nourished patients (ie, weight loss ≥ 10%) with cancer.[9] Compared with controls, the group that received both pre- and postoperative supplementation, which included omega-3 fatty acids and arginine, had a shorter hospital stay and fewer overall complications.

Conclusions

Surgery should not be delayed for either enteral or parenteral nutrition supplementation, except in the most severely malnourished patients, who may experience a modest decrease in the risk for noninfectious complications such as impaired wound healing. Enteral feeding is preferred when feasible, but no adequate trials have directly compared preoperative TPN with enteral feeding in such patients.

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Q: Do all patients undergoing bariatric surgery need polysomnography to evaluate for obstructive sleep apnea?

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A: Yes. Clinical scoring schemes are not accurate enough to replace polysomnography in the evaluation for obstructive sleep apnea (OSA).

Sleep apnea: A prevalent and serious risk factor in bariatric surgery patients

Obesity is associated with an increased risk of OSA. The prevalence of OSA in patients with a body mass index (BMI) greater than 30 is 20% to 40%.[1] Recent series of patients evaluated for bariatric surgery have shown that the prevalence in these patients can range between 70% and 91%.[2–4]

OSA can have a significant effect on both the perioperative and postoperative care of the surgical patient. A 2001 study found that up to one third of patients with OSA undergoing hip replacement or knee replacement surgery developed substantial respiratory or cardiac complications (including arrhythmias, myocardial ischemia, unplanned intensive care unit transfers, and/or reintubation), mostly within the first 72 hours after surgery.[5] A more recent review of more than 3,000 patients undergoing bariatric procedures from a single institution found that sleep apnea was a positive predictive factor for anastomotic leaks.[6] In another series of 311 patients undergoing bariatric surgery, the presence of OSA more than doubled the odds of having a hospital stay longer than 3 days (odds ratio [OR] = 2.25).[7]

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Clinical scoring systems for apnea severity in obese patients

Despite the ease with which it can be assessed, daytime sleepiness is not a good predictor of OSA in the morbidly obese population. Several studies have attempted to determine whether clinical parameters such as the Epworth Sleepiness Scale (ESS) or BMI can predict OSA or its severity. In a study of 66 patients undergoing bariatric surgery, patients with an ESS score greater than 6 were selected to undergo polysomnography for evaluation for OSA.[8] No correlation was noted between the BMI, history of snoring, an elevated ESS score, and the severity of OSA as determined by the respiratory disturbance index.[8]

A larger study of 99 severely symptomatic obese patients undergoing bariatric surgery identified several independent clinical predictors of significant OSA, defined as a score of 15 or greater on the apnea-hypopnea index (AHI).[9] Conveniently expressed as the acronym BASH'IM, these predictors include the following (presented with OR and 95% confidence interval [CI] for an AHI score ≥ 15):

- **BMI ≥ 45** (OR = 4.3; 95% CI, 1.7 to 11.1)
- **Age ≥ 38 years** (OR = 3.4; 95% CI, 1.3 to 9.2)
- **Observed sleep apnea** (OR = 3.3; 95% CI, 1.4 to 8)
- **HbA_{1c} ≥ 6%** (OR = 5.9; 95% CI, 2.2 to 15.8)
- **Fasting plasma insulin ≥ 28 µmol/L** (OR = 10.2; 95% CI, 3.4 to 30)
- **Male sex** (OR = 5.2; 95% CI, 1.9 to 14.8).

Alternately, an additional factor—neck circumference of 43 cm or greater—can replace BMI and male sex and, together with the remaining four factors, provide similar predictive value (Cox and Snell r^2 = 0.46).

Although the mean ESS score for this study population was higher than the community norm, none of these variables was associated with a higher ESS score. Furthermore, clinical symptoms such as habitual snoring were present in 94% of the study population, but the predictive value of such symptoms was poor, except for observed sleep apnea. A composite BASH'IM score of 3 or greater (in which 1 point is assigned for each factor present) was found to have a sensitivity of 80% and specificity of 91% for an AHI score of 15 or greater. The authors concluded that the BASH'IM score can be used to identify patients who are appropriate candidates for polysomnography. For instance, if polysomnography had not been performed on patients with a BASH'IM score of 0 to 1, 49% of negative polysomnographic findings in this study would have been avoided.[9]

Evidence supporting routine polysomnography before bariatric surgery

Polysomnography remains the gold standard for the diagnosis of OSA. In a study of 100 consecutive patients evaluated prior to gastric bypass surgery, Rasheid et al diagnosed OSA by polysomnography in 58% of subjects and concluded that the severity of OSA cannot be reliably predicted by preoperative BMI or ESS score.[10] Similarly, O'Keeffe and Patterson demonstrated a 77% prevalence of OSA by polysomnography in a cohort of 170 consecutive patients presenting for bariatric surgery and found no correlation of OSA with BMI; the prevalence of OSA was higher in severely obese patients (BMI 35 to 39.9) than in morbidly obese patients (BMI 40 to 49.9).[3] In the most recent and largest study to date,[4] 19% of patients presenting for bariatric surgery had a clinical diagnosis of OSA. However, routine polysomnography prior to bariatric surgery demonstrated a 91% prevalence of OSA, as opposed to 58% when clinical parameters and ESS score alone were used to screen for OSA.[4] These and other authors strongly recommend polysomnography for all patients undergoing bariatric surgery.[2–4,10]

Conclusions

Clinical evaluation continues to miss a significant proportion of OSA cases among morbidly obese patients presenting for bariatric surgery, and OSA portends a significant increase in postoperative complications. Until there is a reliable method to predict the presence of OSA, routine polysomnography is indicated for all patients undergoing bariatric surgery.

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Q: Can brain natriuretic peptide identify noncardiac surgery patients at high risk for cardiac events?

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A: Emerging data indicate that preoperative testing for brain natriuretic peptide (BNP) and its related compound, NT-proBNP, is beneficial in identifying patients at high risk for major adverse cardiac events following noncardiac surgery. These major events include acute coronary syndromes, arrhythmias, heart failure, myocardial infarction, and stroke, which constitute a significant source of morbidity and mortality in the perioperative period.

Prognostic and risk-stratifying value of BNP

The prohormone BNP is released from the myocardial cells in the left ventricle in response to volume expansion and is cleaved into BNP and its inactive N-amino terminal fragment (NT-proBNP). These markers are used to assess left ventricular dysfunction and to risk-stratify patients with acute coronary syndromes and heart failure.[1] Plasma BNP also provides prognostic information in patients with chronic heart failure and those with asymptomatic or minimally symptomatic left ventricular dysfunction.[2]

Evidence on BNP and NT-proBNP in noncardiac surgery

A number of recent studies indicate that BNP and NT-proBNP have similar prognostic value in patients scheduled for noncardiac surgery.

Feringa and colleagues prospectively evaluated 335 patients undergoing abdominal aortic aneurysm repair (46%) or lower extremity bypass surgery (54%).[3] Preoperative plasma NT-proBNP was measured at a mean of 24 days before surgery. All patients also underwent dobutamine stress echocardiograms. Multivariable analysis revealed that an NT-proBNP level of 319 ng/L or greater was the strongest predictor of all-cause mortality and major adverse cardiac events among all variables assessed, including age, cardiac risk score, echocardiographic results, and cardiac medications.

Similarly, Dernellis and Panaretou prospectively studied 1,590 patients undergoing noncardiac surgical procedures, of which 40% were orthopedic and 30% were abdominal.[4] Patients had their preoperative BNP level measured within 3 days before surgery and also were risk-stratified according to the Goldman multifactorial cardiac risk index. The authors found that patients who were at low preoperative clinical risk (as defined by the Goldman cardiac risk index) but still suffered perioperative cardiac events were successfully identified by a BNP level of 189 pg/mL or greater. They concluded that BNP is a stronger predictor of postoperative events than is the Goldman cardiac risk index. This study was limited, however, by the fact that the clinicians were not blinded to the BNP levels.

In a prospective study of 190 patients undergoing noncardiac surgery (158 major and 32 minor procedures), Yeh et al found that NT-proBNP was the only factor that was independently associated with postoperative cardiac complications ($P < .001$) among several factors assessed (including age, clinical cardiac impairment, and American Society of Anesthesiologists fitness class).[5] An NT-proBNP level of 450 ng/L or greater had a sensitivity of 100% and a specificity of 82.9% in predicting postoperative cardiac complications in this study.

Gibson and colleagues conducted a prospective

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