CHOC Children's.
Nursing Research

CHOC Children's Hospital
Best Evidence and Recommendations

Use of Midline and Extended Dwell Catheters

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PICO: In pediatric patients, what are the best practices for the indication and use of midline/extended dwell catheters to decrease complication and increase vessel health and preservation?

P (Population/problem): In pediatric patients,
I (Intervention/issue): what are the best practices for indication and use of midline/extended dwell catheters
C (Comparison):
O (Outcome): to decrease complications and increase vessel health and preservation

Background:
Short-term vascular access is frequently required in hospitalized children for the delivery of fluids, medication, and blood product administration. Central line placement may be clinically indicated for repeated medication delivery, chemo/immunotherapy, total parenteral nutrition, plasmapheresis, hemodialysis, repeated blood sampling or hemodynamic monitoring. Bloodstream infection is a common and costly risk of central line placement. It is estimated that there are over 200,000 preventable central line associated bloodstream infections (CLABSIs) in the United States each year, resulting in as many as 25,000 deaths and $21.4 billion in avoidable healthcare costs (Umscheid et al., 2011). Over the past decade, changes in Medicare reimbursement and non-payment for hospital acquired conditions have incentivized a paradigm shift towards improvement of vascular access device selection, insertion, and management.

In recent years, peripherally inserted central catheters (PICCs) have become increasingly popular for venous access in pediatric hospital settings. Compared with traditional central v*e*nous catheters (CVCs), PICCs are associated with *less* risk of complications (including CLABSIs) and have proven to be more cost-effective. Despite these advantages, there are documented limitations and risks of PICC lines including: catheter occlusion, malpositioning, dislodgement, thrombophlebitis, and infection at the site of insertion. In addition, PICCs are associated with significant morbidities including bleeding, pneumothorax, thrombosis, arrhythmias.

An alternative to central lines or PICCs is a midline/extended dwell catheter. These catheters are termed "midlines" because they are longer than peripheral IV catheters, which are generally 1–15 inches long, and shorter than peripherally inserted central catheters (PICCs), which extend into the vena cava. Because they are not central, midlines/extended dwell catheters do not place patients at risk for the complications associated with central lines and are thus becoming a common option for delivery of infusates not requiring central venous access.
The purpose of this evidence-based project was to determine best practices for the indication and use of midline and extended dwell catheters to decrease vascular access complication and increase overall vessel health and preservation.

Search Strategies and Databases Reviewed:

- Databases searched for this review included CINAHL, Medline in EBSCO and Pub Med. Key search words: midline, extended dwell, peripheral access, ultrasound guided access, vancomycin, vessel preservation, infusions standards, neonatal vascular access, MAGIC guidelines, CLABSI, thrombus. These search yielded over 11,200 articles and narrowed down to approximately 50 based on relevance to the population of interest.
- Professional organizational websites reviewed included the Association for Vascular Access (AVA) and Infusion Nurses Society (INS), National Association of Neonatal Nurses (NANN).
- A listserv survey through AVA was sent via the pediatric special interest group to key children's hospitals across the nation regarding current practice and use of midlines and extended dwell in pediatric patients.

Synthesis of Evidence:

Guidelines	Midline versus Extended Dwell Recommendations	Other Recommendations
National Association of Neonatal Nurses (Wyckoff, & Sharpe, 2015).	Midlines as an alternative for those patients who do not require a PICC but do need several days of IV therapy (6-10 days),	For infants, site selection may include: Lower extremity veins (saphenous or popliteal vein) with tip termination below the groin Scalp veins (temporal or posterior auricular vein) with tip termination in the neck, above the thorax region
The Infusion Nurses Society (Gorski, et.all, 2016).	Defines a midline catheter as a catheter that is inserted into the upper arm with the internal tip located at the level or near the axilla distal to the shoulder; while extended dwell catheter is most commonly inserted below the anti-cubital area (see Figure 1). Consider midlines for infusion lasting (1-4wks) for medication and solutions with characteristics well tolerated in peripheral veins. Midline/EDC is used as a peripheral vascular access which should not be used for "continuous vesicant therapy, parenteral nutrition, or infusates with an osmolality greater than	Choose the appropriate type of vascular access device, peripheral or central, to accommodate the patient access needs. The selection should be based on prescribed therapy, treatment regiment, duration of tx., patients vascular characteristics, age, comorbidities, infusion history. Choose the right device is essential to providing safe and reliable vascular access as well as preserving the vasculature of the patient for future access needs.

	900 mOsm/L"22 including dextrose greater than 12.5% IV fluid, total parenteral nutrition greater than 900 mOsm/L, Recognize risk factors associated with infiltration and extravasation identified differences between vesicant, non-vesicant and irritant.	
Centers for Disease Control (CDC, 2017).	Use a midline catheter or peripheral inserted central catheter (PICC) instead of short peripheral catheter, when the duration of IV therapy exceed six days Category II.	
Michigan Appropriateness Guide for Intravenous Catheters (MAGIC). (Moureau, & Chopra, 2016).	Midlines preferred for patients requiring infusions up to 14 days, but may be used in a manner consistent with the clinically indicated removal of peripheral catheter	Midline catheters have lower phlebitis rates than peripheral catheters and lower rates of infection than other central catheters, with peripherally compatible solutions or medications where treatment will likely exceed 6 days. In hospital patients who are likely to require 14 days of intravenous antibiotics transition from peripheral to a Midline or PICC as soon as possible.
Renal Association Clinical Practice Guideline on Vascular Access for Hemodialysis Guideline. (Fluck, & Kumwenda, 2011).	Patients and health professionals should be educated about the preservation of veins in the forearm and for pre-dialysis care should form part of the care bundle	Preservation of peripheral veins for vascular access suggest that all patients that may require renal replacement therapy should have forearm vein preservation.
Central vascular access device guidelines for pediatric home-based patients: Driving best practices**.** (Wall, 2013).	Midline Catheter Available in single or double lumen Indicated for therapy between 5 days and up to 4 weeks.	Infuse peripheral solutions only, pH >5 and > 9, osmolality < 900mOsm/L. Do not infuse irritants, vesicants, and parenteral nutrition Avoid continuous infusion
Using the vessel health and preservation framework to enhance vein assessment and	The lumen diameter will determine flow rate. Some midline catheters will facilitate	Inserted at or just above the antecubital fossa, usually inserted into the basilic, brachial

vascular access device selection. (Shaw, 2017).	blood withdrawal Suitable for IV therapy of 1-4 weeks. The same restrictions on pH and osmolarity is place for midline and extended catheters as for peripheral catheters.	or cephalic veins. Ultrasound or other vein visualization technology to aid vein location is recommended Does not require X-ray confirmation of tip location because the tip does not extend further than the axillary vein.

- Power Wand Trial (CHOC Children's Hospital, 2017-2018) 20 catheters placed for:
    - Antibiotics
    - Factor administration
    - Fluid replacement
    - PPN
    - Apheresis
        - Catheters lasted 4-16 days, with one patient lasting 2 months.
- Choosing the appropriate vascular access device improves patient care, decreases costs, improves patient safety, and improves patient satisfaction. Evidence based practice and research can be used to educate and guide vascular access nurses in selecting the most appropriate vascular access device for each and every patient (Gorski et al., 2016).
- If clinically indicated, central lines should be placed using ultrasound guidance and maintained in accordance with CDC guidelines and INS standards. Best practice also includes collecting and reporting performance data on bundle elements to benchmark against other organizations and drive improvement. (Gorski, et.all, 2016).
- Extended dwell catheters have a reported dwell time of seven to fourteen days, midline catheters have a longer dwell time of up to 6 weeks, compared with 96 hours for short peripheral catheters. The same restrictions on pH and osmolarity is place for midline and extended catheters as for peripheral catheters. (Gorski, et.all, 2016), (Wall, 2013), (Wyckoff, & Sharpe, 2015).
- Commonly inserted in upper extremity (basilic, cephalic, or brachial vein) with tip termination distal to shoulder. For infants, site selection may include:
    - A. Lower extremity veins (saphenous or popliteal vein) with tip termination below the groin
    - B. Scalp veins (temporal or posterior auricular vein) with tip termination in the neck, above the thorax region. (Wyckoff, & Sharpe, 2015). (Gorski, et.all, 2016).

Practice Recommendations:

Indications leading to the selection of a midline device:

- Patients with DIVA score of 4+ being recognized allowing for best vascular access selection. (Riker, et al. 2011)
- Requirement for intravenous medications more than a few days (i.e., 4-5 days), (Wall 2013).
- Frequent blood draws with poor access. (Moureau, & Chopra, 2016).
- Renal failure and pre-renal patients. (Fluck, & Kumwenda, 2011),
- CVAD no longer indicated with continuing vascular access. (Moureau, & Chopra, 2016)
- Continuous infusions, hydrating. (Doellman, May 2017)

- Isotonic, lower osmolarity infusion (<900 mOsm/L) (Infusion Therapy Standards of Practice 2016), (Wyckoff, & Sharpe, 2015).
- Antibiotic agents appropriate for peripheral infusion. Infusion Therapy Standards of Practice 2016)
- Heparin, steroid, antacids, sedation, and analgesia/pain medication infusions
- Treatments requiring extended dwell without need of central venous access. (Moureau, & Chopra, 2016), (Wyckoff, & Sharpe, 2015).
- Therapies that extend longer than 6 days or require reliable access. (Moureau, & Chopra, 2016), (Infusion Therapy Standards of Practice, 2016), (Wyckoff, & Sharpe, 2015).

Plan for implementation

1. Provide opportunities for product evaluation to allow PICC/VA team to evaluate available sizes and catheter material (silicon, polyurethane or polycarbonate urethane).
2. Develop a vascular access decision guide based on MICHIGAN guidelines/INS/NANN/CDC current recommendations.
3. Collaborate with Alliance for Vascular Access Teaching and Research (AVATAR group, Dr Ullman)/ Association of Vascular Access (AVA)/ Pediatric Special Interest Group (PediSIG) to develop mini-MAGIC guidelines
4. Development or use of mini-MAGIC App once available
5. Update and adjust order-set to include the reason for the line
6. Update Medication venous infusion extravasation risk to be most current
7. Update current policy (PICC to include midline/EDC)
8. Policy for care and maintenance of midline/EDC
9. Collect midline and extended dwell catheter data from CHOC Children's PICC team documentation
    a. Vessel size
    b. Medication
    c. Complication
    d. Therapy completion/Not completed

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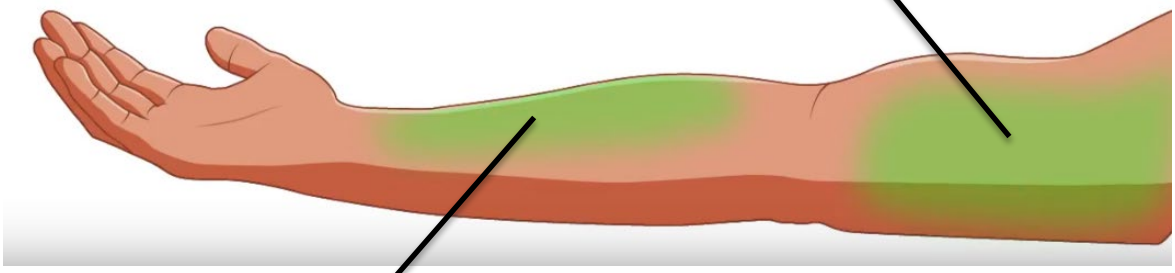
Figure 1

Midline Catheter Placement:
A catheter inserted into the upper arm via the basilic, cephalic, or brachial vein, with the internal tip located level at or near the level of the axilla and distal to the shoulder.

- **Above AC vessel depth 0.25-0.75cm**
- **Catheter length 8-20cm**
- **Lasting 1-29 days**



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Extended Dwell Catheter Placement:
An extended dwell peripheral IV is inserted most commonly into the basilic, brachial, or cephalic veins, usually inserted below AC

- **Lower arm vessel depth 0.25-0.75cm**
- **Catheter length 3-6cm**
- **Lasting 1-14 days**