Effectiveness of Sterile vs. Clean Technique on Blood Culture Contamination Rates: A Quantitative Systematic Review

Primary Reviewer: Mathilde Kubic, MSN, RN, AG-CNS, CCRN  mkubic@wakemed.org  Secondary Reviewer: Diane Hawley, PhD, RN, ACNS-BC, CCNS, CNE

Purpose
Determine effectiveness of sterile vs. clean technique for obtaining venipuncture blood cultures on contamination rates in acute care patients.

Background & Significance
- Lack of “Gold Standard”
- 3x greater risk of contamination with pre-existing catheters vs. venipuncture
- National benchmark ≤ 3% contamination rate
- Delays in accurate treatment
- Antimicrobial stewardship
- Increases LOS by about 5 days
- Avg. $3,000-$8,000 per contamination

Inclusion Criteria
- Acute care patients — any age, gender, diagnosis, requiring blood culture
- Venipuncture collection only
- Clean vs. sterile technique
- Randomized controlled trials, quasi-experimental, prospective, retrospective cohort studies & case control
- 137 studies identified, 32 abstracts screened, 4 full text eligible studies

Conclusions
- Sterile technique is superior to clean technique in obtaining venipuncture blood cultures
- Clinical variations exist
  > Settings, study design, clean & sterile interventions
- Clinical Significance: Contamination rates impact
  > Diagnosing bacteremia or sepsis
  > LOS, patient outcomes, costs
  > Patient satisfaction

Limitations
- Gloving adherence
  > Only reported in 1 study
- Defining contaminants
  > Eliminated "possible" contaminants
- Presumptions of techniques
  > Defining clean & sterile methods
- Alternative collection methods

Results
Using sterile technique results in almost a 2x decrease in the likelihood to contaminate the blood culture during venipuncture collection.
Statistically significant

Blood Culture Contamination Rates

<table>
<thead>
<tr>
<th>Study</th>
<th>DerSimonian &amp; Laird Relative Risk (Risk ... Weight (CI 95% Random)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self WH, et al (Hospital B) (2014)</td>
<td>10.00% 0.36 (0.21,0.62)</td>
</tr>
<tr>
<td>Self WH, et al (Hospital A) (2014)</td>
<td>29.87% 0.56 (0.45,0.70)</td>
</tr>
<tr>
<td>Self WH, et al (2013)</td>
<td>30.65% 0.39 (0.31,0.83)</td>
</tr>
<tr>
<td>Kim N-H, Kim M, Lee S, Yu NR, Kim K-H...</td>
<td>11.38% 0.51 (0.31,0.83)</td>
</tr>
<tr>
<td>Hall et al (2013)</td>
<td>18.09% 0.41 (0.29,0.59)</td>
</tr>
<tr>
<td>Overall</td>
<td>1.0</td>
</tr>
<tr>
<td>Favours Treatment 0.0</td>
<td>10.0 Favours Control</td>
</tr>
</tbody>
</table>

Overall
- Overall Z=8.35, P<0.0001

Heterogeneity Chi squared=6.86, P=0.1