A.S.P.E.N. Clinical Guidelines: Nutrition Support of Hospitalized Adult Patients With Obesity

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Memorial Hospital Pharmacy

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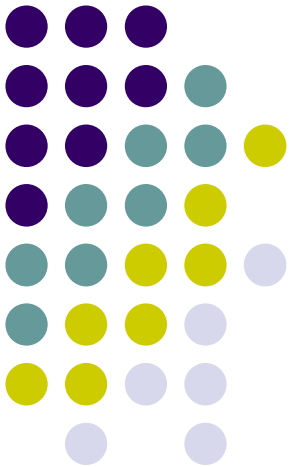

Publication[1]

- Article published in the Journal of Parenteral and Enteral Nutrition
- 23 August 2013
- Authors:
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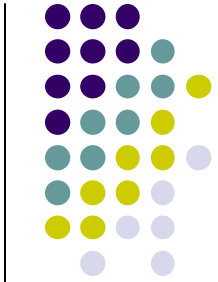
  - American Society for Parenteral and Enteral Nutrition

Background[1]

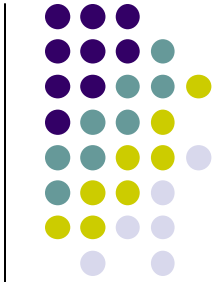
- June 2013: AMA recognized obesity as a disease that requires medical treatment
  - National Health and Nutrition Examination Survey 2009-2010
    - Prevalence of obesity in U.S.
      - 35.5% in adult men (4.4% with BMI ≥ 40)
      - 35.8% in adult women (8.2% with BMI ≥ 40)
  - Majority of publications available for review only look at obesity in patients located in a hospital
  - Guidelines separate recommendations for obese patients based on ICU or non-critically ill
- Bariatric surgery common in U.S. to treat obesity
  - Estimated 200,000 surgeries/year
  - Designed to limit patient's intake – may need nutrition support
- Critically ill patients tend to by hypermetabolic[2]
  - Function of inflammatory response – signs: fever, tachycardia, dyspnea
  - Fever and dyspnea accounted for in PSU equations by Tmax and VE

Methodology[1]



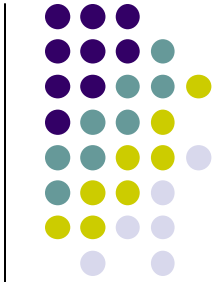
- Utilized GRADE (grading of recommendations, assessment, development and evaluation)
  - Develop clinical questions and then perform literature search for data
  - RCT initially classified as strong – can be downgraded secondary to study limitations
  - Controlled observational studies initially classified as weak – can be downgraded based on limitations or upgraded based on design strengths
- Database Search
  - PubMed, EMBASE, CINAHL
  - First search done on 1 August 2012
  - Update 2 May 2013
  - Inclusion criteria: adult subjects, English language, randomized controlled trials, observational studies, publications over past 10 years

Methodology – Questions[1]



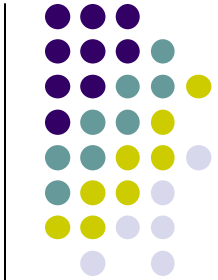
- Do clinical outcomes vary across levels of obesity in critically ill or hospitalized non-ICU patients?
  - 31 articles
- How should energy requirements be determined in obese critically ill or hospitalized non-ICU patients?
  - 9 articles – all had accuracy and bias rates
- Are clinical outcomes improved with hypocaloric, high protein diets in hospitalized patients with obesity?
  - 8 articles – eliminated time restriction to find all articles on topic
- In obese patients who have had a malabsorptive or restrictive surgical procedure, what micronutrients should be evaluated?
  - 22 articles – using terms “copper,” “zinc,” “iron,” “selenium,” “vitamin deficiency,” “nutrient deficiency,” “gastric bypass,” “biliopancreatic diversion,” “ vitamin D,” and “bariatric surgery.”

Do clinical outcomes vary across levels of obesity in critically ill or hospitalized non-ICU patients?[1]



- Recommendations
  - "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 (strong)."
    - Evidence: low
  - "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 (strong)."
    - Evidence: low

Literature Search for Question 1[1]



- Studies found were limited by retrospective database evaluation, small number of obese subjects & overall small sample size
- 8 studies had > 300 obese patients enrolled
  - One showed increased mortality in obese trauma patients, five showed reduced mortality in mixed ICU types, three showed no difference in mortality
  - Studies with > 300 obese patients showed more complications in obese patients (3 smaller studies in trauma patients showed same result)
    - One additional large study in MICU obese patients showed no additional complications
- Hospitalized-non critically ill patients
  - 2 studies with > 300 obese patients
    - One study in surgical patients: lower mortality and LOS
    - Second study in MI patients: higher mortality and no difference in complications
- Conclusion: further research needed but all patients should be screened for nutrition risk and treated appropriately

Table 3. GRADE Table Question 1: Do Clinical Outcomes Vary Across Levels of Obesity in Critically Ill or Hospitalized Non-ICU Patients?[1]

Table 3. GRADE Table Question 1: Do Clinical Outcomes Vary Across Levels of Obesity in Critically Ill or Hospitalized Non-ICU Patients?.

Comparison	Outcome	Quantity, Type of Evidence	Findings	Grade for Outcome	Overall Evidence GRADE
ICU patients					
Obese vs optimal BMI	Mortality (large studies)	8 OBS	1 increased[21] 5 decreased[23,35,42,44,45] 2 no difference[32,46]	Low	Low
	Hospital LOS (large studies)	4 OBS	3 increased[22,29,45] 1 no difference[46]	Low	
	Complications	6 OBS	5 increased[25,37,46-48] 1 no difference[32]	Low	
BMI ≥ 40 kg/m^2 vs optimal BMI	Mortality (large studies)	4 OBS	1 decreased[44] 3 no difference[22,23,45]	Low	
	Hospital LOS (large studies)	4 OBS	2 increased[22,29] 2 no difference[45,46]	Low	
Non-ICU patients					
Obese vs optimal BMI	Mortality	2 OBS	1 increased[49] 1 no difference[91]	Low	

ICU, intensive care unit; LOS, length of stay; OBS, observational study.

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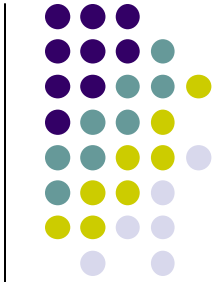
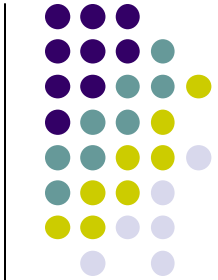
How should energy requirements be determined in obese critically ill or hospitalized non-ICU patients?[1]



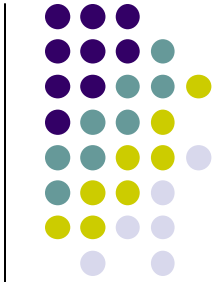
- Recommendations
  - "In the critically ill obese patients, if indirect calorimetry is unavailable, energy requirements should be based on the Penn State University 2010 predictive equation or the modified Penn State University equation if the patient is over the age of 60 years (strong)."
    - Evidence Grade: High
  - "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 (weak)."
    - Evidence Grade: Moderate

Literature Search for Question 2[1]



- Most important goal is to avoid overfeeding
  - Use indirect calorimetry or predictive equation to determine REE (resting energy expenditure) to meet this goal
- Penn State University (PSU) equation most accurate predictor of REE
  - Frankenfield and colleagues compared PSU vs. other equations in patients with BMI ≥ 30 kg/m^2
    - Found that the PSU equation had prediction accuracy of 70% (±10% of REE) with least bias or lowest chance of over or under-estimation
  - Second study looked at patients with a BMI ≥ 45 kg/m^2
    - Found PSU equation had highest accuracy at 76%
  - In older critically ill patients (≥ 60 yo), modified PSU equation had greater accuracy than PSU equation in patients with BMI ≥ 30 kg/m^2
    - accuracy of 70% vs. 58% respectively

Penn State University Equations[1]

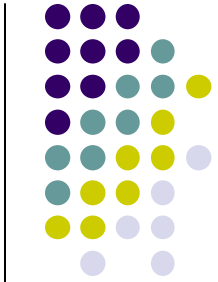


- PSU equation
  - RMR (kcal/d) = MSJ(0.96) + Tmax(167) + VE(31) – 6212
- Modified PSU equation
  - RMR (kcal/d) = MSJ(0.71) + Tmax(85) + VE(64) – 3085

  - Where: MSJ = Mifflin St-Jeor equation; VE = minute ventilation (L/min); Tmax = maximum temperature in prior 24 hrs in degrees C

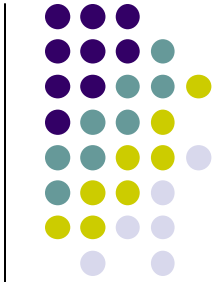
  - MSJ equations:
    - Women (kcal/d) = -161 + 10 x Weight(kg) + 6.25 x Height(cm) – 5 x Age(yr)
    - Men (kcal/d) = 5 + 10 x Weight(kg) + 6.25 x Height(cm) – 5 x Age(yr)

How should energy requirements be determined in obese critically ill or hospitalized non-ICU patients?[1]



- Hospitalized, non-critically ill
  - Can not use PSU or modified PSU equation due to lack of ventilator settings
- Compared 5 studies – weak evidence due to study limitations
  - Studies did not use the same predictive equations
  - Very small samples of obese patients
  - One study reported data collected in 1991
  - One study used information collected from several calorimeters
- Out of these studies, MSJ showed the most accuracy in predicting REE with rate of 70-86%
  - 50% accuracy with Harris-Benedict using adjusted weight
  - 50%, 62-69% accuracy with Harris-Benedict using actual weight

Are clinical outcomes improved with hypocaloric, high protein diets in hospitalized patients with obesity?[1]



- Recommendations
  - "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 (weak). Hypocaloric feeding may be started with 50%-70% of estimated energy requirements 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."
    - Evidence Grade: Low
  - "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 (weak)."
    - Evidence Grade: Low

Table 6. GRADE Table Question 3: Are Clinical Outcomes Improved With Hypocaloric, High Protein Diets in Hospitalized Patients?[1]

Table 6. GRADE Table Question 3: Are Clinical Outcomes Improved With Hypocaloric, High Protein Diets in Hospitalized Patients?

Comparison	Outcome	Quantity, Type Evidence	Finding	Final GRADE	Overall Evidence GRADE
Hypocaloric/high protein vs eucaloric/high protein	LOS	1 OBS	1 decreased[61]	Low	Low
	Nitrogen Balance	1 RCT, 3 OBS	4 no difference[59-62]	Low	
	Weight Loss	1 RCT, 1 OBS	2 no difference[59,60]	Low	

LOS, length of stay; OBS, observational study; RCT, randomized controlled trial.

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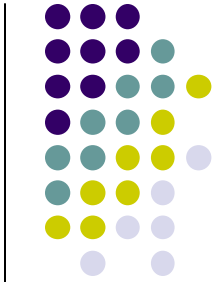
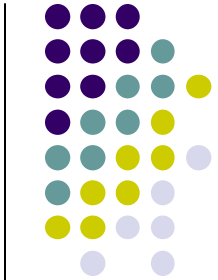
Literature Search for Question 3[1]



- Hypocaloric high protein feeding vs. permissive underfeeding
- Examined 4 comparative studies, 2 case series
  - Hypocaloric, high protein feeding
    - Average intake of 90-140 g of protein, 900-1300 kcals/d
  - One study by Dickerson et al in 2002 showed:
    - Decreased LOS in ICU, duration of antibiotic therapy and a trend toward decreased days of mechanical ventilation in critically ill, obese trauma pts
    - 40 total patients
      - 28 hypocaloric high protein: <20kcal/kg Adj. BW and 2 g/kg IBW protein
      - Baseline BMI = 41.3 ± 4.7 kg/m^2
    - Retrospective record review
- RCT showed no difference in clinical outcomes, mortality or LOS
- Conclusion: Data from the 163 patients in literature show that clinical outcomes with hypocaloric high protein therapy is equivalent and possibly more beneficial than eucaloric therapy

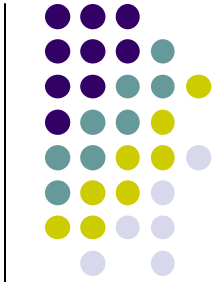
In obese patients who have had malabsorptive or restrictive surgical procedures for weight loss, what micronutrients should be evaluated?[1]



- Recommendation
  - "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 (weak)."
    - Evidence Grade: Low

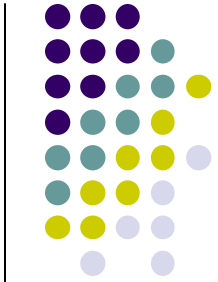
Gastric bypass – RYGB; Biliopancreatic diversion ± duodenal switch - BPD ± DS; sleeve gastrectomy – SG

Literature Search for Question 4[1]



- Data shows that macronutrient deficiency is prominent in obesity and the degree of the deficiency increases as the degree of obesity increases (in patients with no history of bariatric surgery)
  - Documented for alpha & beta carotene, beta cryptoxanthin, lutein/zeaxanthin, lycopene, total carotenoids, iron, selenium, vitamins A, C, D, B_6, B_{12}, and folic acid
- 21 observational studies, 2 RCTs
  - Procedures included RYGB, sleeve gastrectomy, BPD ± DS, adjustable gastric band
  - Follow up varied between studies but longest study showed no deficiency related to restrictive procedures w/o malabsorptive component
  - Other studies did show increased risk of deficiency of iron, copper, zinc, selenium, thiamine, folate and vitamins B_{12} and D (similar in patients with no history of bariatric surgery)

Recommended Dietary Supplementation in Post-Bariatric Surgery Patients[1]



- Daily multiple vitamin/mineral supplement
  - 2 daily doses in patients post SG, RYGB or BPD
- At least 3000 IU vitamin D to achieve a serum 25-hydroxyvitamin D concentration >30 ng/mL
- 2 mg copper daily
- 45-60 mg daily iron from diet and supplements
- Vitamin B_{12} as needed for normal serum levels
- 1200-1500 mg calcium citrate daily in all patients except those who have undergone BPD
- Evaluations for deficiencies:
  - Annually – folic acid, iron, 25-hydroxyvitamin D
  - Only when findings suggest deficiency – copper, zinc, selenium, thiamine

Table 8. GRADE Table Question 4: In Obese Patients Who Have Had a Malabsorptive Surgical Procedure, What Micronutrients Should Be Evaluated?[1]

Table 8. GRADE Table Question 4: In Obese Patients Who Have Had a Malabsorptive Surgical Procedure, What Micronutrients Should Be Evaluated?

Comparison	Outcome/Nutrient Deficiency	Quantity, Type Evidence	Finding	Final GRADE	Overall Evidence GRADE
Preoperative to postoperative RYGB or BPD	Copper	3 OBS	Increased[83,85,95]	Low	Low
	Zinc	3 OBS	Increased[83,85]	Low	
	Iron	3 OBS	Increased[84,97]	Very low	
	Selenium	1 OBS		Low	
	Thiamine	1 OBS	Increased[72]	Low	
	Folic acid	1 OBS	Increased[97]	Low	
	Vitamin B_{12}	2 OBS	Increased[84,97]	Low	
	Vitamin D	5 OBS, 2 RCT	Increased with supplements decreased[97]	Low	

BPD = biliopancreatic diversion; OBS = observational study; RCT, randomized controlled trial; RYGB = Roux-en-Y gastric bypass.

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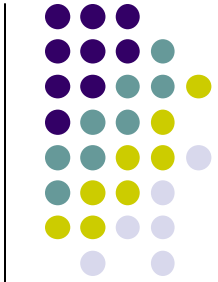
Memorial Hospital Patient Sample – Critically Ill, Obese Patients



	Age	BMI	Equation	Daily Kcal Estimate
Patient 1 – ST (F)	56	49	PSU, VE = 11.2	2453
			22-25 kcal/kg/d IBW	1408-1600
Patient 2 – HT (M)	67	31.7	Mod PSU, VE = 12	2083
			22-25 kcal/kg/d IBW	1555-1768
Patient 3 – MW (F)	62	30	Mod PSU, VE = 7.45	1672
			Mod PSU, VE = 9.67	1815
			22-25 kcal/kg/d IBW	1203-1368
Patient 4 – LO (F)	62	30.2	Mod PSU, VE = 5.84	1607
			Mod PSU, VE = 7.17	1692
			22-25 kcal/kg/d IBW	1456-1655
Patient 5 – DH (M)	62	38.6	Mod PSU, VE = 11.5	2327
			22-25 kcal/kg/d IBW	1657-1883

Considerations in the Application of the PSU and modified PSU equations

- The higher the BMI, the more we seem to underestimate their calorie requirements
- Minute ventilation greatly affects estimated kcal requirements
- Issues with using PSU and modified PSU equation:
  - Do you change kcals/day requirement with every change in weight, Tmax or minute ventilation?
    - Linear relationship between VE and metabolic rate in critically ill patients[2]
  - What equation should be used for other critically ill patients with a BMI ≥ 30 and not on a vent?

Additional Information[3]

- Frankenfield DC, Ashcraft CM, Galvan DA. Longitudinal Prediction of Metabolic Rate in Critically Ill Patients. JPEN. Published May 2012.
  - Compares several methods of determining REE over a period of 7 days
    - Indirect calorimetry performed daily
    - Indirect calorimetry performed on the first day and extrapolated to day 7
    - PSU and modified PSU equations calculated daily
    - ACCP – 25 kcal/kg/day TBW (BMI < 30), 25 kcal/kg/d Adj.BW (BMI ≥ 30)
    - MSJ
- "Cumulative error was calculated as the sum of the equation values minus the sum of the 7 daily measures so that a positive cumulative difference represented an overestimation and a negative cumulative difference represented an underestimation.
- Cumulative results for PSU equations: -486 ± 642 kcal (-3.7% ± 5.1%)
- **Strength**: only study thus far examining longitudinal information for the PSU equations
- **Weakness**: only had 6 patients for the modified PSU equation & 7 patients for the PSU equation

References

1. Choban P, Dickerson R, Malone A, Worthington P, Compher C, American Society for Parenteral and Enteral Nutrition. A.S.P.E.N. Clinical Guidelines: Nutrition Support of Hospitalized Adult Patients With Obesity. *JPEN J Parenter Enteral Nutr*. 2013;014860711349937 4.
2. Frankenfield D. Validation of an Equation for Resting Metabolic Rate in Older Obese, Critically Ill Patients. *JPEN J Parenter Enteral Nutr.* 2011; 35: 264-269.
3. Frankenfield DC, Ashcraft CM, Galvan DA. Longitudinal Prediction of Metabolic Rate in Critically Ill Patients. *JPEN J Parenter Enteral Nutr*. 2012;36:700-712.

Questions??