Vol 6 No 1 April 2026
Solo Journal of Anesthesi, Pain and Critical Care

E-ISSN : 2797-0035
P- ISSN : 2776-1770

REVIEW ARTICLE

Optimizing Critical Care for the Obese Population: From Physiology to Practice

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Article Info :
Submitted : 27-08- 2025
Accepted : 27-04-2026
Published : 30-04-2026
https://doi.org/10.20961/sojaV6i1.108499

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ABSTRACT

Obesity poses distinct issues in the Intensive Care Unit (ICU) owing to its related physiological changes, comorbidities, and the intricacies of management. Obese individuals face heightened risks for respiratory problems, cardiovascular issues, and metabolic dysregulation.

Effective management necessitates customized strategies: Respiratory Support: Elevated positive end-expiratory pressure (PEEP), prone positioning, as well as tailored ventilatory modifications are crucial for managing impaired breathing mechanics and averting lung injury. Hemodynamic Management: Careful fluid management and non-invasive monitoring are needed to address altered cardiovascular dynamics and optimize perfusion. Pharmacologic Adjustments: Dosage modifications for sedatives, analgesics, and vasoactive agents accommodate altered drug metabolism and distribution. Nutritional Support: Hypocaloric, high-protein feeding is advised to meet energy needs while avoiding overfeeding, ideally guided by indirect calorimetry. Thromboprophylaxis and Mobility: Heightened risk for venous thromboembolism (VTE) requires higher anticoagulant doses and early mobilization using bariatric equipment. Furthermore, obesity can also caused obesity paradox, an unexpected survival benefit in septic patients with obesity, likely due to enhanced energy reserves, RAAS activation, and anti-inflammatory effects.

A multidisciplinary and individualized approach is critical to improving outcomes in obese ICU patients, highlighting the need for updated clinical guidelines and further research tailored to this population.

Keywords: Hemodynamic; ICU; Obesity; Respiratory; Ventilator.

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INTRODUCTION

The prevalence of obesity is increasing worldwide. Excess fat tissue can have anatomical and physiological effects that have implications for critical illness. Owing to the elevated obesity prevalence, a growing cohort of obese patients is being referred to critical care units (ICUs). Approximately 25% of individuals admitted to the ICU are classified as overweight, obese, or morbidly obese, with sepsis being the predominant cause of such admissions[1]. These factors increase the complexity of clinical care and impact patient outcomes. [2,3]

DISCUSSION

Obesity is closely linked to physiological alterations and modified medication metabolism, complicating ICU care[4].

A. Physiological Changes in Obesity

1. Respiratory system

a. Decreased functional residual capacity and lung volume in obese individuals elevate the risk of hypoventilation, hypoxemia, and airway obstruction., making airway management very risky because it can cause more rapid oxygen desaturation during intubation procedures[2].

b. Accumulation of fat on the abdominal and chest wall can reduce lung compliance and increase the work of breathing [2].

c. Accumulation of fat around the neck and pharynx can narrow the upper airway, increasing the risk of obstruction and making visualization difficult during intubation[3]

d. Some individuals with obesity may experience alveolar hypoventilation called Obesity-Hypoventilation Syndrome, which can lead to hypoxemia and hypercapnia and a higher prevalence of OSA, which is associated with changes in airway anatomy that can make intubation difficult[5].

2. Cardiovascular System

a. Increased risk of Hypertension, heart failure, arrhythmia, and venous thromboembolism can all be brought on by elevated peripheral vascular resistance and sodium retention[6].

b. Obesity elevates blood volume and cardiac output to satisfy the metabolic demands of excess adipose tissue[7].

3. **Endocrine and Metabolic System**
   a. Excessive Excess adipose tissue adds to insulin resistance and elevates the chance of developing type 2 diabetes [8].
   b. Elevated triglyceride levels and decreased HDL cholesterol are often found in obese individuals[9]
4. **Difficult intravenous access**
   a. Difficult Intravenous Access (DIVA) poses a barrier even for seasoned healthcare personnel and may occur in as many as 59% of patients[10].
   b. Utilizing ultrasonography (USG) in patients with DIVA facilitates a high success rate for first-attempt[10]. The efficacy of intravenous therapy is contingent upon the type of intravenous (IV) catheter employed, as short peripheral catheters (SPCs) are typically insufficiently long to remain securely within the vein[10].
   c. It is advisable that two-thirds of the catheter's length be retained within the vein[10]. This can be difficult in obese people. Long peripheral catheters (LPCs) or midline catheters (MCs) may be deemed appropriate for this patient cohort [10].

B. Airway Management Strategies in Obesity

In this context, many solutions are frequently advised, including the use of a ramping posture, pre-oxygenation using positive pressure breathing, and the utilization of videolaryngoscopy[11,12].

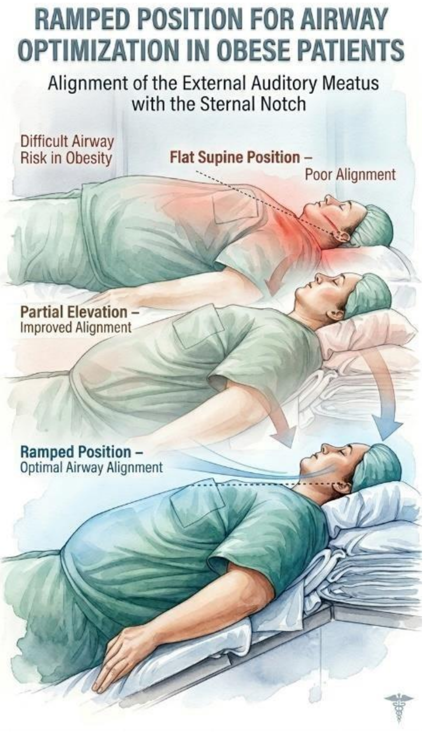

Figure 1. modified ramped position. Adapted from Kim, 2021 [13]

Traditional ventilation with bag-mask ventilation (BMV) may lead to fast desaturation in morbidly obese individuals. Numerous studies indicate that pre-oxygenation with Continuous Positive Airway Pressure (CPAP) or Non-Invasive Ventilation (NIV) enhances oxygenation and permits extended intubation durations[11].

Apnea Oxygenation

Ramachandran et al. demonstrated that oxygen delivery with a nasal cannula at a flow rate of 5 l/min in obese patients significantly prolonged the duration of $SpO_2 \geq 95\%$ during difficult laryngoscopy[14]. A similar study by Moon et al. show a result that the administration of oxygen 15 l/minute via standard nasal cannula will receive 103 seconds safe apnea duration longer than the patient who is not given oxygen administration. Gaszyński assessed the application of nasal Continuous Positive Airway Pressure (CPAP) in obese individuals during intubation attempts. Oxygen 100 % was administered from the gas outlet of the anesthesia machine with flow adjustments and the valve set to maintain an airway pressure of 15 cmH_2O (1.74 kPa). All patients achieved 6 minutes of apnea with SpO_2 remaining above 94% after that period. The authors observed that the use of apneic oxygenation methods in obese patients improved oxygenation efficacy and prolonged apnea time, both of which can be beneficial during difficult airway management[14].

1. **Ventilation Management Strategy**

Obesity causes decreased lung volume and compliance, making mechanical ventilation more difficult and increasing the risk of ventilator-related complications [11]. Application such as increasing PEEP and using the prone position are beneficial in optimizing oxygenation and protecting the lungs in individuals with obesity [11].

Obese patients experience increased breathing and impaired gas exchange. Some causes of increased breathing in obese patients include:

a. The effect of gravity on respiration concerning the abdominal cavity, thoracic cavity, and chest wall. Elevated airway resistance resulting from reduced airway diameter and a higher prevalence of asthma
b. Increased Enhanced tissue resistance elevates the

respiratory workload.

c. Airway closure may occur in dependent lung regions during expiration. This means that these areas require increased airway pressure for lung inflation. If airway closure persists, distal alveoli can collapse. This can be seen due to gas absorption or the use of high oxygen concentrations. The use of pure oxygen can trigger lung collapse within minutes, while the use of room air can trigger lung collapse within hours [11].

Ventilation strategies for obese patients in the ICU

Obese individuals exhibit increased vulnerability to respiratory complications, such as Acute Respiratory Failure (ARF) and Acute Respiratory Distress Syndrome (ARDS).. Several studies have suggested that non-invasive ventilation management, such as Non-Invasive Ventilation (NIV), should be considered for the prevention and management of ARF, although scientific evidence is still limited, especially when compared with High Flow Nasal Cannula (HFNC)[11].

Following intubation for invasive mechanical ventilation, obese patients exhibit increased susceptibility to lung collapse, necessitating elevated PEEP levels to mitigate this risk. The use of low tidal volumes based on predicted body weight (PBW) is recommended for both patients with and without ARDS[11]. The recruitment maneuver (RM) is not recommended, and its use is based on a risk/benefit assessment for each patient. Prone positioning can be used in obese patients with severe ARDS[11].

In clinical settings, Devine formula is often used as a standard formula for calculating PBW.

- *PBW= 50 (for males) or 45.5 (for females) + 0.91 x [(height (cm) – 152.4] = 0.91 x height – [88.7 (for males) or 93.2 (for females)]*[15]

1) Recruitment Manuever (RM)

Increased Increased airway pressure may result in decreased venous return, which can subsequently lead to reduced cardiac preload, diminished cardiac output, and lowered systemic blood pressure. The risk of barotrauma, including pneumothorax or pneumomediastinum, is heightened in patients with pre-existing structural lung damage, such as emphysema, or those undergoing mechanical manipulation of pre-inflamed lungs[11]. Consequently, RM is typically not advised, and its application should be determined by a risk/benefit assessment on a patient-specific basis[11].

2) **Positive End Expiratory Pressure (PEEP)**

PEEP does not directly induce alveolar recruitment; instead, it functions to prevent alveolar derecruitment by maintaining alveolar patency. Protective ventilation strategies can enhance clinical outcomes in patients who do not have ARDS[11]. Obese patients experience increased pressure from fatty tissue on the pleural space, alongside elevated closing pressures, which heightens their susceptibility to pulmonary

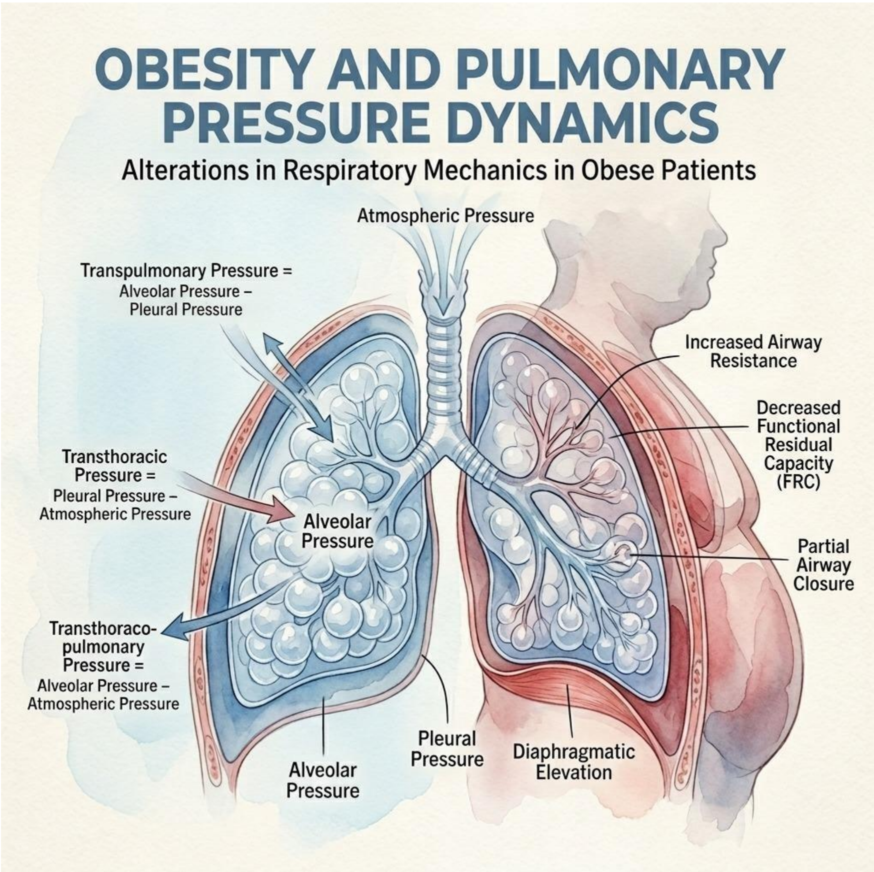

Figure 2. Effect of Obesity toward Respiration System.
Adapted from De Jong, 2020 [11]

complications [11]. (Figure 2).

In patients undergoing bariatric surgery, PEEP was established within a pressure range of 10 to 26 cmH_2O, with a mean pressure of 18 cmH_2O, effectively restoring the end-expiratory lung volume (EELV) to pre-intubation and mechanical ventilation levels [11]. A separate study identified a PEEP level exceeding 15 cmH_2O[11].

This suggests that the optimal effect of PEEP varies according to the needs of each patient [11].

3) Tidal Volume

Limiting tidal volume reduces ventilator-associated lung injury and inflammation in patients with and without ARDS [11]. Normal VT using PBW is determined by expected lung volume, influenced by the patient's height and sex, and seeks to minimize the VT/EELV ratio and mechanical lung stress [11]. Early spontaneous ventilation preserves diaphragmatic tension, redistributes ventilation to dependent lung areas, prevents diaphragmatic muscle atrophy from relaxation, and shortens mechanical ventilation duration [11].

2. Management of Obese Patients with Acute Respiratory Failure

Non-invasive strategies should start with optimizing body positioning, including the reverse Trendelenburg, beach chair, or sitting positions [11]. Adjusting the patient's position can improve lung compliance and facilitate better gas exchange in individuals with morbid obesity [11]. A clinical trial compared non-invasive ventilation (NIV) with standard oxygen and high-flow nasal cannula (HFNC) in patients with hypoxemic acute respiratory failure (ARF). The results indicated a lower mortality rate in the HFNC group compared to NIV, suggesting a potential adverse effect of NIV. NIV can be utilized in obese patients, particularly those who are morbidly obese, by employing Positive End-Expiratory Pressure (PEEP) to enhance oxygenation, lung volume, and alveolar recruitment [11].

In a comparison of 21 obese ARDS patients with non-obese ARDS patients, both groups exhibited similar improvements in alveolar recruitment and oxygenation when PEEP was raised from 5 to 15 cmH_2O [11]. Abdominal pressure and chest wall elasticity were comparable in both groups. Fumagalli et al. observed significant enhancements in oxygenation and lung elasticity with higher PEEP (22 cmH_2O) versus lower PEEP (13 cmH_2O) [11]. Higher PEEP was chosen according to transpulmonary pressure, whereas lower PEEP was determined using PEEP/FiO_2 tables [11]. Abdominal pressure was neither measured nor reported. Prone positioning is crucial for obese ARDS patients. This therapy's safety and effectiveness are comparable in obese and non-obese patients; however, the PaO_2/FiO_2 ratio is significantly higher in obese patients following prone positioning. Prone positioning is the preferred therapy for patients with severe ARDS and obesity. The mechanism of action, special considerations, and clinical effects are outlined in Figure 3 [11].

3. **Weaning and Extubation**

Atelectasis prevention should begin immediately post-extubation using CPAP or NIV. To enable early extubation, sedation must be stopped promptly, and benzodiazepines should be avoided

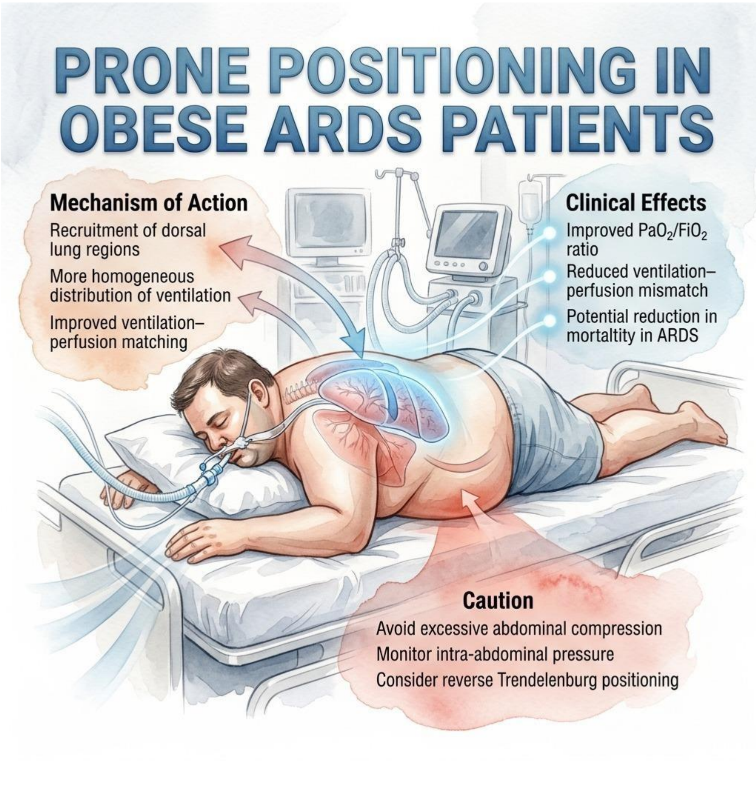

Figure 3. Prone position in patients with obesity.
Adapted from De Jong, 2020 (11)

because of their prolonged effects in obese patients [11].

Prophylactic NIV post-extubation can lower ARF risk by 16% and decrease ICU length of stay. A randomized controlled trial in morbidly among individuals with morbid obesity undergoing bariatric surgery indicated that ventilatory function improved more significantly with immediate CPAP use after extubation than with delayed initiation [11].

C. Hemodynamic Management

Hemodynamic instability is a significant issue in the management of obese patients in the ICU., as these patients have pharmacokinetic and pharmacodynamic differences[16]. Monitoring fluid status and cardiovascular function in obese patients is difficult, with classic methods such as echocardiography and invasive monitoring often providing limited accuracy in these patients [11,17].

Managing cardiovascular issues in obese ICU patients is complex due to their distinct hemodynamic profiles, including elevated blood volume, cardiac output, and systemic vascular resistance. Physiological changes affect the cardiovascular system, raising the risk of left ventricular hypertrophy, heart failure, and hypertension[18].

Obesity increases cardiovascular risk due to both the condition itself and related medical issues such as hypertension, diabetes, insulin resistance, and sleep apnea syndrome [19]. Obesity causes both anatomical and physiological changes in the heart that may progress to cardiac failure. Changes in the myocardial structural is associated with a higher risk of atrial fibrillation and unexpected cardiac arrest [19].

Fluid Management Strategies in Obese Patients

The Surviving Sepsis Campaign (SSC) recommendations advocate for the administration of at least 1 mL/kg (ideal body weight) of crystalloid solution. However, the SSC guidelines do not specifically address obese patients[20]. Fluid management strategies in obese patients differ, focusing on ideal body weight (IBW) versus actual body weight (ABW) [20]. The difference in fluid effects has sparked debate over infusion strategies utilizing IBW versus non-IBW (ABW) approaches [20].

Taylor et al. introduced a fluid management strategy that may offer enhanced benefits for obese patients[21]. The Adjusted Body Weight (AdjBW) fluid strategy offers fluid volumes that are lower than those based on Actual Body Weight (ABW) but higher than those based on Ideal Body Weight (IBW)[22]. (OR 0,29; CI 95% 0,11–0,79)[21]. The most common weight measures used in calculating drug doses in the ICU include:

- Total Body Weight (TBW)
- Ideal Body Weight (IBW)
- Lean Body Weight (LBW)
- Adjusted Body Weight (AdjBW)[21]

Each approach is indicated based on the patient's condition and the type of treatment administered.

Table 1. Common Body Weight Measurements[22]

Body Weight	**Equations**
Body Mass Index (kg/m2)	*Total Body Weight* (TBW) / height (m)²
Ideal Body Weight (kg)	**Man**: 50 kg + 2,3 kg/inch (height > 5 ft) **Woman**: 45,5 kg + 2,3 kg/inch (height>5 ft)
Lean Body Weight (kg)	**Man**: (9.270 × TBW) / (6.680 + 216 × BMI) **Woman**: (9.270 × TBW) / (8.780 + 244 × BMI)
Adjusted Body Weight (kg)	Correction Factor (CF) × (TBW − IBW) + IBW, Where CF = 0,4

This equation is used to calculate the weight distribution of obese patients in safe and effective drug doses[22].

D. Pharmacological Consideration for Obese Patients

The pharmacological management of obese patients is complicated by alterations in body composition that influence drug volume of distribution and clearance [15]. Lipophilic drugs increase their volume of distribution in obese patients, requiring dose adjustments to prevent toxicity or failure to meet therapeutic targets [15].

In obese ICU patients, drug management necessitates dose adjustments to prevent underdosing or overdosing, as obesity influences drug distribution and clearance (4), for example

- Lipophilic drugs can accumulate in fatty tissue, causing prolonged effects.

- Hydrophilic drugs may have a shorter duration of action due to altered body fluid distribution [23].

Weight-based dosing is generally recommended for some drugs, but individual patient factors and comorbidities should also be considered [24].

1. **Vasopressors**

- All commonly used vasopressors are hydrophilic, as evidenced by negative log *P* values[22]. Small distribution volumes and rapid clearance lead to short half-lives for these agents, often requiring continuous intravenous infusions for administration[22].
- For vasopressor medications administered via continuous infusion in obese patients, both non-weight-based and weight-based medications, it is recommended to use IBW or AdjBW for the initial dose. This is important to minimize the risk of error [22].

2. **Antihypertensive Drugs**

- Antihypertensive drug administration for managing hypertension in obese patients requires individual adjustment due to fluid shifts and increased myocardial workload prevalent in this population [25].
- Drug such as ACE inhibitor is frequently used but require close monitoring due to potential impacts on renal perfusion and myocardial function [26].

3. **Analgesia and Sedation**

When implementing strategies for analgesia, sedation, or delirium, guidelines should be followed for obese patients, as for non-obese does. These strategies include:

- Targeting mild sedation,
- Using a validated rating scale,
- Provides daily sedation interruptions,
- Performing spontaneous breathing trials,
- Regular delirium screening.

The recommended drugs based on the guidelines are opioid analgesics, non-opioid analgesics, ketamine, propofol, dexmedetomidine, benzodiazepines and etomidate.

- Opioid Analgesics: The dose is

titrated gradually according to clinical effect and using IBW or AdjBW, particularly in morbidly obese individuals (BMI ≥ 40 kg/m²).

- Non-Opioid Analgesics: Does not require weight-based calculations.
- Ketamine: It is recommended to use IBW or AdjBW in obese patients, particularly in morbidly obese individuals (BMI ≥ 40 kg/m²).
- Propofol: Dose adjustments are required. Using ABW can cause supratherapeutic concentrations, resulting in drug levels in the body exceeding those required for therapeutic effect, which can increase the risk of side effects or toxicity. Therefore, using a dose based on IBW/AdjBW is safer.
- Dexmedetomidine: Dose adjustment using IBW or AdjBW may prevent supratherapeutic concentrations.
- Benzodiazepines: It is safer to calculate the initial dose and continous infusion using the IBW or AdjBW, with small increments titrated until the desired effect is achieved [22].
- Etomidate: ABW is applicable for obese patients with BMI < 40 kg/m², while IBW or AdjBW is recommended for those with BMI ≥ 40 kg/m² [22].

These medications are part of evidence-based guidelines aimed at reducing complications in critically obese ICU patients.[22]

E. Nutritional Needs

Enteral nutrition is favored over parenteral nutrition due to fewer complications and enhanced gastrointestinal integrity support [27].

In obese patients, even though they have excess body fat, many are at risk of malnutrition due to poor eating habits or underlying metabolic disorders. Nutritional support should be balanced to prevent overfeeding, as it may cause hyperglycemia, increase the risk of infection, and prolong the need for mechanical ventilation. In general, a high- protein, hypocaloric diet is recommended to ensure optimal nutrition and prevent further complications associated with obesity [28].

Body Mass Index (BMI) may not consistently reflect a linear correlation with an individual's cardiometabolic status or risk of severe illness. Recent literature describes a J-shaped pattern relating BMI to mortality risk during critical illness, though the concept remains debated (29). The concept known as the obesity paradox refers to the observation that patients who are overweight and obese frequently exhibit reduced mortality compared to those with a normal body weight or severe obesity [29].

The Obesity Paradox

The obesity paradox describes a phenomenon in which obese patients demonstrate a survival advantage over normal-weight patients, particularly in the setting of sepsis. This may be due to:

1. Higher metabolic rates and the inability of adipose tissue to produce immunomodulatory molecules that protect against sepsis are observed in overweight and obese patients, but not in those with morbid obesity [21]
2. The energy reserves contained in adipose tissue can help sustain the catabolic processes triggered by sepsis [1].
3. In obese patients, heightened RAAS function frequently leads to hypertension; however, this may serve as a protective mechanism during sepsis by decreasing the requirement for vasopressors, which have numerous side effects [1].
4. The immunomodulatory role of adipose tissue in obese individuals leads to reduced levels of pro-inflammatory cytokines during severe infections or acute lung injury. This is believed to be linked to chronic inflammation due to obesity .

Nutrition Guidelines for Obese Critically Ill Patients

Nutritional Nutritional guidelines for critically ill obese patients are scarce. Organisations like ASPEN, SCCM, and ESPEN have issued recommendations for patients with obesity (29). An individualised nutritional care approach for obese patients is recommended.

Optimal nutritional support in obese patients is challenging because of changes in nutrient metabolism and pharmacokinetics, particularly in the ICU, which may interfere with both drug delivery and nutrition management[29]. The elements contributing to difficulties in caring for obese patients in critical illness are shown in Figure 4[29]. The elements contributing to difficulties in caring for obese patients in critical illness are shown in Figure 4[29].

The recent ASPEN/SCCM guidelines addressed five key questions regarding nutrition therapy for critical care patients:

1. **Evaluation and Detection of Malnutrition**
   ESPEN, ASPEN/SCCM : Assessing malnutrition in the ICU must be based on general clinical evaluation until standardized validated tools are available[29].

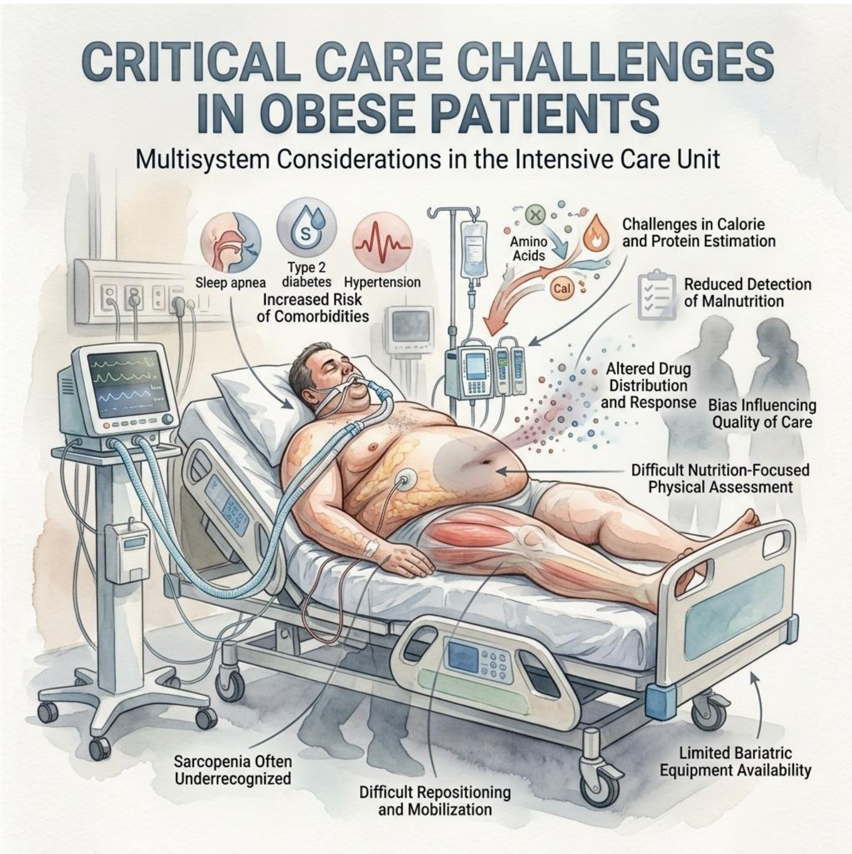

Figure 4. Factors complicating the care of critically ill patients with obesity. Adapted from Dickerson, 2022[28]

Assessment of obese patients must account for potential underlying malnutrition, considering:

- Clinical conditions,
- Signs and symptoms of macro/micronutrient deficiencies,
- Poor muscle quality despite muscle mass[29].

Obese patients require monitoring for refeeding syndrome risk during treatment[29]. This approach seeks to facilitate early detection and management of malnutrition, frequently obscured in obese individuals, to avert additional metabolic complications[29].

2. Energy Requirements Estimation

ESPEN: In obese patients, energy intake should be determined by Indirect Calorimetry (IC)[29]. In the absence of IC, energy intake can be determined using this formula:

Energy intake*= (Actual body weight − Ideal body weight)* × 0.25 + *Ideal body weight.*

ASPEN/SCCM:

- Use IC whenever possible.
- If IC is not available, use a simple BMI-based predictive equation:
  - 11 – 14 kcal/kg actual body weight/day for patients with BMI 30 – 50
  - 22–25 kcal/kg ideal body weight/day for patients with BMI > 50[29].

3. Estimating Protein Requirements, Identifying and Managing the Risk of Sarcopenic Obesity

ESPEN:

- Evaluation of protein intake can be performed using urine nitrogen measurements or assessment of lean body mass with CT scans or other techniques[29].
- In the absence of the methods, protein intake should be aimed at 1.3 g/kg AdjBW/day
- Protein needs may increase in critically ill obese patients [29].

ASPEN/SCCM:

- Recommended protein intake:
- 2 g/kg IBW/day for patients with BMI 30 – 39.9
- 2.5 g/kg IBW/day for patients

with BMI > 40

This approach addresses the protein requirements of critically obese patients, particularly those susceptible to sarcopenic obesity, which involves low muscle mass and increased body fat. This strategy prevents excessive muscle catabolism and maintains optimal metabolic balance[29].

4. Choosing the Ideal Nutrition Regimen

ASPEN/SCCM: Providing patients with a hypocaloric diet enriched in protein without significant renal or hepatic impairment [28]. Nutritional strategies must be individualized to increase protein intake without excessive feedingThe The regimen selection adapts to changing nutritional needs during the disease progression [29].

5. Use of IMN (Immunonutrition)

ASPEN/SCCM: The immune hyperreactivity seen in obesity may be viewed as a prospective benefit of immunomodulating formulations, insufficient research data precludes definitive recommendations currently [29].

- The benefit of IMN for routine use in obese ICU patients remains uncertain [29]
- IMN is recommended for patients with traumatic brain injury (TBI) and post-surgical care in the ICU[29].
- IMN should be considered for patients with severe trauma [29].

F. Thromboprophylaxis in Obese Patients in the ICU

Venous thromboembolism (VTE) exemplifies an obesity-related comorbidity that may negatively affect the efficacy of VTE prophylaxis and treatment due to altered pharmacokinetics and pharmacodynamics. Obesity during critical illness elevates VTE risk due to cytokine activation and proangiogenic factors, leading to a pro-thrombotic and dysfunctional fibrinolytic state[30].

1. Early mobilization

Deep vein thrombosis (DVT) is a major health risk, especially in hospitalized patients with various risk factors, including smoking, hypertension, diabetes, and obesity (31). DVT continues to be a common complication of hospitalization, despite treatment advancements. Early mobilization may be passive, assisted, or active, contingent on the patient profile and available resources [31].

2. **Oral Medications for VTE**

Apixaban and rivaroxaban are frequently utilized direct oral anticoagulants for venous thromboembolism (VTE)[32]. Apixaban and rivaroxaban are direct oral anticoagulants (DOACs) recommended as first-line treatments for these conditions[32]. The classification of dosage defines low as apixaban less than 10 mg/day and rivaroxaban less than 20 mg/day, and high as apixaban 10 mg/day or greater and rivaroxaban 20 mg/day or greater [32].

3. **Intravenous Medications for VTE**

A frequently used approach to prevent VTE in hospitalized or post-surgical patients involves administering a standard prophylactic dose of LMWH, such as enoxaparin 40 mg once daily or 30 mg twice daily [33].

Intravenous unfractionated heparin (UFH) is utilized in managing venous thromboembolism (VTE). While largely supplanted by low molecular weight heparin (LMWH), it is preferred for critically ill patients or those with renal impairment[32]. Raschke compared a fixed-dose regimen (5,000-unit bolus and 1,000 units/hour infusion) with a weight-based nomogram (80 units/kg bolus and 18 units/kg/hour) [33]. The weight-adjusted regimen achieved therapeutic anticoagulation more rapidly and resulted in a significantly lower VTE rate [33].

CONCLUSION

Obese patients in critical condition pose distinct challenges in the ICU, influenced by altered physiology, comorbidities, and pharmacological factors. Literature evidence supports tailored airway techniques, lung-protective ventilation, individualized hemodynamic and drug dosing, targeted nutrition, and proactive thromboprophylaxis with early mobilization. A multidisciplinary, patient-specific management plan is crucial for optimizing clinical outcomes and minimizing complications in this high-risk population.

CONFLICT OF INTEREST

The authors declare no relevant conflicts of interest regarding this article.

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