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## Infusion Nursing Standards of Practice

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Wolters Kluwer Health | Lippincott Williams & Wilkins

# Vascular Access Device Selection and Placement

## 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.<sup>1-9</sup> (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. The tip of a short peripheral catheter terminates in a peripheral vein.<sup>2,3,5,6,10-16</sup> (V)
- C. The nurse should use short peripheral catheters equipped with a passive or active safety mechanism to provide sharps injury protection.<sup>12,16,17</sup> (V)

- D. The use of steel winged devices should be limited to short-term or single-dose administration.<sup>13,14</sup> (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.<sup>5,6,13,14,18-24</sup> (IV)
- F. Peripheral administration of parenteral nutrition via a short peripheral catheter should be used with caution in adults.<sup>21,22</sup> (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.<sup>11,12,16</sup> (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.<sup>9,10,16,25,26</sup> (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.<sup>9,13,14</sup> (V)
- C. Midline catheters are peripheral infusion devices with the tips terminating in either the basilic, cephalic, or brachial vein, distal to the shoulder. The basilic vein is preferred due to vein diameter. The tip does not enter the central vasculature.

Midline catheters inserted via a scalp vein in neonates and pediatric patients should have the tip terminating in the external jugular vein (EJV).<sup>5,16,20,27</sup> (V)

- D. Midline catheters are available as single- or double-lumen (1.9 Fr-5 Fr) polyurethane or silicone devices. Midline catheters for pediatric patients are available in gauge sizes of 22-24.<sup>3,9,10,12-14,16,25,28</sup> (V)

## Practice Criteria

### III. Central Vascular Access Devices (CVADs) (Nontunneled, PICC, Tunneled, Implanted Port)

- A. The nurse should use CVADs to administer short- or long-term continuous or intermittent infusion solutions such as antineoplastic medications, vesicants or known irritants, parenteral nutrition, a variety of antibiotics, and any medications with a pH of less than 5 or greater than 9 and osmolarity of greater than 600mOsm/L.<sup>5,6,13,29</sup> (V)
- B. The nurse should be aware that in order to minimize thrombotic complications, the tip of a CVAD should terminate in the central vasculature, such as the superior vena cava (SVC) or inferior vena cava (IVC). Dialysis catheter tips may terminate in the right atrium.<sup>6,20,30</sup> (V)
- C. CVADs can be manufactured as single or multilumen, silicone, or polyurethane, along with various gauge sizes and lengths; open- or closed-ended; power-injectable; and/or as anti-infective devices.<sup>6,10,13,16,31-34</sup> (V)
- D. The nurse should collaborate with the multidisciplinary team to consider anti-infective CVADs in the following circumstances: expected dwell of more than 5 days; catheter-related bloodstream infection (CR-BSI) rate remains high even after employing other preventive strategies; neutropenic, transplant, burn, hemodialysis, or critically ill patients; catheter insertion or exchange in patients with infection or bacteremia; or for emergency insertions. Anti-infective CVADs have shown a decrease in colonization and/or CR-BSIs. These types of CVADs include devices coated or impregnated with chlorhexidine and silver sulfadiazine, minocycline and rifampin, and silver ion. The nurse should be aware that anti-infective CVADs should not be used in patients with allergies to silver, chlorhexidine, silver sulfadiazine, rifampin, or tetracyclines.<sup>1,29,32,35-51</sup> (I)
- E. CVADs designed to withstand high-pressure injections (up to 300 pounds per square inch [psi]) have been found to be feasible and effective and with published reports of safe use.<sup>6,10,52-57</sup> (II)
- F. The nurse should be knowledgeable about whether the CVAD may be trimmed (considering factors

such as open- versus closed-ended; staggered lumen exits) and should follow the manufacturer's directions for use for altering the device length, should the device require trimming. The use of scissors should be avoided in trimming catheter length. Use of scissors to adjust the length of peripherally inserted central catheters (PICCs) was found to result in rough, irregular surfaces as observed with scanning electron microscopy. If the catheter length is modified, the nurse should document the length in the patient's permanent medical record.<sup>34,58-60</sup> (IV)

- G. The nurse should be aware that there are specific catheter selection and placement recommendations for patients with chronic kidney disease (CKD). Catheters with high flow rates should be used (see Standard 40, *Hemodialysis Vascular Access Devices*).<sup>30</sup> (V)
- H. CVAD tip location and dwell time for CKD patients vary based on type of catheter selected and the specific patient condition. Short-term CVAD tips should be located in the SVC; long-term (tunneled) CVAD tips should be located in the right atrium; femoral CVAD tip locations should be in the IVC. Uncuffed hemodialysis CVADs should be used in hospitalized CKD patients only and dwell up to 1 week. If an uncuffed hemodialysis CVAD is selected for femoral placement, it should be used in bed-bound CKD patients and dwell for only 5 days (see Standard 40, *Hemodialysis Vascular Access Devices*).<sup>30</sup> (V)

## Practice Criteria

### IV. Arterial Catheters

- A. Peripheral or pulmonary arterial catheters should be considered for short-term use for hemodynamic monitoring, obtaining blood samples, and analyzing blood gas in critically ill patients.<sup>28</sup> (V)
- B. The nurse should be aware that the radial artery is the most common insertion site because of easier access and a lower complication rate. Other possible sites are the femoral, axillary, brachial, and tibial posterior arteries.<sup>61-64</sup> (I)
- C. If the radial artery site is selected, a 20-gauge arterial catheter is preferred to decrease the risk of thrombosis.<sup>62</sup> (I)
- D. The nurse should be aware of the potential complications associated with arterial catheters and that rates of complications, such as thrombosis and infection, appear to increase with extended dwell time.<sup>61-65</sup> (I)

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### 33. SITE SELECTION

#### Standard

33.1 Site selection for all vascular access devices (VADs) shall be established in organizational policies, procedures, and/or practice guidelines.

33.2 The vasculature shall accommodate the gauge and length of the catheter required for the prescribed therapy.

33.3 Site selection for vascular access shall include assessment of the patient's condition; age; diagnosis; comorbidities; condition of the vasculature at the insertion site and proximal to the intended insertion site; condition of skin at intended insertion site; history of previous venipunctures and access devices; type and duration of infusion therapy; and patient preference.

33.4 Prior to insertion of a peripherally inserted central catheter (PICC), anatomical measurements shall be taken to determine the length of the catheter required to ensure full advancement of the catheter to the lower third of the superior vena cava and the junction of the superior vena cava and right atrium.

33.5 Placement of central vascular access devices (CVADs) by nurses shall be established in organizational policies, procedures, and/or practice guidelines and in accordance with rules and regulations promulgated by the state's Board of Nursing.

#### Practice Criteria

##### I. Peripheral Venous Access via Short Peripheral Catheters

- A. For adult patients, veins that should be considered for peripheral cannulation are those found on the dorsal and ventral surfaces of the upper extremities, including the metacarpal, cephalic, basilic, and

median veins. Avoid the lateral surface of the wrist for approximately 4-5 inches because of the potential risk for nerve damage. For pediatric patients, similar veins to consider are in the hand, forearm, antecubital area, and upper arm below the axilla, as well as the veins of the scalp, foot, and fingers in infants and toddlers. For adult and pediatric patients: avoid the ventral surface of the wrist due to the pain on insertion and possible damage to the radial nerve.<sup>1-5</sup> (V)

- B. Site selection should be initiated routinely in the distal areas of the upper extremities; subsequent cannulation should be made proximal to the previously cannulated site.<sup>3</sup> (V)
- C. Site selection should be initiated routinely in the nondominant arm. VAD sites should avoid areas of flexion; areas of pain on palpation; veins that are compromised (eg, bruised, infiltrated, phlebitic, sclerosed, or corded); location of valves; and areas of planned procedures. In infants and children, avoid the hand or fingers, or the thumb/finger used for sucking.<sup>2,3,6,7</sup> (V)
- D. Veins of the lower extremities should not be used routinely in the adult population due to risk of tissue damage, thrombophlebitis, and ulceration.<sup>2</sup> (I A/P)
- E. Veins in an upper extremity should be avoided on the side of breast surgery with axillary node dissection, after radiation therapy to that side, or with lymphedema, or the affected extremity from a cerebrovascular accident. For patients with chronic kidney disease stage 4 or 5, avoid forearm and upper-arm veins "suitable for placement of vascular access." A collaborative discussion with the patient and the licensed independent practitioner (LIP) should take place related to the benefits and risks of using a vein in an affected extremity.<sup>3,6,8-12</sup> (V)
- F. Veins in the right arm of infants and children should be avoided after procedures treating congenital cardiac defects that may have decreased blood flow to the subclavian artery.<sup>13</sup> (V)
- G. Cannulation of hemodialysis fistulas and grafts for infusion therapy requires the order of a nephrologist or LIP.<sup>3</sup> (V)
- H. The nurse should consider using visualization technologies that aid in vein identification and selection.<sup>3,14</sup>(V)

## Practice Criteria

### II. Peripheral Venous Access via Midline Catheters

- A. Site selection should be routinely initiated in the region of the antecubital fossa. Veins that should be considered for midline catheter cannulation are the basilic, cephalic, and brachial veins. For neonate and

- pediatric patients, additional site selections include veins in the leg with the tip below the groin and in the scalp with the tip in the neck, above the thorax.<sup>13</sup> (V)
- B. Site selection should avoid areas of pain on palpation, veins that are compromised (eg, bruised, infiltrated, phlebitic, sclerosed, or corded), and for patients with chronic kidney disease stage 4 or 5, avoid forearm and upper-arm veins "suitable for placement of vascular access."<sup>2,3,8,12</sup> (V)
- C. Veins in an upper extremity should be avoided on the side of breast surgery with axillary node dissection, after radiation therapy to that side, or with lymphedema, or the affected extremity from a cerebrovascular accident. For patients with chronic kidney disease stage 4 or 5, avoid upper-arm veins "suitable for placement of vascular access." A collaborative discussion with the patient and the licensed independent practitioner (LIP) should take place related to the benefits and risks of using a vein in an affected extremity.<sup>3,8,9,11</sup> (V)
- D. Veins in the right arm of infants and children should be avoided after procedures treating specific congenital cardiac defects that may have decreased blood flow to the subclavian artery.<sup>13</sup> (V)
- E. The nurse should consider using visualization technologies that aid in vein identification and selection.<sup>14</sup> (V)

## Practice Criteria

### III. Central Venous Access via Peripherally Inserted Central Catheters (PICCs)

- A. Veins that should be considered for PICC cannulation are the basilic, median cubital, cephalic, and brachial veins. For neonate and pediatric patients, additional site selections include the temporal vein and posterior auricular vein in the head and the saphenous vein in the lower extremities.<sup>13,15</sup> (V)
- B. Site selection should avoid areas of pain on palpation; veins that are compromised (eg, bruised, infiltrated, phlebitic, sclerosed, or corded); and for patients with chronic kidney disease stage 4 or 5, avoid forearm and upper-arm veins "suitable for placement of vascular access."<sup>2,8,12</sup> (V)
- C. Veins in an upper extremity should be avoided on the side of breast surgery with axillary node dissection, after radiation therapy to that side, or with lymphedema, or the affected extremity from a cerebrovascular accident. For patients with chronic kidney disease stage 4 or 5, avoid upper-arm veins "suitable for placement of vascular access." A collaborative discussion with the patient and the licensed independent practitioner (LIP) should take place related to the benefits and risks of using a vein in an affected extremity.<sup>8,9,11</sup> (V)
- D. The nurse should consider using visualization technologies that aid in vein identification and selection.<sup>14-16</sup> (V)

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## 34. LOCAL ANESTHESIA FOR VASCULAR ACCESS DEVICE PLACEMENT AND ACCESS

### Standard

- 34.1 Local anesthesia shall be considered based upon nursing assessment of patient condition, needs, risks, and benefits.
- 34.2 When local anesthesia is ordered or necessary, the agent and method that is least invasive and carries the least risk for allergic reaction or infection shall be considered first.
- 34.3 The nurse shall be competent to administer local anesthesia for vascular access device (VAD) placement and access.
- 34.4 Use of local anesthesia shall be established in organizational policies, procedures, and/or practice guidelines, and in accordance with the rules and regulations promulgated by the state's Board of Nursing.

### Practice Criteria

- A. Local anesthetic agents including, but not limited to, topical transdermal agents, intradermal lidocaine, iontophoresis, and pressure-accelerated lidocaine, should be considered and used according to manufacturers' directions for use.<sup>1-10</sup> (II)
- B. The nurse should consider and encourage the use of all available and effective local anesthetic methods and agents prior to each painful dermal procedure in children and some adults. These include topical anesthetics as well as adjunctive and less invasive anxiolytic, cognitive, behavioral, and complementary therapies to reduce pain and discomfort.<sup>11-16</sup> (II)
- C. The nurse should assess the patient for potential allergic reactions, tissue damage, or inadvertent injection of the drug into the vascular system when administering a local anesthetic.<sup>9,17</sup> (V)

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## 35. VASCULAR ACCESS SITE PREPARATION AND DEVICE PLACEMENT

### Standard

35.1 The nurse shall place a vascular access device (VAD) upon the order of a licensed independent practitioner (LIP) in accordance with the rules and regulations promulgated by the state's Board of Nursing and organizational policies, procedures, and/or practice guidelines.

35.2 VAD placement shall be established in organizational policies, procedures, and/or practice guidelines and according to manufacturers' directions for use.

35.3 The nurse shall be competent in insertion technique, infection prevention measures, identifying potential complications, implementing nursing interventions, and in assisting the LIP with VAD placement.

35.4 The nurse shall prepare the intended VAD insertion site with antiseptic solution using aseptic technique.

35.5 Maximal sterile barrier (MSB) precautions, including mask, sterile gown, cap, sterile gloves, protective eyewear, and large full-body drapes, shall be used with the insertion of central vascular access devices (CVADs).

35.6 Antiseptic solutions in a single unit configuration shall be used.

35.7 Only 1 vascular access device shall be used for each catheterization attempt.

35.8 Tip location of a CVAD shall be determined radiographically or by other approved technologies prior to initiation of infusion therapy.

### Practice Criteria

#### I. General

- A. Prior to inserting a vascular access device, the nurse should provide patient education, addressing the rationale for VAD placement; insertion process; expected dwell time; care and maintenance of the device; and signs and symptoms of complications to report (see Standard 12, *Informed Consent*).<sup>1</sup> (V)

- B. If the intended insertion site is visibly soiled, clean the area with soap and water prior to application of antiseptic solution(s).<sup>2,3</sup> (V)
- C. Clipping should be performed to remove excess hair at the insertion site with single-patient-use scissors or disposable-head surgical clippers; microabrasions produced from shaving increase the risk for infection.<sup>4</sup> (V)
- D. The nurse should inspect the VAD for product integrity prior to insertion.<sup>5</sup> (V)
- E. If an artery is inadvertently accessed or if the patient complains of paresthesias, numbness, or tingling upon VAD insertion, the catheter should be immediately removed and the LIP promptly notified, as rapid attention may prevent permanent injury; nerves and arteries are often located in very close proximity to the venipuncture site.<sup>6-8</sup> (V)
- F. No more than 2 attempts at vascular access placement should be made by any 1 nurse, as multiple unsuccessful attempts limit future vascular access and cause patients unnecessary pain. Patients with difficult vascular access require a careful assessment of VAD needs and collaboration with the health care team to discuss appropriate options.<sup>4</sup> (V)
- G. Chlorhexidine solution is preferred for skin antiseptics. One percent to two percent tincture of iodine, iodophor (povidone-iodine), and 70% alcohol may also be used. Chlorhexidine is not recommended for infants under 2 months of age.<sup>4,9</sup> (I)
- H. The nurse should consider using visualization technologies that aid in vein identification and selection.<sup>5,10,11</sup> (V)

### Practice Criteria

#### II. Short Peripheral and Midline Catheters

- A. The nurse should consider the use of methods to promote vascular distention in addition to the appropriate use of tourniquets, such as gravity (positioning the extremity lower than the heart for several minutes), having the patient open and close his or her fist, and lightly stroking the vein downward (see Standard 31, *Tourniquets*).<sup>4,12</sup> (I A/P)
- B. The use of warmth should be considered another method to promote vascular dilation. The use of dry heat was found to increase the likelihood of successful peripheral catheter insertion.<sup>4,12-15</sup> (II)
- C. The nurse should use a new pair of disposable, nonsterile gloves in conjunction with a no-touch technique for peripheral IV insertion. With no-touch technique, the planned IV insertion site is not palpated after skin cleansing unless sterile gloves are worn.<sup>16</sup> (V)
- D. Insertion techniques for midline catheter placement include threading the catheter through an introducer

or using the Modified Seldinger Technique (MST), also known as the microintroducer technique.<sup>5,17-19</sup> (V)

- E. The midline catheter tip location should be at or below the axillary line.<sup>5,17-19</sup> (V)

## Practice Criteria

### III. Central Vascular Access Devices (CVADs)

- A. The nurse should use a standardized checklist to encourage adherence to recommended practices for access site preparation, infection prevention, and safety precautions. The CVAD placement procedure should be stopped for any breaches in sterile technique that occur during the procedure.<sup>9,20,21</sup> (IV)
- B. The nurse should use a standardized supply cart or kit that contains all necessary components for the insertion of a CVAD.<sup>9,20,21</sup> (V)
- C. Ultrasound technology should be used when inserting PICC and percutaneous centrally inserted catheters to increase success rates and decrease insertion-related complications.<sup>22-31</sup> (III)
- D. The nurse should use the Seldinger or Modified Seldinger Technique (MST) as the preferred method for CVAD (ie, peripherally inserted central catheter [PICC], subclavian) insertion due to advantages of decreased vein trauma, decreased insertion complications, and decreased risk of arterial puncture or nerve injury.<sup>8,30-34</sup> (V)
- E. CVADs shall have the tip dwelling within the superior vena cava (SVC) near its junction with the right atrium or, if placed via the femoral vein, shall have the tip dwell in the inferior vena cava (IVC) above the level of the diaphragm.<sup>8,35,36</sup> (IV)
- F. The nurse should be aware that the presence of a pacemaker requires a careful evaluation and thorough assessment to select the appropriate catheter and insertion site. Pacemakers are usually placed on the left side of the chest or abdomen. The contralateral side is preferred for CVAD placement, but if ipsilateral side is selected, a peripherally inserted central venous catheter may be the safest choice. It is important to have the pacemaker evaluated before and after CVAD insertion to determine integrity of the pacemaker unit and leads. There are no published reports of displaced leads noted during CVAD insertion, and there are currently no practice guidelines developed related to pacemakers and CVADs.<sup>37,38</sup> (V)

## Practice Criteria

### IV. Arterial Catheters

- A. The nurse should use a cap, mask, sterile gloves, eyewear, and a large, sterile fenestrated drape when placing a peripheral arterial catheter.<sup>39</sup> (II)

- B. Maximal sterile barrier precautions should be used when placing arterial catheters in the axillary or femoral artery.<sup>39</sup> (II)

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## 36. VASCULAR ACCESS DEVICE STABILIZATION

### Standard

36.1 Vascular access device (VAD) stabilization shall be used to preserve the integrity of the access device, minimize catheter movement at the hub, and prevent catheter dislodgment and loss of access.

36.2 VADs shall be stabilized using a method that does not interfere with assessment and monitoring of the access site or impede vascular circulation or delivery of the prescribed therapy.

36.3 The use of stabilization methods shall be established in organizational policies, procedures, and/or practice guidelines.

36.4 The nurse shall be competent in proper use and application of VAD stabilization methods and devices.

### Practice Criteria

- A. The use of a catheter stabilization device should be considered the preferred alternative to tape or sutures when feasible. Several studies have demonstrated a reduction in overall complications and improved dwell time with peripheral IV catheters. One study demonstrated reduced risk of infection with peripherally inserted central catheters (PICCs) when a catheter stabilization device was used. Sutures were associated with fewer complications when compared to use of tape with PICCs in pediatric patients in a randomized, controlled trial that excluded use of stabilization devices.<sup>1-6</sup> (III)
- B. Transparent semipermeable membrane (TSM) dressings or other dressings are often cited as helpful in stabilizing the catheter; however, there is insufficient evidence supporting their benefits in stabilization at the intravenous catheter hub alone. A randomized, controlled trial with peripheral IV catheters demonstrated that use of a peripheral IV catheter with an integrated stabilization feature in combination with an IV securement dressing performed as well as a standard peripheral IV with a catheter stabilization device. It is important to recognize that these results cannot be generalized to all types of short peripheral catheters.<sup>5,7-11</sup> (III)

- C. The use of alternative methods of VAD stabilization in lieu of sutures should be considered to mitigate the risk of needlestick injury; the use of staples has been cited in the literature as an alternative to sutures, reducing exposure to contaminated sharps. Studies are limited, however; they have not demonstrated benefits and may not be appropriate in the nonsedated patient.<sup>5,6,12</sup> (V)
- D. Use of any stabilization method should be based on evidence as well as analysis of risks versus benefits. While sutures may increase risk of needlestick injury and/or risk of infection due to the presence of suture wounds near the insertion site and development of biofilm on the sutures, sutures may be considered appropriate in special populations such as pediatric patients or those with skin integrity problems, precluding use of tape or an engineered stabilization device.<sup>5,10,13</sup> (V)
- E. If sutures used to stabilize a VAD at placement become loosened or no longer intact, they should be removed and the VAD should be secured using another stabilization method or resutured as appropriate.<sup>5</sup> (V)
- F. Removal and replacement of the engineered stabilization device or tape should be done at established intervals according to the manufacturer's directions for use, and/or in conjunction with replacement of the VAD, or with routine site care and dressing changes.<sup>5,14</sup> (V)
- G. A catheter that migrates externally should not be readvanced into the vein prior to application of a catheter stabilization device; the VAD should be stabilized at the point of external migration and assessed for proper placement in the vasculature before further use.<sup>14</sup> (V)

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## 37. JOINT STABILIZATION

### Standard

- 37.1 Joint stabilization, using such devices as an arm board or limb or finger splint, shall be implemented to facilitate infusion delivery when the catheter is placed in or adjacent to an area of flexion, and is not considered a restraint.
- 37.2 A joint stabilization device shall be considered a single-patient-use device.
- 37.3 The use of joint stabilization devices shall be established in organizational policies, procedures, and/or practice guidelines and according to manufacturers' directions for use.
- 37.4 The nurse shall be competent in the proper use and application of joint stabilization devices.

### Practice Criteria

- A. A joint stabilization device, such as an arm board or limb or finger splint, should be padded and support the area of flexion (ie, finger, hand, arm, foot) in order to maintain a functional position.<sup>1-3</sup> (V)