**Evaluation Study on Antimicrobial Neutralization with Automated Blood Culture Systems at Sunway Medical Centre**

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**ABSTRACT**

This study compared the BioMerieux BacT/ALERT® blood culture (BC) system with Becton Dickinson BACTEC 9120 BC system for recovery and time to detection (TTD) of common isolates from Sunway Medical Centre (SunMed) in the presence of antimicrobial drugs in culture media. A total of 108 bottles were included in the study, which was carried out for a duration of two months from September 2013 to November 2013. 54 bottles were incubated at each BC system. In addition to that, a total of 108 bottles without adding antimicrobial drugs were also tested as controls. The results demonstrated that noIsolates detected for Staphylococcus aureus (SA) and Methicillin-resistant Staphylococcus aureus (MRSA) with presence of Vancomycin for both systems. A substantial difference was noted between BacT/ALERT® and BACTEC for recovery of seeded bacteria, Gram-Negative Bacilli (GNB) is most recovered bacteria by both the systems as compared to Gram-Positive Cocci (GPC). Further more, the mean TTD of seeded bacteria with antimicrobial presence was substantially less with BacT/ALERT® as compare to BACTEC.

**BACKGROUND**

Excellent Quality Management practice as set by the local requirement standard; MS ISO 15189 requires evaluation of new method prior to introducing it in the existing system. Therefore, to compile with the standards, we had done an evaluation study on current BC system i.e. BACTEC with the new BC system from BioMerieux i.e. BacT/ALERT®. BACTEC system uses fluorescent method to detect bacteria growth in the BC bottle whereas BacT/ALERT® uses colorimetric method.

**OBJECTIVE**

This study compared the ability of BacT/ALERT® Plus BC media and BACTEC Plus® media to neutralize antimicrobial drugs such as Cefuroxime (ICX), Piperacillin-tazobactam (TZP) and Vancomycin (Va). The microorganism used in this challenge are Escherichia coli, Staphylococcus aureus, Pseudomonas aeruginosa and MRSA. The selection of the antimicrobial and bacteria were based on common usage of the antimicrobial drugs and bacteria isolates at SunMed.

**MATERIALS AND METHOD**

**AI Study overview**

This is a comparative evaluation study of BacT/ALERT® Plus media and BACTEC Plus media and their ability to remove various antimicrobial drug from BC specimens (antimicrobial neutralization activity). The selected bacteria will be seeded in donor’s whole blood that is less than 5 days old which is kept at 37°C for 24 hours to form 5 cycles and the 6th cycle is the experiment to study on less blood volume usage in blood culture bottle.

Test bottles were inoculated in triplicate for all cycles. Once BC bottle are inoculated with bacterium and antimicrobial suspension, they will be placed immediately in their respective instruments to prevent delayed vial entry effects that may exist for either systems (Refer Flow Chart 1).

**PREPARATION ON ANTIMICROBIAL PEAK CONCENTRATION**

1. Antimicrobial used for testing: Cefuroxime (ICX), Piperacillin-tazobactam (TZP) and Vancomycin (Va).
2. Antimicrobial solution will be prepared from commercial drug powder.
3. Each antibiotic will be tested at peak concentration only as shown table below:

<table>
<thead>
<tr>
<th>No</th>
<th>Antibiotic(s)</th>
<th>Commercial Brand</th>
<th>Concentration</th>
<th>Peak Concentration tested</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Cefuroxime</td>
<td>Zinacef</td>
<td>750mg/ml</td>
<td>150mg/ml</td>
</tr>
<tr>
<td>2</td>
<td>Piperacillin  Tazobactam</td>
<td>Tazocin (TZP)</td>
<td>45g/20ml</td>
<td>500g/20ml</td>
</tr>
<tr>
<td>3</td>
<td>Vancomycin</td>
<td>Vancozin</td>
<td>150mg/ml</td>
<td>750mg/ml</td>
</tr>
</tbody>
</table>

**PREPARATION ON BACTERIA SUSPENSION**

1. Overnight growth for selected bacteria on the appropriate plated culture media.
2. Perform serial dilution to obtain 10 – 100 colony units per (CFU) inoculum range with the turbidity at 1.0 McFarland.
3. To get desired peak concentration, 0.15 μl final dilution added to each BC bottle.

**RESULTS**

The results demonstrated that no isolates detected for Staphylococcus aureus (SA) and Methicillin-resistant Staphylococcus aureus (MRSA) with presence of Vancomycin for both systems. Overall TTD for control bottle is shown in **Table 1** where there was no growth detected for Pseudomonas aeruginosa for both system.

Overall mean TTD for tested seeded bacteria shown in **Table 2**. For individual mean TTD results for each cycle shown at **Graph 1** to **Graph 5**. The mean of TTD of seeded bacteria with antimicrobial was substantially less with BacT/ALERT® then BACTEC system. TTD with less blood volume shown in **Graph 6**.

**DISCUSSION AND LIMITATION**

The efficiency of the neutralization and absorption of antimicrobial agents by these substances is uncertain on final peak concentration prepared; inconsistency of vial vacuum pressure on each of the bottles; limitation on apparatus i.e. large and inaccurate scale on syringe and dilution tube; restriction. Limitation on apparatus i.e. large and inaccurate scale on syringe and dilution tube; non-sterele conical tube for dilution; variances in viability of bacteria suspension after preparation; uncertain on final peak concentration prepared; inconsistency of vial vacuum pressure on each vials will effect on the analysis finding need to be considered.

**CONCLUSIONS**

The overall detection rate in BacT/ALERT® Plus bottles is substantially had a higher detection rate than Bactec Plus bottles (96% and 67% respectively) which indicative of better antimicrobial neutralization in BacT/ALERT® Plus bottle.