

CHAPTER 3

Medication Administration

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KEY TERMS

Buccal
Depot preparations
Injectable pen
Intramuscular
Intraosseous
Intravenous
Medication
administration
error

Medication error
Oral
Subcutaneous
Sublingual
Transdermal
Transmucosal

CHAPTER OBJECTIVES

At the end of the chapter, the reader will be able to:

1. Define key terms.
2. Discuss the nurse's role in medication administration.
3. Identify the eight medication rights and three patient checks.
4. Identify the steps in administering medications using different delivery methods.
5. Discuss current trends in medication administration.
6. Identify methods to help reduce medication errors.

Introduction

Medication is transferred into the body's tissues in one of three ways: (1) by ingestion and absorption in the digestive tract; (2) by passive transfer through porous tissues, such as the skin, the alveoli of the lungs, and the mucous membranes; or (3) by insertion directly into the interior tissues via subcutaneous, intramuscular, or intrathecal injection or intravenous/intraosseous infusion. The central goal of nursing pharmacology is to enable nurses to provide medications to patients safely and appropriately using the route best suited for the administration. Within that seemingly simple statement is held a complex set of information defining the nurse's relationship with his or her patients.

To safely administer medications, a nurse must know the answers to a range of potential questions about his or her patients and their medications: who, what, when, how, and why (TABLE 3-1).

Medication errors are no small matter in nursing practice. The Institute of Medicine's (IOM) first Quality Chasm report, *To Err Is Human: Building a Safer Health System*, noted that medication-related errors contribute to significant morbidity and mortality; errors accounted "for one out of every 131 outpatient deaths and one out of every 854 inpatient deaths in the United States" (IOM, 1999, p. 27; see also Hughes & Blegen, 2008). Furthermore, according to the IOM (1999), medication errors account for more than 7000 deaths annually in the United

States. Contemplating these facts makes it clear that nurses must take an approach toward medicating patients that focuses on ensuring the *right* amount of the right medication gets to the *right* patient at the right time—always.

Before Administering Medications: The Eight Medication "Rights"

A variety of protocols have been instituted to help avoid medication errors. For example, many hospitals and practices use an eight-point checklist



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TABLE 3-1 Key Questions When Administering Medications

General Question	What Nurses Need to Know Is...	Goal
Who	Who is the patient? This means: What is the patient's age, sex, and mental health and physical health status? Are there any factors that could contraindicate this medication being administered?	Ensure that the medication is appropriate for the patient's needs, keeping in mind factors such as physiological issues (e.g., ability to absorb oral medications), biochemical issues (e.g., other medications the patient takes), and social factors (e.g., the patient's known religious or cultural preferences) that may affect whether an ordered medication is appropriate for a given patient.
	Is this <i>patient</i> the same individual for whom the medication was ordered?	Avoid administering the ordered medication to the <i>wrong patient</i> .
What	What <i>medication</i> is to be delivered to this patient?	Ensure that the <i>correct medication</i> is administered in accordance with the prescription or orders of the prescriber.
	What <i>dose</i> was requested on the medication order?	Ensure that the dose administered is in accordance with the orders of the prescriber and allows cross-checking that the dose ordered is appropriate for patient needs.
When	What is the appropriate <i>time</i> to administer this medication?	Avoid administering medication too frequently, too infrequently, at inappropriate times of day, or in inappropriate combination with another medication.
	What duration of administration was ordered for this medication?	Avoid delivering a medication for a longer or shorter <i>duration</i> than was ordered by the prescriber.
	When did this patient last have a dose of this (or any) medication?	Avoid overmedication or potential interactions between medications.
How	<i>In what manner</i> is this medication <i>typically</i> administered?	Avoid selection of inappropriate delivery <i>procedures</i> (e.g., intramuscular injection for a medication intended for intravenous delivery).
	Which <i>route</i> of delivery was ordered for this patient?	Ensure that the medication is delivered via the route ordered by the prescriber.
	Do any factors contraindicate the ordered delivery route in this patient?	Avoid using inappropriate methods of medication delivery.
Why	<i>What condition</i> is the medication intended to treat?	Avoid using medications that are not indicated for a particular condition.
	What is the response that is expected from the use of this medication?	Ensuring that unexpected or unintended actions (e.g., medication allergy) are noted and treated as necessary in a timely fashion.

Note: If any of these questions is overlooked before medication is administered, the potential for a medication error increases.

(**TABLE 3-2**) that includes identifying the correct patient (*who*), by cross-checking the names on the medication order and on the patient's identification bracelet; using two documented patient identifiers, such as name and date of birth; and asking the patient to verbally identify himself or herself, if able to do so. Additionally, using technology, such as a bar-code system when it is available, can decrease medication errors. Checking the medication label

against the medication order can ensure that the correct medication is being prepared for the patient (*what*). Checking the medication order for the correct dosage and verifying its appropriateness by comparing information with drug references, as well as double-checking with another nurse, can also reduce dosing errors. Determining the route of the medication that should be given (*how*) can be verified via a drug reference book, and confirming the

TABLE 3-2 Eight Medication “Rights” Checklist

Right patient	Check the name on the order against the name of the patient.
	Use two patient identifiers (name, birth date are commonly used).
	Ask the patient to identify himself or herself.
	When available, use technology (example: bar-code system).
Right medication	Check the medication label.
	Check the order.
Right dose	Check the order.
	Confirm the appropriateness of the dose using a current drug reference.
	If necessary, calculate the dose and have another nurse calculate the dose as well.
Right route	Again, check the appropriateness of the route ordered.
	Confirm that the patient can take or receive the medication by the ordered route.
Right time	Check the frequency of the ordered medication.
	Confirm when the last dose was given.
	Double-check that you are giving the ordered dose at the correct time.
Right documentation	Document administration <i>after</i> giving the ordered medication.
	Chart the time, verify the route of administration, and any other specific information as necessary—for example, the site of an injection or any laboratory value or vital sign that needs to be checked before giving the drug (e.g., checking the potassium lab value and blood pressure before administering Lasix [furosemide]).
Right reason	Confirm the rationale for the ordered medication. What is the patient’s history? Why is he or she taking this medication?
	Revisit the reasons for long-term medication use.
Right response	Make sure that the drug leads to the desired effect. If an antihypertensive was given, has the patient’s blood pressure improved? Does the patient verbalize improvement in depressive symptoms while taking an antidepressant?
	Be sure to document your monitoring of the patient and any other nursing interventions that are applicable.

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order can reduce errors associated with the wrong route of administration. Furthermore, knowing the appropriate time when a given dose should be administered by checking the prescribed or ordered frequency of the medication dosing, as well as knowing when the previous dose of a medication was given, can eliminate timing errors (*when*). After a medication is administered, it is important to document that the drug was administered both in a timely fashion, and in a correct manner to avoid duplicate dosing, prevent missed doses, note pertinent information such as lab values and vital signs, and review documentation regarding the sites used for previous medication administration. Finally, knowing the reason (*why*) a medication is ordered or prescribed, as well as the expected outcomes, will allow the nurse to provide the optimal care for his or her patients.

All of these procedures must precede *any* delivery of medication. A nurse who fails to perform them has made a medication error regardless of whether the patient actually received the correct dose of medication—if for no other reason than the nurse is unable to document that procedures were performed correctly, which affects the ability of other healthcare providers to continue treatment in a safe and effective way.

Procedures for Administering Medications

To further ensure patient safety, each route of administration (**TABLE 3-3**) has procedures that should be followed to ensure patient safety. These procedures shall be delineated individually below. However, before describing how medications are administered, it is important to review the obstacles that can interfere with performing this task.

WHICH FACTORS HAMPER SAFE MEDICATION ADMINISTRATION?

The goal of any healthcare provider is to administer medication in accordance with correct procedure.

TABLE 3-3 Routes of Administration

Route of Administration	Route Meaning	Example of Medication
Sublingual (SL)	Under the tongue	Nitroglycerin
Inhalation	Into the lungs	Albuterol
Intranasal	Within the nose	Midazolam
Intravenous (IV)	Into the vein	Furosemide
Intramuscular (IM)	Within the muscle	Glucagon
Subcutaneous (SC/SQ)	Between the dermis and muscle layer	Epinephrine
Endotracheal (ET)	Via an ET tube	Atropine
Oral	By mouth	Activated charcoal
Buccal	Between the cheek and gum	Glucose
Rectal (PR)	Rectum, urethra, or vagina	Diazepam
Transdermal	Applied topically to the skin as in a patch	Nitroglycerin
Aural	Ear	Levofloxacin
Intradermal	Within the dermal layer of the skin	PPD (purified protein derivative; Mantoux tuberculosis [TB] test)
Ocular	Drops in the eye	Betaxolol ophthalmic
Gastric	Via a gastric tube	Activated charcoal
Intraosseous (IO)	Into the marrow cavity of the bone when quick IV access is not practical	Furosemide
Intrathecal route*	Lumbar puncture	Baclofen

*Intrathecal medications are generally not administered by nursing staff due to the specialized nature of lumbar puncture procedures. Most such medications are administered by anesthesiologists or other specialist technicians. However, nurses need to maintain awareness of the effects of medications given by this route.

However, *any* procedure can be derailed by the factors that commonly contribute to human error (Reason, 2000; Southwick, 2012):

- **Fatigue.** Tiredness reduces attentiveness to details, making it more likely that a step in a procedure will be missed or performed incorrectly.
- **Interruption.** Stopping midway through a task or being interrupted during a task increases the likelihood that steps will be missed or improperly performed.
- **Multitasking.** Attempting to juggle multiple tasks at the same time usually results in one or more of those tasks being performed poorly.
- **Emotional stress.** An individual who is under emotional stress—whether the source is personal (e.g., marital difficulties, a sick relative) or professional (e.g., fear of layoffs, workplace conflicts)—is more prone to making errors.

Such factors are not always in the nurse's control. If a facility is short-staffed, due to illness for instance, it may not be possible to avoid working long, or multiple shifts, leading to fatigue and emotional stress. However, maintaining awareness of susceptibility to these factors can help the nurse avoid the errors these factors tend to encourage.

SYSTEMIC FACTORS IN MEDICATION ERRORS

It is likewise important to realize that errors do not occur simply because of factors specific to an individual; often, systemic or cultural factors in institutions also create an environment that is error-promoting. For example, studies have found that the transition between shifts—that is, when a new team of providers assumes care for patients after the previous team members finish their working day—is a key period during which errors may develop



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due to ineffective communication of patients' status (Carayon & Wood, 2010). Thus, having institutional processes in place designed to limit errors and fostering a culture that favors a conscious effort to follow those processes *every time* are crucial to reduce such errors and ensure correct administration of medications (Reason, 2000).



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The procedures we describe in the following sections include protocols to help avoid conditions that contribute to medication errors. Most institutions will have specific checklists or processes that must be followed, some of which are specific to particular medications that are prone to be confused (e.g., medications with similar-sounding names), that are similar in function but have critical differences in timing (e.g., short-acting versus long-acting insulins), or that may have profound effects if dosed incorrectly (e.g., anticoagulant or antiarrhythmic agents).

Proper Procedure for Administering All Medications

No matter which delivery route is used, certain steps should be followed when giving any form of medication. First, all of the equipment necessary to administer a medication will need to be gathered prior to the procedure. This equipment should include (1) any necessary keys for opening the medication-dispensing devices, (2) the medication record or patient chart, (3) clean dispensing containers, and (4) drug reference books. It is important to gather your supplies prior to the procedure to decrease interruptions. Hand washing should be performed prior to, and after, all of the necessary steps in the medication administration procedure. All legitimate prescriptions should, at a minimum, include the name of the drug (usually the generic name, but the trade name can be written); the dose of the medication to be given; the *intended* administration time; the *actual* time of administration; and the route of administration. If the prescription is handwritten, it should be legible, unambiguous, and signed and dated by the prescribing practitioner (Ferguson, 2005). Additionally, the medical chart should contain the patient's name, date of birth, and medical record number affixed via a nonremovable label on the chart, and it should clearly state whether the patient has any known allergies to any substances, especially medications (Ferguson, 2005). An updated weight should be documented in the patient chart and recorded on

the medication administration record flow sheet; this should be checked for discrepancies for any weight-dependent medication dosages, especially for pediatric patients (Ferguson, 2005).



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Facility-based policies will exist regarding the number of providers necessary to check the appropriateness of medication prescriptions. Adherence to such policies is especially important when administering controlled substances, pediatric doses of medications, and high-alert medications, which include such drugs as insulin and heparin. Pediatric dosing and administration of controlled substances requires that two nurses check preparations prior to administration of the medications. For all medication administration, at a minimum, the nurse should check the name of the medication (both the generic and trade names), the dose required, time for proper administration, and the previous time the drug was

given (or the most recent time that the drug was taken by the patient). In addition, the legibility of the prescription, the provider's signature, the date when the order or prescription was written by the prescriber, any known patient allergies, and the expiration date of the drug should be included on the order or patient chart (Ferguson, 2005). Any discrepancies between the ordered medication and the medication the nurse has to administer should be verified with the prescriber, or, if that prescriber is not available, with another qualified prescriber familiar with the patient.

Before administering the medication, the nurse must verify that the patient receiving the medication is the patient for whom the medication is prescribed. The easiest way to do this is to check the patient identification band on the patient's wrist, or ask the patient to state his or her name and to match it with the name in the medical record (Ferguson, 2005). Additionally, a second identifier is necessary to verify the patient's identity; this may include the patient's date of birth for easy verification. Informed consent should be obtained prior to administering any medication, to determine the patient's understanding of the medication and its side effects, as well as the option for the patient to refuse any medications (Ferguson, 2005). Any refusal of medication should be appropriately documented in the patient record and reported to the prescribing provider.

Administering Oral Medications

Oral medications in this context are those given by mouth and swallowed (**FIGURE 3-1**). It is important to note that some other medications are delivered orally (e.g., sublingual medications) but are not swallowed; the key difference is that oral medications are designed to pass through the digestive tract, while

Best Practices

It is important to gather your supplies prior to the procedure to decrease interruptions and their potential negative consequences.

Best Practices

Before administering the medication, the nurse must verify that the patient receiving the medication is the patient for whom the medication is prescribed. Matching the patient's name and birth date to the name and birth date on the order is the easiest way to do this.



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FIGURE 3-1 Proper oral medication administration.

Best Practices

Sign the prescription or medical record to verify that the medication has been administered only *after* the patient has taken the medication.

the other types of delivery bypass the digestion process.

Oral medications should be administered using an appropriate delivery system. Solid medications such as tablets and capsules should be given in clean, dry, disposable containers, whereas oral liquid medications, and those requiring oral

syringes, should be measured in syringes designed specifically for the medication-dispensing purpose (Ferguson, 2005). Patients should be placed into a comfortable position and assisted if necessary. It is important to note that medications *should not* be left out for a patient to take at his or her convenience. If the patient is not present when the medication is due, or if the patient does not wish to take it at the prescribed time, then the nurse should return to administer the dose later (documenting the reason for the discrepancy in timing). Additionally, consideration should be given to the patient's ability to swallow oral medications; all medications should be given in the manner prescribed, and crushed only if ordered to do so by the prescriber, and if it is appropriate to crush the specific dosage form of the medication (Morris, 2005).

When dispensing oral medications, the nurse should sign the prescription or medical record to verify that the medication has been administered as ordered, and should do so *only after the patient has taken the medication*—not when the medication

is placed into the dispensing containers (Ferguson, 2005). The nurse should also note the effectiveness of the medication given and document it in the patient record. All medications should be replaced and stored in compliance with the policy of the institution (Ferguson, 2005).

Injecting Medications Safely

Injected medications are delivered into the body using a syringe by one of two routes. **Subcutaneous** medication is delivered “under the skin” (*sub* = “under”, *cutis* = “skin”) by a syringe placed within the fatty layer of tissue just below the dermis (National Institutes of Health [NIH], 2012). The subcutaneous route is sometimes selected because there is little blood flow to the fatty tissue, and the injected medication is therefore absorbed more slowly, sometimes taking as long as 24 hours to be absorbed. Examples of medications that are injected subcutaneously include heparin, growth hormone, insulin, and epinephrine (NIH, 2012). **Intramuscular** injections, as the name implies, are administered directly into muscle tissue. Intramuscular injections are utilized as a medication delivery method because there are no significant barriers to drug absorption and can be absorbed rapidly or slowly (Lehne, 2013).

A variety of considerations affect safety when delivering medications by injection. First, the nurse needs to ascertain which type of injection is required: Is the medication intended for subcutaneous delivery or intramuscular delivery? Second, the nurse should consider the needs of the patient receiving the injection: Is this a pediatric patient who may be unwilling or unable to sit still for an injection? If so, the nurse may need to get an assistant or request a parent's help in holding the child still while delivering the injection. Third, the patient's physical presentation may affect safe and appropriate medication delivery; for example, in a particularly slender patient, the layer of subcutaneous fat may be narrow enough that a syringe inserted at too great an angle (more than 45°) might inadvertently inject the medication into muscle instead fat, while in an obese patient, the opposite

The Parts of the Syringe

A syringe has three major parts: the needle, the barrel, and the plunger (FIGURE 3-2). The needle goes into the skin to enable medication transfer from the barrel. The barrel holds the medicine, and the plunger is used to force the medication out of the syringe. The syringe has marks on the side of the barrel (like a ruler) to indicate the number of cubic centimeters (cc) or milliliters (mL) that can be contained in the syringe, and increments thereof.

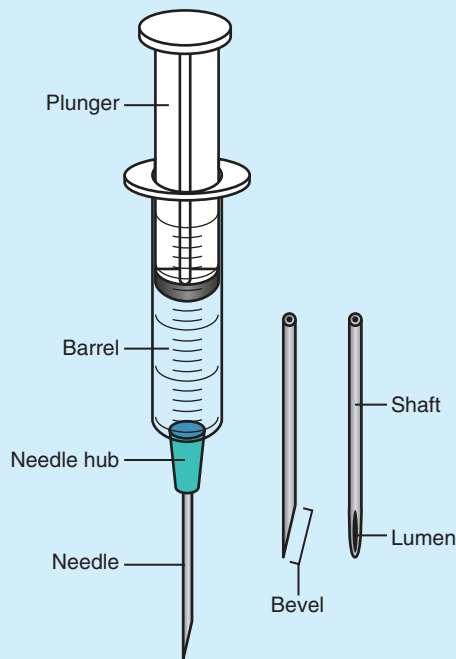


FIGURE 3-2 Parts of a syringe.

problem might impede an intramuscular injection. Note that the nurse's own safety is important as well when it comes to medication injection, as improperly handled syringes can cause needle-stick injuries.

GIVING SUBCUTANEOUS INJECTIONS

Before giving a subcutaneous injection, the nurse should wash his or her hands thoroughly for at least 20 seconds, and assemble the equipment necessary, including:

- Medication in either a multidose vial of liquid or a vial of powder requiring reconstitution, as directed by the manufacturer

- Syringe or pen and needle, appropriate for the size of the adult or child: 0.5 cc, 1 cc, or 2 cc with 27-gauge $\frac{5}{8}$ -inch needle; 3 cc Luer-Lock syringe if the solution is more than 1 cc; 25- to 27-gauge $\frac{5}{8}$ -inch needle or 0.3 mL insulin syringes with 31-gauge $\frac{3}{16}$ - to $\frac{5}{16}$ -inch needle in special circumstances
- Container for syringe disposal
- Sterile 2 × 2-inch gauze pad
- Alcohol pads

Preparing the Medication for a Subcutaneous Injection

The nurse should check the label to verify the correct medication and remove the soft metal or plastic cap protecting the rubber stopper of the vial. If the medication is in a multi-dose vial, record the date and time the vial was first opened on the label. The nurse should clean the exposed rubber stopper with an isopropyl alcohol wipe, remove the syringe from the plastic or paper cover, and attach the needle securely to the syringe, if it is indicated. Next, the nurse should pull back and forth on the plunger by grasping the plunger *handle*, so that contamination of the sterile plunger shaft will be prevented. With the needle capped, pull back on the plunger to fill the syringe with air equal in volume to the amount of medication to be administered.

Remove the cap covering the needle and set it on its side to prevent contamination, also taking care not to touch the sterile needle. The inside of the cap and the needle are sterile, and the cap will be used to cover the needle until the time of medication administration. With the vial upright, push the needle through the cleansed rubber stopper on the vial.

Push the needle into the subcutaneous tissue at a 45° or 90° angle, being careful not to bend the needle (FIGURE 3-3 and FIGURE 3-4). Inject the air (if

Best Practices

There are specific drugs (e.g., chemotherapeutic and radioactive agents) that pose potential danger to the patient and/or nurse if inadvertently spilled. These exceptional drugs require that "negative pressure" be maintained in the vial. If this is true, injection of air into the vial prior to medication withdrawal must be avoided.

Be sure to check that the technique for withdrawing doses from the vial is appropriate *before you start*.

Best Practices

The needle's cap is sterile; it is used to keep the needle sterile after the medication is drawn from the vial. Remove and replace it carefully to maintain sterility.

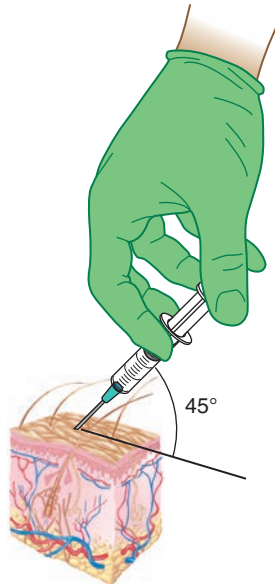


FIGURE 3-3 Image of administering a subcutaneous injection (45° angle).

appropriate) in the syringe into the vial to prevent a vacuum from forming. If too little air or no air is injected, it is difficult to withdraw the medication. If too much air is injected, the plunger may be forced out of the barrel, causing the medication to spill. Remember that there are a few injectable medications for which you want to prevent positive pressure

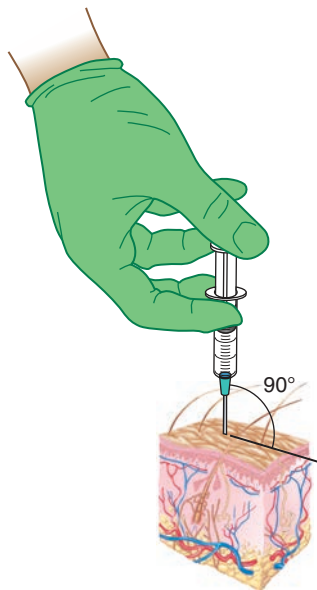
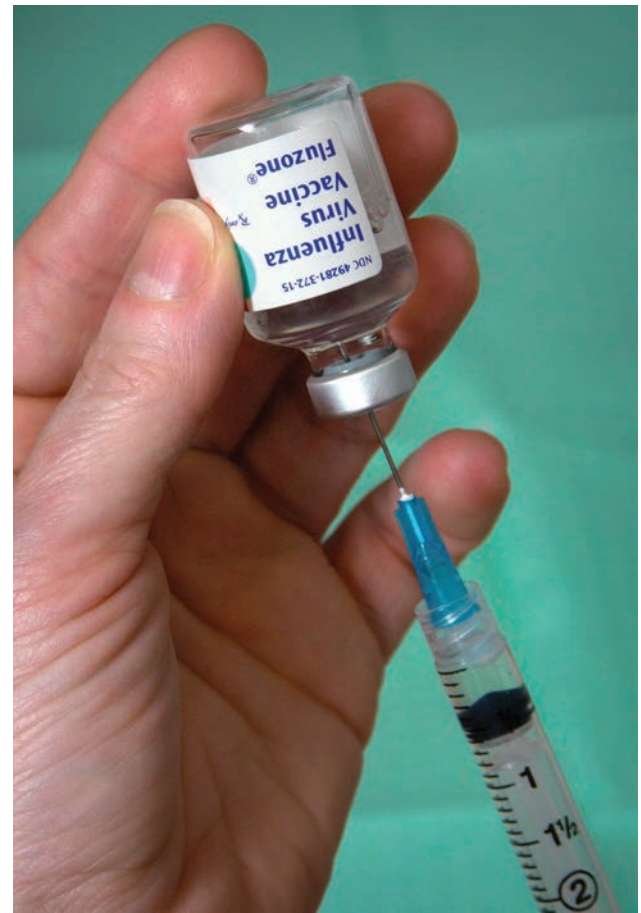


FIGURE 3-4 Image of injection at 90° angle.

from causing the medication to spill on the nurse or the patient.

Turn the needle and vial upside down with the needle remaining in the vial, making sure that the needle is pointed upward. Ensure that the tip of the needle is completely covered by the medication to make it easier to draw up the medication without any air. Pull back on the plunger to fill the syringe with the correct volume of the medication. Keep the vial upside down with the needle in the vial, continuing to point them upward. Tap the syringe with the fingertips to remove any air bubbles in the syringe. Once the bubbles are at the top of the syringe, gently push on the plunger to force the bubbles out of the syringe and back into the vial. Alternatively, if the bubbles cannot be removed from the syringe by tapping with the fingertips, push all of the medication slowly back into the vial and



Courtesy of Jim Gathany/CDC

FIGURE 3-5 Dispensing medication into a syringe.

repeat the previous steps if necessary. It is important to remove the air from the syringe because air takes up the needed space for the medication and because such bubbles can cause pain or discomfort or air emboli if they are injected. After removing the bubbles, check the volume of the medication in the syringe to verify that the *volume* (and therefore the *dose*) is the correct.

Injectable Pens

For some medications, a premeasured pen-like device is available. If the nurse is using such an **injectable pen**, the following steps will be employed.

First, attach the needle to the pen by cleaning the top of the needle with an alcohol wipe and screw the needle onto the injectable pen. Next, use the dial on the pen to set the appropriate dose volume. If priming of the injectable pen is required, this step should be performed before setting the dose. Many injectable pens are manufactured so that a “priming volume” may be set with a dial. The pen needle should be pointed up and the injection button depressed completely. The nurse should see a drop or stream of liquid. If a stream of liquid is not visible, the priming steps should be repeated until this occurs. Dial in the prescribed volume of medication. After the medication is correctly prepared, carefully replace the needle cap to prevent contamination, being careful not to stick any fingers with the needle (NIH, 2012).

Rotating Injection Sites for Subcutaneous Injections

It is important to rotate the injection sites to keep the skin healthy and to prevent scarring and hardening of the fatty tissue. Scarring and hardening of the skin may prevent absorption of the medication (NIH, 2012). Each injection site should be at least 1 inch away from the previous injection site. A series of injections should be started at the highest physical point on the patient (such as the upper arms) as possible (FIGURE 3-6); the sites should then move to the lowest point away from the initial injection site on the body part, such as the upper thighs (NIH, 2012). It is preferable to use all of the sites available

on one body part before moving to another body part, although this may need to be altered for patient comfort (NIH, 2012). Injections should not be administered in red, inflamed, burned, swollen, or damaged skin (NIH, 2012).

General Guidelines for Subcutaneous Injections

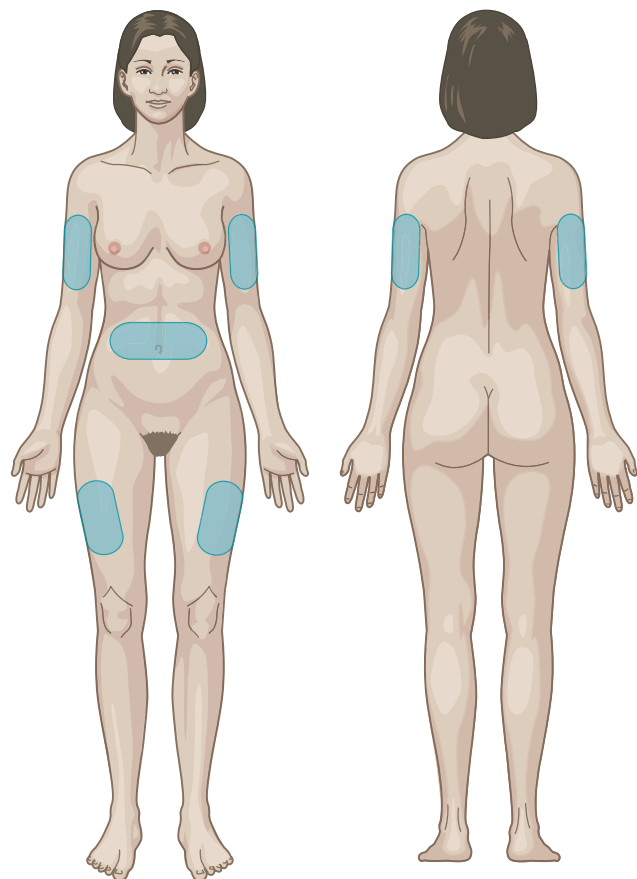
Cleanse the skin thoroughly in a back-and-forth motion with an alcohol swab to eliminate microbes at the injection site. Allow the alcohol to dry completely. Take the cover off of the needle, being careful not to contaminate the needle. Place the cover on its side. The nurse who is administering the dose should hold the

Best Practices

Remove the air from the syringe because air takes up space that should be filled with medication. In addition, bubbles can cause pain or discomfort or air emboli if they are injected.

Best Practices

Rotate injection sites to prevent scarring, and avoid giving injections in damaged or swollen skin.



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FIGURE 3-6 Example of injection site of rotations choices.

Best Practices

Keep your fingers off the syringe plunger until the needle is fully inserted. Otherwise, you may wind up delivering the medication on the skin surface or in the dermis, rather than subcutaneously.

syringe in one hand like a pencil or dart, grasp the patient's skin between his or her thumb and index finger with his or her other hand, and pinch the skin in an upward fashion. The needle should then be quickly thrust all the way into the skin. Avoid pushing the needle into the skin slowly or thrusting the needle in with great force. A common mistake is pressing down on the top of the plunger while

piercing the skin; this can result in the medication being released before the needle is in position, resulting in deposition of medication on the skin surface, or within the skin layers, rather than under the skin; for this reason, it is important to keep one's thumb or finger off the plunger until the needle is completely inserted.

Insert the needle at a 90° right angle into the skin (see Figure 3-3). This angle is important to ensure that the medication will be injected into the fatty tissue. If the patient receiving the injection is a small child or has very little subcutaneous fat or thin skin, a 45° angle is used (see Figure 3-4). If using a pen needle, insert the pen needle at a 90° angle.

After the needle is completely inserted into the skin, release the grasped skin and press down on the plunger to inject all of the medication into the subcutaneous layer at a slow and steady rate. If using a pen, press the injection button completely until it “clicks,” and keep the pen in position for 10 seconds before removing the needle from the skin.

As the needle is pulled out of the skin where it was inserted, gently press a 2 × 2-inch gauze pad onto the needle insertion site. Keeping pressure over the needle insertion site prevents the skin from retracting while removing the needle, causing less pain. The gauze also helps to seal the punctured tissue, preventing any leakage of medication. If indicated, press or rub the injection sites. Not all medications should be massaged into the skin, so the medication manufacturer's information should be consulted. If any fluid or blood is noted at the injection site, press another 2 × 2-inch gauze pad onto the injection site.

If using a pen, untwist the needle on the pen and safely dispose of the needle. Replace the pen cap and store as instructed (NIH, 2012).

Safe Needle Disposal

After any injection, it is important to dispose of needles properly to avoid injuries or the possibility of needle reuse (and potential contamination or infection transmission). The following guidelines will ensure such errors are avoided (NIH, 2012):

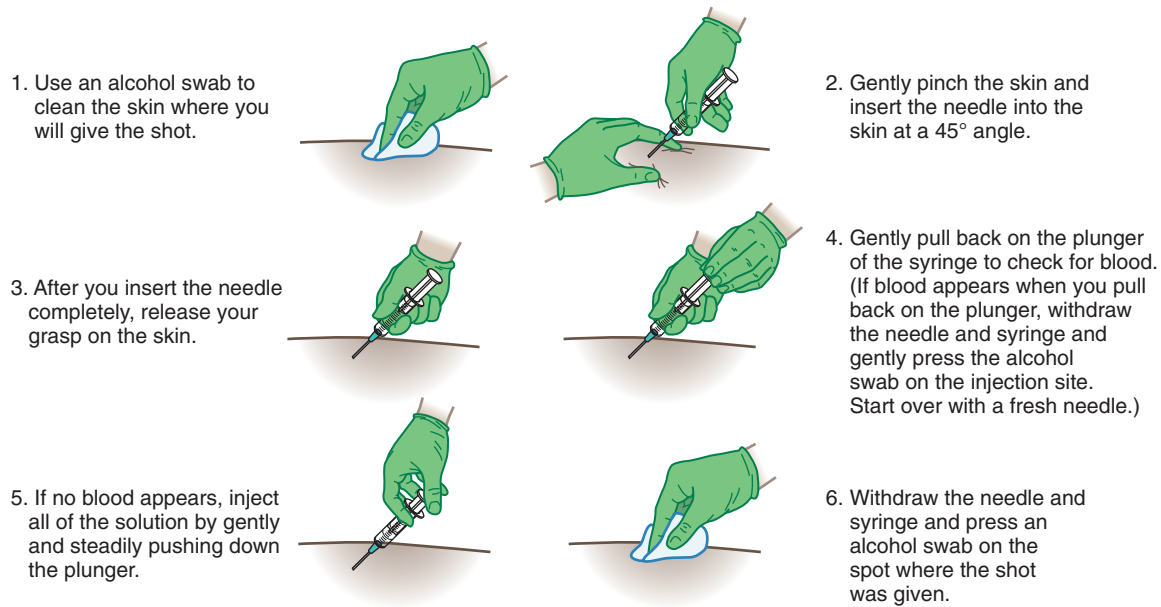
- Do *not* recap needles after use. Doing so increases the likelihood that the used needle will be mistaken for an unused needle and inadvertently reused.
- Immediately after use, place the needle or syringe in a hard plastic or metal container with a tightly secured lid. Keep the container out of reach of children or pets.
- If used in a home setting, when the container is full, take it to a healthcare facility for proper disposal.



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INTRAMUSCULAR INJECTIONS

Some medications, as noted earlier, are injected directly into muscle tissue (FIGURE 3-7). The primary reasons for using intramuscular injections of



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FIGURE 3-7 How to give an intramuscular injection.

medications are (1) administration of poorly soluble drugs and (2) administration of **depot preparations**, which are preparations of medications that are absorbed slowly over an extended period of time (Lehne, 2013). The rate of absorption is determined by two factors: the water solubility of the drug and the blood flow to the injection site. Drugs that are highly soluble in water will be rapidly absorbed within 10 to 30 minutes, whereas drugs that are poorly soluble will be absorbed at a rate greater than 30 minutes (Lehne, 2013, p. 34).

Anatomic Locations for Administering Intramuscular Injections

The muscle chosen for the injection must be able to be exposed completely and easy to access (Beyea & Nicoll, 1995). However, the patient's circumstances must also be considered. Muscles change with age and cannot always be used successfully for every type of intramuscular injection. The dorsogluteal muscle, for example, is never used for children younger than age 3 because it has not developed completely. The deltoid cannot be used if the area is very thin or fragile with no muscle mass or is underused, such as in a frail older adult or infant. It is generally considered good practice to avoid giving

an injection in the dominant arm because any pain or swelling in the injection site might hamper the patient's ability to function using that arm.

The following sites are most commonly used for intramuscular injections.

VASTUS LATERALIS MUSCLE (THIGH) The thigh is used most often for children younger than age 3 but can also be used for adults. An advantage to this location is that it is easy to view the thigh if the patient needs to administer his or her own injectable medication. In infants and children, the site for injection lies below the greater trochanter of the femur and within the upper lateral quadrant of the thigh. For adults, the site is 4 inches below the greater trochanter and 4 inches above the knee, lateral to the middle third of the vastus lateralis muscle. This may be visualized as dividing a patient's thigh from the knee to the hip into three equal parts. The middle third is where an injection should be administered (**FIGURE 3-8**, and **FIGURE 3-9**) (Beyea & Nicoll, 1995; Winslow, 1996).

VENTROGLUTEAL MUSCLE (HIP) The ventrogluteal muscle is a good location for adults and children aged 7 months and older. This site's utility is due to the ease with which bony landmarks may be identified, and

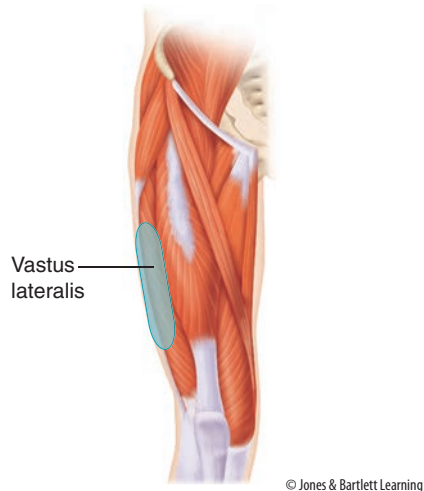


FIGURE 3-8 Administering a Vastus lateralis injection.

there is little danger of inadvertently piercing blood vessels or nerves. The patient should lie on his or her side when receiving a ventrogluteal injection (Beyea & Nicoll, 1995; Winslow, 1996). To find the correct location to give a ventrogluteal injection (in the hip), place the palm of the hand against the greater trochanter and place the index finger on the anterior superior iliac spine. Extend the middle finger along the iliac crest toward the iliac tubercle (right hand to left hip and left hand to right hip; see **FIGURE 3-10**).

DELTOID MUSCLE (UPPER ARM MUSCLE) The patient receiving a deltoid intramuscular injection can be lying down, sitting, or standing. The entire upper arm and shoulder area should be exposed to correctly identify the landmarks. The correct location to give the injection is 1–2 inches (2.5–5

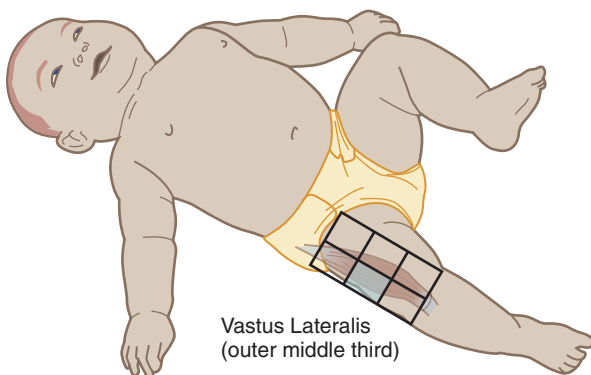


FIGURE 3-9 Visualization of proper thigh.

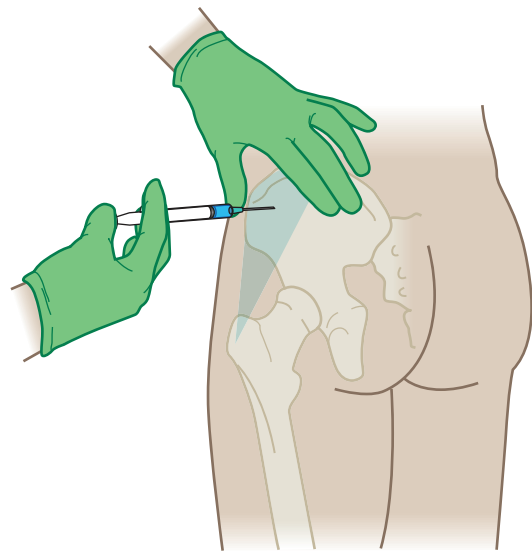


FIGURE 3-10 Administering a ventrogluteal injection.

cm) below the bottom of the acromion process (**FIGURE 3-11**, and **FIGURE 3-12**) (Beyea & Nicoll, 1995; Winslow, 1996).

DORSOGLUTEAL MUSCLE (BUTTOCKS) Expose one buttock cheek completely. Draw an imaginary line between the superior iliac spine and the greater trochanter. Give the injection in an area above this imaginary line (**FIGURE 3-13**) (Beyea & Nicoll, 1995; Winslow, 1996).

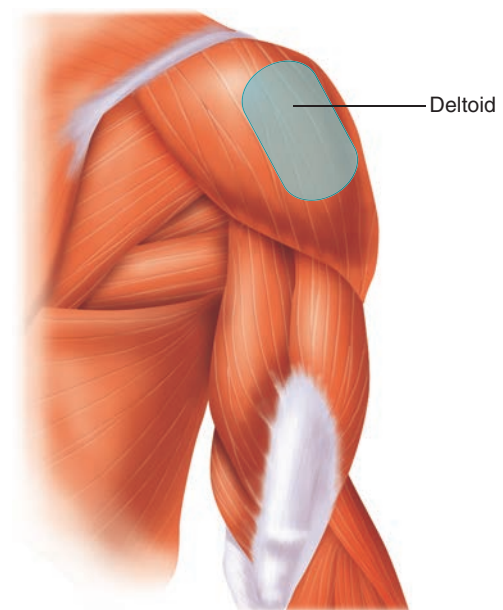


FIGURE 3-11 Administering a deltoid injection.

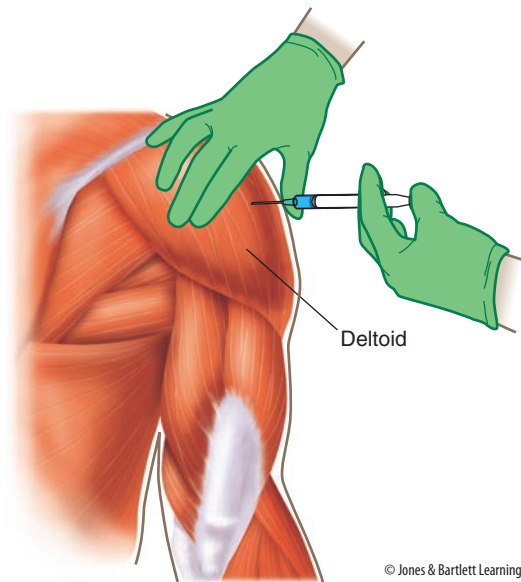


FIGURE 3-12 Administering a deltoid injection.

Supplies Needed for Administering Intramuscular Injections

- Individually wrapped alcohol wipes, or the equivalent.
- Sterile 2 × 2-inch gauze.
- The vial or ampule of medication being administered.

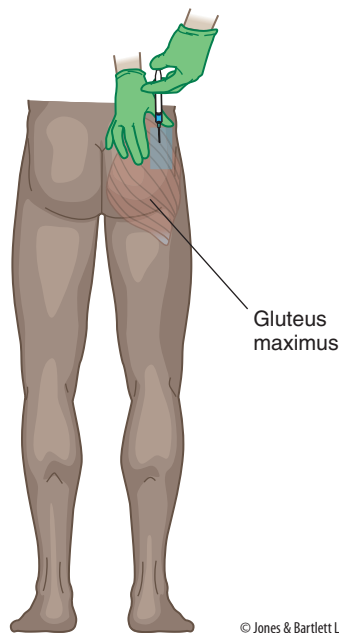


FIGURE 3-13 Administering a dorsogluteal injection.

- The correct-size needle and syringe (1 cc, 3 cc, 5 cc, 10 cc, 20 cc, 30 cc, or 60 cc syringes; ½-inch, ¾-inch, 1-inch, or 1.5-inch needle and ranging from 15- to 33-gauge needle bevel diameter). The needle length and injection site are shown in **TABLE 3-4**.
- Gloves for the protection of the patient and person providing the intramuscular injection.
- A sharps container to dispose of the used syringe and needle.

General Procedure for Administering Intramuscular Injections

As with other procedures, the supplies required (see the preceding list) should be assembled and checked prior to the procedure. The location of the injection should likewise be determined in advance, considering the patient's needs and circumstances. The nurse should wash his or her hands with soap and water for at least 20 seconds and pat them completely dry.

Next, the nurse should put on gloves and open one of the packages of alcohol wipes. The nurse should take the cover off the needle by holding the syringe with his or her writing hand and pulling on the cover with the other hand. This can be thought of as similar to taking a cap off of a pen. The nurse should hold the syringe in his or her dominant hand, then place the syringe under his or her thumb and first finger. The nurse should let the barrel of the syringe rest on the second finger of his or her hand, as is typically done when writing with a pen or pencil.

Wipe the area with the alcohol wipes where the needle will be inserted, and let the area dry completely. Depress and pull the skin a little with the free hand. The nurse should continue to hold the skin a little to the side of where he or she plans to insert the needle. Next, the nurse should use his or her wrist to insert the needle at a 90° angle (i.e., straight into the muscle). The nurse should think of this action similar to that of throwing a dart (**FIGURE 3-14**).

Avoid trying to forcefully push the needle into the patient's muscle, because doing so will cause bruising. The needle is sharp and will go through the skin easily if the wrist action is correct. Remember to let go of the skin to prevent the needle from jerking sideways. Push down on the plunger and

TABLE 3-4 Needle length and injection site of intramuscular injections

Birth–18 years		
Age	Needle length	Injection site
Newborn*	5/8" (16 mm) [†]	Anterolateral thigh
Infant 1–12 months	1" (25 mm)	Anterolateral thigh
Toddler 1–2 years	1"–1¼" (25–32 mm)	Anterolateral thigh [§]
	5/8" [†] –1" (16–25 mm)	Deltoid muscle of the arm
Child/adolescent 3–18 years	5/8" [†] –1" (16–25 mm)	Deltoid muscle of the arm [§]
	1"–1¼" (25–32 mm)	Anterolateral thigh
Aged ≥19 Years		
Sex/weight	Needle length	Injection site
Male and female <60 kg (130 lbs)	1" (25 mm) [¶]	Deltoid muscle of the arm
Female 60–90 kg (130–200 lbs)	1"–1½" (25–38 mm)	
Male 60–118 kg (130–260 lbs)		
Female >90 kg (200 lbs)	1½" (38 mm)	
Male >118 kg (260 lbs)		

*Newborn = first 28 days of life.

[†]If skin stretched tight, subcutaneous tissues not bunched.

[§]Preferred site.

[¶]Certain experts recommend a 5/8" (16 mm) needle for males and females who weigh <60 kg (130 lbs)

Adapted from: Poland GA, Borrud A, Jacobsen RM et al. Determination of deltoid fat pad thickness; implications for needle length in adult immunization. JAMA 1997;277:1709–11.

inject the medicine. Do not force the medicine through the syringe by pushing too hard on the plunger, because some medications will burn or hurt if they are administered too quickly.



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FIGURE 3-14

After all of the medicine is injected, pull the needle out quickly at the same angle that it was inserted. Finally, use the 2 × 2-inch dry sterile gauze to press gently on the location where the needle entered, and apply a bandage as necessary (Higgins, 2005).

Examples of medications that are given as an intramuscular injection include EpiPen (epinephrine), antibiotics, pain medications such as morphine and nonsteroidal anti-inflammatory drugs (NSAIDs), vitamin B₁₂, and vaccinations. Intramuscular injections should not be administered into broken or damaged skin.

Intravenous and Intraosseous Medications

When speed of delivery is important, medications may be delivered directly into the bloodstream by one of two means: intravenous or intraosseous.

Intravenous medications are delivered via a device that punctures a vein and infuses medication directly into the bloodstream at a specific rate and concentration. Medications can be administered via a peripheral line, a saline IV lock, a direct IV line, or a central venous catheter. In addition, medications can be delivered by rapid injections (called a “push” or “IV push”), infused continuously over a specified time period, or given intermittently by mixing it into the IV solution (usually normal saline) at predetermined times.

Intraosseous access is similar in nature except that the puncture goes into bone marrow of a long bone in the arms or legs rather than a vein. The long bones’ marrow contains a network of blood vessels that feed into the central venous canal, so intraosseous access is just as effective as intravenous access for delivering medicines. This route of administration is generally used when intravenous access is difficult or impossible to achieve—for example, in small children with circulatory collapse or adult individuals experiencing vasoconstriction due to shock.

IV MEDICATION SAFETY ISSUES

In its guide to standardization of high-risk IV medications, the San Diego Patient Safety Consortium (2006) lays out a compelling argument for being especially careful when administering IV medications. It notes that IV medications are associated with the highest risk of harm, with 61% of serious and/or life-threatening adverse drug events occurring with these medications. Equally important is the fact that many of the medications given via IV are high-risk drugs in and of themselves, including drugs such as insulin, heparin, morphine, and propofol. Given that the most common form of administration error in IV medications is incorrect dosing—more than one in four errors in IV medication administration is dose related—it is essential that nurses administering intravenous/intraosseous medications pay special attention to the Eight Rights, and particularly to ensuring the right dose. A key point to remember is that for IV delivery, the dose means the *rate* of delivery as well as the *amount* of medication delivered.

Matters of Key Concern When Administering IV Medications

Some of the most important issues to be considered during IV medication administration include the potential for allergic reaction, synergistic or antagonistic effects between medications, and complications of the procedure.

PATIENT’S ALLERGY HISTORY A medication delivered via IV goes directly into the circulation. Allergic reactions to medications delivered by IV therefore tend to be considerably more severe than allergic reactions to those medications delivered by other routes. If the patient has a history of allergy to the prescribed, or similar, medications, the drug should not be used so that severe allergic responses can be at least partly avoided. Be aware that just because there is no *known* history of allergy does not mean the patient will not have an allergic response. At the medication’s first use, any reactions (e.g., hives, difficulty breathing) should be considered a potential allergic response, treated appropriately, and documented.

SYNERGISTIC OR ANTAGONISTIC EFFECTS Medications given in close proximity in time and location may alter each other’s activity. For example, heparin’s anticoagulant effect increases in the presence of penicillin. Thus, when giving an IV medication to a patient who has already received another medication by this or any other route, it is important to double-check for potential drug interactions.

COMPLICATIONS Potential complications related to cannula insertion or use of IV medications include hematoma, infiltration, extravasation, phlebitis, thrombosis, venous spasm, puncture of artery, nerve, tendon, or ligament, septicemia, and fluid overload. Some medications, if infused too rapidly, can cause life-threatening reactions as well. If a central venous catheter is used, pneumothorax is another concern. Nurses should be alert to the specific symptoms of these complications.

Best Practices

In intravenous delivery, the dose means the *rate* of delivery as well as the *amount* of medication delivered.

ADMINISTERING AN IV MEDICATION

After undertaking the necessary checks for correct patient, medication, and dose, collect the supplies needed to administer the medication:

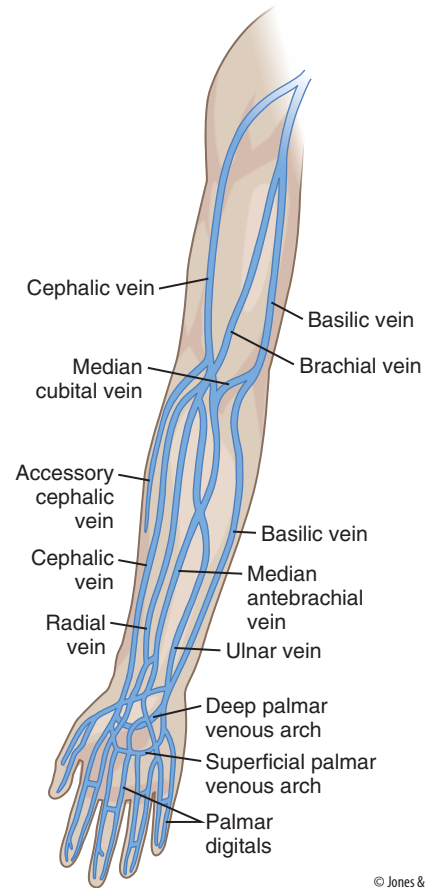
- Medication to be administered
- Alcohol swabs
- Tape or occlusive dressing
- Syringe with needle
- Sterile saline or distilled water (diluent)
- Sodium chloride flush syringe
- Heparin flush (if central venous catheter is indicated)
- Surgical gloves
- Tourniquet

Ensure that the patient is comfortable and warm; this prevents vasoconstriction. Keeping in mind that gaining intravenous access may be frightening to some patients, the nurse should project a reassuring, confident manner. Turn on and position any supplemental light as needed before beginning. If the patient is supine in a mobile bed or gurney, the nurse should raise the bed sufficiently high so that he or she can work without bending over, as comfort for the nurse will assist in accuracy of performing the puncture. A patient who is seated should place the arm to be used on a flat surface so that the nurse can have unimpeded access to it.

Identifying a Site

The veins most commonly used for intravenous access are located in the hand or arm. They include the dorsal digital and metacarpal veins, the cephalic vein, and the basilic vein (FIGURE 3-15).

Examine the arm or appendage to spot large or prominent veins, tapping if necessary to promote greater blood flow. Allow the patient's arm to hang down so that gravity can further promote blood flow. If these strategies do not identify any obvious veins, apply a tourniquet. If the patient (or chart) reports prior IV medication administration, ask the patient where the "best veins" have been for previous administrations, as patients usually know. Bear in mind that if the patient has had prior venous access in recent weeks, it may not be possible to reuse a vein that has already been accessed; look for evidence



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FIGURE 3-15 Veins used for intravenous access.

that a vein may have been recently used, and, if possible avoid any veins that show signs of bruising or new healing. If avoidance is not possible, choose the site that seems to have had the least recent use.

Once the patient and environment are ready and an appropriate site has been identified, the nurse should wash his or her hands for 20 seconds, pat them dry, and put on gloves. If indicated, apply the tourniquet 4–6 inches above the site. Sitting or standing in a comfortable, stable position, the nurse rests the heel of the dominant hand on the patient's arm (or other appendage) into which the access is to be inserted. The nurse then grasps the cannula controls between his or her thumb and index finger and lowers them so that they just touch the insertion point. The nurse then grasps the cannula controls between his or her thumb and index finger and lowers them so that they just touch the insertion point. The bevel of the needle should be facing up, and the angle of entry should be shallow, 20–30° at most. The nurse presses the tip first gently, then firmly, against the skin, informing the patient what

is happening as it occurs, in order to avoid surprising the patient (which can lead to jerking or jumping). The tip should be allowed to rest a few seconds on the skin surface, then gently and quickly pressed through the skin. The hub of the cannula should be held stable as the needle is withdrawn. If a tourniquet is in place, it should be removed *immediately* once the cannula is in place to avoid loss of access and bleeding from the site.

With the cannula in place, the primed extension set is attached to the angiocatheter. Next, the syringe is drawn back slightly until blood return is present, then flushed with 1 mL of normal saline. The set is secured with occlusive dressing and tape, and flushed with saline to ensure patency after taping. The site should be labeled and dated so that it can be changed within 72 hours if it is not removed before that time.



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With access established, the next step is to begin infusing the medication.

Inhaled Medications

Medicine delivery via inhalation is primarily used to treat respiratory disorders for obvious reasons: Inhalation offers the most direct pathway into the lungs and sinuses. Although this route of delivery may eventually include medications for nonrespiratory diseases (for example, diabetes researchers are exploring the potential for an inhaled form

of insulin), for the purposes of this text, it is assumed that the medications are intended as therapy for a respiratory disorder, such as asthma, chronic obstructive pulmonary disease (COPD), sinus congestion, or bronchitis, or is an inhaled form of vaccine (e.g., FluMist).

There are three principal methods for inhaled medication delivery: (1) an inhaler device, (2) a nasal spray, or (3) a nebulizer. This section describes each method in turn.

PROPER PROCEDURE FOR USING A METERED-DOSE INHALER OR DRY-POWDER INHALER

Metered-dose inhalers (MDI, “puffers”) are most frequently used to administer medications for chronic respiratory illnesses such as COPD or asthma. These hand-held devices deliver the medication in aerosol form by means of a propellant in the medication canister so that it can be inhaled directly into the lungs (**FIGURE 3-16**). A similar device called a dry-powder inhaler (DPI) does not use a propellant; instead, the medication is simply inhaled from the device in the form of a fine, dry powder—much like breathing in dust or pollen. The inhaler used by the patient depends on the medication; only those



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FIGURE 3-16

Best Practices

The greatest obstacle to delivery of medication via an inhaler is improper use. Patients need to learn how to use the device properly to maximize the medication's benefits.

medications that are produced in dry-powder form can be delivered with a DPI.

The greatest obstacle to delivery of medication via either type of inhaler is improper use. The correct technique needed to deliver the full dose accurately is neither self-evident nor easy to learn, although the use of *spacers* can improve delivery. Because most of these medications are intended to be self-administered, it is important that a nurse assist the patient in learning how to use the device properly to maximize the benefits the patient gets from the medication (Melani, 2007).

It is also important that the inhaler be kept clean. Buildup of debris can clog the inhaler's exit hole, preventing medication from being released and potentially reducing the dose of medication the patient receives. When working with a patient who uses an inhaler, particularly if the inhaler is not used frequently, examine the hole where the medicine comes out of the inhaler. If any powder or debris is noted in or around the opening, the inhaler should be cleaned. To do so, remove the canister from the L-shaped plastic mouthpiece. Rinse the cap and the plastic mouthpiece in warm water. Let the components air-dry thoroughly (overnight if necessary). When the mouthpiece is completely dry, put the canister back inside the mouthpiece and replace the cap. Do not rinse the other parts. The unit *may* need to be primed again (see following paragraphs) to restore proper function.

Delivering Medication with an Inhaler

Assemble the necessary components, including the medication, the inhaler, and the spacer (if used), and perform the standard checks to ensure the medication, dose, and patient are correct. Take off the cap and shake the inhaler hard. If the patient has not used the inhaler before or has not used it in a while, the device may need to be primed to prepare it for administration of the aerosolized spray (FIGURE 3-17). (The patient will need to look at the instructions that came with the inhaler to learn how to do this properly.)

Instruct the patient to breathe out or exhale completely. Next, instruct the patient to hold the inhaler about 1 inch in front of his or her mouth (about the width of two fingers away). If using a



FIGURE 3-17 Proper use of metered dose inhaler (MDI).

spacer, the patient should insert the inhaler into the round end of the spacer and put the spacer's flat mouthpiece completely inside his or her mouth (it should not simply be pressed against the lips). If the spacer has a mask, fit the mask over the nose and mouth.



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Instruct the patient to breathe in slowly through the mouth while pressing down on the inhaler once (FIGURE 3-18). If a spacer is being used, press down on the inhaler unit before inhaling slowly. Instruct



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FIGURE 3-18 Actuation of a metered dose inhaler (MDI).

the patient to begin to breathe in slowly within 5 seconds of inhaler actuation. Remind the patient to keep breathing in slowly and as deeply as he or she can.

Next, instruct the patient to hold his or her breath while counting to 10 slowly, if the patient is able to hold the breath that long. If the patient is unable to hold his or her breath for 10 seconds, the patient should be instructed to hold the breath for as long as possible, albeit less than 10 seconds. Inform the patient that holding his or her breath for as long as possible allows the medicine to better penetrate into the lungs.

If the patient is using inhaled *rescue* medicine (beta-agonists), wait at least 5 minutes before taking the next puff of the medication. Subsequent inhalations or “puffs” should be spaced 1 to 5 minutes apart and not exceed the prescribed dose. Remind patients that they should wait at least 5 minutes between inhalations or “puffs” of other medicines.

Finally, after they have finished using their inhaler, patients should rinse their mouths with water, gargle, and spit, especially if the medicine contains a steroid. This will help reduce unwanted side effects.

PROPER PROCEDURE FOR ADMINISTERING A NASAL SPRAY

Nasal sprays are generally used for conditions affecting the nose or sinuses, such as congestion related to colds or allergies. The medications are usually one of three types: (1) steroids, which work by decreasing inflammation within the nasal passages; (2) anticholinergics, which work by decreasing secretions from the glands lining the nasal passages, thereby diminishing the symptoms of a runny nose; and (3) decongestants, which work by constricting the blood vessels in the nasal lining, thereby providing temporary relief for a clogged or stuffed nose (Woznicki, 2012).

Decongestant nasal sprays, are available as over-the-counter products. They provide quick relief of symptoms, but the relief is limited, often having the result of causing patients to overuse them in search of continuous relief. This overuse usually has negative consequences, leading to rhinitis medicamentosa or drug-induced rhinitis (Woznicki, 2012). Side effects of overuse of nasal decongestant sprays can include increased risk for sinus infections, headaches, coughing, nasal passage swelling, congestion, and, rarely, septal perforation (Woznicki, 2012). A patient who complains of congestion should be questioned about over-the-counter decongestant use before a prescription nasal spray is offered.

As with inhalers, there is a “right way” and a “wrong way” to use a nasal spray, and patients who will be using such a medication at home should be taught how to administer it correctly. Instruct the patient to shake the bottle gently and remove the dust cover or cap. If the patient is using the pump for the first time or has not used it for a week or more, he or she must prime the pump by holding the pump with the applicator between the forefinger and middle finger and the bottom of the bottle resting on the thumb. Instruct the patient to point the applicator away from his or her face. If the patient is using the pump for the first time, the pump should be pressed down and released six times to prime it. If the patient has used the pump before, but not within the past week, the pump should be pressed down and released until he or she sees a fine spray (**FIGURE 3-19A**). Next, instruct the patient to blow his

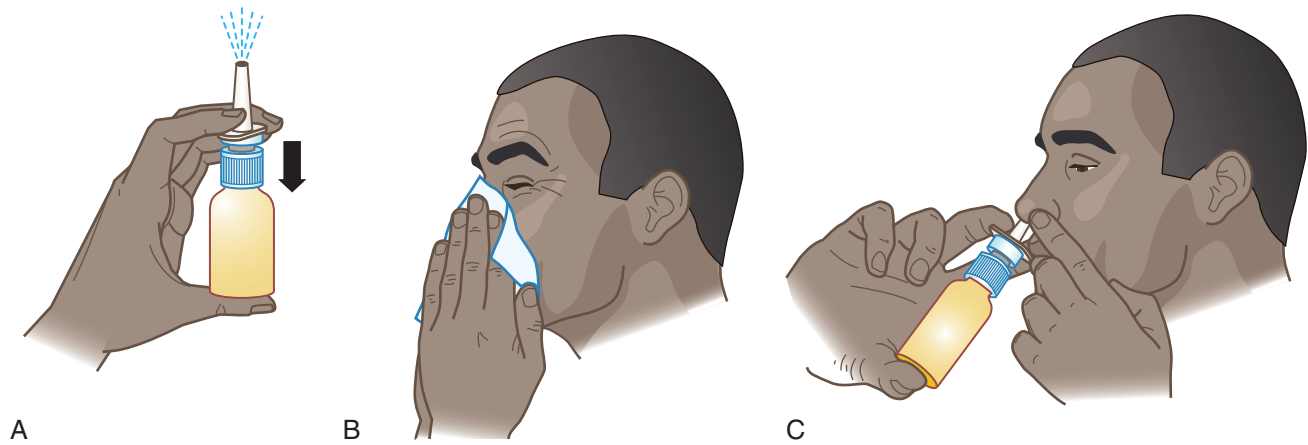


FIGURE 3-19 Procedure for nasal spray administration: (A) Priming; (B) Clearing nostrils; (C) Administration.

or her nose until the nostrils are clear (**FIGURE 3-19B**). Have the patient hold one nostril closed with his or her finger; next, tilt the head slightly forward and carefully put the nasal applicator into the other nostril, being sure to keep the bottle upright. The patient should hold the pump with the applicator between his or her forefinger and middle finger, with the bottom resting on the thumb. The patient should be instructed to begin to breathe in through the nose. While breathing in, the patient should use the forefinger and middle finger to press firmly down on the applicator and release the spray (**FIGURE 3-19C**). Instruct the patient to breathe gently in through the nostril and breathe out through the mouth. If the patient's healthcare provider told him or her to use two sprays, the same process should be repeated using the same nostril, with the patient then switching sides to the other nostril. Finally, wipe the applicator with a clean tissue and cover it with the dust cover or cup.

USING A NEBULIZER

A nebulizer delivers medication by producing a mist that is inhaled by the patient. This method of delivery is preferred for patients who lack the ability to exert conscious control over their inhalation and exhalation—young children, for example, or older adults with chronic conditions that affect their lung function and voluntary muscle control, or

those patients who are cognitively impaired (Dhand, Dolovich, Chipps, Myers, Restrepo, & Farrar, 2012). When used correctly, nebulizers are just as effective as MDI/DPI devices, and in some patients they may be more effective, as the use of a nebulizer mask or mouthpiece reduces the likelihood of underdosing due to the errors in delivery technique often seen with inhalers. If a nebulizer is to be used in the home setting, the patient or the patient's caretaker must be given instruction on its proper use.



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Preparing for Nebulizer Therapy

The nebulizer device usually consists of a compressor machine attached with tubing to a mouthpiece or mask. A mouthpiece is inserted into the patient's mouth between the teeth such that the lips surround

the mouthpiece and form a seal. A mask is fitted over the mouth and nose and is often secured with an elastic strap (if no strap is present, it must be held securely, but not tightly, to the face).

To use the nebulizer, the compressor should be placed on a table or solid surface next to the chair or bed where the patient will sit or lie; the compressor's on-off switch should be within easy reach of the patient if the medication is self-dispensed. The tubing should be free of tangling or kinks, and sufficiently long that the mask or mouthpiece reaches the patient's face with room to spare. The nebulizer cup—a receptacle usually located just below the nebulizer mouthpiece or mask—should be placed on the surface as well. The compressor should be properly plugged into an electrical outlet, and the medication should be nebulized; a clean measuring dropper or syringe should be readily accessible. The patient or care provider should wash and dry his or her hands before handling the syringe and the cup.

Using the Nebulizer

Remove the top of the nebulizer cup. The dose of medicine to be placed in the cup should be confirmed and measured into the syringe or dropper, then dispensed into the bottom of the cup. It is best to place the tip of the measuring device into the cup, rather than letting the medication drip down from above the cup, to avoid spillage. Replace the top, attach the cup to the mouthpiece or mask, and make sure that the tubing is connected to both the cup and the compressor. Switch the compressor on; the mist should be visible through the tubing at the compressor end. If the patient is sitting, he or she should sit up straight, breathing slowly and deeply through the mouth. If possible, the patient should hold his or her breath for 2 or 3 seconds before exhaling, to improve the penetration of the medication into the airways. Continue the treatment for 7 to 10 minutes to ensure that all of the medication is delivered. When the treatment time is finished, the mouthpiece/mask should be removed and the patient instructed to take several deep breaths and cough into a tissue to remove any secretions. The compressor may be turned off and the tissue discarded. Remember to properly clean the nebulizer after use.

Medication Transfer Across Permeable Tissues

While injected medications are inserted *into* tissues, other delivery forms place the medication *onto* or *against* a tissue. These methods take advantage of tissue permeability to transfer medication into the body. They can be classified broadly into two groups: **transdermal** methods, in which medication is spread or placed upon the skin and allowed to seep into it, and **transmucosal** delivery systems, which introduce medication into areas of mucous membranes so that the medication can pass through the membrane into the bloodstream. *Transdermal* delivery systems include medicated patches and topical creams, gels, ointments, and lotions. *Transmucosal* delivery makes use of sublingual (under the tongue), buccal (between cheek and gums), vaginal, and anal mucosa, as appropriate.

ADMINISTERING A TRANSDERMAL PATCH

Use of transdermal patches has become increasingly common in recent years. Most people have become aware of this delivery option through widely marketed nicotine-replacement patches used to aid in smoking cessation, but other medications (e.g., pain medications or hormone therapies) are now being provided in this manner, due to its convenience, the different timing of drug activity (Prausnitz & Langer, 2008), and, in some instances, the ability to bypass the liver's detoxification channels, which can cause oral or injected medications to be eliminated before they reach their destinations (Morrow, 2004).

To properly apply a transdermal patch, the patient should wash his or her hands thoroughly with soap and water for at least 20 seconds. Each patch is individually sealed in a protective package. Open the package at the tear mark if there is one present, or cut the package with scissors if not, taking care not to cut the patch inside. Carefully remove the patch (**FIGURE 3-20A**). The patch is attached to a peelable adhesive liner (**FIGURE 3-20B**). The liner has a slit that divides the backing into two strips. Hold the patch with the adhesive pointed

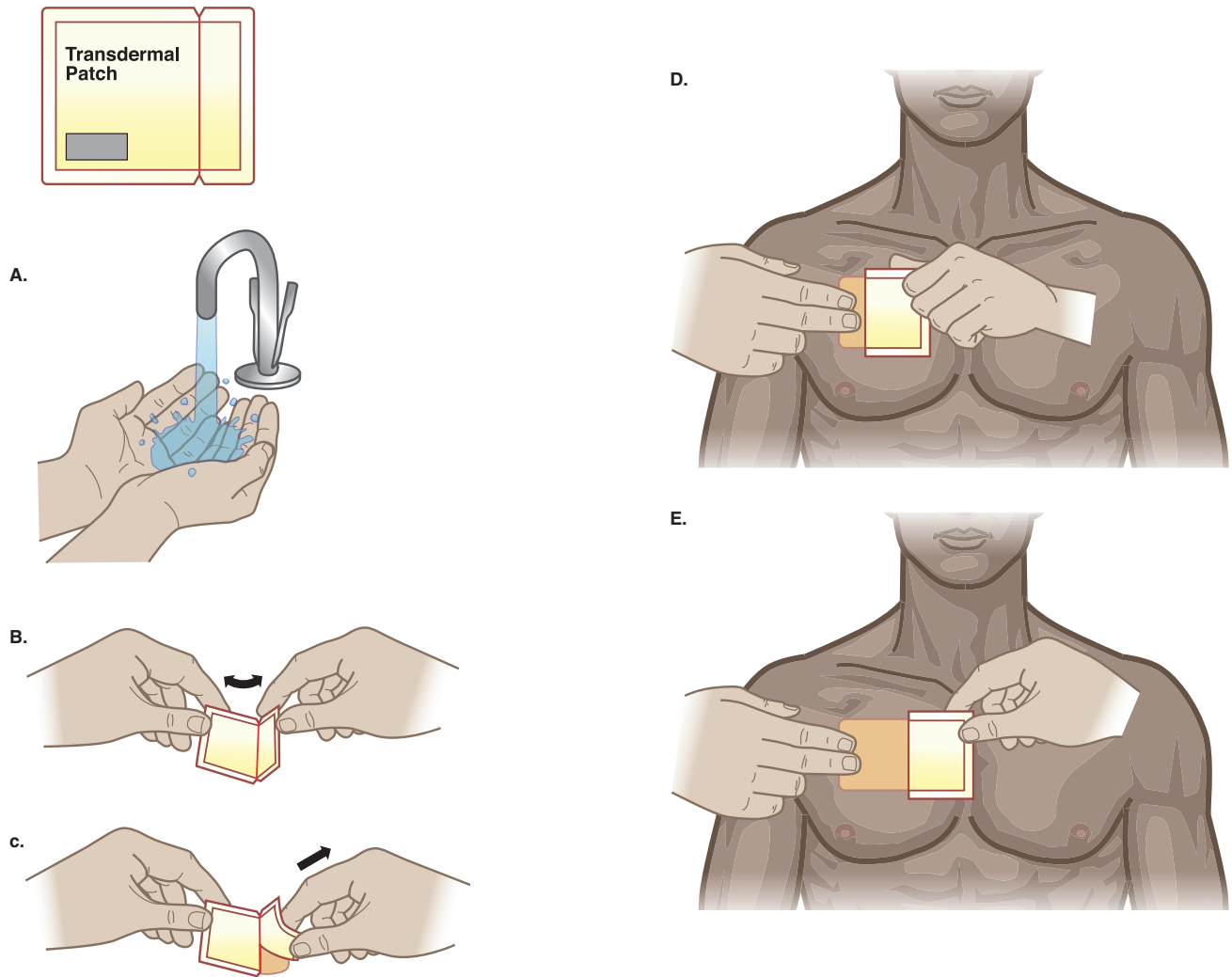


FIGURE 3-20 Application of transdermal patches.

away. For easier application of the patch, the slit should never be facing toward the patient to ensure that it will not stick to other areas of the body. Rotate the patch as necessary to place the slit in a vertical position. Bend both sides of the adhesive liner away at the slit (**FIGURE 3-20C**) and slowly peel off only one of the strips of the liner. Do not touch the exposed sticky side of the patch. Use the remaining strip as a “handle” to apply the sticky side of the patch to the skin (**FIGURE 3-20D**). Press the sticky side on the chosen skin site and smooth it down. Fold back the unattached side of the patch. Grasp the remaining strip and remove it while applying the remainder of the patch to the skin (**FIGURE 3-20E**). Press the patch on the skin and smooth it down with the

palm of a hand. Once the patch is in place, *do not* test the adhesion by pulling on it. After applying the patch, instruct the patient to wash his or her hands to remove any drug. At the time recommended by the prescribing provider, and verified via a literature check, remove and discard the old patch. Place a new patch on a different skin site according to the health-care provider’s instructions.

The patch should be applied to clean, dry, hairless skin. If hair is likely to interfere with the adhesion of the patch, the hair can be clipped or shaved, being careful not to break the skin. Do not apply a transdermal patch to any areas with broken or irritated skin, or immediately after bathing or showering, so the patch will be able to properly adhere to

the skin. It is best to wait until the skin is completely dry. It is important to rotate the sites used for patch application so that the medication can properly absorb into the skin, and to prevent irritation or breakdown of the skin.

Consult the manufacturer's prescribing information to determine if the medication patch can be cut. Certain topical medication patches cannot be cut because doing so will alter the absorption of the medication. Also, with some medications—particularly hormonal therapies such as testosterone—great care should be taken to avoid the medication coming in contact with a the skin of individuals other than the patient. For example, one precaution that patients or caregivers applying any transdermal medication should take when washing after application is to place a tissue in their hand before opening doors or turning on a faucet, so that any medication on the hands prior to washing is not transferred to the door or faucet handle.

APPLYING TOPICAL PREPARATIONS

Topical preparations include ointments, creams, gels, or lotions that are applied to the skin, usually on or above an area affected by an injury, an allergic response, or an infection. Most people have had experience using some form of topical preparation, even if it is merely a soothing aloe gel to treat a sunburn, or lotion for dry skin. What they may not realize, however, is that the majority of people do not apply such preparations properly. For example, most people fail to wash their hands first unless they are visibly dirty, and often (unless an open wound is involved) they will not wash or dry the skin to which the medication is applied. Yet doing so is the key first step to ensuring that the medication is applied in such a way as to maximize its effects while minimizing possible contamination.

In the correct approach to applying a topical preparation, the person who is applying the medicine (be it nurse or patient) must wash his or her hands with soap and water for at least 20 seconds. It is *especially* important that hand washing precede application in cases where the medication is intended to treat wounded, abraded, inflamed, or healing skin to reduce the possibility of microbial

contamination. The skin itself should also be washed and patted (not rubbed) dry—again, a particularly important step when the skin itself is being treated. Be sure that the skin in the affected area is completely dry before applying any topical preparation.

Apply a thin layer or film of medication to the entire area of the skin that is affected. Rub the medication into the skin completely and gently, unless otherwise indicated by the manufacturer's directions. After the topical medication has been applied, wash the hands with soap and water to remove any remaining medication. Treated areas may be covered with normal clothing, but bandages, dressings, or wraps should not be placed over the area unless indicated by the prescribing healthcare provider. Remind the patient to be careful not to wash or wipe off medication from the affected areas of the skin to prevent loss of the medication. Instruct the patient not to swim, bathe, or shower immediately after applying medication because these activities will prevent the medication from properly absorbing into the skin.

As with transdermal patches, it is important to prevent cross-contamination of other people by ensuring that topical medication is not spilled or wiped on surfaces, clothing, towels, and so forth that might be touched by someone else. The nurse or patient applying the topical medication should use only disposable cloths or tissues to wipe medication off hands, and should put a tissue in the hand to grasp door handles or faucet fixtures if he or she must touch them before washing up.

VAGINAL RINGS

Vaginal rings are a form of transmembrane delivery that is generally targeted for hormonal medications, specifically sex steroids. These devices are used for contraceptives and hormones for relief of menopausal symptoms. These devices are flexible rings that are inserted into the vagina and left in place for up to 3 weeks for continuous contraception (i.e., NuvaRing), or up to 3 months of continuous hormone therapy to replace loss of estrogen during menopause (i.e.,

Best Practices

To avoid accidentally transferring topical medications to other people, put a tissue in your hand when turning the faucet on to wash up after application.

Femring). Vaginal estrogen is used to treat vaginal dryness, itching and burning, painful or difficult urination, and urge incontinence in perimenopausal or postmenopausal women (NIH, 2010a). Femring is also used to treat “hot flashes” in women who are experiencing menopause (NIH, 2010b).

Administering Vaginal Rings

After performing the Eight Rights checks, the nurse should wash his or her hands for at least 20 seconds and dry them thoroughly. Remove the vaginal ring from the pouch and save the foil wrapper to properly dispose of the hormonal ring after it is removed. Ask the patient to either lie down on her back with her knees bent or have her squat or stand with one leg up on a chair, step, toilet, or other elevated object; it is best to allow the patient to choose the position that is most comfortable for her so that the nurse can insert the vaginal ring. The nurse should hold the ring between his or her thumb and index finger and press the opposite sides of the ring together to form a figure eight shape (FIGURE 3-21).

The nurse can either hold open the labial folds of the patient’s vagina or have the patient hold open her own folds of skin around her vagina with her hand. Place one side of the figure-eight tip of the ring into her vagina and then use an index finger to gently insert the ring into her vagina.

The vaginal ring does not need to be positioned a certain way inside the patient’s vagina but it will be more comfortable and less likely to fall out if it is placed as far back in the vagina as possible (FIGURE 3-22). Inform the patient that the ring

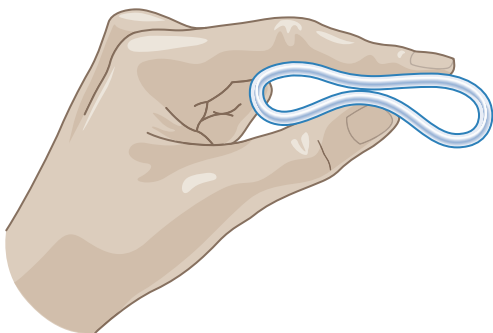


FIGURE 3-21 Holding vaginal ring between thumb and index finger, pressing the opposite sides of the ring together to form a figure eight shape.

cannot go past her cervix so it will not “go too far” in her vagina or “get lost” when it is inserted. If she feels discomfort when the ring is inserted, the nurse should use his or her index finger to insert it farther back into the woman’s vagina. The nurse should inform the patient that the ring may fall out if it is not inserted deeply into the vagina, if the vaginal muscles are weak, or if the woman is straining during a bowel movement. If the ring falls out, it should be washed with warm water and reinserted into the vagina following the steps outlined previously. If the ring falls out and is lost, insert a new ring and leave the new ring in place for the manufacturer’s intended duration (3 weeks for the NuvaRing, 3 months for the Femring). If it falls out often, the patient should consult her healthcare provider.

The nurse should remind the patient that the vaginal ring can be left in place during sexual intercourse. If the patient chooses to remove it, or it falls out, the ring should be washed with warm water and replaced in the vagina as soon as possible.

When it is time to remove the ring from the vagina, instruct the patient to find a position that is most comfortable for her. The nurse should hook his or her index finger under the front rim of the ring or hold the rim between the index and middle fingers to then pull it out. The nurse should gently pull downward and forward to remove the ring. The used ring should be discarded in a sealed trashcan out of reach of children and pets. Do not flush the used ring down the toilet. Finally, insert a new ring as directed according to the prescribing provider’s instructions (NIH, 2010a, 2010b).

ADMINISTERING RECTAL SUPPOSITORIES

To administer a rectal suppository, after performing the Eight Rights checks, the nurse should wash his or her hands thoroughly with soap and water for at least 20 seconds and dry them completely. If the suppository is soft, hold it under cool water or place it in the refrigerator for a few minutes to harden it before removing the wrapper. Remove any wrapper that is present. If half of the suppository is indicated for use, cut the suppository lengthwise with a clean, single-edged razor blade. Consult the manufacturer’s

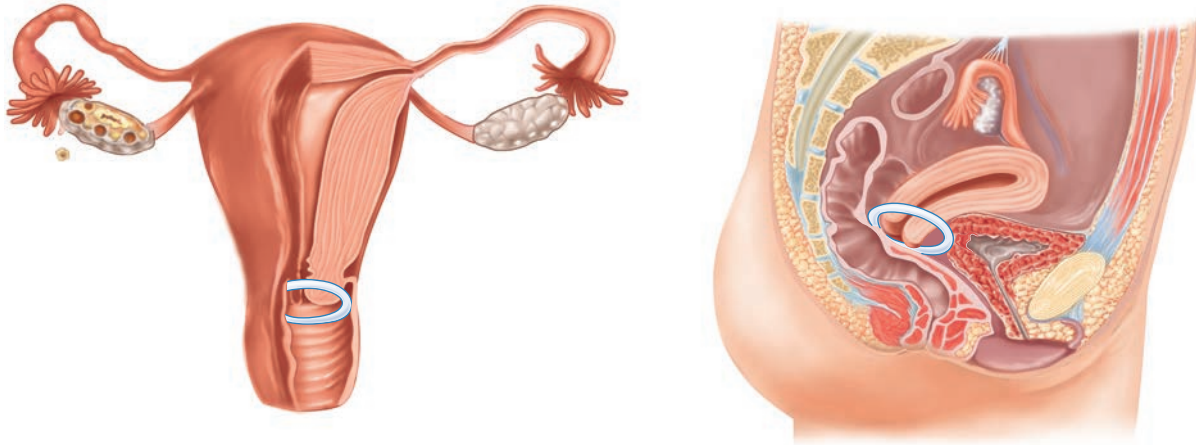


FIGURE 3-22 Proper location for vaginal ring placement.

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directions about suppositories that can be safely cut in half without affecting the efficacy of the drug. The nurse should put on disposable gloves to administer the suppository.

Lubricate the suppository tip with an appropriate lubricant (**FIGURE 3-23**). The use of an improper lubricant (such as an aqueous-based lubricant used with a water-soluble suppository base) may compromise the integrity of the delivery system. The manufacturer's literature for individual suppositories should be consulted for advice regarding suggested appropriate lubricants. If there is no lubricant available, the nurse should moisten the patient's rectal area with cool tap water. The nurse should instruct the patient to lie on his or her side with the lower leg straightened out and the upper leg bent forward at the knee toward the stomach (**FIGURE 3-24**).

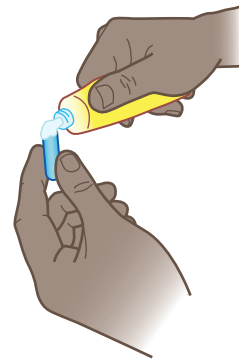


FIGURE 3-23 Lubrication of rectal suppository prior to administration.

Lift the upper buttocks cheek to expose the rectal area and insert the suppository with the finger, pointed end first, until it passes the muscular sphincter of the rectum, about 0.5 to 1 inch in infants, and 1 inch in adults (**FIGURE 3-25**). (If the

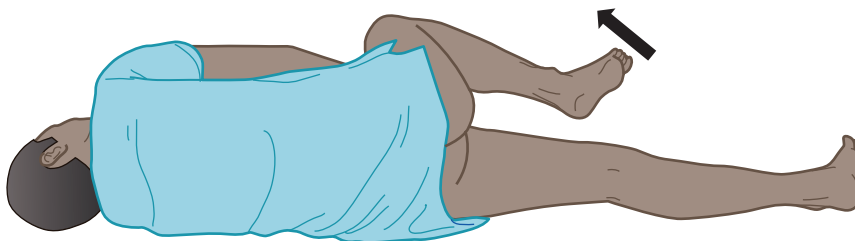


FIGURE 3-24 Proper positioning of the patient for rectal suppository administration.

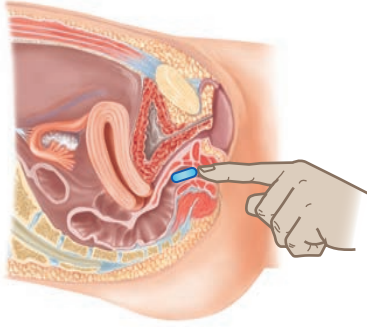


FIGURE 3-25 Proper positioning of a rectal suppository.

suppository is not inserted past the sphincter, the suppository may not remain in place.) Have the patient hold his or her buttocks together for a few seconds and remain lying down for 5 minutes to avoid dislodging the suppository (**FIGURE 3-26**).

The nurse should discard any used materials such as gloves and wrappers, and wash his or her hands thoroughly.

BUCCAL AND SUBLINGUAL ADMINISTRATION

The membranes of the mouth offer certain advantages for administering medications. Key among them is the speed with which such medications are transferred into the bloodstream. The permeability of the oral membranes is considerably greater than that of the skin, although the extent of this permeability depends on where in the mouth the medication is placed, as membrane thickness varies in different parts of the mouth. **Sublingual** (below the tongue) placement results in very rapid absorption due to the thinness of the membranes in this

location, which is why rescue medications such as nitroglycerin for angina relief, and glucose gel for hypoglycemia in diabetes, are provided for sublingual use. This approach works well for medications that can be fully absorbed if held in place for a short time, but not quite as well for medications that need to be held in place over a longer time to maximize absorption. In the latter case, **buccal** (between the cheek and gum) placement is used despite its lower absorption rate.

Recent advances in the use of these routes has led to increased availability of drugs delivered by buccal and sublingual systems (Senel, Rathbone, Cansız, & Pather, 2012). A variety of medications is currently available, including fast-dissolving tablets, films/strips, or sprays. Some are available in this form as over-the-counter products.

Aside from the rapidity of absorption, an advantage of sublingual and buccal delivery is that this route bypasses the digestive tract and the liver, delivering the drug directly into the bloodstream. This can allow for lower quantities of drug to be highly effective, resulting in fewer side effects (Narang & Sharma, 2011). A disadvantage of this delivery system is that it cannot be used in unconscious or combative patients.

Administering a Sublingual or Buccal Medication

SUBLINGUAL MEDICATIONS Patients should be advised to refrain from smoking for an hour prior to use of the medication, as smoking causes vasoconstriction that will impede sublingual absorption. Likewise, the patient should be advised to neither eat nor drink while taking the medication to avoid swallowing

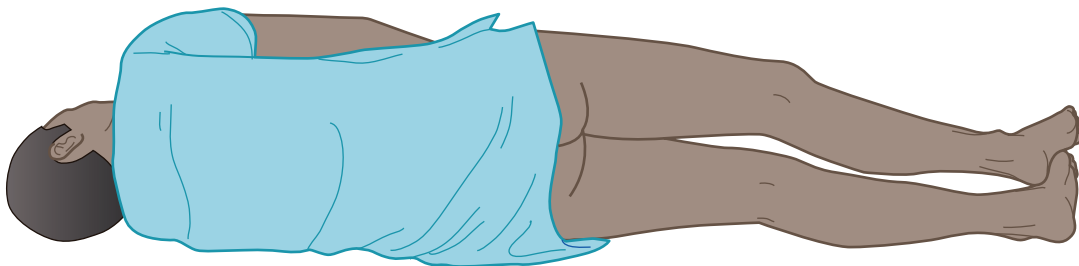


FIGURE 3-26 Temporary patient positioning after rectal suppository administration.

it, which may reduce or obviate its absorption as well. The patient should remain seated and upright while the medication is in place, to avoid accidental swallowing or aspiration of the medication. After performing the Eight Rights checks and prior to administration, the patient should be asked about or inspected for sores, cuts, abrasions, or irritation to the oral mucosa, as the presence of such damage may contraindicate use of the medication.

If the medication is delivered via sublingual spray, the head of the spray bottle should be positioned within the mouth, behind the teeth, while the tongue is raised to ensure that the medication is delivered into the sublingual area. The spray bottle's button should be pressed firmly the prescribed number of times. The patient should wait about 10 minutes before eating or drinking anything to allow the medication to be fully absorbed.

In the case of tablets or strips, the patient should rinse his or her mouth with water prior to placing a tablet or strip under the tongue. The tongue is then raised and the strip or tablet placed underneath it; the tongue may be lowered once the medication is in place, and if possible the patient should tilt his or her head forward to reduce the chance of swallowing it. The patient should avoid standing, moving, talking, opening the mouth, eating, or drinking for at least 10 minutes to ensure the medication is fully absorbed and to minimize the chance of swallowing or dislodging the tablet or strip. Some medications may cause a tingling sensation while in place, but they should not be moved to another location unless strictly necessary for the patient's comfort. (This sensation *may* also be an indication the medication is working correctly.) Most of the time, patients can place tablets or strips into their own mouths without difficulty, but for those patients who cannot, the nurse should be certain to take standard precautions (gloves) prior to placing the medication.

BUCCAL MEDICATIONS The procedure for administering buccal medications is similar to that of sublingual medications, except that the tablet or strip is placed between the cheek and gum line as far back toward the back molars as possible. After the medication is in place, the mouth should be kept closed for up to 10 minutes to allow for complete absorption.

Medication Errors

Earlier in this chapter, the need to avoid medication errors was discussed briefly. That discussion is expanded upon here to emphasize the magnitude and gravity of this problem. It is important for nurses, as the people most commonly charged with delivering medications to patients, to have a strong awareness of the root causes of medication errors, and to understand the steps and systems that can be put into place to reduce their incidence.

Administering medication is where the “rubber meets the road” in medical therapy—it is not only the point at which the therapeutic decisions are put into action, but is also the last point at which errors in the preceding decision-making process (prescribing and dispensing) can be identified prior to causing harm. Nurses should strive to avoid medication errors in their daily practice; thus, not only must they know how to administer medications properly, but they must also be alert enough to identify errors made in previous therapeutic stages.

WHAT ARE MEDICATION ADMINISTRATION ERRORS?

A **medication error** is defined as follows:

Any preventable event that may cause or lead to inappropriate medication use or patient harm while the medication is in the control of the healthcare professional, patient or consumer. Such events may be related to professional practice, healthcare products, procedures and systems including prescribing; order communication; product labeling, packaging and nomenclature; compounding; dispensing; distribution; administration; education; monitoring and use. (Hughes & Blegen, 2008; National Coordinating Council for Medication Error Reporting and Prevention, 2012)

Note that a medication error can occur at any point in the pathway from prescription onward. Indeed, many such errors have been found to occur at the point at which the prescription is actually *written*—which means that the nurse's checks are a key means of restoring accuracy to the treatment

process. In this context, however, the concern centers on errors in *administration* of medication—that is, the ways in which implementation of the therapeutic plan can go wrong.

The definition given by physicians in the literature for a **medication administration error** is “any deviation from the physician’s medication order as written on the patient’s chart” (Headford, McGowan, & Clifford, 2001; Mark & Burlison, 1995). Interestingly, this definition of medication administration errors fails to consider that prescribing errors contribute to medication administration errors (Davydov, Caliendo, Mehl, & Smith, 2004; Headford et al., 2001; Wilson et al., 1998). A nurse who administers 10 mg of a drug to a patient in accordance with the physician’s written instructions is, by this definition, not in error, even if the correct dosage for this patient should have been written as 10 mcg. Yet, an error has indeed been committed—a fairly serious one that, depending on the drug and whether the error is caught in time, could be life-threatening! The definition of “medication administration errors” that nurses use, and that is cited most often in the literature for nurses, is “mistakes associated with drugs and intravenous solutions that are made during the prescription, transcription, dispensing and administration phases of drug preparation and distribution” (Wolf, 1989, p. 8).

Wolf (1989) classifies the errors as either acts of commission or omission, either of which can include violations of the Eight Rights: administering the medication to the wrong patient; administering the patient the wrong drug; administering the patient the correct drug but at the wrong dose, via the wrong route, or with the wrong timing of drug administration; administering a contraindicated drug to the patient; injecting the drug at the wrong site; using the wrong drug form or the wrong infusion rate; using medication beyond its expiration date; or prescribing the wrong medication. Wolf (1989) further notes that errors can be classified as either occurring intentionally or unintentionally.

Medication administration errors are not always due to a mistake by the nurse, but the nurse may nonetheless help prevent them. A situation with high potential for error occurs when patients are charged

with administering their own (or one in their care) medication but are given inadequate information for performing this task—or, having been given appropriate information, nonetheless fail to understand key points of how or when the medication is to be administered. At minimum, a nurse needs to ensure that the patient or caregiver knows each of the following pieces of information: the *name* of each medication that the patient is taking; *why* the patient is taking it; *how often or when* to take it; what the drug *looks* like; the appropriate *means of delivery* (e.g., ensure that medications designed to be delivered via buccal or sublingual delivery are not swallowed); the *dosage*; potential *adverse effects and interactions*; and *symptoms* to watch for (Anderson & Townsend, 2010).

Patients or caregivers who are under the significant stress of coping with an acute illness or injury may not fully grasp instructions given to them in a hospital setting. Thus, for patients being discharged following an acute illness or medical emergency, providing clear written instructions, in conjunction with a follow-up call by the nurse within the first few days after discharge, is very important to ensure that there is complete understanding of how to use medications.

CAUSES AND PREVENTION OF MEDICATION ERRORS

According to McBride-Henry and Foureur (2006), factors that contribute to medication errors can be divided into two subcategories: errors caused by the *system* and errors caused by *individual healthcare professionals*. Earlier, we noted some of the causal factors for individual errors—fatigue, stress, multitasking, and interruption. In addition, medication administration errors can occur because of flaws in the institution’s system and procedures, or the provider’s equipment, procedures, operators, supplies, or environments (Anderson & Webster, 2001), and can occur anywhere in the system. Moreover, errors can occur because of the interface between the nurse and the system in which he or she works. For example, a nurse who undergoes inadequate training regarding the facility’s procedures may learn what is taught, and may even recognize that the

training is insufficient; if he or she has no opportunities to request or receive additional training, however, there is a systemic issue that affects individual performance.

Additionally, prescribing, preparing, and administering medications rely on numerous processes intended to ensure that the patient receives appropriate treatment, and problems can arise in any part of this system as well (McBride-Henry & Foureur, 2006). Finally, acuity levels or seriousness of illness, available nursing staff, access to medication, and policy documentation can affect medication administration error rates (McBride-Henry & Foureur, 2006).

Error avoidance must, therefore, be a priority not only for the individual nurse, but also for the facility for which the nurse works. Standardized procedures should be established and followed as a matter of daily routine, particularly in high-risk medication delivery systems such as intravenous medications. Tools such as procedural checklists can be valuable assets to assist in limiting errors, but only if both the individual nurse's commitment to using them, as well as the facility's culture promotes and reinforces their use. Communication among the various individuals working with a specific patient is a key component, yet systemic barriers to communication remain all too common. Such barriers may include lack of clear-cut processes, inadequate staffing (or the less-common problem of overstaffing, which means

too many people are working on the same problem, thereby impairing communication and efficiency), poor staff training, cluttered or disorganized workspaces, inadequate lighting, or even something as simple as a failure to provide adequate office supplies such as pens, computers, printers, and so forth.

Conclusion: Medication Administration in Nursing Practice

Nurses are continually challenged to ensure that their patients are given the correct medication at the correct time. Obstacles such as inadequate nursing education about patient safety, excessive workloads, untrained staff, fatigue, illegible provider handwriting, flawed dispensing systems, and problems with the labeling of drugs are encountered by nurses on a daily basis. Moreover, harm from medications can arise from unintended sequelae, as well as from errors such as administering the wrong medication or administering the medication at the wrong time, at the wrong dose, via the wrong route, or to the wrong patient (Hughes & Blegen, 2008). Thus, nurses' understanding of pharmacology includes knowledge of not only how medications are administered, but also which factors can contribute to faulty administration of medications.

CHAPTER SUMMARY

- Medications are an essential therapeutic intervention, yet there are multiple challenges to administering them correctly.
- The Eight Rights of medication administration offer nurses a checklist for ensuring that the chance of errors is reduced.
- Medication delivery comes in a variety of forms, each with its unique administration procedures, challenges, advantages, and disadvantages.

- Understanding when and why a given delivery route is preferred for a specific drug is as important as knowing how to correctly administer the drug.
- Medication errors are not solely a matter of individuals making mistakes, however; nurses must also understand the potential for systemic problems that promote medication errors.

Critical Thinking Questions

1. What are the “Eight Rights” of medication administration?
2. Why should nurses know the rationale for a prescription even if they are not the ones prescribing the medication?
3. Name the three basic ways medication can be transferred into the body’s tissues/bloodstream, and provide two specific examples of delivery methods for each of the three forms of transfer.
4. Which modes of delivery may be used in an unconscious patient and which may not?
5. The causes of medication errors occur at both an individual level and a systemic level. What is an example of a factor leading to an *individual* error? Which factors can be considered *systemic* factors leading to medication errors?
6. Which form of medication delivery has the highest error rate? At what point in the administration process do most of the errors occur and why?

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