Technology Innovations in Vascular Access

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Introduction

- **My experience**
  - RN for 35 years
  - PICC Instructor and inserter 26 years

- **As a trainer and active PICC preceptor I represent:**
  - Nurses
  - Physicians
  - Radiological technologists/assistants
  - Respiratory therapists
  - Nurse practitioners/physician assistants
Expansion of VADs in USA

- Early adopters of new technology
- Per capita healthcare dollar over $9,000/person/yr
- 90% of peripheral cannulas placed by nurses
VAD Usage in USA

- Approx 330 million peripheral catheters/yr
- Almost 3 million PICCs per year
- 70% PICCs placed by nurses
- 10% of CVCs now placed by RNs
- VAD Placement by Registered Nurses, Physicians, Nurse Practitioners, Physician Assistants, Radiology Technologists, Respiratory Therapists
Inserters of PICCs

- US Market
- 70% inserted by nurses
- 30% by MDs, Radiology Department and others
- 60% using Ultrasound and Modified Seldinger Technique and rising!
Placement in the USA

- Cost Effective Tiered Practice
- Hospital bedside first choice
- Interventional Radiology second in volume
- Goal is for multidisciplinary teams
CVAD Indications

1. Clinical instability of the patient
2. Chemotherapy for more than 3 months
3. Continuous infusion therapy or long term intermittent therapy
4. Delivery of non-peripherally compatible infusates (irritating or vesicant medications)
5. Frequent phlebotomy every 8 hours or more
6. Intermittent infusion, infrequent phlebotomy or difficult intravenous access (DIVA) with duration of 6 days or more; nursing homes or home care 15 days or more

Reference: INS Standards 2016, Chopra MAGIC 2015
Technology Improvements

- Specialty teams are still the ideal and present in the bigger better hospitals.
- Ultrasound guided peripheral cannulas make up as much as 40/50% of PIV placements.

"Must’ve pressed the wrong button. Hang on, I’ll ask the nurse."
Patient Factor Influence on Technology
Technology Improvements

- **Old PICC insertion techniques**
  - Antecubital access
  - Over the needle peel-way sheath
  - Direct Access and breakaway needles

- **Improvements**
  - Modified Seldinger Technique
  - Upper arm placement with ultrasound
  - C21g needle and wire access
  - Improved materials and valves
  - VP measurement
Current Issues for PICCs

- Improving successful access without malpositioning using ECG
- Ultrasound guided insertion is the standard for PICCs and CVCs
- Focus on selection and indications
PICC Indications

1. Patient requires intravenous access for greater than 14 days. For proposed treatment of 6 or more days ultrasound guided or midline catheter preferred over PICC
2. Clinically stable patient requiring intravenous therapy with peripherally incompatible solutions. Hemodynamically unstable patients where cardiac monitoring or use of vasopressors is necessary in cases less than 14 days and greater than 15 days (CVCs favored over PICCs)
3. PICC is preferred CVAD for critically ill patients with coagulopathies for 14 or fewer days and those requiring 15 or more days of treatment
4. For use with continuous infusions of vesicant, parenteral nutrition, chemically irritating or non-peripherally compatible solutions for any duration. For cyclic chemotherapy with active cancer where treatment is greater than 3 months. Consideration given to discontinuation of PICC when each cycle complete (peripheral catheter preferred when less than 3 months)
5. Use with patients receiving frequent phlebotomy of every eight hours or more with duration of 6 or more days
6. For burn patients where early implementation of PICC decreases risk of bacteremia
7. For use with chronic or lifelong access populations (Sickle Cell, Cystic Fibrosis, Short Gut) or those hospitalized more frequently than 6 times per year (tunneled catheter preferred)
8. For use in patients in palliative treatment, actively dying or on hospice requiring intravenous solutions
9. For skilled nursing facilities when duration of treatment greater than 14 days
10. Prior nephrology approval if GFR less than 30 or creatinine greater than 2.0
11. Single lumen PICCs preferred unless specific indication for additional lumen. Use smaller gauge PICC with fewer lumen to reduce risk of deep vein thrombosis (DVT) (Evans 2013, Grove and Pevec 2000). Measure vein size to establish appropriate catheter size of less than 45% of diameter (Sharp 2014). Position of terminal tip of PICC in lower third of SVC, cavoatrial junction or right atrium.
# Inappropriate PICC Placement

**Inappropriate PICC**

1. Placement of PICC for any non-central indication or use with any infusion other than non-peripherally compatible infusates

2. Placement with confirmed CLABSI without clearance of infection (line free interval 48-72 hours and negative blood culture)

3. Urgent or “STAT” request for PICC for a hemodynamically unstable or critical patient

4. Avoid PICC for inappropriate indications, or for patients with history of thrombosis, hypercoagulability or decreased venous flow to extremities; consider alternative devices and remove PICC when no longer needed

5. For renal failure stage 3b or greater chronic kidney disease with GFR of less than 44mL/min or for patients currently receiving any renal replacement therapy

6. Insertion for infrequent phlebotomy, less than 3 times daily

7. Insertion of a PICC primarily to establishing intravenous access when the duration of treatment is unknown

8. Poor vascular access is no longer an acceptable indication

Reference: Chopra, MAGIC 2015
Technology Improvements

- Ultrasound guidance for needle access
  - Smaller devices, even USB probes
  - Allows consistent upper arm access for better outcomes
  - Integration with tip location
Ultrasound Guided Peripheral Catheter Indications

1. Use visualization technology to establish peripheral access using longer catheters for the purpose of intravenous treatment less than 5 days or greater than 15 days (with transition to midline or PICC)
2. For patients with one or more failed attempts, inability to identify veins visually or those identified as difficult intravenous access (DIVA)
3. For contrast based radiological studies requiring upper extremity access in larger veins with 20, 18 or 16 gauge catheter (where visible veins to accommodate catheter size are not present)

References: INS 2016, Chopra MAGIC 2015
MAGIC Michigan Appropriateness Guide
Evidence to guide practice

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Midline Catheter Indications

1. Treatment involves peripherally appropriate solutions that will likely exceed 6 days
2. Preferred for patients requiring infusions of up to 14 days
3. Patients with difficult access (DIVA) despite ultrasound guided peripheral catheter attempts
4. Single lumen midline is placed unless specific indication for dual lumen with compatible infusions
5. The administration of Vancomycin 6 days was considered safe in one study

References: INS 2016, Chopra MAGIC 2015
Current Issues for PICCs

- Tip location devices changing over to ECG
- Reducing Infection
  - Longer insertions higher risk
  - Technology and aseptic tech
Technology Advances

 Tip Location Devices
  – Avoids jugular, cross chest placement
  – Indicates direction
  – Precision with tip location on the forefront
    • Unable to differentiate position in SVC
    • Particular challenges are Azygos, alternate veins, and arterial access
  – ECG/EKG is the up and coming technique that provides accurate location in CAJ
Current Issues for PICCs

- Clinical Pathways for vessel health and preservation reduces length of stay and cost

Trends and Techniques for Placement

- Power Injection for PICCs and Ports
- Fluoroscopy
- Improvements for prevention of complications at insertion site
  - CHG impregnated drsg
  - Antimicrobial catheters
Evidence to Support Antimicrobial

- One catheter fits all?
- Indications for Anti-Infective CVAD

Indications for Antimicrobial Selection

1. Expected duration of 5 days or more
2. CLABSI remains high despite application of infection prevention measures
3. Patients at higher risk of infection
4. Emergency insertions
5. Catheter exchange (higher risk of infection)

Vessel Health and Preservation in Action

Reaching for Perfection

The Perfect Vascular Access Device

- Durable
- Easy to insert
- Power injectable
- Low complication rate
- Anti-thrombotic
- Anti-infective
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What is the ideal VAD for you?
Best Practice Initiatives

- AVA – SAVE THAT LINE
- S – Scrupulous hand washing
- A – Aseptic technique
- V – Vigorous friction to cap/hub
- E – Ensure patency by flushing

Other – Central Line Bundle and checklist– Institute of Healthcare Improvement [www.IHI.org](http://www.IHI.org)
Factors Driving Practice

- Economics
- Nurses take on greater role with vascular access
- Physicians opt for other procedures
  - PICCs time consuming
  - Takes time to learn ultrasound
- Hospitals promote Specialty Teams for improved outcomes and best practice
The Future

- Handheld ultrasound
- Smaller PICCs and CVCs
- Easy ECG navigation
- More USGPIV and Midlines used
- Intentional clinical pathway for VAD selection and use
Resources

- MAGIC [www.improvepicc.com](http://www.improvepicc.com)
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Thank you for the opportunity to speak with you.

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