Best Practices in the Care of the Obese Patient

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Definition of obesity: adipose tissue accounts for greater than normal percentage of body weight; normal varies among people and locations; normal often associated with ideal body weight (IBW); medication dosing often based on ideal body weight

Ideal body weight: data originally derived from height and weight tables published by Metropolitan Life Insurance Company (MLIC) in 1940s; tables represented attempt to identify weight and height associated with greatest longevity in men and women; data set included only people with insurance through MLIC; policyholders healthier than general population and aged 25 to 59 yr; policyholders self-reported weight and height; measuring equipment not standardized, nor was reported data verified

Changes in IBW over time: people have become larger over time; several formulas developed to calculate IBW; Broca formula—height in centimeters minus 100 for men or 105 for women equals ideal body weight; Lennm et al (2003)—for men and women, multiplying height in meters squared by 22 yields IBW values midway between weight ranges derived from published IBW formulas; IBW arbitrary number used to calculate medication dosages

Morbid obesity: defined as extreme obesity that may shorten patient’s life if untreated; historically calculated as double IBW or IBW plus 100 lb; currently, body mass index (BMI) >40 indicates morbid obesity

BMI standards: ideal—BMI 18 to 25; overweight—BMI 26 to 29; obese—BMI 30 to 39; morbidly obese—BMI >40; super obese—BMI >50; super-super obese—BMI >60

World Health Organization definitions: released in 1998; obese—BMI >30; class 1 obesity—BMI 30 to 34, indicating patient at risk for health problems; class 2 obesity—BMI 35 to 39, indicating severe comorbidities; class 3 obesity—BMI 40, considered markedly severe

United States Government standards: new standards released June 17, 1998; patient overweight and at risk if BMI >25; according to new standards, 59% of men and 50% of women overweight; with release of standards, 35 million people newly classified as overweight

Shortcomings of BMI: BMI only measure of total weight, not direct measure of obesity; distribution of adipose tissue important consideration; women tend toward peripheral obesity in buttocks and hips; men tend toward central, visceral obesity at waist

Metabolic syndrome: characterized by large waist, high triglycerides, hypertension, and diabetes; visceral fat metabolically active and causes problems with inflammation; risk directly correlated with waist circumference and central obesity; obesity associated with poor quality of life, stress on joints, and hormonal imbalance

Obesity paradox: obesity appears to be protective; some studies indicate obese patients survive longer in hospital than nonobese patients; other studies indicate rates of respiratory insufficiency and mortality lower in obese patients than in nonobese patients

Caring for obese patients: obesity associated with numerous medical problems in all organ systems; number of obese patients increasing; obesity serious threat to children and represents significant financial cost; tables in operating room and radiologic scanners must accommodate larger size of patients; obese patients difficult to move

Laryngeal mask airway (LMA): consider endotracheal tube instead of first-generation LMA to minimize risk of aspiration; obese patients have high incidence of gastroesophageal reflux disease, hiatal hernia, and diabetes

Positioning for induction: ideal position for induction in morbidly obese patient involves elevation of head; reverse Trendelenburg position recommended; obese patients desaturate quickly in supine position; difficult anatomy for intubation unique to obese patients, but desaturation occurs more rapidly in obese patients than in nonobese patients

Educational Objectives

The goal of this program is to improve outcomes of obese patients and patients requiring blood transfusions. After hearing and assimilating this program, the clinician will be better able to:

1. Modify perioperative anesthetic plans to account for the unique requirements of obese patients.
2. Diagnose and treat rhabdomyolysis.
3. Consider a strict 1:1:1 transfusion ratio vs point-of-care goal-directed treatment based on the patient’s response and hemostatic condition.
4. Explain the findings and the limitations of the Pragmatic, Randomized Optimal Platelet and Plasma Ratios trial.
5. Choose the appropriate treatment for surgical patients with abnormal bleeding times.

Faculty Disclosure

In adherence to ACCME Standards for Commercial Support, Audio Digest requires all faculty and members of the planning committee to disclose relevant financial relationships within the past 12 months that might create any personal conflicts of interest. Any identified conflicts were resolved to ensure that this educational activity promotes quality in health care and not a proprietary business or commercial interest. For this program, members of the faculty and planning committee reported nothing to disclose. In her lecture, Dr. Shore-Lesserson presents information related to the off-label or investigational use of a therapy, product, or device.
Mask ventilation: treat all morbidly obese patients as having sleep apnea; mask ventilation difficult; on STOP-BANG questionnaire, 3 positive responses indicate possible sleep apnea and >5 positive responses indicate definite sleep apnea; every morbidly obese man meets criteria; literature indicates up to 70% of patients undergoing bariatric surgery have sleep apnea.

Postoperative complications: incidence of complications increased in morbidly obese patients; complications include respiratory depression and pulmonary embolism.

Rhabdomyolysis: lying in one position for prolonged period associated with muscular ischemia, particularly in patients with diabetes, hypertension, or peripheral vascular disease; rhabdomyolysis may develop; incidence of elevated creatine phosphokinase (CPK) and rhabdomyolysis ≥50% in some studies of bariatric patients; hyperkalemia resulting from rhabdomyolysis can lead to cardiac arrhythmias, cardiac arrest, renal failure (due to myoglobinuria), disseminated intravascular coagulation, and compartment syndrome.

Paddling: all pressure points of morbidly obese patients require adequate paddling; ensure lack of traction on nerves when changing position of patient; avoid applying excessive pressure when using tape to secure patient; ensure adequate stabilization.

Presentation of rhabdomyolysis: muscle pain and tenderness; anaglesia from epidural catheters may mask early pain; tea-colored urine late sign; dependent muscles at greatest risk; elevated CPK early sign, followed by elevated myoglobin; maintain adequate hydration and diuresis to prevent renal complications; CPK levels 5 times higher than normal indicate rhabdomyolysis (>1000 U/L by definition); renal complications occur if CPK 10,000 to 20,000 U/L.

**Suggested Reading**


Management of Massive Transfusion:

Is 1:1:1 Ratio Appropriate?

**Linda J. Shore-Lessmer, MD, Professor of Anesthesiology, Hofstra Northwell School of Medicine, Hempstead, NY, and Director of Cardiovascular Anesthesiology, Long Island Jewish Medical Center, New Hyde Park, NY**

Definition of massive transfusion: typically in literature, massive transfusion >10 units of packed red blood cells in 24-hr period; this definition changing; trend moving toward decreased volumes of transfusion; also, patients with massive bleeding probably receive more transfusions in first hours after presenting for treatment; may be more appropriate to consider massive transfusion as large volume given early in treatment period after presentation (eg, some definitions have changed to 10 units in 6-hr period, 5 units in 3-hr period, or any patient receiving transfusion within 2 hr of presentation).

Goal of treatment: to deliver most appropriate therapy for individual patient; transfusion ratio of 1:1:1 may not be appropriate for all patients.

Treatment protocols: strict 1:1:1 transfusion ratio vs point-of-care goal-directed treatment based on patient’s response and hemostatic condition.

Historic ratios: historically, multiple units of red blood cells administered before considering other components; 1:1:1 component ratio gradually evolved; clinicians should consider most appropriate treatment instead of establishing specific ratio.

Viscoelastic instruments: thromboelastography (TEG) — uses cup with piston immersed in whole blood sample; generates tracing as blood coagulates; piston measures force of cup rotating around it; thromboelastometry (TEM) — similar to TEG; piston rotates instead of cup.

Holcomb et al (2012): studied ≥2000 patients presenting to emergency department (ED) with Level I trauma activation; evaluated conventional coagulation tests and TEG for correlation with each other and with transfusion, massive transfusion, and substantial bleeding: substantial bleeding defined as patient who received 5 units in 4 hr, received any blood within 2 hr of presentation, or died within 2 hr of presentation; rapid TEG provides results quickly and allows some lengthy steps of TEG to be bypassed.

Results: rapid TEG correlated with conventional coagulation tests; correlations stronger in patients receiving transfusion; fibrinogen level did not correlate with massive transfusion or substantial bleeding and was not reliable predictor of need for transfusion; TEG variables of α-angle and maximum amplitude (MA), prothrombin time, and partial thromboplastin time correlated when measured on presentation to ED and correlated with amount of transfusion; α-angle predictive of requirement for massive transfusion; all TEG variables and no coagulation tests independent predictors of mortality at 24 hr or 30 days.

Johansson et al (2013): designed algorithm for transfusion in patients with trauma; TEG compared with conventional coagulation tests; if patients failed with transfusion algorithm or became unstable, investigators reverted to transfusion with 1:1:1 ratio; algorithm calls for fresh frozen plasma at moderate-level reaction time (R-value) abnormality, and larger amounts at increasingly severe levels of abnormality; platelet administration guided by MA; algorithm failed in 18% of patients; compared with survivors, nonsurvivors had higher injury severity scores, larger base deficits, lower Glasgow coma scores, and lower TEG, fibrinogen, MA, R-value, G-value, and lysis indices.

Holcomb et al (2015): Pragmatic, Randomized Optimal Platelet and Plasma Ratios (PROPR) trial — prospective, randomized multicenter trial compared 1:1:1 ratio with 1:1:2 ratio; patients with major trauma activation or predicted to experience severe hemorrhage enrolled; patients randomly assigned to 1:1:1 group initial transfusion units did not include platelets in 1:1:2 group; statistical significance not achieved for 24-hr and 30-day mortality; statistical difference found for number of patients who died because of exsanguinations (9% in 1:1:1 group vs 15% in 1:1:2 group); rate of adequate hemostasis as determined by blinded surgeon higher in 1:1:1 group (statistically significant).

Limitations: lack of information about mechanism and severity of injury limited usefulness of conclusions; median time to death ≥100 min in both groups, indicating the likelihood of injuries that could not be treated in time or with massive transfusion protocol.

Commentary: study considered positive despite failing to achieve primary outcome because some factors better in 1:1:1 group with nonsignificant trend toward decreased mortality; West Yorkshire Major Trauma Network to consider changing current recommendations of 1:2 ratio of plasma to blood to 1:1:1 ratio in upcoming guidelines.

Patient management: in 1:1:1 group, first course of transfusion contained 6 units of platelets, plasma, and blood; platelets administered first followed by alternating plasma and blood; patients in 1:1:2 group received plasma and blood in 1:2 ratio until 9 total units transfused; no platelets administered until second round of transfusion; treatment protocols different.
with early administration of platelets only in 1:1:1 group; patients in 1:1:2 group received more plasma and platelets in postintervention period, indicating “catch-up” effect normalizing products received overall; considering total units received by patients during trial, final ratio for 1:1:1 group 1:1.7:1.3 and for 1:1:2 group 1:1.2:1.8; administration of platelets early in patient’s care possibly advantageous

Kautza et al (2012): retrospective review of trauma patients from 2004 to 2009; early patients (2004-2007) compared with more recent patients (2007-2009); patients divided into massive transfusion protocol and submassive transfusion protocol groups; initial presentations similar in each time period; compared with patients in early period, patients in recent period had higher injury severity scores, and fewer required massive transfusion protocol; ratios of plasma to blood and platelets to blood unchanged between time periods in massive transfusion group; ratio of plasma to blood and platelets to blood higher in recent period than in early period in submassively transfused group; percentage of patients receiving plasma or platelets in first 6 hr increased from 50% to 70% over time; early transfusion of components other than red blood cells likely beneficial for trauma patients

Further critique of PROPPR trial: information about mechanism of injury lacking; unclear whether massive transfusion protocol followed; only 45% of patients received massive transfusion; transfusion outcomes not achieved; mortality end points not achieved; no differences observed in ventilator time, multi-organ dysfunction, or renal outcomes; ratios did not differ much

Ideal approach: use patient-centered approach to identify patients requiring massive hemorrhage protocol; individualize treatment based on point-of-care testing; identify patients early; administer plasma and platelets early; consider early administration of tranexamic acid

Schöchl et al (2010): trauma study in which rotational TEM used to direct blood transfusion therapy and pharmacologic treatment; patients with abnormal FIBTEM test received fibrinogen early in management; patients with abnormal extrinsic activation test received prothrombin complex concentrate (PCC); patients received platelet transfusion if initial administration failed; when administered early, fibrinogen strengthens fibrin clot; with pharmacologic protocol, observed mortality lower than predicted by trauma injury severity score and revised injury severity classification

Volume considerations: PCC 60 mL provides same replenishment of coagulation factors as fresh frozen plasma 1500 mL; patients unable to tolerate plasma volume may benefit from reduced volume of transfusion

Guidelines: not firmly established for trauma patients; for surgical patients with abnormal bleeding times, fibrinogen (level of evidence 1c) and PCC recommended

Suggested Reading

1. The original data on ideal body weight were derived from height and weight tables published by Metropolitan Life Insurance Company (MLIC). The policyholders in this data set:
   (A) Were 25 to 59 yr old
   (B) Were less healthy than the general population
   (C) Were covered by MLIC from 1961 to 1970
   (D) Submitted to height and weight measurements at a medical facility

2. The standards for obesity were reclassified by the United States Government in 1998. As a result, _____ of American women were determined to be overweight with a body mass index >25.
   (A) 10%
   (B) 25%
   (C) 50%
   (D) 75%

3. The characteristic cluster of signs that indicate metabolic syndrome includes which of the following?
   1. Hypertension
   2. Coronary artery disease
   3. Diabetes
   4. Peripheral obesity
   5. Central obesity
   (A) 1,2,4
   (B) 1,3,5
   (C) 2,3,4
   (D) 3,4,5

4. The 2011 Fourth National Audit Project study found that the incidence of aspiration in severely obese patients was ______ higher than the incidence of aspiration in nonobese patients when a first-generation laryngeal mask airway was used.
   (A) 2-fold
   (B) 3-fold
   (C) 4-fold
   (D) None of the above; the incidence of aspiration in severely obese patients was no higher than that in nonobese patients

5. Rhabdomyolysis is indicated by a creatine phosphokinase level of at least _____ by definition.
   (A) 250 U/L
   (B) 500 U/L
   (C) 1000 U/L
   (D) 10,000 U/L

6. Which of the following is a finding of Holcomb et al’s (2012) study of thromboelastography in patients with Level I trauma activation?
   (A) Prothrombin time was an independent predictor of mortality at 24 hr
   (B) Partial thromboplastin time was an independent predictor of mortality at 30 days
   (C) Fibrinogen level was a reliable predictor of the need for transfusion
   (D) α-Angle was predictive of the need for massive transfusion

7. Which of the following is a finding of the Pragmatic, Randomized Optimal Platelet and Plasma Ratios (PROPPR) trial comparing a transfusion ratio of 1:1:1 with a transfusion ratio of 1:1:2 in patients with major trauma activation or predicted to experience severe hemorrhage?
   (A) Mortality rate due to exsanguination was significantly lower in the 1:1:1 group than in the 1:1:2 group
   (B) Rate of adequate hemostasis was significantly higher in the 1:1:2 group than in the 1:1:1 group
   (C) Statistical significance was achieved for 24-hr mortality
   (D) Statistical significance was achieved for 30-day mortality

8. Which of the following statements about the PROPPR trial is true?
   (A) Information about the mechanism of injury was recorded
   (B) Transfusion outcomes were achieved
   (C) 85% of patients received a massive transfusion
   (D) No differences were observed in multiorgan dysfunction or renal outcomes

9. 60 mL of prothrombin complex concentrate provides the same replenishment of coagulation factors as ______ of fresh frozen plasma.
   (A) 500 mL
   (B) 1000 mL
   (C) 1500 mL
   (D) 2000 mL

10. The recommendation of fibrinogen in surgical patients with abnormal bleeding times is supported by level ______ evidence.
    (A) 1a
    (B) 1c
    (C) 2a
    (D) 3b

NOTE: On Audio Digest Anesthesiology Volume 58, Issue 19, Dr. Maurer’s comments on the use of glycopyrrolate to block hypersalivation include a mention of ketamine. To clarify, Dr. Maurer is noting that hypersalivation CAUSED BY ketamine is another indication for administration of glycopyrrolate. All answers are being accepted for question 3 | (which included a misinterpretation of these comments).

Answers to Audio Digest Anesthesiology Volume 58, Issue 25: 1-C, 2-C, 3-B, 4-D, 5-D, 6-C, 7-A, 8-C, 9-B, 10-A