



Indications for Peripheral, Midline, and Central Catheters: Summary of the Michigan Appropriateness Guide for Intravenous Catheters Recommendations

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Abstract

Patients admitted to acute care frequently require intravenous access to effectively deliver medications and prescribed treatment. For patients with difficult intravenous access; those requiring multiple attempts; and those who are obese, have diabetes, or have other chronic conditions, determining the vascular access device (VAD) with the lowest risk that best meets the needs of the treatment plan can be confusing. Selection of a VAD should be based on specific indications for that device. In clinical settings, requests for central venous access devices are frequently precipitated simply by failure to establish peripheral access. Selection of the most appropriate VAD is necessary to avoid the potentially serious complications of infection and/or thrombosis. An international panel of experts convened to establish a guide for indications and appropriate use for VADs. This article summarizes the work and recommendations of the panel that created the Michigan Appropriateness Guide for Intravenous Catheters.

Keywords: central venous catheters, peripheral catheters, midline catheters, peripherally inserted central catheters, central line-associated bloodstream infections, thrombosis

Intravenous access is a necessary component of the delivery of medical treatment in hospitals. More than 60% of patients in acute care worldwide, and higher percentages in the United States, require a vascular access device (VAD).¹ Central venous access devices (CVADs) exceed 7 million units per year in the United States and 10 million worldwide,² and although necessary in most cases, each

CVAD carries significant risk to the patient.³⁻⁵ Recent concerns over serious complications of infection and thrombosis require closer scrutiny of CVAD use with particular emphasis on applying evidence-based indications and avoiding potential overuse of peripherally inserted central catheters (PICCs).⁵⁻¹¹ Due to increasing popularity, ease of insertion, low insertion-related complications, reduced cost, and placement primarily by vascular access teams, PICCs now comprise nearly half of all CVADs currently used in the United States.² Despite the advantages and safety in terms of insertion, PICCs are prone to occlusion and venous thrombosis, by a factor of more than 2 in comparison with other CVADs.^{7,12-17} PICC venous thrombosis is known to also affect the risk of lower-extremity thrombosis and potentially contribute to incidence of pulmonary emboli.^{18,19} Selecting the intravenous device with the lowest risk that most effectively supports a patient's treatment plan should be performed based on available evidence and specified indications.

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Method

Recognizing the need to establish evidence-based indications for intravascular devices and specifically PICCs, an international group of expert physicians and clinicians, and 1 patient was selected to work together as part of a University of Michigan/Society of Hospital Medicine-funded initiative. In this initiative, the RAND/UCLA Appropriateness Method²⁰ was applied to develop criteria for the selection of the best VAD for each patient. A systematic literature review was performed and disseminated to the 15-member panel for evaluation, along with 665 patient scenarios. To determine the effect on clinical decision making, devices—including peripheral intravenous catheters, ultrasound-guided peripheral intravenous catheters, midline catheters, nontunneled central venous catheters (CVCs), tunneled CVCs, and ports—were compared with PICCs. Additionally, scenarios evaluating the appropriateness of individual devices were also created. Each scenario was rated based on appropriateness of PICC or other VAD use. The RAND/UCLA Appropriateness Method incorporated information synthesis, panelist selection, patient scenarios, a rating process, and analysis of results all specific to VADs.

Results

The results of the review by the Michigan Appropriateness Guide for Intravenous Catheters (MAGIC) panel included ratings from 391 unique indications of appropriateness or inappropriateness for PICCs and other VADs with 2 rounds of in-person rating scenarios by the panel.²¹ The final results established 38% of these indications as appropriate, 43% as inappropriate, and 19% as neutral or uncertain for the 665 scenarios. Details for each device are summarized in the following sections.

Peripheral Access

Peripheral catheters (eg, peripheral intravenous lines and ultrasound-guided peripheral intravenous lines) establish access into the veins and arteries of the arms and, less frequently, legs or other pediatric or neonatal applications of the scalp.^{22,23} They are inserted using a direct visual approach or with visualization devices such as infrared or ultrasound technology. Peripheral access is considered less invasive than central access and has a lower risk of infection (0.5/1000 catheter-days).^{6,24} Peripheral catheters are considered appropriate for treatment of peripherally compatible medications and solutions (< 900 mOsm/L, not vesicant or irritant) when the duration of treatment is \leq 6 days (Table 1) with transition to midline or PICC when duration is extended.^{25,26}

When multiple peripheral catheter attempts fail, the designation of difficult intravenous access (DIVA) may lead to assessment and access with ultrasound or other forms of visualization technology (Figure 1). Success is enhanced with deeper ultrasound-guided access and the use of longer peripheral catheters.²⁷⁻³⁰ For all patients considered DIVAs, those with \geq 1 failed attempts, inability to identify veins visually, or with a history of difficult access, use of ultrasound or other visual technologies is recommended to help obtain the

Table 1. Peripheral Catheter Indications

- Peripheral intravenous catheter treatment involves the infusion of peripherally compatible solutions for 5 days or fewer
- Patient has adequate veins to accommodate catheter size and length
- Emergent use with placement in the external jugular or foot veins (emergent or < 4 d)
- Cyclic or episodic chemotherapy (nonvesicant) treatment for < 3 mo

preferred peripheral intravenous access.²⁶ Ultrasound-guided peripheral access, commonly inserted in the veins of the forearm, antecubital fossa, or upper arm, is indicated for treatment duration < 6 days or up to 15 days with a transition to midline catheter or PICC if treatment continues. Ultrasound-guided peripheral access is also recommended for contrast-based radiographic studies requiring upper-extremity veins with larger catheters (ie, 20-16 gauge), where visible veins to accommodate the size are not available (Table 2). Evidence supports greater success with ultrasound-guided peripheral catheter access after training.³¹ Greater success with these procedures results in reduced need and avoidance of CVADs.³²⁻³⁴

Current research and guidelines support maintaining peripheral catheters until no longer clinically indicated or until a complication develops.^{22,35-39} Insertion of peripheral catheters into external jugular or leg veins is considered appropriate in emergent situations with verified inserter training before the insertion and treatment is prescribed for 4 days or fewer.²¹ Peripheral catheters in the hand or distal portion of the upper extremity are the preferred choice when chronic kidney disease is present and glomerular filtration rate is < 44 mL/min—stage 3b or greater—with a focus on preserving peripheral and central veins for hemodialysis, fistula, or grafts.²¹



Figure 1. Ultrasound-guided peripheral catheter in the forearm (used with permission from PICC Excellence, Inc).

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