



PART TWO: AN OVERVIEW OF PARENTERAL NUTRITION (PN)

**The Second Handbook in the
Diet and Nutrition Series for Short
Bowel, Intestinal Failure, and
Intestinal Transplant Patients.**



Transplant
UNWRAPPED

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Intestinal Rehabilitation and Transplantation Series

Part One: An Introduction to Nutrition for Short Bowel Syndrome (SBS) and Intestinal Failure

This part gives a background on the digestive system and the small intestine. Part one also provides an overview on short bowel syndrome (SBS), intestinal failure, and intestinal and multivisceral transplantation.

Part Two: An Overview of Parenteral Nutrition (PN)

This part provides an overview of parenteral nutrition, including what it is, types of central lines, possible complications, setting up PN, infection prevention, and tips and tricks from experienced PN users.

Part Three: An Overview of Enteral Nutrition (Tube Feeds)

This part provides background information on enteral nutrition, or tube feeds, including what they are, types of tubes, types of formula, possible complications, and tips and tricks from experienced "tubies."

Part Four: Oral Diet and Nutrition for Short Bowel Syndrome (SBS) and Intestinal Failure

This part provides information on oral diet and nutrition recommendations for those living with short bowel syndrome (SBS) and intestinal failure.

Part Five and Six: Basics of Intestinal Transplant and Post-Intestinal Transplant Nutrition

The first part provides the basics of intestinal transplant. The second part then provides an overview of the post-transplant diet, including what to expect post-transplant, weaning off of PN, starting an oral diet, and food safety tips. It also provides tips on eating after an intestinal transplant from post-transplant patients.

Our Mission

Transplant Unwrapped is a 501(c)(3) non-profit organization with the mission to ensure every patient, caregiver, and member of the intestinal disease community feels well-educated and supported throughout their journey with intestinal failure, intestinal rehabilitation, and intestinal and multivisceral transplantation.

Key to our Handbooks

Be on the lookout for the following icons which indicate a special category of information. Links will also be underlined, bold, and in blue font color.



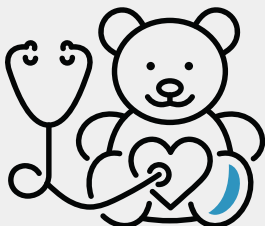
**Tips or
Experiences from
Patients and
Caregivers**



**Link to an External
Resource or
Website**



**Link to a
Transplant
Unwrapped
Resource**



**Information for
Pediatric
Caregivers and
Patients**



**Fun Fact!
An Interesting
Piece of
Information**



**Questions or
important
information to share
with care team.**

Nutritional Assessment

If you are diagnosed with short bowel syndrome (SBS) and/or intestinal failure, a nutritional assessment should be completed to create an **individualized nutrition plan**.

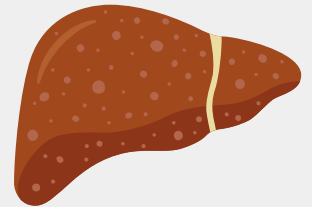
What are things you should expect in a nutritional assessment?



Detailed Weight History



Detailed PN, Tube Feed, and Oral Intake History

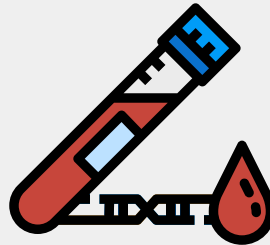


History of PN complications (i.e. sepsis, liver disease, blood clots)



Physical Exam

Check for things that may indicate nutrient deficiencies.
Ex: reduced muscle mass, dry skin



Bloodwork

This includes checking levels of vitamins and minerals, blood cells, and electrolyte levels.



Stool Tests

Can identify fat in stool, indicating malabsorption of fats.

As with any appointment, it is important to prepare. Be sure to know the answers to the information above, as well as a current medication list, diagnoses, surgical history, and past treatments you have tried. You should also write down any questions you may have for your care team.

The Nutrition Plan

After an assessment by your care team, an individualized nutrition plan can be determined. In general, there are **three main options** for getting the **nutrition** your body needs: parenteral nutrition (PN), enteral nutrition (tube feeds), and oral intake.

Option 1: Parenteral Nutrition (PN)

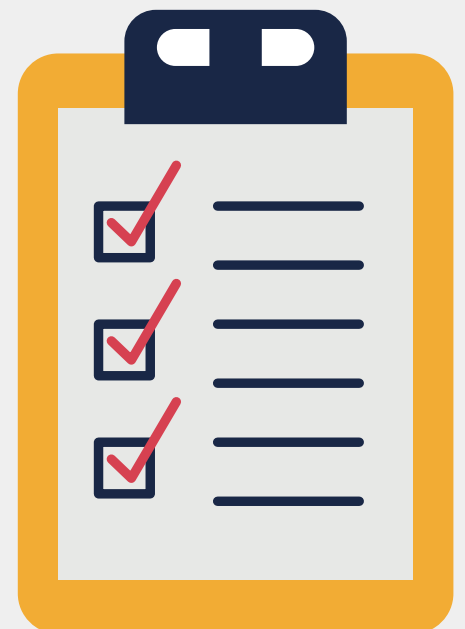
Initially, most patients with short bowel syndrome and/or intestinal failure will be placed on **IV nutrition**, also known as **parenteral nutrition (PN)**, to achieve full nutritional status and stabilize. PN delivers nutrients and fluids through the large veins of the body via a **central venous catheter (CVC)** or central line, bypassing the intestine.

Other names for PN include total parenteral nutrition (TPN) and home parenteral nutrition (HPN).

What are some indications for PN? Administration of PN is based on your small intestine's ability to absorb enough nutrients and fluids to keep you healthy and functioning. This means that any condition that causes short bowel syndrome (SBS) and/or intestinal failure may require PN.

Common reasons people require PN (this list is not all-inclusive, rather, a snapshot):

- Crohn's and Ulcerative Colitis
- Motility disorders, such as chronic intestinal pseudo-obstruction (CIPO)
- Cancer, particularly that of the GI tract
- SBS from congenital conditions
- Cystic fibrosis
- ALS
- Parkinson's Disease
- Ischemic bowel disease
- Necrotizing Enterocolitis (NEC)



Parenteral Nutrition (PN) Basics

What is in the parenteral nutrition solution? PN contains all of the nutrients your body needs to sustain life. Your PN solution will be customized to your nutritional needs. In general, you will need to get weekly bloodwork when you are on PN so the pharmacy can create your customized PN solution.

Three primary energy sources:

1. **Carbohydrates:** This gives your body calories and is the primary energy component in PN. It is usually in the PN as glucose.
2. **Protein:** Helps your body repair tissue, build muscle, fight infections, and carry nutrients through the body.
3. **Fat (lipids):** Source of calories and energy. It also is needed to absorb vitamins A, D, E, K, which help to protect your vital organs, and conserve heat. When your PN bag contains fat (lipids), it will be white.

Types of Lipids:

1. **Intralipid:** This is a soybean oil lipid emulsion (SOLE). SOLEs contain high amounts of a plant-based cholesterol-like compound called phytosterols, found in vegetable oils. These have been found to contribute to the development of cholestasis and disruption of bile acid homeostasis.
2. **Mixed-lipid emulsions:** These lipid emulsions contain various amounts of plant-based oils, fish oils, and medium-chain triglycerides (MCTs). The most commonly known is SMOFlipid® which consists of: 30% soybean oil, 30% MCTs, 25% olive oil, 15% fish oil.
3. **Omegaven®:** This is a fish-oil lipid emulsion (FOLE). It contains minimal phytosterols and is rich in omega-3 fatty acids. It is currently FDA approved for children with parenteral-nutrition associated cholestasis.

Parenteral Nutrition (PN) Basics

PN also contains **micronutrients** your body needs to function:

1. **Vitamins:** Usually, you are required to add these to your PN solution when you are on home TPN. These are what turn the PN solution yellow. Examples: vitamins A, D, E, and K.

2. **Minerals:** These may also be added to PN. Examples are zinc and copper.

3. **Electrolytes:** These are important for the function of most systems of the body. Examples: calcium, potassium, phosphorous, magnesium, and sodium.

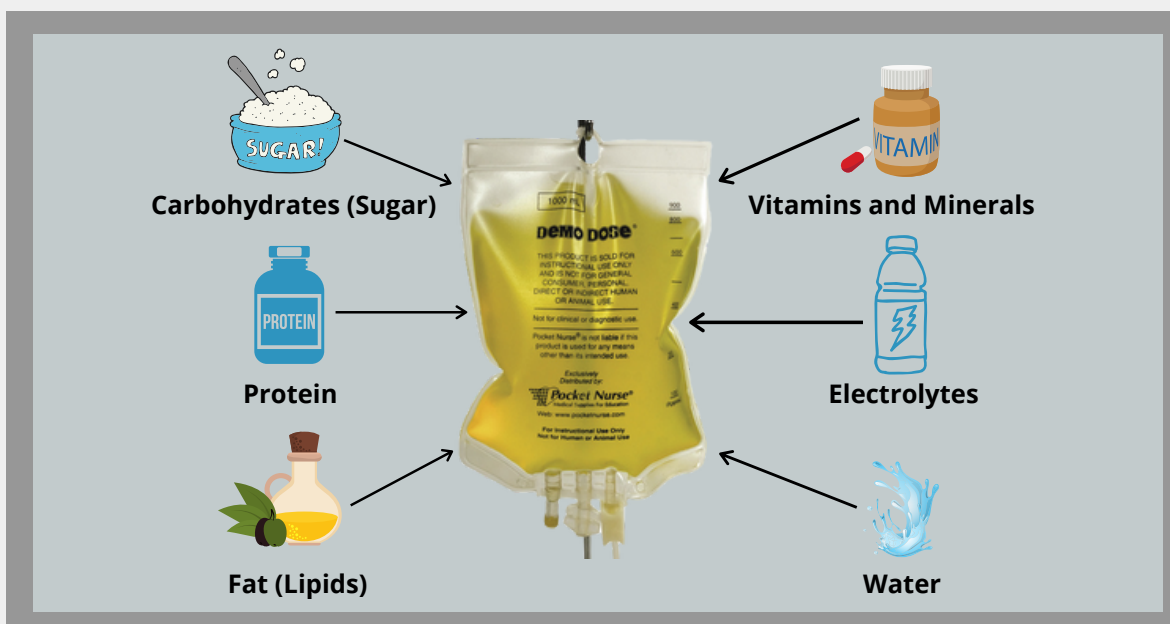
4. **Water:** Water is important to keep you hydrated and your kidneys functioning.

Medications: Sometimes you may add medications to your PN solution:

1. **Insulin:** This helps to control your blood sugar.

2. **Anti-acid:** This helps with stomach acid secretion.

3. **Octreotide:** This is an anti-secretory medication and can help decrease diarrhea.



Central Venous Catheters (CVCs)

How is parenteral nutrition delivered? PN enters the large veins of the body via a central venous catheter (CVC), also known as a central line. A **central line** is a thin tube inserted into a large vein that goes just up to or inside the heart.

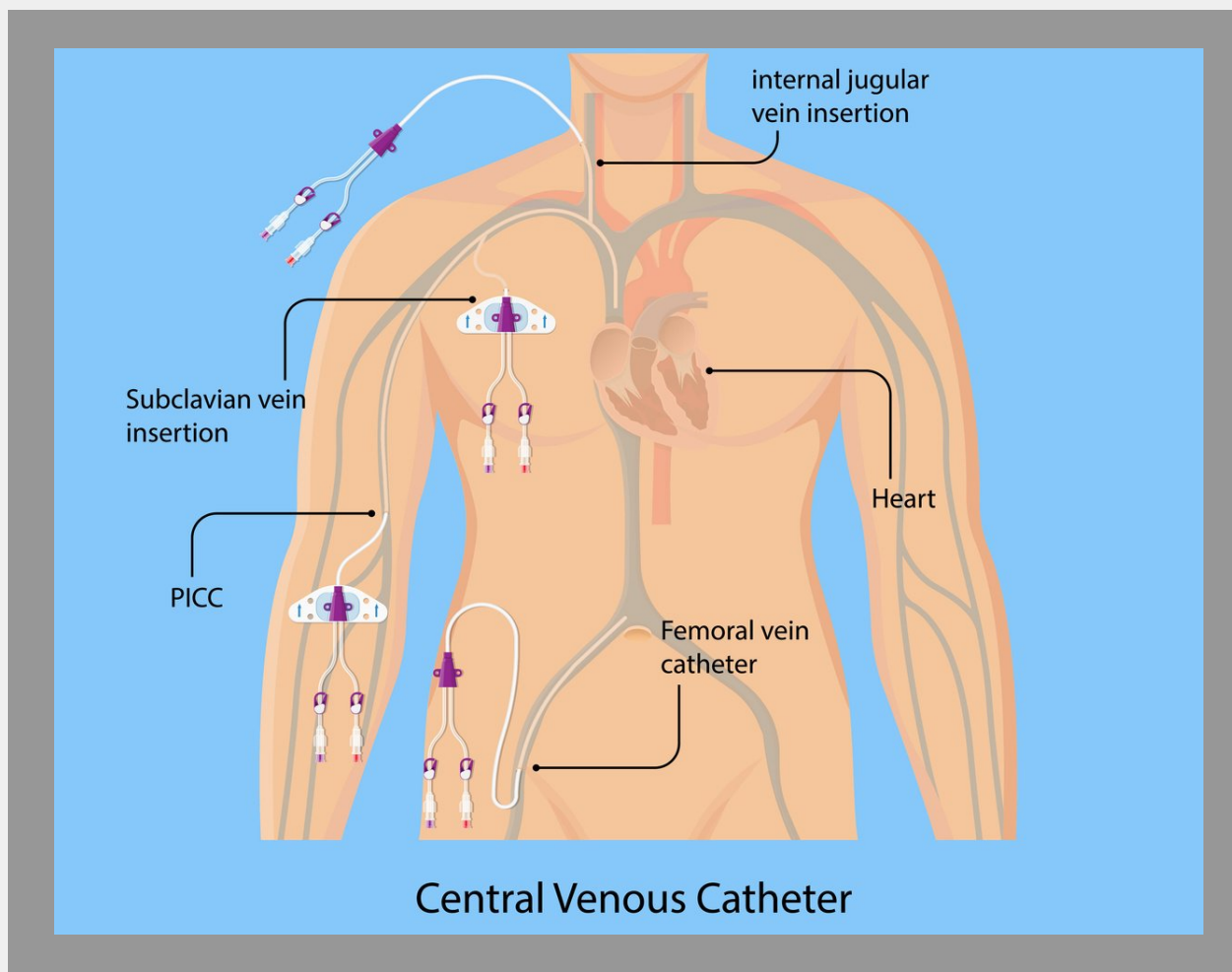
Types of Central Lines

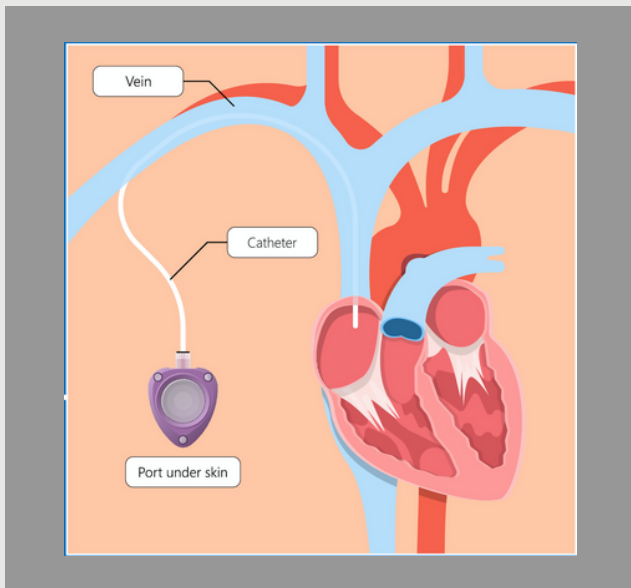
Tunneled Catheter:

- The catheter is passed under the skin. This helps stabilize the line and makes it useful for long-term therapy.
- The catheter can have one or more lumens (access points).
- Examples: Hickman®, Broviac®, Port-a-Cath

Non-Tunneled Catheter:

- Short-term use.
- Placed in a large vein in the arm, neck, groin, or leg.
- Ex: Peripherally Inserted Central Catheter (PICC)





This is a picture of a **Port-a-Cath**, a type of tunneled central line. The port itself is placed under the skin and accessed as needed. When not accessed, it must be flushed occasionally but otherwise does not require care. A port can have multiple lumens (access points) and can be used long-term.

How is a central line (tunneled) inserted?

- During surgery, the surgeon inserts the tip of the catheter under the chest skin and tunnels it into a large vein that goes to the heart.
- There will be two small incisions on the chest after surgery, one where the catheter was inserted into the vein and one that comes out of the chest skin (the "exit site").
- You may have soreness or discomfort at the incision sites.

Caring for Your Central Line

Infection prevention is of the utmost importance when caring for your central line. Some prevention methods include:

- Wash your hands before and after handling your PN or CVC.
- Always scrub your catheter hubs for 15 seconds before and after each use.
- Always cover your central line when taking a shower or getting wet.
- Never let the tip of your PN tubing touch anything other than the connection with your catheter.
- Perform cap changes about every 3 days.
- When your catheter is not in use, be sure it is covered with a cap.
- Remain completely sterile (completely free from bacteria) while doing dressing changes.

Caring for Your Central Line: Dressing Change

When should you change your dressing?

- If the dressing is dry and intact, the dressing can be changed every seven days.
- Other reasons for changing your dressing: You see moisture under the dressing, the dressing becomes wet, or the dressing starts to come off.

Infection prevention when changing central line dressing and/or anytime you handle your central line.

- Central line care should not take place in a bathroom.
- Fans/air conditioners should be turned off, and windows and doors should be closed.
- Limit distractions and the number of people in the room.
- Use your designated supplies and clean, dry surface for all central line care.
- Pets should not be in the room during line care.
- Wear sterile gloves and a mask when changing your dressing.



Infection Prevention Tips from Melinda; Patient and Pediatric Caregiver

It is best to have a single lumen line as double-lumen lines have a higher infection risk. To avoid infection make sure you use are following good sterile techniques, change your dressing and end clave connector weekly, and use proper sterile technique. You should avoid getting your line wet in hot tubs, dirty lakes, or swimming pools; and when you do shower, make sure your central line is covered. I always wear a few tega-derm /opposite (clear adhesive sterile medical bandages) over my line when I shower, but if the dressing does get wet, I change it immediately.

Caring for Your Central Line



Bathing and Showering

- Cover your line with a waterproof dressing.
- If the transparent dressing becomes wet, replace it right away.
- Avoid soaking in tubs, which increases the risk for infection.



Physical Activity

- You should be able to participate in most activities.
- If you are unsure about a particular activity, please consult your care team.



Darryl's Parenteral Nutrition Tips

For those who are just starting TPN, the best advice I have is to ask lots of questions. Any time you access the line there is an inherent risk of infection and other complications, it is important that you are 100% confident in what is going on. You need to make sure you are not only educating yourself, but you are also educating those who are helping you. If you have outside help, such as a nurse, you need to educate them, too. Because nurses have such a huge amount to learn, they may have limited practice with more rare treatments like TPN. Be sure to always take things slowly, double check everything, make sure all tubing connections are secure, have a back-up of all supplies, and always take an emergency kit with you! And do not worry, it gets easier!

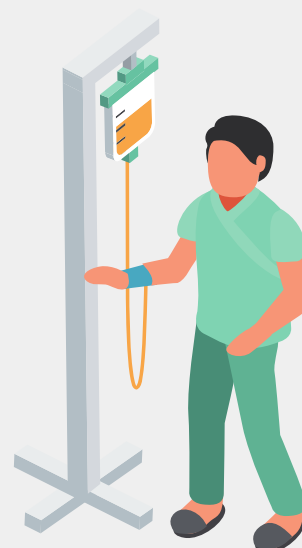
Starting Parenteral Nutrition (PN)

In general, **PN is started as an inpatient** in the hospital, allowing your team to watch for refeeding syndrome and closely monitor electrolytes and other blood levels. **Refeeding syndrome** is a complication that may occur in severely malnourished individuals and results in significant electrolyte and fluid disturbances in the body.

Cycling Parenteral Nutrition (PN)

- At first, most individuals will start PN on a 24-hour continuous cycle. This means the PN runs throughout the entire day.
- Initially, your PN will not contain all of the calories and nutrients your body needs. Over a few days to weeks, your team will gradually increase the glucose (energy/calories) in the PN until your full nutritional requirements are met.
- Once met, your care team will likely start to 'cycle' your PN. Please note: not all people will cycle PN and may have to remain on a continuous infusion. Your team will determine the best option.
- Cycling your PN means decreasing the amount of time that your PN runs. Typically the length of time will go down in increments, such as 24 hours to 18 hours to 16 hours and finally ending at a 12-hour cycle.

Did you know it was only in **1968** that PN became a treatment option for babies with intestinal failure.



Supplies for Parenteral Nutrition (PN)

Your care team will help you find a pharmacy that can deliver your PN solution and associated supplies. Examples include Coram and ThriveRx.

What supplies do you need for parenteral nutrition (PN)?

In general, the supplies you need include:

- Soap/ handwashing materials
- Household disinfectant
- PN solution
- Alcohol swabs
- Gloves
- Saline flushes
- PN Tubing
- Pump
- Any additives your team prescribes, such as multivitamins



Storing the supplies: The PN solution and multivitamins must be refrigerated. Allow these to come to room temperature before infusing..

Administering Parenteral Nutrition (PN)

Getting Ready

1. Clean your work area with a disinfectant. Find a place that has good lighting and is free of dust. **Do not use bathrooms** to set up as many germs can contaminate your line.
2. **Wash your hands.**
3. Set-up supplies on the clean surface area. Try to remain clutter-free.
4. Check the label on your PN bag, including your name, expiration date, drug name, and any additives for you to include.



HOW TO WASH YOUR HANDS!

WASH FOR 20 SECONDS BY SINGING HAPPY BIRTHDAY TWICE.



Apply soap to your hands.



Rub your hands palm to palm.



Rub back to hands.



Scrub between your fingers.



Clean around each of your thumbs.



Rub your fingertips into your palm.



Rub your wrists.
Repeat
for both hands.



Rinse your hands
with water.



Use a disposable towel or
tissue to completely dry
your hands.

Administering Parenteral Nutrition (PN)

The Infusion

The **steps to start your infusion may vary** based on the type of tubing and pump that you have. In general, you will need to know how to:

- Add any additives to your PN solution prescribed (i.e. multivitamins, insulin, etc.);
- Spike the PN bag;
- Prime the tubing;
- Use/ program the pump; and
- Connect the PN to your central line.

Basic Summary of Steps (Please consult your care team for specific instructions. You should be well-versed in setting up your PN solution before leaving the hospital.)

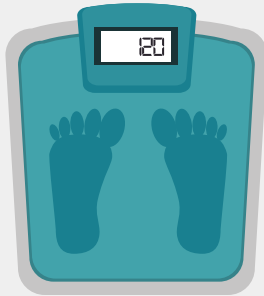
1. Clean the work area
2. Wash your hands.
3. Place supplies on the clean, dry work area.
4. Check to make sure the PN has your personal information on the label.
5. Add any additives to the bag (i.e. multivitamin, insulin)
6. Set up the tubing in the pump.
7. Spike the PN bag.
8. Turn the pump on and select the correct cycle options.
9. Prime the tubing and make sure there are not any air bubbles.
10. Remove the cap from your hub and scrub for at least 15 seconds with alcohol.
11. Flush your line.
12. Scrub your catheter hub again with alcohol.
13. Connect primed tubing to your catheter.
14. Unclamp your catheter and hit start. on your pump.

What should you monitor when you are on parenteral nutrition (PN)?

This will vary between centers, however, it is usually **important to monitor:**



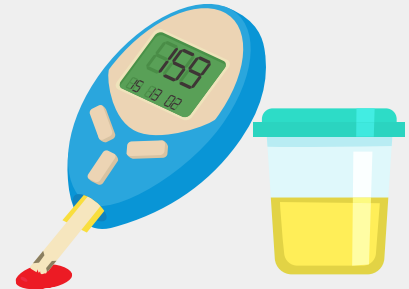
Temperature



Weight



Input and Output



Blood Sugar (either via urine or device)

Parenteral Nutrition (PN) Complications

PN complications can be broken up into 3 categories:

1. Metabolic (i.e. hyperglycemia, hypoglycemia, fluid, and electrolyte imbalance)
2. Catheter-related (mechanicalx (i.e. clot in line, catheter breaks)
3. Infection-related complications (sepsis).

Complications are also classified as short-term or long-term.

Common Short-Term Complications:

- Volume overload
- Hyperglycemia (high blood sugar) and Hypoglycemia (low blood sugar)
- Refeeding Syndrome (hypophosphatemia (low phosphorous), hypomagnesemia (low magnesium), hypokalemia (low potassium))
- Other electrolyte imbalances

Common Long-Term Complications

- Hepatic cholestasis (impaired bile formation or flow)
- Hepatic steatosis (fatty liver)
- Cirrhosis and End-Stage Liver Disease

Central Line Complications: Mechanical

Problem: Catheter Tear

Possible Causes:

- Damaged by a sharp object (scissors, etc.)
- Too much pressure in line when flushing,
- Faulty tubing.
- Wear and tear of the catheter.

What to do:

- Clamp the line between the tear and your body.
- If infusing, stop the infusion.
- Call your care team **right away**.

Prevention:

- Do not use sharp objects near the line.
- Avoid securing your line with a safety pin.
- Avoid too much pressure when flushing your line.
- Look for wear and tear, especially with aged lines.

Problem: Leakage or Breakage.

Signs:

- Liquid leaking from anywhere along tubing or line; dressing is wet after flushing line.

What to do:

- Clamp the line above the point of leakage or breakage.
- Call your care team immediately.

Prevention:

- Never flush against resistance.
- Do not use sharp objects, such as scissors, around the line.
- If you have a young child, pay attention to times when they are teething or possibly chewing on the line.

Central Line Complications: Mechanical

Problem: Line will not flush.

Possible Causes:

- The line is clamped.
- The line or tubing is kinked.
- There is a clot or blockage in the line.

What to do:

- Unclamp it.
- Remove the kink.
- If the line is not kinked or clamped, do not force the solution into the tube. Call your care team or home health company immediately.

Prevention:

- Flush the line frequently and as directed by your care team.

Problem: Central Vein Thrombosis (CVT)

A blood clot has formed in the vein where the catheter lies.

Signs:

- Swelling of the neck, arm, or hand.

What to do:

- Call your care team immediately.

Prevention:

- Flush your line regularly and as recommended by your team.
- Some care teams may recommend flushing your line with heparin to prevent clots.

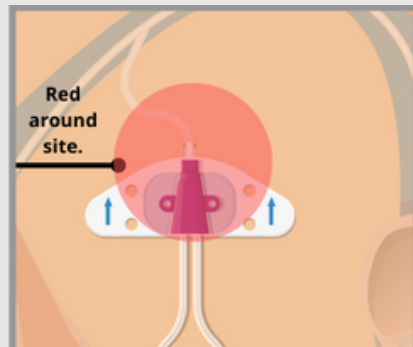
Central Line Complication: Infection

Central lines bring an increased risk of infection. A **Central Line-Associated Blood Stream Infection** or **CLABSI** occurs when bacteria grows in your catheter and travels to the bloodstream. This can lead to sepsis which can be very serious and life-threatening.

Signs and Symptoms of Central Line Infection:



Fever



Redness or swelling around the line.



Pain or tenderness around the line.

What can cause a central line infection?

1. Movement of bacteria from your skin at the insertion site into the tip of the catheter.
2. Contamination of the catheter hub itself.
3. Contaminated infusion (very rare).

Central line infections can be:

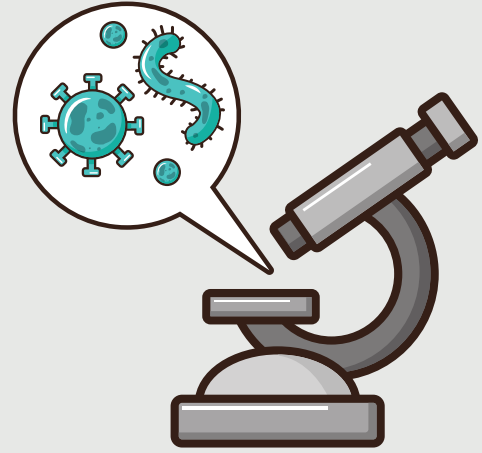
1. **Local:** This is an infection at the catheter exit site.
2. **Systemic:** An infection in the bloodstream (sepsis).

Common Bacteria Leading to Central Line Infections:

- Gram-positive organisms
- Coagulase-negative staphylococci
- Staphylococcus aureus

Central Line Infection

Diagnosis: Blood cultures from the central line. These can take 48-72 hours to get results. Because cultures can take time to grow, your team will also take into account your symptoms to determine the next course of action.



Treatment: Your team will determine the best antibiotic and antimicrobial treatment for you. The organism causing the infection often determines if your line will need to be removed and replaced. For example, the line is usually removed if you have a fungal infection, gram-negative bacilli, valvular heart disease, multiple organisms, or endocarditis. Each case is individualized, and your team will determine the best course for you.

Preventing Central Line Infections: (Please note, this is not an all-inclusive list, refer to your care team for more information on preventing infection)

- **Number one: Wash your hands!** If soap and water are not available, use an instant hand sanitizer that is at least 60%-90% alcohol.
- Pay attention to your dressing and the area around it. If it comes off or if the dressing is wet or dirty change immediately.
- **Do not** let the insertion **site get wet.**
- Continuously **reassess the need** for the central line.
- Always **scrub the line caps** for at least 15 seconds
- Do any **wound, ostomy, or fistula care separately from your PN.** Germs normally live in your intestinal tract. If these germs enter your bloodstream through the IV catheter or PN solution, they could cause a severe blood infection (bacteremia).

Parenteral Nutrition (PN) Complications

PN contains **large amounts of glucose**. This places individuals on PN at risk of developing **hyperglycemia** (too much glucose in the blood) or **hypoglycemia** (too little glucose in the blood).

Hyperglycemia (High Blood Sugar)

Can result from the high amount of glucose infused over a short period. Generally, you will be required to use a urine dipstick test or glucose monitor to assess the levels of glucose (sugar) in your blood to determine if the level is too high.



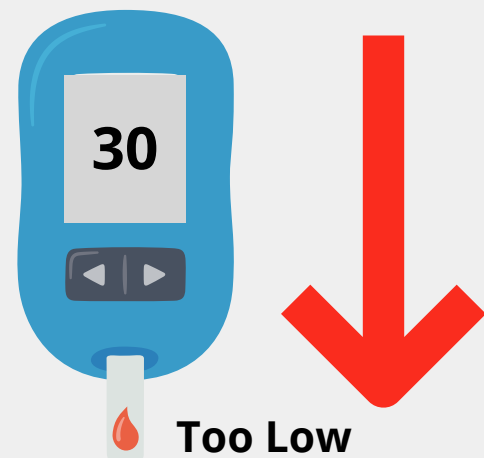
Treatment: Your team may choose to add insulin to your PN or require you to give yourself insulin. Insulin is the hormone in your body that regulates sugar levels, signaling to cells to take in the glucose and store energy for later use.

Hypoglycemia (Low Blood Sugar)

This is when your blood sugar is too low and can occur when your PN is stopped too abruptly.

Signs and Symptoms of Hypoglycemia

- Feeling shaky
- Sweating, clamminess
- Confusion
- Fast heartbeat
- Feeling lightheaded or dizzy



Treatment: Drink orange juice or apple juice to help raise blood sugar. You then need to consult your care team to determine the next steps, so it does not happen again.

Parenteral Nutrition (PN) Complications

Prevention of hypoglycemia:

- Your team may **taper your PN infusion**. This means that the infusion starts slowly over the first hour or two of your infusion and gradually increases until it reaches full speed.
- The hour or two before your PN cycle is going to end, you may also need to taper down.
- The tapers make it **so your body is not shocked by massive amounts of glucose**, which could cause the release of too much insulin, resulting in low blood sugar (hypoglycemia).

Refeeding Syndrome

Refeeding syndrome can occur upon initiation of PN if an individual is severely malnourished.

When the body is in a starved state without carbohydrates, it uses protein and fat stores for energy. When PN is introduced and initiates carbohydrate metabolism, insulin production increases. This causes a movement of electrolytes into cells, particularly phosphate, leading to serious electrolyte and fluid disturbances in the body.

It is a very serious situation and can be life-threatening if not treated. Fluid can shift into the lungs which leads to serious breathing difficulties.

A **hallmark of refeeding syndrome is hypophosphatemia** (low phosphate levels), but concentrations of many electrolytes, such as potassium and magnesium, can become low.

See diagram on next page to see the steps of refeeding syndrome.

Starvation/ Malnutrition

Decreased blood glucose.



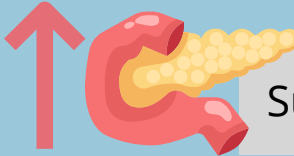
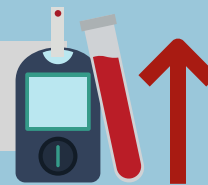
Decreased insulin in blood.



Protein and fat stores used for energy.

Introduction of PN ↓ Leads to Refeeding

Increased blood glucose.



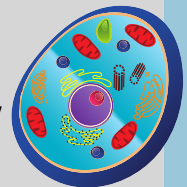
Sudden increase in insulin



Increase glucose uptake into cells.



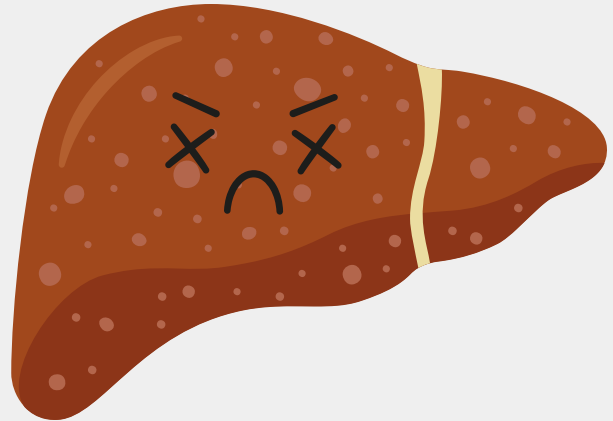
Increase uptake of phosphate, potassium, magnesium into cells.



Result: Hypophosphatemia (low phosphate), hypomagnesemia (low magnesium), hypokalemia (low potassium), salt and water retention (edema)

Parenteral Nutrition Associated Liver Disease (PNALD)

Parenteral Nutrition Associated Liver Disease (PNALD) refers to liver dysfunction that results from the use of parenteral nutrition (PN) in individuals with a nonfunctioning intestine (intestinal failure).



Three Main Types of PNALD:

1. **Steatosis (fatty liver):** This is a benign condition but can progress to fibrosis and cirrhosis. Cirrhosis is scarring of the liver and is generally permanent. The portions of the liver that become cirrhotic are no longer functional. It can progress to cirrhosis and end-stage liver disease.
2. **Cholestasis:** This is when the flow of bile from your liver is reduced or blocked. It can progress to cirrhosis and end-stage liver disease.
3. **Cholelithiasis (gallstones or gallbladder sludge):** Commonly seen in short bowel patients on PN due to reduced concentration of bile acids from altered intestinal-liver (enterohepatic) circulation. Also, with limited oral intake, the gallbladder contracts less, leading to more concentrated bile and an increased risk for developing stones.

Factors affecting PNALD:

- Long-term PN use, more prolonged use = higher risk
- Infusion of high amounts of lipids or dextrose = higher risk
- Type of lipid emulsion, SMOFlipid®, and Omegaven® is shown to have better outcomes

Parenteral Nutrition Associated Liver Disease (PNALD)

Diagnosis:

- **Bloodwork** assesses liver function tests such as alanine transaminase (ALT), aspartate transaminase (AST), alkaline phosphatase (ALP), and bilirubin.
- A **liver or gallbladder ultrasound** may be used to visualize the liver or look for stones.
- Either a **magnetic resonance elastogram or an ultrasound elastogram** may be performed to assess for the presence of fibrosis (scarring).
- The **gold standard** is a **liver biopsy** to assess for fibrosis and cirrhosis.

Treatment: The best option is to get you off of PN. If this is not possible, your team may be able to make adjustments to your PN solution, such as decreasing the amount of glucose or lipids. Also, your team may recommend the use of a different lipid formulation (see SMOFlipid® and Omegaven® for more information). If you have progressed to end-stage liver disease, a liver or multivisceral transplant may be recommended.



Risk Factors for Development of PNALD in Children

- Premature birth
- Disruption of the intestinal-liver circulation of bile acids.
- Slow intestinal motility resulting in bacterial overgrowth.
- High parenteral protein, fat, and/or energy intake
- Frequent line infections.
- Absence of oral feeds (inc. risk for biliary sludge).
- Continuous PN infusion can lead to too much insulin in the blood and is associated with cholestatic liver disease.

Glossary: Useful Terms for Central Lines and Parenteral Nutrition (PN)

Adhesive tape remover: Helps to remove dressing and tape, usually in the form of a pad. Must be completely removed with Chloraprep before placing new dressing, or the dressing will not stick.

Antibacterial soap: Soap that will kill bacteria or germs. Always use before handling your line.

Antibiotics: Medications that fight infections by killing bacteria or stopping it from growing.

Bacteria: Germs that make you sick. Can be treated with antibiotics.

Biopatch: A medicated disc placed around the exit site of your central venous catheter (CVC). Not all dressing change kits contain a biopatch. Consult your care team for their recommendations.

Cannula: A thin tube inserted into your vein to deliver medications, or into your body cavity to remove fluid.

Catheter: A plastic tube that is inserted/put into the body. The catheter can be used to administer parenteral nutrition (PN), fluids, medications, and to draw blood.

CC (cubic centimeter) or mL (milliliter): Units used to measure how much liquid is in a syringe. One cc is the same as one mL.

Central Catheter: An IV catheter that is threaded through a vein to a point close to the heart.

Glossary: Useful Terms for Central Lines and Parenteral Nutrition (PN)

Central Catheter: An IV catheter that is threaded through a vein to a point close to the heart.

Chloraprep: The solution used to clean the skin around the exit site of your central venous catheter. It helps prevent infection.

Clamp: Compresses the catheter line when not in use. You should clamp your line at the thickest portion. Many lines will have an area marked to indicate a proper clamping area.

Dehydration: This is when your body does not have enough fluids.

Enteral Nutrition: Also known as tube feeding. A way of delivering nutrition through a tube directly into the stomach or small intestine.

Exit Site: Area on chest (or other location) where the catheter comes out through the skin.

Flush: This is done to clear out remaining solutions from your catheter or tubing. It is important to flush your line with 0.9% saline frequently to keep the line patent (open).

Heparin: It is a medication (aka blood thinner) used to prevent blood from clotting and blocking your catheter.

Infusion Device: A device (i.e. pump) that controls the speed (rate) of a solution as it enters the vein through your catheter.

Glossary: Useful Terms for Central Lines and Parenteral Nutrition (PN)

Insertion Site: The place where your catheter enters your skin.

Parenteral Nutrition (PN): A method of nutrition in which a special sterile liquid nutrient mixture is given into the blood through a central IV catheter and bypasses the intestine.

Peripheral Catheter: A short intravenous (IV) catheter typically placed in the hand or arm.

Sterile: Completely free from bacteria.

For a more extensive glossary, you can go to the [Transplant Unwrapped Website](#). For kid-friendly definitions, you can go to the [Transplant Unwrapped Kid's Website](#).



Kayla's Insight: Traveling with PN

Parenteral nutrition (PN) should not interfere with your ability to participate in everyday activities, including traveling. If you want to travel, you just need to properly prepare for the trip and flight. First and foremost be sure to pack all of your medical supplies in one suitcase, without any other items. (i.e. in order for the bag to be checked for free, most airlines require the suitcase of supplies to be solely medical and you should not include clothes etc.) Make sure to give yourself an ample amount of time when getting to the airport and communicate any concerns with the TSA. Since I like to travel so much, I have TSA Pre-Check, a program that helps expedite the screening process. My best advice while at the airport is be patient and things should go smoothly.

Knowledge is Power

This handbook has provided the basics of parenteral nutrition. Further information and support services can be found on both the main Transplant Unwrapped Website and the Transplant Unwrapped Kid's Site.

More Info?



info@transplantunwrapped.org



www.transplantunwrapped.org



www.transplantunwrappedkids.org



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