Measuring the Accuracy of Pathogen Identification and Resistance between Genetic (PCR) Technology vs Standard Culture Analysis in Bloodstream Infections

Corey Wachter, PharmD Candidate, Sameer Nagamiyan, PharmD Candidate, Natalie Tucker, PharmD, BCPS, BCIDP, Beth Cady, PharmD, BCPS

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BACKGROUND

- Standard process of obtaining blood culture results and susceptibilities is lengthy (~3 days)
- During this time, the patient may be on empiric, broad spectrum antibiotics → increased side effects and increased antimicrobial resistance
- Rapid diagnostic technology for bloodstream infections is an area of growing interest in infectious diseases
- Multiplex polymerase chain reaction (PCR) is a newer technology that take a much shorter time to analyze positive blood cultures (~60 minutes)
- PCR technology will not report susceptibilities → detects resistance genes instead
- Some providers trust traditional culture and susceptibility methods over PCR technology, thus delaying targeted therapy

OBJECTIVE

- To evaluate the accuracy of a multiplex PCR for species identification plus genetic resistance markers in comparison to the current gold standard for culture/susceptibility testing (Vitek II©)
- To identify the rate of mismatched results among *Staphylococcus* species

METHODS

- Approved by the Investigational Review Board
- Retrospective study evaluating positive blood cultures from 5/1/18 to 4/30/19
- Blood culture samples had to be run through both the PCR and Vitek II©
- Results from both machines were collected and then compared
- Any isolates that were not a match were labeled a mismatch
- Patients with multiple blood cultures drawn in the same admission were included
- Patients with multiple admissions during the study period were included

RESULTS

- Total of 913 blood culture samples were collected with 481 being *Staphylococcus species*
- Focused on the presence or absence of methicillin resistance

Table 1: Number of *Staphylococcus* species analyzed

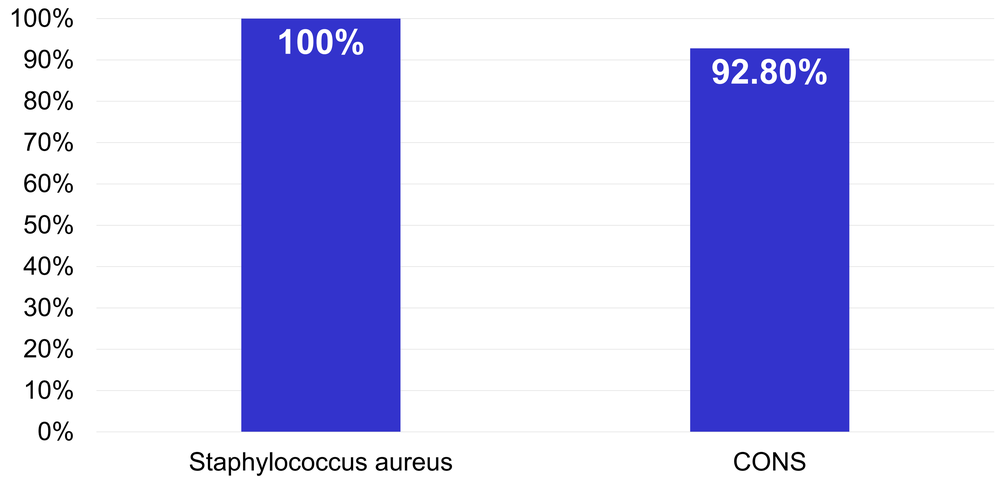
Pathogen	# isolates detected
Staphylococcus aureus	120
Coagulase Negative Staphylococcus (CONS)	361*

***3 isolates were not initially detected by PCR**

Table 2: Analysis of *Staphylococcus aureus* and CONS resistance

***Staphylococcus aureus* results**			
# isolates without mecA detected by PCR	# isolates detected by Vitek II© susceptible to oxacillin	# isolates with mecA detected by PCR	# isolates detected by Vitek II© resistant to oxacillin
58 (48.4%)	**58 (48.4%)**	**62 (51.6%)**	**62 (51.6%)**
Coagulase Negative *Staphylococcus* (CONS) results			
# isolates without mecA detected by PCR	# isolates detected by Vitek II© susceptible to oxacillin	# isolates with mecA detected by PCR	# isolates detected by Vitek II© resistant to oxacillin
152 (42.1%)	**136 (37.7%)**	**209 (57.9%)**	**199 (62.3%)**

Figure 1: Percent of isolates correctly analyzed by PCR



RESULTS

Table 3: Percent of isolates that were mismatched between PCR and Vitek II©

Pathogen	% mismatched
Staphylococcus aureus	0%
CONS	7.2%

Table 4: Summary of mismatch reasons between PCR and Vitek II© for CONS species

Reasons for mismatches for CONS	# isolates
mecA detected, but susceptible to oxacillin	10
Resistant to oxacillin, but mecA not detected	10
Multiple organisms detected	6
Total	26

CONCLUSION

- Rapid diagnostic technology can detect resistant *Staphylococcus* species in blood cultures at a similar rate to standard susceptibility testing
- Rates of accuracy for *S. aureus* isolates were 100% between PCR and Vitek II© and 92.8% for coagulase negative *Staphylococcus* species
- It would be safe to de-escalate antibiotics when treating *Staphylococcus aureus* bloodstream infections with PCR results alone due to 100% accuracy

DISCLOSURES

The authors have nothing to disclose.

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- Patients with multiple blood cultures drawn in the same admission were included
- Patients with multiple admissions during the study period were included

RESULTS

- Total of 913 blood culture samples were collected during study period
- PCR was able to accurately identify almost all isolates correctly, except for CONS and Enterobacteriaceae species

Figure 1: Percent of isolates correctly identified by PCR

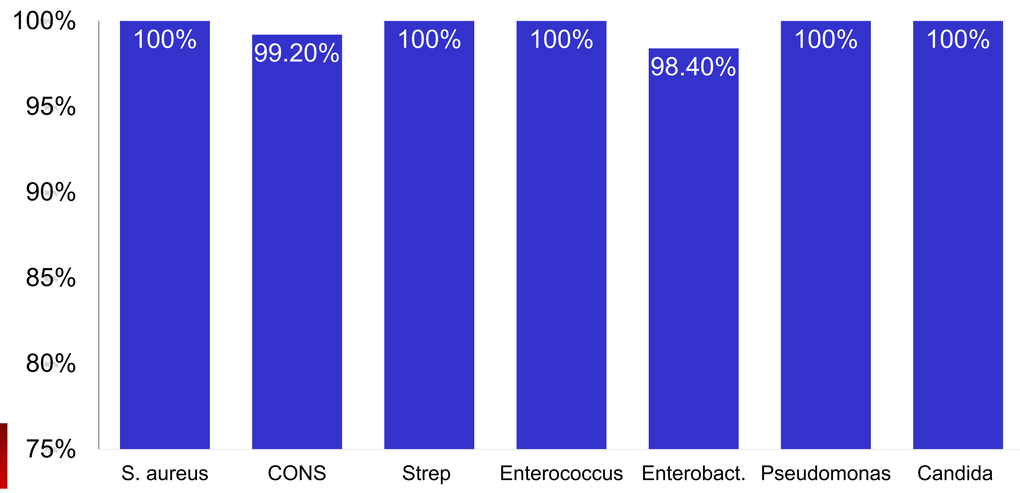

Table 1: Analysis of *S. aureus*, CONS and *Enterococcus species* resistance

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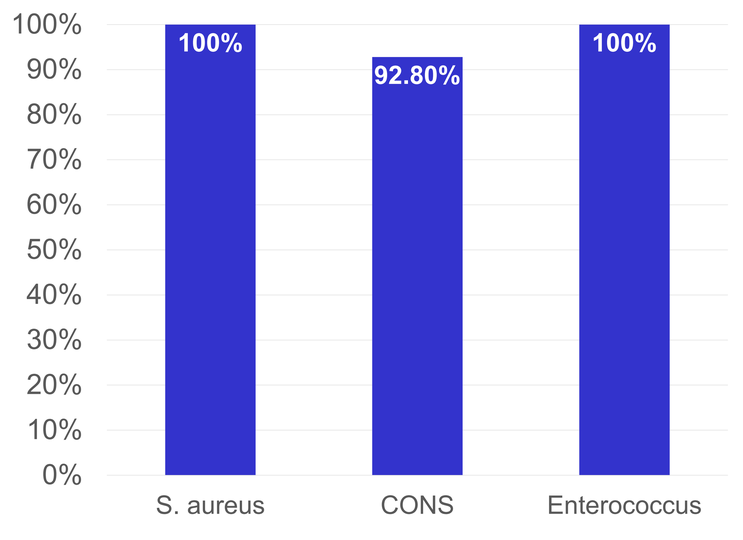
***Enterococcus species* results**			
# isolates without VanA/B detected by PCR	# isolates detected by Vitek II© susceptible to vanc	# isolates with VanA/B detected by PCR	# isolates detected by Vitek II© resistant to vanc
31/37 (83.8%)	**31/37 (83.8%)**	**6/37 (16.2%)**	**6/37(16.2%)**

RESULTS

Figure 2: Percent of "pathogen resistance" correctly identified by PCR



CONCLUSION

- Rapid diagnostic technology can accurately identify a wide variety of pathogens
- Rates of resistance accuracy for *S. aureus* isolates were 100% between PCR and Vitek II© and 92.8% for coagulase negative *Staphylococcus* species
- Rates of resistance accuracy for Enterococcus isolates (both faecalis and faecium) were 100% between PCR and Vitek II©
- It would be safe to de-escalate antibiotics when treating *Staphylococcus aureus* and *Enterococcus sp.* bloodstream infections with PCR results alone due to 100% accuracy

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