Home Infusion Basics for the Non-Infusion Pharmacist

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Infusion pharmacies are licensed as retail pharmacies in Michigan, and they are required to maintain USP 797 standards for all injectable products sold by the pharmacy.

When a patient comes into a pharmacy for counseling with an intravenous line in place, it can be intimidating to a pharmacist who hasn't had any specific training in infusion to answer questions. This article will expand your knowledge in basic home infusion.

Objectives:

1. Become familiar with the terminology used in the infusion industry
2. Understand which patients are candidates for home infusion
3. Explain various types of vascular access devices (IV lines)
4. Increase knowledge of infusion delivery devices
5. Explain pharmacist's responsibilities in an infusion pharmacy

Why Home Infusion?

Nearly 30 years ago, a pioneering group of pharmacists reached out to patients who needed to be treated with IV medications but were being held in the hospital for long periods of time to complete their medication regimen. As there was a growing use of total parenteral nutrition (TPN) that could be administered in patient's homes, these pharmacists sought to treat patients in the most convenient and effective manner. This subsequent home infusion industry has remained small, but it is a niche in the pharmacy profession that is rewarding and clinically challenging. Many types of treatments can now be completed safely in the patient's home—antibiotics, nutrition, hydration, chelation, immune globulin, steroids and pain management are the most common. As a leader for the home infusion team, the pharmacist manages patient education, product selection, equipment selection and patient outcomes.

Who is Treated By Home Infusion?

Patients must have a need for intravenous medication that can't be administered by any other route. Home infusion is expensive, but it is still less costly than staying in a hospital. Payment issues are enormous in home infusion; this article will not deal with the reimbursement issues facing the industry.

When a candidate for home infusion is referred to a home care agency, the pharmacist will perform a needs assessment, taking into consideration the patient's diagnosis, the treatment options available and other unique needs of the patient. If oral, topical or other means to administer the drug are available, most pharmacists will recommend the least expensive option. Once the correct therapy is determined, the pharmacist also will assess physical limitations of the patient, caregiver issues and environmental issues that might affect home infusion, such as the following:

- Is the patient blind, deaf or arthritic to the point that they can't assist with the starting and stopping of therapy?
- Will a caregiver be present while the patient is receiving their medications through the IV site?
- Are there stairs or other possible hindrances to a rolling IV stand?
- Are there pets in the house that could become entangled in IV tubing or cause excessive risk of contamination of IV solutions?
- Does the patient have an adequate and clean space to prepare doses for infusion?
- Does the patient or any of the immediate family have a history of IV drug abuse?

Teaching

When a new patient is approved for home infusion, they need to be taught to administer the doses by themselves or with a caregiver. In most cases, a caregiver is identified who will learn the administration technique along with the patient. That caregiver must commit to being available for every dose until the patient is able to administer safely by themselves. A nurse will spend up to four

hours on a first visit with a patient and caregiver to go over needs assessments and teaching materials. That visit will typically be repeated for the second and/or third doses, and then the patient and caregiver are expected to administer the IV medications on their own. Weekly dressing changes must be done by a registered nurse. The nurse will use that weekly visit to monitor the sterile technique of the patient and/or caregiver, to make sure that doses are being given at the correct times and that no doses are being missed. Most nurses will also use this weekly visit to determine what additional supplies or education the patient requires. Pharmacists can also provide training over the phone, but rarely travel to the patient's home.

Documentation

In the home infusion industry, every patient will have a formal chart kept at the home infusion office. The chart will include demographics, initial assessment and a care plan that details expected outcomes and any potential problems that need to be monitored. There will be a section containing pertinent lab work, a list of all medications that the patient is taking, a set of progress notes where every contact with a patient or caregiver is summarized and a list of all equipment and products sent. Of primary importance in the chart are the actual prescription and communication with physician(s) and nurses, including notes from each visit. The chart will also include a summary of insurance billing and payments. Once therapy is complete, a pharmacist will write a discharge summary that can be quickly reviewed if the patient is referred for home infusion therapy in the future. Pharmacists play a critical role with documentation in the infusion industry. If complications arise, it's important to know exactly what happened and how it can be avoided in the future.

What Are the Various Types of Vascular Access Devices?

A PERIPHERAL IV is any type of needle or flexible cannula inserted through the skin and directed into a vein. These are typically inserted for short-term use. Actual metal needles should only be left in place for the length of one infusion, but short cannulas are designed to be left in place for 72 to 96 hours and may remain longer in emergency situations. A slightly longer peripheral line is called a mid-line catheter. These are inserted through the upper arm and end near the basilica, cephalic or brachial vein. If left in place, these are flushed with normal saline and heparin on a scheduled basis to retain patency. (Patency means that the line remains open or unclogged.)

A SUBCUTANEOUS line is generally a short needle inserted through the skin, generally on the fatty area of the abdomen that allows fluid to be administered slowly into the subcutaneous membranes of the body and absorbed into the blood stream. This method of administration is used for hydration and for low dose, continuous pain relief.

CENTRAL lines are vascular access devices that end in the Superior Vena Cava. There are many types of central lines, but three basic designs are used for home infusion.

A PICC line (Peripherally Inserted Central Catheter) is a long IV catheter inserted through the skin, generally on the upper arm, that is threaded through a vein until it empties into the large vein near the heart, the Superior Vena Cava. This central placement allows the medication being administered to be diluted by large volumes of blood in a rapid time frame to lessen any venous irritation. PICC lines are recommended for therapies expected to last from 10 days to 10 weeks, but there are reports of PICC lines that have remained in use for up to 10 months or even longer in exceptional cases. The insertion site needs to be covered with a special transparent dressing to eliminate insertion site infections and to prevent the line from being tugged in or out of the insertion site. It is important to limit the extreme extension of the arm while a PICC line is in place so that the catheter isn't dislodged. Sports like bowling, tennis and golf are not allowed while a PICC line is in place. PICC lines can have more than one "lumen" or IV line within one device. This allows more than one medication to be administered at one time without the medications physically coming into contact in the IV line. This is necessary if a patient is receiving more than one drug that is incompatible with others.

TUNNELED CENTRAL VENOUS CATHETERS (CVCs) are lines that are inserted into the central venous system via the subclavian or axillary vein, with the catheter line surgically tunneled under the skin so that the access site (lumen) extends out the chest wall. These may have one or more lumens and are initially sutured into place. The sutures require two to three weeks to heal; but once healed, they may be left in place with minimal dressings. Tunneled catheters are intended for long-term therapy. Because the lumen(s) of tunneled catheters extend out through the chest wall, patients can experience some psychological issues, especially with their appearance. Some tunneled catheters have a closed, rounded internal tip with a patented three-way valve that remains closed when the line is not in use. The tip opens when pressure from the infusion comes through the line, then closes when the fluid stops running into the line. This prevents blood from entering the IV catheter. The closed tip, tunneled catheters are designed to not require heparin flushing, but practitioners should always refer to manufacturers guidelines.

POWER PICCs AND POWER CVCs are the newest products on the market. These are made of a strong urethane material designed to allow the rapid injection of contrast media and other fluids. These are identified by their purple color.

PORTS are permanent central IV access devices that have no external parts. They are surgically placed under the skin, typically on the chest wall. The distal end of the catheter is inserted into a central vein. The catheter leads to a small chamber with a membrane that can be punctured by a needle through the skin. These are accessed with the use of a noncoring needle that has a 90 degree angle. The needles (referred to as Huber needles) must be checked for proper placement into the port, then the other end lies across the skin. The needles come in various lengths and sizes depending on the depth of the implanted device, the patient's size and the type of fluid to be infused. Ports are commonly used for chemotherapy patients. When the port is not in use, the needle should be removed and no dressing is needed—the patient can retain a normal routine of bathing and other activity. A port should be flushed once a month when not in use. Ports can have one or two chambers, allowing one or more medications to be infused at one time without physically mixing in the intravenous line.

Chemotherapy Port

Photos taken by Eric M. Miron

When a patient needs intermittent IV therapy, the bag should be timed to be changed as late in the day as possible. This allows the patient to sleep while the bag is heaviest and have a smaller, lighter bag to carry around during the day. Pumps and IV bags can be worn in back packs or fanny packs to allow maximum mobility during the day. Rarely does a patient need an IV pole.

SASH

Most catheters are designed to be flushed with saline and then "heparinized" between uses in order to prevent clotting. New advances in both PICC lines and tunneled catheters have allowed for the elimination of heparin use in many devices. The technology involves small valves that prevent the backflow of blood into the catheter, thus eliminating the need for heparinizing the line. Positive pressure valves have also reduced the backflow of blood into a catheter and reduced the need for heparin. The industry is slowly adapting standards to allow medical personnel to visually determine if a line needs to be heparinized or not.

What is Flushing and How Does it Work?

The infusion industry standard is called SASH. This acronym stands for Saline, Agent, Saline, Heparin. When a dose of medication is to be administered, the line needs to be cleared of any remaining heparin. First, saline (0.9% Sodium Chloride) should be pushed through the line to make sure it is open (patent). Once it is determined that the line is running smoothly, the medication (agent) is administered. Next, to avoid any physical interactions between heparin and the agent, the line would again be flushed with saline. Then, a small amount of low concentration heparin (adults use 100 units/ml) is instilled into the catheter. This heparin is left in place until the next time the medication is due. For safety reasons, flushing is always done with a 10 ml syringe for the most effective pressure. IV catheters can be broken if too much pressure is exerted during flushing or infusion. If a medication is running continuously, there is no need for routine flushing.

Methods of Administering IV Medications

IV Push: The easiest method to learn and the least expensive administration are for medications to be given by IV push. Most antibiotics can be sent to the home in a syringe and administered over five to 10 minutes by slow IV push. This is the least disruptive to a patient's normal routine.

Gravity Flow: The original IV tubing lines ran by gravity alone—the higher you hang a bag above the insertion site, the faster it should run. Many IV sets are equipped with a small chamber where the rate of drops per minute can be controlled. These are safe for hydration IVs or other medications where the rate isn't critical.

Controlled Flow: This IV tubing has a special rate adjustment device that prevents the fluid from running too fast. These devices can't prevent a fluid from running too slowly. They are a step above gravity tubing, but are generally only used for medications that are irritating or dangerous if they run too fast but don't require exact time for blood level monitoring. The problem with gravity and controlled flow tubing are that they can be 'positional.' In other words, the way a patient is sitting, standing or lying down can affect the rate of flow, as well as how high the bag of fluid is hung with each dose.

Subcutaneous IV sets: Any infusion tubing can be used for subcutaneous fluid administration, but some sets are specifically designed for this use. The fluid still makes its way into the blood stream, but this method is easy for a nurse to start on a dehydrated patient, is never irritating to veins and the chance of displaced needles in an arm is eliminated. A downside of subcutaneous infusion is that the amount of fluid that can be infused is limited to an absolute maximum of 1 ml/minute. Some patients can tolerate two subcutaneous sites infusing at one time.

Elastomerics: These are balloon-like containers encased in a semi-hard plastic shell. A patient connects the device to their catheter and releases a clamp. The pressure from the balloon causes the fluid to pass through a valve and into the veins. The valve can be set to control the rate of flow. Elastomerics are always disposable, often making them more expensive than other choices.

Pumping Devices: Home infusion companies use small "ambulatory" pumps to administer critical medications in the home setting. These are small enough to be held in your hand and are light weight so they can be carried in a back pack or fanny pack. A pumping device must be used when the total time of administration of the medication is important to the therapy or the rate of administration is critical. For example, with parenteral nutrition, a pump is necessary so that the infusion can start slowly, run over an exact number of hours and then taper off before completion. With inotropic medication, you want to have a set mg/ml rate that can be maintained over many hours. There are many types of pumping devices that can be programmed to deliver medications in various patterns. Pumps can be purchased that do only one of the following functions. Multi-function pumps can also be programmed to do only one function at a time. Pumps can operate via electrical cord at night, but are battery powered while the patient is ambulatory.

Continuous Flow: A pump can be programmed to provide a specific volume of fluid over any length of time. This is generally the setting used for pain medications

and hydrations containing potassium where the flow must not be allowed to run out of control. It is also used for antibiotics that are dosed on a steady 24-hour regimen, as well as inotropics.

Continuous Flow with Bolus doses: This is a pump setting used exclusively for pain control. A basal (or minimum) rate is determined by the physician to keep the patient relatively pain free. At the press of a button, a patient can give themselves a "bolus" or extra dose of medication. When the order for pain therapy is written, it will have set parameters that are easily programmed into the pump. For example, a pharmacist can program a pump to deliver 2 mg of morphine per hour with up to four bolus doses (extra doses) of 1 mg. You can set the time that must elapse between bolus doses, such as "no more often than every 10 minutes." This type of therapy is referred to as patient-controlled analgesia (PCA).

Intermittent Therapy: With home infusion therapy, it's time consuming and disruptive to give a patient multiple doses of medication throughout the day. By using a pump set on intermittent therapy, you can attach one bag of fluid with 24 hours worth of medication. The pump is then set to run at a very low rate between doses and the equivalent of one dose every set number of hours. For example, nafcillin might be dosed as 2 grams every four hours. The bag would need to contain 12 grams of nafcillin. If the nafcillin was diluted so that 12 grams was available in 300 mls of fluid, you would need to administer 50 mls every four hours, with a small keep vein open (KVO) rate between doses. The keep open rate needs to be small enough to be clinically insignificant. The pump would be set to run at KVO for 3.5 hours, then run at 50 mls over 30 minutes, then back to KVO for 3.5 hours and then run at 50 mls over 30 minutes again, repeating until a 24-hour supply is delivered. With this type of pump programming, the patient only needs to change their bag once every 24 hours.

Escalating rates: Pumps can be set to start a product slowly, then increase the rate in steps until a desired maximum rate is achieved. For example, an IVIG dose might be ordered to start at 20 mls/hour for one hour, then increase to 40 mls/hour for 30 minutes, then 60 mls/hr for 20 minutes, then complete the balance of the six-hour infusion at 100 mls/hr.

Ramping: Ambulatory pumps can be set to start at a very slow dose, increase the rate over a set amount of time, run at a steady rate for a set number of hours and then taper the dose back down to zero. This technique is used for overnight parenteral therapy. For example, a patient needs to receive 1,100 mls of fluid in 12 hours, beginning their feeding at 8 p.m. The pump would start at a very slow rate, perhaps delivering 50 mls over the first hour and building up to the point where it is running at 100 mls/hour for 10 hours. After that time, the pump would slowly taper off to a zero rate, delivering the last 50 mls of the dose during the last hour.

Pharmacist's Responsibility for Patient Care in the Infusion Setting

Patients receiving home infusion must be constantly monitored for outcomes, assessed for continuing need and watched for unanticipated complications. For example, nutritional patients may be on therapy for the rest of their lives, but a pharmacist must monitor their weekly weights, electrolyte levels, ongoing nutritional needs and any potential complications. The pharmacist must be prepared to make nutritional adjustment recommendations to the physician. Pharmacists may consult with a dietician on complicated cases. With antibiotic patients, the pharmacist will monitor WBC counts, C-reactive protein and other lab values to evaluate if the infection is responding to the antibiotic. With aminoglycosides, the pharmacist has a responsibility to monitor the blood levels and keep medication ranges within safe levels to minimize risk to the patient. Recommendations for changes in dose amounts and dosing intervals must be effectively and professionally communicated to physicians and caregivers.

Infusion pharmacists must also monitor complications with venous access devices. Problems such as insertion site infections, catheter occlusions and patency must be addressed. The pharmacist also is responsible for sterile product preparation, stability limits, delivery issues and communication with physicians and other members of the health care team. In this discipline, the pharmacist is expected to make recommendations for therapy changes that will improve outcomes for the patient, including recommending change to oral therapy whenever that is clinically sound.

Summary

Home infusion offers an interesting work experience for a pharmacist who excels in problem solving, documentation and communication. This practice setting requires constant attention to detail and follow up with other health care practitioners. Excellent clinical skills in nutrition, auto-immune diseases, infectious disease states and pain management are a requirement. This is an area of pharmacy practice where you develop very close ties with other health care practitioners as well as close relationships with your patients.

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References

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2. Sasson, MD and Shvartzman, MD. Hypodermoclysis: An Alternative Infusion Technique, American Family Physician, Nov., 2001.

3. Alexander et al, editors. Infusion Nursing: An Evidence-Based Approach, 2006, Chapters 38 and 45.

Continuing Education Self-Assessment Questions

1. Which of the following therapy types can be done safely in the home?
   a. Antibiotics **b.** Parenteral nutrition
   c. Immune globulin **d.** All of the above

2. What is the typical teaching pattern used by a nurse for a home infusion patient?
   a. The patient is trained in the hospital before they are discharged.
   b. A nurse meets once with the family, then once weekly.
   c. A nurse will do up to three initial visits, then weekly or as needed until the patient and caregiver have achieved the training goals.
   d. A nurse must go to the home for every infusion.

3. Which of the following items are included in an initial assessment for a potential infusion patient?
   a. Height, weight, allergies, other medications being taken, physical limitations, available help and home environment
   b. Oral medications that could be substituted, previous experiences with home infusion, past history of IV drug abuse, pets in the home
   c. Both a and b
   d. None of the above

4. The most common concentration of heparin flush solution for adults is:
   a. 1,000 units/ml **b.** 10,000 units/ml
   c. 10 units/ml **d.** 100 units/ml

5. Which of the following is NOT considered a Central Venous Catheter?
   a. A port **b.** A tunneled catheter
   c. A PICC line **d.** A midline catheter

6. Which of the following is NOT true concerning Huber needles:
   a. Specifically designed to be non-coring
   b. Has a 90 degree angle so that it lies across the skin
   c. Manufactured in one standard size
   d. Should be removed when not in use

7. True or false: Charts for home infusion patients are retained at the physician's office, and all communication must be sent there.
   a. True
   b. False

8. What does SASH stand for?
   a. Special Access Subcutaneous Huber needle
   b. Saline, Antibiotic, Saline, Heparin
   c. Saline, Agent, Saline, Heparin
   d. A decorative band used to determine the type of venous access device inserted

9. What pump program would be used for a drug that needs to be slowly introduced into the blood stream and then allowed to run faster and faster if the patient tolerated the medication?
   a. Continuous flow
   b. Intermittent therapy
   c. Escalating rates
   d. Continuous flow with intermittent bolus doses

10. Which of the following professional strengths are important for an infusion pharmacist?
    a. Communication skills, both written and verbal
    b. Clinical skills
    c. Attention to detail
    d. All of the above

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