NICU Nutrition Pathway
Safely Infusing NICU TPN Starter and Custom TPN
April 17th 2018

Pharmacists:
Paul Kasprzak RPH BCPS
Kelly Kopec PharmD
Major Practice Changes in the Preparation and Administration of Custom TPN and TPN Starter

1. New TPN Starter Protocol
   - Day of life one only, infants 1500 grams and less
   - “Concentrated” Starter TPN + Lipid + D5W are co-infused
   - Consistently provides goal protein (3gm/kg/day)

2. Practice of “Concentrating” Custom TPN
   - Volume of enteral feeding and volume of continuous infusions are subtracted from total daily fluid allowance to equal volume of TPN prepared
   - Optimizes parenteral nutrition provided to the neonate
New NICU TPN Starter Protocol

• Indication
  – TPN Starter Protocol is indicated for neonates less than or equal to 1500 grams on day one of life only
  – Infants greater than 1500 grams will receive plain D10W +/- Calcium if IV fluids are needed.

• Reason for change
  – To consistently provide goal protein (3gm/kg/day)

• Caution – the new TPN Starter bag is highly concentrated:
  – Infusion rate of TPN Starter must never be increased from originally prescribed rate of 50 mL/kg/day (2.1 mL/kg/hr)
  – Must co-infuse with IV Fat emulsion and Dextrose infusion
New NICU TPN Starter Protocol
(Indicated on Day of life 1 for neonates < or = 1500 grams)

- **TPN Starter Protocol consists of three orders that are co-infused.**

1. **TPN Starter bag** (Dextrose 10% / Trophamine 6% / Calcium Gluconate 2.33 mEq / Heparin 125 unit/250 mL)
   - **Rate:** 2.1 mL/kg/hr (50mL/kg/day)
   - This is a **highly concentrated** starter bag. The infusion rate must **NOT** exceed 2.1 mL/kg/hr (50mL/kg/day).

2. **Fat emulsion 20%**
   - **Rate:** 0.21 mL/kg/hr (1gm/kg/day = 5mL/kg/day)

3. **Dextrose 5%**
   - **Rate:** Infuse at rate to achieve total fluid allowance goal
Ordering the NICU TPN Starter Protocol

• Provider will order in powerchart via the “NICU TPN Starter PowerPlan AHC”
  – The appropriate dose and infusion rate of the TPN Starter and fat emulsion will auto populate
  – *Patient’s weight must be entered in care connection by the nurse or in the orders by the physician for the TPN starter and fat emulsion order fields to auto populate*

1. Dextrose 10% / Trophamine 6% / Calcium Gluconate 2.33 mEq/ Heparin 125 unit/250 ml
   Rate: 2.1 mL/kg/hr
2. Fat emulsion 20%, Dose: 5mL/kg, Rate: 0.21mL/kg/hr
3. Dextrose 5%, Dose field empty,
   Comment on order: Infuse at rate to achieve total fluid allowance goal

Infusion rate of D5W must be calculated & entered by provider
Calculation of Infusion Rate for D5W

- Provider, Rn and Pharmacist must ensure correct infusion rate for TPN Starter, Fat emulsion, and Dextrose 5% (D5W).
- Dextrose 5% infusion rate = Total daily fluid allowance – TPN Starter – Fats – IV continuous infusions

**Calculation to determine rate of Dextrose 5% to be co-infused with Starter TPN:**
- Total fluid allowance ______mL/kg/day divided by 24 = ______mL/hr
- Starter bag: 2.1mL/kg/hr x ____kg = (-)______mL/hr
- Fat emulsion 20%: 0.21mL/kg/hr x ____kg = (-)______mL/hr
- Total infusions (ex:Art line, sedation, pressors in mL/hr) (-)______mL/hr
- Rate of Dextrose 5% (D5W) (=)______mL/hr
Question 1

• Question: What is the infusion rate of D5W for the following patient on TPN starter protocol?

• Weight 0.8 kg. TF 90mL/kg/day. Art line 0.5mL/hr, Fentanyl drip 0.23mL/hr.

• Total fluid allowance __mL/kg/D x ___kg ÷ 24hr = ______mL/hr

• Starter bag: 2.1 mL/kg/hr x ___kg = (-)______mL/hr

• Fat emulsion 20%: 0.21 mL/kg/hr x ___ kg = (-)______mL/hr

• Infusions (Art line ___mL/hr + Fent ___mL/hr)= (-)______mL/hr

• Rate of Dextrose 5% (D5W) (=)______mL/hr

• A) 1 mL/hr       B) 0.6 mL/hr       C) 0.4 mL/hr       D) 0.2 mL/hr
Question 1

- Correct: C) 0.4 mL/hr
- Question: What is the infusion rate of D5W for the following patient on TPN starter protocol?
- Weight 0.8 kg. TF 90mL/kg/day. Art line 0.5mL/hr, Fentanyl drip 0.23mL/hr.
- Total fluid allowance 90 mL/kg/D x 0.8 kg ÷ 24hr = 3 mL/hr
- Starter bag: 2.1 mL/kg/hr x 0.8 kg = (-) 1.7 mL/hr
- Fat emulsion 20%: 0.21mL/kg/hr x 0.8 kg = (-) 0.17 mL/hr
- Infusions (Art line 0.5 mL/hr + Fent 0.23 mL/hr): (-) 0.73 mL/hr
- Rate of Dextrose 5% (D5W) = 0.4 mL/hr

- A) 1 mL/hr   B) 0.6 mL/hr   C) 0.4 mL/hr   D) 0.2 mL/hr
Question 2

- Question: The provider places an order to increase total fluids to 110 mL/kg/day. What is the new rate of the TPN Starter?

- Weight 0.8 kg. TF 110mL/kg/day. Art line 0.5mL/hr, Fentanyl drip 0.23mL/hr.

- Total fluid allowance ___mL/kg/D x ___kg ÷ 24hr = _____mL/hr

- Starter bag: 2.1 mL/kg/hr x ___kg = (-)_____mL/hr

- Fat emulsion 20%: 0.21 mL/kg/hr x ___ kg = (-)_____mL/hr

- Infusions (Art line ___mL/hr + Fent ___mL/hr)= (-)_____mL/hr

- Volume of Dextrose 5% (D5W) = (=)_____mL/hr

- A) 3.7 mL/hr       B) 2.4 mL/hr       C) 3 mL/hr       D) 1.7 mL/hr
Question 2

Correct answer: D) 1.7 mL/hr

The rate of the TPN Starter must never increase. It will never infuse faster than 2.1mL/kg/hr. The rate of D5W will increase to achieve the new total fluid goal.

• Question: The provider places an order to increase total fluid to 110 mL/kg/day. What is the new rate of the TPN Starter?
• Weight 0.8 kg. TF 110mL/kg/day. Art line 0.5mL/hr, Fentanyl drip 0.23mL/hr.
• Total fluid allowance 110 mL/kg/D x 0.8 kg ÷ 24hr = 3.7 mL/hr
• Starter bag: 2.1 mL/kg/hr x 0.8 kg = (-) 1.7 mL/hr
• Fat emulsion 20%: 0.21 mL/kg/hr x 0.8 kg = (-) 0.17 mL/hr
• Infusions (Art line 0.5 mL/hr + Fent 0.23 mL/hr): (-) 0.73 mL/hr
• Rate of Dextrose 5% (D5W) (=) 1.1 mL/hr

• A) 3.7 mL/hr  B) 2.4 mL/hr  C) 3 mL/hr  D) 1.7 mL/hr
Concentrating TPN

• “Concentrating” the TPN is the practice of subtracting the volume of enteral feeding, continuous infusions and fat emulsion from the total daily fluid allowance to calculate the volume of the TPN.

• This practice will be necessary in order to accurately follow the new feeding guideline in the NICU nutrition pathway.
“Concentrating TPN” - Calculation of Custom TPN Volume

• “Custom” TPN is ordered daily on the Neonatal TPN order form and is tailored to the individual needs of each patient.

• The prepared volume and rate of infusion of the custom TPN will be determined by the patients total fluid intake for 24 hrs minus enteral feedings, the lipid infusion and any other continuous infusions.

• IMPORTANT: The rate of the custom TPN must NEVER exceed the originally prescribed rate. If needed, dextrose (D5,D10) will be co-infused to achieve the total fluid goal.
Custom TPN Calculations

- Total Daily Fluid Intake ______ml/kg/day x ______kg = _____ml
- 24h Non – TPN IV Infusions ______ + ______ +______ (–) _____ml /24hs
- Enteral RX: ______________ at __________ ml q __________hrs (–) _____ml
- Parenteral Nutrition Allowance (=) _____ml.
- Fat Emulsion 20% ____ gm/kg x____ kg = _____ gm x 5 ml/gm (=) _____ml
to infuse over 24 hr = _____ml/hr
- TPN Volume/24 hours (parenteral nutrition allowance – intralipid volume) _____ml
to infuse over 24 hrs = _____ ml/hr
Calculating Custom TPN
Patient Case #1

• Using the following patient case, a Custom TPN volume and rate will be calculated

• Patient BC
• Weight 0.9 kg
• Daily total fluid intake 140 ml/kg/day
• Intralipids are 2 gm/kg/day
• Feeding is donor breast milk at 3 ml Q 3hrs
• Dopamine drip infusing at 0.2 ml/hr (3 mcg/kg/min)
Calculations

wt: 0.9kg, TF: 140 ml/kg/day, fats: 2gm/kg/day, enteral feed: 3ml q3h, dopamine 0.2ml/hr

Total Daily Fluid Intake 140 ml/kg/day * 0.9 kg = 126 ml

24h Non – TPN IV Infusions dopamine 4.8 ml + ____ + ____ (-) 4.8 ml /24hs

Enteral RX: donor breast milk at 3 ml q 3 hrs (-) 24 ml

126 ml – 4.8 ml – 24 ml = 97.2 ml PNA

Parenteral Nutrition Allowance (=) 97.2 ml

Fat Emulsion 20% 2 gm/kg * 0.9 kg = 1.8 gm * 5 ml/gm (=) 9 ml to infuse over 24 hr = 0.38 ml/hr

97.2 ml PNA – 9 ml lipids = 88.2 ml TPN volume

TPN Volume/24 hours (parenteral nutrition allowance – intralipid volume) 88.2 ml to infuse over 24 hrs = 3.7 ml/hr
Calculating Custom TPN  
Patient Case #1

• The patient from case # 2 has become hypotensive. The dopamine drip has increased from 0.2 ml/hr to 0.4 ml/hr.
• The patient has also been made NPO
• How will the change in fluids be managed when a custom TPN is infusing?
  • Patient BC
  • Weight 0.9 kg
  • Daily total fluid intake 140 ml/kg/day
  • Intralipids are 2 gm/kg/day
  • Feeding is donor breast milk at 3 ml Q 3hrs — Patient is now NPO
  • Dopamine Drip infusing at 0.2 ml/hr (3 mcg/kg/min) — Dopamine drip 0.4 ml/hr
Calculating Custom TPN
Patient Case #1

• If the patient is made NPO, the loss in fluids per day is 24 ml or 1 ml/hr
• The increase in dopamine provides the patient an additional 0.2 ml/hr
• An additional fluid must be piggybacked into the TPN at 0.8 ml/hr to maintain a total fluids per day of 140 ml/kg
• The Custom TPN rate cannot be increased to add additional fluids
  – The fluid can be dextrose 5% or 10% depending on the patient’s glucose requirements

Total fluids = 140 ml x 0.9 kg = 126 ml
126 ml – dopamine 9.6 ml/24hrs – intralipid 9 ml/24hrs – TPN of 88.2 ml/24 hrs = 19.2 ml
19.2 ml divided by 24 hrs = 0.8 ml/hr additional fluid required

Total fluids = 140 ml x 0.9 kg = 126 ml divided by 24 = 5.3 ml/hr
5.3 ml/hr – dopamine 0.4 ml/hr – intralipid 0.38 ml/hr – TPN of 3.7 ml/hr =
= 0.8 ml/hr additional fluid required
Calculations

wt: 0.9kg, TF: 140 ml/kg/day, fats: 2gm/kg/day, enteral feed: now npo, dopamine increased to 0.4ml/hr

- The Custom TPN rate cannot be increased to add additional fluids
  - The additional fluid will be dextrose (5%, 10%, or possibly higher depending on the patients glucose requirements).

- Total fluid allowance 140 mL/kg/hr x 0.9kg ÷ 24hr = 5.25 mL/hr
- Custom TPN: 3.7 mL/hr (TPN rate will NOT change) = (-) 3.7 mL/hr
- Fat emulsion 20%: = 2gm/0.9kg x 5ml/gm = 9ml ÷ 24hr = (-) 0.38 mL/hr
- Dopamine increased to 0.4ml/hr (-) 0.4 mL/hr
- Enteral feeds: NPO 0 ml/hr
- Rate of additional fluid (D5W or D10W) (=) 0.77 mL/hr = 0.8ml/hr
Conclusion

• Take home message

• The infusion rate of the TPN starter or the custom TPN will never exceed the originally prescribed hourly rate

• If additional fluids are needed, a dextrose infusion will be co-infused with the custom TPN or TPN starter to achieve the total fluid allowance goal.