

Parenteral Nutrition Guidelines

Nassau University
Medical Center

I. AIM

To establish guidelines that will promote **safe** and **effective** use of parenteral nutrition (PN). Our goal is to enhance the nutritional status of our patients and by doing so, drive improved clinical outcomes. These guidelines include initiation, follow-up, monitoring and modification of parenteral nutrition. Optimal care for patients requiring parenteral nutrition will be delivered by our **multidisciplinary team approach**. It is intended that the process of providing nutritional expertise be inclusive and educational.

Central Parenteral Nutrition (CPN) is the delivery of nutrients via a **central vein**.

Total Parenteral Nutrition (TPN) is the delivery of nutrients sufficient to meet metabolic requirements.

Peripheral Parenteral Nutrition (PPN) is the delivery of nutrients via a **peripheral vein**.

II. Parenteral Nutrition Team Members

Clinical staff that is actively caring for patients will play a crucial role in the identification of patients who require nutritional support and the subsequent initiation and management of parenteral nutrition needs.

Ordering PN should be made directly through our electronic ordering system, **Eclipsys**. The physician ordering parenteral nutrition must be **certified in parenteral nutrition competency**, or be supervised by a **parenteral nutrition team** member that is certified. Parenteral nutrition teams shall be comprised of an Attending Physician certified in the management of parenteral nutrition, a registered dietitian, and a house officer.

Physician: Attending Physicians, Fellows, Residents, and Interns

A physician who has been credentialed in the delivery of parenteral nutrition will initiate parenteral nutrition orders.

Dietitian: Registered dietitians will work closely with the entire team to assure safe and effective delivery of parenteral nutrition.

Surgical Service / Interventional Radiology Service: Both the Surgical Service and the Interventional Radiology Service will assist in the management of venous access.

Nursing: The bedside nurse will communicate across the service continuum and facilitate delivery of parenteral nutrition.

Pharmacy: The pharmacist will be responsible for optimizing the composition of parenteral nutrition, based on their knowledge of product availability. They will also advise on supplementary electrolytes and drugs as necessary.

Infection Control: The infection control team will monitor and advise on episodes of catheter related infectious events.

III. Parenteral Nutrition Committee

In the event that questions regarding the delivery of parenteral nutrition can not be satisfactorily addressed by a parenteral nutrition team, a member of the **Parenteral Nutrition Committee** will be available for further discussion. **Kathy Hill, Lisa Musillo, and Faina Iskhakova**, represent their respective disciplines and will be available to trouble-shoot. **Drs Rubinstein, Ciminera, Batista, Paulose and Mustacchia** are members of the PN Committee and represent their respective disciplines, and they will also be available to trouble-shoot. **(Appendix 1)**

IV. Indications for Parenteral Nutrition

Parenteral Nutrition is indicated to prevent the adverse effects of malnutrition when the gastrointestinal tract is not working, not available, or not appropriate.

Parenteral nutrition may be useful for (but is not limited to) the following situations:

1. Extreme prematurity, premature infants <1500 grams
2. Any infant with unstable cardiorespiratory status who can not be advanced to full enteral feedings in 2-3 days
3. Failure to thrive
4. Malnourished patients in whom the use of the intestine is not anticipated for >7 days after major abdominal surgery
5. Patients with specific conditions severely affecting the gastrointestinal tract (such as severe mucositis following systemic chemotherapy, upper gastrointestinal strictures or fistulae, severe acute pancreatitis where jejunal feeding is contraindicated, congenital intestinal anomalies, necrotizing enterocolitis)
6. Patients with major resections of the small intestine (short bowel syndrome) before compensatory adaptation occurs
7. Patients in the Intensive Care Unit (ICU) with systemic inflammatory response syndrome (SIRS) or multiple organ dysfunction syndrome (MODS) in whom enteral support is contraindicated or not tolerated
8. Non-functioning gut (e.g. paralytic ileus)

The duration of parenteral nutrition depends on the return of normal gut function. Provision of PN for less than 7 days in adults is usually not clinically indicated as the risks outweigh the benefits; but, it is accepted that this will sometimes occur as a consequence of early identification and intervention in “at-risk” patients.

Long Term PN may be required in a small number of patients, including those with:

9. Extreme short bowel syndrome of any etiology
10. Other causes of prolonged intestinal failure (atresia, radiation enteritis, marked inflammatory or motility disorders)

V. Initiation and Monitoring of Parenteral Nutrition

1. Overview

The **identification** and **selection** of patients requiring Parenteral Nutrition, and the subsequent implementation and monitoring of this treatment, consists of a number of overlapping phases. These phases will be carried out by a multi-disciplinary team and are described below.

2. Screening

When there is concern regarding a patient's nutritional status, and the potential need for parenteral nutrition, they should be referred to the ward or ICU dietitian for a full assessment. This may take place on one or more occasions if appropriate.

Recommendations will be made and documented in the patient's chart. If parenteral nutrition is indicated, **a physician certified in the management of parenteral nutrition** will place the order.

3. Enrollment

Once the multi-disciplinary team has assessed the patient and agreed on the need for PN, venous access will be acquired. The surgical service and interventional radiology will be available to assist in this process. When choosing the mode of venous access (peripheral, non-tunneled, tunneled, or implanted port) consider the likely duration of treatment, and limitations of that form of venous access. If the patient requires additional fluids or intravenous drug administration, and has limited peripheral access, a double or triple lumen line may then be inserted as clinically indicated. The appropriate venous access should be chosen early. Both CPN and PPN require one line or port **dedicated** exclusively for the infusion of PN (except in pediatrics when no other access is possible). Malnutrition is the culmination of a gradual process and cannot be considered an "emergency". **Never** use dialysis access for PN administration.

4. Initiation of PN

a) Prior to initiating PN, baseline laboratory values should be checked (**section X.**) and fluid and electrolyte abnormalities corrected. In those at risk of developing re-feeding syndrome, additional intravenous supplementation may be required. Adults and children (>12 yrs old) are at risk for refeeding syndrome when the serum potassium (K) < 3.3 mmol/L, phosphorus (P) < 2.7 mg/dL, and magnesium (Mg) < 1.6 mg/dL. Neonates and children < 12 yrs may be at risk when serum P < 4.5 mg/dL, in addition to K < 3.3 mmol/L, and Mg < 1.6 mg/dL. Adult individuals at risk should receive a dose of IV Thiamine before the initiation of PN. The 'at risk' pediatric population requires adequate supplementation of group B vitamins before the initiation of PN. Remember to check and correct fluid and electrolyte abnormalities, after supplementing thiamine or other group B vitamins, and prior to starting PN. Dietitians will provide their expert opinion and insight during the order writing process.

b) All PN is to be ordered or reordered daily, according to age appropriate order form. Parenteral nutrition orders should be submitted before 1:00 pm. Orders submitted after 1:00 pm will not be compounded. Customized PN will not be available on off hours (a pre-mixed PN solution (Clinimix) is available for older pediatric and adult patients).

5. Early Monitoring Phase

For the first week after initiation of PN the patient will be monitored very closely. This includes **immediate** and **Q6** hourly inspection of the parenteral nutrition **line site** for the **first 24 hours** after placement, along with an assessment of fluids and laboratory values (**section X.**) in an ongoing manner. **All neonates** and **pediatric** patients up to the **age of 6 years**, and any other individual that is **limited** in their ability to **reliably express themselves**, shall have their parenteral nutrition line site checked **Q shift** or more frequently, as indicated. If there is any evidence of line infiltration, the attending physician, in discussion with the surgical and/or interventional radiology service, shall consider immediately removing and replacing the line. If the patient suffers notable metabolic disturbances, with respect to fluid and electrolyte or metabolic parameters, the patient will be monitored intensively. This will consist of a **daily** assessment by the medical team and the dietitian, and the appropriate laboratory tests (**section X.**) It may be necessary to modify either nutritional support or overall patient care to obtain the best patient outcomes. Communication between the members of the clinical team and the Parenteral Nutrition Team will be maintained during this process.

6. Stable Patient Phase

Once the patient becomes stable on PN, a less intensive monitoring process will be required (**section X.**).

7. Refeeding Syndrome

Refeeding syndrome is defined as severe fluid and electrolyte shifts and related metabolic disturbances in malnourished patients undergoing refeeding. Signs are hypophosphatemia, hypokalemia, hypomagnesemia, altered glucose metabolism, fluid balance abnormalities, and vitamin deficiency. (**Appendix 2**)

8. Re-introduction of Diet

An enteral diet will be introduced in a graded fashion when the patient demonstrates the ability to resume enteral feeding. Discussion with the ward dietitian and other members of the clinical team will allow appropriate reduction or cessation of PN.

9. Cessation of PN

PN will usually be stopped when enteral nutritional intake is deemed adequate. Cessation of PN is determined by a variety of factors and is a decision based on a team consensus. PN may also be stopped for other reasons including emergency surgery and major metabolic disorders, this decision should also be discussed amongst the team members, and a consensus should also drive this decision. If PN needs to be stopped suddenly or unexpectedly, an infusion of 10% dextrose should be initiated.

VI. Intravenous Access (Appendix 3: for extensive line management details)

1. Obtaining Intravenous Access

- Peripheral access should only be used for the short term administration of parenteral nutrition. The clinical team should decide on the appropriate access

early. If needed, the surgical and interventional radiology services are available to assess the patient and advise on the most appropriate route.

- Peripheral parenteral nutrition is not without its complications, primarily the development of peripheral vein thrombophlebitis (PVT). This can be reduced by selecting a large vein, and by performing cannulation away from the joint.
- The patient may have a peripherally inserted central catheter (PICC) placed for PN; reserve veins in the antecubital fossa for this purpose. PICCs can remain in place for up to thirty days (or greater in select circumstances).
- For long term PN, a tunneled central venous catheter will be inserted via the subclavian (except in individuals with advanced chronic kidney disease) or jugular vein.
- X-ray confirmation of a newly inserted central venous catheter (CVC) or PICC is mandatory before beginning infusion.

2. Parenteral Nutrition requires the use of a 0.22 micron in-line filter. IV lipids are piggybacked below the filter.

3. A dedicated single-lumen line is the safest route of PN administration. The more times a line is manipulated the greater the risk of infection. Aseptic technique should be used. Nothing else should be given through this lumen, nor should blood be sampled from the line under routine circumstances (except in extraordinary circumstances).

4. If a multi-lumen line is clinically indicated, one lumen should be **dedicated** for PN use only. Again, nothing else should be given through this lumen, nor should blood be sampled from this lumen (except in extraordinary circumstances).

VII. Management of Line Problems

1. Need to Stop PN Suddenly or Unexpectedly?

a) If PN is stopped suddenly or unexpectedly, rebound hypoglycemia may occur; this may be severe and potentially dangerous. To minimize this effect, an infusion of 10% dextrose should be initiated at the same rate that the PN solution was administered -for one or two hours. Beyond this time, and in patients with large fluid losses or requirements, IV fluids should be administered as clinically indicated.

b) Planned cessation of PN would take place when the patient is tolerating an enteral diet and fluids. In this situation dextrose-containing IV fluids are not required.

c) When PN is being administered over periods of <24 hours, down-ramping (reducing the hourly infusion rate by at least 50% for the last hour of feeding) should occur to prevent rebound hypoglycemia.

d) If PN is held for procedures, scans, or a surgery and the anticipated interruption is greater than 1 hour, a blood glucose reading should be obtained 30 minutes to 1 hour after the PN solution is discontinued -to identify potential rebound hypoglycemia. If the

anticipated delay of PN is less than one hour, blood glucose monitoring is not necessary during this interruption.

2. Line Infection

a) Failure to recognize a line infection, and remove the catheter promptly, may prove to be life threatening to the patient. Line infection may presents in several ways, including entry site infection (erythema, induration, or pus), unexplained fever or bacteremia.

1. Suspect a line infection when there are clinical signs of sepsis (such as fever, rigors, elevated white cell count).
2. Patients with line sepsis can have alternative sources of infection; therefore, other potential sources of infection should be sought out:
 - Take a history
 - Examine the patient (look for signs of endocarditis, pneumonia, cholangitis, deep vein thrombosis, superficial phlebitis, and line insertion site infection)
 - Consider a UTI, and obtain a chest x-ray if the clinical scenario dictates
 - Obtain blood cultures through the PN line and an additional peripheral set of blood cultures (2 sets in total, each bottle inoculated with 10ml of blood, except in pediatrics where less blood is used)
 - Review the details with the clinical team and a member of the parenteral nutrition team
3. Make a decision about antibiotics based on the clinical picture and a discussion with the clinical team (and the infectious disease service if needed).

b) If any member of the hospital team has a concern regarding the management of the central line, they are required to discuss their concern with a senior member of their team and the surgical or interventional radiology services. If the concern regarding the management of the central line is not satisfactorily resolved, a member of the PN committee should be contacted. Central line management concerns may include, but are not limited to: fever, site dressing, site bleeding, site pain, site inflammation, line flushing and line aspiration.

3. Loss of Line

a) If the access line is lost for any reason the patient should be started on a replacement IV infusion until another line is placed. Generally, the line will be modified or replaced as soon as possible. For problems with catheter occlusion see **Appendix 3**.

- b) The risk of venous catheter occlusion may be minimized in several ways:
- Immediately flushing with 10 ml normal saline in adults and older children (lesser amount is used in neonates and younger children) once an infusion has finished.
 - Use a push-pause positive pressure flushing technique to increase intraluminal turbulence and prevent blood flashback within the catheter tip for PICCs.
 - Varied concentrations of heparinized saline may be instilled when the catheter is not used for more than 8 hours.

VIII. Prescribing Parenteral Nutrition

Many patients requiring PN will have fluid and electrolyte imbalances before starting parenteral nutrition, and by definition a degree of protein/energy malnutrition. Optimization of fluid and electrolyte status is essential before starting PN. For adults at risk of refeeding syndrome, additional thiamine should be administered; pediatric patients at risk, should receive adequate provision of group B vitamins.

The clinical team in charge of the patient is responsible for optimizing the fluid and electrolyte status. The PN prescription will be reviewed, on a daily basis, by the clinician responsible for the patient, with the dietitian's input.

1. Recommended Composition of PN

A patients' nutritional requirements are based on standardized equations. Individual patients have unique nutritional and electrolyte needs; therefore, individualized PN formulations are prescribed.

The PN solution is provided as a 2 in 1 solution (dextrose – amino acids) with additives (electrolytes, vitamins, & trace elements) and a lipid emulsion infused separately as an IV piggyback. The infusion of a PN solution and lipid emulsion should be completed within 24 hours.

2. Starting PN

After the following electrolyte abnormalities (K, P, Mg) have been corrected, it is standard to start with full strength PN from day one in adults. In the neonatal and pediatric patients and in those patients at-risk of refeeding syndrome, a starter regimen is generally used. It is necessary to give a single dose of thiamine at least 30 minutes prior to commencing the daily PN (for 3-7 days) for those adults at high risk of refeeding syndrome.

a) Energy Substrates:

The **certified** clinician (along with the dietitian) will calculate the patient's energy requirements -provided as carbohydrates, lipids, and amino acids. These requirements are based on the patient's underlying clinical condition, age, sex, body weight and activity level. This may be varied if clinically significant glucose intolerance develops, or if there is a requirement for a lipid free PN regimen.

1. Carbohydrate

Carbohydrates are the primary fuel source. If refeeding syndrome is a consideration, PN should be initiated with a starter regimen.

2. Lipid

Intravenous fat emulsion (IVFE) is used to provide energy and is a source of essential fatty acids.

3. Protein

PN protein is provided in the form of amino acids. The total protein requirements are calculated by the **certified** clinician along with the dietitian and are based on the clinical condition of the patient.

b) Electrolytes

These are modified according to clinical and laboratory data. Electrolytes are reviewed according to schedule (**section X.**) and modified as necessary. It is the responsibility of the clinical team to check the electrolyte profile prior to modifying the PN electrolyte prescription.

c) Vitamins and Trace Elements

These are added routinely on a daily basis. Extra zinc, copper, and chromium may be required in patients with large gastrointestinal losses. Patients on long-term PN will have routine micronutrient screening undertaken.

d) Volume

The overall aim is to provide maintenance fluid volume via the PN. Losses from wounds, drains, stomas and fistulae should be replaced and managed separately.

e) Medications

Limited drug additions (including -insulin, famotidine, and heparin) can be made to the PN. Do NOT add insulin or any other additives to solutions outside the pharmacy.

IX. Nursing Care of Patients on PN

1. The Ward Nursing Staff will Perform the Following Tasks on PN patients:

- Prior to PN administration:
 1. The patient's identity is verified.
 2. The PN label is reviewed for accuracy against the physician's order.
 3. The PN label is reviewed for expiration dates.
 4. The PN bag is visually inspected for precipitates or other visual changes.
Do not hang if there is not an identity match.
- Daily weights (before starting PN and daily thereafter).
- Minimum 8 hourly temperature reading and blood pressure. Also observe for clinical evidence of infection, and general well being. Notify the physician for any of the following:
 - Critical laboratory values
 - Signs and symptoms of venous access infection or infiltration
 - Signs and symptoms of acute lipid intolerance: fever, chills, vomiting, urticaria, chest/back pain with onset during infusion
 - Signs and symptoms of rapid infusion reaction to lipids: palpitations, tachypnea, wheezing, cyanosis, nausea, pain at injection site, headache, oily taste in mouth
 - Signs and symptoms of fluid volume overload or dehydration.
- Maintain accurate fluid balance flow chart and summary.
- Glucose monitoring 6 hourly for the first 24 hours, then daily when stable (or more frequently in the neonatal population) and as clinically indicated.
- Daily assessment for venous access site infection or leakage, unless a **neonate** or up to **age 6**, or suffering from some impairment and unable to **reliably express themselves** -then **Q shift** - or more frequently.

- Bag change will be at 18:00 hours each day.
- PN solution will be sent from pharmacy in amber light-resistant covering that should be zipped to the tubing connection to minimize any light. The UV light protective covering should be maintained at all times. Bags and tubing should not be in direct sun light.
- An electronic infusion pump is required to infuse PN and lipid emulsion.
- The PN infusion and lipid must be completed within 24 hours of initiating the infusion. Any remaining contents after 24 hours are discarded.
- Administration sets, extension tubing and in-line filter (for PN and lipid infusions) are changed every 24 hours.
- Use only low sorbing (non-DEHP [diethyl hexyl phthalate]) tubing for PN and lipid emulsion administration.
- An occluded filter should never be removed to allow a PN formulation (including Clinimix) to infuse freely.
- When administering lipids as piggyback, use an in-line Y-set (pediatrics or adults) or other secure needleless connector.
- Attach a sterile luer locking connector cap when the line is not in use.
- When PN administration is temporarily held, a sterile luer locking connector cap should be attached to the PN solution tubing; the same PN solution can be reconnected to complete the infusion within 24 hours from initiation of the bag.
- Avoid administration of medications via PN line. In patient populations with limited venous access, compatible drugs may be infused with the PN **only** under the following conditions:
 - There is documented compatibility of the medication when infused with the PN and / or lipid
 - **EXCEPTION:** In pediatrics and in patients with limited venous access, incompatible drugs may be given via the PN line when:
 - PN infusion is held
 - The line is flushed before and after the drug
 - The patient is monitored for fluctuations in blood glucose when PN is interrupted for greater than one hour.
- The flow rate can only be changed when an order is written by a physician.
- Avoid interruption of the infusion unless absolutely necessary.

Documentation:

- Bag and prescription checked to assure accuracy prior to PN initiation.
- Record inputs and outputs on flow sheet. Sign for on Medical Administration Record (MAR).
- Dressing change.

2. Storage of PN on the Ward

- Bags not yet connected to the patient must be stored in a refrigerator (between 36 F and 42 °F) for no longer than 48 hours. Discard solutions after 48 hours.
- Bags stored in a refrigerator must be kept well away from any freezer compartment to prevent ice crystal formation in the PN.

- Bags that have been refrigerated should be removed at least 1 to 2 hours before being hung and infused, to allow the solution to reach room temperature.
- Bags should not be in direct sun light. The UV light protective covering should be maintained on the PN bag and zipped to the tubing connection at all times.

X. Medical Monitoring of Patients on PN

1. It is the responsibility of the medical staff on each clinical team to ensure that PN blood draws are done.
2. The clinical team will arrange full metabolic screening on long-term PN or "at-risk" patients.
3. Baseline: the tests outlined in the table below should be obtained prior to initiating PN; and all the electrolyte (K, P, Mg) abnormalities corrected
4. New/Unstable patient: daily monitoring as outlined below. Stable patient: as outlined below.
5. Results should be monitored by the clinical team, but will also be reviewed by PN team when prescribing PN.
6. The clinical team retains overall responsibility for the patient.

Table. Suggested Monitoring for PN

Parameter	Baseline	Critically Ill Patients	Stable Patients
Basic Metabolic Panel	Yes	Daily	Twice weekly
BUN, Creatinine	Yes	Daily	Twice weekly
Calcium	Yes	Daily	Twice weekly
Phosphorus	Yes	Daily	Twice weekly
Magnesium	Yes	Daily	Twice weekly
Liver Function Tests	Yes	Daily	Twice weekly
– neonates	Yes	Weekly	Weekly
CBC with differential	Yes	Daily	Weekly
PT, PTT	Yes	Weekly	Weekly
Serum triglycerides	Yes	Weekly	Weekly
Albumin	Yes	Daily	Weekly
Prealbumin (except neonates)	Yes	Weekly	Weekly
C-reactive protein (adults only)	Yes	Weekly	Weekly
Glucose – adults	Yes	Q6 hours (until controlled)	Daily (if controlled)
– pediatrics	Yes	Q6 hours or as needed	Daily (if controlled)
– neonates	Yes	Q 6 hours	Q 6 hours
Weight	Yes	Daily	3 times per week
– neonates	Yes	Twice daily	Daily
Intake and output	Daily	Daily	Daily
Nitrogen balance	As needed	As needed	As needed

XI. Stopping Parenteral Nutrition

- 1.** Patients will be started on an enteral or oral diet when thought appropriate. PN will be weaned off or discontinued in those patients who are able to tolerate and absorb enteral feeding.
- 2.** PN will usually be stopped when enteral intake is deemed adequate by the clinical team, with PN team input. As a general rule, cessation of PN is determined by a variety of factors and is a multi-disciplinary decision. Clinical observation by the nursing staff will identify the rare patient who has problems after cessation (hypoglycemia, intolerance of enteral feeds) and any concerns should be reported to the PN team.
- 3.** Occasionally PN needs to be stopped for other reasons such as acute operations, major metabolic disorders or problems with equipment. If PN needs to stop suddenly or unexpectedly an infusion of 10% dextrose -at the same rate that the PN solution was being administered- should be initiated for one to two hours. Beyond this time additional IV fluids and electrolytes should be administered as clinically indicated.

XII. Line Removal

The clinical team will decide on removal of central lines. The surgical service and the interventional radiology service and the Parenteral Nutrition Team will be available to advise.

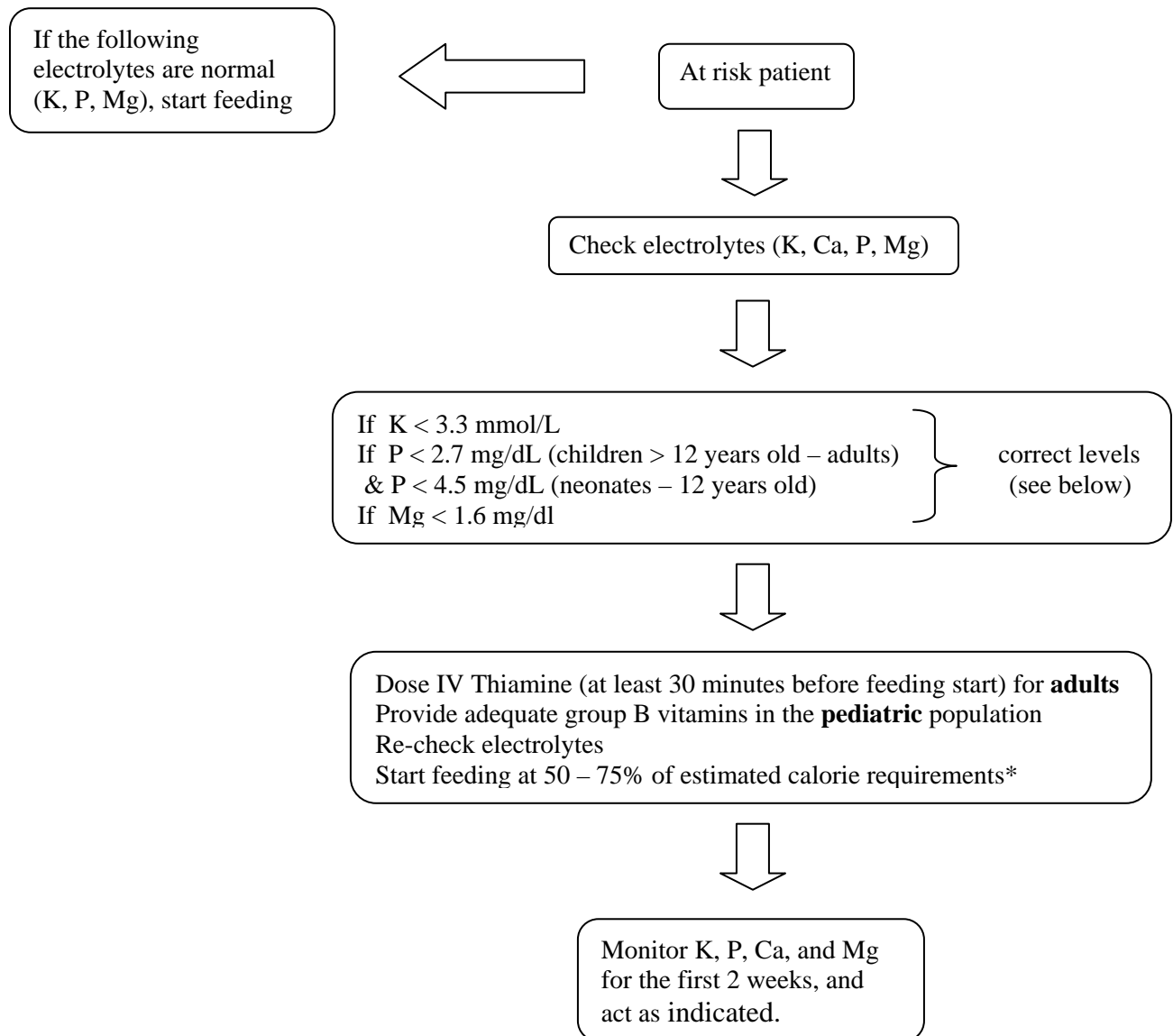
Appendix 1: PN Contacts

- Nutrition consults and PN ordering should be made directly through our electronic ordering system, ***Eclipsys***.
- The physician ordering parenteral nutrition must be **certified in parenteral nutrition competency**, or be supervised by a parenteral nutrition team member that is certified.
- **Parenteral nutrition teams** shall be comprised of an Attending Physician **certified** in the management of parenteral nutrition, a registered dietitian, and a house officer.

Person	Role	Preferred contact
Lisa Musillo	PN Committee Member Dietitian	Ext: 2-6623 Pager: (516) 651-2142
Kathy Hill	PN Committee Member Dietitian	Ext: 2-6425 Pager: (516) 651-2133
Laurie Haufler	PN Committee Member Nursing	Ext: 2-6330 Pager: (516) 651-1934
Linda Maksym	PN Committee Member Infection Control	Ext: 2-5463 Pager: (516) 651-5130
Paul Mustacchia	PN Committee Chairman Gastroenterologist	Ext: 2-6501 Pager: (516) 651-5075
Sofia Rubinstein	PN Committee Member Nephrologist	Ext: 2-8879 Pager: (516) 651-1012
Peter Ciminera	PN Committee Member Pediatric Intensivist	Ext: 2-6330 Pager: (516) 651-5930
Ammukutty Paulose	PN Committee Member Neonatologist	Ext: 2-3316 Pager: (516) 651-4601
Faina Iskhakova	PN Committee Member Pharm D	Ext: 2-6618 Pager: (516) 651-1068
Kaleem Rizvon	Gastroenterologist	Ext: 2-6501 Pager: (516) 651-5060
Richard Batista	Surgeon	Ext: 2-6703 Pager: (516) 651-8189
Krishnaiyer Subramani	Gastroenterologist	Ext: 2-6501 Pager: (516) 651-5081
Ali Karakurum	Gastroenterologist	Ext: 2-6501 Pager: (516) 651-5160

Appendix 2: Refeeding Guidelines

Refeeding syndrome is defined as severe fluid and electrolyte shifts and related metabolic implications in malnourished patients undergoing refeeding. Signs are hypophosphatemia, hypokalemia, hypomagnesemia, altered glucose metabolism, fluid balance abnormalities, and vitamin deficiency.



Start at *50 – 75% of estimated calorie requirements for the first 24hrs, then increase gradually within the first week to full feeding, with careful monitoring and supplementation of electrolytes as required. The **clinical team has the responsibility for correcting fluid and electrolyte imbalances prior to starting PN**, the PN team will be available to advise on the regimen and rate.

Appendix 3: Policy for the Management of Venous Access for PN

I. Overview

Obtain informed consent, a complete blood count, and coagulation profile.
Proceed if these values are in an acceptable range.

II. Insertion

- A. Maximal Barrier Precautions (MBP) are required for asepsis during insertion, and conform to the NYSDH Professional Conduct Law. Personnel assisting with or inserting the central line shall:
- Wash hands prior to donning sterile gloves
 - Wear masks applied to prevent venting at the sides
 - Wear hair cap and sterile surgical gowns
 - Apply a body-length sterile surgical drape from the patient's head to foot
 - Prepare the insertion site with chlorhexidine gluconate as a surgical scrub, allow to dry.
- B. Documentation
1. A printed Procedure Form (H761X), giving the site, date and type of catheter, must be filled out by the physician upon completion, and placed in the patient's chart (except for neonatal ICU that maintains its own policy).

III. Catheter and Site Selection

- A. A single lumen central venous catheter should be used unless multiple ports are essential for management of the patient.
- B. Lines should be removed as soon as they are no longer medically necessary.
- C. Subclavian followed by jugular access sites have lower infection rates and should be chosen before femoral sites. There may be individual exceptions that will be dealt with on a case-by-case basis.
- D. Femoral insertion sites should only be used when no other sites are available or appropriate. Antibiotic impregnated-catheters should be used at this site in adults.

IV. Care and Maintenance of the Site

- A. Do not use topical antibiotic ointment or creams on insertion site.
- B. The dedicated PN port should not be used for collecting specimens (except in patients with no other possible access).
- C. The site may be dressed with either a transparent or gauze dressing, which must completely and securely cover the site.
- D. All dressings must be checked for integrity every shift by nursing and changed if no longer providing a secure, protective covering for the site.
- E. Frequency of dressing change:
1. Gauze dressings must be changed every **72 hours** or if the integrity of the dressing becomes compromised (dressing loose, soiled or wet), for central and peripheral catheters

2. Transparent dressings may remain in place up to 7 days. Dressings should be changed more frequently if an appropriate protective covering is not maintained.
 3. Dressings should be changed weekly for PICCs.
- F. Care must be taken to prevent contamination of the site with infected secretions:
1. oropharyngeal for internal jugular access.
 2. urine and feces for femoral access.

V. Site Inspection and Documentation

- A. Daily (or more frequent in pediatrics) inspection and palpation of the site must be performed and documented by Nursing. Aseptic technique is used.
- B. The site should be assessed for the presence of erythema, induration and purulent drainage and so noted in the progress notes by Nursing.

VI. Site Rotation/Administration Set Rotation

- A. Central venous catheters, including PICCs, tunneled, non-tunneled and implanted devices
 1. Sites will not be routinely replaced, medical management and site condition will dictate site duration.
 2. Administration sets for PN and lipids and in line filters are replaced every 24 hours or more frequently if become occluded.

VII. Femoral Insertion Sites

- A. The use of multi-lumen catheters should be avoided.
- B. If replacement at a non-femoral site becomes possible, the line should be relocated as soon as possible if prolonged central line placement is required.

VIII. Changes over a Guide Wire

- A. Do not use guidewire exchanges routinely for central non-tunneled catheters
- B. Use a guidewire exchange to replace a malfunctioning non-tunneled catheter only if no evidence of infection is present.
 1. Maintain sterile technique before handling the new catheter when guidewire exchanges are performed.
 2. Remove the existing catheter and insert a new catheter over a guidewire.
 3. Send the removed catheter for semi-quantitative culture.
 4. If the catheter culture indicates infection/colonization, remove the newly inserted catheter and insert a new catheter at a different insertion site, complete Procedure Form for new insertion.
 5. Rationale for this need should be documented in the Progress Note.
- C. Do not use guidewire assisted catheter exchange in patients where catheter-related infection is documented.
 1. If the patient requires continued vascular access, remove the implicated catheter.
 2. Replace the catheter with another at a different insertion site.

IX. Suspected Infection

- A. Lines should be removed and the site changed if the patient appears to be septic and no other source is evident.
- C. If sepsis is suspected or the central line is removed due to evidence of local infection (induration, purulent drainage), the distal 2 inches of the catheter should be aseptically cut and sent to microbiology for semi-quantitative analysis.