Reducing blood culture contamination by an educational intervention

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INTRODUCTION.

• Blood culture represents a critical tool and a positive blood culture prior to antibiotic initiation can suggest a definitive diagnosis.

• It is the “standard of care” in sepsis management.

• False-positive results often lead to diagnostic uncertainty in clinical management and are associated with increased health care costs due to unnecessary treatment and testing.
Blood Culture Collection

Receipt in Laboratory

Loading on Blood Culture Machine

Blood Culture Flags Positive

Removal and Initial Work

Identification and Sensitivities

Reporting of Results

Transport Time to Laboratory (TT)

Time from Receipt to Loading

Time to Detection (TTD)

Time from Flagging Positive to Removal

Time from Removal to Results of Gram Stain, Identification and Sensitivities

Time from Results Availability to Reporting Results

Time from Collection to Loading

Time from Placement to Detection

Time from Flagging Positive to Identification and Susceptibility Results

Time to Reporting

Time to Positivity (TTP)

Laboratory Turnaround Time (LTAT)

Turnaround Time (TAT)

Key:
- Time Variable – Opportunity to Improve
- Time Variable – NO Opportunity to Improve
Symptoms Start

Patient seeks medical advice, treatment initiated

Patient dependent time variable. No opportunity to improve.

Therapeutic Window

Time

Inappropriate Treatment

Appropriate Treatment

Patient Dies

Delayed Blood Culture Result

Wrong report

Rapid Blood Culture Result

Right pathogen reported

Patient Survives

Critical Time

Therapeutic Window

Rapid Blood Culture Result

Critical Time

Patient Dies

Appropriate Treatment

Inappropriate Treatment

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Critical Time

Patient Survives

Rapid Blood Culture Result

Right pathogen reported
Objectives

1. To identify the *rate of contamination* of blood culture for each clinical area.

2. To know the *type of microorganism* commonly isolated as contaminants.

3. To review the same *(1 & 2)* post educational intervention.
Methodology

This Prospective – Observational Outcome audit was conducted after obtaining IHEC approval.
Methodology

1. **Standard of care** - Blood culture contamination rate should be $\leq 3\%$ of all blood cultures done.

2. **Prepare an audit plan** - Data collection tool

3. **Audit**: Three Months. (August to October-2015) - 2582 blood cultures studied

4. **Educational Intervention** – (April – 2016) – *onsite orientation program* for nurses & phlebotomists on proper sample collection for blood culture.

5. **Re-audit / Post Audit** - Three months (May to July-2016) – 3818 blood cultures studied
Methodology

(1) 5 – 10 ml blood

(2) Added to 50 – 100 ml fluid medium (broth)

(3) Subculture on Solid medium

(4) Bacterial Growth
## MONTHWISE DISTRIBUTION OF BLOOD CULTURE +ves & CONTAMINANTS.

<table>
<thead>
<tr>
<th>MONTH</th>
<th>NO OF BLOOD CULTURES</th>
<th>CULTURE POSITIVE (%)</th>
<th>NO OF CONTAMINANTS (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AUGUST-15</td>
<td>799</td>
<td>119 (14.89)</td>
<td>103 (13.01)</td>
</tr>
<tr>
<td>SEPTEMBER-15</td>
<td>851</td>
<td>139 (16.31)</td>
<td>123 (14.45)</td>
</tr>
<tr>
<td>OCTOBER -15</td>
<td>932</td>
<td>187 (19.97)</td>
<td>149 (15.98)</td>
</tr>
<tr>
<td>TOTAL</td>
<td>2582</td>
<td>445 (17.23)</td>
<td>375 (14.52)</td>
</tr>
</tbody>
</table>
## Area wise Isolation of blood culture contaminants

<table>
<thead>
<tr>
<th>Various clinical areas</th>
<th>No Of Contaminants Isolated (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICUs</td>
<td>117 (11.1)</td>
</tr>
<tr>
<td>GENERAL WARDs</td>
<td>100 (18.9)</td>
</tr>
<tr>
<td>EMD</td>
<td>46 (31.72)</td>
</tr>
<tr>
<td>OPD / Central collection</td>
<td>52 (32.71)</td>
</tr>
<tr>
<td>OTHER WARDs</td>
<td>60 (8.63)</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>375 (14.52)</strong></td>
</tr>
</tbody>
</table>
Various contaminants isolated

Skin flora predominates

- Diphtheroids: 8%
- MSCONS: 30%
- Streptococcal species: 5%
- ASB: 57%
Educational intervention –
Staff nurses & Phlebotomists
Month-wise distribution of blood culture positives & contaminants

<table>
<thead>
<tr>
<th>Month</th>
<th>No of blood cultures</th>
<th>Culture positive</th>
<th>No of contaminants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aug-15</td>
<td>799</td>
<td>119</td>
<td>103</td>
</tr>
<tr>
<td>Sep-15</td>
<td>851</td>
<td>139</td>
<td>123</td>
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<td>932</td>
<td>187</td>
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</tr>
<tr>
<td>Total</td>
<td>2582</td>
<td>445</td>
<td>375</td>
</tr>
<tr>
<td>May-16</td>
<td>1257</td>
<td>230</td>
<td>60</td>
</tr>
<tr>
<td>Jun-16</td>
<td>1270</td>
<td>269</td>
<td>98</td>
</tr>
<tr>
<td>Jul-16</td>
<td>1291</td>
<td>257</td>
<td>104</td>
</tr>
<tr>
<td>Total</td>
<td>3818</td>
<td>756</td>
<td>262</td>
</tr>
</tbody>
</table>

Educational intervention
Month-wise blood culture contamination rates

Educational intervention
### Pre vs Post
Area-wise blood culture contaminants (%)

<table>
<thead>
<tr>
<th>Various clinical areas</th>
<th>No Of Contaminants Isolated (%)</th>
<th>PRE AUDIT</th>
<th>POST AUDIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICUs</td>
<td>117 (11.1)</td>
<td></td>
<td>40 (3.47)</td>
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<tr>
<td>GENERAL WARDs</td>
<td>100 (18.9)</td>
<td></td>
<td>58 (5.93)</td>
</tr>
<tr>
<td>EMD</td>
<td>46 (31.72)</td>
<td></td>
<td>69 (13.42)</td>
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<tr>
<td>OPD / Central collection</td>
<td>52 (32.71)</td>
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<td>20 (5.98)</td>
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<tr>
<td>OTHER WARDs</td>
<td>60 (8.63)</td>
<td></td>
<td>75 (8.91)</td>
</tr>
<tr>
<td>TOTAL</td>
<td>375 (14.52)</td>
<td></td>
<td>262 (6.8)</td>
</tr>
</tbody>
</table>

53% reduction in the contamination rates post intervention
Statistically significant - 0.001
Conclusion

• **Contaminations may outgrow** the pathogens and may delay appropriate management & increases cost.

• **Education intervention** was found to reduce blood culture contamination significantly (53%).

• With **higher staff attrition** – Frequent training is required to further reduce contamination and sustain the change demonstrated.
Recommendations

1. To emphasize **proper pre sampling skin preparation** and decontamination of the blood culture bottle tops. (*posters displayed at all clinical areas*)

2. At **induction and periodic hands-on training** to improve aseptic sample collection technique for blood culture.

3. Sample collection only by **trained phlebotomists** (?!!?!).  

4. To provide monthly **feedbacks** on the contamination rates to the wards / units / Dept.