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ABSTRACT

Extreme obesity in the intensive care unit

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Morbid obesity is a highly serious condition that significantly impairs health worldwide. This is especially prominent during the COVID-19 pandemic, as lockdowns and reduced physical activity contributed to the problem. Overweight and obese adults are at a higher risk of various acute and chronic medical conditions, including hypertension, heart disease, diabetes, respiratory problems, certain cancers, gout, and arthritis. While some individuals may have higher muscle or bone mass accounting for excess weight, the majority of those exceeding 20% of their ideal body weight have excessive fat. Disturbingly, obesity rates in the USA have been progressively increasing since the first survey conducted in 1960. Recent data shows that obesity prevalence in the USA is three times higher than in France and one-and-a-half times higher than in England. Given the widespread nature of obesity and its association with numerous diseases, it is not surprising that many obese patients require treatment in the intensive care unit (ICU).

Morbid obesity, defined as having a body mass index (BMI) above 40 Kg/m^2, is associated with an increased risk of mortality. Critically ill morbidly obese patients pose unique challenges to the critical care team, and tend to experience more complications during ICU admission, leading to longer hospital stays and poorer outcomes.

Managing critically ill patients who are morbidly obese is a difficult and formidable task. Understanding the physiological changes and complications specific to this group may help improve their outcomes. A systemic approach is usually necessary when caring for these individuals in the ICU.

In terms of pulmonary function, increasing BMI leads to significant abnormalities, such as reduced lung capacity, functional residual capacity, and vital capacity by up to 30%. Lung function tests reveal a restrictive pattern. Breathing becomes more laborious due to abnormal chest elasticity, increased chest wall resistance, airway resistance, abnormal diaphragmatic position, upper airway resistance, and the need to eliminate higher levels of carbon dioxide. Severe obesity often causes low blood oxygen levels, resulting from ventilation-perfusion mismatching caused by alveolar collapse and airway closure at the bases of the lungs.

When obese patients require mechanical ventilation, their small lung volumes and increased airway resistance necessitate the use of relatively small tidal volumes, which should be determined by airway pressures and blood gas levels rather than the patient's weight. Positive end-expiratory pressure (PEEP) can help prevent airway closure and lung collapse. Weaning obese patients from mechanical ventilation is frequently challenging, and a 45-degree reverse Trendelenburg position may facilitate the process. Obese patients also have a higher incidence of pulmonary complications following surgery.

Morbid obesity significantly increases the risk of pulmonary embolism and postoperative thromboembolic disease, likely due to decreased mobility, venous stasis, and increased thrombotic potential. Endotracheal intubation can be particularly challenging in morbidly obese patients due to limited neck mobility and mouth opening, requiring experienced clinicians for airway management.

Total blood volume and resting cardiac output increase in proportion to the excess weight of morbidly obese individuals. The rise in cardiac output is mainly due to an increase in stroke volume, resulting in normal cardiac and stroke indexes. Although obese patients have increased baseline oxygen consumption, their ejection fraction is depressed at rest and after exercise. Blood pressure measurements using cuff sphygmomanometry may be inaccurate in obese patients, and continuous monitoring with an arterial cannula is advisable. The pharmacokinetics of drugs are altered in obesity, depending on their properties and mode of metabolism. Dosing should take these factors into account to avoid toxic drug levels based on the patient's actual body weight.

Despite having excess body fat and lean mass, obese individuals are prone to developing protein energy malnutrition during metabolic stress, especially if their nutritional status was already poor before injury. Nutrition should not be withheld from obese patients under the misconception that weight reduction.

Keywords: morbid obesity, critically ill, ICU

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