Scelta corretta tra PICC e Midline

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Come scegliere tra PICC e Midline?

- Tipologia di infusioni?
- Caratteristiche della molecola da infondere (pH, osmolarità?)
- Tempo di permanenza previsto?
- Tasso di complicanze (infezioni, trombosi)?

CDC Guidelines 2011

Guidelines for the Prevention of Intravascular Catheter-Related Infections, 2011

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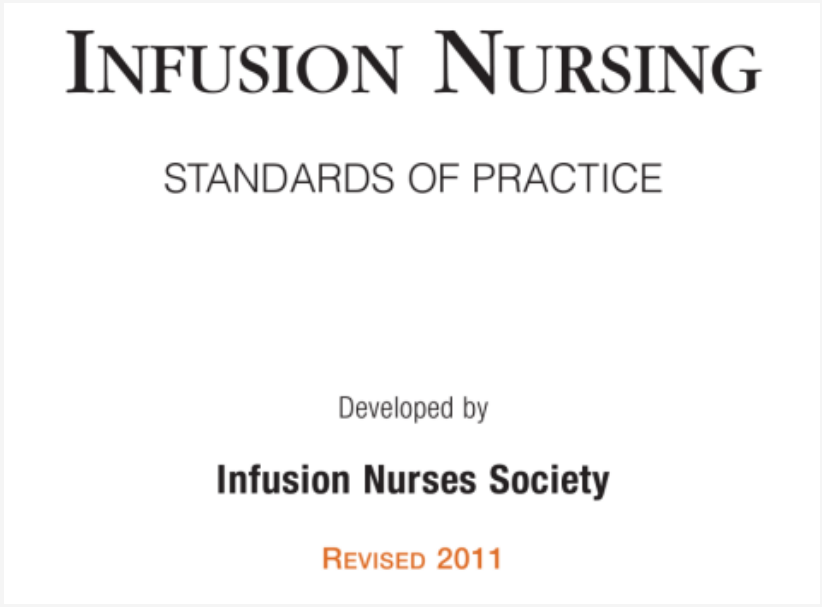
Selection of Catheters and Sites

Peripheral Catheters and Midline Catheters

1. In adults, use an upper-extremity site for catheter insertion. Replace a catheter inserted in a lower extremity site to an upper extremity site as soon as possible. Category II
2. In pediatric patients, the upper or lower extremities or the scalp (in neonates or young infants) can be used as the catheter insertion site [32, 33]. Category II
3. Select catheters on the basis of the intended purpose and duration of use, known infectious and non-infectious complications (e.g., phlebitis and infiltration), and experience of individual catheter operators [33–35]. Category IB
4. Avoid the use of steel needles for the administration of fluids and medication that might cause tissue necrosis if extravasation occurs [33, 34]. Category IA
5. Use a midline catheter or peripherally inserted central catheter (PICC), instead of a short peripheral catheter, when the duration of IV therapy will likely exceed six days. Category II

Indicazioni ad accesso venoso periferico (SPC o Midline – INS 2011)



32. VASCULAR ACCESS DEVICE SELECTION

Standard

32.1 Indications and protocols for vascular access devices (VADs) shall be established in organizational policies, procedures, and/or practice guidelines and according to manufacturers' directions for use.
32.2 The nurse shall select the appropriate type of catheter (peripheral or central) to accommodate the patient's vascular access needs based on the prescribed therapy or treatment regimen, length of treatment, duration of dwell, vascular integrity, patient preference, and ability and resources available to care for the device.
32.3 The catheter selected shall be of the smallest gauge and length with the fewest number of lumens and shall be the least invasive device needed to accommodate and manage the prescribed therapy.
32.4 The nurse shall not alter the vascular access device outside the manufacturer's directions for use.

Practice Criteria

I. Short Peripheral Catheters

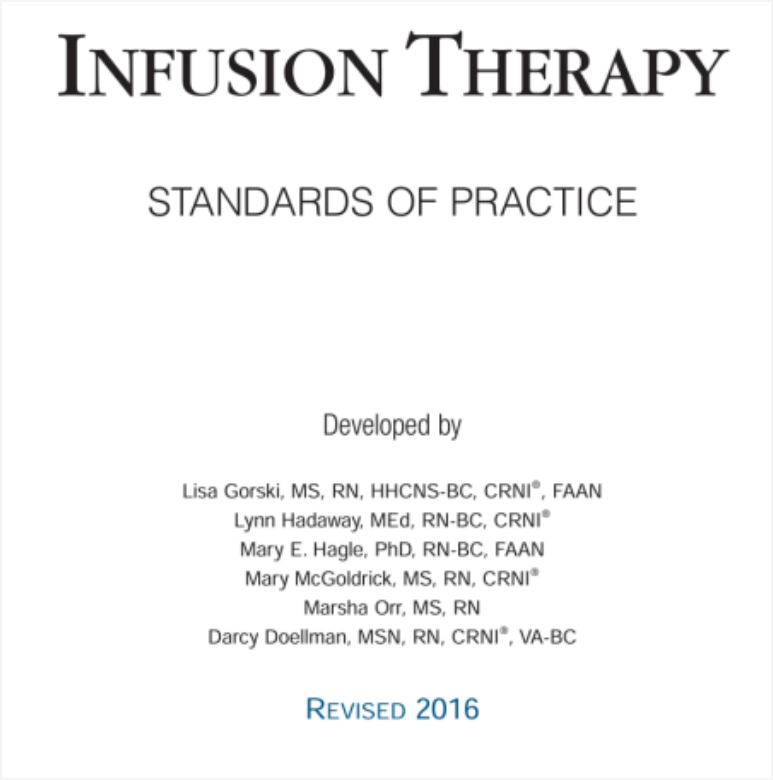
A. The nurse should select a short peripheral catheter based on prescribed therapies, duration of treatment (usually for treatments of less than 1 week), availability of peripheral vascular access sites, diagnosis, known complications of the device, and the inserter's experience.[1-9] (V)
B. A short peripheral catheter comes in a variety of gauge sizes (ie, 14-27); winged or nonwinged; single or double lumen; or over-the-needle catheters.
D. The use of steel winged devices should be limited to short-term or single-dose administration.[13,14] (V)
E. Therapies not appropriate for short peripheral catheters include continuous vesicant therapy, parenteral nutrition, infusates with pH less than 5 or greater than 9, and infusates with an osmolality greater than 600 mOsm/L. The nurse should collaborate with the pharmacist and the licensed independent practitioner (LIP) to assist in selection of the most appropriate vascular access device based on a projected treatment plan.[5,6,13,14,18-24] (IV)
F. Peripheral administration of parenteral nutrition via a short peripheral catheter should be used with caution in adults.[21,22] (IV)
G. The nurse should be aware that a short peripheral catheter of 14-24 gauge for adults and 22-24 gauge for pediatric or neonates can generally be used for administration of blood or blood products.[11,12,16] (V)

Practice Criteria

II. Midline Catheters

A. The nurse should consider selection of midline catheters for therapies anticipated to last 1-4 weeks. Reported dwell time for midline catheters in neonates is 6-10 days.[9,10,16,25,26] (V)
B. A midline catheter should be used for hydration, intravenous solutions, pain medications, and some antibiotics. Therapies not appropriate for midline catheters include continuous vesicant therapy, parenteral nutrition, infusates with pH less than 5 or greater than 9, and infusates with an osmolality greater than 600 mOsm/L.[9,13,14] (V)

Indicazioni ad accesso venoso periferico (SPC o Midline – INS 2016)



INFUSION THERAPY

STANDARDS OF PRACTICE

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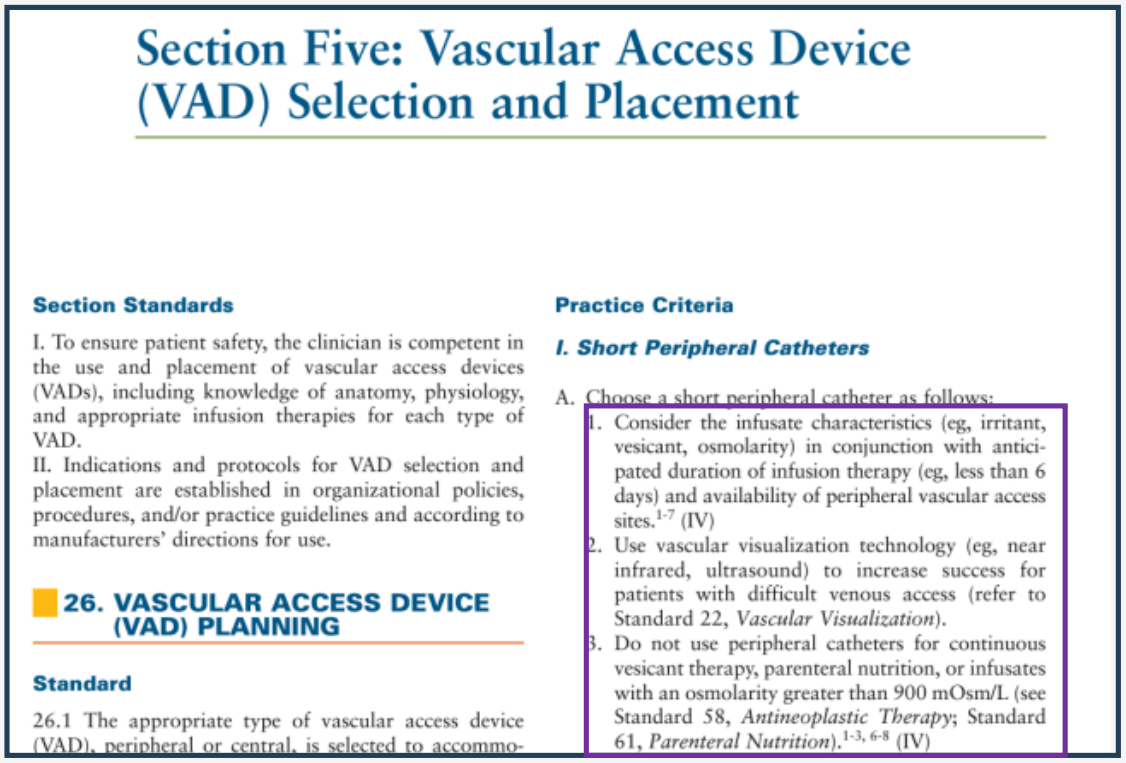


Section Five: Vascular Access Device (VAD) Selection and Placement

Section Standards

I. To ensure patient safety, the clinician is competent in the use and placement of vascular access devices (VADs), including knowledge of anatomy, physiology, and appropriate infusion therapies for each type of VAD.
II. Indications and protocols for VAD selection and placement are established in organizational policies, procedures, and/or practice guidelines and according to manufacturers' directions for use.

26. VASCULAR ACCESS DEVICE (VAD) PLANNING

Standard

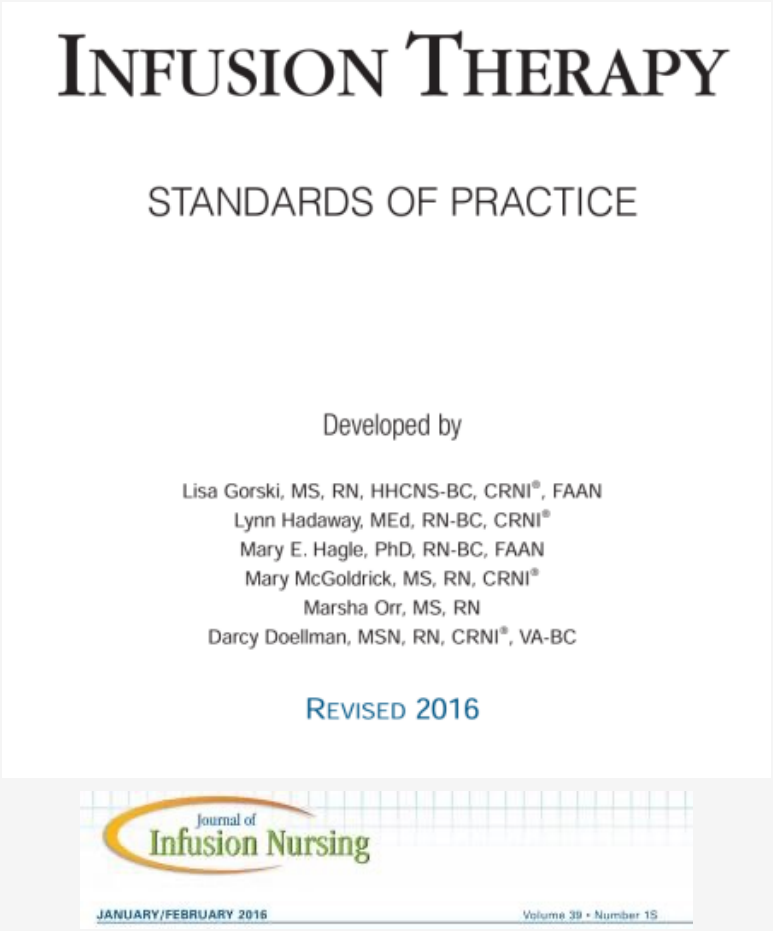
26.1 The appropriate type of vascular access device (VAD), peripheral or central, is selected to accommo-

Practice Criteria

I. Short Peripheral Catheters

A. Choose a short peripheral catheter as follows:
1. Consider the infusate characteristics (eg, irritant, vesicant, osmolarity) in conjunction with anticipated duration of infusion therapy (eg, less than 6 days) and availability of peripheral vascular access sites.[1-7] (IV)
2. Use vascular visualization technology (eg, near infrared, ultrasound) to increase success for patients with difficult venous access (refer to Standard 22, *Vascular Visualization*).
3. Do not use peripheral catheters for continuous vesicant therapy, parenteral nutrition, or infusates with an osmolarity greater than 900 mOsm/L (see Standard 58, *Antineoplastic Therapy*; Standard 61, *Parenteral Nutrition*).[1-3, 6-8] (IV)

Indicazioni ad accesso venoso periferico (SPC o Midline – INS 2016)

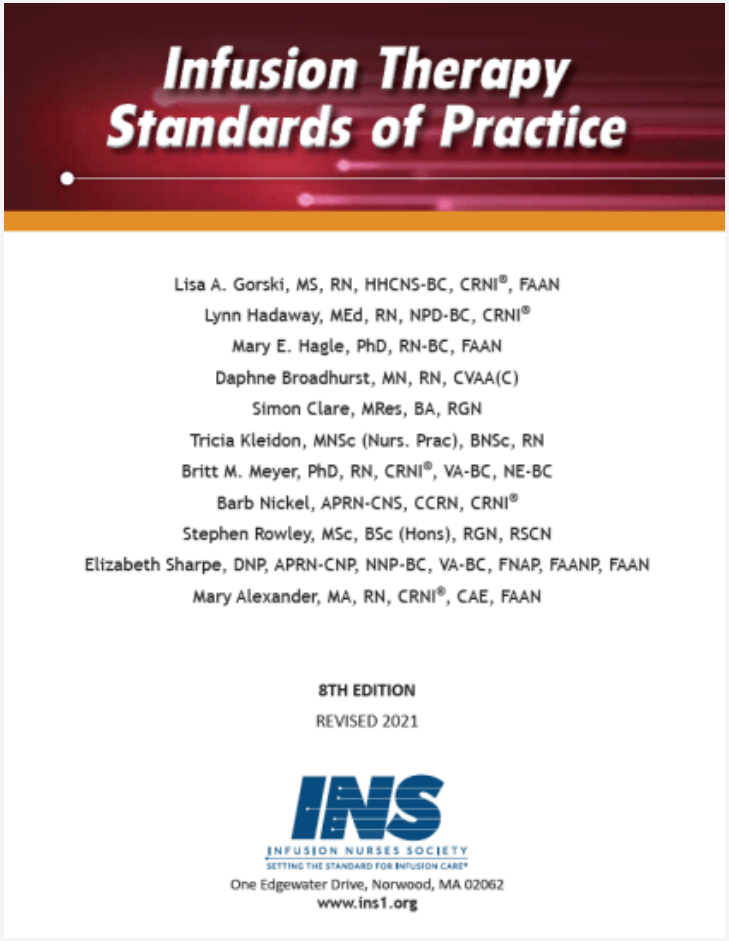


II. Midline Catheters

A. Choose a midline catheter as follows:

1. Consider infusate characteristics in conjunction with anticipated duration of treatment (eg, 1-4 weeks).[1-3,5] (IV)
2. Consider a midline catheter for medications and solutions such as antimicrobials, fluid replacement, and analgesics with characteristics that are well tolerated by peripheral veins.[11-14] (V)
3. Do not use midline catheters for continuous vesicant therapy, parenteral nutrition, or infusates with an osmolarity greater than 900 mOsm/L (see Standard 61, *Parenteral Nutrition*).[1-3, 6,11] (V)
4. Use caution with intermittent vesicant administration due to risk of undetected extravasation. The administration of vancomycin for less than 6 days through a midline catheter was found to be safe in 1 study.[1-3, 15] (IV)
5. Avoid the use of a midline catheter when the patient has a history of thrombosis, hypercoagulability, decreased venous flow to the extremities, or end-stage renal disease requiring vein preservation.[1,16-17] (IV)

Indicazioni ad accesso venoso periferico (SPC o Midline – INS 2021)



Infusion Therapy Standards of Practice

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Section Five: Vascular Access Device Selection and Placement

Section Standards

I. Insertion and removal of vascular access devices (VADs) are performed by providers/clinicians within the boundaries of their identified scope of practice, based on their licensure, upon documented competency, and in accordance with organizational policies, procedures, and/or practice guidelines.
II. Indications and protocols for VAD selection and insertion are established in organizational policies, procedures, and/or practice guidelines and according to manufacturers' directions for use.

KEY DEFINITIONS

Peripheral intravenous catheters (PIVCs): are inserted into and reside in veins of the periphery that includes all extremities, the external jugular vein, and scalp veins in neonates. PIVCs are inserted into superficial veins located just under the skin in the superficial tissue, as well as deep veins located under the muscle tissue.

INS categorizes 3 types of PIVCs:

Short peripheral intravenous catheter (short PIVC): an over-the-needle catheter with a hollow metal stylet (needle) positioned inside the catheter, generally inserted in superficial veins.
Long peripheral intravenous catheter (long PIVC): inserted in either superficial or deep peripheral veins and offers an option when a short PIVC is not long enough to adequately cannulate the available vein. A long PIVC can be inserted via traditional over-the-needle technique or with more advanced procedures, such as Seldinger and accelerated Seldinger techniques.
Midline catheter: inserted into a peripheral vein of the upper arm via the basilic, cephalic, or brachial vein with the terminal tip located at the level of the axilla in children and adults; for neonates, in addition to arm veins, midline catheters may be inserted via a scalp vein with the distal tip located in the jugular vein above the clavicle or in the lower extremity with the distal tip located below the inguinal crease.

26. VASCULAR ACCESS DEVICE PLANNING

Standard

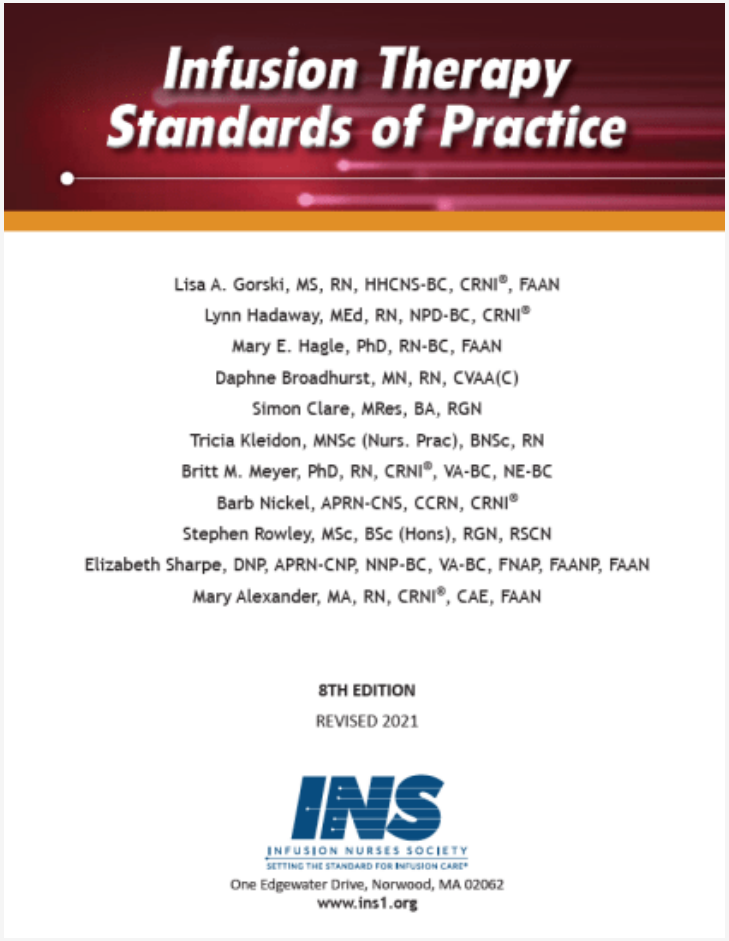
26.1 Infusion therapy is initiated based on the patient's diagnosis, review of alternative routes of therapy, and consideration of the risks versus the benefits of various treatment modalities.
26.2 The appropriate type of VAD, peripheral or central, is selected to accommodate the patient's vascular access needs based on the prescribed therapy or treatment regimen, including anticipated duration of therapy, vascular characteristics, patient's age, comorbidities, history of infusion therapy, preference for VAD type and location, and ability and resources available to care for the device.
26.3 Selection of the most appropriate VAD occurs at the earliest opportunity and is a collaborative process among the health care team, the patient, and the patient's caregiver(s).
26.4 The least invasive VAD with the smallest outer diameter and fewest number of lumens needed for the prescribed therapy is selected.
26.5 Vessel health and preservation are prioritized when planning vascular access.

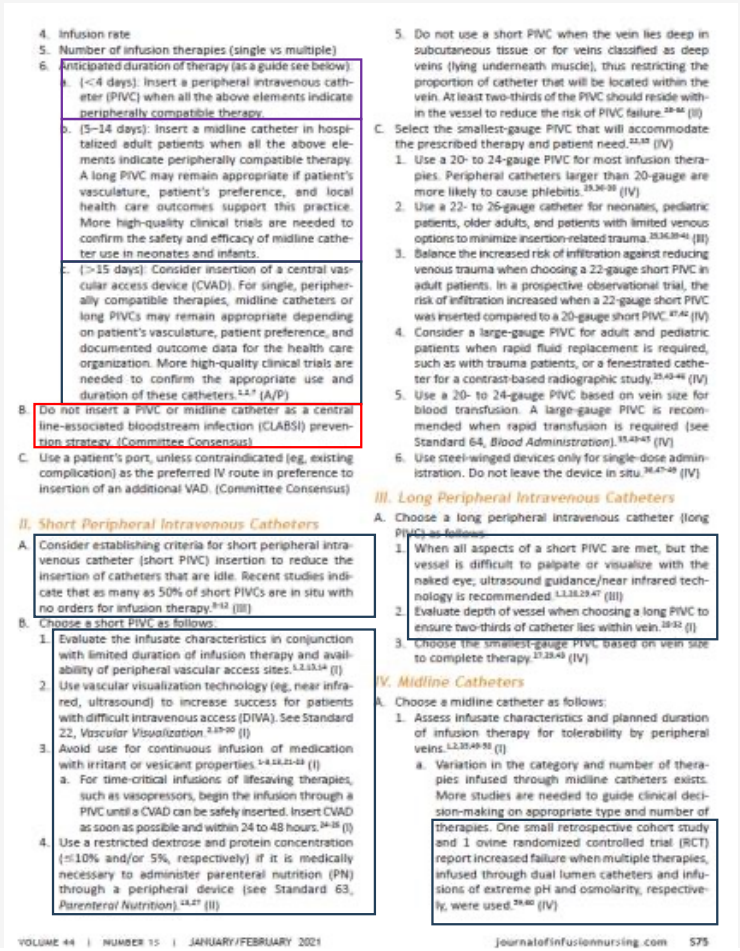
Practice Recommendations

I. General

A. Collaborate with an interprofessional team to identify medications that should and should not be given through peripheral veins. Peripheral parenteral therapy should ideally be isotonic and of physiological pH. When this is not achievable, peripheral intravenous (IV) infusion of extremes of pH and osmolarity should be avoided to reduce vascular endothelial damage. In clinical practice, many parameters, including administration site, number of infusion therapies, vein selected, related venous blood flow, infusion volume, infusion time, and planned duration of therapy, contribute to vessel damage. There is no well-defined and generally recognized pH or osmolarity limit. Factors to consider include, but are not limited to[1-6]: (A/P)
   1. Diluent used to dilute medications to provide the final osmolarity of IV infusion
   2. pH of infusate
   3. Method of administration (eg, continuous or intermittent infusion or manual injection [ie, IV push])

Indicazioni ad accesso venoso periferico (SPC o Midline – INS 2021)





4. Infusion rate
5. Number of infusion therapies (single vs multiple)
6. Anticipated duration of therapy (as a guide see below):
   a. (<4 days): Insert a peripheral intravenous catheter (PIVC) when all the above elements indicate peripherally compatible therapy.
   b. (5–14 days): Insert a midline catheter in hospitalized adult patients when all the above elements indicate peripherally compatible therapy. A long PIVC may remain appropriate if patient's vasculature, patient's preference, and local health care outcomes support this practice. More high-quality clinical trials are needed to confirm the safety and efficacy of midline catheter use in neonates and infants.
   c. (>15 days): Consider insertion of a central vascular access device (CVAD). For single, peripherally compatible therapies, midline catheters or long PIVCs may remain appropriate depending on patient's vasculature, patient preference, and documented outcome data for the health care organization. More high-quality clinical trials are needed to confirm the appropriate use and duration of these catheters.[1,2,7] (A/P)

B. Do not insert a PIVC or midline catheter as a central line–associated bloodstream infection (CLABSI) prevention strategy. (Committee Consensus)

C. Use a patient's port, unless contraindicated (eg, existing complication) as the preferred IV route in preference to insertion of an additional VAD. (Committee Consensus)

II. Short Peripheral Intravenous Catheters

A. Consider establishing criteria for short peripheral intravenous catheter (short PIVC) insertion to reduce the insertion of catheters that are idle. Recent studies indicate that as many as 50% of short PIVCs are in situ with no orders for infusion therapy.[8-12] (III)

B. Choose a short PIVC as follows:
   1. Evaluate the infusate characteristics in conjunction with limited duration of infusion therapy and availability of peripheral vascular access sites.[1,2,13,14] (I)
   2. Use vascular visualization technology (eg, near infrared, ultrasound) to increase success for patients with difficult intravenous access (DIVA). See Standard 22, *Vascular Visualization*.[2,15-20] (I)
   3. Avoid use for continuous infusion of medication with irritant or vesicant properties.[1-4,18,21-23] (I)
      a. For time-critical infusions of lifesaving therapies, such as vasopressors, begin the infusion through a PIVC until a CVAD can be safely inserted. Insert CVAD as soon as possible and within 24 to 48 hours.[24-26] (I)
   4. Use a restricted dextrose and protein concentration (≤10% and/or 5%, respectively) *if it is* medically necessary to administer parenteral nutrition (PN) through a peripheral device (see Standard 63, *Parenteral Nutrition*).[18,27] (II)
   5. Do not use a short PIVC when the vein lies deep in subcutaneous tissue or for veins classified as deep veins (lying underneath muscle), thus restricting the proportion of catheter that will be located within the vein. At least two-thirds of the PIVC should reside within the vessel to reduce the risk of PIVC failure.[28-34] (III)

C. Select the smallest-gauge PIVC that will accommodate the prescribed therapy and patient need.[22,35] (IV)
   1. Use a 20- to 24-gauge PIVC for most infusion therapies. Peripheral catheters larger than 20-gauge are more likely to cause phlebitis.[29,36-38] (IV)
   2. Use a 22- to 26-gauge catheter for neonates, pediatric patients, older adults, and patients with limited venous options to minimize insertion-related trauma.[29,36,38-41] (III)
   3. Balance the increased risk of infiltration against reducing venous trauma when choosing a 22-gauge short PIVC in adult patients. In a prospective observational trial, the risk of infiltration increased when a 22-gauge short PIVC was inserted compared to a 20-gauge short PIVC.[37,42] (IV)
   4. Consider a large-gauge PIVC for adult and pediatric patients when rapid fluid replacement is required, such as with trauma patients, or a fenestrated catheter for a contrast-based radiographic study.[25,43-46] (IV)
   5. Use a 20- to 24-gauge PIVC based on vein size for blood transfusion. A large-gauge PIVC is recommended when rapid transfusion is required (see Standard 64, *Blood Administration*).[25,43-45] (IV)
   6. Use steel-winged devices only for single-dose administration. Do not leave the device in situ.[36,47-49] (IV)

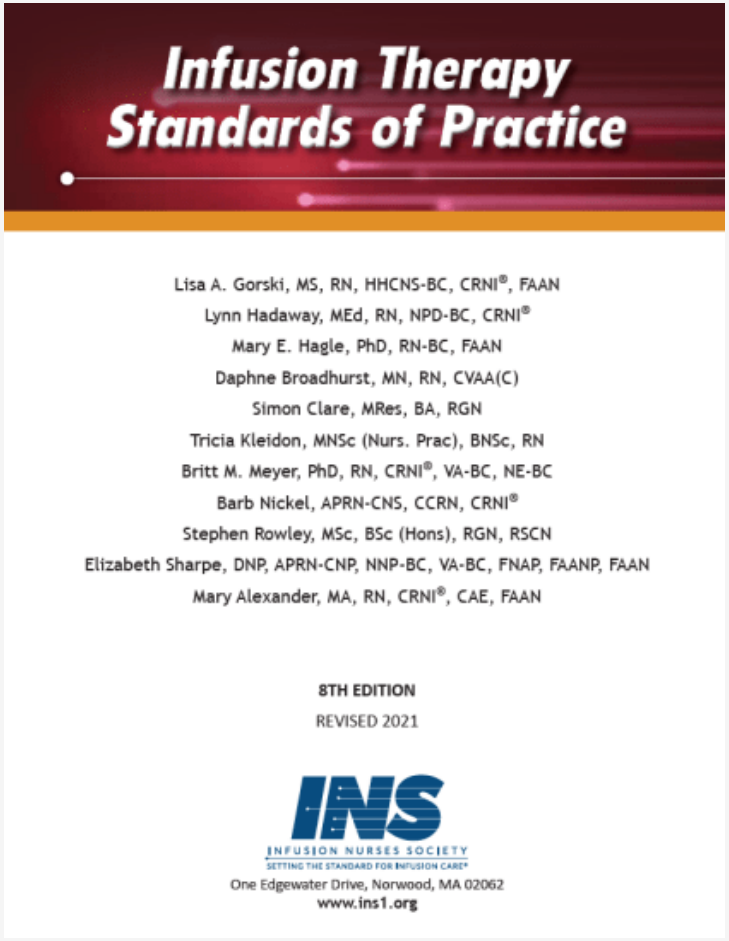
III. Long Peripheral Intravenous Catheters

A. Choose a long peripheral intravenous catheter (long PIVC) as follows:
   1. When all aspects of a short PIVC are met, but the vessel is difficult to palpate or visualize with the naked eye; ultrasound guidance/near infrared technology is recommended.[1,2,18,23,47] (III)
   2. Evaluate depth of vessel when choosing a long PIVC to ensure two-thirds of catheter lies within vein.[20-32] (I)
   3. Choose the smallest-gauge PIVC based on vein size to complete therapy.[17,23,43] (IV)

IV. Midline Catheters

A. Choose a midline catheter as follows:
   1. Assess infusate characteristics and planned duration of infusion therapy for tolerability by peripheral veins.[1,2,35,49-51] (I)
      a. Variation in the category and number of therapies infused through midline catheters exists. More studies are needed to guide clinical decision-making on appropriate type and number of therapies. One small retrospective cohort study and 1 ovine randomized controlled trial (RCT) report increased failure when multiple therapies, infused through dual lumen catheters and infusions of extreme pH and osmolarity, respectively, were used.[39,60] (IV)

Indicazioni ad accesso venoso periferico (SPC o Midline – INS 2021)



2. Use a midline catheter for medications and solutions such as antimicrobials, fluid replacement, and analgesics with characteristics that are well-tolerated by peripheral veins.[1,2,52] (I)
3. Assess the clinical benefit of using a midline catheter that inhibits bacterial attachment and biofilm formation.[61,62] (IV)
4. Do not use midline catheters for continuous vesicant therapy, PN, or infusates with extremes of pH or osmolarity (see Standard 63, *Parenteral Nutrition*).[2,13,51,52,63] (I)
5. Increase catheter site surveillance when administering intermittent infusions of known irritants and vesicants due to increased risk of phlebitis or extravasation.[52,64,65] (III)
   a. Evaluate the risk and benefit of intermittently infusing vesicant medication for more than 6 days.[59,60,66] (IV)
   b. Further research is needed to establish the safety of using midline catheters for intermittent vesicant therapy and as a strategy for reducing catheter-associated bloodstream infection (CABSI). Some midline catheters have been associated with bloodstream infection (BSI) rates similar to those of central venous catheters.[67,68] (IV)
6. Avoid the use of a midline catheter when the patient has a history of thrombosis, hypercoagulability, decreased venous flow to the extremities, or end-stage renal disease requiring vein preservation.[7,52,53,69] (III)

MAGIC, Annals of Internal Medicine 2015

Annals of Internal Medicine SUPPLEMENT

The Michigan Appropriateness Guide for Intravenous Catheters (MAGIC): Results From a Multispecialty Panel Using the RAND/UCLA Appropriateness Method

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Use of peripherally inserted central catheters (PICCs) has grown substantially in recent years. Increasing use has led to the realization that PICCs are associated with important complications, including thrombosis and infection. Moreover, some PICCs may not be placed for clinically valid reasons. Defining appropriate indications for insertion, maintenance, and care of PICCs is thus important for patient safety.

An international panel was convened that applied the RAND/UCLA Appropriateness Method to develop criteria for use of PICCs. After systematic reviews of the literature, scenarios related to PICC use, care, and maintenance were developed according to patient population (for example, general hospitalized, critically ill, cancer, kidney disease), indication for insertion (infusion of peripherally compatible infusates vs. vesicants), and duration of use (≤5 days, 6 to 14 days, 15 to 30 days, or ≥31 days). Within each scenario, appropriateness of PICC use was compared with that of other venous access devices.

After review of 665 scenarios, 253 (38%) were rated as appropriate, 124 (19%) as neutral/uncertain, and 288 (43%) as inappropriate. For peripherally compatible infusions, PICC use was rated as inappropriate when the proposed duration of use was 5 or fewer days. Midline catheters and ultrasonography-guided peripheral intravenous catheters were preferred to PICCs for use between 6 and 14 days. In critically ill patients, nontunneled central venous catheters were preferred over PICCs when 14 or fewer days of use were likely. In patients with cancer, PICCs were rated as appropriate for irritant or vesicant infusion, regardless of duration.

The panel of experts used a validated method to develop appropriate indications for PICC use across patient populations. These criteria can be used to improve care, inform quality improvement efforts, and advance the safety of medical patients.

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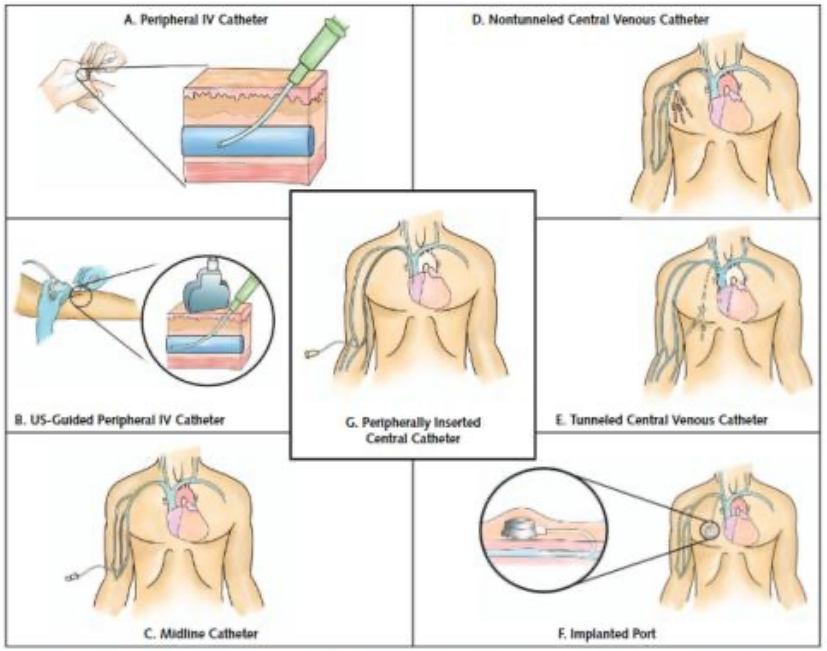
MAGIC, Annals of Internal Medicine 2015

Figure 1. Vascular access devices reviewed to formulate appropriateness ratings.



IV = intravenous; US = ultrasonography. A. Peripheral IV catheter. These devices are typically 3 to 6 cm, enter and terminate in the peripheral veins (cross-section), and are often placed in the upper extremity in veins of the hand. B. US-guided peripheral IV catheter. Ultrasonography may be used to facilitate placement of peripheral intravenous catheters in arm veins that are difficult to palpate or visualize. "Long" peripheral IV catheters (typically ≥8 cm) that are specifically designed to reach deeper veins are also available for insertion under US guidance. C. Midline catheter. These devices are 7.5 to 25 cm in length and are typically inserted in veins above the antecubital fossa. The catheter tip resides in the basilic or cephalic vein, terminating just short of the subclavian vein. These devices cannot accommodate irritant or vesicant infusions. D. Nontunneled central venous catheter. Also referred to as "acute" or "short-term" central venous catheters, these are often inserted for durations of 7 to 14 d. They are typically 15 to 25 cm and are placed via direct puncture and cannulation of the internal jugular, subclavian, or femoral veins. E. Tunneled central venous catheter. These differ from nontunneled catheters in that the insertion site on the skin and site of ultimate venipuncture are physically separated, often by several centimeters, reducing the risk for bacterial entry into the bloodstream and facilitating optimal location of the catheter for care of the exit site. Tunneled devices may be cuffed or noncuffed; the former devices have a polyethylene or silicone flange that anchors the catheter within the subcutaneous tissue and limits entry of bacteria along the extraluminal surface of the device. F. Implanted port. Ports are implanted in the subcutaneous tissue of the chest and feature a reservoir for injection or aspiration (inset) and a catheter that communicates from the reservoir to a deep vein of the chest, thus providing central venous access. Ports are cosmetically more desirable than other types of central venous catheter and can remain in place for months or years. G. Peripherally inserted central catheter. These long vascular access devices (>45 cm) are inserted into peripheral veins of the upper arm in adults and advanced so that the tip of the catheter resides in the lower portion of the superior vena cava or upper portion of the right atrium. They are similar to central venous catheters in that they provide access to the central circulation, but they do so without the insertion risks associated with direct puncture of deep veins in the neck, chest, or groin.

MAGIC, Annals of Internal Medicine 2015

Figure 3. Venous access device recommendations for infusion of peripherally compatible infusate.

Device Type	Proposed Duration of Infusion			
	≤5 d	6–14 d	15–30 d	≥31 d
Peripheral IV catheter	No preference between peripheral IV and US-guided peripheral IV catheters for use ≤5 d			
US-guided peripheral IV catheter	US-guided peripheral IV catheter preferred to peripheral IV catheter if proposed duration is 6–14 d			
Nontunneled/acute central venous catheter	Central venous catheter preferred in critically ill patients or if hemodynamic monitoring is needed for 6–14 d			
Midline catheter	Midline catheter preferred to PICC if proposed duration is ≤14 d			
PICC		PICC preferred to midline catheter if proposed duration of infusion is ≥15 d		
Tunneled catheter				PICC preferred to tunneled catheter and ports for infusion 15–30 d
Port				

Appropriate | Neutral | Inappropriate | Disagreement

IV = intravenous; PICC = peripherally inserted central catheter; US = ultrasonography.

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European recommendations on the proper indication and use of peripheral venous access devices (the ERPIUP consensus): A WoCoVA project

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ERPIUP, Journal of Vascular Access 2021

Table 1. Summary of recommendations.

Definition and classification

Peripheral VADs are defined as catheters whose tip is located in the venous system but outside the superior vena cava, the right atrium and the inferior vena cava.

On the basis of their length, they can be classified as (a) short peripheral catheters (SPC) (< 6 cm); (b) long peripheral catheters (LPC) (6–15 cm); (c) midline catheters or "midclavicular" (MC) (>15 cm). SPC may be further classified as "simple" or "integrated", on the basis of their design and material.

Indications

PVADs are indicated in the following circumstances: (a) Short to medium term infusion of peripherally compatible solutions (intravenous solutions with pH 5–9; drugs with osmolarity <600 mOsm/L; parenteral nutrition with osmolarity <800–850 mOsm/L; any drug or solution not associated with potential endothelial damage). (b) Apheresis/ultrafiltration, but only in specific situations and using specific devices.

PVADs are contraindicated in the following circumstances: infusion of vesicant drugs or prolonged infusion (>30 min) of peripherally incompatible solutions; repeated daily blood sampling; hemodialysis; need for hemodynamic monitoring; need for long term intravenous access (>3–4 months).

The indications for specific PVADs are mainly based on the expected duration of treatment: SPC are appropriate for emergency and/or short duration access (24–48 h); "integrated" SPC are appropriate for non-emergency access, when the expected duration is 2–7 days; LPC are appropriate in DIVA patients, or when expected duration is 1–4 weeks; MCs are appropriate when expected duration > 4 weeks.

Raccomandazioni GAVeCeLT, www.gavecelt.it 2021

GAVeCeLT
Gli Accessi Venosi Centrali a Lungo Termine

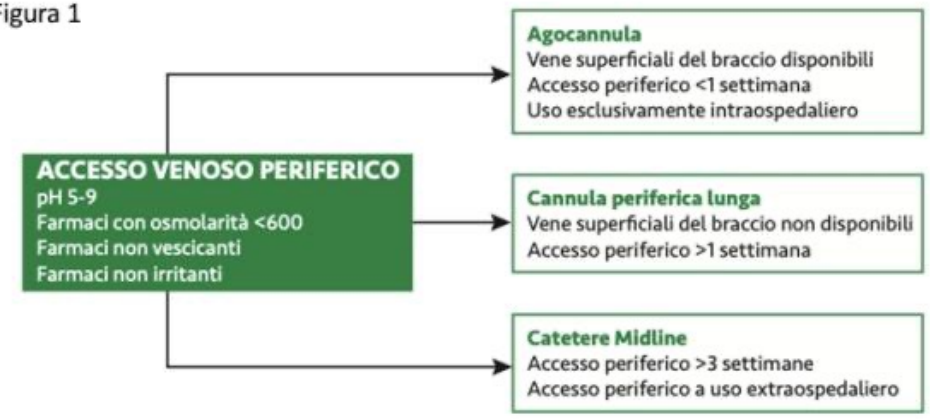
RACCOMANDAZIONI GAVeCeLT 2021
PER LA INDICAZIONE, L'IMPIANTO E LA GESTIONE
DEI DISPOSITIVI PER ACCESSO VENOSO

a cura di Mauro Pittiruti e Giancarlo Scoppettuolo

Da quanto detto sopra si evince che la corretta indicazione ad un accesso venoso centrale si ha nei seguenti casi:

1. necessità di infusione di farmaci con pH <5 o >9 o vescicanti o comunque non compatibili con la via venosa periferica;
2. necessità di nutrizione parenterale (con la possibile eccezione di brevi trattamenti con nutrizione parenterale a base lipidica e comunque con osmolarità < 800 mOsm/litro)
3. necessità di emodialisi;
4. necessità di ripetuti prelievi ematici;
5. necessità di monitoraggio emodinamico.

Figura 1



Cawcutt, Infect Contr Hosp Epidemiol 2019

Infection Control & Hospital Epidemiology (2019), **40**, 674–680
doi:10.1017/ice.2019.49

Review

Optimizing vascular-access device decision-making in the era of midline catheters

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Abstract

This narrative review addresses vascular access device choice from peripheral intravenous catheters through central venous catheters, including the evolving use of midline catheters. The review incorporates best practices, published algorithms, and complications extending beyond CLABSI and phlebitis to assist clinicians in navigating complex vascular access decisions.

(Received 6 December 2018; accepted 20 February 2019)

Cawcutt, Infect Contr Hosp Epidemiol 2019

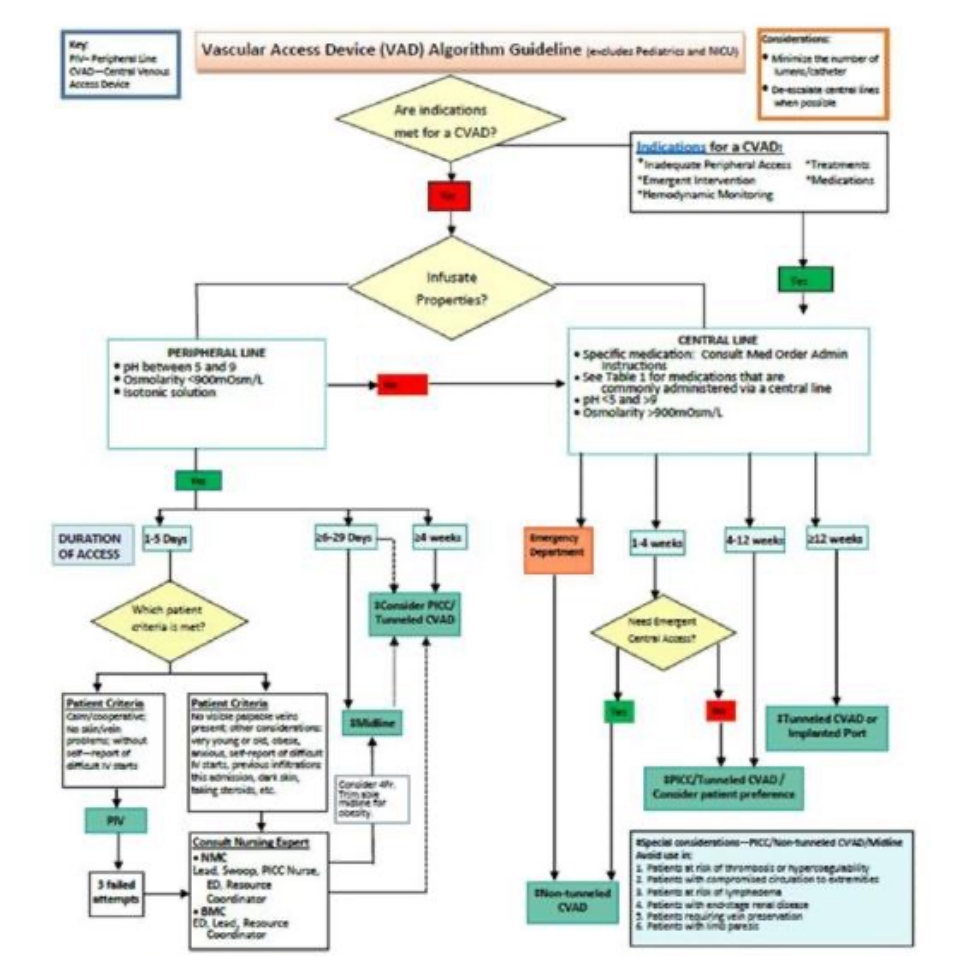

Fig. 3. Nebraska Medicine vascular access algorithm.

Raccomandazioni Farmacisti Spagnoli, Drugs in R&D, 2020

Drugs in R&D
https://doi.org/10.1007/s40268-020-00329-w

ORIGINAL RESEARCH ARTICLE

Standardization and Chemical Characterization of Intravenous Therapy in Adult Patients: A Step Further in Medication Safety

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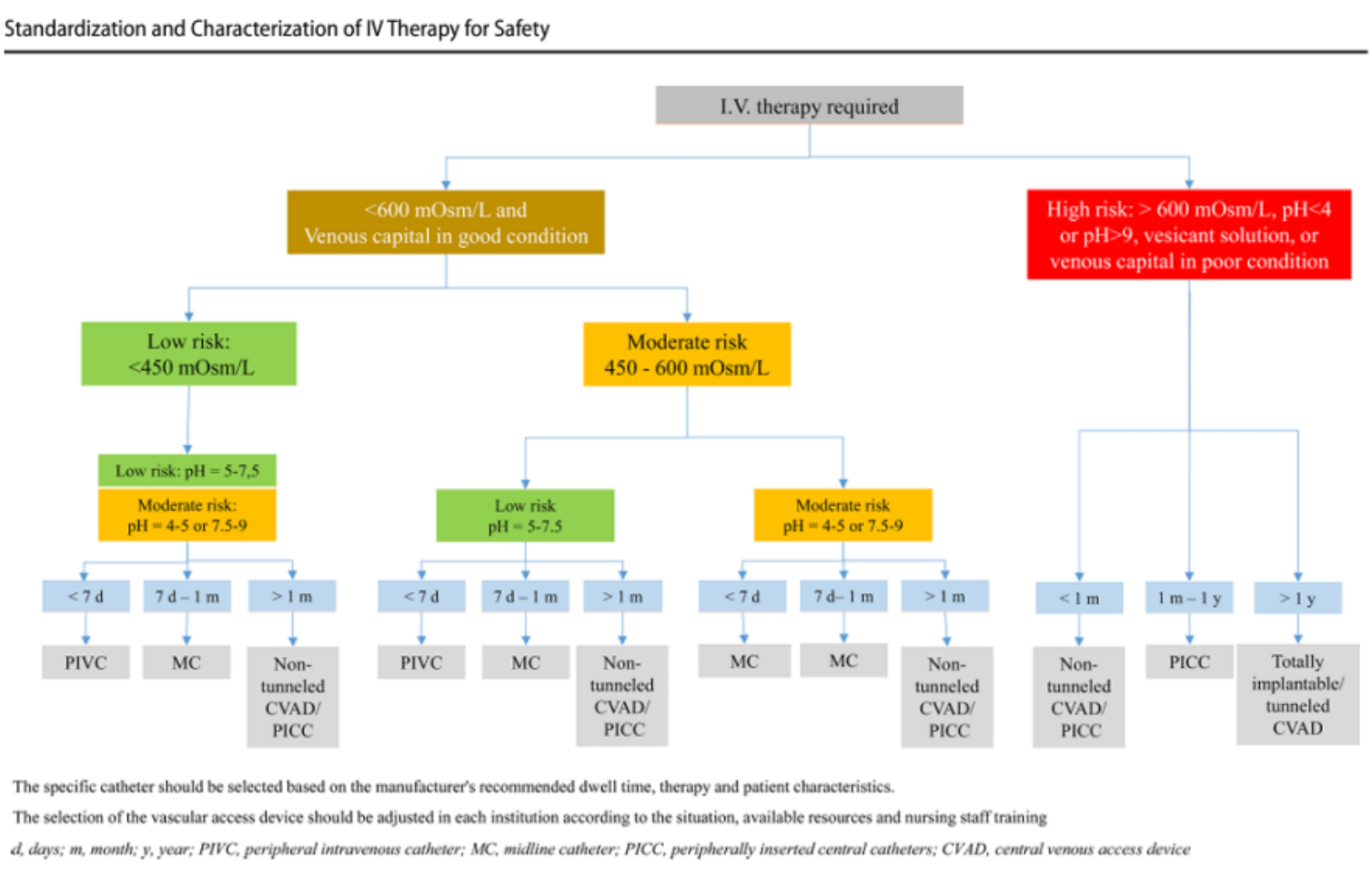
Raccomandazioni Farmacisti Spagnoli, Drugs in R&D, 2020

Table 2 (continued)

DRUG	CONCENTRATION	DILUENT	MEAN OSMOLALITY[a]	DENSITY[b]	MEAN OSMOLARITY[c]	pH	VESICANT
DAPTOMYCIN (CUBICIN® vial 350 mg, 500 mg) MERCK SHARP & DOHME DE ESPAÑA, S.A.	7 mg/mL (350 mg/50 mL)	NS	289±1.53	1.008	292	4.53±0.01	NO
	10 mg/mL (500 mg/50 mL)	NS	295±1.15	1.008	297	4.50±0.01	NO
DEXKETOPROFEN (ENANTYUM® amp 50 mg/2 mL) LABORATORIOS MENARINI	1 mg/mL (50 mg/50 mL)	D5W	390±1.53	1.019	397	7.18±0.02	NO
		NS	373±0.58	1.009	376	7.31±0.02	NO
DEXMEDETOMIDINE (DEXDOR® amp 200 µg/2 mL) ORION PHARMA, S.L.	4 µg/mL (5 amp/250 mL)	D5W	298±1.73	1.017	303	4.18±0.01	NO
		NS	278±0.58	1.006	279	5.60±0.02	NO
	8 µg/mL (10 amp/250 mL)	D5W	300±2.08	1.018	306	4.20±0.01	NO
		NS	277±0.58	1.006	279	5.54±0.01	NO
DIGOXIN (amp 0.5 mg/2 mL) KERN PHARMA, S.L.	5 µg/mL (0.5 mg/100 mL)	D5W	446±0.58	1.019	455	6.03±0.03	YES
		NS	418±2.08	1.006	421	6.09±0.05	YES
	10 µg/mL (0.5 mg/50 mL)	D5W	608±2.00	1.019	620	6.25±0.02	YES
		NS	568±2.08	1.007	572	6.14±0.04	YES
		1/2S	458±1.73	1.004	460	6.12±0.01	YES
DIPOTASSIUM PHOSPHATE (amp 1 M 10 mL) FRESENIUS KABI ESPAÑA, S.A	1 amp/250 mL	D5W	378±1.53	1.026	387	9.28±0.01	YES
		NS	359±1.15	1.013	363	9.53±0.01	YES
	2 amp/250 mL	D5W	447±1.15	1.030	461	9.41±0.01	YES
		NS	434±0.58	1.020	443	9.63±0.01	YES
DOBUTAMINE (amp 250 mg/20 mL) PFIZER, S.L.U	1 mg/mL (250 mg/250 mL)	D5W	282±1.53	1.018	287	3.95±0.01	YES
		NS	266±1.73	1.007	268	4.55±0.01	YES
	2 mg/mL (500 mg/250 mL)	D5W	264±0.58	1.017	269	3.83±0.01	YES
		NS	250±0.58	1.007	251	4.17±0.01	YES
DOPAMINE (amp 200 mg/5 mL)	1.6 mg/mL (400 mg/250 mL)	D5W	312±1.73	1.020	318	4.30±0.01	YES

Raccomandazioni Farmacisti Spagnoli, Drugs in R&D, 2020



Borgonovo, Antibiotics 2023

antibiotics

MDPI

Systematic Review

Physicochemical Characteristics of Antimicrobials and Practical Recommendations for Intravenous Administration: A Systematic Review

Fabio Borgonovo [1,†], Massimiliano Quici [2,†], Antonio Gidaro [2,*,†], Davide Giustivi [3,†], Dario Cattaneo [4], Cristina Gervasoni [1], Maria Calloni [2], Elena Martini [2], Leyla La Cava [2], Spinello Antinori [1], Chiara Cogliati [2], Andrea Gori [1] and Antonella Foschi [1,†]

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Abstract: Most antimicrobial drugs need an intravenous (IV) administration to achieve maximum efficacy against target pathogens. IV administration is related to complications, such as tissue infiltration and thrombo-phlebitis. This systematic review aims to provide practical recommendations about diluent, pH, osmolarity, dosage, infusion rate, vesicant properties, and phlebitis rate of the most commonly used antimicrobial drugs evaluated in randomized controlled studies (RCT) till 31 March 2023. The authors searched for available IV antimicrobial drugs in RCT in PUBMED EMBASE®, EBSCO® CINAHL®, and the Cochrane Controlled Clinical trials. Drugs' chemical features were searched online, in drug data sheets, and in scientific papers, establishing that the drugs with a pH of <5 or >9, osmolarity >600 mOsm/L, high incidence of phlebitis reported in the literature, and vesicant drugs need the adoption of utmost caution during administration. We evaluated 931 papers; 232 studies were included. A total of 82 antimicrobials were identified. Regarding antibiotics, 37 reach the "caution" criterion, as well as seven antivirals, 10 antifungals, and three antiprotozoals. In this subgroup of antimicrobials, the correct vascular access device (VAD) selection is essential to avoid complications due to the administration through a peripheral vein. Knowing the physicochemical characteristics of antimicrobials is crucial to improve the patient's safety significantly, thus avoiding administration errors and local side effects.

Citation: Borgonovo, F.; Quici, M.; Gidaro, A.; Giustivi, D.; Cattaneo, D.; Gervasoni, C.; Calloni, M.; Martini, E.; La Cava, L.; Antinori, S.; et al. Physicochemical Characteristics of Antimicrobials and Practical Recommendations for Intravenous Administration: A Systematic Review. *Antibiotics* **2023**, *12*, 1338. https://doi.org/10.3390/antibiotics12081338

Caparas, J Vasc Access 2014

J Vasc Access 2014; 15 (4): 251-256
DOI: 10.5301/jva.5000220

ORIGINAL ARTICLE
OPEN ACCESS

Safe administration of vancomycin through a novel midline catheter: a randomized, prospective clinical trial

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ABSTRACT

Background: **According to the 2011 Infusion Nursing Standards of Practice, the low pH of intravenous vancomycin requires that it be administered through a central line. However, a careful review of the literature and a retrospective analysis of the experience at New York Hospital Queens (NYHQ) did not support the position of the Standards.**

Purpose: **A prospective, controlled, randomized clinical trial was conducted to determine if intravenous vancomycin could be safely administered through a novel midline catheter (POWERWAND®, Access Scientific, San Diego, CA).**

Methods: **Patients scheduled to receive short-term (<6 days) intravenous vancomycin were randomly assigned to receive treatment through either a peripherally inserted central catheter (PICC) or the midline study device. Complications and the costs of insertion were recorded.**

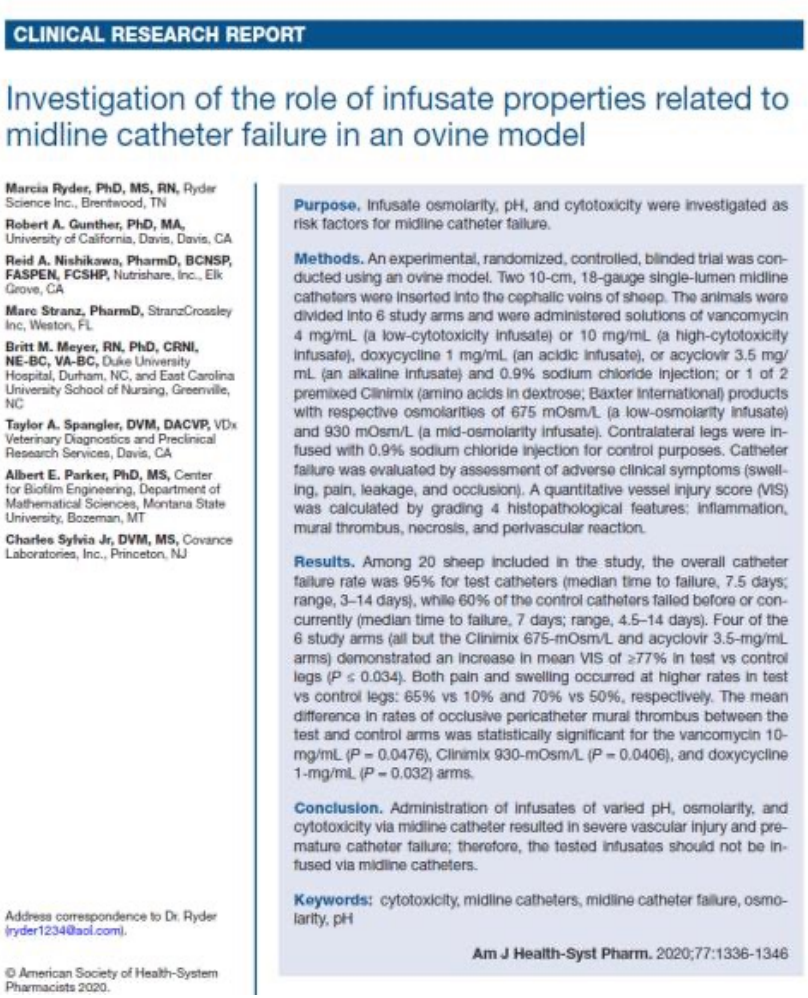
Results: **The two groups did not differ significantly with respect to total complications (17.9% with PICCs vs. 19.9% with the midline), phlebitis (0% vs. 0%) or thrombosis (0% vs. 0%). One suspected catheter-associated bloodstream infection did occur in the PICC group. Insertion costs were $90.00 less per insertion in the midline group.**

Conclusions: **Short-term intravenous vancomycin can be safely and cost-efficiently administered in the deep vessels of the upper arm using the midline study device.**

Key words: Infusion-phlebitis, INS Standards, Midline, pH, Phlebitis, Vancomycin

Accepted: January 12, 2014

Ryder, Am J Health-Syst Pharm 2020



CLINICAL RESEARCH REPORT

Investigation of the role of infusate properties related to midline catheter failure in an ovine model

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Purpose. Infusate osmolarity, pH, and cytotoxicity were investigated as risk factors for midline catheter failure.

Methods. An experimental, randomized, controlled, blinded trial was conducted using an ovine model. Two 10-cm, 18-gauge single-lumen midline catheters were inserted into the cephalic veins of sheep. The animals were divided into 6 study arms and were administered solutions of vancomycin 4 mg/mL (a low-cytotoxicity infusate) or 10 mg/mL (a high-cytotoxicity infusate), doxycycline 1 mg/mL (an acidic infusate), or acyclovir 3.5 mg/mL (an alkaline infusate) and 0.9% sodium chloride injection; or 1 of 2 premixed Clinimix (amino acids in dextrose; Baxter International) products with respective osmolarities of 675 mOsm/L (a low-osmolarity infusate) and 930 mOsm/L (a mid-osmolarity infusate). Contralateral legs were infused with 0.9% sodium chloride injection for control purposes. Catheter failure was evaluated by assessment of adverse clinical symptoms (swelling, pain, leakage, and occlusion). A quantitative vessel injury score (VIS) was calculated by grading 4 histopathological features: inflammation, mural thrombus, necrosis, and perivascular reaction.

Results. Among 20 sheep included in the study, the overall catheter failure rate was 95% for test catheters (median time to failure, 7.5 days; range, 3–14 days), while 60% of the control catheters failed before or concurrently (median time to failure, 7 days; range, 4.5–14 days). Four of the 6 study arms (all but the Clinimix 675-mOsm/L and acyclovir 3.5-mg/mL arms) demonstrated an increase in mean VIS of ≥77% in test vs control legs ($P \leq 0.034$). Both pain and swelling occurred at higher rates in test vs control legs: 65% vs 10% and 70% vs 50%, respectively. The mean difference in rates of occlusive pericatheter mural thrombus between the test and control arms was statistically significant for the vancomycin 10-mg/mL ($P = 0.0476$), Clinimix 930-mOsm/L ($P = 0.0406$), and doxycycline 1-mg/mL ($P = 0.032$) arms.

Conclusion. Administration of infusates of varied pH, osmolarity, and cytotoxicity via midline catheter resulted in severe vascular injury and premature catheter failure; therefore, the tested infusates should not be infused via midline catheters.

Keywords: cytotoxicity, midline catheters, midline catheter failure, osmolarity, pH

Am J Health-Syst Pharm. 2020;77:1336-1346

Tripathi, Crit Care Med 2021

The Practice and Complications of Midline Catheters: A Systematic Review

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Shubhi Kaushik, MBBS[3]

OBJECTIVE: Midline catheters are considered "midway" regarding vascular access. The objective of this systematic review was to explore the current practice, dwell time, and complication rates of midline catheters.

DESIGN: Systematic review.

SETTING: Search on four databases, PubMed, CINAHL, Scopus, and Embase, were conducted for English language articles published after the year 2000.

MEASUREMENTS AND MAIN RESULTS: A total of 987 articles were identified, of which 31 manuscripts met the inclusion criteria and were selected for review. Quality assurance was performed based on the Newcastle-Ottawa score. Average dwell time and complication rates were calculated for studies involving adult patients and adjusted for sample size. This analysis included data from the placement of 18,972 midline catheters across five countries. Aside from two randomized control trials, most of the studies analyzed were cohort studies. One pediatric and two neonatal studies were included. The average dwell time was 16.3 days ($n = 4,412$). The adjusted mean infection rate was 0.28/1,000 catheter days, with 64% of studies not reporting any infection with midline catheter. The failure rate of midline catheters was 12.5%. Adjusted average rates of other significant complications included the following: deep vein thrombosis (4.1%), dislodgement (5.0%), occlusion (3.8%), phlebitis (3.4%), and infiltration (1.9%).

CONCLUSIONS: The dwell times and failure rates of midline catheters compare favorably against published data on other types of catheters. Their infection rates are also lower than the reported rates of central venous catheters; however, they have a higher rate of mechanical complications. Active surveillance of infections due to midline catheters is recommended. More data are needed from pediatric and neonatal populations.

Johnson, Am J Infect Control 2023

American Journal of Infection Control 51 (2023) 563–566

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Major Article

Midline catheters: A 3-year experience at a veterans administration medical center

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Key Words:
Vascular access device
Short-term antibiotic infusion
Catheter dislodgement
Venous thromboembolism
Catheter related bloodstream infection

Background: Midline catheters are recommended over peripherally inserted central catheters as short-term vascular access device for peripherally compatible infusates. We assessed the effectiveness and safety of midline catheters.

Methods: Data from midline catheter placements from June 2016 to May 2019 at a tertiary-care Veterans Administration medical center were retrospectively collected. Patients were followed until catheter removal or death, whichever occurred first. The primary outcome was completion of intended therapy; secondary outcomes were catheter-related complications, including major (eg, catheter-related bloodstream infections [CRBSI] or venous thromboembolism [VTE]) and minor (eg, catheter occlusion, kinking, dislodgement) events.

Results: Of 115 midlines, 62 (53.9%) were for antibiotic infusion and 49 (32.6%) for difficult access. The median dwell time was 11 days (interquartile range, 5.5-19.5 days). Midline catheters lasted through completion of therapy in 93 patients (80.9%). Catheter-related complications occurred in 27 patients (23.5%), including catheter dislodgement in 10 patients (8.7%), catheter kinking in 8 (7.0%), and catheter occlusion in 3 (2.6%). Only 1 patient experienced a major complication, a deep venous thrombosis (0.9%).

Conclusions: Midlines appear to be effective and safe for short-term vascular access in patients requiring peripherally compatible infusates. While the rate of major complications is low, minor complications that necessitate device removal are common.

Keller, Pharmacotherapy 2018

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Antimicrobial Agents and Catheter Complications in Outpatient Parenteral Antimicrobial Therapy

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Keller, Pharmacotherapy 2018

Author Manuscript

Abstract

Objectives—Debate about whether certain antimicrobial agents traditionally considered vesicants increase the risk of catheter complications has led to uncertainty in venous catheter placement protocols. To understand whether patients requiring home-based outpatient parenteral antimicrobial therapy (OPAT) should receive peripheral catheters (such as midline catheters) versus central venous catheters, and to understand whether certain antimicrobial agents place home-based OPAT patients at higher risk for catheter complications, we investigated associations between antimicrobial agent(s) and catheter complications.

Methods—We performed a prospective cohort study of patients requiring home-based OPAT discharged from two urban tertiary care academic medical centers, including telephone surveys and chart abstractions. Multivariable Poisson regressions were used to evaluate: (1) associations between antimicrobial agents traditionally considered vesicants, based on pH or osmolarity, and catheter complication rates, and (2) associations between antimicrobial agent and rates of catheter complications.

Results—Vesicant antimicrobials defined using pH or osmolarity criteria were not associated with an increased rate of catheter complications (adjusted incidence rate ratio [aIRR]: 1.63, 95% confidence interval [CI]: 0.89–2.96). Vancomycin was associated with an increased rate of catheter complications, as was daptomycin (aIRR: 2.32 [95% CI: 1.20–4.46] and 4.45 [95% CI: 1.02–

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CONFLICT OF INTEREST STATEMENT

The authors have no conflicts of interest to declare.

Urtecho, Open Forum Infect Dis 2023

Open Forum Infectious Diseases

MAJOR ARTICLE

Comparing Complication Rates of Midline Catheter vs Peripherally Inserted Central Catheter. A Systematic Review and Meta-analysis

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Background. Peripherally inserted central catheters (PICCs) and midlines are commonly used devices for reliable vascular access. Infection and thrombosis are the main adverse effects of these catheters. We aimed to evaluate the relative risk of complications from midlines and PICCs.

Methods. We conducted a systematic review and meta-analysis of randomized controlled trials (RCTs) and observational studies. The primary outcomes were catheter-related bloodstream infection (CRBSI) and thrombosis. Secondary outcomes evaluated included mortality, failure to complete therapy, catheter occlusion, phlebitis, and catheter fracture. The certainty of evidence was assessed using the GRADE approach.

Results. Of 8368 citations identified, 20 studies met the eligibility criteria, including 1 RCT and 19 observational studies. Midline use was associated with fewer patients with CRBSI compared with PICCs (odds ratio [OR], 0.24; 95% CI, 0.15–0.38). This association was not observed when we evaluated risk per catheter. No significant association was found between catheters when evaluating risk of localized thrombosis and pulmonary embolism. A subgroup analysis based on location of thrombosis showed higher rates of superficial venous thrombosis in patients using midlines (OR, 2.30; 95% CI, 1.48–3.57). We did not identify any significant difference between midlines and PICCs for the secondary outcomes.

Conclusions. Our findings suggest that patients who use midlines might experience fewer CRBSIs than those who use PICCs. However, the use of midline catheters was associated with greater risk of superficial vein thrombosis. These findings can help guide future cost-benefit analyses and direct comparative RCTs to further characterize the efficacy and risks of PICCs vs midline catheters.

Keywords. PICC; catheter; infection; midline; thrombosis.

Bahl, Ther Clin Risk Manag 2022

Therapeutics and Clinical Risk Management

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ORIGINAL RESEARCH

Risk Factors for Midline Catheter Failure: A Secondary Analysis of an Existing Trial

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Objective: While midline catheters (MCs) are considered to be a reliable form of vascular access, up to 25% of the placements culminate in failure. We aimed to explore risk factors for MC failure.

Methods: We performed an analysis of existing randomized controlled trial data involving a comparison of two midline catheters. The study aimed to assess risk factors related to MC failure, including patient, procedure, catheter, and vein characteristics. Cox regression was used for univariable and multivariable analyses to evaluate the association between characteristics and MC failure.

Results: Among 191 patients that were included in this secondary analysis, more patients were female (114/191 [59.7%]) and average age was 60.2 (SD = 16.7) years. Clinical indications for MC placement included antibiotics (60.7%), difficult venous access (32.5%), or both (6.8%). In a univariable Cox regression analysis, the increase in pulse rate (HR 1.02; 95% CI, 1.00–1.04; P=0.02), temperature ≥38°C (HR 5.59; 95% CI, 1.96–15.94; P=0.001), oxygen saturation <93% (HR 2.91; 95% CI, 1.03–8.24; P=0.04), norepinephrine in dextrose infusion (HR 2.41; 95% CI, 1.17–4.97; P=0.02) and cephalic vein insertion (HR, 2.47; 95% CI, 1.09–5.57; P=0.03) were all associated with higher risk of MC failure. In a multivariable Cox model, difficult venous access (aHR 2.05; 95% CI, 1.04–4.05; P=0.04) and norepinephrine in dextrose (aHR 2.29; 95% CI, 1.09–4.82; P=0.03) was associated with catheter failure.

Conclusion: Elevated pulse rate, decreased oxygen saturation level, temperature ≥38°C, and norepinephrine use were each associated with an increased risk of MC failure. These factors should be considered when selecting the most appropriate vascular access device for individual patients. Additionally, the cephalic vein insertion has the highest risk for MC failure and other access points could be preferentially considered.

Keywords: midline catheter, complications, risk factors, midline catheter failure, vesicants, vascular access

Swaminathan, JAMA Intern Med 2022

Research

JAMA Internal Medicine | Original Investigation

Safety and Outcomes of Midline Catheters vs Peripherally Inserted Central Catheters for Patients With Short-term Indications

A Multicenter Study

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Swaminathan, JAMA Intern Med 2022

Table 1. Patient, Device, and Hospital Characteristics (n = 10 863) (continued)

Characteristic	No. (%)		Standardized mean difference	Total, No. (%)
	Midline (n = 5105)	PICC (n = 5758)		
Device characteristics				
Presence of another CVC	549 (10.8)	608 (10.6)	0.006	1157 (10.7)
PICC/CVC in prior 6 mo	712 (13.9)	1179 (20.5)	−0.174	1891 (17.4)
Placement attempts				
1	4456 (87.3)	5121 (88.9)	−0.051	9577 (88.2)
≥2	649 (12.7)	637 (11.1)	0.051	1286 (11.8)
Inserted in right arm	2761 (54.2)	4107 (71.4)	−0.360	6868 (63.3)
Power injectable devices	4388 (86.0)	5411 (94.0)	−0.269	9799 (90.2)
Insertion vein				
Basilic	2488 (48.7)	3492 (60.6)	−0.241	5980 (55.0)
Brachial	1893 (37.1)	1873 (32.5)	0.096	3766 (34.7)
Other/unknown	724 (14.2)	393 (6.8)	−0.241	1117 (10.3)
Inserted by				
Vascular access nurse	4652 (98.1)	4492 (83.5)	0.520	9144 (90.3)
Interventional radiologist	77 (1.6)	877 (16.3)	−0.532	954 (9.4)
Other/unknown	15 (0.3)	12 (0.2)	0.019	27 (0.3)
Placement indication				
Short-term antibiotics	2046 (40.1)	4102 (71.2)	−0.661	6148 (56.6)
Chemotherapy	5 (0.1)	76 (1.3)	−0.146	81 (0.7)
Difficult access/blood draws	3694 (72.4)	2307 (40.1)	0.688	6001 (55.2)
Multiple fluids	62 (1.2)	239 (4.2)	−0.183	301 (2.8)
TPN	2 (<0.1)	218 (3.8)	−0.276	220 (2.0)
No. of device lumens				
Single	4334 (84.9)	3637 (63.2)	0.512	7971 (73.4)
Double	762 (14.9)	1750 (30.4)	−0.376	2512 (23.1)
Triple/quadruple	9 (0.2)	371 (6.4)	−0.355	380 (3.5)
Gauge				
4F	4464 (87.4)	3425 (59.5)	0.668	7889 (72.6)
5F	638 (12.5)	2202 (38.2)	−0.619	2840 (26.1)
≥6F	3 (0.1)	131 (2.3)	−0.208	134 (1.2)

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Table 2. Overall Frequency of Device Complications Stratified by Indication for Use

	No. (%)		
Outcome	Total	Midline	PICC
Short-term IV antibiotic therapy			
No.	6148	2046	4102
Any major complication	433 (7.0)	71 (3.5)	362 (8.8)
Primary BSI	77 (1.3)	5 (0.2)	72 (1.8)
Catheter occlusion	281 (4.6)	45 (2.2)	236 (5.8)
DVT	81 (1.3)	20 (1.0)	61 (1.5)
Pulmonary embolism	12 (0.2)	3 (0.1)	9 (0.2)
Difficult IV access			
No.	6001	3694	2307
Any major complication	426 (7.1)	146 (4.0)	280 (12.1)
Primary BSI	42 (0.7)	15 (0.4)	27 (1.2)
Catheter occlusion	291 (4.8)	69 (1.9)	222 (9.6)
DVT	99 (1.6)	60 (1.6)	39 (1.7)
Pulmonary embolism	13 (0.2)	7 (0.2)	6 (0.3)

Abbreviations: BSI, bloodstream infection; DVT, deep vein thrombosis; IV, intravenous; PICC, peripherally inserted central catheter.

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Table 3. Device Complications (per 1000 Catheter Days) Stratified by Device Indication

Outcome	No./d (rate per 1000 catheter days)		
	Total	Midline	PICC
Short-term IV antibiotic therapy			
No.	6148	2046	4102
Any major complication	433/84 342 (5.1)	71/19 077 (3.7)	362/65 265 (5.6)
Primary BSI	77/84 342 (0.9)	5/19 077 (0.3)	72/65 265 (1.1)
Catheter occlusion	281/84 342 (3.3)	45/19 077 (2.4)	236/65 265 (3.6)
DVT	81/84 342 (1.0)	20/19 077 (1.1)	61/65 265 (0.9)
Pulmonary embolism	12/84 342 (0.1)	3/19 077 (0.2)	9/65 265 (0.1)
Difficult IV access			
No.	6001	3694	2307
Any major complication	426/67 487 (6.3)	146/31 644 (4.6)	280/35 843 (7.8)
Primary BSI	42/67 487 (0.6)	15/31 644 (0.5)	27/35 843 (0.8)
Catheter occlusion	291/67 487 (4.3)	69/31 644 (2.2)	222/35 843 (6.2)
DVT	99/67 487 (1.5)	60/31 644 (1.9)	39/35 843 (1.1)
Pulmonary embolism	13/67 487 (0.2)	7/31 644 (0.2)	6/35 843 (0.2)

Abbreviations: BSI, bloodstream infection; DVT, deep vein thrombosis; IV, intravenous; PICC, peripherally inserted central catheter.

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Table 4. Multivariate Analysis Showing Odds of Major Complications Stratified by Device Type[a]

Outcome	No. (%)			OR (95% CI)	*P* value	HR (95% CI)	*P* value
	Total (n = 10 863)	Midline (n = 5105)	PICC (n = 5758)				
Any major complication	769 (7.1)	200 (3.9)	569 (9.9)	1.99 (1.61-2.47)	<.001	1.21 (1.02-1.44)	.03
Primary BSI	112 (1.0)	19 (0.4)	93 (1.6)	4.44 (2.52-7.82)	<.001	1.76 (1.06-2.92)	.03
Catheter occlusion	510 (4.7)	105 (2.1)	405 (7.0)	2.24 (1.70-2.96)	<.001	1.58 (1.26-1.97)	<.001
DVT	160 (1.5)	74 (1.4)	86 (1.5)	0.93 (0.63-1.37)	.70	0.53 (0.38-0.74)	<.001
PE	22 (0.2)	8 (0.2)	14 (0.2)	1.29 (0.46-3.61)	.62	0.92 (0.36-2.32)	.85

Abbreviations: BSI, bloodstream infection; CLABSI, central line–associated blood stream infection; CVC, central venous catheter; DVT, deep vein thrombosis; HR, hazard ratio; OR, odds ratio; PE, pulmonary embolism; PICC, peripherally inserted central catheter.

[a] For logistic mixed-effect models, results were estimated using robust sandwich covariance matrix estimates to account for hospital-level correlation. Patient- and device-level adjustments include age, sex, catheter lumens, line duration, Charlson comorbidity score, previous CVC placements, and history of prior DVT, PE, CLABSI, or cancer. For Cox proportional hazards models, results were adjusted for hospital clustering by calculating SEs using robust sandwich estimates for each site. Patient- and device-level adjustments include age, sex, catheter lumens, line duration, Charlson comorbidity score, previous CVC placements, and history of prior DVT, PE, CLABSI, or cancer.

Chopra, BMJ Qual Saf 2019

Original research

Variation in use and outcomes related to midline catheters: results from a multicentre pilot study

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Abstract

Background While midline vascular catheters are gaining popularity in clinical practice, patterns of use and outcomes related to these devices are not well known.

Methods Trained abstractors collected data from medical records of hospitalised patients who received midline catheters in 12 hospitals. Device characteristics, patterns of use and outcomes were assessed at device removal or at 30 days. Rates of major (upper-extremity deep vein thrombosis [DVT], bloodstream infection [BSI] and catheter occlusion) and minor complications were assessed. χ^2 tests were used to examine differences in rates of complication by number of lumens, reasons for catheter removal l, and hospital-level differences in rates of midline use.

Results Complete data on 1161 midlines representing 5%–72% of all midlines placed in participating hospitals between 1 January 2017 and 1 March 2018 were available. Most (70.8%) midlines were placed in general ward settings for difficult intravenous access (61.4%). The median dwell time of midlines across hospitals was 6 days; almost half (49%) were removed within 5 days of insertion. A major or minor complication occurred in 10.3% of midlines, with minor complications such as dislodgement, leaking and infiltration accounting for 71% of all adverse events. While rates of major complications including occlusion, upper-extremity DVT and BSI were low (2.2%, 1.4% and 0.3%, respectively), they were just as likely to lead to midline removal as minor complications (53.8% vs 52.5%, p=0.90). Across hospitals, absolute volume of midlines placed varied from 100 to 1837 devices, with corresponding utilisation rates of 0.97%–12.92% (p<0.001).

Conclusion Midline use and outcomes vary widely across hospitals. Although rates of major complications are low, device removal as a result of adverse events is common.

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Original Research Article

PICC versus midlines: Comparison of peripherally inserted central catheters and midline catheters with respect to incidence of thromboembolic and infectious complications

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ABSTRACT

Introduction: To decrease the complications related to central catheters there has been an increasing utilization of peripherally inserted central catheters (PICC) and ultrasound-guided long peripheral intravenous catheters (i.e. midlines). While the complications of PICC lines are well described there is less reported data on complications related to midline catheters. Our study aims are to compare the incidences of infectious and deep venous thrombosis (DVT) and sepsis related to PICCs and Midlines.

Methods: We performed a single-center retrospective review at an academic hospital. Data were collected on patients admitted between 1/1/2014–5/31/2016. Patient demographics, hospital length of stay (LOS), and ventilator days were collected. Outcomes of interest were line-related infections and thromboembolic events after the placement of these catheters. Endpoints were compared between three groups (PICC group, midline group and PICC placement followed by midline placement group). Univariate and multivariable analyses were used to compare across the three groups.

Results: The study included 3560 unique patients with 5058 catheters. There was an increase in use of midlines over the observed study period (245% increase from the end of 2015 to the middle of 2016). We found no significant differences in the rates of DVT among the three groups (PICC 4%, midline 3% and PICC-midline 4%; p = 0.12). There were no differences across the groups for sepsis (PICC 29%, midline 27%, and PICC-midline 32%; p = 0.14) or septic shock (PICC 7%, midline 8%, and PICC-midline 6%; p = 0.39). Adjusted means LOS were higher for patients with PICC lines compared to midlines, in both females and males. PICC group stayed longer, on average, on the ventilator compared to the midline group. No other significant differences were seen among groups.

Conclusion: Increased utilization of midline catheters were not associated with decreased risk of DVT or sepsis when compared to peripherally inserted central catheters.

Hogle, Am J Infect Contr 2020

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Brief Report

A comparison of the incidence of midline catheter–associated bloodstream infections to that of central line–associated bloodstream infections in 5 acute care hospitals

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Key Words:
Intravenous therapy
Blood stream infection
Bacteremia
Intravascular catheter

In a retrospective study conducted over 12 months in a multi-hospital system, the incidence of bloodstream infections associated with midline catheters was not significantly lower than that associated with central venous catheters (0.88 vs 1.10 infections per 1,000 catheter-days). Additional research is needed to further characterize the infectious risks of midline catheters and to determine optimal strategies to minimize these risks.

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Research Article

A Meta-Analysis of Incidence of Catheter-Related Bloodstream Infection with Midline Catheters and Peripherally Inserted Central Catheters

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In order to provide reference for the prevention and treatment of CRBSI during clinical intravenous infusion therapy, this paper investigates the incidence of catheter-related bloodstream infection (CRBSI) in the treatment of midline catheters (MCs) and peripherally inserted central catheters (PICCs) by intravenous infusion. Web of Science, PubMed, Scopus, Embase, Cochrane Library, and ProQuest are searched to collect CRBSI-related studies on MC and PICC. The retrieval time is from the database construction to August 2020. Two researchers independently searched and screened literature quality evaluation and extracted data according to inclusion and exclusion criteria, and RevMan 5.3 software was used for analysis. Eleven studies are included with a total of 33809 patients. The incidence of CRBSI in the MC group is 0.599% (43/7079), and that in the PICC group is 0.4993% (133/26630). Meta-analysis showed that the incidence of CRBSI in the MC group is higher than that in the PICC group (OR = 0.72, 95% CI = 0.43–1.08, $P = 0.11$), and the difference is statistically significant when low-quality studies are excluded (OR = 0.60, 95% CI = 0.39–0.93, $P = 0.02$). There is no significant difference in the incidence of CRBSI between MC group and PICC group ($P > 0.05$), American subgroup (OR = 0.52), and British subgroup (OR = 4.86), the results of the two groups are opposite, and the incidence of CRBSI between the MC group and PICC group is statistically significant. There is no significant difference in the incidence of CRBSI between the adult and other subgroups (all $P > 0.05$). There is no significant difference in the incidence of CRBSI between the MC group and the PICC group ($P > 0.05$). Overall, the inter-study stability is general, the quality is good and the medium is good, and there is no obvious publication bias. The risk of CRBSI in MC and PICC is systematically evaluated and meta-analyzed for the first time. The incidence of CRBSI in MC group is lower than that in PICC group during intravenous infusion therapy. Under the same conditions, MC patients can be given priority for intravenous infusion therapy. More high-quality and child-related studies are needed to further evaluate and explore the risk of CRBSI between MC and PICC.

Frondizi, Am J Infect Contr 2023

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Major Article

Complications associated with the use of peripherally inserted central catheters and midline catheters in COVID-19 patients: An observational prospective study

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Frondizi, Am J Infect Contr 2023

Table 2
Total catheter days and incidence of CRBSI among PICCs and MCs

	PICCs	MCs
Total number	69	158
Catheter days	889	1,863
CRBSI (%)	4 (5.8)	6 (3.8)
CRBSI/catheter days	4.5	3.2
Days before onset of CRBSI (mean)	13.17 + 8.35	14.25 + 3.59
Days before onset of CRBSI (CI)	4.04-21.93	8.53-19.97

NOTE. There was no statistical difference in the incidence of CRBSI or in the time of their onset, comparing PICCs and MCs.
CI, confidence interval; CRBSI, catheter-related bloodstream infection; MCs, midline catheters; PICCs, peripherally inserted central catheters.

CONCLUSIONI

Dalla Edizione 2016 delle Linee Guida INS, la scelta tra accesso venoso periferico e centrale (e di conseguenza tra PICC e Midline) è meno netta e definita

Esiste da diversi anni una consolidata tendenza a favorire gli accessi venosi periferici per ridurre teoricamente il rischio di CRBSI

I dati pubblicati negli ultimi anni (molti purtroppo retrospettivi) sui Midline in termini di complicanze sono però piuttosto eterogenei e ancora non permettono di definirne con sicurezza i tassi

Sicuramente occorrono studi prospettici che permettano di definire la scelta appropriata tra PICC e Midline in termini di molecole infuse (pH, osmolarità, caratteristiche irritanti o vescicanti intrinseche) e di durata del trattamento.

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