Rapid MIC determination for β-lactamase–mediated resistant Gram-negative organisms with the LifeScale AST system

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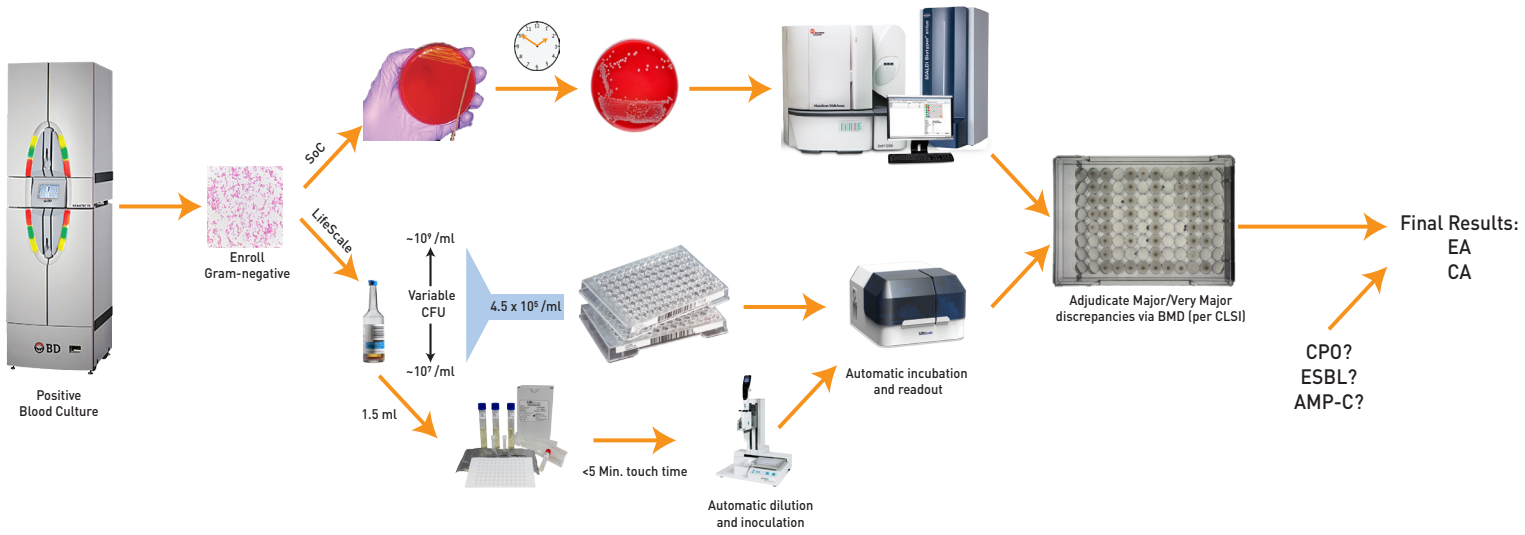
Background

In an October 2025 report, the World Health Organization (WHO) warned that drug-resistant Gram-negative bacteria continue to pose an escalating global threat[1]. A significant challenge in combating antimicrobial resistance is obtaining rapid and reliable susceptibility information to guide timely clinical management. Accurate MIC results for organisms harboring resistant mechanisms such as ESBL, cabapenemase, and AmpC producers are essential to optimize patient outcomes and limit transmission. The LifeScale AST system (Affinity Biosensors), is an FDA-cleared rapid AST platform that provides MICs and interpretive criteria directly from positive blood cultures (PBC) for gram-negative bacilli within approximately 4.5 hours[2].

Introduction

The objective of this study was to evaluate the accuracy and clinical utility of rapid AST reporting by the LifeScale AST system for Gram-negative bloodstream isolates harboring key β-lactam resistance mechanisms. Across 9 clinical sites, LifeScale AST performance was assessed for PBCs identified as ESBL, CPO, or AmpC producers using each site's routine phenotypic or genotypic method. LifeScale results were compared with SOC results, and major and very major discrepancies were resolved by reference broth microdilution (rBMD) following CLSI guidelines.[3]

Study Methods



Positive blood culture samples detected positive by FDA approved continuous-monitoring blood culture system and confirmed as Gram-negative by Gram stain were enrolled in the study. Blood cultures were processed on the LifeScale AST system and FDA approved standard-of-care (SOC) AST system at each site (MicroScan WalkAway (5), VITEK 2 (3), BD Phoenix (1)). Performance was assessed for isolates identified as ESBL, CPO, or AmpC producers using each site's routine phenotypic or genotypic method. Discrepancies were adjudicated by CLSI guided BMD test.

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Table 1. Study population. ESBLs include CTX-M–positive strains, carbapenemases include OXA-, KPC-, NDM-, and IMP-positive strains.

	Total	*Acinetobacter baumannii*	*Acinetobacter spp.*	*Citrobacter Koseri**	*Citrobacter freundii*	*Enterobacter cloacae complex*	*Escherichia coli*	*Klebsiella oxytoca**	*klebsiella pneumoniae*	*Proteus mirabilis*	*Salmonella spp.*
ESBL	154	0	0	1	1	2	108	7	33	1	1
CTX-M	96	0	0	1	0	1	71	3	17	1	1
Carbapenemases	33	2	2	0	0	0	6	4	18	1	0
OXA	6	2	2	0	0	0	0	0	2	0	0
KPC	6	0	0	0	0	0	1	0	4	1	0
NDM	13	0	0	1	0	0	5	4	3	0	0
IMP	1	0	0	0	0	0	0	0	1	0	0
AMP-C	2	0	0	0	1	0	1	0	0	0	0
Total Species	189	2	2	1	2	2	115	11	51	2	1

*CTX-M and NDM genes detected in 1 sample

Table 2. Overall LifeScale AST Performance Across All Antibiotics

Total Samples	Essential Agreement	Categorical Agreement	Very Major Errors	Major Errors	Minor Errors
189	94.88%	93.18%	2/1278 (0.16%)	10/909 (1.10%)	143/2274 (6.29%)

Table 3. LifeScale AST Performance by Resistance Mechanism Across All Antibiotics

Resistance Mechanism	Total Samples	Essential Agreement	Categorical Agreement	Very Major Errors	Major Errors	Minor Errors
ESBL	154	94.67%	93.19%	0/817 (0.00%)	10/724 (1.38%)	98/1586 (6.18%)
CTX-M	96	94.60%	92.38%	0/476 (0.00%)	5/438 (1.14%)	67/945 (7.09%)
Carbapenemases	33	91.76%	93.81%	1/222 (0.45%)	0/55 (0.00%)	17/291 (5.84%)
OXA	6	94.29%	94.29%	0/23 (0.00%)	0/10 (0.00%)	2/35 (5.71%)
KPC	6	83.33%	93.75%	1/29 (3.45%)	0/17 (0.00%)	2/48 (4.17%)
NDM	13	93.10%	93.97%	0/106 (0.00%)	0/5 (0.00%)	7/116 (6.03%)
IMP	1	100.00%	87.50%	0/6 (0.00%)	0/2 (0.00%)	1/8 (12.50%)
AMP-C	2	95.45%	90.91%	0/6 (0.00%)	0/15 (0.00%)	2/22 (9.09%)

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Table 4. LifeScale AST Performance for Clinically Relevant Antibiotics in ESBL-, CPO-, and AmpC-Positive Samples

Resistance Mechanism	Antibiotics	%R	EA	CA	Very Major Errors	Major Errors	Minor Errors
ESBL Positive	All	33.58%	94.91%	94.27%	0/369 (0.00%)	10/701 (1.42%)	53/1099 (4.82%)
	Cefepime	87.33%	85.11%	90.00%	0/131 (0.00%)	1/11 (9.09%)	14/150 (9.33%)
	Ceftazidime/Avibactam	1.14%	98.85%	100.00%	0/1 (0.00%)	0/87 (0.00%)	0/88 (0.00%)
	Ertapenem	8.41%	97.78%	97.20%	0/9 (0.00%)	0/96 (0.00%)	3/107 (2.80%)
	Gentamicin	28.48%	99.34%	98.68%	0/43 (0.00%)	0/106 (0.00%)	2/151 (1.32%)
	Levofloxacin	64.00%	96.00%	86.00%	0/96 (0.00%)	2/46 (4.35%)	19/150 (12.67%)
	Meropenem	1.32%	98.01%	96.69%	0/2 (0.00%)	1/147 (0.68%)	4/151 (2.65%)
	Meropenem/Vaborbactam	0.00%	98.63%	98.65%	0/0 (0.00%)	0/73 (0.00%)	1/74 (1.35%)
	Piperacillin/Tazobactam	11.71%	85.83%	86.49%	0/13 (0.00%)	5/92 (5.43%)	10/111 (9.01%)
	Trimethoprim/Sulfamethoxazole	63.25%	97.44%	99.15%	0/74 (0.00%)	1/43 (2.33%)	0/117 (0.00%)
CPO	All	64.96%	91.03%	96.55%	1/100 (1.00%)	0/43 (0.00%)	13/154 (8.44%)
	Ceftazidime/Avibactam	54.55%	100.00%	100.00%	0/12 (0.00%)	0/10 (0.00%)	0/22 (0.00%)
	Ertapenem	100.00%	95.00%	100.00%	0/20 (0.00%)	0/0 (0.00%)	0/20 (0.00%)
	Gentamicin	55.56%	100.00%	100.00%	0/15 (0.00%)	0/12 (0.00%)	0/27 (0.00%)
	Levofloxacin	50.00%	93.33%	73.33%	0/15 (0.00%)	0/6 (0.00%)	8/30 (26.67%)
	Meropenem	81.25%	78.13%	84.38%	1/26 (3.85%)	0/4 (0.00%)	4/32 (12.50%)
	Meropenem/Vaborbactam	25.00%	83.33%	91.67%	0/3 (0.00%)	0/9 (0.00%)	1/12 (8.33%)
	Trimethoprim/Sulfamethoxazole	81.82%	100.00%	100.00%	0/9 (0.00%)	0/2 (0.00%)	0/11 (0.00%)
AMP-C	All	8.33%	100.00%	100.00%	0/1 (0.00%)	0/11 (0.00%)	0/12 (0.00%)
	Cefepime	0.00%	100.00%	100.00%	-	0/2 (0.00%)	0/2 (0.00%)
	Ertapenem	0.00%	100.00%	100.00%	-	0/2 (0.00%)	0/2 (0.00%)
	Gentamicin	50.00%	100.00%	100.00%	0/1 (0.00%)	0/1 (0.00%)	0/2 (0.00%)
	Levofloxacin	0.00%	100.00%	100.00%	-	0/2 (0.00%)	0/2 (0.00%)
	Meropenem	0.00%	100.00%	100.00%	-	0/2 (0.00%)	0/2 (0.00%)
	Piperacillin/Tazobactam	0.00%	100.00%	100.00%	-	0/1 (0.00%)	0/1 (0.00%)
	Trimethoprim/Sulfamethoxazole	0.00%	100.00%	100.00%	-	0/1 (0.00%)	0/1 (0.00%)

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Table 5. LifeScale AST Demonstrated Fewer Very Major Errors (VMEs) Than Standard-of-Care Testing for Clinically Relevant Antibiotics in Samples Harboring Resistance Mechanisms

	SOC VS BMD*					LS VS BMD*				
Resistance Mechanism	Eseential Agreement	Categorical Agreement	Very Major Errors	Major Errors	Minor Errors	Eseential Agreement	Categorical Agreement	Very Major Errors	Major Errors	Minor Errors
ESBL	214/237 (90.30%)	216/247 (87.45%)	13/90 (14.44%)	8/171 (4.68%)	10/247 (4.05%)	226/251 (90.04%)	229/251 (91.24%)	1/89 (1.12%)	12/154 (7.79%)	9/251 (3.59%)
CPO	36/49 (73.47%)	41/52 (78.88%)	1/29 (3.44%)	4/19 (21.05%)	6/53 (11.32%)	45/53 (84.91%)	46/53 (86.79%)	1/29 (3.44%)	2/19 (10.53%)	4/53 (7.55%)
Total	**250/286 (87.41%)**	**257/299 (85.95%)**	**14/119 (11.76%)**	**12/190 (6.31%)**	**16/300 (5.33%)**	**271/304 (89.14%)**	**275/304 (90.46%)**	**2/118 (1.69%)**	**14/173 (8.10%)**	**13/304 (4.28%)**

*Reference BMD data were available only for samples with discrepant results between LifeScale and SOC testing.

Table 6. Average Time to Final AST Results for Patient Samples Harboring Resistance Mechanisms

Species	Number of Samples	Average Time to Results / Hours
AMP-C	2	6:17*
CPO	33	4:43
ESBL	154	4:36
Total	**189**	**4:38**

*Time to Results was extended due to workflow delays associated with stacking multiple samples.

Conclusions

The LifeScale AST System demonstrated rapid and accurate direct from positive blood culture AST results for ESBL-, CPO-, and AmpC- positive Gram-negative patient samples across nine clinical sites. When discrepancies were evaluated by reference BMD, LifeScale showed greater accuracy than SOC testing. By enabling earlier optimization of antimicrobial therapy and more informed infection-control responses, the timely AST reporting provided by the LifeScale AST system may improve patient outcomes and help reduce the transmission of antimicrobial-resistant organisms.

Acknowledgments

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