Mass General Brigham

# Nutrition Support for the Critically Ill Obese Patient

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November 5, 2022

# Disclosures

*Dr. Apovian has participated on advisory boards for:*

- Orexigen
- Gelesis
- Allergan
- Abbott Nutrition
- EnteroMedics
- Zafgen
- Real Appeal
- Nutrisystem
- Tivity
- Novo Nordisk
- Scientific Intake
- Bariatrix Nutrition
- SetPoint Health
- Xeno Biosciences
- Rhythm
- Janssen
- Tivity Health
- Roman Health Ventures
- Jazz

*Dr. Apovian has received research funding from:*

- Gelesis
- Novo Nordisk

# Obesity in the ICU

- >106,000 ICU beds in US hospitals, with 80% filled, 2021
- > 42% of US older adults have obesity
- **~50% of U.S. ICU patients have obesity**
- Sarcopenic obesity (combination of low skeletal muscle mass and high obesity) can be found in older, critically ill patients
  - Should be viewed as at risk for malnutrition due to higher fat stores and stigma/bias associated with obesity
  - These patients may not receive early nutrition support

American Hospital Association. Fast Facts on U.S. Hospitals, 2021. https://wwwaha.org/statistics/fast-facts-us-hospitals.
McKendry J, Thomas ACQ, Phillips SM. Nutr Clin Pract. 2020 Aug;35(4):607-616.

# BMI and Excess Body Fat

**Waist circumference (WC) and waist-hip ratio (WHR) are tools to assess fat distribution and contribute to risk stratification**

- **BMI: poor marker of excess body fat** in patients with either increased or low muscle mass (sarcopenic obesity)
- Patients with similar BMI may have different obesity-related complications depending on the distribution of excess fat (visceral and ectopic versus subcutaneous fat)
- Adipose tissue is highly metabolically active
- Visceral adipose tissue has a more deleterious adipocyte secretory profile resulting in insulin resistance and a chronic low-grade inflammatory and procoagulant state
- Subcutaneous fat in the lower body may act as a metabolic sink for excess fat and protect other tissues/organs from lipotoxicity

| | | Disease risk: Waist Circumference (WC) | |
|---|---|---|---|
| **Diagnosis** | **BMI WHO classification [weight (kg)/height m$^2$]** | **MALES ≤ 94 cm FEMALES ≤ 80 cm** | **MALES > 94 cm FEMALES > 80 cm** |
| Underweight | < 18.5 | | |
| Normal weight | 18.5–24.9 | | |
| Overweight | 25–29.9 | Increased | High |
| Obesity class I (moderate obesity) | 30–34.9 | High | Very high |
| Obesity class II (severe obesity) | 35–39.9 | Very high | Very high |
| Obesity class III (very severe obesity) | ≥ 40 | Extremely high | Extremely high |

Schetz M, et al. *Intensive Care Med*. 2019 Jun;45(6):757-769.

# GUIDELINES
## for the Provision and Assessment of Nutrition Support Therapy in the Adult Critically Ill Patient

**Section Q.**

**Obesity in Critical Illness**

Pages 196 - 199

*Clinical Guidelines*

aspen

Journal of Parenteral and Enteral Nutrition
Volume 40 Number 2
February 2016 159–211

DOI: 10.1177/0148607115621863
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**Guidelines for the Provision and Assessment of Nutrition Support Therapy in the Adult Critically Ill Patient: Society of Critical Care Medicine (SCCM) and American Society for Parenteral and Enteral Nutrition (A.S.P.E.N.)**

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**Keywords**
nutrition; critical care; intensive care unit; enteral; parenteral; evidence-based medicine; Grading of Recommendations, Assessment, Development, and Evaluation criteria; guidelines

**Preliminary Remarks (Intent of Guidelines)**

A.S.P.E.N. and SCCM are both nonprofit organizations composed of multidisciplinary healthcare professionals. The mission of A.S.P.E.N. is to improve patient care by advancing the science and practice of clinical nutrition and metabolism. The mission of SCCM is to secure the highest-quality care for all critically ill and injured patients.

*Guideline Limitations*

These A.S.P.E.N.-SCCM Clinical Guidelines are based on general conclusions of health professionals who, in developing such guidelines, have balanced potential benefits to be derived from a particular mode of medical therapy against certain risks inherent with such therapy. However, practice guidelines are not intended as absolute requirements. The use of these practice guidelines does not in any way project or guarantee any specific benefit in outcome or survival.

**The judgment of the healthcare professional based on individual circumstances of the patient must always take precedence over the recommendations in these guidelines.**

The guidelines offer basic recommendations that are supported by review and analysis of the current literature, other national and international guidelines, and a blend of expert opinion and clinical practicality. The population of critically ill patients in an intensive care unit (ICU) is not homogeneous. Many of the studies on which the guidelines are based are limited by sample size, patient heterogeneity, variability in disease severity, lack of baseline nutrition status, and insufficient statistical power for analysis.

*Periodic Guideline Review and Update*

This particular report is an update and expansion of guidelines published by A.S.P.E.N. and SCCM in 2009.[1] Governing bodies of both A.S.P.E.N. and SCCM have mandated that these guidelines be updated every 3–5 years. The database of randomized controlled trials (RCTs) that served as the platform for the analysis of the literature was assembled in a joint "harmonization process" with the Canadian Clinical Guidelines group. Once completed, each group operated separately in its interpretation of the studies and derivation of guideline recommendations.[2] The current A.S.P.E.N. and SCCM guidelines included in this paper were derived from data obtained via literature searches by the authors through December 31, 2013. Although the committee was aware of landmark studies published after this date, these data were not included in this manuscript. The process by which the literature was evaluated necessitated a common end date for the search review. Adding a last-minute landmark trial would have introduced bias unless a formalized literature search was reconducted for all sections of the manuscript.

**Target Patient Population for Guideline**

The target of these guidelines is intended to be the adult (≥18 years) critically ill patient expected to require a length of stay (LOS) greater than 2 or 3 days in a medical ICU (MICU) or surgical ICU (SICU). The current guidelines were expanded to include a number of additional subsets of patients who met the above criteria but were not included in the previous 2009 guidelines. Specific patient populations addressed by these expanded and updated guidelines include organ failure (pulmonary, renal, and liver), acute pancreatitis, surgical subsets (trauma, traumatic brain injury [TBI], open abdomen [OA],

McClave SA, et al. JPEN J Parenter Enteral Nutr. 2016 Feb;40(2):159-211. (page 196)

# Target Patient Population for Guideline

- Adult (≥18 years) critically ill patient expected to require a length of stay (LOS) greater than 2 or 3 days in a medical ICU (MICU) or surgical ICU (SICU)
- Current guidelines were expanded to include additional subsets of patients who met the above criteria and not included in the previous 2009 guidelines
- Specific patient populations addressed by these expanded and updated guidelines include:
  - Organ failure (pulmonary, renal, and liver)
  - Acute pancreatitis
  - Surgical subsets (trauma, traumatic brain injury, open abdomen, burns)
  - Sepsis
  - Postoperative major surgery
  - Chronic critically ill
  - **Critically ill obese**
    - The addition of PN or the use of total PN (in the acute phase) needs to be considered on a case-by-case basis

McClave SA, et al. *JPEN J Parenter Enteral Nutr*. 2016 Feb;40(2):159-211. (pages 159-160)
Hill A, Elke G, Weimann A. *Nutrients*. 2021 Aug 19;13(8):2851.

# Nutrition Assessment: Tools

- There are **no validated and recommended tools** to estimate the nutritional status of a critically ill patient
- In (semi-) elective admissions, a screening for malnutrition in standard care before major surgery may be practical and is recommended
- Several tools to estimate nutrition risk are the:
  - Nutrition Risk Score (NRS 2002)
  - NUTRIC (Nutrition Risk in the Critically Ill) Score
  - Subjective Global Assessment (SGA)
  - Malnutrition Universal Screening Tool (MUST)
- Many of these tools include some of the following factors:
  - Medical history: age, comorbidities, loss of physical function
  - Nutrition history: weight loss, reduced food intake, loss of appetite
  - Physical examination: BMI, edema, body composition
  - Severity of disease: critically ill patients are severely ill by definition

Hill A, Elke G, Weimann A. *Nutrients.* 2021 Aug 19;13(8):2851.

# Obesity in Critical Illness

- **Patients with a BMI >30 have an OR of 1.5 for having malnutrition** (P = .02)
- Reasons for the surprisingly high rate of malnutrition in patients with obesity may stem in part from:
  - Unintentional weight loss early after admission to the ICU
  - Lack of attention from clinicians who misinterpret the high BMI to represent additional nutrition reserves that protect the patient from insult

McClave SA, et al. *JPEN J Parenter Enteral Nutr*. 2016 Feb;40(2):159-211. (page 196)

# Obesity in Critical Illness

- ICU patients with obesity are more likely than lean subjects to have problems with fuel utilization, predisposing them to greater loss of lean body mass
- Patients with obesity are at greater risk for insulin resistance and futile fuel cycling of lipid metabolism (increases in both lipolysis and lipogenesis)
- In an early study of trauma patients with obesity in a SICU derived only 39% of their REE from fat metabolism vs. 61% in their lean counterparts[1]
- These patients derived a higher percentage of energy needs from protein metabolism, indicating greater potential for erosion of lean body mass

1. Jeevanandam M, Young DH, Schiller WR. *J Clin Invest*. 1991; 87(1): 262- 269.
2. McClave SA, et al. *JPEN J Parenter Enteral Nutr.* 2016 Feb;40(2):159-211. (page 196)

# The Obesity Paradox

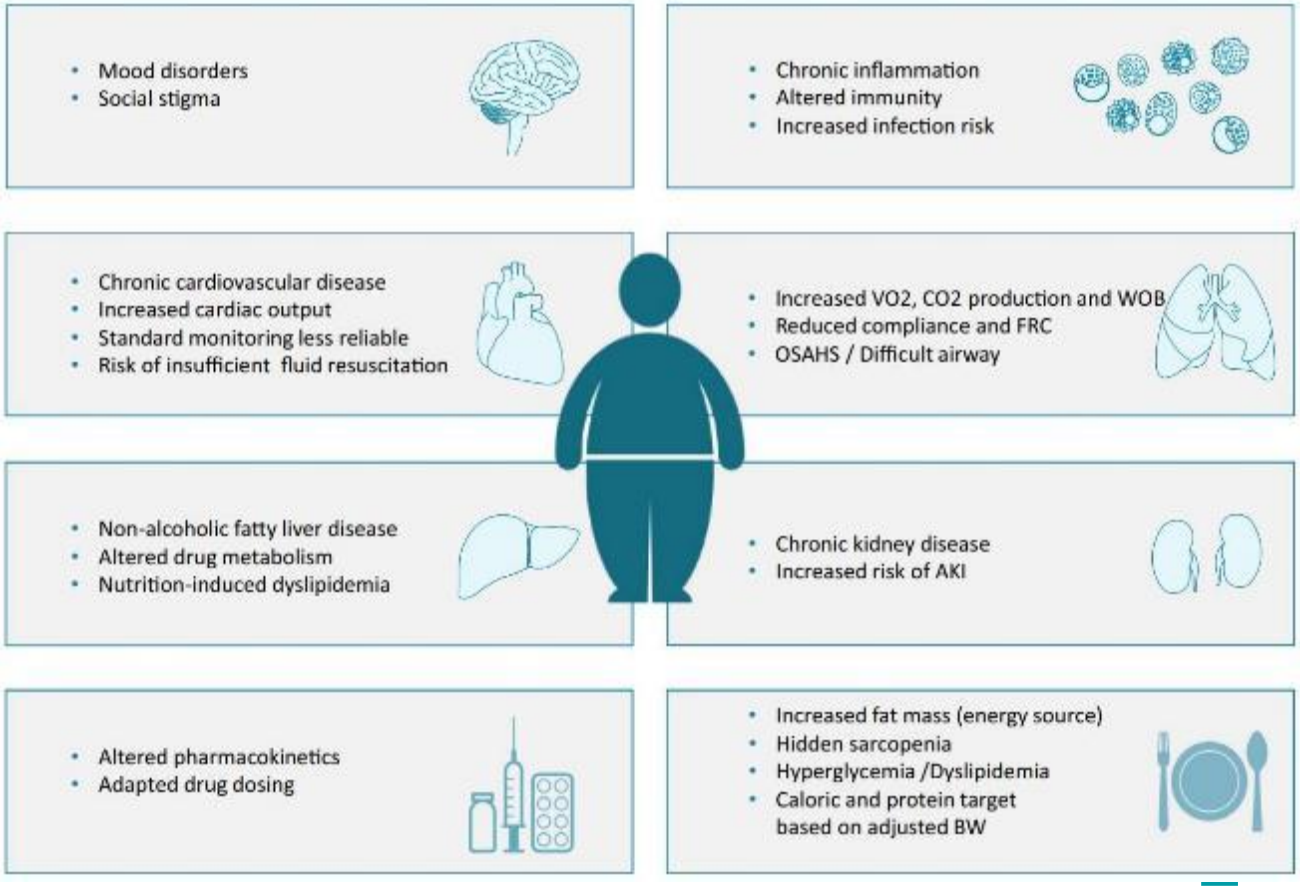
Obesity increases the risk of obesity-related disease but paradoxically is associated with increased survival in patients with these diagnoses is called "obesity paradox"

- Large cohort studies in the general population have demonstrated an increased mortality risk in both overweight and obese individuals[1]
- Recent data in hospitalized **patients or patients with chronic illnesses showed a relationship between BMI and mortality**, with ***overweight and moderate obesity being associated with lower mortality*** compared with a normal BMI or more severe obesity
  - Observed in heart failure, coronary artery disease, end-stage kidney disease, pneumonia, sepsis, acute respiratory distress syndrome (ARDS), general critical illness


1. Heymsfield SB, Wadden TA. *N Engl J Med.* 2017 Jan 19;376(3):254-266.
2. Schetz M, et al. *Intensive Care Med*. 2019 Jun;45(6):757-769.

# Impact of obesity on organ systems and their management during critical illness

Although moderate obesity may paradoxically decrease mortality in ICU patients, increased adipose tissue has an impact on several organ systems, increases morbidity and requires an adapted ICU management

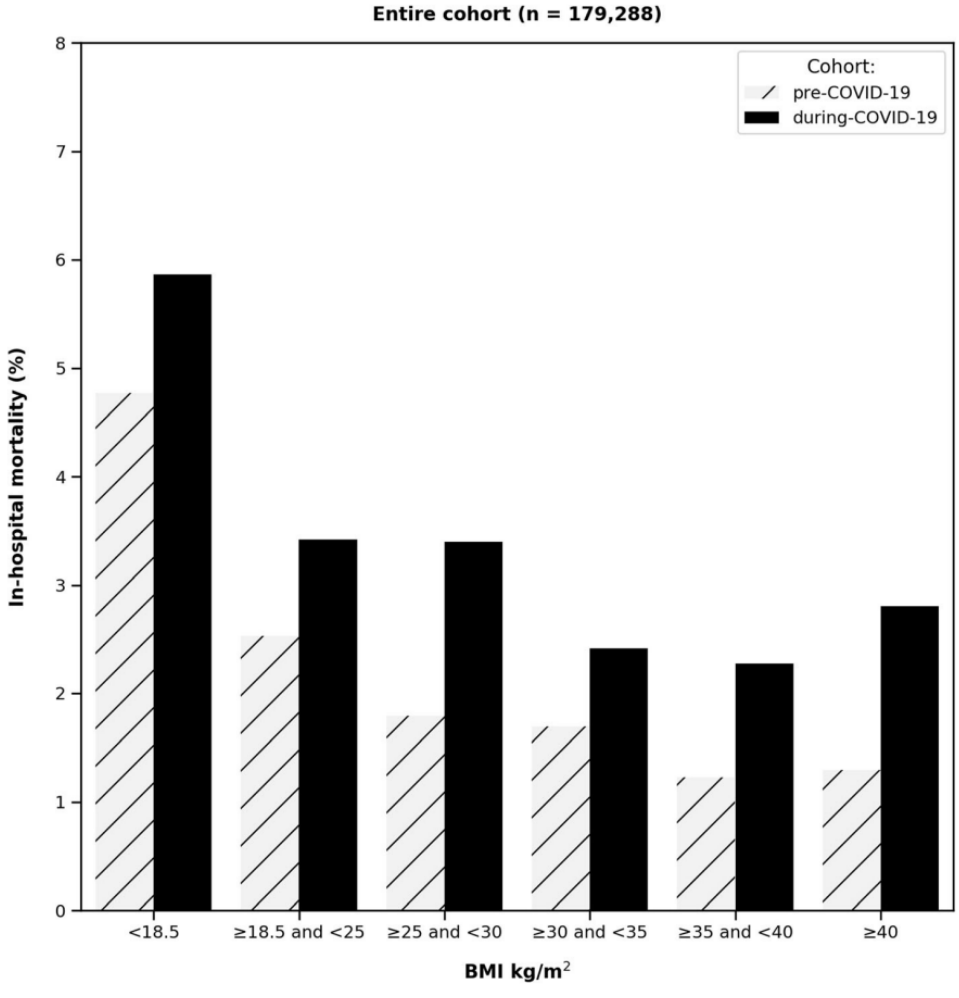



Schetz M, et al. *Intensive Care Med*. 2019 Jun;45(6):757-769.

# Mortality Rates Higher During COVID-19 Pandemic

Medical ward patients with severe obesity have a lower risk for mortality vs. normal BMI

Does not apply during COVID-19, where obesity was a leading risk factor for mortality in the medical wards




Mount Sinai Health System, NYC
N = 179,288
(149,098 admitted before Covid; 30,190 during covid)

Soffer S, et al. *BMC Endocr Disord*. 2022 Jan 6;22(1):13.

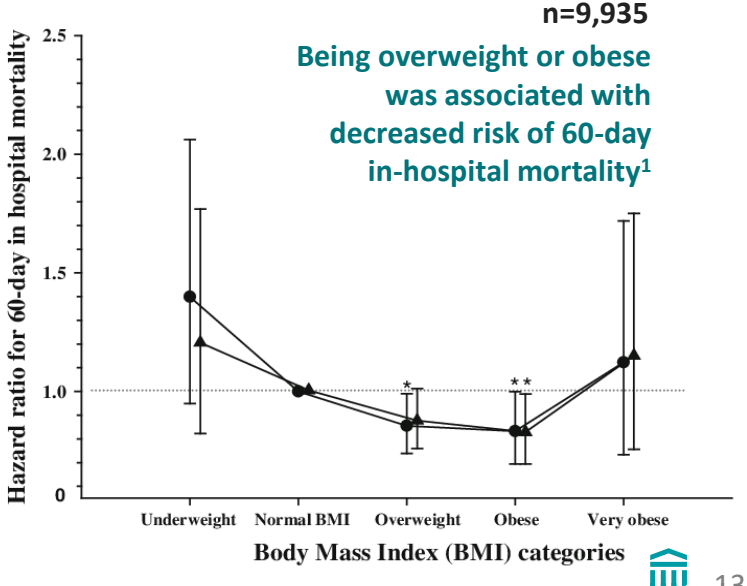
# The Obesity Paradox in Critical Illness

- The obesity paradox may contribute to clinicians' illusion that patients with obesity do not need nutrition therapy early in their ICU stay
  - The mortality curve for BMI is U-shaped, with mortality **highest** in patients with class III severe obesity with BMI >40 and in people with BMI <25
  - **Mortality is *lowest* in subjects with BMI in the range of 30–40 (class I and II obesity); this protective effect of moderate obesity is the OBESITY PARADOX**
- Raises question of whether BMI in this range is the best indicator of risk- ??

**OBESITY PARADOX**
**in ICU Patients with Obesity:**

Should not be used as rationale to withhold feeding

Should not stop clinicians from considering early administration of nutrition therapy




1. Hutagalung R, et al. *Intensive Care Med*. 2011 Nov;37(11):1793-9.
2. McClave SA, et al. *JPEN J Parenter Enteral Nutr*. 2016 Feb;40(2):159-211. (page 196)

# Principles and Goals for Feeding the Critically Ill Patient with Obesity

- Support lean body mass
- Promote anabolism and positive nitrogen balance
- Avoid overfeeding and worsening co-morbid conditions (i.e. hyperglycemia, increased CO2 production, fluid overload)
- Promote glycemic control and wound healing
- Include an exercise program to optimize lean muscle mass

McKendry J, Thomas ACQ, Phillips SM. *Nutr Clin Pract*. 2020 Aug;35(4):607-616.
McClave SA, et al. *JPEN J Parenter Enteral Nutr*. 2016 Feb;40(2):159-211.

# ASPEN/SCCM Expert Consensus

## For Feeding the Critically Ill Patient with Obesity

- Early start within 24-48 hours of ICU admission for patients with obesity who cannot sustain volitional intake
- Nutritional assessment to include: metabolic syndrome biomarkers, comorbidities evaluation, inflammation/SIRS, central adiposity, sarcopenia, BMI>40
- High –protein feeding to preserve lean body mass, mobilize adipose stores, minimize overfeeding
- For all classes of obesity, the EN regimen should not exceed 65-70% of target energy requirements as measured by indirect calorimetry; if IC is unavailable:
  - BMI 30-50: use 11-14 kcal/kg actual body weight/day
  - BMI >50: use 22-25 kcal/kg actual body weight/day

https://www.nutritioncare.org/Guidelines_and_Clinical_Resources/Resources_for_Critical_Care_Clinicians/

# ASPEN/SCCM Expert Consensus

## For Feeding the Critically Ill Patient with Obesity

- Protein should be provided in the range from:
  - BMI 30-40: 2.0 g/kg ideal body weight/day
  - BMI ≥40: 2.5 g/kg ideal body weight/day

**TARGET: 154 – 193 gms/day**

- If available, use an enteral formula with low caloric density and reduced NPC:N
  - Additional monitoring is needed to assess worsening of hyperglycemia, hyperlipidemia, hypercapnia, fluid overload, hepatic fat accumulation
- For patients with a history of bariatric surgery to receive supplemental thiamine prior to dextrose-containing IV fluids or nutrition therapy
  - Additionally, evaluate for micronutrient deficiencies

https://www.nutritioncare.org/Guidelines_and_Clinical_Resources/Resources_for_Critical_Care_Clinicians/

# Clinical Guidelines Informing Nutrition Provision in Critically Ill Adults with Obesity

- 650,000 million adults worldwide had obesity, 2016
- In the largest analysis of international nutrition provision during critical illness (n=17,154) **≥ 50% of patients were overweight or had obesity**

**KEY POINTS**

- Obesity is associated with increased morbidity in the general population, but the impact of obesity in critical illness on clinical outcomes is more complex
- Clinical **guidelines recommend hypocaloric energy provision with high protein** intake for hospitalized and critically ill obese patients
- Commonly used predictive equations are less accurate in overweight and obese patients vs. normal weight, and **indirect calorimetry is preferred to calculate energy expenditure**
- Clinicians should **manage the nutrition of the obese critically ill patient as any other patient**; conservatively in the first week of ICU stay, with an aim to meet energy and protein requirements after this time

Lambell K, Peake S, Ridley E. *Clin Nutr*. 2019 Aug;38(4):1957.

# Minimal high-quality research exists investigating the impact of nutrition on clinical and functional outcomes in critically ill patients with obesity

Randomised trials informing recommendations for nutrition in obese critically ill patients

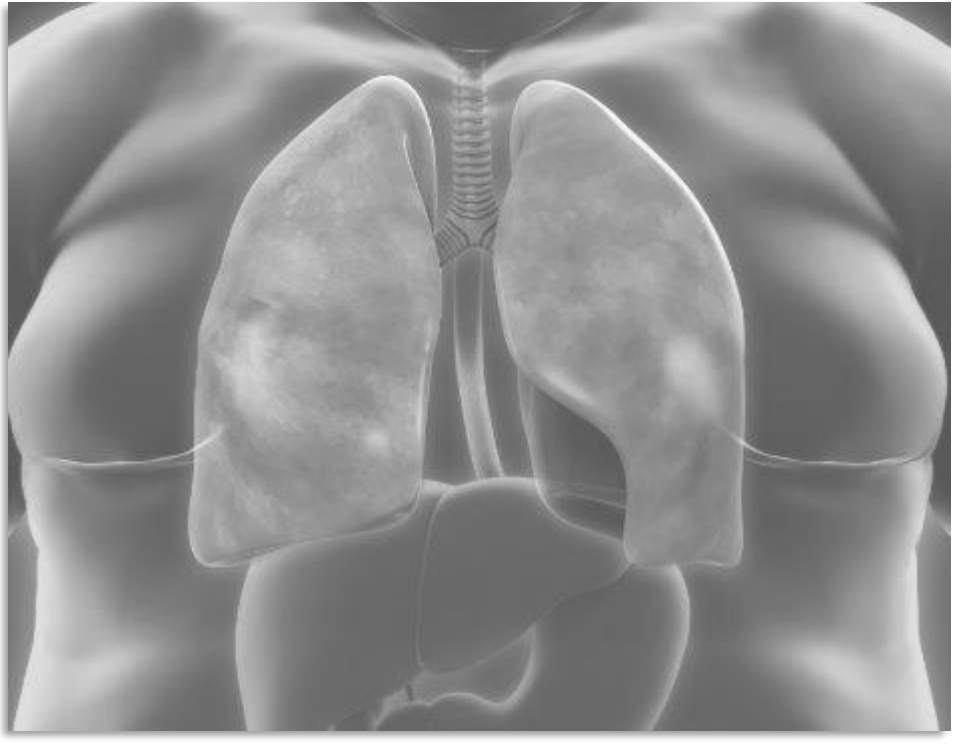
| Paper | Trial details | | | Intervention | | | Control | | | Outcomes |
|---|---|---|---|---|---|---|---|---|---|---|
| | Population | n | Study aim and details | Energy | Protein | Actual intake Mean (SD) | Energy | Protein | Actual intake Mean (SD) | |
| Choban et al, 1997 | Obese adult patient referred for PN (13 patients in ICU) | 30 | To assess the efficacy of hypocaloric vs eucaloric PN with protein at 2 g/kg IBW Double blind | Hypocaloric Aim for kcal/nitrogen ratio of 75:1 | High protein | 1293 (299) kcal and 120 (27)g protein | Eucaloric Aim 150:1 kcal/nitrogen ratio | High protein | 1936 (198) kcal and 108 (14) g protein (1.2 g/kg actual weight, 2 g/kg IBW) | Weight change; 0 (6.3) kg (Hypocaloric) vs 2.7 (7) kg (Eucaloric) |
| Burge et al, 1994 | Hospitalised obese patients referred to nutrition service for PN | 16 | To determine if nitrogen balance could be maintained in patients receiving hypocaloric, high protein PN Double blind | Hypocaloric 50% REE; kcal/nitrogen ratio of 75:1 | High protein | 1285 (374) kcal (14 kcal/ABW) and 111 (32) g protein (1.3 g/kg ABW, 2 g/kg IBW) | Eucaloric 100% of REE; aim 150:1 kcal/nitrogen ratio | High protein | 2492 (298) kcal (25 kcal/kg/actual weight) and 130 (15) g protein (1.2 g/kg or 2 g/kg IBW) | No clinical outcomes reported Weight change; - 4.1 (6)] kg (Hypocaloric) vs – 7.4 (8.4) kg [(Eucaloric) |

**More research is needed**

ICU: Intensive Care Unit; IBW: Ideal body weight PN: parenteral nutrition; SD: standard deviation

Lambell K, Peake S, Ridley E. Clin Nutr. 2019 Aug;38(4):1957.

# The Respiratory System



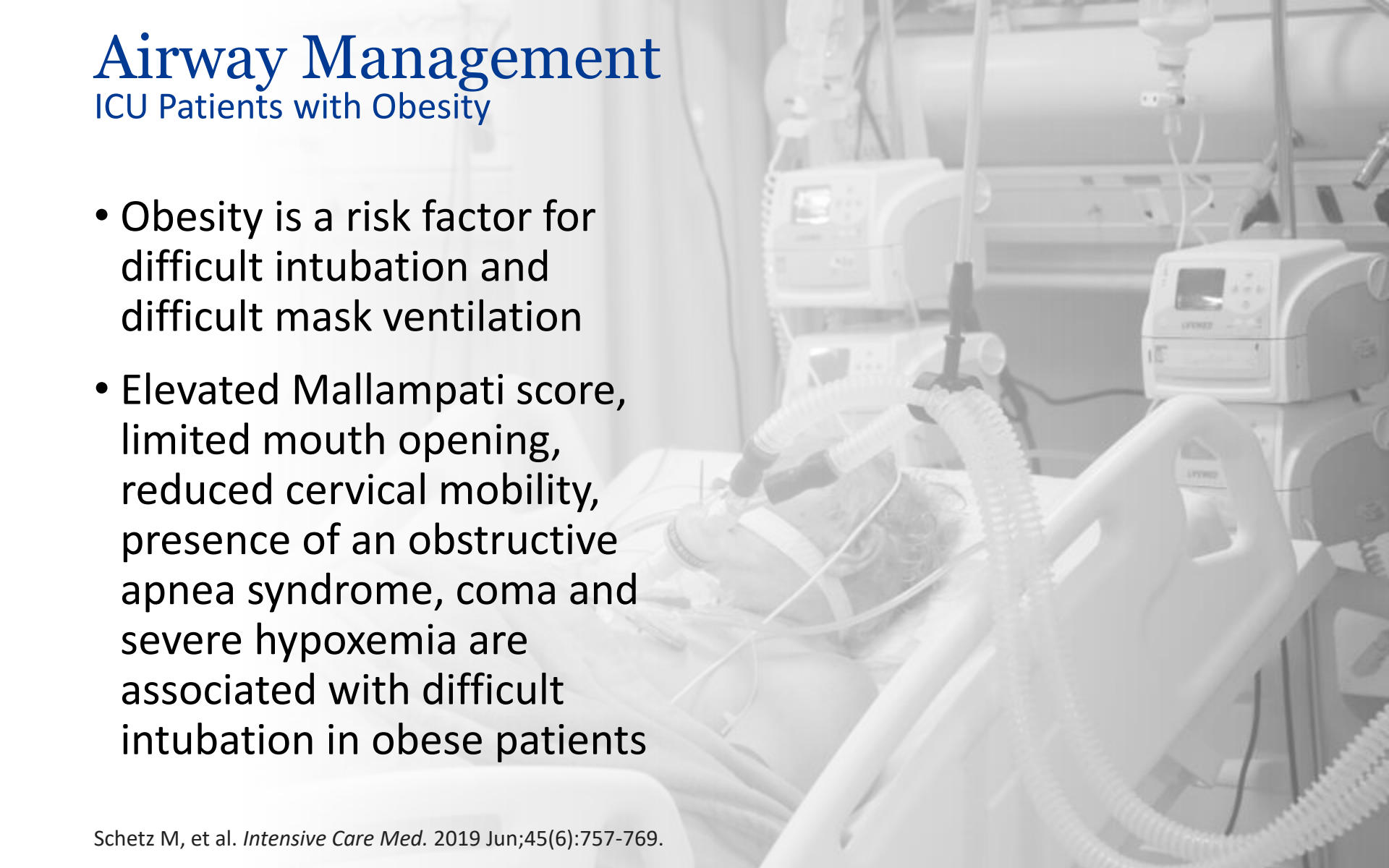
- One of the main objectives of the critical care management of obese patients is prevention of respiratory complications
- Respiratory management of ICU patients with obesity may differ between patients with healthy lungs and those with ARDS at ICU admission

Schetz M, et al. *Intensive Care Med.* 2019 Jun;45(6):757-769.

# Airway Management

## ICU Patients with Obesity

- Obesity is a risk factor for difficult intubation and difficult mask ventilation
- Elevated Mallampati score, limited mouth opening, reduced cervical mobility, presence of an obstructive apnea syndrome, coma and severe hypoxemia are associated with difficult intubation in obese patients



Schetz M, et al. *Intensive Care Med.* 2019 Jun;45(6):757-769.

# Airway Management
## ICU Patients with Obesity

- To limit desaturation during the intubation procedure, preoxygenation must be optimized.
- A preoxygenation of 5 min with noninvasive ventilation (NIV) in a sitting position, associating pressure support and positive end-expiratory pressure (PEEP) permits reaching an exhaled fraction in oxygen>90% more quickly than standard bag valve mask ventilation in patients with obesity
- Te OPTINIV preoxygenation technique [associating a high-flow nasal cannula (HFNC) with NIV] was more effective at reducing oxygen desaturation vs. the reference method using NIV alone in a randomized controlled trial including obese and nonobese patients with severe acute respiratory failure

Schetz M, et al. *Intensive Care Med.* 2019 Jun;45(6):757-769.

# Invasive mechanical ventilation in non-ARDS

## ICU Patients with Obesity

- Protective ventilation should be applied in obese patients, using low tidal volume [set according to ideal body weight (IBW)], moderate-to-high PEEP and recruitment maneuvers
- Te respiratory mechanics, alveolar recruitment and gas exchanges are significantly improved by application of PEEP ≥ 10 cmH2O (improvement of respiratory compliance and decrease of inspiratory resistance)
- Commonly used PEEP by clinicians (11.6±2.9 cmH2O) was shown inadequate for minimizing atelectasis and “optimizing” ventilation
- A recruitment maneuver followed by PEEP titration significantly improved lung volumes, respiratory system elastance and oxygenation
- Optimal PEEP levels were around 20 cmH20; 12 cmH2O was found effective

Schetz M, et al. *Intensive Care Med.* 2019 Jun;45(6):757-769.

# Invasive mechanical ventilation in ARDS

## ICU Patients with Obesity

- High PEEP has been reported to be associated with better survival in obese patients with ARDS
- Contrary to non-obese patients, driving pressure might not be appropriate to assess the severity and prognosis of obese ARDS patients
- Low-to-negative values of transpulmonary pressure predict lung collapse and intratidal recruitment/derecruitment
  - These results further support the monitoring of transpulmonary pressure using esophageal pressure even if future studies are needed to demonstrate its safety and efficiency
- Prone position is a therapy of choice
- Reverse Trendelenburg position and optimal abdominal fat positioning can help to avoid complications of increased abdominal pressure as bowel ischemia after failure or impossibility of using prone positioning
- Neuromuscular blockers, veno-venous extracorporeal membrane oxygenation (ECMO) can also be safely used

Schetz M, et al. *Intensive Care Med.* 2019 Jun;45(6):757-769.

# Europe vs. US Guidelines

| Suggestions | ESPEN guidelines | ASPEN guidelines |
|---|---|---|
| For calculating the energy target if measurement of REE is not possible | | |
| In general | 20–25 kcal/kg actual BW/day<br>Below 70% of REE should be given during 'early' acute phase | 25–30 kcal/kg actual BW/day |
| In obese | Same as above, but calculated according to adjusted BW[a]<br>If REE measured, set target to 80–100% of REE after the early acute phase (within days 3–7) | 11–14 kcal/kg actual BW/day if BMI 30–50 kg/m$^2$<br>22–25 kcal/kg ideal BW[b]/day if BMI > 50 kg/m$^2$<br>If REE measured, set target to 65–70% of REE |
| For calculating protein target | | |
| In general | 1.3 g/kg actual BW/day | 1.2–2.0 g/kg actual BW/day |
| In obese | Same as above, but calculated with adjusted BW[a] | 2.0–2.5 g/kg ideal BW[b]/day |
| For adjustment of nutritional therapy according to serum markers[c] | | |
| Glucose | Below 10 mmol/l (180 g/l)<br>Consider lowering carbohydrate administration when > 6 U insulin/h is needed for > 24 h | Below 10 mmol/l (180 g/l) |
| Urea | Consider lowering protein administration if > 30 mmol/l:<br>Probably only justified if protein administration > 1.5 g/kg BW/day | – |
| Triglycerids | Investigate and consider lowering fat administration if > 5.6 mmol/l | – |

Schetz M, et al. *Intensive Care Med*. 2019 Jun;45(6):757-769.

# Europe vs. US Guidelines

| Suggestions | ESPEN guidelines | ASPEN guidelines |
|---|---|---|
| Examples for calculating energy and protein targets in obese[d] | | |
| Example 1: male 120 kg, 185 cm ≥ BMI = 35.1 kg/m$^2$<br>Ideal BW[b] = 77 kg[b] and adjusted BW[a] 86–88 kg | | |
| Energy target | Calculated with adjusted BW[a]<br>25 kcal × 86–88 kg<br>Target = 2150–2200 kcal/day | Calculated with actual BW<br>14 kcal × 120 kg<br>Target = 1680 kcal/day |
| Protein target | Calculated with adjusted BW[a]<br>1.3 g × 92–96 kg[a]<br>Target = 120–125 g/day | Calculated with ideal BW[b]<br>2.0–2.5 g × 77 kg[b]<br>Target = 154–193 g/day |
| Example 2: female 140 kg, 165 cm ≥ BMI = 51.5 kg/m$^2$<br>Ideal BW[b]: 53 kg and adjusted BW[a] = 70–75 kg | | |
| Energy target | Calculated with adjusted BW[a]<br>25 kcal × 70–75 kg<br>Target = 1750–1875 kcal/day | Calculated with ideal BW[b]<br>25 kcal × 53 kg<br>Target = 1325 kcal/day |
| Protein target | Calculated with adjusted BW[a]<br>1.3 g × 70–75 kg<br>Target = 91–98 g/day | Calculated with ideal BW[b]<br>2.0–2.5 g × 53 kg<br>Target = 106–133 g/day |

REE resting energy expenditure, BW body weight a Adjusted BW=ideal BW+20–25% of difference between actual and ideal BW (actual BW−ideal BW) b Ideal BW: for males: 0.9×(height in cm−100); for females: 0.9×(height in cm−106) suggested in ESPEN guidelines, no specific suggestion for calculating ideal BW in ASPEN guidelines c No difference in guideline targets regardless of whether applied to normal weight or obese individuals d The upper level of suggested energy targets in kcal/BW/day is taken as a basis for calculations

Schetz M, et al. *Intensive Care Med*. 2019 Jun;45(6):757-769.

# QUESTION

What is the amount of protein recommended per day by ASPEN for ICU patients with obesity?

1. 130 – 140 gms/day
2. 154 – 193 gms/day
3. 99 – 110 gms/day
4. 120 – 125 gms/day

# Summary

- ~50% of U.S. ICU patients have obesity
- Waist circumference (WC) and waist-hip ratio (WHR) are better tools than BMI alone to assess fat distribution and contribute to risk stratification
- Obesity increases the risk of obesity-related disease but paradoxically is associated with increased survival in patients with these diagnoses is called “obesity paradox”
- RESOURCE: 2016 GUIDELINES for the Provision and Assessment of Nutrition Support Therapy in the Adult Critically Ill Patient

# Parenteral Nutrition Resources

Recommendations and Guidelines

- ***NEW!*** ASPEN Lipid Injectable Emulsion Safety Recommendations Part 2: Neonate and Pediatric Considerations *2021*
- ***NEW!*** Recommendations for Photoprotection of Parenteral Nutrition for Neonates and Premature Infants: ASPEN Position Paper *2021*
  - ***NEW!*** Use of Photoprotection for Parenteral Nutrition in Premature Infants Part 1: Background on Photoprotection (Video 1) *2021*
  - ***NEW!*** Use of Photoprotection for Parenteral Nutrition in Premature Infants Part 2: Implementation of Photoprotection (Video 2) *2021*
  - ***NEW!*** ASPEN Recommendations for Photoprotection of Parenteral Nutrition for Premature Infants Podcast *2021*
- Update on the Use of Filters for Parenteral Nutrition: An ASPEN Position Paper *2020*
  - ***NEW!*** Filtering Parenteral Nutrition at Home: A Recommended Practice Change *Infusion Magazine 2021*
  - ***NEW!*** Recommended Practice Change in the Use of Filters for Parenteral Nutrition (Video 1) *2021*
  - ***NEW!*** Filtering the Problems: Best Practices and Troubleshooting Parenteral Nutrition Administration (Video 2) *2021*
  - ***NEW!*** Update on the Use of Filters for Parenteral Nutrition Fact Sheet *2021*
  - ***NEW!*** Filtered Food for Thought: An Interview with Two ASPEN Experts *2021*
- 2020 ASPEN Lipid Injectable Emulsion Safety Recommendations, Part 1: Background and Adult Considerations *2020*
  - ***NEW!*** ILE Safety Recommendations Fact Sheet for Adult Patients *2021*
- Appropriate Dosing for Parenteral Nutrition: Persistent shortages of parenteral nutrition (PN) components have led to a tendency of practitioners providing less than adequate dosing, which can lead to nutrient deficiencies and impair growth and healing. This document provides the requirements and recommendations for dosing of nutrients for a complete PN prescription. *2019*
- Indications and Appropriateness of Parenteral Nutrition: This document provides clinicians and other stakeholders, such as policy makers and third-party payers, current perspectives on the use of PN in a variety of healthcare settings. *2018*
- 2014 ASPEN Clinical Guidelines: Parenteral Nutrition Ordering, Order Review, Compounding, Labeling, and Dispensing *2014*
- ASPEN Parenteral Nutrition Safety Consensus Recommendations *2014*
- ASPEN Consensus Recommendations for Refeeding Syndrome *2020*

https://www.nutritioncare.org/PNResources/