

Comparison of Automated Reading and Incubation System (ARIS®)/Sensititre® to Vitek® for Antimicrobial Susceptibility Testing

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ABSTRACT*

Background: The ARIS/Sensititre (TREK Diagnostic Systems, Cleveland, OH) has been evaluated against MicroScan (Dade Behring, West Sacramento, CA) for automated susceptibility testing. The ARIS/Sensititre has not been compared to the Vitek (V1) (bioMérieux, Durham, NC).

Methods: 285 clinical isolates were tested on ARIS/Sensititre and V1, which yielded 2564 antimicrobial-organism combinations. ARIS/Sensititre results were compared to V1 results, with V1 being the initial reference. Only antimicrobial-organism combinations appropriate for routine use and reporting were included. Results were analyzed for essential agreement and categorical agreement. Essential agreement is defined as minimal inhibitory concentrations (MICs) within ±1 two-fold dilution. Categorical errors are defined as: minor (intermediate result versus either SS or RR result), major (ARIS/Sensititre, R; V1, S [falsely resistant]), or very major (ARIS/Sensititre, S; V1, R [falsely susceptible]). Only isolates with major or very major errors were repeated on both systems. Isolates with persistent major or very major errors were subjected to blind discrepant testing using the NCCLS M7 frozen reference method. **Results:** After discrepant analysis, 197 gram-negative isolates (2286 antimicrobial-organism combinations), essential agreement was 94.8%. Categorical agreement showed 4.3% minor, 0% major and 0.9% very major errors. For 88 gram-positive isolates (684 antimicrobial-organism combinations), essential agreement was 88.9% with categorical errors of 1.5% minor, 0.4% major and 0.5% very major. Discrepant analysis favored Sensititre 14:3 over Vitek. **Conclusions:** ARIS/Sensititre yields results generally comparable to V1. Reference testing of discrepant isolates favored Sensititre more often. ARIS/Sensititre is a viable option for automated antimicrobial susceptibility testing.

*Modified Abstract

INTRODUCTION

This study evaluated performance of Sensititre Gram-positive and Gram-negative customized prepared MIC plates read using the Automated Reading and Incubation System (ARIS®) compared to Vitek (V1) for automated antimicrobial susceptibility testing of clinical isolates.

MATERIALS & METHODS

• 285 Clinical Isolates Tested (Table 1):

1. Gram-Positive 88
2. Gram-Negative 197

• Antibiotics tested (Shown in Tables 2 and 3)

• QC organisms were run each day of testing as per NCCLS.

1. ATCC 29213
2. ATCC 29212
3. ATCC 25922
4. ATCC 27853
5. ATCC 35218

• Sensititre Set-up:

1. Inocula were adjusted to a 0.5 McFarland standard using the Sensititre nephelometer.
2. Plates were inoculated as per manufacturer's instructions.

• Vitek Set-up:

1. Inocula were prepared using the Vitek colorimeter.
2. Cards were inoculated as per manufacturer's instructions.

• Data Analysis (Table 4):

1. Sensititre/ARIS results were compared to Vitek results and analyzed for:
 - Essential agreement: MICs ±1 two-fold dilution
 - Categorical errors:
 - Minor¹, intermediate versus sensitive or resistant
 - Major², falsely resistant (ARIS, R; Vitek, S)
 - Very major², falsely susceptible (ARIS, S; Vitek, R)

¹ Minor errors that were in essential agreement were not tallied as errors. For example: an MIC of 8 µg/ml (sensitive) compared to 16 µg/ml (intermediate) is within 1 two-fold dilution and thus was not considered to be a minor error.

² Isolates with Major or Very major error were subjected to repeat testing on both systems. Isolates with persistent Major or Very major errors were sent for blinded arbitration using the NCCLS M7 frozen reference method (Table 5).

Table 1: Isolates Tested

Organism	No. tested	Organism	No. tested
Gram-negative:		Gram-positive:	
<i>Escherichia coli</i>	36	<i>Enterococcus faecalis</i>	29
<i>Klebsiella spp.</i>	36	<i>Staphylococcus aureus</i>	26
<i>Proteus spp.</i>	29	<i>Enterococcus faecium</i>	26
<i>Pseudomonas spp.</i>	24	Coagulase-negative staph	7
<i>Enterobacter spp.</i>	21	Total Gram-positive	88
<i>Serratia marcescens</i>	11		
<i>Citrobacter spp.</i>	10		
<i>Providencia spp.</i>	10		
<i>Acinetobacter spp.</i>	11		
Miscellaneous*	9		
Total Gram-negative	197		

Total 285

* Includes 5 *Morganella*, 2 *Salmonella* and one each *Alcaligenes* and *Flavobacterium*

Table 2: Gram-Negative Antimicrobics

	Amikacin	
	Ampicillin	
	Ampicillin/Sulbactam	
	Aztreonam	
	Cefazolin	
	Cefepime	
	Cefotetan	
	Ceftazidime	
	Ceftriaxone	
	Gentamicin	
	Imipenem	
	Levofloxacin	
	Nitrofurantoin	
	Piperacillin	
	Tobramycin	
	Trimethoprim/Sulfamethoxazole	

Table 3: Gram-Positive Antimicrobics

Ampicillin
Cefazolin
Chloramphenicol
Clindamycin
Erythromycin
Gentamicin
Gentamicin 500
Levofloxacin
Nitrofurantoin
Oxacillin
Penicillin
Streptomycin
Tetracycline
Vancomycin

RESULTS

Table 4: Performance of Sensititre/ARIS compared to Vitek after discrepant analysis

Organism	No. tested	Essential agreement	Categorical Errors (%)		
			Minor	Major	Very Major
Gram-negative	197	94.0%	81 (4.3%)	0 (0%)	4 (0.9%)
Gram-positive	88	88.9%	10 (1.5%)	2 (0.4%)	1 (0.5%)

Table 5: Results of Arbitration for Major and Very Major Errors

Organism	Antimicrobial	MIC (µg/ml)			Resulting error	
		Sensititre	Vitek	Reference	Sensititre	Vitek
CoNS	cefazolin	<2	>32	2		Major
CoNS	cefazolin	<2	>32	1		Major
CoNS	cefazolin	<2	>32	1		Major
CoNS	clindamycin	>2	<0.5	0.06	Major	
CoNS	erythromycin	>4	<0.5	>16		Very major
<i>Enterococcus faecium</i>	ampicillin	16	2	>32	Essential*	Very major
<i>Staphylococcus aureus</i>	ampicillin	<0.25	>16	1	Very major	Major
<i>Staphylococcus aureus</i>	erythromycin	>4	<0.5	>16		Very major
<i>Staphylococcus aureus</i>	erythromycin	>4	1	>16		Very major
<i>Citrobacter freundii</i>	ampicillin	8	>32	16		Minor
<i>Citrobacter freundii</i>	cefazolin	8	>32	>32	Very major	
<i>Enterobacter aerogenes</i>	ampicillin	8	>32	4		Major
<i>Enterobacter aerogenes</i>	ampicillin-sulbactam	8	>32	4		Major
<i>Enterobacter aerogenes</i>	cefazolin	4	>32	4		Major
<i>Enterobacter gergoviae</i>	ampicillin	8	>32	4		Major
<i>Enterobacter gergoviae</i>	ampicillin	8	>32	4		Major
<i>Enterobacter gergoviae</i>	ampicillin-sulbactam	8	>32	8		Major
<i>Enterobacter gergoviae</i>	ampicillin-sulbactam	8	>32	4		Major
<i>Klebsiella pneumoniae</i>	ampicillin	8	>32	32	Very major	

*Resulted in no categorical error but there was still an essential error

CONCLUSIONS

- ARIS/Sensititre performed well compared to Vitek for susceptibility testing of 285 clinical isolates (Table 4).
 1. 94.0% essential agreement for gram negative isolates
 2. 88.9% essential agreement for gram positive isolates.

- Essential and categorical error rates were within generally accepted limits¹, with the exception of gram-positive essential agreement.
 1. Results noted in the arbitration table tended to favor Sensititre results more often than Vitek (Table 5).

- ARIS/Sensititre is a valid option for automated antimicrobial susceptibility testing in the clinical laboratory.

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