Poster #906

# Impact of Accelerate Rapid Diagnostic Technology on Time to Optimal Therapy in Gram Negative Bloodstream Infection

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## Abstract

**Background**: Previous studies at our institution evaluating rapid diagnostic testing (RDT) for blood culture identification (BCID) did not show significant differences in time to optimal antimicrobial therapy for Gram negative bloodstream infections (GNBSI). Recent studies of Accelerate Pheno® system (Accelerate-PS) for blood culture identification and susceptibility have shown significant reduction in time to optimal antimicrobial therapy. This study evaluated the impact of Accelerate-PS compared to BCID RDT on time to optimal antimicrobial therapy for GNBSI.

**Methods**: A single center, retrospective, cohort study included adult patients with GNBSI from February 2017 to January 2018 (pre-implementation) and February 2020 to January 2021 (post-implementation). The primary outcome was time to optimal antimicrobial therapy for GNBSI, defined as time from positive blood cultures to time patient received optimal antimicrobial therapy. Secondary outcomes include duration of therapy, rate of antimicrobial-related adverse effects, hospital length of stay, in-hospital mortality, and infection-related readmission.

**Results**: The final cohort included 190 patients in pre-implementation group and 179 patients in post-implementation group. *Escherichia coli* and *Klebsiella* species were the most common pathogens and urinary tract was the most common source of bacteremia in both groups. More patients in the pre-implementation group had congestive heart failure while more patients in the post-implementation group had peripheral vascular disease. Patients in the post-implementation group had higher Pitt bacteremia scores (1.05 vs. 1.34, P=0.022). Patients in the post-implementation group had significantly shorter time to optimal therapy (mean 60.62 hours vs. 20.17 hours, P< 0.001) and shorter duration of therapy (mean 366.56 vs 310.24 hours, P < 0.001) than in the pre-implementation group. There were no differences in mortality or readmission at 30-days.

**Conclusions**: The results of this study indicate that incorporation of Accelerate-PS into microbiology lab workflow significantly reduces time to optimal antimicrobial therapy for GNBSI. Rapid diagnostic testing is a vital component of a robust antimicrobial stewardship program (ASP).

## Background

**Evolution of RDT for BSI at Prisma Health-Upstate**:

**Pre-BCID Intervention**
- February 2016 – February 2017
- Project design and collect pre-BCID BSI data to evaluate impact of BCID on time to optimal therapy for BSI

**Post-BCID Intervention**
- March 2017 – February 2018
- Compared time to optimal therapy between pre-BCID and post-BCID interventions in BSI

**Gram Negative Multi-Drug Resistance Risk Factors**
- October 2018 – June 2019
- Compared preliminary data for GNBSI from pre/post-BCID intervention to determine rate of resistance to broad-spectrum beta-lactam antibiotics

**Accelerate-PS Rapid Diagnostic Technology**
- New evaluation
- Compare time to optimal therapy for GNBSI between pre-Accelerate-PS and post-Accelerate-PS technology

| Pre-BCID vs Post-BCID | Risk Factors for Multi-Drug Resistance in GNBSI |
|---|---|
| • Significant reduction in time to optimal therapy in Gram positive bloodstream infections (GPBSI) (41.2 hr vs 19.4 hr; p <0.01)<br>• Significant reduction in time to optimal therapy for MSSA (53.4 hr vs 24.7 hr p <0.01)<br>• No difference in time to optimal therapy in GNBSI (63 hr vs 62 hr) | • ESBLs were identified in 16/123 (12%) of GNBSI<br>• Patients with documented ceftriaxone resistance had 1 or more risk factors associated with extend-spectrum beta-lactamases (ESBLs)<br>• Supported the use of ceftriaxone as empiric therapy in severe infections in patients without documents risk factors for MDROs |

## Methods

**Study design:**
- Single center, retrospective, cohort study
- Comparing GNBSI outcomes pre-implementation vs post-implementation of Accelerate-PS

**Pre-Implementation of Accelerate-PS**
**February 2017-January 2018 (BCID Technology Utilized)**

vs

**Post-Implementation of Accelerate-PS**
**February 2020-January 2021**

## Methods (Cont.)

| Inclusion | Exclusion |
|---|---|
| ≥18 years of age | Polymicrobial Gram stain or organism not identified by RDT |
| Admission to GMH | Death or transfer within 48 hours of admission |
| Positive blood cultures with gram-negative Gram stains | Transfer in from non-Prisma Health facility |
| | Admission to a pediatric unit |

| Outcomes | | |
|---|---|---|
| **Primary Outcome** | Time to optimal antimicrobial therapy for GNBSI | |
| **Secondary Outcomes** | Duration of antimicrobial therapy<br>Length of hospital stay<br>30-day infection related readmission | In-hospital mortality<br>Antimicrobial related adverse events |

## Microbiology Process

**Microbiology RDT workflow:**

**Blood Culture**
- Blood culture bottles placed in incubator
- Incubator alerts for growth
- Gram stain performed and sample placed on appropriate RDT instrument

**BCID Only**
- Gram positive, Gram negative and yeast isolated from blood run on BCID panel
- Organism identification in about 1 hour
- Susceptibilities determined via Vitek reported in about 48 hours

**BCID and Accelerate-PS**
- Gram positives and yeasts run on BCID
- Gram negative bloodstream pathogens run on Accelerate-PS
- Accelerate-PS provides identification in about 2 hours and susceptibilities 7 hours later

## Results

Adult patients were screened for inclusion via with a positive blood culture report obtained from the electronic health record (EHR)

393 Patients Screened

369 Included

24 Excluded
RDT not performed

190 BCID

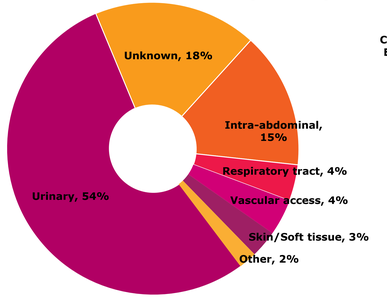
179 Accelerate-PS

| Baseline Characteristics | BCID (n=190) | Accelerate-PS (n=179) | p-value |
|---|---|---|---|
| Age (years), Mean ± SD | 65.14 ± 14.90 | 64.53 ± 14.58 | 0.642 |
| Gender, Male, N (%) | 94 (49.5) | 91 (50.8) | 0.835 |
| Race, N (%) | | | |
| White | 134 (70.5) | 128 (71.5) | |
| Black or African American | 46 (24.2) | 38 (21.2) | 0.781 |
| Hispanic | 5 (2.6) | 8 (4.5) | |
| Asian | 3 (1.6) | 4 (2.2) | |
| Unknown/Not Reported | 2 (1.1) | 1 (0.6) | |
| Penicillin Allergy Reported, N (%) | 29 (15.3) | 40 (22.3) | 0.084 |
| Infectious Disease Consult, N (%) | 35 (18.4) | 44 (24.6) | 0.164 |
| Pitt Bacteremia Score, Mean ± SD | 1.05 ± 1.69 | 1.34 ± 1.76 | 0.022* |
| Charlson Comorbidity Index Score, Mean ± SD | 4.69 ± 2.87 | 4.51 ± 2.63 | 0.587 |
| **Comorbidities** | | | |
| Hypertension, N (%) | 135 (71.1) | 119 (66.5) | 0.369 |
| Chronic Kidney Disease, N (%) | 46 (24.2) | 38 (21.2) | 0.536 |
| Diabetes, N (%) | 75 (39.5) | 73 (40.8) | 0.832 |
| Congestive Heart Failure, N (%) | 37 (19.5) | 20 (11.2) | 0.031* |
| Peripheral Vascular Disease, N (%) | 6 (3.2) | 15 (8.4) | 0.041* |
| Implanted Prostheses, N (%) | 4 (2.1) | 9 (5.0) | 0.162 |

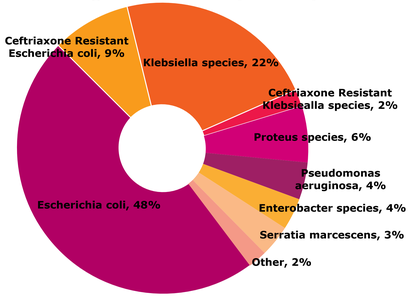
## Results (Cont.)

There were no differences identified in source of bacteremia or pathogens isolated in the BCID vs Accelerate-PS groups

**Source of Bacteremia (n=369)**




**Pathogens Isolated (n=369)**




| Outcomes | BCID (n=190) | Accelerate-PS (n=179) | p-value |
|---|---|---|---|
| Time from Positive Blood Culture to Optimal Gram-Negative Therapy (hours), Mean ± SD | 60.62 ± 51.91 | 20.17 ± 38.42 | < 0.001* |
| Duration of Antimicrobial Therapy (hours), Mean ± SD | 366.56 ± 154.26 | 310.24 ± 183.24 | < 0.001* |
| Length of Stay (days), Mean ± SD | 9.48 ± 11.33 | 12.71 ± 36.25 | 0.524 |
| 30-Day Readmission, N (%) | 16 (8.4) | 22 (12.3) | 0.235 |
| Patient Discharge Disposition, N (%) | | | |
| Discharged alive | 171 (90.0) | 161 (89.9) | 1 |
| Expired | 6 (3.2) | 5 (2.8) | |
| Left against medical advice | 1 (0.5) | 1 (0.6) | |
| Hospice | 12 (6.3) | 12 (6.7) | |

| Adverse Effects | BCID (n=190) | Accelerate-PS (n=179) | p-value |
|---|---|---|---|
| Clostridioides difficile, N (%) | 7 (3.7) | 4 (2.2) | 0.545 |
| Nephrotoxicity, N (%) | 9 (4.7) | 11 (6.1) | 0.648 |
| Neutropenia (ANC<1000), N (%) | 1 (0.5) | 1 (0.6) | 1 |
| Thrombocytopenia (Platelets<1000), N (%) | 12 (6.3) | 11 (6.1) | 1 |

## Conclusion

- Incorporation of Accelerate-PS into microbiology lab workflow significantly reduces time to optimal antimicrobial therapy for GNBSI
- Duration of antimicrobial therapy was also reduced in the Accelerate-PS group with no impact on length of stay or 30-day readmission
- Rapid diagnostic testing is a vital component of a robust antimicrobial stewardship program (ASP)

## Authors Disclosures

JS is on the Gilead Speaker's Bureau
The additional authors have nothing to disclose concerning financial or personal relationships with commercial entities that may have interest in the subject matter of this presentation.

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