IV Therapy Series: Taking Orders

OLYMPIA RESOL, RN, MPH, CRNI, CARN

Course Objectives

At the end of the course, the student should be able to:

- Identify the most common reasons for IV therapy;
- Determine who can give IV therapy orders;
- Particularize what are included in an IV therapy order;
- Understand the guidelines related to intravenous therapy;
- Ascertain the two main types of venous access;
- And lastly, the student should get acquainted with health information technology (HIT) integration in IV therapy.

Introduction

Intravenous therapy is treatment that infuses intravenous solutions, medications, blood, or blood products directly into a vein (Perry, Potter, & Ostendorf, 2014). Intravenous therapy is an effective and fast-acting way to administer fluid or medication treatment in emergency situations, and for patients who are unable to take medications orally. Approximately eighty percent (80%) of all patients in the hospital setting will receive intravenous therapy.

According to (Waitt, Waitt, & Pirmohamed (2004), the most common reasons for IV therapy include:

1. To replace fluids and electrolytes and maintain fluid and electrolyte balance: The body's fluid balance is regulated through hormones and is affected by fluid volumes, distribution of fluids in the body, and the concentration of solutes in the fluid. If a patient is ill and has fluid loss related to decreased intake, surgery, vomiting, diarrhea, or diaphoresis, the patient may require IV therapy.

According to (Waitt, Waitt, & Pirmohamed (2004), the most common reasons for IV therapy include:

2. To administer medications, including chemotherapy, anesthetics, and diagnostic reagents: About forty percent (40%) of all antibiotics are given intravenously.

According to (Waitt, Waitt, & Pirmohamed (2004), the most common reasons for IV therapy include:

3. To administer blood or blood products: The donated blood from another individual can be used in surgery, to treat medical conditions such as shock or trauma, or to treat a failure in the production of red blood cells. The infusion restores circulating volumes, improving the ability to carry oxygen and replace blood components that are deficient in the body.

According to (Waitt, Waitt, & Pirmohamed (2004), the most common reasons for IV therapy include:

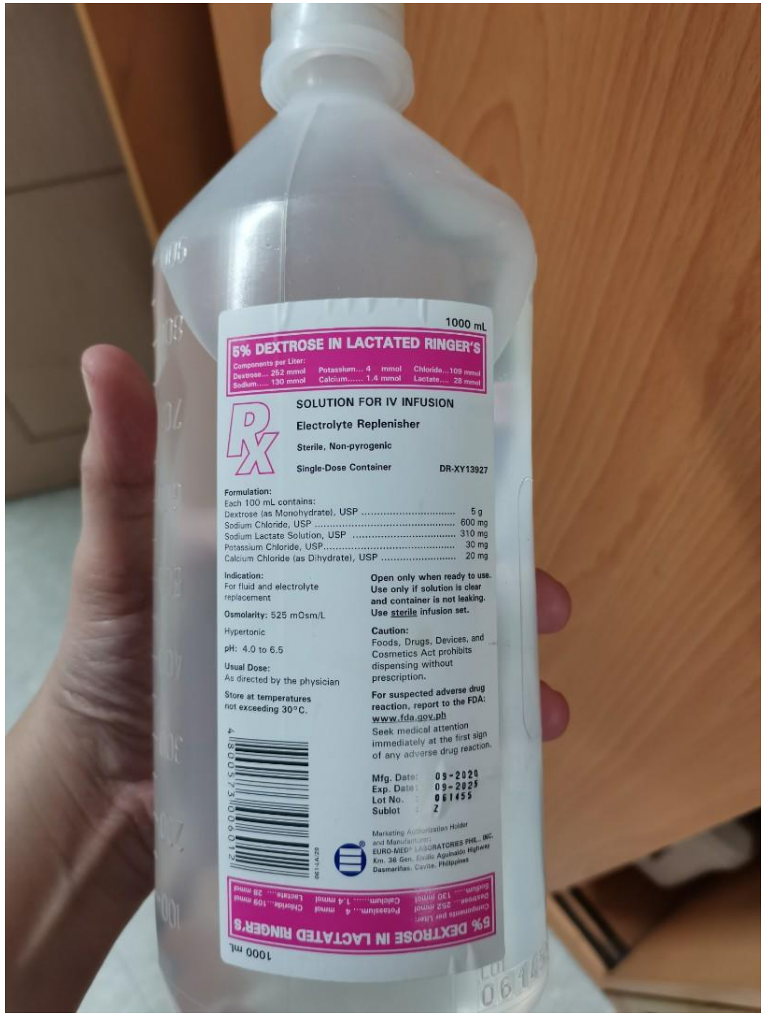
4. To deliver nutrients and nutritional supplements: IV therapy can deliver some or all of the nutritional requirements for patients unable to obtain adequate amounts orally or by other routes.

Who can give IV therapy orders?

IV fluid therapy is ordered by a physician or nurse practitioner.

What are included in an IV therapy order?

The order must include the type of solution or medication, rate of infusion, duration, date, and time.



How long does IV therapy take place?

IV therapy may be for short or long duration, depending on the needs of the patient (Perry et al, 2014).

Table 3: Insulin

	IV	SQ
Onset	15 minutes	30 minutes
Peak	15 - 30 minutes	2.5 - 5 hours
Duration	2 - 6 hours	5 - 12 hours
Indication	Hyperkalemia: 10 units IV once with D50 DKA: 0.1 units/kg IV	Diabetes management: 0.3-0.5 units/kg/day divided into product specific doses

Guidelines Related to Intravenous Therapy

IV therapy is an invasive procedure, and therefore significant complications can occur if the wrong amount of IV fluids or the incorrect medication is given.

Guidelines Related to Intravenous Therapy

Aseptic technique must be maintained throughout all IV therapy procedures, including initiation of IV therapy, preparing and maintaining equipment, and discontinuing an IV system. Always perform hand hygiene before handling all IV equipment. If an administration set or solution becomes contaminated with a non-sterile surface, it should be replaced with a new one to prevent introducing bacteria or other contaminants into the system (Centers for Disease Control [CDC], 2011).

Guidelines Related to Intravenous Therapy

Understand the indications and duration for IV therapy for each patient. Practice guidelines recommend that patients receiving IV therapy for more than six days should be assessed for an intermediate or long-term device (CDC, 2011).

Guidelines Related to Intravenous Therapy

If a patient has an order to keep a vein open, or "TKVO," the usual rate of infusion is twenty (20) to fifty (50) ml per hour (Fraser Health Authority, 2014).

Guidelines Related to Intravenous Therapy

Complications may occur with IV therapy, including but not limited to localized infection, catheter-related bloodstream infection (CR-BSI), fluid overload, and complications related to the type and amount of solution or medication given (Perry et al., 2014).

Guidelines Related to Intravenous Therapy

- For an infusing peripheral IV, the site must be assessed every two (2) hours and p.r.n.
- A saline lock site must be assessed every twelve (12) hours and p.r.n.

Types of Venous Access

Safe and reliable venous access for infusions is a critical component of patient care in the acute and community health setting. There are a variety of options available, and a venous access device must be selected based on the duration of IV therapy, type of medication or solution to be infused, and the needs of the patient. In practice, it is important to understand the options of appropriate devices available. This section will describe two types of venous access: peripheral IV access and central venous catheters.

Peripheral IV

A peripheral IV is a common, preferred method for short-term IV therapy in the hospital setting. A peripheral IV (PIV) (see Figure 8.1) is a short intravenous catheter inserted by percutaneous venipuncture into a peripheral vein, held in place with a sterile transparent dressing to keep the site sterile and prevent accidental dislodgement (CDC, 2011). Upper extremities (hands and arms) are the preferred sites for insertion by a specially trained health care provider. If a lower extremity is used, remove the peripheral IV and re-site in the upper extremities as soon as possible (CDC, 2011; McCallum & Higgins, 2012). The hub of a short intravenous catheter is usually attached to IV extension tubing with a positive pressure cap (Fraser Health Authority, 2014).

Peripheral IV

PIVs are used for infusions under six days and for solutions that are iso-osmotic or near iso-osmotic (CDC, 2011). They are easy to monitor and can be inserted at the bedside. CDC (2011) recommends that PIVs be replaced every 72 to 96 hours to prevent infection and phlebitis in adults. Most agencies require training to initiate IV therapy, but the care and preparation of equipment, and the maintenance of an IV system can be completed each shift by the trained health care provider.

Peripheral IV

PIVs are prone to phlebitis and infection, and should be removed (CDC, 2011) as follows:

- Every 72 to 96 hours and p.r.n.
- As soon as the patient is stable and no longer requires IV fluid therapy
- As soon as the patient is stable following insertion of a cannula in an area of flexion
- Immediately if tenderness, swelling, redness, or purulent drainage occurs at the insertion site
- When the administration set is changed (IV tubing)

Figure 8.1 Peripheral intravenous (IV) catheter (PIV)

Peripheral IV

Several potential complications may arise from peripheral intravenous therapy. It is the responsibility of the health care provider to monitor for signs and symptoms of complications and intervene appropriately. Complications can be categorized as local or systemic. Most complications are avoidable if simple hand hygiene and safe principles are adhered to for each patient at every point of contact (Fraser Health Authority, 2014; McCallum & Higgins, 2012).

Central Venous Catheters

A central venous catheter (CVC) (see Figure 8.2), also known as a central line or central venous access device, is an intravenous catheter that is inserted into a large vein in the central circulation system, where the tip of the catheter terminates in the superior vena cava (SVC) that leads to an area just above the right atrium. CVCs have become common in health care settings for patients who require IV medication administration and other IV treatment requirements. CVCs can remain in place for more than one year. Some CVC devices may be inserted at the bedside, while other central lines are inserted surgically. Central lines are inserted by a physician or specially trained health care provider, and the use of ultrasound guided placement is recommended to reduce time of insertion and complications (Safer Healthcare Now, 2012).

Central Venous Catheters

A CVC has many advantages over a peripheral IV line, including the ability to deliver fluids or medications that would be overly irritating to peripheral veins, and the ability to access multiple lumens to deliver multiple medications at the same time (Fraser Health Authority, 2014). Central venous catheters can be inserted percutaneously or surgically through the jugular, subclavian, or femoral veins, or via the chest or upper arm peripheral veins (Perry et al., 2014). Femoral veins are not recommended, as the rate of infection is increased in adults (CDC, 2011; Safer Healthcare Now, 2012). To have a CVC inserted or removed, an order by a physician or nurse practitioner must be obtained. Site selection for a CVC may be based on numerous factors, such as the condition of the patient, patient’s age, and type and duration of IV therapy.

Central Venous Catheters

The majority of patients in an ICU will have a CVC to receive fluids and medications. A chest X-ray is given to determine correct placement before inserting, or to confirm a suspected dislodgement (Fraser Health Authority, 2014). An IV pump must be used with all CVCs to prevent complications.

Central Venous Catheters

CVCs are typically inserted for patients requiring more than six days of intravenous therapy or who:

- Require antineoplastic medications
- Are seriously or chronically ill
- Require vesicant or irritant medications
- Require toxic medications or multiple medications
- Require central venous pressure monitoring
- Require long-term venous access or dialysis
- Require total parenteral nutrition
- Require medications with a pH greater than 9 or less than 5, or osmolality of greater than 600mOsm/L
- Have poor vasculature
- Have had multiple PIV insertions/attempts (e.g., two attempts by two different IV therapy practitioners)

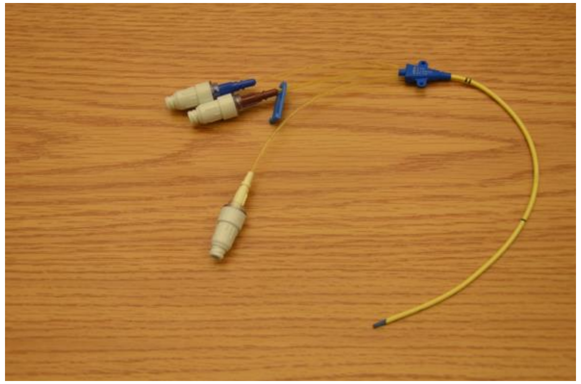


Figure 8.2 Central venous catheter (CVC) with three lumens

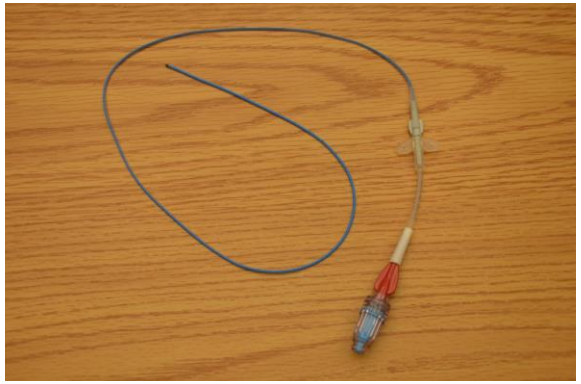


Figure 8.3 Peripherally inserted central catheter (PICC) with one lumen

Central Venous Catheters

A central line is made up of lumens. A lumen is a small hollow channel within the CVC tube. A CVC may have single, double, triple, or quadruple lumens (Perry et al., 2014). Depending on the type of CVC, it may be internally or externally inserted, and may have an open-ended or valved tip. Open-ended devices are those in which the catheter tip is open like a “straw.” These have a higher risk for complications, such as hemorrhage, air embolism, and occlusion from fibrin or clots. Valved devices are those in which the tip is configured with a three-way pressure-activated valve (Perry et al., 2014). It is important to know what type of central line is being used, as this will impact how to care for and manage the equipment for specific procedures.

Types Of Central Venous Catheters (CVCS)

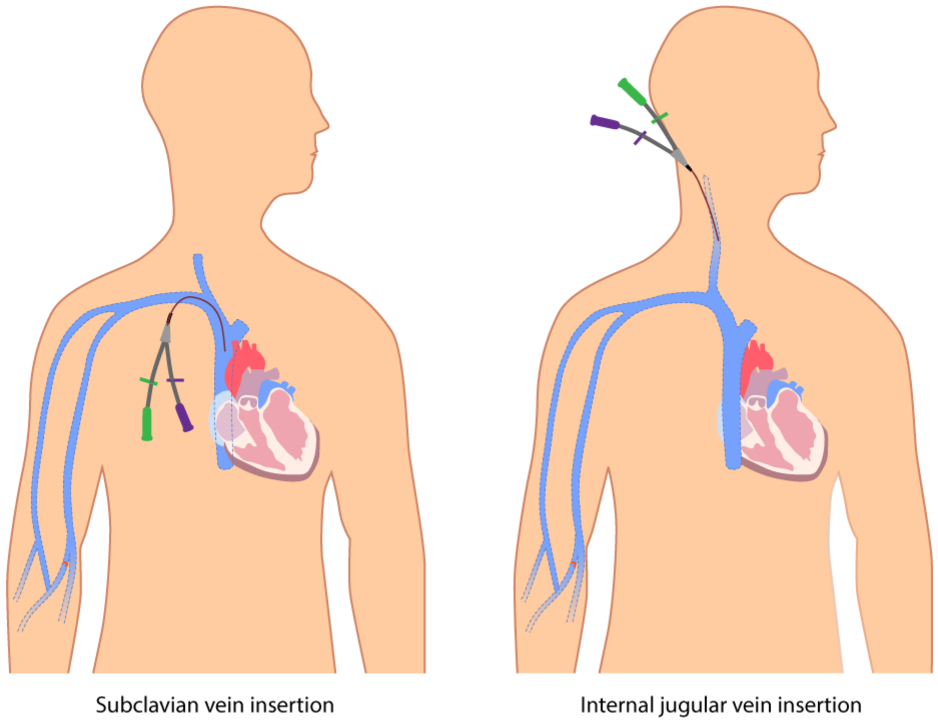
Safety considerations:

- CVC care and maintenance requires specialized training to prevent complications.
- Central lines heighten the risk for patients to develop a nosocomial infection. Strict adherence to aseptic technique is required for all CVC care.

Percutaneous central venous catheter (CVC)

Tip location: The tip of the catheter is located in the SVC. The entry site is the exit site.

- Can be inserted at the bedside by specially trained physician or nurse. The percutaneous CVC is inserted directly through the skin. The internal or external jugular, subclavian, or femoral vein is used.



Central venous catheters

Percutaneous central venous catheter (CVC)

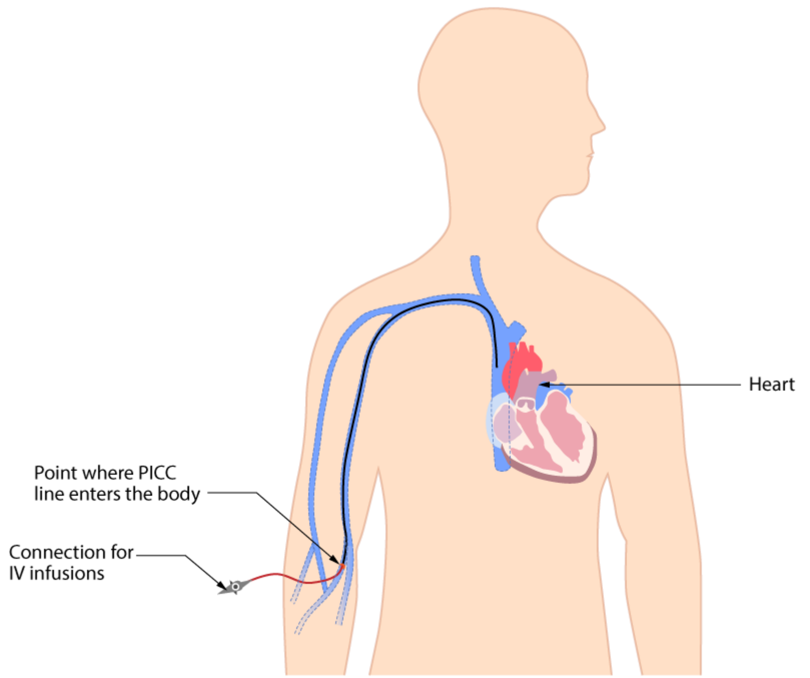
- Most commonly used in critically ill patients. Can be used for days to weeks, and the patient must remain in the hospital. Usually held in place with sutures or a manufactured securement device.

Internal jugular venous catheter (upper CVC)

Peripherally inserted central catheter (PICC)

Tip location: The tip is located in the SVC.

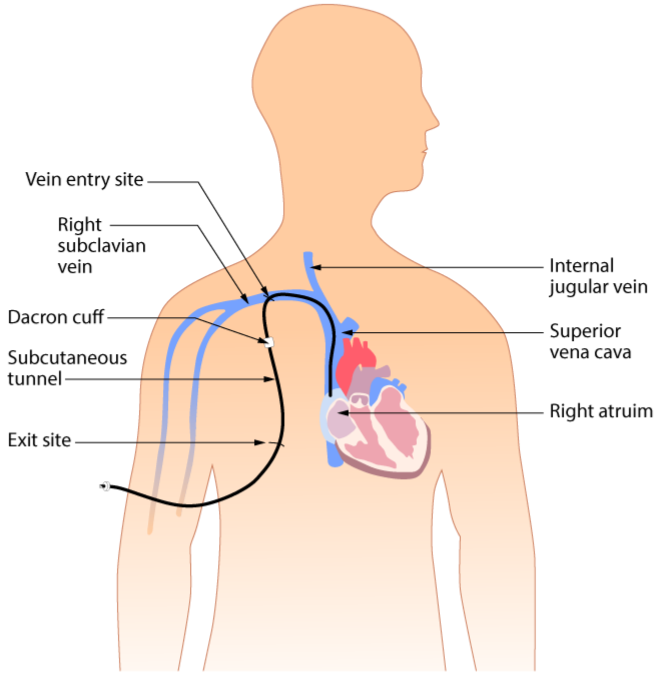
A PICC (see Figure 8.3) may be inserted at the bedside, in a home or radiology setting. The line is inserted through the antecubital fossa or upper arm (basilic or cephalic vein) and is threaded the full length until the tip reaches the SVC. Can provide venous access for up to one year. The patient may go home with a PICC. PICCs can easily occlude and may not be used with dilantin IV. It is held in place with sutures or a manufactured securement device.



PICC line inserted in the upper arm (through the basilic vein)

Subcutaneous or tunnelled central venous catheter

A tunnelled CVC, also known as a Hickman, Broviac, or Groshong, is a long-term CVC with a proximal end tunnelled subcutaneously from the insertion site and brought out through the skin at an exit site. Insertion is a surgical procedure, in which the catheter is tunnelled subcutaneously under the skin in the chest area before it enters the SVC. A tunnelled catheter may remain inserted for months to years. These CVCs have a low infection rate due to a Dacron cuff, an antimicrobial cuff surrounding the catheter near the entry site, which is coated in antimicrobial solution and holds the catheter in place after two to three weeks of insertion.



Tunnelled CVC

Implanted central venous catheter (ICVC, port a cath)

The implanted central venous catheter (ICVC) is inserted into a vessel, body cavity, or organ and is attached to a reservoir or "port," located under the skin. The ICVC is also referred to as a port a catheter or port a cath. A surgical procedure is required to insert the device, which is considered permanent. The device may be placed in the chest, abdomen, or inner aspect of the forearms. It is often better for body image. The ICVC can be accessed using a non-coring needle. A patient may return home with this type of CVC.

Chest with ICVC inserted

ICVC under the skin

Data source: Fulcher & Frazier, 2011; Perry et al., 2014

Central Venous Catheters

CVCs have specific protocols for accessing, flushing, disconnecting, and assessment. All health care providers require specialized training to care for, manage complications related to, and maintain CVCs as per agency policy. Never access or use a central line for IV therapy unless trained as per agency policy.

Central Venous Catheters

Health care providers should assess a patient with a central line at the beginning and the end of every shift, and as needed. For example, if the central line has been compromised (pulled or kinked), ensure it is functioning correctly.

Central Venous Catheters

Each assessment should include:

- Type of CVC and insertion date:

  reason for CVC
- Dressing: is it dry and intact?
- Lines: secure with stat-lock, sutures,

  or Steri-Strips?
- Review: patient still requires a CVC?
- Insertion site: free from redness, pain, swelling?
- Positive pressure cap: attached securely?
- IV fluids: running through an IV pump?
- Lumens: number of lumens and type of fluids running through each?
- Vital signs: fever?
- Respiratory/cardiovascular check: any signs and symptoms of fluid overload?

Infusion Order Form Example

ID INFUSION CARE

INFUSION ORDER FORM

Patient Name: ____DOB: ___/___/___ MR#:_________

ALLERGIES:______________________________ **Phone number:**_________________________

Diagnosis: _______________________________________ICD 9:________________________

Medication: ____________________Dose:_________ Frequency: ________IV type: _________

Medication: ____________________Dose:_________ Frequency: ________IV type: _________

Duration: _____________________ ID Care Start Date: _________ ID Care Stop Date: ________

Other IV treatment received for this admission if applicable: _____________________________

Wound care: Yes ☐ No ☐ Wound Care Details: _______________________________

If yes, please fill out the green card and attach it to the front of the chart

Labs ordered: _______________________ Frequency: Initial dose only ☐ Weekly ☐

Facility where PICC line was inserted: ______________ PICC info obtained: yes ☐ no ☐

Original Order: ☐Infuse box ☐ Office Visit ☐ Email ☐ Verbal ☐ Other: _______

____ ______________________
Ordering Physician Date

____ ______________________
Nurses Signature Date

This Section is for ORDER CHANGES ONLY

Change Indicated: ____

Ordering MD/NP:____________________ Nurse signature:_______________ Date:_________

Change Indicated: ____

Ordering MD/NP:____________________ Nurse signature:_______________ Date:_________

Change Indicated: ____

Ordering MD/NP:____________________ Nurse signature:_______________ Date:________

If treatment has been extended, please include new stop date

The Right Specialists-The Right Care

Infusion Order Form Example

HYDRATION ORDER FORM

REQUIRED INFORMATION

☐ Patient demographics & insurance information
☐ This signed order form from the provider
☐ Recent labs and notes if available

Patient Name: ______________________________ DOB: ________________

Allergies: ☐NKDA ______________________________ Phone: ________________

HISTORY

☐ Renal Impairment
☐ Congestive Heart Failure E_f% ________
☐ Other History: ____
☐ Diabetes
☐ Other Cardiac History: ______________________

DIAGNOSIS

☐ Dehydration (276.51)
☐ Nausea/Vomiting (787.01)
☐ Hyperemesis of Pregnancy (643.10)
☐ Gastroenteritis (558.9)
☐ Electrolyte Imbalance (276.9)
☐ Other: ______________________________

FLUID

☐ Normal Saline
☐ .45 Normal Saline
☐ D5 – (5% Dextrose)
☐ D5NS – (D5 Normal Saline)
☐ D5 .45NS – (D5 – .45 Normal Saline)
☐ D5 Lactated Ringers
☐ Lactated Ringers
☐ Other: ______________________________

VOLUME

☐ 1 Liter (1000ml)
☐ 2 Liters (2000ml)
☐ Other: ______________________

RATE OF ADMINISTRATION

☐ Bolus, as tolerated
☐ Over 1 hour
☐ Over 2 hours
☐ Over ________ hour(s)

ADDITIONAL IV MEDICATIONS

☐ Zofran IVP ☐4mg ☐8mg
☐ Reglan IV ☐10mg-100ml NS

FREQUENCY

☐ One infusion only
☐ Every day for ______ days
☐ Other

Physician Name ______________________ Phone ______________ Fax ______________

Signature ______________________________ Date ____________

Infusion Solutions OF DELAWARE, LLC

200 Banning Street, Suite 260 Dover, DE 19904
Phone: 302-674-4627
Fax: 302-674-4628

Northwestern Medicine®

Infusion Therapy Medication Administration

Order Processing: Fax Form: **CDH PTC: Fax (630) 933-2444** *Phone (630)933-6272* **Delnor OPIC: Fax (630)208-3467** *Phone (630)208-4446*		
Patient Name:	**DOB:**	**MRN** ***(if known)***
Height: cm	**Weight:** kg	
Allergies (list all with reactions):		

Diagnosis and Code REQUIRED for submitting form

Diagnosis:___________________________________**Code:**____________________

Please complete all applicable fields to avoid any delays in scheduling or phone calls for clarification.

Attention provider: Prior to signing orders you will need to define the dose, the interval, and the number of treatments. Patient to start treatment on: (Date) __________________

Medication	Dose	Interval	# of Treatments

Attention provider: Nursing to enter a future lab orders prior to discharge for the following: circle all that apply and define the frequency for the lab draw **(example: daily, prior to each infusion, weekly {Monday, Tuesday, Wednesday, Thursday, Friday}, every other week, once a month)**

Lab	Frequency	Or Dose #
BMP		
BUN/Creatinine		
CBC		
CBC-Diff		
CMP		
Other:		

Pre-Medications:

- ☐ Acetaminophen (Tylenol) 650 mg, PO, Once, Administer prior to infusion
- ☐ Diphenhydramine 25 mg IV Push, Once, Administer prior to infusion
- ☐ Diphenhydramine 25 mg, PO, Once, Administer prior to infusion
- ☐ Methylprednisolone (Solu-Medrol) 100 mg IV Push, Once, Administer 30 minutes prior to infusion

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Patient Name:	**DOB:**	**MRN** ***(if known)***
Height: cm	**Weight:** kg	
Allergies (list all with reactions):		

Nursing Orders

- ☐ Infusion Nurse to assess the patient's vascular access and initiate orders for line care per department policies and procedures.

Hypersensitivity/Anaphylaxis Reaction:

- ☑ Diphenhydramine (Benadryl) 25 mg IV Push PRN Hypersensitivity Reaction or itching. May repeat X 1 if symptoms persist after 30 minutes.
- ☑ Epinephrine (Adrenaline) 0.3 mg Sub-Q Once PRN Anaphylaxis or Severe Bronchospasm.
- ☑ Hydrocortisone sodium succinate PF (Solu-Cortef) 100 mg IV Push Once PRN Hypersensitivity Reaction, Itching, rash, hives and/or shortness of breath.
- ☑ Oxygen: 2-3 L/min for Hypersensitivity and/or Anaphylaxis reaction.
- ☑ Notify Provider of hypersensitivity/anaphylactic reaction.
- ☑ Sodium Chloride 0.9% IV Bolus 250 mL over 15 minutes Once PRN Hypersensitivity and/or Anaphylaxis reaction.

Provider Name: ________________________________**Signature:**____________________________

Date: _____________________________________ **Time:** __________________________________

Health Information Technology Integration

The American healthcare system, like those in other developed nations, has begun to aggressively embrace health information technology (HIT) as a panacea for improving value (i.e., benefit/cost ratio), safety, efficiency, and even patient satisfaction. In fact, the scientific evidence supporting the widespread belief in this “technology elixir” is limited, and examples of false starts and abject failures are numerous. Nonetheless, HIT is here to stay and does provide opportunities to improve the safety and efficiency of infusion management.

Disclaimer: The following technologies are expensive (at least currently) so do not expect your facility to have them unless you work in a big network.

Automated Programming and Documentation

If the existing HIT already contains the essential patient-specific medication therapy information, why isn't this information routinely and automatically sent to and available on the appropriate infusion pump (i.e., electronic data input)? Why don't pumps routinely and automatically send their infusion information to the existing HIT for therapy verification, clinical documentation, and other purposes like decision support (i.e., electronic data output)? These notions are not new, and the impediments are not primarily technological. In fact, some pump vendors are already doing one or both with selected HIT vendors in selected clinical sites. However, appreciable impediments to ubiquitous bidirectional data sharing between pumps and HIT remain, with the same being true for other bedside devices (e.g., physiological monitors).

Patient-Specific Therapy

To date, infusion pumps have accommodated patient identification as well as weight and height, but these have had to be entered by the bedside provider manually. In addition, other patient-specific attributes influencing therapy effectiveness or safety have not been available at the pump. For example, if an infused drug to which the patient is allergic is inadvertently ordered, administration is the last chance to catch the error and prevent harm. If the pump “knew” a patient's medication allergies, it could generate an alert during pump programming. Few clinicians are willing to enter patient allergies or other patient-specific data manually on an infusion pump (and manual entry is problematic due to potential data input errors). These factors underscore the value of a robust HIT system that is interconnected to the infusion system software.

Electronic Dashboards

Additional HIT integration benefits are beginning to be realized through the development and use of electronic displays of infusion therapy status. These displays, sometimes called dashboards, can be synchronized via wireless with all pumps in a unit. Such dashboards have the capacity to strengthen clinical workflow by highlighting issues and events as they occur and thereby allowing for intermediary action. For example, a dashboard on a tablet computer carried by a ward nurse who is covering eight patients can inform her of an ongoing occlusion alarm in one room or a fluid infusion that has run dry.

Electronic Dashboards

Similarly, an infusion dashboard at the central nursing station can highlight an air-in-line alarm in one room or a new medication ordered to be administered to another patient. Nurses can thereby monitor multiple active pumps from a single screen, increasing efficiency, and more readily coordinating timely care with other clinicians on their team. Thus, with this technology, a fleet of pumps can be viewable and managed contemporaneously as they are being handled intelligently at the bedside. Such integrated task management technology can also reside as a web app on a cell phone to provide the nurse with a continually updated to-do list.

Electronic Dashboards

Further, dashboards can help keep track of the pump fleet on a unit, facilitate acquisition of an unused pump, and avoid pump hoarding. With a different dashboard, pharmacists can monitor a unit's pump fleet to identify when new infusions need to be mixed and delivered to the unit. Similarly, the pharmacist can identify any pumps that have not been upgraded to the latest version of the institution's drug library. Another dashboard can allow healthcare technology managers to be able to monitor an entire hospital's pump fleet for maintenance issues (e.g., need for battery replacement) or software upgrades. Much like the smart pump user interface, these dashboards need to provide usable, useful, and actionable information and be more widely available.

Example Case: The Future of Infusion Therapy

Nurse Jim Smith receives a text message on his cell phone that an IV gentamycin dose is due on his patient Gilda Jones (who was admitted to the hospital with a pneumonia requiring IV antibiotics). Jim goes to the medication dispensing station and types in Gilda Jones' name. Because it is due in a few minutes, the gentamycin order is presented at the top of the list of all of Mrs. Jones' medication orders.

Example Case: The Future of Infusion Therapy

After Jim reviews and selects the gentamycin, the correct unit dose is dispensed in an IV bag that also contains an RFID tag. Jim takes the bag into the patient room and assesses Mrs. Jones. Jim then logs into the IV pump (currently administering maintenance fluid therapy) with his fingerprint after the pump automatically recognizes him from the RFID tag on his hospital name badge. The pump then asks Jim to confirm the patient's name and medical record number. He does this with a secure custom application on his cell phone, linked by Bluetooth to the pump, that reads the RFID tag on Mrs. Jones wristband and transmits it to the pump. The pump then presents a list of pending orders for Mrs. Jones, where the gentamycin order appears first (because there were no overdue orders, and it is the most current). Jim selects the gentamycin order, confirms all of the “five rights” on the screen, connects the distal end of the gentamycin bag's tubing into the pump's secondary inlet port, and hits “start infusion.”

Example Case: The Future of Infusion Therapy

The time at which the infusion began, and its other attributes are automatically sent to the EHR, as well as to the pharmacy's computer system. During the infusion, the pump monitors downstream pressure and flow characteristics and uses advanced software algorithms to identify potential changes, such as pending infiltration. Concurrently, Jim can monitor the infusion's status from an infusion status display on his smart phone. Further, in near real time, the amount of drug infused is sent to Mrs. Jones' electronic medical record so that her physician can see the progress of the prescribed treatment.

Sources

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