# REFEEDING SYNDROME THROUGH THE LIFECYCLE

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## DISCLOSURES

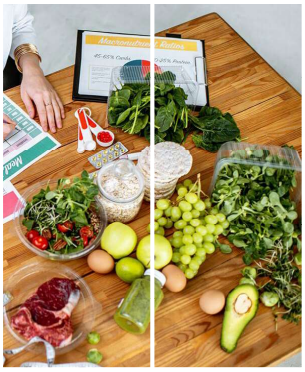
There are no relevant financial relationship(s) with ineligible companies for anyone who was in control of the content of this activity.

## LEARNING OBJECTIVES

- The audience will be able to
  - Identify patients at risk for refeeding syndrome
  - Provide feeding advancement plan for a patient at risk for refeeding syndrome
  - Recommend appropriate monitoring for a patient at risk for refeeding syndrome

## OUTLINE

- Introduction
  - Background and definition
  - Metabolic pathway
- Identify patients at risk for refeeding
- Determine feeding plan and advancement
- Monitoring and Evaluation
- Case studies
  - Adult
  - Pediatric



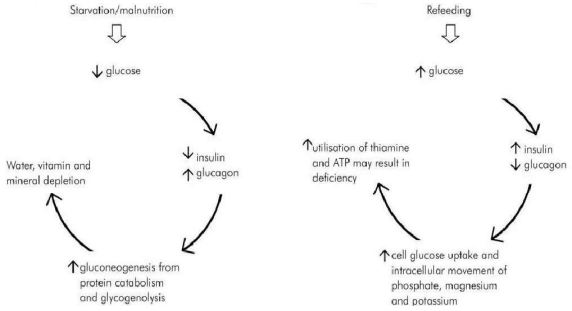
## DEFINING REFEEDING SYNDROME[1,3,12]

- A widely accepted hallmark of refeeding syndrome is development of hypophosphatemia within 72 hours of nutrition support intervention
- According to ASPEN, the diagnosing criteria of refeeding syndrome is (all met within 5 days of resuming energy supply):
  - Mild: 10-20% drop in serum phosphate, potassium, and/or magnesium
  - Moderate: 20-30% drop in serum phosphate, potassium, and/or magnesium
  - Severe: >30% drop in serum phosphate, potassium, and/or magnesium AND/OR thiamin deficiency AND/OR presence of severe organ dysfunction
- Data in pediatric population is less widely available than the adult population

## PROCESS OF REFEEDING SYNDROME[1,2,3,4]

- Acute metabolic disturbance occurring when patients are refed at or near their goal nutrition prescription after a time of prolonged fasting and/or inadequate nutrition provision
- The body transitions from a catabolic state to an anabolic state causing rapid shifts of both intracellular and extracellular electrolytes
- These shifts increase the intracellular demand for phosphorus, potassium, magnesium, and thiamin
- Results in low serum levels of:
  - Phosphorus
  - Magnesium
  - Potassium
  - Thiamin
- Can result in life threatening complications

## BASIC METABOLIC PATHWAY




Reprinted from Crook et al (2001) The importance of the refeeding syndrome. Nutrition, 17, 632-637, with permission from Elsevier.

## COMPLICATIONS FROM REFEEDING SYNDROME[5]

| Hypophosphatemia (can result in death) | Hypokalemia (can result in death) | Hypomagnesemia (can result in death) | Thiamin Deficiency (can result in death) | Sodium Retention | Hyperglycemia |
|---|---|---|---|---|---|
| Cardiac: hypotension, decreased stroke volume | Cardiac: arrythmias | Cardiac: arrythmias | Encephalopathy, lactic acidosis | Fluid overload, pulmonary edema, cardiac compromise | Cardiac: hypotension |
| Respiratory: impaired diaphragm contractility, dyspnea, respiratory failure | Respiratory failure | Neurologic: weakness, tremor, tetany, seizures, AMS, coma | | | Respiratory: hypercapnea, respiratory failure |
| Neurologic: paresthesia, weakness, confusion, disorientation, lethargy, areflexic paralysis, seizures, coma | Neurologic: weakness, paralysis<br>Muscular: rhabdomyolysis, muscle necrosis | GI: nausea, vomiting, diarrhea | | | Other: ketoacidosis, coma, impaired immune function |
| Hematologic: leukocyte dysfunction, hemolysis, thrombocytopenia | GI: nausea, vomiting, constipation | Other: refractory hypokalemia and hypocalcemia | | | |

## ASPEN CONSENSUS CRITERIA FOR ADULTS AT RISK FOR REFEEDING SYNDROME[4]

| | Moderate Risk (need 2 criteria) | Severe Risk (need 1 criteria) |
|---|---|---|
| BMI | 16 to 18.5 | <16 |
| Weight loss | 5% in 1 month | 7.5% in 3 months or >10% in 6 months |
| Energy Intake | None/negligible for 6 days OR <75% for >7 days OR <75% for >1 month | None/negligible for 7 days OR <50% for >5 days with illness OR <50% for >1 month |
| Prefeeding serum K, Phos, Mg | Minimally low of nl requiring minimal or single dose supplementation | Moderately to significantly low requiring multiple dose supplementation |
| Subcutaneous fat loss | Moderate loss | Severe loss |
| Skeletal muscle mass loss | Low to moderate loss | Severe loss |
| High risk comorbidities | Moderate disease | Severe disease |

## COMPARE WITH ADULT MALNUTRITION CRITERIA (ASPEN/AND)[8]

| | Chronic illness | | Acute illness | |
|---|---|---|---|---|
| Indicator | Moderate | Severe | Moderate | Severe |
| Energy intake | < 75% of energy needs for > 7 days | ≤ 50% of energy needs for ≥ 5 days | < 75% of energy needs for ≥ 1 month | ≤ 75% of energy needs for ≥ 1 month |
| Weight loss | 1–2% 1 week<br>5% 1 month<br>7.5% 3 months | > 2% 1 week<br>> 5% 1 month<br>> 7.5% 3 months | 5% 1 month<br>7.5% 3 months<br>10% 6 months<br>20% 1 year | > 5% 1 month<br>> 7.5% 3 months<br>> 10% 6 months<br>>20% 1 year |
| Loss of subcutaneous fat | Mild | Moderate | Mild | Severe |
| Muscle mass | Mild | Moderate | Mild | Severe |
| Fluid accumulation | Mild | Moderate to severe | Mild | Severe |
| Grip strength | N/A | Measurably reduced | N/A | Measurably reduced |

## RISK FACTORS FOR REFEEDING SYNDROME (ADULT)[4]

Acquired immunodeficiency syndrome
Chronic alcohol or drug use disorder
Dysphagia and esophageal dysmotility
Food insecurity and homelessness
Failure to thrive
Hyperemesis gravidarum with protracted vomiting
Major stressors or surgery without nutrition for prolonged periods of time
Advanced neurologic impairment with inability to communicate needs
Post bariatric surgery
Postoperative patients with complications
Prolonged fasting/eating disorders
Refugees
Protein malnourishment
Malabsorptive states
Cancer

Adapted from ASPEN Refeeding Consensus Statement 2020

## SCREENING IN PEDIATRIC REFEEDING SYNDROME[12]

- There are currently no recommended screening techniques as they have been found to be low sensitivity and could lead to a delay in reaching goal nutrition
- NICU population sees comparable electrolyte derangements
  - Specifically, the IUGR/SGA/VLBW groups
    - Lower muscle mass, glycogen stores, adipose tissue, bone mineralization, and Ca/Phos stores
  - Early and high doses of PN AA are common practice in these populations
  - Increase in incidence of neonates with severe hypophosphatemia and other electrolyte abnormalities within the first few days of life
  - Likely because the cells are in an early anabolic state, which increases uptake of Phos and K and releases Ca from bone tissue

## PEDIATRIC MALNUTRITION CRITERIA[6]

| Indicator (z score) | Age | Mild | Moderate | Severe |
|---|---|---|---|---|
| **BMI for age** | 2 - 20 yrs | -1 to -1.9 | -2 to -2.9 | -3 or less |
| **Weight for Length** | 1 mo - 2 yrs | -1 to -1.9 | -2 to -2.9 | -3 or less |
| **MUAC** | 6 mo – 19 yrs | -1 to -1.9 | -2 to -2.9 | -3 or less |
| **Height or Length** | 1 mo – 20 yrs | No data | No data | -3 or less |

## PEDIATRIC MALNUTRITION CRITERIA[6]

| Indicator | Age | Mild | Moderate | Severe |
|---|---|---|---|---|
| **Weight gain velocity** | 1 mo – 2 yrs | < 75% of norm for expected wt gain | 50 – 75% of norm | < 25% of norm |
| **Weight loss** | 2 – 20 yrs | 5% of usual body weight | 7.5% of usual body weight | 10% of usual body weight |
| **Deceleration in W for L/H Z-Score** | 1 mo – 20 yrs | ≥ 1 SD decline | ≥ 2 SD decline | ≥ 3 SD decline |
| **Inadequate nutrient intake** | 1 mo – 20 yrs | 51 - 75% estimated needs | 26 – 50% estimated needs | < 25% estimated needs |

## NEONATAL MALNUTRITION CRITERIA[7]

| Primary Indicators Requiring One Indicator | | | | |
|---|---|---|---|---|
| **Indicator** | **Mild Malnutrition** | **Moderate Malnutrition** | **Severe Malnutrition** | **Use of Indicator** |
| Decline in weight-for-age z score | Decline of 0.8-1.2 SD | Decline of ~1.2-2 SD | Decline of ~2 SD | Not appropriate for first 2 weeks of life |
| Weight gain velocity | <75% of expected rate of weight gain to maintain growth rate | <50% of expected rate of weight gain to maintain growth rate | <25% of expected rate of weight gain to maintain growth rate | Not appropriate for first 2 weeks of life |
| Nutrient intake | ≥3-5 consecutive days of protein/energy intake ≤75% of estimated needs | ≥5-7 consecutive days of protein/energy intake ≤75% of estimated needs | ≥7 consecutive days of protein/energy intake ≤75% of estimated needs | Preferred indicator during first 2 weeks of life |
| **Primary Indicators Requiring Two or More Indicators** | | | | |
| **Indicator** | **Mild Malnutrition** | **Moderate Malnutrition** | **Severe Malnutrition** | **Use of Indicator** |
| Days to regain birthweight | 15-18 | 19-21 | >21 | Use in conjunction with nutrient intake |
| Linear growth velocity | <75% of expected rate of linear gain to maintain expected growth rate | <50% of expected rate of linear gain to maintain expected growth rate | <25% of expected rate of linear gain to maintain expected growth rate | Not appropriate for first 2 weeks of life<br>May be deferred in critically ill, unstable infants<br>Use in conjunction with another indicator when accurate length measurement available |
| Decline in length-for-age z score | Decline of 0.8-1.2 SD | Decline of >1.2-2 SD | Decline of >2 SD | Not appropriate for first 2 weeks of life<br>May be deferred in critically ill, unstable infants<br>Use in conjunction with another indicator when accurate length measurement available |

## RISK FACTORS FOR REFEEDING SYNDROME (PEDIATRIC)[1,5]

- Inadequate nutrition for ~2 weeks
- Uncontrolled diabetes
- Cancer
- Anorexia nervosa
- Malabsorption (ex: IBD, CF, SBS, chronic pancreatitis)
- **Low birth weight**
- **Premature birth**
- Chronic infections (ex: HIV)
- <80% of ideal body weight
- Acute weight loss greater than 10% in the past 1-2 months (includes obese patients with excessive weight loss)
- Malnutrition
- **Neglected dependents**
- Post-operative patients (specifically bariatric surgery patients)
- Homeless/refugees

# DETERMINING FEEDING PLAN AND ADVANCEMENT

## ASPEN CONSENSUS RECOMMENDATIONS FOR AVOIDANCE/TREATMENT OF REFEEDING SYNDROME IN ADULTS[4]

| Aspect of Care | Recommendation |
|---|---|
| Energy | • 100 to150gm dextrose or 10 to 20kcal/kg dosing wt for initial 24hrs of parenteral nutrition (PN)<br>• Initial glucose infusion rate (GIR) should be ~2mg/kg/min dosing wt<br>• If IV fluids with dextrose have infused for several days prior to PN consider the effect of the total dextrose dose from these fluids on K/Mg/Phos.<br>• Example: D5 0.45NS at 100mL/hr = 120gm dextrose provided per day<br>• D/c any IV fluids with dextrose when PN initiated |
| Electrolytes | • Check K/Mg/Phos before PN initiation for baseline values.<br>• Replete K/Mg/Phos prior to PN initiation if indicated.<br>• If K/Mg/Phos are refractory to correction or drop by >50% of baseline once PN initiated decrease dextrose gms by 50%.<br>• Advance PN by 33% of goal every 24 to 48hrs once K/Mg/Phos are nl and stable |
| Thiamin | • 100mg thiamin IVPB **before** any dextrose containing fluids given.<br>• Add 100mg thiamin to PN for 5 to 7 days once PN initiated.<br>• Checking serum thiamin of no value |
| Multivitamins | • Add full dose of MVI to PN daily |

## THIAMIN (ADULT)[9,10,13]

- Systematic review of 177 hyperemesis gravidarum cases with Wernicke Korsakoff Syndrome (WKS)[1]
- WKS triad – oculomotor dysfunction, ataxia, altered mental status
  - **500mg thiamine IVPB q8hr until triad symptoms resolved**
    - usually requires at least 9 doses
  - Lower thiamine doses resulted in 64% progression to chronic cognitive dysfunction as Korsakoff syndrome.
- Monitor for lactic acidosis
- WKS most common occurrence at 10 to 15 wks gestation after ~7 wks of vomiting
- 50% fetal demise, 5% maternal mortality with WKS

## LACTIC ACIDOSIS AND THIAMIN

- 3 Types of lactic acidosis:
  - Serum lactate nl range 0.5 to 1mmoL/L
  - Type A – hypoperfusion/hypovolemia/hypoxia – responds to resuscitation
  - Type B – inability to metabolize lactate, drug interaction, thiamine deficiency – does not respond to resuscitation
  - Type D – malabsorption disorder where gut bacteria metabolize carbohydrates to D-lactic acid which is absorbed and elevates serum lactate
- Type B observed with refeeding/severe malnutrition
  - Prolonged NPO status/starvation
  - Limited access to nutrition/food insecurity
  - Inability to tolerate nutrition – protracted nausea/vomiting/diarrhea/chronic abdominal pain

## PREVENTION OF REFEEDING SYNDROME IN PEDIATRICS[3,12]

- Aim for an individualized approach with close monitoring and re-evaluation while refeeding the patient
- No current universal nutrition initiation and advancement process to prevent refeeding syndrome
  - Even in ED population, no clear consensus on advancement protocols
- Follow/adapt the ASPEN Consensus Recommendations
- For high-risk neonates: closely monitor serum phosphate and electrolyte levels during the first week of life

## ASPEN CONSENSUS RECOMMENDATIONS FOR PEDIATRIC PATIENTS AT RISK FOR REFEEDING SYNDROME[3]

1. 40-50% of nutrition goal while keeping GIR around 4-6 mg/kg/min (EN and PN dextrose goal)
2. Advance GIR by 1-2 mg/kg/min daily until you reach goal; keeping in mind age-appropriate maximum GIR
3. Consider dextrose containing IV fluids when creating your starting point. Patients tolerating D5 fluids for 2-3 days without electrolyte shifts might be able to tolerate a slightly higher starting point.
4. No recommended restriction for fluid, protein, or sodium
5. Give 2 mg/kg thiamin to a max of 100-200 mg/day before initiating nutrition support and ideally before dextrose containing IV fluids
6. Continue thiamin supplementation for 5-7 days or longer depending on severity
7. Give the standard PN MVI as long as medically appropriate. For EN fed patients give enteral MVI 1x/day x10 days or longer as medically appropriate
8. Replete electrolytes as needed; if electrolytes become difficult to manage or drop significantly while initiating feeds consider decreasing calorie provision/grams of dextrose given by 50% and then advance by ~33% every 1-2 days depending on individual progress

## MONITORING FOR THE HIGH-RISK PATIENT[3]

- Check serum potassium, magnesium, and phosphorus prior to starting nutrition support or dextrose containing fluids
- Monitor serum potassium, magnesium, and phosphorus q12h (or more often if medically appropriate) for the first 3 days in high-risk patients
- No evidence on the benefit of checking a thiamin level prior to supplementing during nutrition support initiation
- Recommend q4h vital signs for the first 24 hours after nutrition support initiation
- Daily weights
- Monitor strict I&O
- Monitor appropriateness of estimated needs as nutrition is advanced

## GLUCOSE INFUSION RATE (GIR)

- GIR predicts how quickly carbohydrates are delivered to the patient
- Calculate GIR using IBW or current body weight
- To calculate GIR (mg/kg/min):
  - $\frac{\text{IV Rate (mL/hr)} * \text{Dextrose Concentration (g/mL)} * 1000 \text{ (mg/g)}}{60 \text{ (mins/hr)} * \text{weight (kg)}}$

Example: D15% run @ 10 mL/hr in a 5 kg patient:

$$\frac{10\text{mL/hr} \times 0.15 * 1000}{60 * 5\text{ kg}} = 5 \text{ mg/kg/min}$$

- Shortcut to calculate GIR: % Dextrose (g/100mL * volume (mL/kg/d) / 1.44
  (1.44 = 1440 min/d / 1000 mg/g glucose)
- When increasing GIR, blood glucose should be monitored, and increases should be made progressively and slowly

## IV FLUID EXAMPLE

- Every 1 L of D5 has 50 g of dextrose (5% dextrose concentration)
- Example: If we initiate D5 @ 50 mL/hr (1200 mL/day) on a 15 kg 2-year-old
  - How many grams of dextrose are provided from IVFs?
    - 60 g dextrose/day
  - What is the GIR provided for this patient?
    - 2.8 mg/kg/min

## GLUCOSE INFUSION RATE IN ADULTS

- Estimates oxidation rate or utilization – minimum 2mg/kg/dosing wt
- If there has been dextrose exposure from maintenance intravenous fluids (MIVF) AND K/Phos/Mg are stable or repleted may consider up to 2.5mg/kg/min.
  - Calculated for PN initiation, not for maintenance intravenous fluids
- For dosing wt use admit wt if ≤ BMI 30, if admit wt > BMI 30 then use BMI =25 for dosing wt.
- Admit wt 96kg, Ht 165cm, BMI=35 so dosing wt is BMI = 25 or 68kg
- 2mg/kg/min x 68kg x 1440min/day divided by 1000mg/gm = ~196gm dextrose for dextrose initiation dose in PN.

# ADULT CASE STUDY

## PN IN GRAVIDARUM HYPEREMESIS CASE STUDY

27yr female 11weeks gestation admitted with persistent N/V x 5 weeks.

Refractory to antiemetic and nutrition therapies.

Oral intake has been small amounts of ginger tea, toast, crackers and applesauce as able to tolerate.

Hypotensive to 85/55 and tachycardic to 110 to 120 bpm.

Ht 165.1cm/65 inches

Pregravid wt 58kg BMI = 21.3

Current wt 52kg BMI =19.1

Wt loss >10% over 5 weeks

## NUTRITION ASSESSMENT FINDINGS

- Poor skin turgor
- Moderate skeletal muscle wasting: temporalis/trapezius
- Prominent acromion process, clavicle and ribs
- Moderate subcutaneous fat loss at triceps skinfold
- No oculomotor dysfunction
- Reports unstable gait at times over past week
- Admits to worsening "fog brain"

## NUTRITION ASSESSMENT FINDINGS

Serum Phos 2mg/dL (nl 2.5 to 4.5mg/dL, ≥3mg/dL for repletion)

Serum K 3.1meq/L (nl 3.5 to 5meq/L, ≥3.8meq/L for repletion)

Serum Mg 1.6mg/dL (nl 1.8 to 2.9mg/dL, ≥1.8mg/dL for repletion)

Ionized Ca 1.14mmoL/L (nl 1.12 to 1.31mmoL)

Serum Na 138

Serum lactate 2.8mmoL/L (nl 0.5 to 1mmoL/L)

## MALNUTRITION DIAGNOSIS STATEMENT

- Severe malnutrition as related to chronic inflammation as evidenced by:
  - ≤75% energy needs for ≥ one month,
  - >5% weight loss in one month,
  - Moderate skeletal muscle loss

## PHOSPHORUS REPLETION[11]

| Phos Range | Repletion Dose |
|---|---|
| <3.0 to 2.2 mg/dL | 0.32mmoL/kg dosing wt |
| <2.2 to 1.5 mg/dL | 0.64mmol/kg dosing wt |
| <1.5 mg/dL | 1.0mmol/kg dosing wt |

- Use K salt (KPhos) if K <4, use Na salt (NaPhos) if K =/>4
- For dosing wt calculations use actual wt if actual wt is < BMI 30
- If actual wt is >BMI 30 use a BMI of 25 as the dosing wt

## THERAPIES ORDERED

- D5 0.45NS at 75mL/hr (90gm dextrose) ordered after 2L NS bolus
  - 77meq Na and 50gm dextrose per liter
- 500mg thiamine IVPB q8hr x 9 doses
- Serum Phos/K/Mg q12hr
- Serum lactate daily x 3 days
- 15mmoL KPhos IVPB x 2 – also provides 40meq K
  - Dosing wt 52kg x 0.64mmoL Phos =31mmoL, use K salt with K <4
- 4gm Mg sulfate IVPB x 1
- Vascular Access Team consult for PICC placement
- Consult to RDN for parenteral nutrition script

## WRITING THE PARENTERAL NUTRITION SCRIPT

Dosing wt = 52kg
Energy 52kg x 10 to 20kcal/kg= 520 to 1040kcal
Protein 52kg x 1.2gm/kg = 62gm pro
GIR 52kg x 2mg/min/kg ~150gm dextrose
For refeeding 100 to 150gm dextrose per day

Macronutrients

| | |
|---|---|
| 65gm pro | 260kcal |
| 120gm dextrose | 408kcal |
| 20gm lipid | 200kcal |
| | 868kcal for ~16kcal/kg |

## WRITING THE PN SCRIPT

Adjusted Holliday-Segar = ~2000mL

Electrolyte Additives

- 0.45 NS = 77meq Na/L x 2L = 154meq Na
- Add 30mmoL NaPhos (1.33meq Na per mmoL = 40meq Na
- Add 115meq NaCl
- Add 1meq K/kg dosing wt ~ 55meq KCl
- Mg sulfate dosed in range of 10 to 20meq, add 16meq
- Ca gluconate dosed in range of 10 to 20meq, add 12meq
- Add 10mL MVI and 1mL MTE plus 100mg thiamine and 1mg folate

## WRITING THE PN SCRIPT

Macronutrients

65gm pro (provides 55meq acetate)
120gm dextrose
20gm lipid
2000mL fluid
868kcal for 16kcal/kg
1.25gm pro/kg

**D/c D5 0.45NS at 75mL/hr when PN hangs**

Electrolytes and Micronutrients

115meq NaCl
30mmoL NaPhos for 40meq Na
55meq KCl
16meq Mg
12meq Ca
10mL MVI
1mL MTE
100mg thiamin
1mg folate

## MONITORING PN

- Consider what time the PN bag hangs and what time labs are drawn
  - Ex. PN bag hangs at 2100 and labs are drawn at 0400, we will see very little effect from the most recent PN bag
- Avoid changes in K, Phos and/or Mg dose in the PN script for the first 48-72 hours
  - K/Mg/Phos repletion initially should be done outside the bag as IVPB(s)

## WHAT'S NEXT?

- Once K/Phos/Mg have stabilized in nl ranges begin to advance dextrose and lipid by an increase of one-third.
- Continue increases in kcal every other day **IF** K/Phos/Mg remain in nl ranges.
- Remove 100mg thiamine after PN day 7.
- If PN continues to be needed at 2 wks transition to cyclic PN
  - Start with 18hr cycle working down to a 12hr cycle to permit time untethered to a pump.
  - Cycling is hepatoprotective moving the liver between the fasted and fed states.

## TRANSITIONING TO ORAL NUTRITION

- Monitor for efficacy of anti-emetics therapies
- Schedule antiemetics around oral trials/mealtimes.
- Trial liquids when no emesis x 24hrs
  - 30 to 60mL q2hr as tolerated
  - Prefer lower fat, allow pt preference.
  - Small frequent feedings as diet advances.
- Monitor energy/protein intake – decrease energy/protein in PN when consistently tolerating =/> 75%

## TRANSITIONING TO ENTERAL NUTRITION

- If oral intake inadequate and/or has oral aversion once N/V controlled
- Trial gastric EN proceeding post-pyloric if fails gastric
  - EN appears to have an antiemetic effect
  - Although EN is preferred over PN there is a 54% failure rate
- Use polymeric formula – no indication for peptide if digestion/absorption of small bowel intact.
- Initiate at 10mL/hr advancing by 10mL q 6 to 8hr to goal as tolerated.
- D/c PN when tolerating TFs at 60 to 75% of goal

# PEDIATRIC CASE STUDY

## BACKGROUND/NUTRITION HISTORY

- 6 yr old Female with hx of 3q13.31 deletion syndrome presented to OSH with poor eating and fever x 2 days
- Reported intake: drinks "home blended" formula (example from day before admission: chicken, rice, carrots, peaches, ½ bottle Pediasure, almond milk to make ~3 cups total). No solids. Drinks about 4-5 cups of blended mixture + Pediasure/d.
- Had normal intake until 2 days prior to admission (per Mom)

## ANTHROPOMETRICS

Using CDC growth chart:

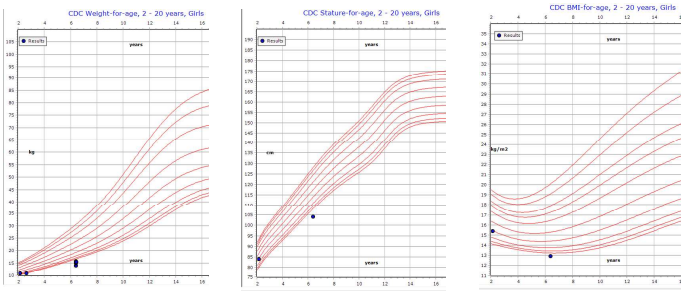
02/15/24 – 14 kg (0%, -3.59 z-score)
104 cm (0%, -2.71 z-score)
BMI: 12.9 kg/m2 (1%, -2.29 z-score)
05/11/20 – 10.85 kg (3%, -1.88 z-score)
11/18/19 – 10.85 kg (11%, -1.21 z-score)
84 cm (26%, -0.64 z-score)
BMI: 15.4 kg/m2 (24%, -0.71 z-score)

MUAC (2/16/24) (R arm): 13 cm (0%, -4.84 z score)

Mom reported UBW of 35 lbs (15.9 kg). Weights have been fluctuating between 30-40 lbs for the past 3 years (since 3 years of age).

12% body weight loss from reported UBW (15.9 kg)

## ANTHROPOMETRICS




## MALNUTRITION DIAGNOSIS STATEMENT

- Severe malnutrition related to lack of food or nutrition support as evidenced by:
  - MUAC z score -3 or less (severe)
  - Weight loss >10% UBW (severe)
  - BMI/Age z score -2 to -2.9 (moderate)

## NUTRITION ASSESSMENT

- Obtained zinc, B12, folic acid, and iron panel
  - Iron (serum): < 10 (L)
  - UIBC: 211 mCg/dL
  - TIBC: Incalculable
  - % Saturation: Incalculable
  - Vitamin B12: >1500 (H)
  - Folate: >23
  - Zinc: 48.8 mCg/dL (L)

## NUTRITION ASSESSMENT

- Estimated Nutrient needs:
  - Energy: 95-105 kcal/kg/d, 1330-1470 kcal/d
  - Protein: 1.5-3.0 g/kg/d, 21-42 g pro/d
  - Fluid: 1200 mL/d

**HIGH RISK FOR REFEEDING SYNDROME**

## NUTRITION RECOMMENDATIONS

- Slow advancement of EN (using Pediasure Enteral 1.0):
  - Day 1: 105 mL/feed x 5 feeds
  - Day 2: 160 mL/feed x 5 feeds
  - Day 3: 215 mL/feed x 5 feeds
  - Day 4 (Goal): 265 mL/feed x 5 feeds
- BMP, Mag, Phos q8hrs for first 72 hours of feeding advancement, replete PRN

## BREAKDOWN OF NUTRITION RECOMMENDATIONS

- On D5½NS @ 20 mL/hr at time of assessment (GIR 1.2 mg/kg/min)
- Grams CHO in Pediasure Enteral 1.0: 139 g CHO/L
  - Starting (105 mL x 5): 73 g CHO (GIR 3.6 mg/kg/min*)
  - Advancement: (55 mL x 5): 38 g CHO/day (GIR 1.9 mg/kg/min*)

*Estimated: assuming that all enteral feeds are digested and absorbed

## NUTRITION RECOMMENDATIONS CONTINUED

- IV Thiamin 2 mg/kg/day for a total of 5-7 days
- Multivitamin with iron 1 tablet QD
- Daily weights (chair scale)
- Monthly heights
- MUAC (R arm) every other week
- Iron (ferrous sulfate): 3-6 mg/kg/d elemental iron in 3 divided doses for 6 weeks
- Zinc (zinc sulfate): 1-2 mg/kg/d elemental zinc for 4-6 weeks

## NUTRITION ASSESSMENT FINDINGS

- Received q8hr labs for the first 72 hours of nutrition advancement (2/16-2/19)

| | 2/15/24 | 2/16/24 | 2/17/24 | 2/18/24 | 2/19/24 |
|---|---|---|---|---|---|
| Na (mmol/L) | 156 (H) | 160 (H) | 161 (H) | 148 (H) | 145 |
| Mg (mg/dL) | 3.2 (H) | 3.8 (H) | 3.4 (H) | 1.7 | 1.6 |
| BG (mg/dL) | 100 | 132 (H) | 174 (H) | 134 (H) | 110 (H) |
| Phos (mg/dL) | 2.8 (L) | 2.4 (L) | 1.7 (L) | 2.7 | 2.6 (L) |
| K (mmol/L) | 4.2 | 3.8 | 3.7 | 3.2 (L) | 3.7 |

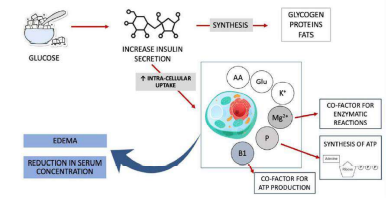
- Labs spaced to q24hrs on 2/20

## WHAT'S NEXT?

- Thiamin discontinued after Day 5
- Continued iron and zinc supplementation, multivitamin
- G tube placed and growing well on initial feeding plan
- Speech therapy for oral aversion

## CONCLUSION

- Complete full nutrition assessment
- Note risk factors associated with risk for refeeding syndrome
- Diagnose and document malnutrition if indicated
- Follow refeeding guidelines when reintroducing nutrition
  - EN or oral
  - PN

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## THANK YOU

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