BRINGING THE PERIPHERY INTO FOCUS

RISKS ASSOCIATED WITH PERIPHERAL IVS

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OBJECTIVES

• Identify risks associated with Peripheral Intravenous (PIV) Catheters

• Discuss changes in standards and guidelines impacting practice

• Explore the evolving practices in PIV management and risk reduction
RIGHT TO THE POINT:
PIV SCOPE AND MAGNITUDE

- PIVs are most frequently used invasive device in hospitals
- Up to 70% of patients require a PIV during their hospital stay¹
- 330M IV catheters are sold in the US each year

NOTHING ROUTINE ABOUT IT: 
THE PATIENT EXPERIENCE

• **60%** of first attempts to insert are unsuccessful¹

• **27%** of patients endure 3 or more attempts¹,²

• **57%** of RNs report that they were not taught how to insert PIVs during nursing school³

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WHAT ABOUT INFECTION?

BSI related to PIV

- 0.2-0.7 per 1,000 device-days infection rate\(^1\)
- Population is so large that the number of patients potentially affected is actually quite significant
- This risk exists with or without extended dwell times\(^4\)

\(\checkmark\) Vascular Catheters are the single most common source of bacteremia and fungemia\(^2\)

\(\checkmark\) An estimated 5% to 25% of peripheral catheters were colonized with bacteria at the time of removal\(^3\)

\(\checkmark\) As many as 10,000 *Staphylococcus aureus* bacteremias from peripheral catheters annually in the United States\(^3\)

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3. Short Peripheral Intravenous Catheters and Infections. Lynn Hadaway MEd, RN, BC, CRNI® Journal of Infusion Nursing, August 2012 Vol 35:4
<table>
<thead>
<tr>
<th>Device</th>
<th>All studies</th>
<th>Studies requiring microbial concordance between catheter and blood cultures</th>
<th>Studies requiring microbial concordance and all devices cultured</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. of studies</td>
<td>IVD-related BSIs per 1000 IVD-days (95% CI)</td>
<td>No. of studies</td>
</tr>
<tr>
<td>Peripheral IV catheters</td>
<td>10</td>
<td>0.5 (0.2-0.7)</td>
<td>9</td>
</tr>
<tr>
<td>Midline catheters</td>
<td>3</td>
<td>0.2 (0.0-0.5)</td>
<td>2</td>
</tr>
<tr>
<td>Arterial catheters for hemodynamic monitoring</td>
<td>14</td>
<td>1.7 (1.2-2.3)</td>
<td>11</td>
</tr>
<tr>
<td>Peripherally inserted central catheters</td>
<td>15</td>
<td>1.0 (0.8-1.2)</td>
<td>5</td>
</tr>
<tr>
<td>Noncuffed central venous catheters</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nonmedicated</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nontunneled</td>
<td>79</td>
<td>2.7 (2.6-2.9)</td>
<td>63</td>
</tr>
<tr>
<td>Tunneled</td>
<td>9</td>
<td>1.7 (1.2-2.3)</td>
<td>7</td>
</tr>
<tr>
<td>Medicated</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chlorhexidine-silver-sulfadiazine</td>
<td>18</td>
<td>1.6 (1.3-2.0)</td>
<td>16</td>
</tr>
<tr>
<td>Minocycline-rifampin</td>
<td>3</td>
<td>1.2 (0.3-2.1)</td>
<td>3</td>
</tr>
<tr>
<td>Pulmonary artery catheters</td>
<td>13</td>
<td>3.7 (2.4-5.0)</td>
<td>11</td>
</tr>
<tr>
<td>Noncuffed, nontunneled hemodialysis catheters</td>
<td>16</td>
<td>4.8 (4.2-5.3)</td>
<td>11</td>
</tr>
</tbody>
</table>

*BSI = bloodstream infection; CI = confidence interval; IV = intravenous; IVD = intravascular device.
A Comparison of Bloodstream Infections in Central and Peripheral Venous Catheters

- Prospective study OUTSIDE of the ICU
  - 150 catheter-related infections (147 pts)
    - 77 PVC*-related (0.19 per 1,000 pt days)
    - 73 CVC-related (0.18 per 1,000 pt days)
- PVC related infections originated from lines placed in the ER 42% of the time
  - No CVCs were placed in ER
- Number of days to onset
  - Emergency Room: 3.7 days
  - Nursing units: 5.7 days

*PVC = Peripheral Venous Catheter
A Comparison of Bloodstream Infections in Central and Peripheral Venous Catheters

(continued)

- S. aureus more prevalent as pathogen in PVC vs. CVC (53% vs. 33%)
  - 5 MRSA+ cases noted in the PVC-BSI group
  - 5 MRSA+ cases noted in the CVC-BSI group

- Patients with S. aureus had more complications than from other organisms
  - Empyema, septic arthritis (including patients with prosthetic joints)
    - The risk of S. aureus seeding a prosthetic joint is estimated to be 34%
    - Significant not only for patients but for mandatory reporting now taking place in the United States

Pujol M et al., J Hosp Infect 2007;67:22-9
Peripheral Venous Catheter – Related Staphylococcus aureus Bacteremia

- 24 S. aureus bacteremias
- 12% of all device related S. aureus bacteremias were caused by PVCs
- Average treatment in this study was 19 days
- Some serious complications
  - 2 patient deaths and one transfer to hospice
  - 2 I&D of local site infections
  - Upper extremity DVT from PICC placed to treat PIV BSI
  - 10 events that would be reportable to CMS today
    - 8 MRSA bacteremias
    - 2 C. diff

APPRECIATION OF ROLE OF PIV IN HOSPITAL ONSET S. AUREUS BACTEREMIA – NEW EVIDENCE

- 122 episodes of primary SA HABSI:
  - 78 (64%) were CLABSIs
  - 38 MRSA+
  - 44 (36%) were non-CLABSI*
    - 19 MRSA+

- Complicated SA HABSI was significantly more common in the non-CLABSI group
  - (15.9% [n = 7] vs 0% [n = 0], P ≤ .001)

* (source: PIV or midline)

SYSTEMATIC REVIEW OF SHORT-TERM PERIPHERAL VENOUS CATHETER RELATED BSI; APPLYING THE BRAKES ON CLINICALLY-DRIVEN PRACTICE?

• PVCs accounted for a mean of 6.3% and 23% of nosocomial BSIs and nosocomial catheter-related BSIs

• Incidence of PVCR-BSIs was 0.18% among 85063 PVCs (range, 0–2.2%)

• Prolonged dwell time and catheter insertion under emergent conditions increased risk

• 2- to 64-fold greater risk of CR-BSI from a CVC than a PVC however there are an estimated 200 million adults/yr with PVCs placed
## Systematic Review of Short-Term Peripheral Venous Catheter Related BSI

<table>
<thead>
<tr>
<th>Study, First Author [Ref]</th>
<th>Staphylococcus aureus CR-BSIs due to PVCs</th>
<th>Staphylococcus aureus BSIs due to PVCs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mylotte [50]</td>
<td>50% of 28 CR-BSIs</td>
<td>18% of 79 BSIs</td>
</tr>
<tr>
<td>Thomas[^a] [51]</td>
<td>50% of 305 CR-BSIs</td>
<td></td>
</tr>
<tr>
<td>Kok [52]</td>
<td>41% of 75 CR-BSIs</td>
<td>25% of 123 BSIs</td>
</tr>
<tr>
<td>Bruno [55]</td>
<td></td>
<td>35% of 31 BSIs[^b]</td>
</tr>
<tr>
<td>Trinh [53]</td>
<td>12% of 196 CR-BSIs[^c]</td>
<td></td>
</tr>
<tr>
<td>Mestre [46]</td>
<td>64% of 14 CR-BSIs</td>
<td>28% of 32 BSIs</td>
</tr>
<tr>
<td>Stuart [56]</td>
<td></td>
<td>24% of 583 BSIs</td>
</tr>
<tr>
<td>Morris [54]</td>
<td>44% of 121 CR-BSIs</td>
<td>20% of 261 BSIs</td>
</tr>
<tr>
<td>Rhodes [57]</td>
<td>24% of 151 BSIs[^d]</td>
<td></td>
</tr>
<tr>
<td>Austin[^a] [49]</td>
<td>7.6% of 445 BSIs</td>
<td></td>
</tr>
</tbody>
</table>

Abbreviations: BSI, bloodstream infection; CR-BSI, catheter-related bloodstream infection; PVC, peripheral vascular catheter.
NEED MORE REASONS TO BE CONCERNED?

1. In 2008 the Center for Medicare and Medicaid Services (CMS) began its program of disallowing reimbursement for vascular catheter-associated infections. (Note: there is no modification for type or location of the catheter or the type – local or bloodstream [BSI] – of infection)

2. Vascular catheter-related infections would encompass all devices used to access the vasculature without regard to specific tip location or limiting only to BSIs.

3. Reporting standards are changing.

THE AFFORDABLE CARE ACT: VALUE BASED PURCHASING

As part of the Affordable Care Act, congress has authorized the inpatient Value Based Purchasing Program, which provides a data reporting infrastructure for hospitals to help ensure quality patient outcomes.

- Value Based Purchasing program is part of the Centers for Medicare & Medicaid Services (CMS)
- CMS efforts have been linked to the Medicare payment system to improve healthcare quality, which includes quality of care provided in the inpatient setting.

The Changing Healthcare Landscape

VALUE BASED PURCHASING TIMELINE\(^1,2\)

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Clinical Process of Care

Efficiency

Outcomes: mortality

Efficiency

Safety: CLABSI, CAUTI, SSI, MRSA, C. Dif

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DHHS HAI Action Plan \(^2\)

2020 Proposal

(From 2015 Baseline)

50% ↓ MRSA \(\textit{NHSN}\)

50% ↓ CLABSI

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Healthcare-associated infections (HAIs) are infections patients can get while receiving medical treatment in a healthcare facility. Working toward the elimination of HAIs is a CDC priority. The standardized infection ratio (SIR) is a summary statistic that can be used to track HAI prevention progress over time; lower SIRs are better. The infection data are reported to CDC’s National Healthcare Safety Network (NHSN). HAI data for nearly all U.S. hospitals are published on the Hospital Compare website. This report is based on 2014 data, published in 2016.

### CLABSI

**Central Line-Associated Bloodstream Infections**

- **50% Lower compared to nat’l baseline**
- U.S. hospitals reported a significant decrease in CLABSI between 2013 and 2014.
- Among the 2,442 hospitals in U.S. with enough data to calculate an SIR, 10% had an SIR significantly higher (worse) than 0.50, the value of the national SIR.

### CAUTI

**Catheter-Associated Urinary Tract Infections**

- **0% No change compared to nat’l baseline**
- U.S. hospitals reported a significant decrease in CAUTI between 2013 and 2014.
- Among the 2,880 U.S. hospitals with enough data to calculate an SIR, 12% had an SIR significantly higher (worse) than 1.00, the value of the national SIR.

### SSIs

**Surgical Site Infections**

- **SSI: Abdominal Hysterectomy**
  - **17% Lower compared to nat’l baseline**
  - U.S. hospitals reported no significant change in SSIs related to abdominal hysterectomy surgery between 2013 and 2014.
  - Among the 794 U.S. hospitals with enough data to calculate an SIR, 6% had an SIR significantly higher (worse) than 0.83, the value of the national SIR.

- **SSI: Colon Surgery**
  - **2% Lower compared to nat’l baseline**
  - U.S. hospitals reported a significant increase in SSIs related to colon surgery between 2013 and 2014.
  - Among the 2,051 U.S. hospitals with enough data to calculate an SIR, 8% had an SIR significantly higher (worse) than 0.98, the value of the national SIR.

### C. difficile Infections

**Laboratory-Identified Hospital-Onset C. difficile Infections**

- **8% Lower compared to nat’l baseline**
- U.S. hospitals reported a significant increase in C. difficile infections between 2013 and 2014.
- Among the 3,554 U.S. hospitals with enough data to calculate an SIR, 11% had an SIR significantly higher (worse) than 0.92, the value of the national SIR.

*Statistically significant*
Guidelines and Standards

**CDC 2011**

- “There is no need to replace peripheral catheters more frequently than every 72-96 hours to reduce risk of infection and phlebitis in adults [36, 140, 141]. Category 1B”

- “No recommendation is made regarding replacement of peripheral catheters in adults only when clinically indicated [142–144]. Unresolved issue”

**SHEA 2014**

- Peripheral artery catheters and peripheral venous catheters are not included in most surveillance systems, although they are associated with risk of bloodstream infection independent of CVCs

INS Standards of Practice 2016

- Consider monitoring bloodstream infection rates for peripheral catheters, or vascular catheter associated infections (peripheral) regularly

- Notify the LIP about signs and symptoms of suspected catheter related infection and discuss the need for obtaining cultures (e.g. drainage, blood culture) before removing a peripheral catheter
INS Standards of Practice 2016

- **Make no more than 2 attempts at short peripheral intravenous access per clinician, and limit total attempts to no more than 4**

- **Use a new pair of disposable, nonsterile gloves in conjunction with a “no-touch” technique for peripheral IV insertion, meaning that the insertion site is not palpated after skin antisepsis**

- **Consider increased attention to aseptic technique, including strict attention to skin antisepsis and the use of sterile gloves, when placing short peripheral catheters... contamination of nonsterile gloves is documented**
INS Standards of Practice 2016

• Use the venous site most likely to last the full length of the prescribed therapy

• Perform dressing changes on short peripheral catheters if the dressing becomes damp, loosened, and/or visibly soiled and at least every 5 to 7 days.

• Remove the short peripheral catheter if it is no longer included in the plan of care or has not been used for 24 hours or more (V)

• Remove short peripheral and midline catheters in pediatric and adult patients when clinically indicated based on findings from site assessment and or clinical signs and symptoms of systemic complications (e.g., Bloodstream infection).
INS Standards of Practice 2016

• Signs and symptoms of complications with or without infusion through the catheter include but are not limited to the presence of (I)

1. Any level of pain and or tenderness with or without palpation

2. Changes in color: erythema or blanching

3. Changes in skin temperature: hot or cold

4. Edema

5. Induration

6. Leakage of fluid or purulent drainage from the puncture site

7. Other types of dysfunction (e.g., resistance when flushing, absence of the blood return)
POTENTIAL BENEFITS OF LONGER DWELL

Fewer Invasive Procedures

- Improved patient experience
- Increased nursing efficiency
- Vein preservation
- Fewer breaches in skin
- Reduction in material costs

Regardless of dwell time, risks are still associated with PIVs\textsuperscript{1}

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\textsuperscript{1} Rickard et al, Routine versus clinically indicated replacement of peripheral intravenous catheters: a randomised controlled equivalence trial. Lancet 2012 380:1066-74.
Entry Points of Exogenous Contamination of Vascular Devices

Central Venous Catheter

1. Contamination of catheter hubs
2. Skin organisms

Blood Vessel Access

Peripheral Venous Catheter

1. Contamination of catheter hubs
2. Skin organisms

Blood Vessel Access
WHAT ARE YOU DOING TO REDUCE SKIN COLONIZATION AROUND PIVS?

Regardless of the insertion site, skin organisms are responsible for 60% of all CRBSIs.  

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**CVC Site Assessment and Care**

- “The sensitivity of local inflammation for diagnosis of CVC-related BSI was dismal (0-3%)”

- “In general, site appearance cannot be relied on to identify catheter colonization or CVC-related BSI.”

- “Monitor the catheter sites visually when changing the dressing or by palpation through an intact dressing …if patients have tenderness at the insertion site, fever without obvious source, or other manifestations suggesting local or bloodstream infection, the dressing should be removed to allow thorough examination of the site.”

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**PIV Site Assessment and Care**

**INS 2016 Standards for identification of PIV Complications**

- **Visual Assessment**
  - Infiltration
  - Redness >1 cm from insertion site
  - Phlebitis
  - Non-intact or saturated dressing

- **Palpation**
  - Warmth
  - Palpable cord beyond the IV catheter tip

- **Subjective Patient Information**
  - Tenderness, pain or discomfort
  - Numbness or tingling

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3. Infusion Therapy Standards of Practice, Journal of Infusion Nursing. 2016, V39 (1S)
BUILDING A BETTER PROCESS

• Education
• Standards of Practice
  • Clinical indication
• Bundles
  • Insertion practices
  • Maintenance practices
“Were you taught to insert short peripheral IV catheters while in school?” (N=344)

- **43% Yes**
- **57% No**

“If no, how did you learn to insert short peripheral IV” (N=235)

- **On-the-job training 71%**
- **See one, do one 11%**
- **Trial and error 5%**
- **Attended a PIV insertion workshop 9%**
- **Other 4%**

**MOVING TO CLINICAL INDICATION**

**Understanding Clinical Indication**

*Not a foreign concept*

- Pediatrics
- Current “PRN” or complication related site changes
- Physician-ordered extensions

**Back to Basics**

- Staff competency/assessment expectations (including ER)
- Compliance with good skin prep and strict aseptic technique
- “No touch” technique at insertion
- Optimal insertion location, gauge, technique

- Protecting the site from bacterial re-colonization
- Device dressing and securement
- Scrub the Hub / disinfectant caps
- SURVEILLANCE – who will monitor the patient outcomes?
THE BUNDLE APPROACH

The reduction in CLABSI incidence in 2009 compared with 2001 was greatest for *Staphylococcus aureus* CLABSIs –

A 73% Reduction

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   http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6008a4.htm
674 bed hospital reduces bloodstream infections, realizes multiple efficiencies and improved patient outcomes through peripheral IV policy change and peripheral IV bundle creation.
PIV CASE STUDY

CHALLENGE:

• Conducted surveillance on all lab-confirmed bloodstream infections for the past 13 years
• Aware of the inherent risks associated with PIVs
• A cluster of infections in the fall of 2013

SOLUTION:

• Improved maintenance practices
• Improved focus on line management and patient hygiene
• PIV related product enhancements
• Protective Disk with CHG added to PIV dressings
• A move to Clinically Indicated replacement (February, 2014)
• Extensive education (IV basics, PIV bundle, patient safety)

METHODODIST HOSPITALS
1 YEAR POST IMPLEMENTATION

37% Reduction in House-wide LC-BSIs
19% Reduction in PIV related BSIs
48% Reduction in PIV Kit usage
75% Reduction in CLABSIs (68% Fewer CLABSIs compared to NHSN prediction)

Reduced IV “sticks”
Positive patient feedback
Positive staff feedback

METHODIST HOSPITALS
2 YEAR POST IMPLEMENTATION

37% Reduction in House-wide LC-BSIs
sustained

25% Reduction in PIV related BSIs
6% further reduction

75% Reduction in CLABSIs
(68% Fewer CLABSIs compared to NHSN prediction)
sustained

DeVries, M. – Oral Abstract, AVA 2016, Orlando, FL

1st Place Oral Abstract AVA 2016
MOVING THE NEEDLE:
ONE STANDARD OF CARE FOR ALL
VASCULAR ACCESS DEVICES

- Protective Disk with CHG
- Alcohol Impregnated Caps
- Scrub the Hub Prior to Access
- Sterile Transparent Dressing
- CHG Solution Skin Prep
- Flushing Protocols
Evidence You Should Ask For

- Cleared Indication
- Highest Level of Evidence/ Studies
- National Guideline Recommendations
RESOURCES, IMPLEMENTATION TOOLS, & EDUCATIONAL SUPPORT
To make a large impact, make a small change to the most frequently performed invasive procedure in your institution.