Extended-Dwell PIVs: “A New Tool in the Toolbox”
The Emerging Evidence

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Disclosures

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Objectives

- 2016 INS Standards of Practice
- Review Vascular Toolbox
- Define Extended Dwell Catheter
- Discuss Ultrasound Guided PIV data
- Review Current EDC Options
- Concerns with EDC
INS Standards of Practice

“Use the venous site most likely to last the full length of the prescribed therapy, using the forearm to increase dwell time, decrease pain during dwell time, promote self-care, and prevent accidental removal and occlusions.”

Infusion Therapy Standards of Practice. 2016: S54
Today’s Toolbox
(In-Patient, Non-cuffed VADs)

Peripheral IVs (PIVs) >300 Million Sold (US)

Midlines (MLs) Fastest Growing VAD Sector
CVADs PICCs & CVCs total >8 million
Others (e.g. Acute hemodialysis, etc.)
Peripheral IV Catheters

PIVs

History: 1950s First Over-Needle IV Catheter—It was PVC, 2 inches long, 16 gauge

The Evidence Base:

<table>
<thead>
<tr>
<th>Condition</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bloodstream Infection</td>
<td>0.07-0.5/1000 c-d</td>
</tr>
<tr>
<td>Total Complications</td>
<td>47-65%</td>
</tr>
<tr>
<td>Average Dwell Time</td>
<td>35-65 (w/SL) hrs.</td>
</tr>
<tr>
<td>Phlebitis</td>
<td>7-70%</td>
</tr>
<tr>
<td>Infiltration</td>
<td>7-27%</td>
</tr>
<tr>
<td>Dislodgement</td>
<td>16-47%</td>
</tr>
<tr>
<td>First Attempt Success</td>
<td>&lt; 50%</td>
</tr>
<tr>
<td>Completion of Therapy</td>
<td>47%</td>
</tr>
</tbody>
</table>

Remember: These are PERCUTANEOUS PIVs
Vascular Access Tool Box
Filling the Void

Florence Nightingale: “Give me the proper tools, fresh air and sunshine, and I can cure even the sickest and most downfallen…”

Yesterday............PIVs & CVADs
Today.................PIVs, UGPIVs, MLs & CVADs
**Tomorrow**........PIVs, UGPIVs, UGEDCs, EDCs, MLs & CVADs
What is an “Extended-Dwell PIV or EDC?”

Criteria:
• Longer than a PIV. Shorter than a midline:
• PROVEN AVERAGE (MEAN) DWELL TIME > 96 HOURS
• Power-Injectable
• Low Complications, High Completion of Therapy
• High (>80%) first-attempt success rate
• Ideally, blood drawable
• Ideally, anti-infective

Why do we need an Extended-Dwell PIV?

• Traditional PIVs (1.88”). are NOT WORKING in DIVAs, requiring ultrasound-guided PIVs and extended peripheral IV therapy:
  - For U/S guided PIVs:
    - Median survival = 26 hours
    - Overall FAILURE RATE = 44%
      - 42% Infiltrated
      - 23% Dislodged
      - 33% “Were not flushing”
    - FAILURE RATE AT ONE HOUR = 10%

2. Khan MS, Sabnis VB, Phansalkar DS, Prasad SP, Karnam AHF. Use of ultrasound in peripheral venous catheterization in adult emergency and critical care units. Anaesth Pain & Intensive Care 2015;19(3):303-310
And yet, U/S-Guided PIVs do offer significant benefits...

- High “Success Rates” (not necessarily first-attempt success)
- Reduced need to place CVADs (3 studies)
- Removal of existing CVCs (fewer central line days)
- Patient Satisfaction (fewer needle sticks)

2. Khan MS, Sabnis VB, Phansalkar DS, Prasad SP, Karnam AHF. Use of ultrasound in peripheral venous catheterization in adult emergency and critical care units. Anaesth Pain & Intensive Care 2015;19(3):303-310


Which is why MAGIC includes indications for U/S-guided Peripheral Catheters

- For patients with:
  - One or more failed attempts
  - Inability to identify veins visually, or
  - Veins identified are difficult intravenous access (e.g. forearm, antecubital or upper arm)
  - For contrast based upper extremity access...where visible veins to accommodate catheter size are not present.

Why do U/S-guided PIVs fail?

• Because all the factors that cause ~50% of regular PIVs to fail are still active in U/S-guided PIVs: e.g., traumatic insertions, like back-wall ing, leading to phlebitis, infiltration, etc.

• MATERIAL—Polyurethane softens quickly.

• LENGTH—deeper vessels clearly need longer catheter.
So all we need is a longer PIV of the same polyurethane material. Right?

WRONG:

1. 12cm Polyurethane IV (Seldinger)\(^6\)
   - 20.9% Thrombosis
   - 11.4% Occlusion/phlebitis
   - 2.3% Infiltration

2. 6.35cm Polyurethane IV (over-needle)\(^7\)
   - 44% Failure Rate
   - Median Survival 26 hrs.

Clearly, it takes more than just a little more length and the same ‘ole material to make an effective EDC
How about adding a guidewire?

One well-studied 2.25” guidewire assisted, polyurethane PIV:

- Average dwell time = 2.4, 4.4 days
- This by definition is NOT AN EXTENDED DWELL CATHETER.


So—if not just length and a guidewire--what does it take to make a TRUE EDC?

Reduction in central line utilization due to an ultrasound-guided, extended-dwell IV catheter

Method: This is a single-center, prospective cohort study extending from May 1 to June 30. The PIV used was either an 18g/1.88” or 20g/1.88” over-needle, polyurethane catheter as selected by the clinician at the bedside. The EDPIV used was a 3Fr/2.4” over-wire catheter. All lines were placed with sterile technique (including sterile probe cover) using the dynamic ultrasound method in the transverse axis. Skin antisepsis was achieved with 2% chlorhexidine gluconate. Securement was done with a 3.5 x 4.5 inch bordered transparent dressing.

Results: A total of 361 patients were observed: 278 UGPIVs, 83 UGEDPIVs. Average dwell time in the UGPIV group was 5.08 days (1-16 days) with 5.7% having their central lines removed upon placement of UGPIV. Average dwell time in the UGEDPIV group was 10.7 days (1-29 days) with 37.3% having their central lines removed upon placement of UGEDPIV. Numerous UGEDPIV patients were discharged home for antibiotics; had they been followed, the EDPIV dwell time may have been even longer. Central line utilization (i.e., percentage of central lines per overall patient days) decreased from 20.3% during the same period the previous year, during which EDPIVs were not used, to 17.2%--a 15.3% reduction.

Conclusion: The ultrasound-guided extended-dwell catheter outperformed the standard PIV, lasting over twice as long. Most important, during the trial period, 37.3% of patients receiving the UGEDPIV were able to have their central lines removed upon placement, resulting in a 15.3% decrease in central line utilization.
What made the Difference?

Average Dwell Time = 10.7 days

1. Material Science: An entirely new catheter material—retains its tip longer, softens once in the vessel. NOT A POLYURETHANE, rather a blended co-polymer.

2. Atraumatic insertion method: These EDCs or EDPIVs were placed using an over-wire procedure that begins with a 24g angiocath. The guidewire has a smooth, plastic tip.

So, it is the combination of:
- small gauge introducer needle,
- well-engineered wire, AND MOST IMPORTANTLY…
- a new and better material
What should I be most concerned about with EDCs?

Answer: INFECTION

CDC (Guidelines 2011) -- PIVs allowed to dwell past 96 hours, i.e. extended-dwell: “…the risk of CRBSIs with this strategy is not well studied.” (pg. 45)

REMEMBER: Virtually ALL catheter-related bloodstream infections are BIOFILM INFECTIONS
Polyurethane

- Standard polyurethane catheters have been shown to bloom additives to their surfaces during normal aging.

- These surface additives are proven to “facilitate bacterial attachment”


Have no fear...

Other options are here

- New technology removes dangerous surface additives and creates surface micro-texturing thereby inhibiting bacterial attachment\(^1\)

- \textit{70\% reduction in bacteria and biofilm formation} in comparison with a standard polyurethane catheter\(^1\)

\begin{itemize}
  \item Based on laboratory test results which may not be indicative of clinical results. Preclinical in-vitro evaluations do not necessarily predict clinical performance with respect to catheter-related bloodstream infection.
\end{itemize}
How do I prevent biofilm formation on my EDC?

- Usual infection prevention methods
  - Hand washing, drapes, chlorhexidine, etc.

- Consider chlorhexidine-impregnated sponge or transparent dressing

- Make an evidence-based decision--which catheter material has a published track record of zero to low CRBSIs?
Summing Up

• The use of ultrasound guidance has created a new and growing need for a true EDC

• Simply extending the length of standard PIVs or adding a guidewire does not suffice

• New materials and insertion tools are necessary to TRULY achieve extended dwell times

• As true EDCs appear, be cautious about CRBSI risk and take preventive measures
References