

WHAT HOME PARENTERAL NUTRITION (HPN) IS ALL ABOUT

The purpose of this manual is to help you safely give parenteral nutrition (PN) at home. Parenteral nutrition means providing nutrition by vein. Parenteral nutrition has nutrients the body normally would get from eating a well balanced diet.

All of us need nutrients from each of six basic groups:

1. Protein builds and repairs body tissues.
2. Carbohydrates provide energy.
3. Fat provides a stored energy source and promotes healthy skin.
4. Vitamins help the body properly use fat, carbohydrate, and protein.
5. Minerals aid in a variety of bodily functions such as muscle contraction, blood clotting, and bone repair.
6. Water regulates body temperature, transports nutrients, and rids the body of waste.

The goal of the home parenteral nutrition (HPN) program is to safely provide nutritional support for good health and daily activities. Giving parenteral nutrition at home may improve your quality of life and decrease the number of your hospitalizations. As you read this manual, write down any questions you have. We will answer them during the training period. You may also wish to turn to Appendix A, “Helpful Hints” section of this manual, to read some of the most frequently asked questions by patients and their families.

We want you to return to as normal a lifestyle as possible. With advance notice, we can help you return to work, or take a vacation, but some modifications in your lifestyle will likely be necessary. We are interested in addressing all your questions and concerns and in understanding your own specific needs, so that over the course of your training you will have those needs met and become confident about your home PN therapy.

TRAINING

Learning about PN is something you can do. It will require time, attention to detail, and a lot of practice. We are prepared to help you learn what you will need to know.

The training period will allow you to learn how to safely infuse your PN at home. The training time varies from person to person. Practicing and reading this manual between lessons will help you to remember the steps, making it easier to do, and may lead to an earlier discharge from the hospital.

It is important to listen and be involved in learning your care. Even when you become familiar with HPN, always be careful to take your time so that you do not miss any of the steps. Becoming forgetful or careless may lead to problems such as infection, which could be very serious and may result in readmission to the hospital.

COMMITMENT AND SUPPORT

The most important part of a successful home parenteral nutrition program is your commitment. Support from a family member or friend is also of great importance. If possible, this person should go through training with you. They can support you if you are sick or need help.

CONVENIENCE

Parenteral nutrition is usually infused at night with a pump. This allows you to be free of the pump and intravenous (IV) tubing during the day. Your health status and nutritional needs will determine your infusion time.

PEOPLE WHO ARE CARING FOR YOU

HOMEMED

HomeMed is the University of Michigan Health System's Home Infusion Service. They will be providing your PN solution, supplies, and training before discharge. They will also monitor your care once you are home. There are various members of *HomeMed* who will help you prepare for your discharge on PN. The *HomeMed* Training Team is based in the hospital and is responsible for your training prior to going home. Once discharged, a pharmacist, a dietitian, and a nurse (your primary *HomeMed* clinicians) will continue to monitor your progress on PN with your physician. This is done by drawing your blood, follow-up telephone calls, and having a member of the *HomeMed* staff see you at your clinic visits with your physician.

A Team Technician organizes the delivery of your supplies. A technician will contact you weekly for your supply needs. Contact your technician if, at any time, you need additional supplies or your supplies run low. Notify your technician to arrange to have your sharps container picked up once it is $\frac{3}{4}$ full.

Another member of the *HomeMed* staff, a Patient Accounts Representative (PAR), is available to you should you have questions or concerns regarding your insurance billing.

All these individuals are available during regular business hours. The telephone number for *HomeMed* is 1-800-862-2731. Should you have questions concerning your PN therapy outside of business hours, an answering service will page the *HomeMed* clinician on call for you. The telephone number is the same, 1-800-862-2731; a clinician is available 24 hours a day, 7 days a week, including holidays. The answering service will ask for your name, telephone number, and a brief message explaining what you need. A clinician will call back as soon as possible. If you do not receive a call back within 15 minutes, please call again.

VISITING NURSE AGENCY

Often, a visiting nurse will assist you with your PN therapy once at home. A nurse from Discharge Planning arranges this before you are discharged. This nurse will contact you and provide the name and telephone phone number of the Visiting Nurse Agency who will assist you once discharged from the hospital. This information should be recorded on the front page of this manual.

HOME NUTRITION SUPPORT & ADVOCACY GROUP

The Oley Foundation is a non-profit, independent, national group that has been serving patients on home tube feedings or PN for more than a decade. They provide up-to-date information, outreach services, conference activities and emotional support for patients, their families, caregivers and professionals. Oley programs include a bi-monthly newsletter, regional support groups and a support network for children on home nutrition therapy. All services and educational materials are free to patients and their caregivers. We encourage you to learn more about their services and to join this very important organization. To obtain more information:

The Oley Foundation
214 Hun Memorial, A-28
Albany Medical Center
Albany, NY 12208-3478

1-800-776-OLEY (Toll free in USA)
1-518-262-5079 (Outside the USA)
Fax: 1-518-262-5528
Web page: www.oley.org

STEPS TO MINIMIZE CONTAMINATION

The term "sterile" will be used frequently. A product is sterile after undergoing a special process that eliminates germs. Steps that you can take to minimize contamination are as follows:

1. Before starting any procedure, **ALWAYS** wash your hands thoroughly with an antibacterial soap such as Dial[®]. This will decrease the risk of infection.
2. Select a work area free of dust and drafts, and away from household traffic such as a spare bedroom. Keep this area free of dust, lint, and clutter. Pets should not be allowed in these areas. Adequate light should be provided. **Do not use bathrooms.** They are likely to have a large number of germs.
3. The PN work area should be used only for PN procedures. A stable tray, Formica[®] or similar products (e.g., metal, glass or Plexiglas) placed over a dresser or end table can be used. Clean your work surface with a household cleaner such as bleach, alcohol, or dish soap or you may place a clean paper towel on your work surface. Try not to touch the surface more than is needed after you have cleaned it.
4. Work at a comfortable pace. *The risk of contamination increases if you rush through the procedures.*
5. Store all your PN solutions and supplies away from other household items. Do not store urine test kits, ostomy supplies, or similar items with any PN solutions or supplies.
6. Keep all PN supplies, especially needles, syringes, and medications out of the reach of children and pets.
7. A refrigerator will be provided to store your PN solutions and additives that need refrigeration. Only these items should be stored in this refrigerator. Do not store any food in this refrigerator.
8. Make sure each item is sterile by checking for visible signs of contamination, such as an opened package or cloudy fluid. A good rule of thumb to follow is: **when in doubt - throw it out.** Call *HomeMed* if you have questions as to whether to throw the item away or return it to us.
9. When piercing, opening, or connecting sterile items, **allow only sterile surfaces to touch other sterile surfaces.** Never touch sterile surfaces with your hands or allow a sterile item to contact a non-sterile surface. Parts of supplies that must be kept sterile are protected with a cover.

10. If you are inserting a sterile needle through a non-sterile surface, always use an alcohol wipe to **vigorously** clean the surface first. Never retouch this area after cleaning it. Do not reuse alcohol wipes.
11. Contaminated or damaged supplies should **NEVER** be used (for example: protective coverings on medication vials or needle caps).
12. Some drug vials will be used more than once. More than one dose can be withdrawn from these containers (multidose vial). Other drugs must be thrown out after the correct dose has been withdrawn (single dose vial). We will let you know which drug containers you may use more than once. Whenever reusing a medication vial, always clean the top with an alcohol wipe. Most multidose vials will need to be refrigerated after using unless the label tells you to do otherwise.

HANDWASHING

Thorough handwashing is a very important step before any procedure. Washing will clean hands, but not sterilize them, so care must still be taken when handling your catheter or supplies. Use an antibacterial soap such as Dial®. Only you or your caregiver should use this soap.

Wound, ostomy, or fistula care **MUST** be done separately from PN procedures. Germs normally live in your intestinal tract and in ostomy or fistula fluids. If these germs or germs from improperly washed hands enter your bloodstream through the catheter or PN solution, they could cause a severe blood infection (septicemia).

Procedure Using Soap:

1. Turn on water and adjust to warm. Leave water running throughout the entire procedure.
2. Wet your hands and wrists under the running water.
3. Apply antibacterial soap and scrub **VIGOROUSLY** for 15 seconds. Work lather between fingers and under nails, over palms and back of hands.
4. Rinse hands and wrists under running water with your fingers pointing up towards the ceiling.
5. Dry hands with paper towel. Turn off the water using a paper towel.

If you wish, you may also use a waterless soap to wash your hands. Always check the label to be certain that the gel contains either ethyl alcohol (ethanol), normal propyl alcohol (n-propyl) or isopropyl alcohol in concentrations between 60 to 90%. You may not be able to use waterless soap if you have a rash or cuts on your hands. This is because waterless soap contains ethyl alcohol which may cause a stinging or burning feeling. If this occurs, use an antibacterial soap. Also, do not use a waterless soap if your hands become soiled with body fluids, wash with soap and water.

Procedure Using Waterless Soap:

1. Place a dime size amount of gel in one hand.
2. Rub into palms and backsides of hands and between fingers.

3. Rub gently for about 10 seconds and let air dry.

HEPARIN LOCK FLUSH

Heparin Lock flush (or heparinized saline) is injected into the catheter daily to prevent blood clots from forming when the catheter is not in use. If this procedure is not done shortly after stopping the PN infusion, blood may enter and clot off the catheter.

This heparin dose is small and should not affect your body's ability to clot. The heparin dose and concentration (units/mL) for flushing your catheter will be taught to you during your training. Your catheter should be flushed with heparinized saline when your infusion is finished, if blood has been drawn from the catheter, or if blood backs up into the catheter.

Each lumen of your catheter must be flushed every 24 hours, even when not infusing PN daily.

CATHETER CARE TIPS

Your catheter is made of a very soft, flexible material which can easily be damaged. It is important that you follow a few special guidelines to prolong its life.

1. Change the area where you clamp the extension tubing or catheter.
2. Whenever you are removing a catheter cap or putting on a new one, make sure you hold the end of the catheter with an alcohol wipe. Extreme care must be taken not to touch the opened hub with anything. Do not touch open hub with fingers or drop the catheter onto your skin.
3. When away from home, take a Heparin Lock flush syringe, blunt needles, and alcohol wipes in case of an emergency.
4. When you are not infusing your PN solution, keep the capped end of the catheter taped to your chest or arm in such a way that there is no tension on the catheter. This will prevent tugging and accidentally pulling out the catheter.
5. **DO NOT** use sharp objects such as pins or scissors near the catheter.

6. Always use a catheter clamp for clamping. Never clamp the catheter with something that has rough edges or teeth that could easily puncture the catheter.
7. Care should be taken to prevent kinking or pinching of the catheter.
8. If you have a peripherally inserted catheter (PICC), be careful not to tug on it during your daily activities or while changing the dressing.

CATHETER EMERGENCY SITUATIONS

Emergencies may occur with the catheter. These include:

- blood backing up in the catheter
- air in the catheter
- leaking catheter, filters, or tubing

YOUR FIRST REACTION MUST BE TO CLAMP THE CATHETER. This stops blood or air from traveling any further inside your catheter. Your next step should be to wash your hands. If blood has backed up in the catheter, flush the catheter with Heparin Lock flush and apply a new catheter cap.

In the case of air in the catheter or a leak in the catheter, again clamp the catheter to prevent air from traveling any further into your body. Then call your visiting nurse or a *HomeMed* clinician for further assistance.

PLACEMENT OF YOUR CATHETER

A peripherally inserted central catheter (PICC) is a soft, flexible catheter that has been inserted in your vein by either a doctor or a nurse. The catheters are approximately 27-30 inches long, but are cut to your body size. The end of your catheter is placed in a large vein with the tip near your heart (Figure 1). A chest x-ray is taken after it has been inserted to check the location of the catheter.

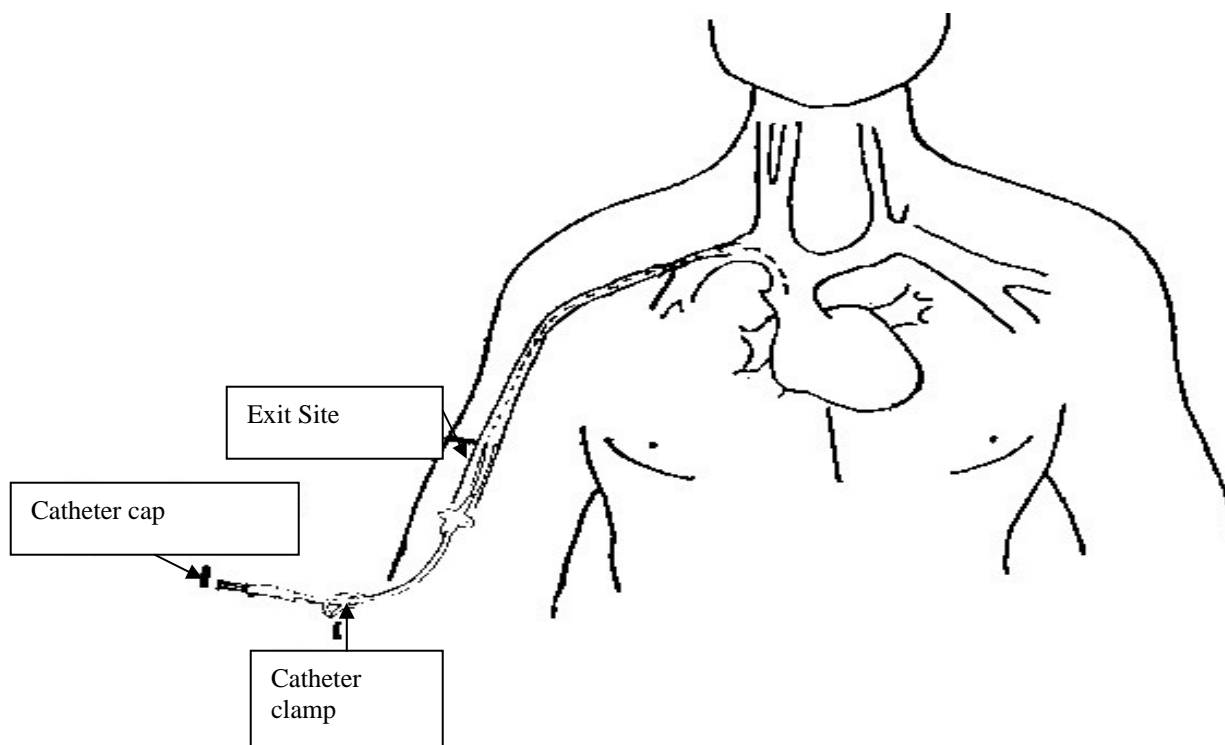


FIGURE 1 - PLACEMENT OF A PICC

The capped end of the catheter comes out of your arm and is called the exit site. The exit site must always be kept very clean and covered with a sterile (germ-free) dressing. Before you leave the hospital, the amount of PICC tubing on the skin should be measured from the exit site. If the catheter is accidentally pulled, the catheter may not be in its correct place. Measuring the catheter length will help us decide if the catheter should still be used for your parenteral nutrition. If the catheter is shorter or longer than when it was placed, call your physician or *HomeMed*.

Your PICC can be used for several weeks or months. If your catheter remains in place for a long time, you may see a small red bump at the exit site. This is normal. If you notice any drainage or tenderness at the exit site, call your physician or *HomeMed*.

DRESSING CHANGE PROCEDURE USING A TRANSPARENT DRESSING

Key Points:

1. Change the dressing once a week or more frequently if it becomes soiled, loose, or wet.
2. Avoid pulling, bending, or kinking the catheter unnecessarily to prevent the catheter from cracking and leaking.
3. Apply a plastic wrap or cut a plastic bag and tape it above and below the exit site when showering or bathing.
4. The dressing change kit will contain sterile gloves. You will not need to use sterile gloves to change your dressing. However, your visiting nurse may choose to do so. You may use a pair of gloves to remove the old dressing. Discard the supplies you do not need.

Supplies: Supplies:

(1) PICC Dressing Change Kit which contains the following:

- (1) pair of sterile gloves
- (1) ChloroPrep® packet (3 per package)
- (1) gauze sponge
- (1) skin prep pad
- (1) sterile drape
- (1) Transparent dressing

Paper towels

Procedure:

1. Wash your hands.
2. Gather supplies and place them in a corner of the work area.
3. Clean your work area.
4. Open the dressing kit. Remove sterile drape. Open drape and place on your work surface. Place contents of the kit on the sterile drape.



5. Remove the old transparent dressing. Do this by pulling the dressing one corner at a time toward the catheter exit site. After all the corners are loosened, hold the catheter down and pull the dressing up and off. **DO NOT TOUCH** the skin or catheter that was under the dressing.
6. Carefully inspect the exit site for any sign of infection (*swelling, redness, drainage, or tenderness*). If any of these signs are present, notify your physician or *HomeMed* after finishing the dressing change procedure.
7. Remove the ChloroPrep® swabstick from the package one at a time.
8. Gently press the swabstick against the catheter exit site. Carefully clean the area around the catheter by using a back and forth motion for 30 seconds. Completely clean an area 2 inches around the catheter exit site. Repeat with each swabstick. (Figure 1.)

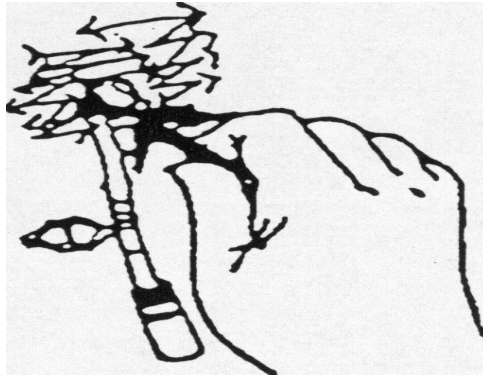


Figure 1. – Cleaning Around the Catheter

9. Allow the ChloroPrep® to **air dry** for approximately 30 seconds. Do not blot or wipe away. Do not fan or blow on area.
10. Discard the swabsticks after a single use.
11. Apply skin prep to the area around the catheter exit site, starting 1 inch away from the catheter and working outward. Let dry until smooth and shiny.
12. Peel the backing from the dressing.
13. Apply the dressing by placing the center of the transparent window over the catheter exit site, while holding the split side of the dressing off the skin. Then, overlap the softcloth tabs under the catheter this should form a tight seal around catheter disc.

14. Press dressing into place.
15. Slowly remove the frame on the dressing while smoothing down the dressing edges. Smooth from the center toward the edges, using firm pressure.
16. Take one steri-strip from the frame of the dressing. Criss-cross or “butterfly” it around the catheter and attach it over the dressing. (Figure 2.)
17. Place the other steri-strip over the butterfly to hold it in place.

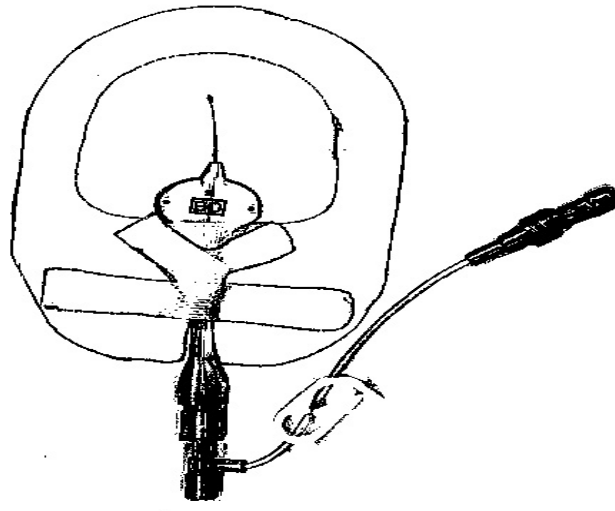


Figure 2. – Placement of Steri-strips

CHANGING THE CAPS ON YOUR CATHETER

Key Points:

1. Change the caps on the end of each lumen of your catheter once a week.
2. Rewash your hands if they become soiled or if you need to interrupt the procedure for any reason.
3. Before removing the caps from the lumens of your catheter, make sure the lumens are **CLAMPED** to prevent air from entering your bloodstream.

Supplies:

(2) alcohol wipes for each catheter lumen

Caps for each catheter lumen

Procedure:

1. Wash your hands.
2. Gather supplies and place them in a corner of the work area.
3. Clean work area.
4. Peel back the wrapper(s) on new cap(s) and open the alcohol wipes.
5. **CLAMP** the catheter or the catheter lumens you will be placing the new caps on.
6. Place one of the alcohol wipes around the catheter hub. While holding the catheter hub with one alcohol wipe, wipe the catheter-cap junction with the second alcohol wipe. Place this second alcohol wipe on the catheter cap. Remove the catheter cap by twisting counter-clockwise. Keep holding the catheter hub with the alcohol wipe—**DO NOT** drop the catheter hub. Place the old catheter cap and alcohol wipe on your work surface.
7. Pick the new cap out of the wrapper. Remove the clear protective tip off the end of the cap.
8. Place the new cap on the catheter.
9. Twist the new cap clock-wise to tighten.
10. If you have more than one lumen, change each of the caps using new alcohol wipes and cap.
11. After the caps are changed, loop the catheter onto the dressing and tape. The cap and catheter end should point upward.

Home parenteral nutrition solutions contain the appropriate amounts of protein, calories, fluids and other nutrients to meet your body's needs. These solutions are similar to the parenteral nutrition solutions you received in the hospital. The difference is that home solutions usually have all the ingredients in a single plastic container instead of giving the fat emulsion and additional IV fluids separately. The fat emulsion gives your PN bag a milky white appearance.

INFUSING PARENTERAL NUTRITION SOLUTIONS

Parenteral nutrition is usually infused at night with an infusion pump. This allows you to be free of the pump and tubing during the day and is commonly called “cycling.” We will show you how to program the pump to give you the amount of nutrition and fluids you will need at home over the amount of time ordered by your physician. Once started, the pump gradually increases the rate of your PN solution at the beginning of the cycle and decreases it at the end of the cycle. This will give your body time to adjust to the amount of glucose in your PN solution. Many features are built into the pump to protect you during the delivery of your PN solution. The display screen provides information to you. You may hear an occasional beep coming from the pump. This beep lets you know that an adjustment may be needed. You can read the display screen to see what is causing the alarm. Please refer to the pump programming section for reference on the alerts, alarms and troubleshooting the infusion pump, and your PN pump program. You will also be given a pump manual, which discusses the pump in more detail.

PREPARATION OF PARENTERAL NUTRITION (PN) SOLUTION

PRESCRIPTION AND PROTOCOL

A copy of your PN prescription will be delivered to your home in your box of PN supplies, along with the PN solution and a refrigerator to store it in.

The PN solution is prepared by the pharmacist at *HomeMed* and delivered to your home. It contains all of the prescribed nutrients that are stable for 9 days when refrigerated.

Remember to check the expiration date on the label of the PN solution before infusing it.

At home, you will add vitamins, heparin, and occasionally insulin and other medications to the PN solution. These additives are not stable for long periods of time and cannot be added by the *HomeMed Pharmacy*. The Home Compounding Protocol Sheet provides step-by-step directions for adding any additional medications to your PN solution. This will be reviewed in your teaching sessions.

If for any reason your prescription changes, your clinician at *HomeMed* will contact you. A new PN prescription and, if necessary, a new compounding protocol will be sent to you.







Throw away your old PN prescription as changes are made.

PN PRESCRIPTION AND COMPOUNDING SHEETS

Your current PN prescription and compounding sheets should be placed in this section. Whenever either is changed, the previous one should be thrown away and replaced with the current sheets.

INFUSION PUMP GUIDE

Listed below are some important keys on your infusion pump. You will need to become familiar with these keys in order to operate your pump.

Pump key	What it does
	Press the [START] key to begin your PN. As the pump delivers the PN, you will see the amount infused displayed on the screen.
	The [YES/ENTER] key allows you to enter the correct program to infuse your PN. The screen will tell you when to press this key.
	If you need to stop your pump, press the [STOP] key.
	To quiet an alarm, press the [SILENCE] key. The screen will tell you what the alarm means.
	Press the [HELP] key if you are unsure as to how to correct the alarm problem. Step-by-step instructions will guide you on how to correct the alarm condition.
	Press the [BACK-UP] key to exit the help screen or to return to the previous screen.

RESTARTING THE GEMSTAR® PUMP PROGRAM

INSERT TUBING INTO THE PUMP	
PRESS THE ON/OFF KEY TO TURN PUMP ON	
UNIT SELF TEST IN PROGRESS	
USING BATTERIES	<u>Press [YES/ENTER] key</u>
Screen display: 1 = RESUME PROGRAM 2 = CLR PROG & SHIFT 3 = CLR PROG,SHIFT & HISTORY	<u>Press [#1] key to RESUME PROGRAM</u>
PROGRAM REVIEW	<u>Press [▼] key to review</u>
WHEN REVIEW COMPLETE	<u>Press [YES/ENTER] key</u> * REMOVE AIR FROM TUBING BY PRESSING THE PURGE KEY BEFORE CONNECTING TO THE IV CATHETER *
	<u>Press [CHANGE] key</u>
	<u>Press [# 1] key for NEW CONTAINER</u>
	<u>Press [START] key</u>

[] If you are connected to your pump at all times and need to change your IV bag:

	<u>Press [STOP] key</u> * ON THE DAY YOU CHANGE YOUR TUBING, REMOVE AIR BY PRESSING THE PURGE KEY BEFORE CONNECTING THE IV TUBING TO THE IV CATHETER *
	<u>Press [CHANGE] key</u>
	<u>Press [#1] key for NEW CONTAINER</u>
	<u>Press [START] key</u>

ALERTS, ALARMS AND TROUBLESHOOTING

The GemStar® pump uses screen messages and audible beeps to let you know about conditions that need your attention. Below you will find some of the most common alerts and alarm messages displayed by the pump and tips on how to solve the problem.

Screen Display	Cause	Solution
LOW BATTERIES	Pump detects drop in battery power	<ol style="list-style-type: none"> 1. Press the [SILENCE] key 2. Press [STOP] key 3. Replace batteries
START	Pump is programmed but has remained in the stop mode for more than 3 minutes	<ol style="list-style-type: none"> 1. Press the [SILENCE] key 2. Press the [START] key or turn the pump off
CHECK CASSETTE	Cassette not installed, or installed improperly	<ol style="list-style-type: none"> 1. Press [SILENCE] key 2. Press [STOP] key 3. Reinstall the cassette 4. Press [START] key to begin infusion
DIST. OCCLUSION	A blockage has been detected in the IV tubing BELOW the pump (i.e. between the pump and the catheter)	<ol style="list-style-type: none"> 1. Press the [SILENCE] key 2. Press the [STOP] key 3. √ IV tubing for kinks or blockages BELOW the pump and correct 4. √ that all clamps are open 5. Press firmly down on the cassette 6. Press the [START] key

Screen Display	Cause	Solution
<div style="border: 1px solid black; padding: 10px; text-align: center;"> END OF INFUSION </div>	Pump has delivered container amount programmed	<ol style="list-style-type: none"> 1. Press the [SILENCE] key to mute alarm for 2 minutes 2. Press the [STOP] key 3. Flush catheter
<div style="border: 1px solid black; padding: 10px; text-align: center;"> AIR-IN-LINE </div>	Air has been detected in line	<ol style="list-style-type: none"> 1. Press [SILENCE] to mute alarm for 1 minute 2. Press [STOP] 3. Check line connections Disconnect IV tubing from patient and follow the prime procedure 4. Reconnect the pump set to the patient-access device 5. Press [START] to begin delivery

HOW TO REMOVE AIR FROM THE IV TUBING

If you need to remove air from the PN tubing:

1. Press the **[SILENCE]** key if the pump is alarming. Then press the **[STOP]** key.
2. Disconnect the IV tubing from the patient keeping the end of the locking blunt cannula sterile. If the tubing is dropped or touches any unsterile object, you will need to change the locking blunt cannula.
3. Press the **[PURGE]** key. Make sure to disconnect IV tubing from the patient.
4. Press and hold the **[PURGE]** key until the air is removed from the IV tubing. Once all the air is removed, release the **[PURGE]** key.
5. When the priming is complete (there is no air in the IV tubing), press the **[YES/ENTER]** key to return the pump to the stop mode.
6. Clean the catheter cap with an alcohol wipe and reinsert the locking blunt cannula.
7. Press the **[START]** key and follow the instructions on the screen.

EMERGENCIES

If you are infusing your PN solution and need to leave your home immediately, take your backpack with you. There may also be situations in which you will need to stop your PN during the middle of your cycle. If at any time you need to do this, call your *HomeMed* clinician who will be able to safely tell you how quickly you can taper your PN solution. To begin auto tapering, press the **[STOP]** key and follow the steps.

DO YOU WANT AUTO
TAPERING?
YES OR NO

Press the **[YES/ENTER]** key to start.

AUTO TAPERING DOWN
TIME
0:00 HRS: MIN
ENTER WHEN DONE

Use the numeric keys to enter the tapering down time as instructed by the *HomeMed* clinician or your physician. Press **[YES/ENTER]** key.

DO YOU WANT TO START
TAPERING?
YES OR NO

Press **[YES/ENTER]** to start your pump to begin tapering your solution down.

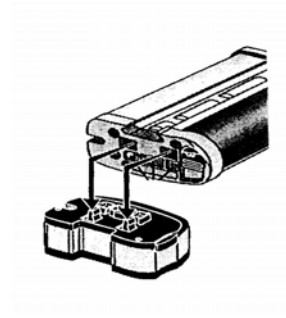
INFUSION PUMP CARE AND MAINTENANCE

1. **DO NOT** place the pump in any fluids or cleaning solutions.
2. **AVOID** dropping or hitting the pump. If the pump is dropped or hit, always recheck the program. If using disposable AA batteries check the battery compartment cover to ensure that it is flush with the bottom of the pump.
3. **NEVER** use sharp objects such as pens, pencils, fingernails, paper clips or needles to clean the pump.
4. *HomeMed* will check your pump every year. Please call if you believe it has been longer than a year without being serviced.
5. If the pump needs cleaning, use a soft cloth dampened with a mixture of household bleach and water (1 part bleach to 10 parts of water). Clean the sensor faces, tubing channel, plunger tip and sensor pins (located in the cassette pocket), with a cotton swab moistened with the bleach solution at least once a month. (Do not use alcohol wipes). Dry the pump after cleaning.
6. You may wash the backpack in regular detergent in your washing machine. After washing, dry under low heat in your dryer.
7. **NEVER** use the pump in the presence of flammable or explosive vapors.
8. **ALWAYS** avoid sources of high intensity electromagnetic radiation such as X-ray machines. While infusing medications with the GemStar® pump stand at least 10 feet away from cell phones or two-way radios that are being used.
9. **DO NOT** shower or tub bathe when infusing your PN with the pump.

INFUSION PUMP BATTERIES

1. You will receive one rechargeable battery pack with your delivery.
2. The battery pack light is yellow while the battery pack is charging. When the battery pack is fully charged, the battery pack light is green.
3. It will take a minimum of 8 hours to recharge the battery pack.
4. The battery pack and the AC charger may be used at the same time while attached to the pump. If you do this, you will need to recharge the battery, as it will lose some of its power.
5. The life of the battery depends upon the care. Under normal circumstances, the battery should last approximately one year. After one year of use, the battery pack should be replaced to be sure it is working properly.

6. If at any time your battery packs fail or you are unable to recharge your battery packs, use two “AA” alkaline disposable batteries.
7. When the pump is connected to the battery pack at power-on, the pump displays USING EXT BATT.
8. When the pump is connected to the battery pack, the pump’s green LED flashes and the battery pack light is off.
9. Disposable batteries should always be the pump, even when using rechargeable battery pack.
10. To use the rechargeable battery pack:
 - Line up connectors on the top of the battery pack with the holes on the bottom of the pump.
 - Snap the battery pack into place.



11. To release the battery pack:
 - Press the release button on the battery pack.
 - Pull the battery pack straight out from the pump.

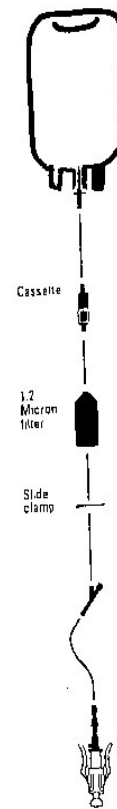
STARTING THE PN SOLUTION

Supplies:


- Mixed parenteral nutrition solution
- GemStar®IV tubing pump set with attached antisiphon valve
- Alcohol wipe
- Locking blunt cannula
- Infusion pump with battery pack

Procedure:

1. Connect the battery pack.
2. Wash your hands.
3. Gather supplies and place in a corner of the work area.
4. Clean your work area.
5. Remove the pump tubing from the package. Place on the clean work surface.
6. Open the alcohol wipes
7. Lay the PN bag flat on your work surface. Remove the white protective tab from the port on the PN bag.
8. Remove the cap from the spiked end of the IV tubing being careful not to touch the spiked end with your fingers.
9. Insert the spike into the bag by using a twisting motion while applying pressure against the winged portion of the IV tubing. Be careful not to touch the spike or puncture the bag.
10. Insert the IV tubing cassette into the pump. Press on cassette until you hear a click. Make sure all four cassette latches are clearly visible after the cassette is installed.
11. Turn the GemStar® pump on. Review the pump program with the instruction sheets given to you by your *HomeMed* clinician.

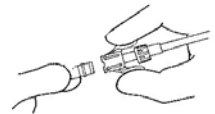


12. Prime the tubing on the GemStar® pump by pressing the **[PURGE]** key. The screen will display the following prompts:

SCREEN DISPLAY	WHAT TO DO
<div style="border: 1px solid black; padding: 10px; text-align: center;"> PRIME THE SET? YES OR NO </div>	Press the [YES/ENTER] key to begin priming.
<div style="border: 1px solid black; padding: 10px; text-align: center;"> TO PRIME, PRESS AND HOLD THE PURGE KEY </div>	Press and hold the [PURGE] key while holding The blue filter with the pointed end up. Make sure all air is removed from the container, cassette and tubing. <div style="text-align: right; margin-top: 10px;">  </div>
<div style="border: 1px solid black; padding: 10px; text-align: center;"> PRIME COMPLETE? YES OR NO </div>	When the [PURGE] key is released, you will see this display. If there is no air the tubing, press [YES/ENTER] . If you continue to see air in the tubing, press the [NO] key and continue to prime the tubing.

After you have finished priming the tubing:

13. Open the locking blunt cannula, being careful not to touch the end that does not have a protective cover. Twist this open end of the locking blunt cannula onto the end of the IV tubing.
14. Using an alcohol wipe, **vigorously** scrub the end of the catheter cap.
15. Remove the clear protective cover from the end of the locking blunt cannula.
16. Holding the catheter in one hand and the locking blunt cannula in the other, insert the locking blunt cannula into the catheter.
17. Open all catheter clamps.
18. Push the green **[START]** button on the GemStar® pump to begin the infusion. Make sure the pump is infusing by checking the screen. There should be arrows moving across the screen.



19. Once your pump has started infusing, place the IV bag and pump into the backpack/fanny pack.

DISCONTINUING THE PN SOLUTION

Supplies:

(1) Roll of 2-inch tape

Prefilled syringe of Heparin flush (one syringe for each lumen of catheter) check expiration date

Blunt needle (one for each syringe)

Alcohol wipes

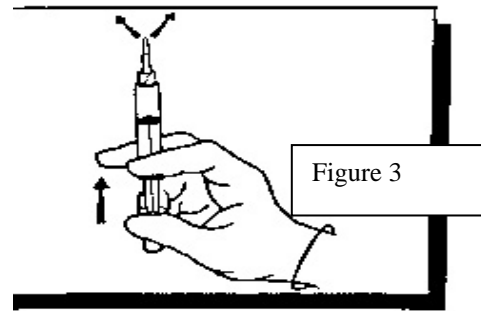
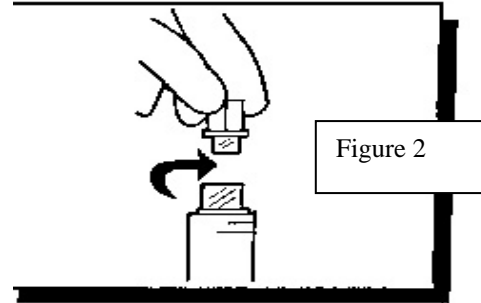
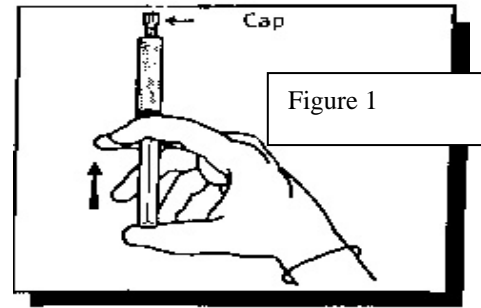
Procedure:

1. Wash your hands.
2. Gather supplies and place in a corner of your work area.
3. Clean your work area.

PREPARING YOUR HEPARIN FLUSH SYRINGE

4. Hold the prefilled heparin syringe upward (figure 1).
5. **Do not remove the cap.** Press on the plunger (figure 1). **DO NOT** pull back on the plunger.
6. Remove the protective cap from the end of the prefilled syringe (figure 2).
7. Attach a blunt needle to the syringe by:

Twisting the green cap off the blunt needle. Attach the needle to the syringe by turning the needle clockwise. Do not remove the gray cap that protects the blunt needle.
8. Hold the syringe with the needle pointing upward. If bubbles appear, gently tap the sides of the syringe. The bubbles will rise to the top of the syringe.
9. Push the plunger to the 5 mL mark to push all the air out of the syringe (figure 3).



10. Open the alcohol wipes. Remove the tape holding the catheter to your chest/arm.
11. Press the **[STOP]** button on the infusion pump.
12. Disconnect the locking blunt cannula from your catheter.
13. **Vigorously** scrub the end of the catheter cap with an alcohol pad.
14. Remove the gray protective cap from the blunt needle of your heparin flush.
15. Insert the needle into the cap of your catheter and inject heparin lock flush solution with a pumping action. When 0.5mL remains in the syringe gently push forward on the syringe plunger and clamp the catheter. Pull the needle/syringe out.
16. Repeat Steps 12-15 for each lumen of your catheter. **REMEMBER THAT ALL LUMENS OF YOUR CATHETER MUST BE FLUSHED DAILY!**
17. Loop the catheter and tape it next to the dressing.

18. Turn the power off on the infusion pump.
19. Remove the tubing from the pump and discard in the trash.

INFUSING EXTRA IV FLUIDS

Occasionally your physician may wish to infuse more fluid than your PN solution. The most common fluids are:

- dextrose 10% water (D₁₀W)
- dextrose 5% water and 0.45% normal saline (D₅W/0.45% Sodium Chloride)
- dextrose 5% water and 0.45% normal saline with 20 mEq KCl (potassium)
- lactated ringers (LR)
- normal saline (0.9% Sodium Chloride)

You will receive a small supply of one or two of these fluids once you are discharged from the hospital. You should infuse these only as directed by your physician or *HomeMed* clinician.

Key Points:

1. Check the bag for leaks, and floating materials. Check the expiration date and contents of the fluid.
2. If the bag has expired or if you find any leaks or floating materials, set aside that IV bag and use another one. Notify *HomeMed* if this should occur.
3. IV solutions do not usually need to be refrigerated. *HomeMed* will instruct you on whether or not your IV solutions need to be kept in the refrigerator.
4. IV tubing used for IV fluids may be used for 3 days (72 hours) as long as you put a new locking blunt cannula on the end of the tubing after using it. This will keep the tubing sterile.

Supplies:

IV Solution

- (1) Primary IV set
- (1) DIAL -A -FLO[®] extension set
- (2) Locking blunt cannulas
- (1) alcohol wipe

Procedure:

1. Wash your hands.
2. Gather supplies and place in a corner of your work area.
3. Clean your work area.
4. Attach the Primary IV tubing to the DIAL-A-FLO[®] tubing by:
 - Removing the clear flat cap off the end of the Primary IV tubing set.
 - Removing the clear cap on the short tubing end of the DIAL-A-FLO[®]. **Keep both tips sterile.**
 - Attaching the DIAL-A-FLO[®] tubing to the Primary IV set by twisting clockwise.
5. Turn the DIAL-A-FLO[®] to the “off” position.
6. Remove the white tab on the IV bag to expose the spike port.
7. Remove the spike cover on the end of the IV tubing. **Do not touch the spike.**
8. Insert the spike of the IV tubing into the spike port of the IV bag using a pushing-twisting motion.
9. Hang the IV bag with the attached tubing on the IV pole.
10. Squeeze and release the drip chamber of the IV tubing until it is half full of fluid.
11. Turn the DIAL-A-FLO[®] to the “open” position to fill the IV tubing with fluid. When the fluid is at the end of the IV tubing, turn DIAL-A-FLO[®] to the “off” position.
12. Remove the clear cap from the end of the IV tubing.
13. Remove the locking blunt cannula from the package. Touch only the “wings”. Connect the locking blunt cannula to the IV tubing.
14. Hang the IV tubing over the IV pole. **Do not let the tubing fall on the floor.**
15. Unclamp your catheter.
16. **Vigorously** scrub the end of the cap on your catheter with an alcohol wipe.
17. Remove the clear protective cap from the locking blunt cannula attached to the IV tubing.
18. Insert the locking blunt cannula into the cap on your catheter.

19. Set the DIAL-A-FLO[®] to the desired IV rate as directed by your physician or *HomeMed* clinician.
20. When your infusion is done, close the roller clamp on the IV tubing then **wash your hands**.
21. Disconnect the IV tubing from the cap on your catheter. With one hand, hold your catheter. With your other hand squeeze the “wings” of the locking blunt cannula together and gently pull.
22. Attach a new locking blunt cannula to the end of the IV tubing if you need to save it for your next infusion.
23. **Vigorously** scrub the end of the cap on your catheter with an alcohol wipe.
24. Inject the Heparin Lock flush:
 - Remove the cap from the heparin flush syringe needle.
 - Insert the needle into the cap of your catheter and inject heparin flush solution with a pumping action.
 - When 0.5ml remains in the syringe gently push forward on the syringe plunger and clamp the catheter. Pull the needle/syringe out.
26. The cap on your catheter does not need to be covered. You will clean the cap before you give your next PN solution or flush the catheter.
27. Place the syringe(s) and needle(s) into the sharps container.

PLANNING YOUR DAY

Listed below is a quick list of the procedures you will need to do in the morning and at night. For step-by-step instructions for each procedure, go back to the specific section of this manual.

Stopping PN

1. Wash hands.
2. Clean work area.
3. Prepare the Heparin Lock flush. (pg. 28)
4. Press the **[STOP]** key on the infusion pump.
5. Flush the IV catheter. (pg. 29)
6. Turn off pump. Remove tubing from the pump. Throw the IV tubing and PN bag away.
7. Take out a new PN bag from the refrigerator. Check it for cracks, leaks, particles and separation of fluid.
8. Plug in battery pack to recharge.
(It takes 8 hours to recharge battery pack)

Starting PN

1. Obtain daily weight and temperature and record on Daily Monitoring Form. (pg.36)
2. Place battery pack on pump. (pg. 25)
3. Gather supplies.
4. Wash hands.
5. Clean work area.
6. Mix additives in PN bag.
7. Wash hands.
8. Spike PN bag with IV tubing. (pg. 26)
9. Place IV tubing into the infusion pump.

10. Turn on pump. You will see the screens as printed below:

- Self test
- Using batteries- press **[YES/ENTER]** key
- Screen display:
 - ①=RESUME PROGRAM
 - 2=CLR PROG & SHIFT
 - 3 =CLR PROG, SHIFT &

HISTORY

press the **[#1]** key-RESUME

PROGRAM

- Review program press the **[DOWN]** arrow.
 - Press the **[YES/ENTER]** key if correct.
 - Press the **[CHANGE]** key.
 - Press the **[#1]** key-NEW CONTAINER
 - Press **[PURGE]** key to prime air from IV tubing.
12. Attach the locking blunt cannula to the end of the IV tubing
 13. Connect IV tubing to catheter.
 14. Open catheter clamp and press the **[START]** key to place pump in run mode.
 15. Check urine fractional 3-4 hours into cycle. If greater than **500** call *HomeMed* at 1-800-862-2731.

INTAKE AND OUTPUT MEASUREMENT

You may be asked to measure intake and output on a daily basis. This will help your *HomeMed* clinicians and physician estimate the fluid balance within your body. "Intake" includes all fluids taken into the body, both intravenous and oral fluids. "Output" includes urine, diarrhea, vomit, and any other drainage, such as from a wound, ostomy, or fistula that is measurable ("Intake" should be greater than "Output").

Procedure:

1. Measure all fluids, both IV and orally, each day. Use the following table to help you convert from ounces (oz) to millimeters (mL).

Fluid Equivalents

1 ounce (oz)	30 mL
Coffee cup (8 oz).....	240 mL
Can of soda (12 oz)	360 mL
Popsicle (whole)... ..	100 mL
Water glass (8 oz)	240 mL
Small juice (4 oz).....	120mL

2. Measure all fluid output, such as urine, diarrhea, vomit, ostomy and fistula drainage. A measuring device will be provided prior to discharge to help you measure output.
3. Record the intake and output on the form provided in this section. *Bring this record with you when you come for a clinic visit.* Refer to the section "Notify Your Physician" for concerns about fluid balances.

DAILY WEIGHTS

Daily weights will help *HomeMed* clinicians and your physician determine if you are receiving too much or too little fluid. Weigh yourself at the same time each day wearing similar clothing. Infants should be weighed without clothes, on an infant scale. If you do not have an infant scale, be sure your baby is weighed at every clinic visit or by the visiting nurse. Record your weight daily on the form provided in this section. *Please bring this information each time you come into the clinic.*

GROWTH CHARTS

If your child is on HPN it is important to plot his or her weight, length and head circumference (if less than 1 year of age) on a growth curve. These measurements are usually done at your clinic appointment. This will assist your physician and *HomeMed* clinician to provide the nutrients needed for you child to grow appropriately.

URINE FRACTIONALS

You may need to test your urine for sugar. If there is more sugar in the bloodstream than your body can handle, your body will get rid of the extra sugar in the urine.

Key Points:

1. Urine fractionals should be checked approximately 3 to 4 hours after you have started your PN infusion. You may also be asked to check your urine if you are experiencing signs or symptoms of high blood sugar (see Appendix B).
2. If your urine fractional is 500 or greater, **notify *HomeMed* or your physician**.
3. Keep a record of your urine fractionals (FX) and the approximate time the urine was checked on your monitoring form.

PROCEDURE FOR ADULTS

Supplies:

- (1) Urine test strip
- Urine specimen
- Clean container such as a paper cup

1. Collect urine sample in clean container.
2. Wash your hands.
3. Remove one test strip from the container. Close the cover tightly.
4. Dip test strip into the urine specimen and then remove immediately.

5. Draw the edge of the strip along the rim of the specimen container to remove excess urine.
6. Wait AT LEAST two minutes, and then compare the color on the test strip while holding it next to the color chart on the container.
7. If the result is 500 or greater, **CALL *HomeMed* OR YOUR PHYSICIAN.**
6. Record the results on your monitoring form.

PROCEDURE FOR INFANTS AND CHILDREN WITH DIAPERS

Supplies:

(1) Urine test strip

Urine specimen

Gloves

(2) Cotton balls

5 mL syringe

1. Place 2 dry cotton balls into a dry diaper to obtain the urine.
2. Wash your hands.
3. Remove one (1) test strip from the container. Close the container cover tightly.
4. Put on a "clean" pair of gloves.
5. Remove the plunger from the 5 mL syringe.
6. Remove the cotton balls from the wet diaper and place them in the syringe.
7. Replace the plunger, remove the syringe cap and squeeze a small amount of urine onto the test strip by pressing down on the plunger.
8. Wait AT LEAST two minutes, and then compare the color on the test strip while holding it next to the color chart on the container.
9. Record the results on your monitoring form. If the result is 500 or greater, **CALL *HomeMed* OR YOUR PHYSICIAN.**

POTENTIALS COMPLICATION OF PN THERAPY

Complications can occur with PN therapy. By following the instructions in this manual, these complications may be prevented. The complications of PN are classified as mechanical, infectious, and metabolic. Refer to Appendix B for a list of signs and symptoms of electrolyte and nutrient deficiencies.

MECHANICAL COMPLICATIONS

CLOTTING: occurs when fluids stop flowing through the catheter causing blood to flow back into the catheter.

Signs of clotting	Possible causes	Prevention	What to do
<p>Unable to flush your catheter or infusion pump alarms “occlusion”.</p> <p>Catheter is sluggish when you flush it.</p>	<p>Kinks in the tubing or catheter or a closed clamp.</p> <p>Not following directions for catheter care.</p> <p>Clogged filter.</p>	<p>Avoid kinks in catheter when taping to your arm or chest.</p> <p>Always flush your catheter whenever PN solution is completed, interrupted, after blood drawing, or if blood backs up into the tubing. Follow the directions shown to you during training. When stopping the infusion, always clamp the catheter while the pump is still infusing.</p> <p>Always change PN tubing daily.</p>	<p>Retape catheter. Open clamps.</p> <p>Notify your <i>HomeMed</i> clinician or physician if your catheter becomes difficult to flush.</p> <p>DO NOT use force when flushing your catheter.</p> <p>Change tubing.</p>

CATHETER DISPLACEMENT: the tip of the catheter may have moved from the vein in your chest into a smaller vein in your neck.

Signs of catheter displacement	Possible causes	Prevention	What to do
Pain in the neck or shoulder when infusing PN. Swelling or puffiness at catheter site when infusing PN.	Catheter is very flexible.	None. A chest x-ray may be needed to check the catheter location.	Stop the PN infusion, flush the catheter and call your physician immediately.

CATHETER BREAKAGE: the catheter leaks or breaks

Signs of catheter breakage	Possible causes	Prevention	What to do
Leaking of PN fluid or blood.	<p>Cut or tear in the catheter by scissors, pins, or other sharp objects.</p> <p>Using a clamp on the catheter with teeth or rough edges.</p> <p>Clamping the catheter in the same spot repeatedly.</p>	<p>NEVER use sharp objects near the catheter.</p> <p>Always use a catheter clamp for clamping.</p> <p>Rotate the sites where you clamp your catheter.</p>	<p>Clamp the catheter as close to your body as possible.</p> <p>Call your physician or <i>HomeMed</i> clinician. Your catheter will most likely need to be replaced.</p>

THROMBOSIS: blood clot formation

Signs of thrombosis	Possible causes	Prevention	What to do
Arm (on the same side as your catheter) becomes swollen and cool to touch. May also cause swollen neck, chest or arm veins.	Catheter may cause blood flow obstruction.	None	Stop the PN infusion, flush the catheter and call your physician immediately.

AIR EMBOLISM: a large amount of air enters the blood system

Symptoms of air embolism	Possible Causes	Prevention	What to do
<p>Shortness of breath, coughing</p> <p>Chest pain</p> <p>Loss of consciousness</p> <p>INFANTS may have:</p> <ul style="list-style-type: none"> • a higher than usual breathing rate • a bluish coloring to lips or skin • loss of consciousness • nasal flaring 	<p>The catheter is not clamped when the cap is removed.</p> <p>The IV tubing becomes separated at a connection or the cap falls off the end of the catheter.</p> <p>The IV tubing or filter is not filled correctly.</p>	<p><u>ALWAYS</u> clamp the catheter whenever the catheter is opened to air.</p> <p>Tighten all tubing, connections and caps.</p> <p>Fill the IV tubing carefully so air is not left in the tubing or filter.</p>	<p>If large amounts of air are seen in the tubing, clamp the catheter, stop the infusion, clear the tubing of air and restart the infusion.</p> <p>FOR SYMPTOMS OF AN AIR EMBOLISM: Clamp the catheter and call for an ambulance.</p> <p>Take small breaths only.</p> <p>Lie on your left side with feet and legs elevated and your chest and head down.</p> <p>If you are able, attach a syringe to your catheter and withdraw the air from the catheter until you get a blood return. Then flush with Heparin Lock flush.</p>

INFECTIOUS COMPLICATIONS: symptoms of infections may occur either at the catheter exit site (local) or within the bloodstream (systemic).

LOCAL: infection at the exit site.

Symptoms of local infection	Possible causes	Prevention	What to do
<p>At catheter exit site:</p> <ul style="list-style-type: none"> • Redness • Swelling • Tenderness • Drainage 	<p>Touching the exit site with your hands.</p> <p>Rushing through the dressing procedure.</p> <p>Not washing hands before dressing changes.</p> <p>Sutures left at the exit site.</p>	<p>Avoid touching exit site with hands.</p> <p>Take your time. Follow procedures as shown to you in your training session.</p> <p>Wash hands with antibacterial soap before starting or stopping PN, changing dressing or whenever interrupted during procedure.</p> <p>Possibly remove suture in clinic or by your visiting nurse.</p>	<p>Call your physician.</p> <p>You may need to change dressing every day until infection has cleared, then you may return to your previous dressing change schedule.</p>

INFECTION - SYSTEMIC: an infection within the bloodstream. Systemic symptoms may be caused by another source of infection such as a “flu” virus, bladder infection or pneumonia.

Symptoms of systemic infection	Possible causes	Prevention	What to do
Fever Chills Sweating Weakness	Sloppy technique. Not following procedures. Not washing hands with antibacterial soap before sterile procedures. Using contaminated supplies or PN solution.	Take your time. Do not rush through procedures. Follow procedures as shown to you in your training session. Wash hands with antibacterial soap before changing dressing. If you think you contaminated any supplies or solutions, throw them out.	Take your temperature. If your temperature is greater than 101.5° (F) orally or 102° (F) rectally, call your physician or <i>HomeMed</i> immediately. If you are infusing your PN and begin to experience a temperature or shaking chills, save your bag and tubing. It may be needed to check for contamination.

METABOLIC COMPLICATIONS: blood tests will be done periodically and any changes in the PN will be based on these lab reports.

HYPERGLYCEMIA: a higher than normal level of sugar in the blood.

Symptoms of hyperglycemia	Possible causes	Prevention	What to do
<ul style="list-style-type: none"> • weakness • feeling tired and thirsty • dry mouth • headache • increase in urine output 	PN has infused too fast. Body is unable to process the amount of sugar in you PN solution. Infection	Always use an infusion pump and taper your PN solution. <u>DO NOT PRESS THE PURGE KEY</u> when your tubing is connected to your catheter. Follow procedures as shown to you during	Check your urine fractional. Call your physician or <i>HomeMed</i> if your urine fractional is greater than 500. Take your temperature. Call your <i>HomeMed</i> clinician or physician if greater than 101.5°(F)

		training.	
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HYPOGLYCEMIA: a lower than normal level of sugar in the blood.

Symptoms of hypoglycemia	Possible causes	Prevention	What to do
<ul style="list-style-type: none"> • nervous • irritable • headache • dizziness &/or cold sweats Infants may be: <ul style="list-style-type: none"> • lethargic • clammy to touch pale 	PN is suddenly stopped.	Do not stop your PN infusion in the middle of a cycle unless directed by your physician. ALWAYS taper your PN solution.	Drink something with sugar in it such as orange juice or suck on a hard candy Call your physician or <i>HomeMed</i> if these symptoms continue.

FLUID IMBALANCE: fluid balance will be affected by your nutritional and health status.

Symptoms of fluid imbalance	Possible causes	Prevention	What to do
Weight loss or gain of 3 pounds or more for 2 days in a row. New or increased swelling in your feet, ankles, or fingers. Infants: sunken or puffiness around the eyes, fullness of the “soft spot” on the head, a depressed “soft spot”, or difficult, rapid, labored breathing.	The amount of PN solution may be too little or too much. Increased fluid loss or decreased urine output (for infants: decreased diaper changes).	Weigh yourself every day at the same time. Keep track of your intake and output, and weight daily. Record on Daily Monitoring Form.	Call your physician or <i>HomeMed</i> clinician.

NOTIFY YOUR PHYSICIAN OR *HOMEMED* CLINICIAN

IMMEDIATELY:

1. If you are unable to infuse any or part of the PN solution.
2. If you meet firm resistance in the catheter when flushing your catheter.
3. If you have a hole or break in your catheter.
4. If you have pain in the neck or shoulder when infusing the PN solution.
5. If your urine fractionals are 500 or greater.
6. If you experience symptoms of hypoglycemia or hyperglycemia.
7. If you experience symptoms of systemic (body-wide) infection such as fever, chills, sweats or weakness.
8. If your arm (on the same side of your catheter) becomes swollen, cool or painful.
9. *Call for an ambulance* if you experience symptoms of air embolism: shortness of breath, coughing, and chest pain.
10. In children, if there is no urine output for more than eight to twelve hours.
11. For infants, if weight loss or gain is greater than 50 grams a day, or if they have puffy eyes, full or “depressed” soft spot, decrease in diaper changes, lethargy, or difficult, rapid or labored breathing.

CALL IN THE MORNING:

1. If your urine output is less than 800 mL per day for two days in a row.
2. If there is new or increased swelling in your feet, ankles or fingers.
3. If you have vomiting, diarrhea or a sudden increase in fistula drainage.
4. If you have a weight loss or gain of three pounds or more for two days in a row.
5. If you see redness, swelling, tenderness and/or drainage at the catheter exit site.
6. If your catheter is sluggish when flushing but you are still able to flush it.

The following hints may help you to adjust to PN more easily:

SUPPLIES

1. Organize your supplies in a cupboard, closet shelf, or drawer.
2. Identify a special corner or room for preparing your PN solution. The area should be clean, dry and less traveled than other areas of your home. Pets should be kept away from this area.
3. Order your supplies as scheduled.
4. Count your supplies when each delivery arrives. Notify *HomeMed* if you have any problems with equipment, supplies, medications or delivery.

PN SOLUTION

1. Allow your PN solution to warm to room temperature. Take it out of the refrigerator at least 8 hours before using. If you forget, you may wrap the PN bag in a warm clean towel or place it inside a plastic zip lock bag and place in warm water. Do not microwave PN solution.
2. Try to infuse your PN solutions at the same time every day.
3. PN solutions must be used within 24 hours after taking the solution out of the refrigerator.
4. Mix your solutions just before you are ready to start your infusion. If vitamins or heparin are added too far in advance, they will breakdown and you will not get what your body needs.
5. It is very important to keep your PN refrigerator clean at all times to prevent infections. *Only PN and medications should be placed in this refrigerator!*
6. Do not “skip” a day of PN unless directed to do so by your physician or *HomeMed*. This may result in dehydration.

EMERGENCIES

1. Keep supplies necessary to flush your line with you at all times.
2. You may wish to purchase a medical alert bracelet at your local pharmacy stating your medical condition and the presence of your permanent catheter.
3. Keep your PN manual, infusion pump manual and telephone numbers in a place where you can find them easily if problems arise.

4. If you are infusing your PN solution and need to leave your home immediately, do not stop the infusion. Put the PN solution in the backpack and take it with you.
5. If you need to temporarily relocate from your home, please contact our office with your temporary address and phone number.
6. If you lose power to your refrigerator, remove your PN solution and additives and store them in a portable cooler with ice. This will keep your PN and medications stored safely for at least 24 hours. Call your *HomeMed* clinician for further instructions.

TRAVEL

1. Notify *HomeMed* of your plans as far ahead of time as possible so that your supplies can be shipped directly to your destination.
2. If you are going on a short trip (2 to 3 days), store your PN solution in a portable cooler with ice packs. Replace the ice packs daily or more frequently if necessary.

MEDICAL TREATMENT

1. Notify your *HomeMed* clinicians or your physician in advance of any dental work or minor surgery to be done. You may need to take antibiotics.
2. Notify your *HomeMed* clinicians or your physician if you are admitted to a hospital or if you are started on any medications.

ACTIVITIES

1. If you have a Hickman/Broviac catheter, swim only in chlorinated pools - avoid lakes and ponds. You may shower and bathe. The catheter dressing should be changed if it gets wet.
2. If you have a PICC, swimming is not allowed. Before bathing or showering, cover the area around the PICC with plastic wrap. Tape above and below the dressed area.
3. Infants receiving parenteral nutrition can be held and cuddled. The catheter should always be looped securely to the chest because the baby may pull the catheter while crawling. Keep the end of the catheter away from diaper area.

GENERAL

1. Organize your day. Located in “Planning Your Day” is a list of activities you will need to do in the morning and in the evening.
2. Call your physician or *HomeMed* if your instructions are not perfectly clear.
3. Brush and floss your teeth and use mouthwash two to three times a day.
4. If you have a cold or are sick, wear a mask when starting, stopping or mixing your PN solution or when changing your catheter dressing.
5. If you are unsure if something is sterile, consider it contaminated and use a new one.
6. Wash your hands with an antibacterial soap before any procedure.
7. Follow the instructions as shown to you during your training period. Do not rush through the procedures.
8. Always use a clean work surface.
9. If you notice that the filter is leaking or cracked, change the IV tubing.
10. Remember to change your PICC catheter dressing every 7 days or sooner if it becomes soiled, wet or loose. Tunneled catheters should be changed every 3 to 7 days, depending on the type of dressing. Follow the instructions given to you by the clinician.
11. Never open the catheter to air without clamping it first.
12. Do not stop your PN solution suddenly. Always “taper” if at all possible.
13. If your battery packs do not work, use the disposable batteries sent to you by *HomeMed*. Call *HomeMed* in the morning to replace the battery pack.
14. Follow HomeMed protocol for starting and stopping your PN solution, and for IV catheter care. Please call HomeMed for question, or before making any changes from the instruction given to you at the time of your training.
15. Please call 1-800-862-2731 if you have any questions.

APPENDIX A

FREQUENTLY ASKED QUESTIONS

1. How will I get the supplies I need to administer my PN at home? *HomeMed*, the University of Michigan Health System's Home Infusion Provider, will supply them. All the supplies you will need to administer PN, for about one week, will come to your home the same day or evening of discharge from the hospital. A Team Technician from *HomeMed* will contact you the day of discharge to see what time you will be at home so a delivery time can be organized. The Team Technician will also discuss with you a schedule for delivering further supplies to your home, usually once a week.
2. What types of things will they provide? Your PN solution, a refrigerator (specifically for PN), tubing, extension tubing, locking blunt cannulas, pump, battery pack, backpack, syringes, needles, heparin flush, medication to be added to the PN solution, alcohol wipes, dressing change kits, tape, sharps container, IV pole, extra IV fluid, hydrogen peroxide, masks etc.
3. How will I learn how to administer PN with all the supplies above? The *HomeMed* Training Team will instruct you in the hospital. Equipment will be brought to your room to practice with and you will be given written material to read also. Once you are at home, a visiting nurse will reinforce what you have learned in the hospital.
4. When will the Visiting Nurse come to my home? A Visiting Nurse Agency (VNA) will be contacted before your discharge. This nurse is the best person to ask when they will come to your home. Generally, it's around 7pm or 8pm the evening of discharge. This is because most people are "cycled" on their PN and are due to be hooked up at this time of the evening.
5. What is "Cycling"? In the hospital, PN is hooked up to your catheter 24 hours a day. At home, many patients are on PN only 12 hours per day, and generally infuse at night while sleeping. Prior to discharge, *HomeMed* works with your physician towards cycling your PN down to 12 hours. Each patient is different, due to their age and medical status, in terms of how quickly the PN cycle can be lowered. If you are not on a 12 hour cycle at discharge, you may be able to continue to be "cycled down" once at home with the help of your *HomeMed* clinician.
6. Who are my *HomeMed* clinicians? The team of clinicians who will care for you are listed in the front of this manual. They will be in contact with you frequently once you are home on PN. They will monitor your labs and PN progress with your physician.

7. Who do I contact if I'm missing supplies? During your first visit with your VNA, it's a good idea to go through your supplies with your nurse to verify that you have all the items necessary to start your PN therapy. The Team Technician at *HomeMed* is the individual to contact if something is missing. Their name and extension numbers are listed in the front of your PN manual. Please wait until morning to contact them if it's not urgent. If it's necessary to have the item that night, contact the 24-hour on call number: 1-800-862-2731.
8. How often is IV tubing changed? Every day due to the high sugar content in the PN.
9. There is some other clear IV fluid in my box. What are these used for? Some patients may need additional hydration while on PN at home. This may be due to increased vomiting, diarrhea, ostomy output, etc. Your *HomeMed* clinician will inform you what IV fluids to use if additional hydration becomes necessary. Generally, these hydration fluids do not need to be refrigerated unless the label directs you to do so.
10. I see a different type of tubing in my box with a dial on it. What is this used for? This is used if it is necessary to infuse extra hydration fluids. If required, your *HomeMed* clinician will discuss this with you. This type of tubing can be used for three days, since the sugar content is lower in hydration fluids.
11. Who do I call when my sharps container is full? Contact your Team Technician at *HomeMed* to pick the full one up and to bring you an empty one to use.
12. I have the urine test sticks in my box to check my sugar. Why is this so important to do 3 to 4 hours into my cycle? Your PN solution contains a large amount of sugar (glucose) delivered in your PN in a short period of time, due to being cycled. The time during the infusion when you will be receiving the greatest amount of sugar is between the taper up and taper down periods. This is when you need to check your urine. If your body is having difficulty handling this amount of sugar, the kidneys will try to remove as much of the excess sugar as possible and pass it into your urine. If your urine fractionals are high, changes will need to be made in your PN solution because you can easily become dehydrated (see complications for symptoms). Your *HomeMed* clinician will be asking you what your urine fractionals have been when they contact you. This is a key part of PN monitoring.
13. They check blood glucose levels in the hospital. Do I need to check these at home too? Generally, in most patients, urine fractionals are all that is needed. Certain patients, such as diabetics, are requested to monitor blood glucose levels. If blood glucose checks are needed, the *HomeMed* Training Team will inform you of this in your training period.

14. If I do feel hypoglycemic, hyperglycemic, dehydrated etc., who do I contact? You can contact your *HomeMed* clinician or your physician.

15. I'm feeling great on PN. I'm gaining weight and have lots of energy. Can I just skip a day of PN? **NO!** When you are ready to “come off” PN, this is done slowly and only under the supervision of your physician and *HomeMed* clinicians.

16. I'm feeling so good; I'd like to travel a little bit. Is this possible while on PN? Yes, you can travel, if approved by your physician. Contact your *HomeMed* clinician and Team Technician to assist you with organizing this.

APPENDIX B

SIGNS AND SYMPTOMS OF ELECTROLYTE AND NUTRIENT IMBALANCES

MAJOR ELECTROLYTES

SODIUM

Important for fluid balance and many vital functions.

Hypernatremia (High Sodium)

- Thirsty
- Rough, dry tongue
- Decreased urine output
- Decreased weight

Hyponatremia (Low Sodium)

- Weakness
- Apathy
- Weight gain, swelling in the hands and feet
- Headaches, shortness of breath

POTASSIUM

Involved in many important actions including heart function.

Hyperkalemia (High Potassium)

- Weakness
- Generally tired
- Muscle cramping or twitching

Hypokalemia (Low Potassium)

- Decreased reflexes
- Muscle cramping or twitching
- Muscle weakness
- Rapid, weak pulse

CALCIUM

Necessary for bone growth, blood clotting muscle, nerve, and heart function.

Hypercalcemia (High Calcium)

- Drowsiness, tiredness
- Loss of appetite
- Nausea, vomiting
- Muscle weakness
- Deep bone pain

Hypocalcemia (Low Calcium)

- Twitching
- Seizures
- Tingling around the mouth
- Spasms of the feet or hands
- Numbness, tingling of hands or feet
- Abdominal cramping
- Nausea, vomiting, diarrhea

MAGNESIUM

Mineral found in soft tissue, muscle and bones.

Hypermagnesemia (High Magnesium)

- Drowsiness
- Tiredness
- Flushing
- Muscle weakness

Hypomagnesemia (Low Magnesium)

- Not able to sleep
- Leg, foot cramps
- Muscle weakness, twitching, tremors

PHOSPHORUS

An element needed for normal metabolism of carbohydrates, protein and fat. Needed for normal muscle contraction and heart function.

Hyperphosphatemia (High Phosphorus)

- Numbness, tingling of extremities
- Muscle cramps
- Nausea, vomiting, diarrhea
- Dry skin
- Brittle nails
- Tingling around the mouth

Hypophosphatemia (Low Phosphorus)

- Tiredness
- Muscle weakness
- Loss of appetite
- Mild bone pain

GLUCOSE

BLOOD GLUCOSE

Sugar found in the blood.

Hyperglycemia (High Blood Sugar)

- Weakness
- Tired
- Thirst
- Headache
- Dry mouth
- Increased urine output
- Irritability, confusion

Hypoglycemia (Low Blood Sugar)

- Nervousness
- Headache
- Cold sweats
- Dizziness
- Irritability, confusion

FLUID
FLUID IMBALANCES

Fluid Overload (Water Excess)

- Confusion, poor coordination
- Nausea
- Muscle cramps, weakness
- Headache
- Weight gain
- Moist skin
- Swelling in legs
- Intake greater than output
- Shortness of breath
- Light, large amounts of urine output

Dehydration (Water loss)

- Dizziness, weakness
- Thirst
- Dry skin and mucous membranes
- Swollen, dry and fissured tongue
- Weight loss
- Decreased urine output
- Dark, concentrated urine
- Foul smelling urine

NUTRIENT DEFICIENCIES

NUTRIENT

Vitamin K

FUNCTION

Vitamin important in blood clotting; controls bleeding

SYMPTOMS

- Bruising easily
- Bloody nose
- Cut that bleeds too long
- Bleeding gums

Fat Emulsion

Provides essential fatty acids

- Scaly skin (dermatitis)
- Loss of hair
- Oily taste in mouth

Zinc

Trace element involved in many enzyme systems

- Scaly skin (dermatitis)
- Loss of hair
- Red rash

Biotin

Vitamin important in nutrient metabolism

- Loss of hair
- Depression

B₁₂, Folic Acid, Iron

Prevents anemia

- Anemia
- Tiredness

Trace Elements

Promote the efficient use of nutrients within our bodies

- Metallic taste in mouth

GLOSSARY

AIR EMBOLISM	an air bubble that is carried in the bloodstream
AMINO ACID SOLUTION	intravenous protein
AMPULE	a small, sealed glass container for one dose of a medication
ASEPTIC	bacteria free, sterile
CATHETER (INTRAVENOUS)	a slender tube of plastic or silastic inserted into a blood vessel for infusing fluid
CATHETER CLAMP	prevents flow of liquids through a section of tubing
COMPOUNDING	preparing your PN solution
CONTAMINATION	the presence of bacteria which makes an item unsterile
CYCLIC PN	method of PN infusion where the day is divided into "cycles" - PN is infused during the same time period each day
DEXTROSE	(glucose) simple sugar that is a major caloric source in PN
DEHYDRATION	a decrease in body water. Signs and symptoms include thirst, low urine output. Frequent causes are diarrhea, increased stoma output, vomiting
ELECTROLYTE	an important chemical necessary in any cell's functioning (i.e., sodium, potassium)
ENTERAL	using the gut (intestine) as opposed to veins (parenteral)
FAT EMULSION	(same as lipids, Liposyn [®] , Intralipid [®]) - liquefied fat for IV administration
GAUGE	measurement for diameter of needles - the larger the number - the smaller the diameter
GLYCEMIA	Sugar or glucose in the blood
HEPARIN	a drug which prevents the blood from clotting
HYPER	prefix meaning above, excessive or beyond normal
HYPERAL	slang term for hyperalimentation, PN (Parenteral Nutrition)

HYPERALIMENTATION	infusion of a dextrose and amino acid solution to provide calories and protein to meet daily nutritional requirements
HYPO	prefix meaning below or less than normal
INTRAVENOUS (IV)	through the vein
LUER LOCK	a special type of IV tubing connection which twists together and prevents ends from pulling apart
MULTIDOSE	a container or vial that can be used more than one time if it is refrigerated
MVI	(Multiple Vitamin Injection same as Infuvite Adult and Pediatric, MVI-12 [®] , MVI-Pediatric [®]) - vitamin solution used in PN daily - contains ascorbic acid (vitamin C), vitamins A, D, E, the B Complex vitamins, folic acid and biotin
PARENTERAL NUTRITION (PN)	infusion of a dextrose and amino acid solution to provide calories and protein to meet daily nutritional requirements
PATENCY	open, not obstructed
PICC (Percutaneously Inserted Central Catheter)	a catheter that is inserted in the arm into the subclavian vein
PIGGYBACK	technique for infusing 2 IV solutions through one line - a needle is used to plug one IV into another using a rubber entry port
PRIMING	filling the IV tubing with fluid
SEPSIS	bacteria in the blood
SINGLE DOSE – (UNIT DOSE)	a container or vial which can be used only once
SUBCUTANEOUS	under the skin
SUPERIOR VENA CAVA	large vein that empties into the right side of the heart
SYSTEMIC	throughout the body
TRACE ELEMENTS	promote the efficient use of nutrients within our bodies
URINE FRACTIONALS	urine testing done to check for sugar in the urine- should be negative