Peripheral IVs: THINK BIG. LOOK SMALL.

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Objectives

- Review data surrounding risks associated with Peripheral IVs (PIVs)
- Discuss how care and maintenance of PIVs relates to the changing healthcare landscape
- Identify strategies to lessen risks associated with PIV complications and sequelae
BSI Definitions

Laboratory-confirmed bloodstream infections (LCBI) that are not secondary to a community-acquired infection or an HAI meeting CDC/NHSN criteria at another body site

- **CR-BSI Catheter Related BSI**\(^1\)
  - A clinical definition used when diagnosing & treating patients
  - More thoroughly identifies the catheter as the source
  - Not used for surveillance

- **CLA-BSI - Central Line Associated BSI**\(^2\)
  - Used for surveillance
  - A laboratory-confirmed bloodstream infection (LCBI) where central line (CL) or umbilical catheter (UC) was
    - in place for >2 calendar days on the date of event, with day of device placement being Day 1 **AND**
    - in place on the date of event or the day before.

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Just the Facts
Peripheral IVs are the most frequently used invasive device in hospitals¹

70% of acute care patients require a short PIV catheter during their stay¹

60% of first attempts are unsuccessful²

27% of patients endure 3 or more attempts²,³

57% of RNs report that they were not taught how to insert PIVs during nursing school⁴

<table>
<thead>
<tr>
<th>Device</th>
<th>No. of studies</th>
<th>IVD-related BSIs per 1000 IVD-days (95% CI)</th>
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<tr>
<td>Peripheral IV catheters</td>
<td>10</td>
<td>0.5 (0.2-0.7)</td>
<td>9</td>
<td>0.6 (0.2-0.9)</td>
<td>9</td>
<td>0.6 (0.2-0.9)</td>
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<td>Midline catheters</td>
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<td>2</td>
<td>0.2 (0.0-0.5)</td>
<td>1</td>
<td>0.2 (0.0-0.5)</td>
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<td>Arterial catheters for hemodynamic monitoring</td>
<td>14</td>
<td>1.7 (1.2-2.3)</td>
<td>11</td>
<td>1.3 (0.8-1.9)</td>
<td>8</td>
<td>1.4 (0.8-2.0)</td>
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<td>Peripherally inserted central catheters</td>
<td>15</td>
<td>1.0 (0.8-1.2)</td>
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<td>0.8 (0.4-1.3)</td>
<td>4</td>
<td>0.8 (0.4-1.2)</td>
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<td>Noncuffed central venous catheters</td>
<td></td>
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<tr>
<td>Nonmedicated</td>
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<tr>
<td>Nontunneled</td>
<td>79</td>
<td>2.7 (2.6-2.9)</td>
<td>63</td>
<td>2.9 (2.7-3.2)</td>
<td>50</td>
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<td>Tunneled</td>
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<td>1.7 (1.2-2.3)</td>
<td>7</td>
<td>0.9 (0.4-1.3)</td>
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<td>2.1 (1.0-3.2)</td>
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<td>Medicated</td>
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<tr>
<td>Chlorhexidine-silver-sulfadiazine</td>
<td>18</td>
<td>1.6 (1.3-2.0)</td>
<td>16</td>
<td>1.3 (1.0-1.7)</td>
<td>16</td>
<td>1.3 (1.0-1.7)</td>
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<tr>
<td>Minocycline-rifampin</td>
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<td>1.2 (0.3-2.1)</td>
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<td>1.2 (0.3-2.1)</td>
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<td>Pulmonary artery catheters</td>
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<td>3.7 (2.4-5.0)</td>
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<td>3.3 (2.0-4.6)</td>
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<td>3.3 (1.9-4.6)</td>
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<td>Noncuffed, nontunneled hemodialysis catheters</td>
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<td>5.0 (4.2-5.8)</td>
<td>9</td>
<td>6.1 (4.9-7.4)</td>
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</tbody>
</table>

*BSI = bloodstream infection; CI = confidence interval; IV = intravenous; IVD = intravascular device.
Trinh, et al

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
• Antecubital fossa (67%)

• Placement in Emergency Room (67%)

• Placement outside of the hospital (16%)
  • 2 from outside facilities
  • 2 field starts

Pujol, et al

A Comparison of Bloodstream Infections in Central and Peripheral Venous Catheters

- Prospective study OUTSIDE of the ICU (Oct. 2001 – March 2003)
- 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
- S. aureus more prevalent as pathogen in PIV vs. CVC (53% vs. 33%)
• Number of days to onset
  • Emergency Room: 3.7 days
  • Nursing units: 5.7 days

• *S. aureus* was more prevalent in peripheral lines, but MRSA was about the same

• 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
Not Without Risk

Ritchie 2007 (New Zealand)

Looked at 345 PIVs

- 22/345 had signs of infections (6%)
  - 6/44 in greater than 72 hours (14%)
  - 16/301 in less than 72 hours (5%)

Hong 2008 (Korea)

- Purulent thrombophlebitis from IV; positive for C. albicans
- Developed fungal spondylitis in vertebrae
- Patient died

Case study of 75 year old man
  - History of CAD & CHF
  - Admitted for CHF exacerbation

PIV in for 4 days
  - RN requested orders to leave IV in an additional day or two because placement (given edema) would be difficult

On day 6
  - Patient developed erythema at the IV site
  - Later that day developed fever and chills
  - Blood cultures grew MRSA

Subsequently
  - Patient complained of back pain
  - MRI of the spine revealed epidural abscess
  - Abscess fluid positive for MRSA

Treatment
  - 6 weeks of intravenous antibiotics
  - Estimated to have cost hundreds of thousands of dollars
What is Clinically Indicated Replacement?

“Routine” Replacement¹

- Removal and reinsertion at scheduled intervals
  - 48, 72, 96 hours
- Based on clock, not on patient condition

Clinically Indicated²

- Removal if the PIV based on assessment findings, i.e. when the PIV:
  - Is no longer included in the plan of care
  - Has not been used for 24 hours or more
  - Exhibits signs or symptoms of complications
- Reinsertion if warranted by patient condition/medical plan of care

2. Infusion Therapy Standards of Practice, Journal of Infusion Nursing. 2016. V39 (1S)
Methodist Hospitals, NW Indiana

• Background
  • 674 beds
  • Previous standard of care for PIVs
    • Routine replacement every 72-96h
    • Transparent film and tape dressings
    • Basic PIV policy not reflective of recent guideline updates
  • 13 years of PIV related LC-BSI data
  • Fall 2013 infection cluster

M. DeVries. Oral abstract, AVA Annual Scientific Meeting, September 2015
Methodist Hospitals, NW Indiana

A Move to Clinical Indication

- Building the Case
  - Benefits of a longer dwell
  - Economic benefits
  - “WIIFM”
- Creating a PIV Bundle
  - Policy revision
  - Materials conversions
  - Education and support
- Implementation and Evaluation

Vein preservation
Improved patient experience
Increased nursing efficiency
Fewer breaches in skin
Reduction in material costs
Closed system catheter
Protective Disk with CHG
Sterile gloves
Alcohol impregnated caps
Replacement when clinically indicated
Securement dressing

M. DeVries. Oral abstract, AVA Annual Scientific Meeting, September 2015
Methodist Hospitals:
1 Year Post Implementation

37% Reduction in House-wide LC-BSIs

19% Reduction in PIV related BSIs

48% Reduction in PIV Kit usage

68% Fewer CLABSIs (compared to NHSN prediction)

Reduced IV “sticks”

Positive patient feedback

Positive staff feedback

M. DeVries. Oral abstract, AVA Annual Scientific Meeting, September 2015
Can you measure the impact on patient experience?

Press Ganey:
Top Box: Overall patient satisfaction
Tests and Treatment: Courtesy of the person starting IV

• We hypothesized that overall satisfaction could be improved by improving the overall experience with IVs.
• One year after introducing our protected clinical indication bundle we experienced
  • Increase of 23 percentile ranking improvement with top box
  • 24 percentile ranking improvement with courtesy of person starting IV.
  • This suggests an quantifiable association worth further study.

More things to consider...

• What is the contribution of PIVs to CLABSIs?
  • Pre-implementation of clinical indication: 20% of CLABSIs also have peripheral IVs
  • Year one after implementation: 12% of CLABSIs also have peripheral IVs
  • Year two after implementation: 10% of CLABSIs also have peripheral IVs
Affordable Care and PIVs: It Pays to Pay Attention
Clinical process gives way to outcomes and efficiency over time as the model becomes more Pay for Performance.

The Affordable Care Act

Value Based Purchasing Timeline

<table>
<thead>
<tr>
<th>FY 2018 Value Based Purchasing Domains*</th>
<th>Baseline Period</th>
<th>Performance Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinical Process of Care</td>
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</table>


What’s the real cost?

Example:

• CLABSI
  • Baseline 1.4/1,000 = 41 CLABSI/year expected
  • 52% reduction = 21 fewer CLABSI
    • 20% mortality = 4 fewer deaths

• LOS
  • ALOS/CLABSI = 2.7 days = 56.7 days prevented
  • Avg. LOS at Hospital X = 4.5 days = 13 new/additional admissions
Cochrane Peripheral Vascular Diseases Group

- Assessed impact of removing peripheral catheters when clinically indicated versus removing and re-siting routinely
- Found no conclusive benefit in changing PIV routinely (eg. every 72 hours to 96 hours)
- Looked at phlebitis as well as bacteremia

Results:

- Changing for clinical need rather than on routine schedule reduced the rate of bacteremia 44%  
  – OR = 0.57  P= 0.37
- 24% increase in phlebitis in the clinical change group  
  – OR= 1.24 P=0.09

Seven additional trials were reviewed with a total of 4895 patients.
No significant difference in the catheter related BSI group between clinical indication and routine change.
No significant difference in phlebitis rate between the two groups.
  No difference whether the infusion was continuous or intermittent.
Cannulation costs were lower (approximately 7 Australian dollars in the clinical indication group).

Lancet summary

• Routine replacement increases:
  • Costs
  • Staff time
  • Number of procedures patients must undergo

• We need to think about getting our dwell time to be our average length of staff, and we will be saving our patients from needless restarts
  • 5907 catheters in randomized, multi-center study
    • Clinical indication (1593 patients) - average 99 hours
    • Routine rotation (1690 patients) – average 70 hours

Guidelines and Standards

**CDC- HICPAC 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.
- Replace peripheral catheters in children only when clinically indicated.
- Remove peripheral venous catheters if the patient develops signs of phlebitis.

**APIC 2016**

- Repeated (PIV) sites may be required for lengthy courses... thus increasing costs
- Superficial phlebitis results in pain, and lack of (PIV) sites can delay treatment and prolong hospitalization.
- Venipuncture has been documented to produce nerve damage, such as complex regional pain syndrome.
- Additionally, the vesicant nature of medications can result in necrotic ulcers requiring surgical debridement.

**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.

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

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

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.
INS Standards of Practice 2016

- 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.

- Consider the use of maximal sterile barrier precautions with midline catheter insertion.

- For peripheral catheters, consider two options for catheter stabilization: (1) in integrated stabilization feature on the catheter hub combined with a bordered polyurethane securement dressing or (2) a standard round hub peripheral catheter in combination with an adhesive ESD.
• **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)

• **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**

• **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)**

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*Infusion Therapy Standards of Practice, Journal of Infusion Nursing. 2016, V39 (1S)*
The Origin of Microorganisms Causing CRBSI

1. Contaminated Catheter Hub = 12%
2. Contaminated Infusate = <1%
3. Skin Organisms = 60%
   Unknown = 28%

Entry Points for Exogenous Contamination of Vascular Devices

1. Contamination of catheter hubs
2. Skin organisms
• What are you doing for the PIVs that are staying in longer than 72 hours to reduce skin colonization?

• A product exists that can help reduce the skin flora if you are leaving your catheters in for longer periods of time (up to 7 days at a time)

Protected Clinical Indication

- Cleared Indication for Reduction of CRBSI
- Highest Level of Evidence/ Studies
- National Guideline Recommendations
What about midlines?

• In an effort to reduce CLABSI incidence many hospitals are looking increasingly to midline catheters as part of their solution.
• Midlines are considered peripheral catheters per INS standards and CDC definitions regarding tip termination.
• How are you protecting your patients with these lines?
  • Insertion? INS says consider maximum sterile barriers.
  • Protection? These lines may dwell for up to 29 days
• How are you measuring success?
  • Decrease in central line days?
  • Decrease in CLABSI?
  • Material costs and time savings?
  • Incidence of Midline associated bloodstream infection?

Infusion Therapy Standards of Practice, Journal of Infusion Nursing. 2016, V39 (1S)
Clinical Indication: Key Considerations

- Staff competency & assessment expectations
- Skin prep & no touch technique
- Optimal Placement to allow dwell time
- Protect the site from bacterial recolonization
- Defining when the catheter must come out
- Meticulous hub hygiene
- Surveillance – who will monitor outcomes?
- Catheter securement
- Protect the site from bacterial recolonization
- Staff competency & assessment expectations
Resources, Implementation Tools & Educational Support
To make a large impact, make a small change to the most frequently performed invasive procedure in your institution.