



RDs In Practice: Advancing Practice in Pediatric Nutrition
Supporting the Pediatric Intensive Care Patient

Round Table:

Challenges of the Obese Pediatric Patient- *Jan Skaar, RD, CSP, CNSC, CLE*

Program Objectives:

Upon completion of this round table, participants should be able to:

1. Define pediatric obesity and over-weight
2. Review potential complications in providing nutrition support to the obese critically ill child
3. Review evidence-based recommendations
4. Discuss practical issues in developing a nutrition plan for the obese critically ill child

References:

1. Pediatric Critical Care Nutrition. Praveen S. Goday, MD, CNSC and Nilesh M. Mehta, MD. Mc Graw Hill Education, Publisher, 2015.
2. Validation of predictive equations for resting energy expenditure in obese adolescents. *Am J Clin Nutr* 2010; 91:1244-54. Hofsteenge, G et al.
3. Measure and predicted resting metabolic rate in obese and nonobese adolescents. *J Pediatr* 1995; 127:571-7. Molnar, D. et al.
4. A.S.P.E.N. Clinical Guidelines: Nutrition Support of Hospitalized Adult Patients with Obesity. *JPEN J Parenter Enteral Nutr.* 2013;37:714-744. Choban, P et al.
5. A.S.P.E.N. Clinical Guidelines: Nutrition Support of Hospitalized Pediatric Patients with Obesity. *JPEN J Parenter Enteral Nutr.* 2010; 34:13-20. Jesuit, C et al.
6. Challenges to Nutrition Therapy in the Pediatric Critically Ill Obese Patient. *Nutrition in Clinic Practice*, 2015: 30, 432-439. Martinez, E, et al.



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I. Definitions and prevalence of obesity:

Obesity defined as excess body fat. BMI is not a direct measure of body fat but correlates strongly with percent body fat in adults, the correlation is less so in children.

Adults- 35% of adults in the U.S obese, defined as BMI >30 kg/m²; also classified into 3 categories, I-III (BMI 30-34.9 class I; BMI 35-39.9 class II; BMI >40 class III)

Pediatrics- 1 in 6 children (16.9%) in the U.S. is obese, defined as a BMI >95th% for 2-20years; for older adolescents, BMI at or above the 95th% or a BMI >30, whichever is lower. For children under age 2, wt/length >95th% considered overweight, (not referred to as obese in this age range).

II. Complications/risk factors for obese critically ill child:

Adipose tissue is an active metabolic and endocrine organ, signaling to other tissues and organs (pro-inflammatory cytokines: leptin, TNF alpha, IL-6 increased; anti-inflammatory cytokines: adiponectin, IL-10 decreased). The side effects of adipose tissue are multi-systemic, altering cardiovascular and lung function, hematologic and endocrine function. HTN, obstructive sleep apnea, cardiomyopathy, pulmonary HTN, insulin resistance, NAFLD, deep vein thrombosis and pulmonary emboli are all associated with obesity. Airway management, positioning, vascular access and medication dosing are challenging, in addition to providing appropriate nutrition support. Risk for fluid overload and electrolyte abnormalities are high.

Obesity is associated with increased ventilator days and prolonged ICU LOS in adults. Studies in pediatrics are mixed as to morbidity and mortality. A systematic review indicated that childhood obesity may be a risk factor for higher mortality in critical illness, oncology diagnoses, and transplants.

III. Evidence-based Recommendations:

ASPEN Guidelines for adults

Table 1. Nutrition Support Clinical Guideline Recommendations in Adult Patients With Obesity.

Question	Recommendation	Recommendation Grade and Evidence Quality
1. Do clinical outcomes vary across levels of obesity in critically ill or hospitalized non-ICU patients?	1a. Critically ill patients with obesity experience more complications than patients with optimal BMI levels. Nutrition assessment and development of a nutrition support plan is recommended within 48 hours of ICU admission.	Recommendation: Strong Evidence: Low
	1b. All hospitalized patients, regardless of BMI, should be screened for nutrition risk within 48 hours of admission, with nutrition assessment for patients who are considered at risk.	Recommendation: Strong Evidence: Low
2. How should energy requirements be determined in obese critically ill or hospitalized non-ICU patients?	2a. In the critically ill obese patient, if indirect calorimetry is unavailable, energy requirements should be based on the Penn State University 2010 predictive equation, or the modified Penn State equation if the patient is over the age of 60 years.	Recommendation: Strong Evidence: High
	2b. In the hospitalized obese patient, if indirect calorimetry is unavailable and the Penn State University equations cannot be used, energy requirements may be based on the Mifflin–St Jeor equation using actual body weight.	Recommendation: Weak Evidence: Moderate
3. Are clinical outcomes improved with hypocaloric, high protein diets in hospitalized patients with obesity?	3a. Clinical outcomes are at least equivalent in patients supported with high protein, hypocaloric feeding to those supported with high protein, eucaloric feeding. A trial of hypocaloric, high protein feeding is suggested in patients who do not have severe renal or hepatic dysfunction. Hypocaloric feeding may be started with 50%-70% of estimated energy needs or < 14 kcal/kg actual weight. High protein feeding may be started with 1.2 g/kg actual weight or 2-2.5 g/kg ideal body weight, with adjustment of goal protein intake by the results of nitrogen balance studies.	Recommendation: Weak Evidence: Low
	3b. Hypocaloric, low protein feedings are associated with unfavorable outcomes. Clinical vigilance for adequate protein provision is suggested in patients who do not have severe renal or hepatic dysfunction.	Recommendation: Weak Evidence: Low
4. In obese patients who have had a malabsorptive or restrictive surgical procedure, what micronutrients should be evaluated?	4. Patients who have undergone sleeve gastrectomy, gastric bypass, or biliopancreatic diversion ± duodenal switch have increased risk of nutrient deficiency. In acutely ill hospitalized patients with history of these procedures, evaluation for evidence of depletion of iron, copper, zinc, selenium, thiamine, folate, and vitamins B ₁₂ and D is suggested as well as repletion of deficiency states.	Recommendation: Weak Evidence: Low

ICU, intensive care unit.

ASPEN guidelines for obese children (see attached reference):

- No recommendations for predictive equations in absence of IC.
- No evidence for hypocaloric nutrition therapy in critically ill obese children.
- No guidelines for using ideal body weight (IBW), actual body weight (ABW) or an adjusted body weight (AjBW) for assessment.

IV. What are your colleagues doing?

PEDI-RD listserv queries (2011-2014):

~31 responses to questions posted regarding methods and weights used for assessment in obese children:

<i>Weight used</i>	<i>IBW@50th</i>	<i>IBW(@75-95th)</i>	<i>ActualBW</i>	<i>Mixed</i>
<i>responses</i>	8	5	7	9

Method	DRI/ RDA	WHO/ Schofield	Kcals/ cm	TEE	Penn St/Mifflin St.Jeor	Adult kcals/ cm	IC	N2 bal	Mixed
responses	6	4	5	5	1	2	1	1	4

- A wide variety of approaches are used by clinicians to assess calorie, protein and fluid needs.
- Not everyone has a metabolic cart.
- Evidence-based guidelines are limited.

Round table attendee:

Please answer the following question and return to the table speaker when completed.

“What weight and method or equation would you use to assess the calorie, protein and fluid needs for a critically ill pediatric obese child or adolescent?”

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Case Study:

M. J. is a 16yo obese F with **systemic lupus erythematosus** and persistent **Bell's palsy**, presented to the ED with difficulty breathing and gasping and was found to have hypochloremia and hyponatremia. 7 days prior to admission, it was noted by her mother, patient had a skin abscess, increasing in size, underneath her left breast. She was prescribed with Keflex by her rheumatologist, took it for 2 days before developing **abdominal pain**, NBNB emesis x 5, diarrhea 2-3x/day. She also had a history of abdominal pain and vomiting 3-5 times/day since mid-May and a reported weight loss of 40 pounds. I & D of the abscess was performed at an outside hospital and the patient was started on antibiotics. She was also noted to have severe pain and migraine **headaches** requiring Dilaudid and morphine. She subsequently developed difficulty swallowing and was started on fluconazole. She was admitted to PICU from ED for close airway monitoring, empiric antibiotics due to immunosuppression and correction of **electrolyte abnormalities**.

Anthropometrics:

Wt-106.2kg Ht-165cm BMI- 39
IBW @ 50th% BMI- 56.6kg Wt @ 85th% BMI-68kg AjBW (25% factor)-68.9kg

Labs include: Na 133 K 4.1 Cl 98 (82) CO2 24 BUN 3 Cr 0.4 glu 164
AST/ALT 39/35 (wnl) CRP 25.2 BNP 26 (wnl)

Medications include: fluconazole, clindamycin, pepcid, carafate, benadryl elixir + Maalox swish and swallow, Miralax, Zofran prn, morphine prn pain (usual medications include Plaquenil and CellCept for her lupus)

Patient is given isotonic IVF @ 100mls/hr and her hyponatremia is corrected, however, by hospital day 3 she has had minimal oral intake due to persistent, intermittent vomiting and difficulty swallowing. Her condition worsens, she develops septic shock and she is intubated. The medical team requests recommendations for parenteral nutrition support.

What recommendations would you make re:

Fluids?

Caloric goals?

Protein goals?

In the absence of IC, what weight and estimation calculations would you use?

Suggestions:

Fluids: Provide PN with no greater than maintenance fluids based on the agreed upon dose calculating weight, IBW or an adjusted BW to prevent fluid overload. Maintenance fluids based on actual weight would provide 3500mls/day vs 2400-2600 mls/day using an IBW. Fluid management should be discussed daily with the medical team.

Fluid management must take into account the disease state, electrolytes, glucose, body weight and fluid balance. Goals are to maintain intravascular volume, end organ perfusion while extravascular lung water and pulmonary edema. Typical estimations for fluid requirements (Holliday, Segar) are for healthy children. Patients on ventilator support will have decreased evaporative losses from the respiratory tract. After treatment for septic shock and hypotension, patients may be in positive fluid balance with the need for diuresis in the setting of ALI or ARDS. Increasing fluid balance in patients with ALI is associated with worse outcomes and increased ventilator days.

Calories: Comparing a variety of estimates may be prudent. This patient will not need calories for activity or growth while on sedation and ventilator support. She is in an acute metabolic stress response state.

Schofield with actual body weight = 1853 kcals/day

WHO with actual body weight = 2039 kcals/day

Penn State Equation 2010 = requires T max and Ve (minute ventilation); has 70% accuracy

IOM BEE for overweight, obese girls = 1974 kcals/day

Protein: 1.2g/kg actual body weight= 127gms/day

2gms/kg IBW = 114gms/day

Renal function needs to be assessed by following labs, UOP, fluid balance.

(Consideration may be given to collecting 24hr urine for a N2 balance if patient has a foley and is not in renal failure)

Collaborate, Communicate, and be Consistent in working with your medical team, pharmacist, nurse and family in prescribing nutrition support. If using a weight other than actual, be sure to communicate this clearly so to avoid the risk of fluid and electrolyte abnormalities from PN fluctuations. Monitor for changes in clinical status closely to adjust the Rx. Most importantly, **DO NO HARM.**

