Evaluation of Testing Methods for Carben penem Resistant Gram-Negative Bacilli

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INTRODUCTION

Carben penem Resistant Enterobacteriaceae (CRE) are becoming an increasing global health threat and a great concern to healthcare providers worldwide. Efficient and robust screening methods for detecting CRE are in demand to contain the spread of infections between patients. CRE can be detected through automated antimicrobial susceptibility testing (AST), phenotypic, and molecular methods. However, there are limitations to these methods. Our study will aid in rapid and accurate identification of CRE carriers, as well as increase sensitivity and specificity of current confirmatory test methods. The study involved the validation of 2010 CLSI carben penem and cephalosporin antimicrobial breakpoints on the Vitek® which gave 100% categorical agreement for ceftazolin while the remaining drug classes had multiple major and very major errors, (2) verifying the use of the mCIM for screening for CRE which of 19 known CDC isolates tested, specificity of 100% and sensitivity of 63.64% were reported, and (3) validation of rectal swab specimens for the detection of CRE on the Cepheid® GeneXpert CARBA-R assay which resulted in 100% sensitivity and specificity for the detection of five carben penemase genes. In conclusion, 2010 CLSI carben penem and cephalosporin antimicrobial breakpoints for the Vitek® will require further testing; mCIM may be used as a screening method, and rectal swabs are an appropriate specimen type for carben penemase gene detection on the Cepheid® GeneXpert.

METHODS

Vitek® 2 (bioMérieux) AST for Cephaloridine and Carben penems.

Bacterial isolates: Thirty-Five Enterobacteriaceae frozen isolates were recovered at AUUM

Procedure: Vitek® 2 AST testing was performed using AST-GN69 and AST-XN06 cards (bioMérieux, Durham, NC), according to the manufacturer’s instructions.

Modified Carben penem Inactivation Method (mCIM).

Bacterial isolates: Twenty-seven isolates (16 Enterobacteriaceae, 4 Pseudomonas aeruginosa, and 7 Acinetobacter baumannii).

Procedure: The mCIM procedure modified by McMullen et al. (2017) was used. The negative control was a meropenem disk incubated in TSB with no organism. Zones were measured after overnight incubation (18-24 hours) at 35°C.

Analysis of Rectal Swabs as Specimen Type on Cepheid GeneXpert CARBA R.

Bacterial isolates: Five negative stool samples were prepared. Ten mock swabs samples positive for one of five known organisms carrying the following carben penemase genes detected by the assay: blaCre, blpOp, blpOp, blpOp, and blpOp (blaCMA-R). Procedure: All specimens were run using the Xpert Carba-R cartridge and analyzed using the Cepheid GeneXpert according to the manufacturer’s instructions.

RESULTS

Table 1. Calculated categorical agreement, very major, and major errors from validation of carben penem and cephalosporin antimicrobial breakpoints on Vitek® 2.

Table 2. modified Carben penem Inactivation Method (mCIM) Results.

Table 3. Detection of CRE on Cepheid® GeneXpert Using Rectal Swabs.

CONCLUSIONS

Validation of CLSI M310-S24 breakpoints to identify carben penem and cephalosporin antimicrobial susceptibilities on Vitek® 2 AST.

1. Most of the discrepancies are seen in the carben penem class of antimicrobials.
2. Further testing, with more isolates, is needed to validate updated CRE breakpoints on the Vitek®.

Validation of the mCIM for phenotypic screening of CRE.

1. The mCIM is accurate in detecting other clinically significant gram-negative bacilli.
2. The mCIM may be used with Vitek® 2 as a way to improve CRE identification.

Detection of CRE on Cepheid® GeneXpert Using Rectal Swabs.

1. Rectal swabs can be used as a reliable specimen type on the Cepheid® GeneXpert® CARBA-R assay.
2. Rectal swabs can be implemented as a screening tool.

CLINICAL IMPLICATIONS

Our evaluation will:

- Improve lab efficiency by implementing a workflow that will allow for the rapid and accurate identification of CRE carriers in the clinical setting.
- Increase the sensitivity and specificity of current confirmatory test methods.
- Assist in infection control.
- Aid in antimicrobial stewardship.

REFERENCES


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