## Purpose
To provide guidelines for parenteral nutrition for infants in the Neonatal Nursery that are unable to meet nutritional requirements orally. The goal is to meet estimated energy and protein requirements, as identified by dietitian’s assessment, within the first 3-5 days of initiation of therapy in an appropriate ratio of protein, carbohydrate and fat.

## Policy Statement
Parenteral nutrition (PN) may be standardized as Enhanced Dextrose Solution (EDS) or customized parenteral nutrition. EDS is started for infants less than 33 weeks gestation when customized PN is not available immediately. Customized PN solutions are prescribed individually for each infant on PN order forms. Following a decision to start parenteral nutrition, a dietitian completes the custom PN order form. The form is co-signed by a Neonatologist/Designate and completed forms are sent to Pharmacy by 1100 hours. Each day of PN is ordered on the PN order form. The lipid order is also written on the Patient Care Order Form. Routine bloodwork is needed while the infant is on PN to monitor the nutritional and metabolic progress. Changes to the PN orders are made as necessary.

Parenteral nutrition allows for variation of all macro and micro nutrients. The macronutrients are carbohydrates, proteins and fats in the form of dextrose, amino acid, and 20% lipid emulsion. The micronutrients are sodium, potassium, calcium, phosphorus, magnesium, vitamins and trace elements. Other additives include heparin, carnitine, and acetate. Dextrose and amino acids are the major components of the bag. Lipid is dispensed separately.

## Applicability
All Covenant Health Neonatal Nursery staff.

## Principles
**WHEN TO ORDER PARENTERAL NUTRITION**
1. Any infant requiring major surgery before the establishment of milk feeds.
2. Gastrointestinal anomalies requiring surgery – gastroschisis, omphalocele, intestinal atresias, necrotizing enterocolitis, ileus, pseudo obstruction or Hirschsprungs.
4. GI perfusion compromised by conditions such as cardiovascular or respiratory instability, congenital heart disease, and use of certain medications.
5. PN should be considered within 24 hours if an infant is expected to have a delay in reaching full volume enteral feeds beyond 3-4 days.
6. Lipid Initiation and Advancement:
   a. Initiate in stable babies at 1 gram/kg/day.
   b. Initiate in ELBW babies at 0.5 grams/kg/day.
   c. Increment all advancements by 0.5 grams/kg/day to a maximum of 3 grams / kg / day.
   d. Careful advancements of 0.5 grams/kg/day for infants at risk for hypertryglycerideremia.
e. When triglyceride levels exceed the tolerance level of 2.3 mmol/L suggest stopping for 24 hours and re-initiate in increments of 0.5 grams/kg/day. Re-check triglyceride levels twice per week. If infant develops lipid intolerance, provide 0.5 grams/kg/day to prevent essential fatty acid deficiency. Infants at risk for hypertryglyceridemia include those with sepsis, renal failure, corticoid treatment, elevated serum glucose levels, and the critically ill and/or surgical infant.

f. Be aware of IV lipid use and the potential risks for infection, microbial growth (M. Furfur), pulmonary system effects, parenteral nutrition associated liver disease, vitamin K antagonists, and fat overload syndrome.

MONITORING GUIDELINES

1. PN blood work should be done twice weekly including the following laboratory measurements: electrolytes, glucose, ionized calcium, magnesium, phosphorus, triglyceride, urea, CRP, and prealbumin. In medically stable infants, PN blood work can be reduced to weekly measurements once lab results are stable and full PN prescription is achieved.

2. PN blood work should be discontinued before three to four days of reaching full enteral feed volume.

3. If the infant is receiving PN for >30 days, monitor liver function tests (LFT’s), total and conjugated bilirubin, AST, ALT, alkaline phosphatase, and GGT and trace elements (serum copper, zinc, and selenium). Longer term follow-up may be required depending on clinical status.

4. Other monthly blood work to consider in ELBW or critically ill infants includes follow up of LFT/trace elements, fat-soluble vitamins, and bone metabolism tests (ionized calcium, phosphorus, alkaline phosphatase, vitamin D and magnesium) depending on clinical status.

SPECIAL CONSIDERATIONS

1. Never speed up Amino Acid Dextrose solution or lipid rates to make up for lost volume or when fluids are increased unless charge nurse or physician / NNP consulted. Usually an increase is not more than 10% greater than the ordered volume (on the PN order form).

2. Amino Acid Dextrose solution is labeled with osmolality. Solutions with osmolality greater than 1000 milliosmole are infused through a central line. Solutions with osmolality between 1000 & 1100 milliosmole and infused with Lipid solution may be infused through a peripheral line with a written order.

3. An interstitial IV on an infant receiving PN is restarted immediately because interruption of PN may lead to reactive hypoglycemia. If the IV has been out over 1/2 hour check a glucose. Notify the charge nurse if unable to restart the IV.

4. An additional IV must be started for the infusion of a blood product if the infant is NPO or not receiving at least 1/2 volume of their calculated full feeds while receiving PN. If an IV start is not possible, the infant's glucose must be checked every 1/2 hour during the time the blood product is infusing. If the glucose is less than 2.5 mmol/L, the blood product is discontinued and the PN restarted to bring the infant's glucose level to 2.5 mmol/L or greater before completion of the transfusion.

5. If the supply of Amino Acid Dextrose solution is depleted and the new supply is not yet available, a dextrose infusion is substituted in the interim. The Neonatologist/Designate will order the appropriate solution.
6. PN lines should be changed with a no-touch, clean technique every 96 hours. Before entering PN line or changing tubing, the access port or connection site is cleansed with an antiseptic swab. PN lines are to have a .22 micron filter. Lipid containers and lines are to be changed every 24 hours.

7. Check for compatibility of all medications except sodium, potassium, and acetate before administering through the PN line.

8. Amino acid dextrose solutions experience oxidative stress related to light exposure. The amino acid dextrose solution containers must be covered with a light protection bag administration lines must be protected with an opaque covering when a baby is under phototherapy.

Related Documents
Adapted with permission from Stollery Children’s Policy and Procedure Manual:
Parenteral Nutrition, December 2010

RELATED POLICIES AND PROCEDURES
Enteral Feed
Fluid Calculations
Intravenous Therapy
Medication Administration
Parenteral Nutrition Line Change
References
American Dietetic Association (2009).
Randomized trial of very low birth weight infants receiving higher rates of infusion of
intravenous fat emulsions during the first week of life. Pediatrics, 122, 743-751.
DOI:10.1542/ped.200702282.
EuropEan Society of Parenteral and Enteral Nutrition (2005)
Grimm, H., & Kraus, A. (2001). Immunonutrition- supplementary amino acids and fatty acids
ameliorate immune deficiency in critically ill patients. Langenbeck’s Archives Surgery,
386, 369-376.
and its implications in the neonatal population. The Journal of Pediatric
Pharmacology and Therapeutics. 14(3) 132-143.
Khovidhunkit, W., Kim, M., Memon, R.A., Shigenaga, J.K., Moser, A.H., Feingold, K.R., &
Grufeld, C. (2004). Effects of infection, inflammation on lipid and lipoprotein
metabolism mechanisms and consequences to the host. Journal of Lipid Research,
45, 1169-1196. DOI:10.1194/jlr.R300019-JLR200.
Intravenous fat emulsions current applications, safety profile and clinical implications.

Revisions
Total Parenteral Nutrition, May 2007
November 2015
Signing

Original signed
GAIL CAMERON
SENIOR DIRECTOR OPERATIONS
MATERNAL, NEONATAL & CHILD HEALTH PROGRAMS
COVENANT HEALTH
GREY NUNS & MISERCORDIA HOSPITALS

Original signed
DR. PAUL BYRNE
MEDICAL DIRECTOR
NEONATAL PROGRAM
COVENANT HEALTH
GREY NUNS HOSPITAL

Original signed
DR. SHARIF SHAIK
MEDICAL DIRECTOR
NEONATAL PROGRAM
COVENANT HEALTH
MISERCORDIA HOSPITAL

May, 2016
DATE

May, 2016
DATE

May, 2016
DATE