



Case report

A case report of malignant obesity hypoventilation syndrome: A weighty problem in our ICUs

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ABSTRACT

Introduction: The obesity epidemic is reflected by increasing numbers of morbidly obese patients being admitted to intensive care units (ICUs). These are complicated patients whose care involves many diagnostic and treatment challenges. We are presenting a fatal case of super obesity, hypoventilation, and multi-organ failure known as malignant obesity hypoventilation syndrome (MOHS).

Case presentation: 35 year old African American gentleman with a body mass index (BMI) of 115 kg/m² presented to the hospital with respiratory distress. On admission he was noted to have multi-organ dysfunction including respiratory failure, renal failure, cardiac and liver abnormalities. His hospital course was remarkable for recurrent cardiac arrest following extubation, complicated tracheostomy, and progressive organ failure despite medical therapy. After a 30 day hospitalization, patient and family decided on terminal extubation owing to worsening medical condition and lack of therapeutic and disposition options.

Discussion: The super obese present a number of challenges when admitted to the ICU. Patients with respiratory distress are frequently misdiagnosed and treated for asthma and COPD when obesity hypoventilation syndrome (OHS) is more consistent with the clinical picture. OHS in the superobese is often accompanied by multi-system organ dysfunction, a condition with high morbidity and mortality, with limited treatment options. Standard imaging techniques and procedures are made difficult or impossible by body habitus and often require expert intervention. Surgical options have been used in the treatment of the super obese and resulted in rapid weight loss, improvement in respiratory function, as well as improved metabolism and decreased inflammation. The role of surgery in MOHS remains to be elucidated.

Conclusion: Physicians should be aware of MOHS as a common condition with high morbidity and mortality. Optimal management remains to be determined.

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1. Introduction

The prevalence of obesity have been rising over the last twenty years currently affecting over 1 in 3 Americans [1]. Over the same time span, class III Obesity (severe or morbid obesity: BMI > 40 kg/m²) in US adults rose by 141% in non-diabetics and 345% in type 2 diabetes mellitus patients with a current prevalence of 6.6% [2,3]. Epidemiological data shows an increased risk of death of 1% for each pound increase between 30 and 42 years of age and 2% between 50 and 62 years [4]. Mortality is higher among hospitalized

patients less than age 65, with a BMI > 30 kg/m² [5]. The cumulative duration of exposure to obesity may be even more important, with longer duration being independently associated with increased risk of hospitalizations and length of stay [6].

As the number of morbidly obese patients admitted to the ICU continues to rise, physicians will increasingly take care of this challenging population. Morbid obesity has been associated with longer ICU length of stay and prolonged mechanical ventilation, with increased overall mortality and ICU mortality currently under debate [7,8]. Factors contributing to ICU mortality in extreme-obesity include increased catheter and blood stream infections [9], limited imaging modalities, increased skin breakdown [10], and diagnostic errors. Additionally, a condition called MOHS was

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recently described [11]. MOHS, a disorder characterized by hypoventilation and multi-organ dysfunction due primarily to severe obesity is one of the under recognized causes of ICU mortality. We are presenting a case of severe obesity and MOHS resulting in mortality to alert clinicians to this common, frequently misdiagnosed, condition with high morbidity and mortality.

2. Case

A 35 year old African American gentleman with a past medical history of class III obesity, asthma, depression, hypertension, hyperlipidemia, and type 2 diabetes mellitus who presented to a community hospital with cough and difficulty breathing. He was started on antibiotics and bronchodilators for pneumonia and asthma exacerbation. He appeared lethargic and was intubated when his arterial blood gas (ABG) revealed a PCO₂ of 120 mmHg. He was extubated after correction of hypercarbia, but developed hypoxemic respiratory failure, resulting in PEA arrest requiring re-intubation. A day later, he was extubated again, this time to BiPAP and transferred to the medical ICU at our tertiary care center.

On arrival, he was hemodynamically stable with mild tachycardia and with a normal O₂ saturation. He was 182.8 cm tall, with a weight of 383 kg (kg), BMI 114.5 kg/m². On examination he had profound generalized obesity with a crowded oropharynx and large neck. His lungs were clear and heart sounds were regular. Abdomen was immense with no palpable organomegaly. Lower extremity exam revealed 2 + pitting edema. He had multiple pressure ulcers on his buttocks and breast folds.

Bloodwork revealed a creatinine of 2.18 mg/dL with GFR of 44 ml/min/1.73 m², Hemoglobin 8.0 g/dl, white blood count 11.9K, mildly elevated LFTs, albumin of 1.9 g/dl and INR of 1.5. Lactic acid was 1.3 mmol/L, pro BNP 3921 pg/ml, and hemoglobin A1c was 7.3%. ABG showed a pH of 7.23, pCO₂ of 91 mmHg and pO₂ of 114 mmHg on Bipap 20/10 with 40%FiO₂. A blood culture drawn from his right internal jugular central line grew out *S. epidermidis*. A chest radiograph was non diagnostic (Fig. 1).

In the medical ICU, he completed a course of steroids and antibiotics and was maintained on bronchodilators around the clock. He was noted to have daytime hypercarbia and initially required

continuous BiPAP, which was weaned to nocturnal use only. Pressure ulcers were treated with local wound care and frequent repositioning, requiring ten staff members for mobilization using a 1000lb patient lift system. Nephrology, Cardiology, Infectious Disease, and Endocrine services were consulted and the patient was treated with copious fluids, often 10 L a day or more to maintain a stable blood pressure and adequate urine output. After a period of monitoring and stabilization he was transferred to a regular floor.

Two days after transfer, he was discovered unresponsive, in pulseless electrical activity (PEA) arrest. He was resuscitated and re-intubated for the second time over the course of two weeks. The diagnosis of pulmonary embolism was entertained, but could not be confirmed as the patient exceeded the weight limitations of our CT scanner. Cardiac echocardiogram showed a dilated right ventricle with reduced ejection fraction, as well as dilated left atrium, left ventricular hypertrophy, and LVEF of 60%. Given these findings, anticoagulation was initiated.

Given repeated episodes of respiratory failure and cardiac arrest, it was deemed unsafe to extubate the patient without definitive airway management. Otolaryngology evaluation revealed that a standard tracheostomy would be unsafe due to the excess thoracic adipose tissue (Fig. 2). The patient was taken to the operating room with otolaryngology and plastic surgery and 30 + lbs of lipoid tissue was removed from the chest, prior to tracheostomy placement.

Subsequent hospital course was complicated by worsening renal function and failed attempts to wean the patient off of the ventilator. A bariatric surgery evaluation determined that several hundred pounds weight loss would be required to qualify for surgery. We explored options for discharge to a chronic ventilator facility without success, due to the difficulties posed by managing a super obese patient on a ventilator.

Eventually, the patient expressed a desire to be taken off the ventilator. After extensive discussions with the patient, his family, palliative care, and ethics teams, he was disconnected from the ventilator on day 30 of his hospitalization, and passed away from hypoxic respiratory arrest.

As per the patient's wishes to be cremated, multiple facilities were contacted post mortem without success due to his size and their concern for fire (one facility just had a fire after cremating a

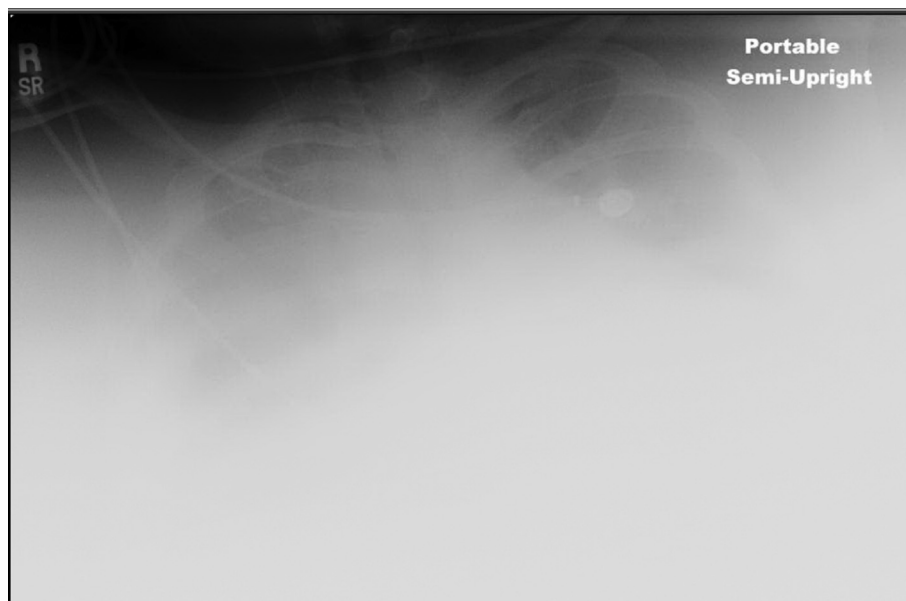


Fig. 1. Admission chest X-ray.



Fig. 2. Excess adipose tissue in the region of the neck and thorax complicating tracheostomy.

700lbs patient). Therefore, he spent several days in a refrigeration truck, as he could not be accommodated in the morgue, until a suitable crematorium could be identified.

3. Discussion

Our patient presented with a complex of signs/symptoms consistent with previous descriptions of malignant obesity hypoventilation syndrome (MOHS) [11], with a BMI greater than 40 kg/m² and a PaCO₂ greater than 45 mm Hg in the context of renal failure, LV and RV dysfunction, anemia, and liver function abnormalities. With increased prevalence of morbid and super obesity, we are treating an increasing number of individuals with BMI > 40 in our tertiary care ICU. These complex patients present many diagnostic, treatment, and ethical challenges.

The morbidly obese with respiratory issues are often erroneously diagnosed with asthma and COPD. Notably, our patient was also previously diagnosed with asthma and treated for COPD exacerbation, although a diagnosis of obstructive sleep apnea and OHS is better supported by the clinical picture. Physicians should be more vigilant for the diagnosis of OHS in this setting.

Extreme obesity also complicates imaging techniques. As was the case in our patient, the super obese will frequently exceed the limits of CT scanners and MRI machines, make x-ray and ultrasound techniques less reliable, and even complicate blood draws for laboratory analysis. Moreover, dynamic measurements of volume responsiveness, the preferred modalities in the ICU setting [12], are made more difficult by increased body size.

We considered weight loss as a potential therapy to improve the patient's medical condition and wean ventilator assistance. Given the greater magnitude of weight reduction with bariatric surgery versus intensive medical therapy [13] or weight loss medications, [14] we consulted our bariatric surgery team. Different forms of bariatric surgery have been considered for super obese (BMI > 50 kg/m²) patients. In a trial of patients with a BMI of 50–60 kg/m², duodenal switch resulted in greater weight loss and greater improvements in cardiometabolic risk factors 5 years after surgery compared with Roux-en-y gastric bypass. However, duodenal switch was associated with more surgical, nutritional,

and gastrointestinal adverse effects [15]. Bariatric surgery in morbid obesity has been shown to improve lung function parameters including vital capacity, peak expiratory flow, functional residual capacity, total lung capacity and FEV₁/FVC ratio [16,17]. In the context of MOHS, it is interesting to note that some of the biochemical changes including improved glucose metabolism and decreased inflammation occur almost immediately following surgery. Given the mortality rate of 20% for individuals meeting criteria for MOHS, potential therapeutic options including bariatric surgery need further research.

There were also many ethical dilemmas faced in the care of this patient. He was too ill to return home, and yet we had difficulty locating a nursing home or rehabilitation facility that would accept a patient with his degree of medical complexity and cost of care. As a result he was faced with the prospect of an indefinite hospitalization. Given such an outlook, combined with the fact that he was not able to wean from the ventilator and required a tracheostomy, it is not surprising that he chose terminal extubation. It is worth noting that patients and other decision makers grossly overestimate survival and quality of life after tracheostomy placement for prolonged mechanical ventilation, despite data showing 50% mortality prior to discharge [18] and only 9% one year survival with good functional status [19]. However, given his history of depression, we had to take great care to insure his decision was an informed one, not clouded by mental illness, delirium, pain, anxiety, and frustration. We involved social work, psychiatry, palliative care, as well as the patient's family in helping him make this decision. Finally, it is regrettable, that even post-mortem, we had difficulty fulfilling his wishes regarding cremation, as few facilities were equipped to handle a patient his size.

4. Conclusions

We present a case of a patient with an unusually high BMI, who presented to our medical ICU with a clinical picture consistent with malignant obesity hypoventilation syndrome (MOHS). As obesity rates continue to increase nationwide, more morbidly obese patients will require intensive care, and MOHS will be encountered with increasing frequency. Physicians should be aware of this

relatively common syndrome with high morbidity and mortality, so that correct diagnosis and prognosis can be established. This report adds to the understanding of illness in extremely obese critical care patients. Further study is needed to characterize the optimal treatment of this condition, including medical and surgical therapies. Given the complexity of these patients, a multidisciplinary care approach is necessary for best outcomes.

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IRB approval

The contents of this case report were submitted to the institutional review board at Medstar Washington Hospital Center. After review it was determined that this activity does not constitute research and thus IRB approval is not required. Please see attached letter.

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