Application and Use of Midline Catheters in Clinical Practice

CentraCare Health
Vascular Access Conference
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Conflict of interest:
Bard Access- Per Diem Clinical educator

The outcomes for this program include:
- Review the history and definition of midline catheters
- Discuss indications and contraindications for use of midline catheters
- Compare advantages/disadvantages of products currently available
- Evaluate potential cost benefit, cost reduction of implementing midline program
- Describe criteria to establish an effective midline program

What is a Midline catheter?
Definition:
- A midline is a Vascular Access Device
- Measuring between 3 (8 cm) and 8 inches (20 cm) in length or less

Insertion site:
- Inserted in the basilic, brachial, or cephalic vein in the upper arm

Catheter tip location:
- the the distal tip dwelling vein at or below the axilla and distal to the shoulder
- Catheter tip remains in the periphery and s not advanced past the shoulder
### Midline Catheters Clinical Practice Issues to consider

- The economic incentive of "value-based purchasing" coupled with patient satisfaction act as a driving force for hospitals to consider processes and devices that are reliable and safe, thus increasing quality.
- Issues related to CLABSI and the lack of reimbursement for prolonged hospitalization and treatment undergird the need to choose intravenous devices wisely.
- Stents such as midline catheters and the increased use of ultrasound to insert peripheral intravenous catheters both provide options to remove CVADs when they are no longer necessary; reducing the risk of CLABSI.
- Economic gains associated with the use of midline catheters include the elimination of costs associated with tip confirmation, which is not needed for midlines; the elimination of thrombolytic agents for the treatment of occlusions; lower insertion device costs; and the potential for reduced length of stay.

### History of the Midline Catheter

- 1950’s: IntraCath® devices; intended most often for subclavian access. Rigid materials and indelicate cannulation methods limited the adoption and use of these early midlines.
- 1980’s: MerliCare introduced the Landmark® midline catheter, made of a unique material—Aquavene®—that softened once in the bloodstream. Additionally, the cannulation method of the Landmark midline was cleverly designed to provide easy insertion while reducing vessel trauma. Two independent studies showed low bloodstream infection rates with the Landmark midline—0.3 percent and 0.3 per 1,000 catheter days.(33,34) Unfortunately,
- 1992 and 1995, acute hypersensitivity-like reaction became associated with the Landmark midline and attributed, rightly or wrongly, to its novel material and/or insertion technique. The device was withdrawn from the market.

### Indications for Use:

- Ideal for IV therapy lasting <30 days
- Use with near isotonic solutions
- Fluids with osmolality <900mOsm/L
- Patients that are difficult IV access (DIVA)
- Patients who are difficult IV access whose IV therapy is expected to exceed 44 hours and/or anticipated to have frequent lab draws.
- Absence of the clear indication for a central venous catheter (CDC)
- IV therapy is likely to exceed 6 days

### Patients with the following conditions are candidates for midline catheters:

- Cellulitis
- Diabetes
- Pneumonia
- Congestive heart failure
- Abscess
- Bronchitis/asthma
- Pyelonephritis
- Osteomyelitis
- Chronic renal failure (with approval of nephrology)
- Major surgery
- Burns
- Obesity
- Malnutrition
- Dehydration
- Stroke/transient ischemic attack
- Contractures
- Multiple tattoos
- Poor vasculature
- Advanced age
- Chronic conditions
Treatment indications include:

- Continuous infusions, hydration
- Isotonic infuses, lower osmolarity infusion (<900 mOsm)
- Antibiotic agents appropriate for peripheral infusion
- Heparin
- Steroids
- Antacids
- Sedation
- Analgesia/pain medication infusions
- Treatments requiring extended dwell without need of central venous access
- Therapies that extend longer than 6 days or require reliable access

Duration of therapy

- All midlines are cleared by the FDA for “less than 30 day” usage.
- However; the CDC guidelines allow for the dwell times in excess of 30 days, provided there is no evidence of infection or other complication

Contraindications:

- Continuous vesicant therapy
- Parenteral nutrition
- Infusates with an osmolarity greater than 900 mOsm.L

SPECIAL CONSIDERATIONS FOR MIDLINE USE

Avoid use in:
- Patients at risk of thrombosis, hypercoagulability
- Patients with compromised circulation
- Decreased blood flow to the extremities
- Patients at risk of lymph edema
- Patients with end stage renal disease requiring vein preservation

Venous access device recommendations for infusion of:
peripherally compatible infusate.

Venous access device recommendations for:
infusion of non–peripherally compatible infusates.

Venous access device recommendations for:
patients with difficult venous access.
Comparison of Peripheral IV and Midlines

<table>
<thead>
<tr>
<th>Parameter</th>
<th>PIV</th>
<th>Midline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Dwell time</td>
<td>44 hours (1.83 days)</td>
<td>283.2 hours (11.8 days)</td>
</tr>
<tr>
<td>Infection rate per 1000 catheter days</td>
<td>0.5</td>
<td>0.2</td>
</tr>
<tr>
<td>Insertion technique</td>
<td>Aseptic - clean</td>
<td>Sterile</td>
</tr>
<tr>
<td>Use of ultrasound</td>
<td>No, unless multiple failed attempts and/or history of poor peripheral venous integrity</td>
<td>Yes</td>
</tr>
<tr>
<td>Blood draw from device</td>
<td>Preferably not routine</td>
<td>Yes</td>
</tr>
<tr>
<td>Use to deliver infusions with osmolarity greater than 600mOsm/L</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Cost</td>
<td>5-15</td>
<td>$5</td>
</tr>
</tbody>
</table>
Comparison of Midlines and PICC’s

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Midline</th>
<th>PICC</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Average Dwell time</strong></td>
<td>283.2 hours (11.8 days)</td>
<td>393.6 hours (16.4 days)</td>
</tr>
<tr>
<td><strong>Infection Rate - per 1000 catheter days</strong></td>
<td>0.2</td>
<td>1.1</td>
</tr>
<tr>
<td><strong>Occlusion Rate</strong></td>
<td>1.9-29%</td>
<td>25-33%</td>
</tr>
<tr>
<td><strong>Insertion technique</strong></td>
<td>Sterile</td>
<td>Sterile</td>
</tr>
<tr>
<td><strong>Use of ultrasound</strong></td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td><strong>Use to deliver infusions with osmolarity greater than 600mOsm/L</strong></td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Catheter tip</strong></td>
<td>Peripheral- axilla</td>
<td>SVC/ACJ</td>
</tr>
<tr>
<td><strong>XR or tip verification</strong></td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Cost</strong></td>
<td>$5</td>
<td>$55</td>
</tr>
</tbody>
</table>

Advantages/Disadvantages of Midlines

**Advantages**
- Suitable for all IV fluids and drugs that would be administered through a PIV
- Distal tip is at the axillary vein, not SVC. Solutions > 10% Dextrose, vesicants or corrosive substances cannot be administered due to risk of extravasation
- Longer dwell time than PIV, reducing need for repeated PIV re-starts
- Infusing fluid by gravity is not always possible and an infusion pump may be necessary to infuse drugs and fluids at the desired rate
- Provides long term alternative for IV therapy when central venous access is not required or there is no clinical benefit
- Compromised anatomy such as presence of lymphedema, previous infection or phlebitis affecting the arm will preclude the use of a midline catheter
- Ease of insertion
- Patient comforted, decreased number of IV re-starts
- Suited for patients with difficult veins not requiring central venous access

**Disadvantages**
- Distal tip is at the axillary vein, not SVC. Solutions > 10% Dextrose, vesicants or corrosive substances cannot be administered due to risk of extravasation
- Longer dwell time than PIV, reducing need for repeated PIV re-starts
- Infusing fluid by gravity is not always possible and an infusion pump may be necessary to infuse drugs and fluids at the desired rate
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- Ease of insertion
- Patient comforted, decreased number of IV re-starts
- Suited for patients with difficult veins not requiring central venous access
- May be difficult to place PICC in patient with difficult access

Recommendations for Placing Midline Catheters in the Adult Acute Care Setting
- Use strict aseptic technique and maximal barrier precautions
- Insert under ultrasound guidance above the antecubital crease
- Basilic vein preferable, veins of the upper arm
- Catheter distal tip should be or below the axillary vein

Care and Maintenance
- Similar to PICC
  - Flushing
  - Tubing changes
  - Connector changes
  - Dressing changes
  - Blood draws
  - Trouble shooting
  - Removing catheter
Types of MIDLINE catheters available

<table>
<thead>
<tr>
<th>Insertion Technique:</th>
<th>Sizes Available:</th>
<th>Catheter length:</th>
<th>Power Injectable:</th>
</tr>
</thead>
<tbody>
<tr>
<td>AST - Accelerated Seldinger Technique</td>
<td>3FR Single lumen, 4FR Single lumen</td>
<td>8 cm – 20 cm</td>
<td>Yes</td>
</tr>
<tr>
<td>MST - Modified Seldinger Technique</td>
<td>5FR Dual lumen</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Establishing a Midline Program:

Establishing current operational costs:

PIV insertion:
- Equipment
- IV start kit
- PIV
- NS flush
- Extension tubing with or without needleless connector
- Personnel time 20 minutes/per insertion at $xxx.00/hour

Total: Example - $30.00
Note: Add $10.00 for ultrasound PIV insertion

Get the Data:

- Point prevalence data:
  - CVAD volume of VAD per class per patient care unit (over at last the last 3-6 months)
  - PIV
  - Non-tunneled CVC
  - PICC
  - Tunneled CVC
  - Implanted port

Establishing a Midline Program:

- What is your facilities device selection criteria, do you have this documented in hospital protocol?
- Who is placing PIV’s
- What is the estimated number of patients that have a PICC ordered for failed PIV insertion?
- What is the estimated number of patients that have multiple PIV’s placed over a period of time?
- What is the staff and patient satisfaction for your current services for IV insertion?
- Who is placing CVC’s/PICC’s
- What is your criteria for placing a PICC?
- What is your facility’s CLABSI rate, occlusion rate, thrombosis rate?
Estimate operational cost/ reduction)cost avoidance

- What is your facility's daily/monthly PIV volume?
- Do you have a site rotation time or when clinically indicated?
- What is your average PIV dwell time?
- What is the volume of patients that had 4 failed PIV or VP attempts?
- What do you estimate the % of PIV's would be eliminated if a midline was placed/month?

Total potential cost avoidance PIV
- # (100) x estimated operational costs
- Ex: 100 x 30.00 = $3,000.00/month
- Estimate operational cost savings per year= $36,000.00

Establish current operational costs: PICC

PICC insertion:
- Equipment
- PICC with full barrier insertion kit
- Any add on equipment, (i.e. Biopatch, NS flushes, sterile gloves
- Personnel time 60 minutes/per insertion at $ 50.00/hour
- Cost of CXR or tip positioning sterile separate

Total: Example- $350.00

Estimate operational cost reduction

Cost avoidance

- What is your facility's daily/monthly PICC volume?
- What is the volume of patients that had a PICC ordered fro failed PIV or VP attempts?
- What do you estimate the % of PICCs would be eliminated if a midline was placed/month?
- Total potential cost avoidance PICC
  - # x estimated operational costs
  - Ex: 20 (5% of 100 insertions/month) x 350.00 = $7,000.00

Estimate operational cost savings per year= $84,000.00

Estimated Operational Cost reduction:

Monthly:
- PIV - $ 3,000.00
- PICC-$ 7,000.00
- Total- $10,000.00

Annual:
- PIV- $ 36,000.00
- PICC-$ 84,000.00

Total: $120,000.00
Establish current operational costs: Catheter occlusion

Estimated PICC occlusion rates: 25-33%
Estimated midline occlusion rate 1.9-29%

- What is the cost of treating catheter occlusion?
- What is the volume of tPA used over the last 3-6 months.
- Estimated costs to treat catheter occlusion/month
- Establish current operational costs:
- Potential cost reduction if decreased by 10%

Establish current operational costs: Catheter thrombosis

Estimated PICC thrombosis rates - 27.2% (Range 1-38.5%)
Estimated midline thrombosis rate < 2.0%

- What is the cost of treating catheter thrombosis?
- What is the volume of positive upper extremity ultrasounds over the last 3-6 months.
- Estimated costs to treat thrombosis
- Potential cost reduction if decreased by 20%

Establish current operational costs: CLABSI Reduction

Estimated PICC infection rates per 1000 catheter days - 1.1
Estimated midline infection rate per 1000 catheter days: 0.2

- What is the cost estimated cost of CLABSI?
  - Estimated $32,254.00 per incident
- What is the rate of CLABSI per 1000 catheter days at your facility?
- Potential cost reduction if incidence was decreased by 1, more?

Pre-implementation of a midline program:

- Gain champions from physicians, administrations and infection prevention specialist.
- Establish buy-in fro midline program
- Create and administer patient and staff satisfaction survey
- Consider midline product to trial,
- Establish criteria and duration for successful product trial
- Create proposal and develop protocol for orders, policy and procedure
- Create plan for education and implement team training then expand throughout the facility.
Post implementation:
Keep statistics in:
- Number of devices placed
- Arm, vessel selected, vessel diameter
- Catheter size, catheter
- Length
- Dwell time
- Complications/infections
- Any special related conditions
- Attempts per device
- Modify policies/procedures as needed
- Repeat patient/staff satisfaction survey

And Finally:
Report successes, improved outcomes and estimated operational cost savings and cost avoidance to your program champions and facility administration.

Thank you Questions?

References: