

## Prevalence and Effects of Obesity-Associated Hypoventilation in Hospitalized Patients

Nowbar S, Burkart KM, Gonzales R, et al. Obesity-associated hypoventilation in hospitalized patients: prevalence, effects, and outcome. *Am J Med* 2004;116:1-7.

### Study Overview

**Objective.** To determine the prevalence and effects of obesity-associated hypoventilation in hospitalized patients.

**Design.** Prospective evaluation of consecutive patients admitted to the medical service.

**Settings and participants.** Adults with a body mass index (BMI)  $\geq 35$  kg/m<sup>2</sup> who were admitted to 1 of 3 teaching hospitals in Denver, CO. Participants were given a sleep questionnaire, and neuropsychologic, arterial blood gas, and pulmonary function tests were performed.

**Main outcome measures.** Rate of hypoventilation, defined as a high PaCO<sub>2</sub> ( $\geq 43$  mm Hg) and low pH ( $\leq 7.42$ ). Other important outcomes included subjective sleepiness, attention/concentration, use of intensive care services, mortality, and discharge to a long-term care facility.

**Main results.** Of the 4332 patients admitted over a 6-month period, 277 (6%) were severely obese (BMI  $\geq 35$  kg/m<sup>2</sup>). Approximately 25% of the patients refused to participate, and another 20% were ineligible due to other causes of hypoventilation. Of the 150 patients enrolled, nearly 31% had hypoventilation. Obese patients with hypoventilation were more likely to be sleepy and have poor concentration than obese patients without hypoventilation. Obese patients with hypoventilation were slightly more likely to need intensive care services and long-term care at discharge and had higher long-term mortality.

**Conclusion.** Hypoventilation was common among hospitalized patients with obesity and was associated with complications during hospitalization and excess mortality at 1 year.

### Commentary

Obesity is a rapidly growing public health epidemic in the United States. It is associated with increased rates of diabetes, hypertension, and coronary heart disease. Further, because severe obesity can restrict lung expansion, it can lead to hypoventilation. Whether this complication of severe obesity represents a major clinical problem for hospitalized patients is unknown.

Nowbar et al found that nearly 1 in 3 patients with obesity had hypoventilation. This is a staggeringly high rate and must be interpreted with caution. First, the authors used a PaCO<sub>2</sub> level of  $\geq 43$  mm Hg as a cut-off for elevated PaCO<sub>2</sub>. They reasoned that this cut-off represents a number more than 2 standard deviations above the mean PaCO<sub>2</sub> in normal men and women. However, patients who are hospitalized are not a normal, random subset of the population. Whether patients with chronic diseases not associated with hypoventilation (eg, diabetes, ischemic heart disease) have normal ventilation is unclear. The authors could have addressed this by sampling some nonobese patients admitted to the hospital at the same time to determine their average PaCO<sub>2</sub> and using this average to define hypoventilation. Alternatively, a PaCO<sub>2</sub> level that is likely to cause clinical complications could have been used. The level used by Nowbar and colleagues is low enough to classify many patients with very mild CO<sub>2</sub> retention as having hypoventilation.

The other major finding of a higher rate of morbidity and mortality in obese patients with hypoventilation is potentially important but also must be interpreted with caution. While their findings of worse outcomes in and outside the hospital seem robust, it is unclear whether obesity-associated hypoventilation represents the cause or effect of these outcomes. It is possible that obese patients with hypoventilation have more serious heart disease or other conditions that lead to subtle hypoventilation. Again, the study might have been strengthened by assessing the outcome of patients with nonobesity hypoventilation. A finding of poor outcomes in these patients would have supported the argument that the hypoventilation itself was the cause of the morbidity and mortality.

### Applications for Clinical Practice

Nowbar and colleagues have added to our understanding of why patients with obesity seem to have worse outcomes in the hospital than those without obesity. The study suggests that hypoventilation might be the mechanism. If it is, then focusing on patients with hypoventilation and intervening to improve ventilation may improve patient outcomes.

—Review by Ashish K. Jha, MD