RN Signature: _____ Time Noted: _____ Date _____

UNIVERSITY MEDICAL CENTER

Pediatric Parenteral Nutrition Order Sheet

❑ Central ❑ Peripheral

All orders must be received in main pharmacy by 1:00PM Fax 3988
Please verify placement of central catheter prior to ordering TPN.

Addressograph

Date:	Age:	Indication for Parenteral Nutrition (PN):	Dosing Weight (kg):

I. MACRONUTRIENTS	Enter Quantities per Total Volume over 24 hours	Recommended Daily Ranges			
Lipid Emulsion 20% (20 gm/100ml)	❑ No Lipid Emulsion ❑ 20% / _____ ml (Up to 500 ml)	Age	Start Dose	Increase By	Max Dose
		Term infants	1 gm/kg/day	0.5-1 gm/kg/day	3 gm/kg/day
		Older children	1 gm/kg/day	1 gm/kg/day	2.5 gm/kg/day
Rate for Lipid Infusion	ml/hour over 12 hours				
Total Volume of Base solution	ml	Base Solution = Amino Acid + Dextrose			
Amino Acid	grams	Refer to guidelines for estimated protein requirements			
Dextrose	grams	Refer to guidelines for maximum dextrose infusion			
Rate for Base Solution	ml/hour over 24 hours	Total Calories: (Optional)			

II. ELECTROLYTES:	Enter 24 hour Requirements	Term Infant	<40 kg	≥40 kg
Sodium (mEq)	mEq Sodium Chloride mEq Sodium Acetate	2-4 mEq/kg	2-4 mEq/kg	2-4 mEq/kg
Phosphate (mM) 15 mM PO_4 = 22 mEq K 15 mM PO_4 = 20 mEq Na	mM Potassium Phosphate mM Sodium Phosphate	1-2 mM/kg	0.5-2 mM/kg	0.25-1 mM/kg
Potassium (mEq)	mEq Potassium Chloride mEq Potassium Acetate	2-4 mEq/kg	2-4 mEq/kg	2-4 mEq/kg
Calcium (mEq)	mEq Calcium Gluconate	2.5-3.5 mEq/kg	1-2.5 mEq/kg	0.2-0.3 mEq/kg
Magnesium (mEq)	mEq Magnesium Sulfate	0.25-1 mEq/kg	0.25-1 mEq/kg	0.25-0.5 mEq/kg

III. ADDITIVES:		
Ranitidine	mg	Pediatric: 2-4 mg/kg (maximum 150 mg/day)
Folic Acid	mg	
Regular Insulin	units	See Guidelines for Dosing
Heparin	Standard addition 1 unit/ml	❑ Omit Heparin
MVI-Pediatric	Added per pharmacy based on weight (Refer to guidelines for dose)	
Trace Elements-Pediatric	Added per pharmacy protocol	❑ Cholestasis (Direct Bilirubin > 2 mg/dl) (See Guidelines on back)
Cysteine	Added per pharmacy protocol	
Other:		

IV. CYCLING: (Please check box if cycling desired)

❑ Cycle over _____ hours; begin infusion at 6 PM.
Please do not hang $D_{10}W$ at the end of TPN infusion
Check fingerstick 1 hour from end of infusion

Cycled Rates: _____ ml/hr (1st hour)
_____ ml/hr
_____ ml/hr (last hour)

MD Signature: _____

Pager: _____ Time _____

For Pharmacy Use:

Prepared by: _____ Checked by: _____

STANDING LABORATORY ORDERS:
1. Baseline chemscreen, magnesium, phosphate & triglycerides
2. Daily miniscreen, magnesium and phosphate or per MD order
3. Fingerstick for blood glucose Q6h until controlled, then per MD order
4. Weekly triglycerides, LFT, Total Bili, & Direct Bili on Monday
5. If TPN is interrupted, hang $D_{10}W$ at the same rate for at least 6 hours to prevent hypoglycemia. $D_{10}W$ is not necessary upon discontinuation of PPN

GUIDELINES FOR PEDIATRIC PARENTERAL NUTRITION

(These guidelines assume normal renal/hepatic function and may not be applicable to all patients)
For assistance with parenteral nutrition, please consult Pediatric Dietitian or Pediatric Pharmacist

A. Indications for Parenteral Nutrition (PN):

Pediatric-aged patients who are candidates for PN are those requiring nonvolutional feeding who are either already malnourished or are at risk for developing malnutrition. PN is indicated only when oral or enteral nutrition (EN) will not be expected to meet nutritional needs alone within 5 days. Indications for PN include surgical GI disorders, intractable diarrhea of infancy, short bowel syndrome, inflammatory bowel disease, intractable chylothorax, cystic fibrosis or intensive cancer treatment.

B. Baseline Fluid Requirements:

Body Weight	Baseline Fluid Requirements per Day (ml/kg)
2.5-10 kg	100 mL/kg
11-20 kg	1000 mL + 50 mL/kg for each kg > 10 kg
>20 kg	1500 mL + 20 mL/kg for each kg > 20 kg

When calculating fluid volume for TPN, take into account the fluid administered via medication and maintenance infusions.

C. Estimation of Nutritional Requirements:

Calorie Requirements RDA*

Category	Age (yr)	kcal/kg
Infants	0-0.5	108
	0.5-1	98
Children	1-3	102
	4-6	90
	7-10	70
Males	11-14	55
	15-18	45
Females	11-14	47
	15-18	40

*RDA recommendations apply to energy needs of normal, healthy growing children. In children who are critically ill, activity and growth may account for little of the daily energy requirement, therefore RDA may overestimate caloric needs.

D. Amino Acid (AA) (4 kcal/gm):

1. Determine protein needs:
   - 31 day- 1 year old: 2-2.5 g/kg/day
   - Children: 1.5-2 g/kg/day
   - Adolescents: 0.8-2 g/kg/day

2. General Guideline for Initiation and Advancement:

Age	Initial	Daily Increase	Maximum
Term to 1 year	1-1.5 g/kg/day	1 g/kg/day	2.5-3 g/kg/day
1 year to 10 years	1-1.5 g/kg/day	1 g/kg/day	2-2.5 g/kg/day
>10 years	1-1.5 g/kg/day	1 g/kg/day	1.5-2 g/kg/day

3. Trophamine (10% stock solution) will be used to formulate TPN solutions for infants (<1 year of age). Cysteine 40mg/gram AA may be included in pediatric TPN to increase the Ca/Phos solubility per pharmacy protocol. All other pediatric patients will receive standard AA solution prepared with a 15% stock solution.

E. Carbohydrates (Dextrose) (3.4 kcal/gm):

1. Peripheral: Maximum recommended dextrose concentration is 100 gm/liter
2. Central: Initiate with dextrose at 4-6 mg/kg/min. and increase in increments of 2-4 mg/kg/min each day as tolerated. Dextrose infusions should not exceed the following rates:

Maximum Glucose Oxidation Rates:	
Infant	12 mg/kg/min
Children	10 mg/kg/min
Adolescent	6 mg/kg/min

*Excess carbohydrate administration has been associated with hyperglycemia, cholestasis, hepatic steatosis and increased CO_2 production.

F. Lipid Emulsion: (20% =2 kcal/ml)

1. Lipid emulsions are isotonic and can be administered via peripheral or central vein.
2. Lipid intake should be reduced or avoided if serum triglycerides >200 mg/dL during the time lipids are not infusing.
3. Lipid intake should provide at least 0.5-1 g/kg/day to prevent essential fatty acid deficiency.

G. Electrolytes/Acid-Base:

1. Calcium and phosphate have limited solubilities in PN solutions. In general, the product of calcium (mEq/L) times phosphate (mmol/L) should not exceed 300 when the amino acid concentration is < 4% to avoid the formation of a precipitate. Contact the IV room pharmacist for information regarding the solubility of a specific TPN solution.
2. Sodium and potassium can be included in a TPN solution as either an acetate or chloride salt. Acetate functions as a precursor to bicarbonate. When metabolic acidosis is present, Na or K can be provided predominantly as the acetate salt.

H. Vitamins:

1. Pediatric multivitamin formulations will be added to TPN for children up to 11 years of age per pharmacy protocol. Children 11 years and older will receive the adult multivitamin formulation.
2. Each 5 mL of pediatric multivitamin contains:

Vit A (retinol)	2300 IU	Vit D_3	400 IU
Vit E (dl-α tocopherol)	7 IU	Vit C (ascorbic acid)	80 mg
Vit B_1 (thiamine)	1.2 mg	Vit B_2 (riboflavin)	1.4 mg
Vit B_6 (pyridoxine)	1 mg	Vit B_{12} (cyanocobalamin)	1 mcg
Niacinamide	17 mg	Folic acid	140 mcg
Pantothenic Acid	5 mg	Biotin	20 mcg
Vitamin K	200 mcg		

I. Trace Elements:

1. Trace elements will be added per pharmacy protocol based on age specific requirements. Please consult pharmacy for further details.
2. Patients experiencing significant gastrointestinal loss from the small bowel (i.e., ileostomy output) may require increased zinc supplementation.
3. Manganese and copper are eliminated via biliary tract. If the "Cholestasis" box is checked, manganese and copper will be omitted from TPN.

J. Peripheral Parenteral Nutrition (PPN):

1. Total calorie and protein requirements may not be met in all patients by PPN due to the osmolarity and volume considerations. **Due to increased risk of phlebitis, PPN should not exceed a 10 day duration**
2. The osmolarity of PPN solutions should not exceed 900 mOsm/L. The osmolality of the PPN solution can be estimated by the following equation:
   PPN Osmolarity (mOsm/L)=
   (grams of dextrose/L X 5) + (grams of AA/L X 10) + (mEq cations/L X 2)

K. Insulin:

For patients with glucose levels persistently >200 mg/dl, 0.1 units of regular insulin per gram dextrose may be added to PN solution (e.g. 20 units insulin per 200gm dextrose). If glucose levels are persistently >200 mg/dl, the PN insulin may be increased by 0.05 units of regular insulin per gram dextrose up to 0.2 units of insulin per gram of dextrose (eg. 40 units/L of 20% dextrose). If glucose remains above 200 mg/dl despite insulin coverage of PN solution and sliding scale with regular insulin, initiation of a separate insulin infusion may be helpful in achieving adequate glycemic control.

Blood Glucose Goal: 100 – 150 mg/dl

L. Additives:

Ranitidine: 2-4 mg/kg in PN solution q 24 hours
Renal dose: CLcr < 50ml/min give 75% normal dose
CLcr < 10 ml/min give 50% normal dose

PO/IV H_2 antagonists will be automatically discontinued by pharmacy if IV ranitidine is added to the TPN solution.

M. Cycling of TPN:

Cycling is a method of reducing the duration of PN infusion to a shorter interval. If home TPN is planned, cycling should begin 4 days prior to discharge. Please contact Pediatric Dietitian or Pharm.D. for assistance with cycling schedules.