures from 2011

- Chart review was performed to assess time to tailoring of ABX by physicians following Gram stain, ID, and AST results.

Results





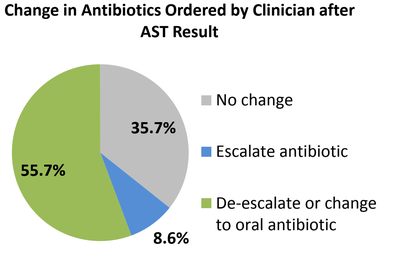
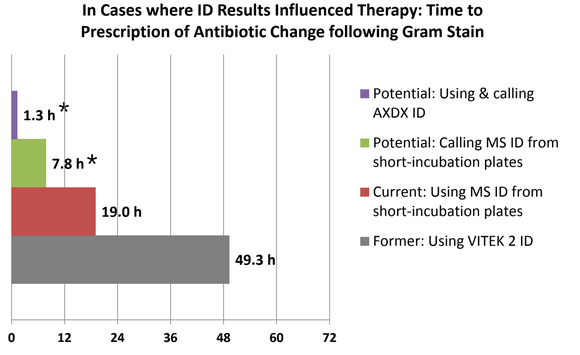


Figure 1: Changes in antibiotics ordered for Gram-negative bloodstream infections following Gram stain, ID, and AST results



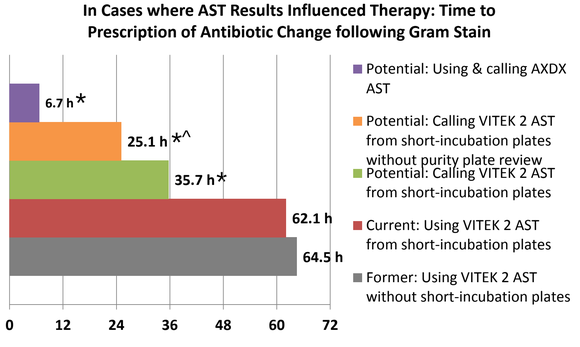


Figure 2: Time to actual and potential antibiotic tailoring by varied ID and AST methods

*AXDX TATs and all Potential Method TATs were statistically significant compared to Current Method TATs (P <0.0001, t test)

^A review of 239 non-AXDX study blood cultures in our laboratory revealed this would result in minor errors 0.4% of the time, major errors 1.3% of the time, but no very major errors.

Table 1: Blood culture isolates and patient locations (n=70)

Blood Culture Isolates	
Escherichia coli	55.7%
Klebsiella pneumoniae	17.1%
Pseudomonas aeruginosa	8.6%
Enterobacter cloacae	5.7%
E. coli + K. pneumoniae	5.7%
Serratia marcescens	2.9%
Acinetobacter baumanii	1.4%
Klebsiella oxytoca	1.4%
S. marcescens + Enterococcus faecalis	1.4%
Patient Locations	
ER	54.3%
Medicine	11.4%
ICU	10.0%
Surgery	8.6%
Transplant Unit	5.7%
Other	10.0%

Conclusions

- AXDX generated the shortest ID and AST TATs with the greatest potential to significantly shorten the time to ABX tailoring in Gram-negative bacilli bloodstream infections thereby impacting patient outcomes.
- Calling ID and AST results directly to physicians or releasing AST results from VITEK® 2 prior to purity plate review would also have the potential to significantly improve time to ABX change compared to current methods.
- Prospective studies evaluating the impact of the reduced TATs associated with AXDX on patient outcomes are needed.

References

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