Central Line Bundles
&
Vantex Antimicrobial Catheter
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Introduction: Central Line Bundles

Challenges in Vascular Access
It is estimated that at least five million central venous catheters (CVCs) are inserted on an annual basis in the United States.\textsuperscript{1} The use of CVCs is linked with central line associated blood stream infections (CLABSIs), which are one of the most dangerous and costly nosocomial infections. In this context, CLABSIs are also referred to as catheter related blood stream infections (CRBSIs). CLABSIs are estimated to occur in 3 to 7\% of venous catheter placements and may cost as much as $45,000 per occurrence.\textsuperscript{1,2} These estimates stress the importance of limiting CVC related infections through comprehensive prevention strategies.

Medline Central Line Bundle
Many CLABSIs are thought to occur during central line insertion and maintenance, when central line components are at high risk of bacterial contamination. At the frontier of infection prevention strategies are bundles and kits that simplify and standardize care. Bundles and kits promote aseptic technique through many facets, including the use of appropriate barrier precautions, skin antiseptics, and step-by-step checklists; they are clinically proven to reduce infections associated with central line insertion and maintenance.\textsuperscript{3-8}

Clinical Evidence
This is a summary of clinical evidence supporting the use of central line bundles and kits. The following data are from clinical studies published in medical journals.
A multicenter, phased, cluster-randomized controlled trial to reduce central line-associated bloodstream infections in intensive care units


**Intervention**

The intervention group underwent a phased implementation of a comprehensive infection prevention bundle:

1. Hand washing prior to line placement
2. Use of appropriate barrier precautions
3. Avoiding unnecessary line placements at the femoral site
4. Use of chlorhexidine skin antiseptic prior to line placement and maintenance

**Methods**

A multi-center, randomized, controlled study where 45 ICUs from 35 different hospitals were randomized into two groups. One group implemented the infection prevention bundle and one group did not.

**Results**

<table>
<thead>
<tr>
<th></th>
<th>Pre-Intervention CLABSI rate (CLABSI/1000 line days)</th>
<th>Post-Intervention CLABSI rate (CLABSI/1000 line days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bundle Group</td>
<td>4.48</td>
<td>1.33</td>
</tr>
<tr>
<td>Control Group</td>
<td>2.71</td>
<td>2.16</td>
</tr>
</tbody>
</table>

- CLABSI rate was significantly reduced in the bundle group compared to control
  - \( P = 0.003 \)
- Both groups were eventually transitioned to using the bundle. At 19 months post-bundle, both groups sustained CLABSI rates lower than 1.0 per 1000 line days

**Conclusion**

The use of a CLABSI prevention bundle significantly reduced CLABSI rates compared to the group that did not use the bundle. Bundles that emphasize the aspects above may provide clinical benefits to patients.
3 MEDLINE | CENTRAL LINE BUNDLE
An Intervention to Decrease Catheter-Related Bloodstream Infections in the ICU


Intervention
The intervention was a multi-faceted bundle, composed of the following elements:

1. Use of appropriate sterile barrier precautions
2. Emphasis on proper hand hygiene prior to procedures
3. Use of chlorhexidine skin antiseptic prior to line placement
4. Avoiding unnecessary line placements at the femoral site
5. Education on CLABSIs and infection control practices

Methods
A multi-center, quality improvement project where 103 Intensive Care Units in Michigan implemented a CLABSI prevention bundle. The overall CLABSI rates were recorded and studied; a total of 375,757 catheter-days were included in the final analysis.

Results

<table>
<thead>
<tr>
<th>7.7*</th>
<th>CLABSI rate prior to bundle implementation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.4*</td>
<td>CLABSI rate 16 months after bundle implementation</td>
</tr>
</tbody>
</table>

*CLABSI rate presented as the number of CLABSIs per 1000 central line days

CLABSI rate was significantly reduced after bundle implementation

P < 0.002

Conclusion
This study demonstrates that using a bundle of CLABSI prevention interventions may significantly reduce CLABSI rates over time. Bundles that emphasize the aspects above may provide clinical benefits to patients.


**Intervention**
The intervention was a multi-faceted bundle, composed of the following elements:

1. Use of appropriate sterile barrier precautions
2. Use of chlorhexidine skin antiseptic prior to line placement
3. Avoiding unnecessary line placements at the femoral site
4. Standardizing the composition of all central line kits
5. Education on CLABSIs and appropriate dressing change practices

**Methods**
A multi-center, quality improvement project where 32 hospitals implemented a CLABSI prevention bundle in their intensive care units. The overall CLABSI rates were recorded and studied for four years post-bundle intervention and compared to pre-bundle rates.

**Results**

<table>
<thead>
<tr>
<th></th>
<th>CLABSI rate prior to bundle implementation</th>
<th>CLABSI rate after bundle implementation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4.31*</td>
<td>1.36*</td>
</tr>
</tbody>
</table>

*CLABSI rate presented as the number of CLABSIs per 1000 central line days

- CLABSI rate was significantly reduced after bundle implementation
  - \( P < 0.001 \)

**Conclusion**
This study published by the CDC demonstrates that the use of a CLABSI prevention bundle may reduce CLABSI rates. Bundles that emphasize the aspects above may provide clinical benefits to patients.
**Improving central line maintenance to reduce central line-associated bloodstream infections**


**Intervention**
The intervention was a central line maintenance kit, which included supplies laid out to promote ease of use and best practice. Some components of the kit were:

1. Hand sanitizer
2. Sterile barriers, including exam gloves and mask
3. Chlorhexidine skin antiseptic
4. Antimicrobial dressing and cap
5. Instructions and best practice checklist

**Methods**
A 29-month, prospective, observational study where a tertiary hospital implemented the use of central line maintenance kits for all line maintenance procedures. CLABSI rates before and after kit implementation were recorded and compared.

**Results**

<table>
<thead>
<tr>
<th></th>
<th>CLABSI rate prior to kit implementation</th>
<th>CLABSI rate after kit implementation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2.21*</td>
<td>0.0*</td>
</tr>
</tbody>
</table>

*CLABSI rate presented as the number of CLABSIs per 1000 patient line days, sample size: 4,570 line days

- CLABSI rate was significantly reduced after kit implementation
  - \( P = 0.0005 \)

**Conclusion**
The use of a central line maintenance kit significantly reduced CLABSI rates compared to the pre-intervention period. Standardized kits that promote best practice may provide clinical benefits to patients.
Prevention of Catheter-Related Blood Stream Infection: Back to Basics?


**Intervention**

Standard Polyurethane CVC and Chlorhexidine coated CVC. Both groups used of a multi-faceted infection prevention bundle, composed of the following elements:

1. Focus on hand hygiene and antisepsis
2. Use of maximum sterile barrier precautions
3. Use of a dedicated CVC cart
4. Chlorhexidine skin antiseptic
5. Line placement instructions and best practice checklist

**Methods**

A prospective trial where a surgical ICU implemented use of a chlorhexidine coated CVC. The CLABSI rates of the intervention group were compared to pre-intervention, where standard polyurethane CVCs were utilized. The baseline CLABSI rate was already low due to use of a CLABSI prevention bundle. The author’s sought to determine if the antimicrobial CVC provided benefits beyond those attributed to the prevention bundle.

**Results**

- **0.80*** · CLABSI rate with bundle, but without chlorhexidine CVC
- **0.70*** · CLABSI rate with the bundle and chlorhexidine CVC

*CLABSI rate presented as the number of CLABSIs per 1000 patient line days, sample size: 4,570 line days

- CLABSI rate was not significantly changed by the antimicrobial CVC
  - P > 0.05

**Conclusion**

A bundle of infection prevention interventions may be more effective than an antimicrobial CVC. This is especially true in cases where CLABSI rate is already low. Use of a comprehensive infection bundle should be prioritized over use of antimicrobial catheters.
Introduction: Vantex Antimicrobial Catheter

Beyond the Bundle
Bundles and kits that standardize care and promote best practice are the first step in reducing infection risk. When these interventions do not reduce CLABSIs to goal levels, or when a dramatic reduction is desired, healthcare institutions may turn to CVCs that are coated with antimicrobials such as antibiotics, certain metals, or other antiseptics. Clinical evidence suggests that antimicrobial catheters may reduce CLABSI rates.9-13

The Vantex Solution
The Medline Vantex CVC is an infection prevention strategy that does not rely on traditional antibiotics. The catheter utilizes a polymeric silver, carbon, and platinum alloy to prevent colonization of microorganisms through the release of natural silver ions (Ag\(^+\)).

Vantex technology uses the natural thermodynamic properties of silver and platinum to facilitate the release of silver ions. The addition of carbon to the polymer creates long-lasting antimicrobial effects by permitting slow and consistent silver dispersal. Silver in its ionic form is a proven bactericidal and fungicidal element that has been in medical use for decades.14

Multidrug-Resistant Organisms
Ionic silver is experimentally proven to fight off resistant bacteria such as methicillin resistant Staphylococcus aureus, methicillin resistant Staphylococcus epidermis, multidrug-resistant Pseudomonas species, and Escherichia. coli.15-17 Multi-drug resistant organisms plague healthcare systems and are estimated by the Center for Disease Control and Prevention to cost as much as 3.5 billion dollars annually to treat.18 Silver ions have the potential to eliminate these organisms prophylactically, reducing bacterial proliferation before an infection occurs.

Clinical Evidence
This is a summary of clinical evidence supporting the use of Vantex central venous catheters. The following data are from clinical studies published in medical journals.
A prospective, randomized study in critically ill patients using the Oligon Vantex catheter


Intervention
Standard Polyurethane CVC & Vantex CVC

Methods
A prospective, randomized, controlled study where 206 patients in the ICU received one of the two catheters, each catheter remained in place for at least four full days.

Results

Central Line-Associated Blood Stream Infection Rate

<table>
<thead>
<tr>
<th>CVC Type</th>
<th>Polyurethane</th>
<th>Vantex</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard Polyurethane</td>
<td>4%</td>
<td>1%</td>
</tr>
<tr>
<td>Vantex CVC</td>
<td>3%</td>
<td>0%</td>
</tr>
<tr>
<td>CLABSI Rate</td>
<td>8%</td>
<td>10%</td>
</tr>
</tbody>
</table>

Catheter Colonization Rates
- Polyurethane CVC: colonized in 44% of cases
- Vantex CVC: colonized in 29% of cases
  - P = 0.04

CLABSI Rates
- Polyurethane CVC: CLABSI in 4% of cases
- Vantex CVC: CLABSI in 1% of cases
  - P < 0.001

Conclusion
Vantex CVCs were more effective at preventing bacterial colonization and CLABSI than polyurethane CVCs
Impact of central venous catheter type and methods on catheter-related colonization and bacteraemia


Intervention
Standard Polyurethane CVC & Vantex CVC

Methods
A prospective, randomized, multi-center, controlled study where 539 patients in the ICU received one of the two CVCs, totaling 3,355 catheter days.

Results

<table>
<thead>
<tr>
<th></th>
<th>CLABSI rate with VantexCVC</th>
<th>CLABSI rate with Polyurethane CVC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polyurethane CVC</td>
<td>0%</td>
<td>0.4%</td>
</tr>
<tr>
<td>Vantex CVC</td>
<td>0.4%</td>
<td>0%</td>
</tr>
</tbody>
</table>

Catheter Colonization Rates
- Polyurethane CVC: colonized in 24.4% of cases
- Vantex CVC: colonized in 24.5% of cases
  - P > 0.05

CLABSI Rates
- Polyurethane CVC: CLABSI in 0.4% of cases
- Vantex CVC: CLABSI in 0% of cases
  - P > 0.05

Conclusion
Vantex CVCs displayed similar colonization rates as polyurethane CVCs. There was no significant difference in CLABSI rates, though rates were exceptionally low for both groups.

It is possible that better adherence to best practice guidelines in both groups explains the low CLABSI rates; these results are consistent with those of other studies, where reduction of CLABSI rates was attributed to a CLABSI prevention bundle even though an antimicrobial catheter was utilized.7,19
A prospective, randomized trial of rifampicin-minocycline-coated and silver-platinum-carbon-impregnated central venous catheters


**Intervention**
Rifampicin-minocycline (RM) coated CVC & Vantex CVC

**Methods**
A prospective, randomized, single-center, controlled study where 780 patients in the ICU received one of the two CVCs, totaling 4,293 catheter days.

**Results**

<table>
<thead>
<tr>
<th>CVC Type</th>
<th>Catheter Colonization Rates</th>
<th>CLABSI Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>RM Coated</td>
<td>colonized in 8.9% of cases</td>
<td>1.4%</td>
</tr>
<tr>
<td>RM Coated</td>
<td>colonized in 14.6% of cases</td>
<td></td>
</tr>
<tr>
<td>Vantex</td>
<td>colonized in 17.7% of cases</td>
<td>1.7%</td>
</tr>
</tbody>
</table>

**Conclusion**
Patients with Vantex CVCs presented with similar CLABSI rates as those treated with rifampicin-minocycline coated CVCs. The RM group displayed a lower colonization rate than the Vantex group.
Impact of oligon central venous catheters on catheter colonization and catheter-related blood stream infection


**Intervention**
Benzalkonium coated CVC & Vantex CVC

**Methods**
A multi-center, prospective, randomized, controlled study where 545 patients in the medical or surgical units received one of the two CVCs

**Results**

<table>
<thead>
<tr>
<th>CVC Type</th>
<th>Colonization Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benzalkonium Coated</td>
<td>29.6%</td>
</tr>
<tr>
<td>Vantex Coated</td>
<td>18.6%</td>
</tr>
</tbody>
</table>

· $P = 0.003$

**CLABSI Rates**
- Benzalkonium CVC: CLABSI in 4.3% of cases
- Vantex CVC: CLABSI in 3.3% of cases
  - $P > 0.05$

**Conclusion**
Vantex CVCs were more effective at reducing bacterial colonization than Benzalkonium CVCs, but there was no significant difference in CLABSI rates between the two patient groups.
Three years experience in implementing HICPAC recommendations for the reduction of central venous catheter-related bloodstream infections


Intervention
CLABSI education program, Vantex CVC, central line insertion kit, and chlorhexidine skin prep

Methods
A quality improvement project, where CLABSI rates were followed as different infection prevention strategies were implemented over the course of four years. At baseline, a silver-chlorhexidine catheter was used with povidone-iodine skin antiseptic. The first intervention was CLABSI education, then Vantex catheters, then a central line insertion kit, and finally 2% chlorhexidine skin antiseptic used prior to line insertion. Each of these interventions built upon one another, except for the Vantex CVC which completely replaced the silver-chlorhexidine CVC.

Results

<table>
<thead>
<tr>
<th>Intervention</th>
<th>CLABSI/1000 Line Days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silver-Chlorhexide Coated CVC (12 months)</td>
<td>15</td>
</tr>
<tr>
<td>CLABSI Education (12 months)</td>
<td>6.4</td>
</tr>
<tr>
<td>Vantex CVC (9 months)</td>
<td>3.3</td>
</tr>
<tr>
<td>Sterile Insertion Kits (3 months)</td>
<td>4.2</td>
</tr>
<tr>
<td>CHG Antiseptic (15 months)</td>
<td>1.6</td>
</tr>
</tbody>
</table>

Conclusion
Vantex CVCs, among other interventions, were integral in the effort to reduce CLABSI rates in this institution.
References
