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Case Report of Parenteral Nutrition



HISTORY TIMELINES

February 2011

1° hospitalization

5-12 October
2012

2° hospitalization

20 Oct - 8 Nov
2012

3° hospitalization

26 October:

- 1° nutritional consultation

30 October:

- 2° nutritional consultation

January 2015

4° hospitalization

OKI, a 7-year-old, FS, Burmese

HISTORY:

5-12 October 2012

+ **ACUTE RENAL FAILURE** (CRE 16.1 – BUN 259 – Phos 14.5) with partial right ureteral obstruction

- Treated medically which resolved

19 October 2012

+ **ANOREXIC** over the weekend

- Enteral feeding 5Fr nasoesophageal tube placed (CliniCare Liquid Diet 170 ml)

+ **VOMITING**

+ Further enlargement of the right renal pelvis and no movement of the mineralized ureterolith

- Ureteral STENT placement

20 October - 8 November 2012

- SURGERY: mineralized ureteral plug in a circumcaval ureter was found



Severe GASTRIC STASIS (unresponsive to motility enhancements)

--HEMATOLOGY--		--CHEMISTRY--		---SA ICU---	
Rbc (5.9-9.9 mcL)	4.13	PHOSPHORUS (2.4-8.2 mg/dL)	3.0	HEMOGLOBIN (9.3-15.9 g/dL)	5.5
Hb (9.3-15.9 g/dL)	6.2	CALCIUM (8.2-10.8 mg/dL)	8.3	pH (7.24-7.4)	7.379
Hct (29-48%)	17.3	BUN (14-36 mg/dL)	19	pCO2 (40-45 mmHg)	39.4
Mcv (37-61fL)	41.9	CREATININE (0.6-2.4 mg/dL)	1.2	pO2	35.5
Mch (11-21 pg)	15.0	TOTAL PROTEIN (5.2-8.8 gm/dL)	5.4	HCO3- (19-24 mEq/L)	22.7
Mchc (30-38 g/dL)	35.8	ALBUMIN (2.5-3.9 g/L)	2.1	CO2 TOTAL (12-30 mmol/L)	23.9
Rdw (14- 31%)	17.5	GLOBULIN (2.3-5.3 g/dL)	3.3	BASE DEFICIT/BASE EXCESS	-1.7
Wbc (3.5-16.0 x10 ³ /μL)	14240	ALT (10-100 u/L)	47	SODIUM (145-158 mmol/L)	152
%bands (0-3)	22	AST (10-100 u/L)	62	POTASSIUM (3.4-5.6 mmol/L)	4.1
%bands COMMENT	SL TOX	ALP (6-102 u/L)	28	CALCIUM (IONIZED)	1.24
%neut (35-75)	72	GGT (1-10 u/L)	2	CHLORIDE (104-128 mmol/L)	111
%neut COMMENT	SL TOX	CHOLESTEROL (75-220 mg/dL)	129	GLUCOSE (64-170 mg/dL)	224
%lymph (20-45)	5	BILIRUBIN TOTAL (0.1-0.4 mg/dL)	0.4	LACTATE	0.8
%mono (1-4)	1				
%eosin					
%baso (0-1)					
Plt (200-500 x10 ³ /μL)	460000				
Mpv	19.5				




persistent VOMITING and GASTRIC FLUID ACCUMULATION

with ENTERAL FEEDING (CliniCare liquid diet)

1st NUTRITIONAL CONSULTATION (26 October)

- **Body Weight:** 3.3 Kg **BCS:** 4/9
- **Treatments:** intravenous fluids, analgesia, antibiotics and prokinetics.
- Cardiovascularly stable
- Hyperglycemia and hypoalbuminemia; Lipemia to serum

Reason: OKI tolerated only 120 ml of CliniCare Liquid Diet per Day (120 Kcal/day < RER)  Inadequate nutritional support for 5 days post-surgery (NE-Tube) + 2 days before hospitalization

Custom Central Parenteral Nutrition (CPN) formulation?

Goal: meet her RER; higher protein content and less fat

Calculations for Parenteral Formulation

Resting Energy Requirement (RER) = $70 \times (3.3)^{0.75} = 171 \text{ Kcal/day (715 kJ/day)}$

1. Protein Requirement:

$8 \text{ g} : 100 \text{ kcal} = X : 171 = 15.39 \text{ g (61.56 Kcal, 36\% ME)}$

10% amino acid solution = 0.1 g protein/ml

$15.39 \text{ g} : X = 0.1 \text{ g} : 1 \text{ ml} = 153.9 \text{ ml}$

2. Non Protein calories:

$171 \text{ (RER)} - 61.56 \text{ (kcal Protein)} = 109.4 \text{ Kcal (457.7 kJ)}$

Ratio 55: 45 $60.17 \text{ kcal (251.7 kJ)} : 49.23 \text{ kcal (205.97 kJ)}$

3. Lipid solution (20% = 2 kcal/ ml)

$60.17 \text{ kcal} : X = 2 \text{ kcal} : 1 \text{ ml} = 30 \text{ ml (35\% ME)}$

4. Dextrose solution (70% = 2.38 kcal/ml)

$49.23 \text{ kcal} : X = 2.38 \text{ kcal} : 1 \text{ ml} = 20.6 \text{ ml (29\% ME)}$

Calculations for Parenteral Formulation

5. Calculate Volume of Vitamin-B Complex

REQUIREMENTS (Perea, 2012)

Thiamin 0.29 mg/1000 kcal solution	0.049mg /171 kcal (715 kJ)
Riboflavin 0.63 mg/1000 kcal solution	0.10 mg/ 171 kcal
Niacin 3.3 mg/1000 kcal solution	0.56 mg/ 171 kcal
Pantothenic Acid 2.9 mg/1000 kcal solution	0.49 mg/171 kcal
Pyridoxine 0.29 mg/1000 kcal solution	0.049 mg/171 kcal
Cyanocobalamin 6.0 mcg/1000 kcal solution	0.001mg/171 kcal

Thiamin 0.049 mg : x = 12.5 mg : 1 ml	= 0.004 ml
Riboflavin 0.10 mg : x = 2 mg : 1 ml	= 0.05 ml
Niacin 0.56 mg : x = 12.5 mg : 1 ml	= 0.04 ml
Pantothenic Acid 0.49 mg: x = 5 mg: 1 ml	= 0.098 ml
Pyridoxine 0.049 mg : x = 5 mg: 1 ml	= 0.0098 ml
Cyanocobalamin 0.001mg: x = 0.005 mg: 1 ml	= 0.2 ml

Dietary Minimum Requirement of Vitamin-B Complex = 0.4 ml/204 ml CPN

1ml Vitamin B Complex /100 kcal PN solution (NRC 2006) = 1.7 ml/day

Calculations for Parenteral Formulation

6. Total Volume and Osmolarity

0.154 L of 10% Amino acid solution x 998 mOsm/L = 153.69 mOsmol

0.03 L of 20% Lipid solution x 260 mOsm/L = 7.8 mOsmol

0.02 L of 70% Dextrose solution x 3640 mOsmol/L = 72.80 mOsmol

0.0015 L of B-Vitamin complex x 382 mOsmol/L = 0.573 mOsmol

204 ml TOTAL VOLUME

234.8 TOTAL mOsmol

The total solution osmolarity : 1138 mOsm/L

7. Determinate volume of Crystalloid solution (for daily fluid requirement):

70 ml/kg x 3.3 kg = 231 ml/day

231 ml – 204 ml (PN) = **27 ml of Lactated Ringer's solution**

1° Formulation Central Parenteral Nutrition (CPN)

INGREDIENT	RER	AMOUNT	Energy
CPN	50%	102 ml/24h or 4 ml/h	85.5 Kcal (357 kJ)
	75%	152 ml/24h or 6 ml/h	128 Kcal (535 kJ)
	100%	204 ml/24 h or 8.5 ml/h	171 Kcal (715 kJ)
Vitamin B Complex	100%	1.7 ml/204 ml CPN	
Lactated Ringer's solution	100%	27 ml/24h or 1.1ml/h	

The CPN provided 0.83 kcal/ml (3.47 kJ/ml), with 36% protein, 35% fat, and 29% carbohydrate on a metabolizable energy (ME) basis.

To be more conservative due to the current hyperglycemia, start at 50% RER and increase in 25% increments every 24 hours, as tolerated.

MONITORING Guidelines

- **Body weight (kg):** every 12 hrs
- **TPR** (including thoracic auscultation): every 6 hrs for the first 3 days
- **Serum magnesium, potassium and phosphorous:** every 12 hrs until full rate, then every 24 hrs
- **Triglycerides:** every 12 hrs if lipemic serum is present
- **BUN, CREA, albumin and PT:** every 24 hrs for the first 3 days
- **PCV & TS and lipemic serum index:** every 24 hrs for the first 3 days
- **Blood and Urine Glucose (BG):** every 4 hrs until full goal rate
 - **BG <250 mg/dL:** Increase the rate towards the goal rate. Hold present infusion rate if administering at goal rate.
 - **BG=250-300 mg/dL:** If during the weaning on period, hold present infusion rate. If administering at goal rate and BG level continues over 2 consecutive measurements at 4 hrs intervals or if the urine glucose analysis is >1+, consider insulin administration, decrease rate by 25% or decrease dextrose content of solution.
 - **BG >300 mg/dL** consider insulin administration (1 unit/10 g dextrose), decrease rate by 25% or decrease dextrose content of solution.



AZOTEMIA increased (BUN 41 mg/dL and CREA 1.8 mg/dL)

+ Potassium (2.1 mEq/L) and Phosphorus decreased (0.45 mmol/L)

- SERUM LIPEMIA and HYPERGLYCEMIA improved (GLU: 175 mg/dL)
- No vomitus or nausea
- Other parameters within normal ranges

2ND NUTRITIONAL CONSULTATION (30 October)

Custom CPN + Enteral feeding?

Body Weight: 3.3 Kg BCS: 4/9

Goal: supplementation of potassium and phosphorous; decrease protein; transition from CPN to enteral feedings

Determine Volume of Potassium

Severe hypokalemia = 2.1 mEq/L (normal range of 3.5 to 5.5 mEq/L)



start with **40 or more mEq potassium/L**

mEq K⁺ final concentration in PN = 0.04 mEq K⁺ desired x 204 total
macronutrients volume **= 8.16 mEq**

K⁺ from Lactated Ringer's solution = 27 ml x 4 mEq/L **= 0.10 mEq**

8.16 mEq – 0.10 mEq = 8 mEq

Volume KPO₄ = 8 : x = 4.4 mEq : 1 ml **= 1.8 ml /day**

Calculate Total Phosphorus

1.8 ml KPO₄ X 3 mM P/ml = 5.4 mM phosphorus /day

Start CPN at 100% RER and decreased as enteral feedings are increased

INGREDIENT	RER	AMOUNT	Energy
CPN	25%	51 ml/24h or 2 ml/h	42.3 Kcal (176,9 kJ)
	50%	102 ml/24h or 4 ml/h	85.5 Kcal (357 kJ)
	75%	152 ml/24h or 6 ml/h	128 Kcal (535 kJ)
	100%	204 ml/24 h or 8.5 ml/h	171 Kcal (715 kJ)
Vitamin B Complex	100%	1.7 ml/204 ml CPN	
Potassium phosphate	100%	1.8 ml to 204 ml CPN	
CliniCare Canine/Feline Liquid Diet	25%	42.7 ml/24 h or 1.7 ml/h	42.7 Kcal (178 kJ)
	50%	89 ml/24 h or 4ml/h	89 Kcal (372 kJ)
	75%	130 ml/24 h or 5ml/h	130 Kcal (543 kJ)
	100%	171 ml/ 24 h or 7ml/h	171 Kcal (715 kJ)

CLINICARE® Canine/Feline Liquid Diet

Calorie Content (ME calculated): 1 kcal/mL (4,2 kJ/mL) ; 1023 kcal/kg (4280 kJ/kg)

Calorie Distribution: protein 30%; fat 45%; carbohydrate 25%

Transition from CPN to ENTERAL FEEDING

CPN FORMULA + CLINICARE DOG/CAT LIQUID DIET

TIME	INGREDIENT	RER	AMOUNT	Energy
1° DAY	CPN	75%	152 ml/24h or 6 ml/h	128 Kcal (535 kJ)
	CliniCare Canine/ Feline Liquid Diet	25%	42.7 ml/24 h or 1.7 ml/ h	43 Kcal (178 kJ)
2° DAY	CPN	50%	102 ml/24h or 4 ml/h	85 Kcal (357 kJ)
	CliniCare Canine/ Feline Liquid Diet	50%	89 ml/24 h or 4ml/h	89 Kcal (372 kJ)
3° DAY	CPN	25%	51 ml/24h or 2 ml/h	42 Kcal (176,9 kJ)
	CliniCare Canine/ Feline Liquid Diet	75%	130 ml/24 h or 5ml/h	130 Kcal (543 kJ)
4° DAY	CliniCare Canine/ Feline Liquid Diet	100%	171 ml/ 24 h or 7ml/h	171 Kcal (715 kJ)

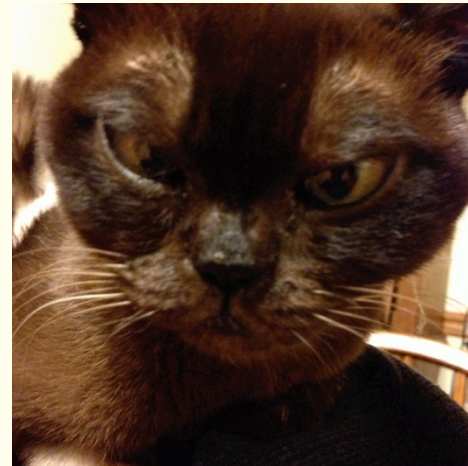
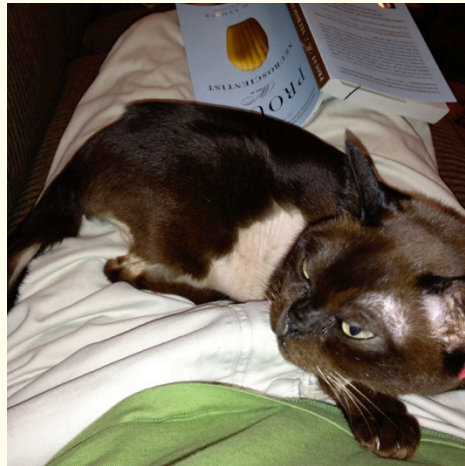
Follow-Up

- OKI showed significant **improvement in her metabolic state**, but unfortunately, **her clinical condition improved only marginally**
- Oki required **enteral feeding via E-tube for 3 years**, until she was **10 years old**
- On 1st January 2015, Oki was presented for recent onset lethargy, vomiting, and a cervical abscess associated with her E-tube.
- She was **euthanized** on January 9th, 2015 due to concerns over quality of life, and lack of therapeutic response. NECROPSY results reveal **pyothorax, subcutaneous abscess/cellulitis, and E-tube abscess**.

--CHEMISTRY--	
PHOSPHORUS (2.4-8.2 mg/dL)	4.1
CALCIUM (8.2-10.8 mg/dL)	9.2
BUN (14-36 mg/dL)	20
CREATININE (0.6-2.4 mg/dL)	1
TOTAL PROTEIN (5.2-8.8 gm/dL)	5.9
ALBUMIN (2.5-3.9 g/L)	2.9
GLOBULIN (2.3-5.3 g/dL)	3.0
ALT (10-100 u/L)	98
AST (10-100 u/L)	26
ALP (6-102 u/L)	47
GGT (1-10 u/L)	1
CHOLESTEROL (75-220 mg/dL)	161
BILIRUBIN TOTAL (0.1-0.4 mg/dL)	0.2
SODIUM (145-158 mmol/L)	152
POTASSIUM (3.4-5.6 mmol/L)	3.9
GLUCOSE (64-170 mg/dL)	160

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THANK YOU FOR YOUR ATTENTION