1807

Impact of Rapid Diagnostic Testing and Antimicrobial Stewardship on the Time to Escalation/De-escalation of Antimicrobial Regimens for Gram-Negative Bloodstream Infections at a Large Community Hospital

Gerard Gawrys, PharmD, BCPS[1,2], Grace C. Lee, PharmD, PhD, BCPS[2], Khine Tun, PharmD[1,2], Jordan Meckel, PharmD, Connor Zheng, PharmD.

[1]Methodist Hospital, San Antonio, TX, USA, [2]Pharmacotherapy Division, The University of Texas at Austin College of Pharmacy and The University of Texas Health San Antonio, School of Medicine, San Antonio, TX, USA

Contact information
Gerard Gawrys
Methodist Hospital
San Antonio, TX, USA
Gerard.Gawrys@mhshealth.com
T: 210-575-6145

INTRODUCTION

- Prompt identification of an etiologic pathogen is vital for the optimal management of bloodstream infections (BSIs)
- Standard microbiological testing typically requires 48-72 hours for identification of organisms
- Verigene® blood culture gram-negative (BC-GN) test (Luminex Corporation, Northbook, IL, USA) is a rapid diagnostic test that detects gram-negative (GN) bacteria and resistance markers with a turnaround time of two hours
- It has implications for the treatment of BSIs, particularly for cases with resistant GN organisms
- There is limited data evaluating the impact of BC-GN testing in conjunction with antimicrobial stewardship efforts on antimicrobial optimization and clinical outcomes at community hospitals

OBJECTIVE

- The primary objective of the study was to assess the impact of BC-GN testing with pharmacy-driven antimicrobial stewardship team (AST) interventions on time to optimal therapy (TOT) from initial culture positivity
- Secondary outcomes included TOT based on clinical pharmacy staffing presence, length of stay and all-cause mortality

METHODS

Study Design

- This was a retrospective pre- and post-intervention study conducted at a 950-bed hospital in San Antonio, Texas across two study periods: July 1, 2012 to July 31, 2014 in the pre-intervention group and July 1, 2015 to July 31, 2017 in the post intervention group

Interventions

- The BC-GN test identifies four gram-negative species (*E. coli, K. pneumoniae, K. oxytoca, P. aeruginosa*) and four genera (*Acinetobacter, Proteus, Citrobacter, Enterobacter*) and discerns resistance markers for CTX-M, IMP, KPC, NDM, VIM and OXA genes
- The results from the BC-GN test are transmitted to VigiLanz™ (VigiLanz Corporation, Minneapolis, MN, USA) that provides electronic notifications for real-time AST review and interventions by clinical pharmacists

Study Population

Inclusion Criteria

- Patients aged 18 years and older admitted for the first time with initial blood culture positivity for study pathogens

Exclusion Criteria

- Patients with polymicrobial positive blood cultures
- Patients who died, were discharged or transferred prior to the blood culture becoming positive via gram stain (GS)

Definitions

- Antimicrobial therapy optimization: a change in gram-negative antimicrobial regimen (including escalation and de-escalation) based on the antimicrobial susceptibility results
- Time to antimicrobial therapy optimization: time from the GS to escalate or de-escalate optimal antimicrobial therapy based on the antimicrobial susceptibility results
- Fully staffed clinical pharmacy hours: defined as 0700 to 2000 on weekdays

Statistical Analyses

- Categorical variables were analyzed using x^2 test, and continuous variables were analyzed using the student t test or Wilcoxon Rank Sum
- A *p*-value < 0.05 was considered statistically significant
- All analyses were performed using SPSS 23.0® (IBM Crop, Armonk, NY, USA)

RESULTS

Figure 1. Inclusion/Exclusion of Study Patients

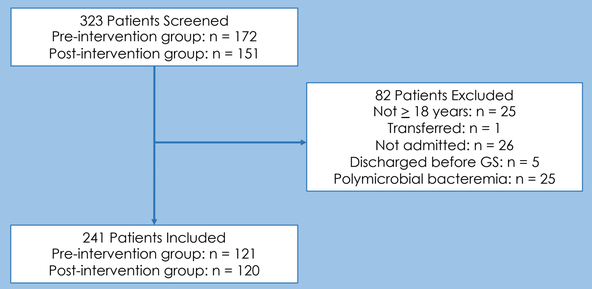


Table 1. Baseline Characteristics

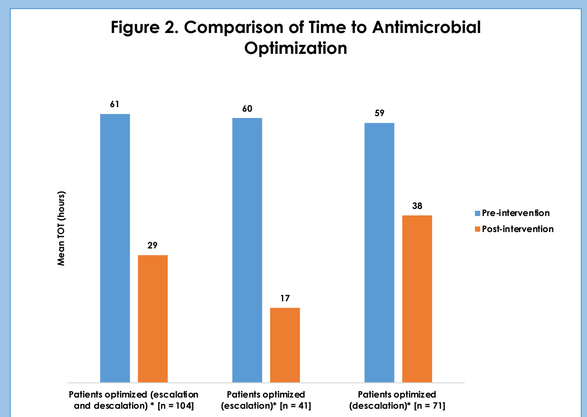
	Pre-intervention (n = 121)	Post-intervention (n = 120)	*p*-value
Age, years ± SD	68 ± 17	65 ± 17	0.152
Sex, male (%)	49 (41)	56 (47)	0.401
ICU admission (%)	35 (29)	47 (39)	0.243
ICU admission at time of collection (%)	9 (7)	28 (23)	0.001
ICU admission ≥ 48 hours after gram negative BSI onset (%)	3 (3)	4 (3)	0.536
Pitt bacteremia score ± SD	1.3 ± 1.7	1.8 ± 1.8	0.051
Neutropenia [ANC < 500 cells/mm^3] (%)	20 (17)	20 (17)	0.608
Optimal antimicrobial therapy at time of GS (%)	52 (43)	48 (40)	0.834
Potential optimization of antimicrobial therapy at time of GS (%)	69 (57)	72 (60)	0.639
MRSA coverage at time of GS (%)	18 (15)	42 (35)	0.001
Infection Sources (%) • Urinary/Genitourinary • Gastrointestinal/Intra-abdominal • Respiratory • Skin and soft tissues • Central nervous system • Central line • Unknown	 74 (61) 32 (26) 0 1 (1) 0 4 (3) 10 (8)	 64 (53) 30 (25) 5 (4) 5 (4) 0 5 (4) 11 (9)	0.126
Organisms (%) • *Acinetobacter* spp. • *Citrobacter* spp. • *Enterobacter* spp. • *Escherichia coli* • *Klebsiella oxytoca* • *Klebsiella pneumoniae* • *Pseudomonas aeruginosa* • *Proteus* spp.	 2 (2) 0 4 (3) 73 (60) 3 (3) 23 (19) 12 (10) 4 (3)	 0 1 (1) 7 (6) 68 (57) 2 (2) 23 (19) 16 (13) 3 (3)	0.671
MDR and ESBL producing organisms(%)	25 (21)	30 (25)	0.422

Data presented as n (%), mean ± SD (standard deviation): ICU = intensive care unit, GS = gram stain, ANC = absolute neutrophil count, MRSA = methicillin-resistant *Staphylococcus aureus*, MDR/ESBL = multidrug resistant/extended spectrum beta-lactamase; *Statistical significance

Table 2. Antimicrobial Optimization Outcomes

	Pre-intervention (n = 69)	Post-intervention (n = 71)	*p*-value
Antimicrobial therapy optimization (%) Escalation (%) De-escalation (%)	42 (61) 13 (19) 29 (42)	61 (86) 28 (39) 33 (46)	0.001* 0.009* 0.748
Not optimized antimicrobial therapy (%)	27 (39)	10 (14)	0.001*
Optimal antimicrobial therapy by 24 hours after GS (%)	4 (6)	28 (39)	0.001*

Figure 2. Comparison of Time to Antimicrobial Optimization

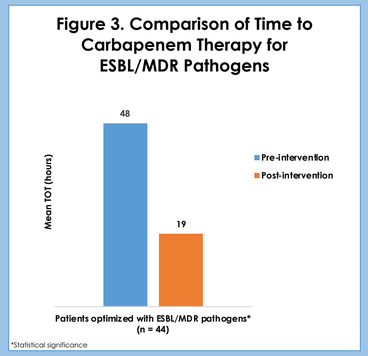


*Statistical significance

Table 3. Antimicrobial Outcomes of ESBL/MDR Pathogens

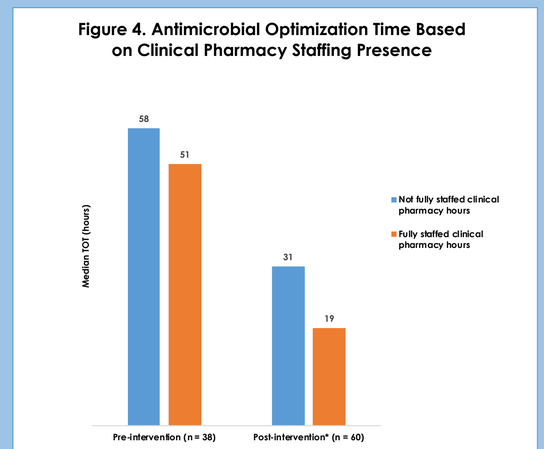
	Pre-intervention (n = 19)	Post-intervention (n = 25)	*p*-value
Optimal carbapenem therapy by 24 hours after GS (%)	2 (11)	15 (60)	0.001*

Figure 3. Comparison of Time to Carbapenem Therapy for ESBL/MDR Pathogens



*Statistical significance

Figure 4. Antimicrobial Optimization Time Based on Clinical Pharmacy Staffing Presence



*Statistical significance

Table 4. Secondary Outcomes

	Pre-intervention (n = 69)	Post-intervention (n = 71)	*p*-value
In-hospital all-cause mortality (%)	3 (3)	6 (5)	0.302
Hospital LOS, days ± SD	11.6 ± 10.1	15.8 ± 29	0.849
ICU LOS, days ± SD	4.6 ± 3.7	10.2 ± 34	0.064
ID service consultation (%)	19 (28)	33 (46)	0.078

Data presented as n (%) or mean ± SD (standard deviation): LOS = length of stay, ID = infectious diseases, ICU = intensive care unit; *Statistical significance

LIMITATIONS

- Spectrum of activity of antimicrobial agents against gram-negative BSI was not objectively defined
- The individual impact on antimicrobial outcomes by either implementation of BC-GN testing, utilization of VigiLanz™ or active AST review/intervention cannot be differentiated

CONCLUSION

- The implementation of rapid diagnostic testing combined with pharmacy-driven AST substantially decreased the time to optimal antimicrobial therapy in patients with gram-negative bacteremia
- This also highlights the positive impact of clinical pharmacy staff on shortening time to optimal therapy

DISCLOSURE

The authors have nothing to disclose.

2018 ID Week, Dec 4-6th, San Francisco, CA