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Innovative Central Line Bundle Achieves Zero Rate of CRBSIs for 33 Months

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Central Line Bundle

Background

Catheter-related bloodstream infections (CRBSI) are common, costly, and potentially lethal. (Mermel 2000) According to the National Nosocomial Infections Surveillance (NNIS) system of the Centers for Disease control and prevention (CDC), the median rate of catheter-related bloodstream infection in ICUs of all types of catheters ranges from 1.8 to 5.2 per 1000 catheter days. The average cost of treating a CRBSI ranges from $25,000 to $45,000 per occurrence.(O'Grady 2002, NNIS2004) The major identified causes of CRBSI are bacterial contamination, migration of the catheter and catheter wall adhesion with subsequent biofilm development occurring during colonization of both the extraluminal catheter tract and intraluminal fluid pathway. (Ryder 2005) VAD selection, insertion site selection, surface disinfection (skin and septum), insertion technique, CVC care and maintenance, and connector design are critical to the prevention of bacterial contamination and colonization.

Purpose

Selection of a straightforward evidenced based set of practices (bundle) that, when performed collectively and reliably, will reduce CRBSI rate ensuring optimal outcomes for patients requiring central line access.

Methods

Bundle selection was based on available research, CDC and IHI recommendations, new product technology, the amount of change required by the bedside nurse, and product ease of use. To achieve success with limited personnel resources, a combination of behavioral practices and product technologies associated with lowering CRBSI that supported existing nursing practice were selected. The Centers for Disease Control definition for intravascular device-related bloodstream infection was used to identify CRBSI. Laboratory confirmed bloodstream infection must meet at least one of the criteria described in figure 1. Infection control data for CRBSI in the intensive care units for 2005 (baseline) was compared to the infection control data in the intensive care units for 2006, 2007 and first three quarters of 2008. PICC data acquired at the time of insertion (hospital wide) for 2005 (baseline) was compared to the PICC data acquired during 2006, 2007 and first three quarters of 2008.

Sample

All patients in the 16 bed Intensive Care Unit, and the 16 bed Trauma/Neuro Intensive Care Unit (total 32 beds) during the baseline year 2005 and the implementation period of 2006 continuing through the first three quarters of 2008 were used for CRBSI tracking. All patients (hospital wide) who had a PICC placement order were used for PICC data acquisition. Our facility is a 240 bed acute care, community based, not for profit hospital with a full scope of medicine, surgery, maternal child and specialty services. We do not have a Burn Unit. Average Daily Census of 188.

Discussion

Product design when combined with consistent practice positively impacts CRBSI rates. Achieving consistent behaviors depends on intense staff education. The preparation and educational support house wide was not only extensive, but weighed heavily on this developing and expanding inpatient PICC team. The commitment, passion and overall developing expertise of these PICC team members made this bundle and these practices an ongoing success story.

Limitations

1. Inability to correctly capture central line days in 2005 resulted in using the measure of incidence of CRBSI in lieu of incidence of CRBSI divided by central line days.
2. Lack of randomization or matched samples.
3. No data on co-morbidities.
4. Site specific settings in one geographic location.

Conclusion

When prevention practice activities and innovative products are combined, the synergist effect is greater than when the same strategies and/or products are used independently. The products and practices identified in this bundle enhance accepted behavior practices related to CVC care and maintenance. Taking full ownership of the PICC process from assessment, to insertion, to maintenance, and to catheter discontinuation, has promoted a high level of consistency in care delivery, increased insertion success rates, improved patient outcomes, decreased catheter-related complications, and improved continuity of care for our patients. Having a specialized high tech PICC team at SRMC achieved over 5000 PICC lines inserted with a Zero CRBSI rate. While some of the bundle components have not been widely researched, the early outcome of the bundle provides a basis for additional study and refinement.

Implications for Nursing

1. Further robust methodological studies need to be implemented to determine the significance of this bundle on CRBSI rates in order to affect evidence based practice.
2. Bundling improves practice adherence, consistency and data collection.
3. PICCs are a viable option for central venous access.
4. Specialized trained PICC team provides a high level of consistency in care delivery with an improved continuity of patient care.
5. Incorporating a specialized PICC team combined with products designed for extraluminal and intraluminal protection can eliminate CRBSI.

Team Members

- Sophie Harnage, RN, BSN Clinical Manager of Infusion Services
- Deborah Dix, RN, MS Director of Cancer Services
- Barbara Nelson RN, PHD Chief Nurse Executive
- Liz Metz Director of Materials Management
- Robert Berg MT(ASCP), MBA, CIC, Infection Control
- Randy Martin MD, Infectious Disease
- Holly Hamm, RN, CRNI Resource Nurse PICC Team
- Sutter Roseville Medical Center PICC Team

Center for Disease Control

CRBSI Definition

Figure 1

CODE: BSI-LCBI

DEFINITION: Laboratory-confirmed blood stream infection must meet at least one of the following criteria:

Criterion 1: Patient has a recognized pathogen cultured from one or more blood cultures AND organism cultured from blood is not related to an infection at another site.

Criterion 2: Patient has at least one of the following signs or symptoms: fever (>38 degrees C), chills, or hypotension and at least one for the following:

*Common skin contaminant (e.g., diphtheroids, Bacillus sp., Propionibacterium sp., coagulase-negative staphylococci, or micrococci) is cultured from two or more blood cultures drawn on separate occasions.

*Common skin contaminant (e.g., diptheroids, Bacillus sp., Propionibacterium sp., coagulase-negative staphylococci or micrococci) is cultured from at least one blood culture from a patient with an intravascular line, and the physician institutes appropriate antimicrobial therapy.

*Positive antigen test on blood (e.g., *Haemophilus influenzae, Streptococcus pheumoniae, Neisseria meningitides, or group B Streptococcus*)

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Practice 1: Full Barrier Precautions

Developed a custom full barrier kit for all central line insertions based on CDC guidelines.

Inserviced nursing staff and placed kit in all patient care areas.

Practice 2: Ultrasound Guided PICC placement for all PICC insertions

Basilic vein, upper arm vein of choice for lower site risk of CRBSI.

- •Increased success and decreased interventional radiology referrals
- •Increased patient satisfaction

Practice 3: Antimicrobial Interventions

Developed a central line dressing kit with all components included to protect both the extraluminal and intraluminal pathway.

- •Alcohol/chloroprep swabsticks for skin prep
- •Protective disk impregnated with chlorhexadine Gluconate to be placed around the catheter at the insertion site.
- •Statlock securement device to decrease catheter migration added by PICC nurse.
- •Sealing of all catheter edges with tegaderm dressing to prevent site contamination.

Practice 4: Neutral Connector System

Neutral Connector (In-Vision ® Plus) on all lumens of Central lines.

- •Supports successful septum disinfection.
- •Minimal priming volume and no dead space.
- •Saline flush only.

Practice 5: IV Connector Septum Disinfection

Disinfection of connector ports with 70% alcohol for 10-15 seconds with vigorous back and forth motion prior to each access based on CDC recommendations.

Practice 6: Flushing Protocol

Flushing CVCs is critical for removing intraluminal surface fibrin. This minimizes bacterial adherence and subsequent biofilm formation.

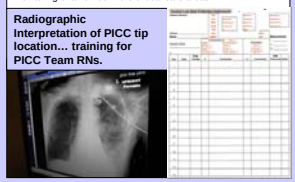
The Central Venous Flush policy was revised to include verifying patency by checking for blood return while flushing all CVCs with 10ml (20ml with blood draw) NS every 8 hours and PRN use (excluding ports and dialysis catheters).

Practice 7: Daily Monitoring of PICC Lines by PICC team

Continuous monitoring of practice decreases complications and increases compliance with the bundle.

Daily monitoring of all PICCs throughout the hospital. Daily monitoring of all CVCs in the critical care areas.

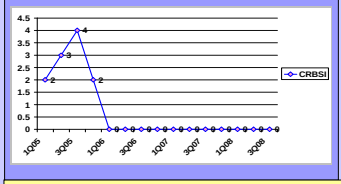
Radiographic Interpretation of PICC tip location... training for PICC Team RNs.



Overview of Results

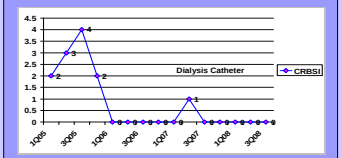
Central Line Descriptors	2005	2006	2007	1st, 2nd, and 3rd Qtr 2008
Average Monthly PICC Volume	60	131	189	220
PICC Volume	767	1570	2266	661
Insertion Success Rate	92%	98%	98%	98%
Interventional Radiology Rate	8%	2%	2%	2%
Insertion Location	Antecubital	Upper Arm, Basilic Vein (preferred)	Upper Arm, Basilic Vein (preferred)	Upper Arm, Basilic Vein (preferred)
Insertion Technique SonoSite® (iLook® 25)	Traditional/Modified Seldinger	100% Ultrasound Guided	100% Ultrasound Guided	100% Ultrasound Guided
Maximum Barrier	PICC team only	All central lines	All central lines	All central lines
Skin Preparation Chloroprep ®	Inconsistent	Consistent	Consistent	Consistent
Insertion Site Antimicrobial Biopatch ®	Inconsistent	Consistent	Consistent	Consistent
Line Stabilization Statlock ®	Inconsistent	Consistent	Consistent	Consistent
Connector InVision Plus ® Neutral ®	Positive Pressure Device	Neutral Device	Neutral Device	Neutral Device
RN Training	Annual In-Service Day	One-on-One Training at the bedside	One-on-One Training at the bedside	One-on-One Training at the bedside
Flushing Protocol	Normal Saline followed by Heparin (positive pressure flush)	Flush 10ml NS every 8 hours and PRN use (push/pause technique)	Flush 10ml NS every 8 hours and PRN use (push/pause technique)	Flush 10ml NS every 8 hours and PRN use (push/pause technique)
Dressing	24 hour pressure gauze dressing then weekly	No pressure dressing (exception excessive bleeding) Weekly dressing change	No pressure dressing (exception excessive bleeding) Weekly dressing change	No pressure dressing (exception excessive bleeding) Weekly dressing change
Line Monitoring	Completed q week with dressing change	Completed daily during site checks.	Completed daily during site checks.	Completed daily during site checks.

Incidence of CRBSI in PICC Lines January 2005 - September 2008

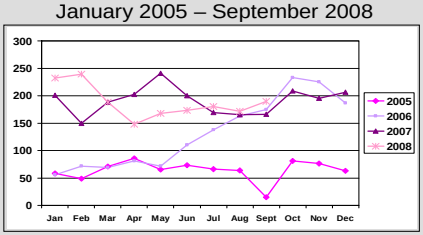
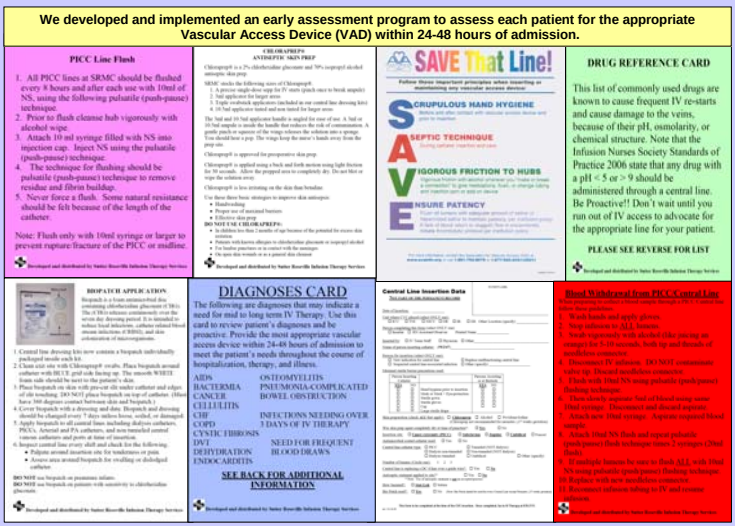


CRBSI indicated in graph below was inserted and maintained by contracted agency that did not follow Sutter Roseville Medical Center policies or bundle.

Incidence of CRBSI in all Central Lines January 2005 - September 2008



PICC line Insertions January 2005 – September 2008



We developed and implemented an early assessment program to assess each patient for the appropriate Vascular Access Device (VAD) within 24-48 hours of admission.