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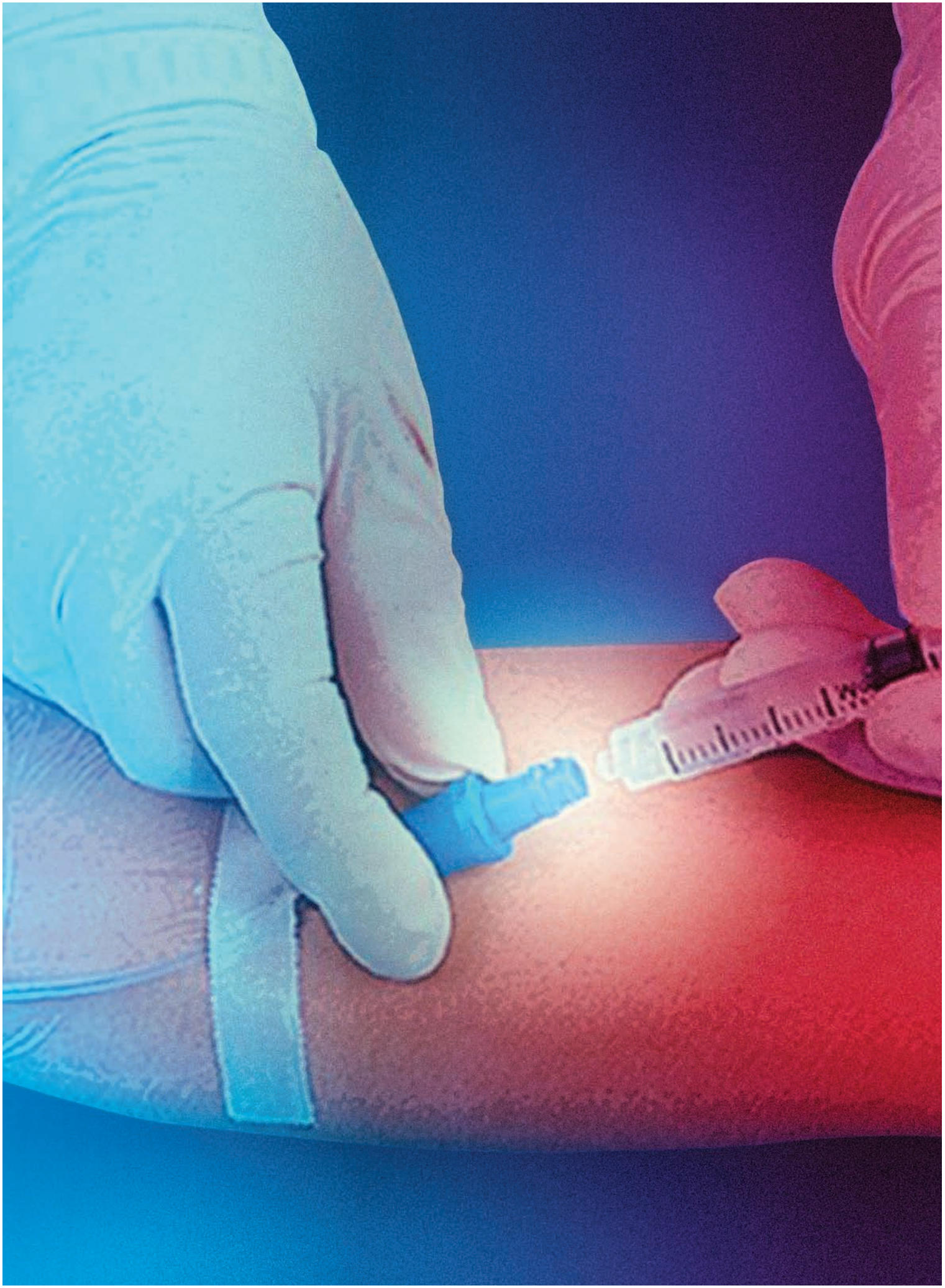
Evidence-based safe practice guidelines for

I.V. push medications

By Ann D. Shastay, MSN, RN, AOCN

WHILE MUCH EMPHASIS has been placed on the improvement of I.V. *infusion* safety, little published evidence or standardized best practices are associated with I.V. *push* injections. Although health-care organizations typically require competency validation for nurses and other professionals with I.V. administration responsibilities, much of this validation focuses on placing and managing vascular access devices. Graduate nurses may learn much of their I.V. therapy/I.V. medication delivery information, and gain most of their experience, from a coworker or preceptor during initial job orientation. These factors contribute to variation in knowledge and skill development and a lack of standard practices across organizations, potentially compromising patient safety.

Roy Scott



To address unsafe practices and at-risk behaviors associated with the preparation and administration of I.V. push medications in adults, the Institute for Safe Medication Practices (ISMP) obtained an educational grant from BD to hold a national summit of expert stakeholders. The 56 participants included representatives from hospitals and other frontline providers, professional organizations such as the Infusion Nurses Society (INS) and the ECRI Institute, regulatory bodies such as the FDA and The Joint Commission, and product vendors. During the 2-day summit, participants reached consensus on various practices for I.V. push medications, relying on the synthesis of the best evidence currently available, expert opinion, and manufacturers' guidelines. Regulatory requirements were also acknowledged and included as appropriate. All summit participants were volunteers and received no compensation beyond travel and meeting expense reimbursement.

Based on guidelines issued by summit participants and prepared by ISMP, this article summarizes important safe practice guidelines for the preparation, labeling, and administration of I.V. push medications for adult patients. For the full guidelines and a complete listing of participants and references, visit http://www.ismp.org/Tools/guidelines/IVSummitPush/IVPushMedGuidelines.pdf.

PREPARING I.V. PUSH MEDICATIONS

The following guidelines represent consensus standards for safe practices associated with the preparation of I.V. push medication prescribed for adults.

• **Use sterile technique when preparing and administering I.V. push medications, flush/locking solutions, and other parenteral solutions administered by direct I.V. injection.** Sterile technique includes hand hygiene before and after preparation and administration of medications or solutions; disinfection of the medication access diaphragm on a vial or neck of an ampule before accessing the medication or solution; disinfection of the I.V. access port, needleless connector, or other vascular access device before medication administration; and use of personal protective equipment if contact and exposure to blood or body fluids is possible.

• **Withdraw I.V. push medications from glass ampules using a filter needle or straw, unless specific drugs preclude their use.** Although controversial, the use of a filter needle or straw to reduce the risk of glass particle contamination was supported by a consensus of summit participants after careful consideration of its impact on safety and its ability to be implemented in most healthcare organizations.

• **Dilute I.V. push medications *only* when recommended by the manufacturer, supported by evidence in peer-reviewed biomedical literature, or in accordance with approved institutional guidelines.** Dilution of medications before administering a medication I.V. push may be required by the manufacturer; whenever possible, this should occur in the pharmacy before the medication is dispensed. Unnecessary dilution adds complexity to the drug administration process and introduces an avoidable risk of making medication errors and contaminating sterile I.V. medications or solutions.

A recent ISMP survey of nurses (RNs and LPNs) suggested that unnecessary dilution of I.V. push medications happens frequently, even with medications provided in prefilled syringes or pharmacy-dispensed syringes that contain a patient-specific dose.[1] An earlier study found that errors related to dilution most frequently included using the wrong diluent.[2] ISMP has also received reports of errors related to the administration of the wrong medication or solution due to unlabeled or mislabeled syringes of diluted medications.

• **If dilution or reconstitution of an I.V. push medication becomes necessary outside of the pharmacy sterile compounding area, perform these tasks immediately before administration in a clean, uncluttered, and functionally separate location using organization-approved, readily available drug information resources and sterile equipment and supplies.** Special procedures, including the use of a dedicated workspace, are considered essential to maintain asepsis when I.V. push medications are prepared for immediate use in less than an International Standards Organization (ISO) Class 5 environment.

ISO, an independent international organization, has established "cleanroom" levels ranging from Class 1 (cleanest) to Class 9 (least clean) based on factors such as level of environmental pollutants.[3] For more about cleanroom levels, visit www.iso.org.

The Association for Professionals in Infection Control and Epidemiology (APIC) suggests that, in addition to a clean and dry workspace, parenteral medication preparation must be performed away from obvious contamination sources such as water and sinks.[4] Advance preparation of immediate-use syringes or I.V. infusions (the night before or even hours before) outside of an ISO Class 5 environment is considered a controversial issue, and this practice isn't supported by APIC, the U.S. Pharmacopeial Convention (USP), INS, or ISMP.

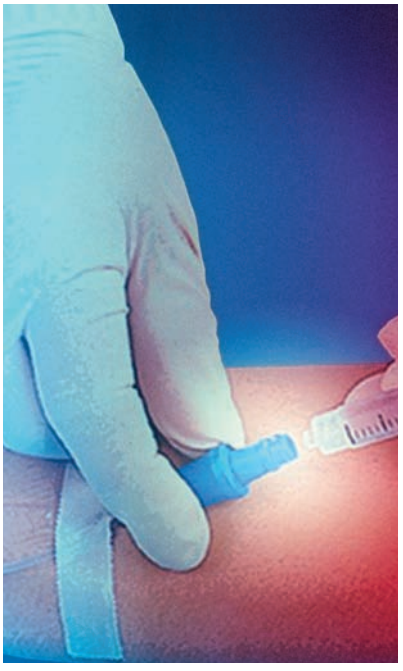
• **Provide instructions and access to the proper diluent when reconstitution or dilution is necessary outside of the pharmacy sterile compounding area.** If reconstitution or dilution of a medication is necessary, take steps to provide ready access to the proper diluent and instructions for reconstitution or dilution to support safe practice. In some facilities, this consists of pharmacy-prepared kits; in other facilities, this information is available in an electronic medication administration record (eMAR) in an expanded view as part of the eMAR entry.

• **Do *not* withdraw I.V. push medications from commercially available, cartridge-type syringes into another syringe for administration.** This type of system was introduced to

the marketplace to save time and reduce the potential for medication errors by limiting the number of steps required to prepare an injectable medication. With their easy-loading cartridges, these syringes may also help avoid delays in drug administration. Over the years, however, nurses have adopted an unsafe practice of using the prefilled syringe cartridges as single-dose or multiple-dose vials by withdrawing the medication from the cartridges.[5] Using the cartridges as vials can lead to contamination because the cartridges weren't intended to be used in this manner. This unsafe practice also can lead to dosing errors, drug mix-ups, and other types of medication errors, particularly because the prepared syringes are often unlabeled. Utilizing the cartridges as vials is also not economical when comparing the cost of prefilled syringes or vials of the same medication.

• **Do *not* dilute or reconstitute I.V. push medications by drawing up the contents into a commercially available, prefilled flush syringe of 0.9% sodium chloride.** Commercially available prefilled syringes of 0.9% sodium chloride and heparin are regulated by the FDA as devices, not as medications. These devices have been approved for the flushing of vascular access devices, *not* for the reconstitution, dilution, and/or subsequent administration of I.V. push medications. Such use would be considered "off label" and isn't how manufacturers intended these products to be used. These prefilled flush syringes haven't been tested for product safety when used in this manner.

Warnings intended to limit the use of prefilled syringes for medication preparation and administration appear on some syringe barrels, clearly stating "I.V. flush only." Some manufacturers have also limited or removed the gradation markings on the prefilled flush syringes in order to prevent measurement of a secondary medication in the flush syringe. When prefilled syringes are used in an off-label manner, the practitioner and employer bear the legal liability for any adverse events occurring from this practice.[6]



Label all clinician-prepared syringes unless the medication or solution is prepared at the bedside and administered immediately.

The mislabeling that occurs when medications are added to a prefilled syringe and a secondary label isn't applied creates significant risk for errors. In many cases, the manufacturer's label is permanently affixed to the syringe barrel and contains product codes and a barcode as well as specific information about the fluid and its volume. When another medication is added to this syringe, the manufacturer's label can't be amended without covering the original information.[6] In that case, a syringe may remain labeled as 0.9% sodium chloride, for example, even though it also contains the diluted or reconstituted medication. This unsafe practice is widespread and many who use it mistakenly believe the risk of an error is insignificant. Summit participants disagreed with this view and arrived at a consensus that the practice must be eliminated.

• **When necessary to prepare more than one medication in a single syringe for I.V. push administration, limit preparation to the pharmacy.** Combining more than one medication in a single syringe for I.V. push use is seldom necessary and error-prone. This practice could also result in unwanted changes in the medications due to incompatibilities. Unless required for immediate use, compounding more than one drug in a single syringe should be carried out in the pharmacy, in a USP-compliant cleanroom.

• ***Never* use I.V. solutions in containers intended for infusion, including mini bags, as common-source containers (multiple-dose products) to prepare I.V. flush syringes or to dilute or reconstitute medications for one or more patients in clinical care areas.** I.V. infusion bags are labeled by the manufacturer as single-dose containers, and as such are intended for administration as a single dose for use promptly after the container is opened. Any unused portions should be discarded.[7] APIC standards also suggest never using I.V. solution bags or bottles to obtain flush solutions, diluents, or for any other purpose for more than one patient.[4] Examples in the literature can be found in which the use of common-source infusion bags has resulted in the administration of contaminated injection solution.

Some respondents to an ISMP survey erroneously suggested this practice was safe because they discarded the solution after 24 hours. However, limiting use to 24 hours doesn't prevent disease transmission if the bag becomes contaminated.[8] The CDC's guideline for safe injection practices also indicates that practitioners shouldn't use bags or bottles of I.V. solution as a common source of supply for multiple patients.[9] If the solution becomes contaminated, it could transmit disease to many patients.

LABELING I.V. PUSH MEDICATIONS

The following guidelines represent consensus standards for safe practices

associated with labeling I.V. push medications prescribed for adults.

• Appropriately label all clinician-prepared syringes of I.V. push medications or solutions, unless the medication or solution is prepared at the patient's bedside and is immediately administered to the patient without any break in the process. Facilities should provide all drug preparation areas (inpatient and outpatient) with commercially available preprinted labels that allow for easy application on syringes, and provide prompts for appropriate documentation of the intended drug and contents (including drug name and concentration/dose). Medications or solutions in unlabeled syringes are unidentifiable and have been mistaken for different medications or solutions and administered to the wrong patient, in the wrong dose, and/or by the wrong route. Many errors associated with unlabeled containers have resulted in serious patient harm or death.

• If the clinician needs to prepare and administer more than one syringe of medication or solution to a single patient at the bedside:

—prepare each medication or solution separately, and immediately administer it before preparing the next syringe.

—or, if preparing several I.V. push medications at a time for sequential I.V. push administration, label each syringe as it's being prepared, before the preparation of any subsequent syringes.

It's not safe to prepare a syringe away from the patient's bedside and carry it unlabeled to the bedside, even if the intent is to administer it immediately. Clinicians have been unexpectedly interrupted or distracted while carrying an unlabeled syringe to the bedside, increasing the risk of a mix-up.[10] Also, The Joint Commission National Patient Safety Goal (03.04.01) requires practitioners to "label all medications, medication containers (for example, syringes, medicine cups, basins), or other solutions on and off the sterile field."[11]

• Alternatively, if a practitioner prepares one or more medications or solutions away from the patient's bedside, immediately label each syringe, one at a time, before preparing the next medication or solution.

• Bring only one patient's labeled syringe(s) to the bedside for administration. Group consensus determined that completing an entire sequence of preparing, scanning, and administering a medication for I.V. push injection before the preparation of a second parenteral medication will limit the possibility of error due to syringe swap. If more than one syringe must be prepared, completing the preparation and labeling of one syringe at a time is the safer approach.

• Provide clinical units with blank or printed, ready-to-apply labels, including sterilized labels where needed, to support safe labeling practices. An American Nurses Association study identified that the top reasons nurses don't label syringes included concerns that the labels may cover the measurement gradation on the syringe barrel, impairing the ability to accurately check the dosage, and lack of a suitable label. Preprinted, ready-to-apply labels, including available sterilized labels where needed, can support safe labeling practices.[12]

• Immediately discard any unattended, unlabeled syringes containing any type of solution. Unlabeled syringes should always be considered unidentifiable unless prepared at the bedside and administered immediately by the preparer. Administration of an I.V. push medication from an unlabeled syringe, even if the practitioner "thinks" that he or she knows what the unlabeled syringe contains, carries high risk and has resulted in severe patient harm and even death.[10]

• Never prelabel empty syringes in anticipation of use. Errors have occurred when a prelabeled syringe was mistakenly selected and the wrong medication or solution was drawn into the syringe. Instead, label each syringe immediately *after* preparation, one at a time.

ADMINISTERING I.V. PUSH MEDICATIONS

The following guidelines represent consensus standards for safe practices associated with administering I.V. push medications prescribed for adults.

• Perform an appropriate clinical and vascular access site assessment of the patient before and after the administration of I.V. push medications. An appropriate clinical assessment includes an evaluation of the prescribed therapy for the patient's age and clinical status (reason for drug treatment), the drug name, dose, route, rate of administration, and frequency. The practitioner should assess the patient for therapy indications and contraindications, have knowledge of the size and type of venous access device, confirm that the vascular access device is functional (for example, aspirating for positive blood return and encountering no resistance when manually flushing a vascular access device), and verify that the patient is clinically suited for the prescribed I.V. push medication.[13] For example, perform a comprehensive pain assessment using a validated and appropriate pain rating scale both before and at the appropriate time (typically within 30 minutes) after administering an I.V. opioid.

As with any medication, the practitioner administering an I.V. push medication should carefully review the vial or syringe label; confirm accuracy of the patient, drug, dose/strength, route, and time the medication is due by comparing the drug label against the prescription or MAR; confirm the integrity of the container (intact; no leaks), check for any visible contamination (precipitate, lack of clarity); verify the potency (within the beyond-use date); and validate that any special storage conditions have been met.[10,13]

Before, during, and after administration, practitioners should assess the patient's venous access site for any signs of infiltration or extravasation, monitor the patient for potential adverse events and reactions, and be prepared to initiate appropriate

interventions should an adverse event occur.[10,13]

• **Unless its use would result in a clinically significant delay and potential patient harm (for example, delaying emergency administration of I.V. atropine for symptomatic bradycardia with a pulse), use barcode scanning or similar technology immediately prior to the administration of I.V. push medications to confirm patient identification and the correct medication.** Use of approved automation and other technology to confirm the correct patient and drug prior to I.V. push administration is a more efficient and effective error-reduction strategy than a manual check performed by a practitioner. Even in an emergency, some automated dispensing cabinet (ADC) systems can aid in the accurate selection of medications by requiring barcode scanning at the ADC once a medication is selected from the ADC screen. This can be accomplished even if a prescription has yet to be entered into the electronic health record.

• **Administer I.V. push medications and any subsequent I.V. flush at the rate recommended by the manufacturer, supported by evidence in peer-reviewed biomedical literature, or in accordance with approved institutional guidelines. Use an appropriate volume of the subsequent I.V. flush to ensure that the entire drug dose has been administered.** Rates for I.V. push medication administration listed as "slow" or "fast" are considered ambiguous and should be clarified. In some cases, the speed at which a practitioner administers a medication makes a therapeutic difference or may contribute to an adverse reaction. An example would be the inappropriately slow administration of I.V. push adenosine to treat stable, regular, narrow-complex tachycardia with a pulse refractory to vagal maneuvers. Practitioners who administer I.V. push medications without a watch or second hand tend to underestimate the time that has passed, often administering medications at a rate faster than recommended.[14] Therefore, practitioners who administer I.V. push medications over a period of seconds to minutes must have immediate access to a watch or clock *with a second hand or with a digital display of minutes and seconds.* Because not all locations where I.V. medications are administered have a viewable wall clock, it's suggested that the practitioner wear a watch.

The rate and volume of the subsequent flush can also result in unintended rapid or delayed administration of a drug. The medication left in any dead space in tubing or catheters will be flushed into the vascular system at the same rate that the flush or associated compatible I.V. solution is being administered.

• **Assess the patency of central venous access devices using, at a minimum, a 10 mL diameter-sized syringe filled with preservative-free 0.9% sodium chloride. Once patency has been confirmed, I.V. push administration of the medication can be given in a syringe appropriately sized to measure and administer the required dose.** Care should be taken when assessing for central venous access device patency to avoid possible catheter rupture. Manufacturers recommend using, at minimum, a 10 mL diameter-sized syringe for assessing patency because a syringe of this size generates lower injection pressure than a syringe with a small diameter, such as a 5 mL syringe. After patency has been established, however, medications can be administered in a syringe appropriately sized for the dose of the I.V. push medication required.[13] Many facilities have created policies stipulating that a 10 mL syringe be used for all procedures involving a central venous access device, when in fact, it isn't necessary to introduce risk through a syringe-to-syringe transfer in order to administer medications.

• **When administering I.V. push medications through an existing I.V. infusion line, use a needleless connector that's proximal (closest) to the patient, unless contraindicated in current evidence-based literature, or unless the proximal site is inaccessible for use, such as during a sterile procedure.** Access points closest to the patient are preferable for use during I.V. push medication administration and subsequent flushing procedures, as they allow the medication to reach the central circulation as soon as possible with a minimal amount of flushing required. Medications administered I.V. push in a distal port (away from the patient) may linger in the I.V. tubing of an existing line, and thus may actually be administered at a later time based on the infusion rate of the existing I.V. fluids, or it may not actually be administered at all if the I.V. line is dislodged or discontinued before the medication reaches the patient. The use of distal ports for I.V. medication administration has occasionally resulted in patient harm if the patient was no longer being monitored when the full dose of medication finally reached the patient.[10]

On occasion, the proximal port may be unavailable when a patient is positioned under sterile drapes for a procedure. In this case, using the next proximal port to the patient is appropriate. When using a more distal site, staff need to be aware of and account for the dead space in the tubing after I.V. push medication administration to ensure that the entire dose has been administered at the intended rate of injection.

Reporting errors improves safety

Report adverse events, close calls (near misses), and hazardous conditions associated with I.V. push medications internally within the healthcare organization as well as in confidence to external safety organizations such as ISMP for shared learning. Healthcare providers and safety agencies use error and adverse event reporting programs to learn about actual and potential safety risks and the underlying system and

behavioral circumstances that lead to human errors. The goal of learning from events is to create reliable systems and enhance the ability of staff to make safe behavioral choices. Sharing "close call" events is also important in order to improve the design of systems within the organization.[15]

Federally certified Patient Safety Organizations (PSOs) such as ISMP create a secure external environment where clinicians and healthcare organizations can report errors and close calls and receive expert assistance in analyzing individual events and aggregate data, thus identifying and helping to reduce the risks associated with patient care and improving quality.

Facilities should use both internal and external information about adverse events, close calls, and hazardous conditions associated with I.V. push medications for continuous quality improvement. By addressing common, preventable adverse occurrences, a healthcare organization has the opportunity to become safer and to enhance the quality of care delivered. In addition, sharing errors and close calls with an external PSO allows the entire healthcare community to benefit from lessons learned. ■

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