Critical Care of Patients With Obesity
Donna Charlebois and Debbie Wilmoth

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A total of 61% of adults in the United States are overweight or obese.\(^1\) During the past 2 decades, the prevalence of obesity in adults has nearly doubled, from 15% to an estimated 27%,\(^1\) leading former Surgeon General David Satcher to warn that “overweight and obesity may soon cause as much preventable disease and death as cigarette smoking.”\(^7\)

Obesity is a major public health challenge in terms of morbidity, mortality, diminished productivity, and expenditure of healthcare dollars. About 300,000 deaths associated with obesity and overweight occur annually in the United States, at an estimated total cost of $117 billion in the year 2000.\(^3\)

The increase in the prevalence of obesity has prompted the development of the medical specialty of bariatrics (from the Greek word *baros*, meaning weight).\(^5\) Persons who are obese are at increased risk for mortality and morbidity associated with hypertension, heart disease, type 2 diabetes, stroke, gallbladder disease, osteoarthritis, sleep apnea, asthma, and endometrial, breast, and colon cancer.\(^2\) The prevalence of these conditions increases as the degree of obesity increases\(^6\) (Table 1).

**Obesity As a Risk Factor**

Compared with patients of more normal weight, patients who are obese experience more thromboembolic disease, myocardial infarction, respiratory failure requiring mechanical ventilation, sepsis, surgical morbidity, critical illness, and death.\(^8\) Obesity is associated with increased mortality both in the community and in the hospital setting.\(^9\)

### Table 1: Prevalence of Conditions Associated with Obesity

<table>
<thead>
<tr>
<th>Condition</th>
<th>Prevalence Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypertension</td>
<td>High</td>
</tr>
<tr>
<td>Heart Disease</td>
<td>High</td>
</tr>
<tr>
<td>Type 2 Diabetes</td>
<td>High</td>
</tr>
<tr>
<td>Stroke</td>
<td>High</td>
</tr>
<tr>
<td>Gallbladder Disease</td>
<td>High</td>
</tr>
<tr>
<td>Osteoarthritis</td>
<td>High</td>
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<td>Endometrial Cancer</td>
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<tr>
<td>Breast Cancer</td>
<td>High</td>
</tr>
<tr>
<td>Colon Cancer</td>
<td>High</td>
</tr>
</tbody>
</table>

### Authors

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Debbie Wilmoth has an extensive background in critical care nursing. She is currently working in the quality performance improvement program at the University of Virginia Medical Center.

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*This article has been designated for CE credit. A closed-book, multiple-choice examination follows this article, which tests your knowledge of the following objectives:
1. Identify factors in patients with obesity that impact critical illness
2. Explain several pharmacological considerations for patients with obesity
3. Discuss challenges to the management of pulmonary complications and weaning from mechanical ventilation in patients with obesity*
ity associated with wound complications, and sudden death after even minor surgical procedures. Once they are admitted to a critical care unit, patients who are obese are less likely than those who are not obese to respond favorably to therapy. Critical illnesses in patients with obesity present a unique set of challenges for interdisciplinary healthcare teams (see Case Study). In this article, we discuss the unique pulmonary and cardiac pathophysiological characteristics of patients who are obese and offer recommendations for care management for patients with obesity who become immobilized and are treated with mechanical ventilation as the result of critical illness.

**Pulmonary Function in Obesity**

Perhaps the most challenging aspects of caring for patients with obesity who are critically ill are management of pulmonary complications and weaning from mechanical ventilation. Pulmonary function is compromised in persons who are obese, and the compromise increases as weight increases.

**Gas Exchange**

Oxygenation exponentially decreases as body mass index increases. During normal inspiration, the diaphragm descends as it contracts, pushing the abdominal contents downward and forward, increasing the volume of the thoracic cavity to allow room for expansion of the lungs. In persons who are obese, abdominal fat elevates the diaphragm, preventing its full excursion, reducing functional residual capacity to as little as one third of normal, and causing collapse of alveoli in the lung bases. The chronic underventilation of well-perfused lower lung regions contributes to pulmonary shunt and is a factor in the severely impaired oxygenation of persons who are obese.

Ventilatory failure due to obesity alone is uncommon because retention of carbon dioxide is easily offset by an increase in minute ventilation. However, when an obstructive component or accompanying pulmonary or systemic pathological change occurs, making it impossible to main-

**Pulmonary Compliance**

Compliance refers to distensibility and describes the ability of the lung to be inflated. In patients with obesity, compliance of both the lungs and the chest wall is decreased. Chest wall compliance is decreased by the deposition of fat around the ribs, diaphragm, and abdomen. This fat forces the inspiratory muscles to work harder to overcome the lung’s elastic properties to work harder to overcome the lung’s elastic properties in order to expand the lungs. Lung compliance is decreased because the alveoli collapse, making the lungs stiffer and more difficult to inflate during inspiration. The combined effect is increased work of breathing.

**Work of Breathing**

Work of breathing is defined as "the work that the respiratory muscle must generate in order to overcome the elastic and flow-resistive forces of the lung and chest wall." To produce the same amount of ventilation as patients with more normal weight, persons who are obese must exert more diaphragmatic activity to overcome pulmonary elastance, thus increasing the percentage of cardiac output necessary to supply the diaphragm. The respiratory muscles of persons who are obese perform more than twice as much work as those of persons who are not obese, making work of breathing in overweight persons close to or greater than the commonly reported limits of muscle fatigue.

These conditions are magnified when persons who are obese become critically ill. Change in position from sitting to supine causes an increase in the work of breathing, ventilatory failure may ensue.
in oxygen consumption. Because the pulmonary reserve in healthy persons with obesity is limited, a pathological change such as sepsis or pneumonia can be a substantial risk for respiratory failure.11

The Cardiovascular System in Obesity

Obesity and excess abdominal fat are directly related to high levels of total cholesterol, low-density lipoprotein cholesterol, triglycerides, elevated blood pressure, and low levels of high-density lipoprotein cholesterol.6 In a study6 of men in Britain, an increase of body mass index by as little as 1 unit was associated with a 10% increase in the rate of coronary events.

Altered Cardiovascular Physiology and Structure

Obesity is an independent risk factor for congestive heart failure, a major cause of death in persons who are obese.7 In a recently published 14-year follow-up7 to the Framingham Heart Study, the risk of heart failure in subjects with obesity was double the risk in subjects with a normal body mass index.8 Obesity has been consistently associated with left ventricular hypertrophy and dilatation, both precursors of heart failure.12 Eccentric left ventricular hypertrophy, manifested by chamber dilatation and wall thickening, is the most common cardiac abnormality in patients with obesity.

Persons with obesity are at risk for sleep apnea, which can be obstructive or central in origin. The chronic hypoxemia that occurs with sleep apnea may result in polycythemia and in pulmonary hypertension with resultant right ventricular dysfunction.

Weaning From Mechanical Ventilation

Weaning from mechanical ventilation in patients who are obese requires meticulous attention to detail and a proactive approach by an interdisciplinary team. If possible, intubation should be avoided by using noninvasive ventilation strategies (eg, bilevel or mask ventilation) when those strategies are appropriate. Fat deposits in the neck in patients with obesity may hamper intubation efforts because of difficulty in positioning the head and neck.13 Tracheostomy should be considered early in the course of the patient’s critical illness, especially in patients who have obstructive sleep apnea. In a recent study,16 bedside percutaneous dilatational tracheostomy was safely performed in a series of 13 patients with obesity.

Patients who are obese have a baseline decrease in compliance that is exacerbated in conditions such as pleural effusion and abdominal distension due to ascites or ileus. Any acute causes of decreased compliance should be treated promptly.

Mode of Ventilation

No data suggest that any one mode of ventilation is superior to any other mode in patients with obesity. According to Marik and Varon,14 calculating the set tidal volume on the basis of actual body weight (ABW) in patients who are obese can result in high airway pressures and alveolar overdistension. These authors14 recommend calculating the initial tidal volume according to ideal body weight (IBW) and then making adjustments on the basis of airway pressures (plateau pressure) and the results of arterial blood gas analysis.

Common practice is to “rest” patients receiving mechanical ventilation during the first 24 to 48 hours of intubation to unload the fatigued diaphragm. This practice becomes even more important in patients who are obese, who are prone to respiratory muscle fatigue.17 Resting the respiratory muscles involves using strategies that prevent patients from...
triggering the ventilator. Patients can be rested on pressure-support ventilation, either alone or with a backup rate. Patients should be monitored for signs that their respiratory muscles are not being rested. For patients treated with pressure-support ventilation as a stand-alone mode, the respiratory rate should be 20/min or less and the exhaled tidal volume should be 8 to 12 mL/kg. For patients treated with pressure-support ventilation with a backup rate, the combined rate of spontaneous and delivered breaths should equal 20 or less. Target rates can usually be achieved by adjusting the inspiratory pressure level on the basis of respiratory rate and tidal volume.

Positioning

As mentioned previously, patients with obesity are prone to atelectasis because of limitations of diaphragmatic excursion. This decrease in lung compliance is exacerbated when patients are supine, and can cause a decrease in tidal volume and an increase in respiratory rate, resulting in even more atelectasis.

In a study in which they compared tidal volume and respiratory rate in different positions in patients with obesity, abdominal distension, and ascites, Burns et al found that the reverse Trendelenburg position at 45° resulted in significantly larger tidal volumes and lower respiratory rates than did elevating the head of bed to 90°.

The gastric volume of the stomach is larger in persons who are obese than in persons who are not obese. The large panniculus and increased intra-abdominal fat in persons who are obese result in high intra-abdominal pressures. Consequently, patients with obesity are at high risk for gastric reflux and for aspiration pneumonia. Elevation of the head of the bed may decrease the occurrence of aspiration. Patients with obesity should be placed in the reverse Trendelenburg position at 45° after their hemodynamic status is stabilized (see Figure).

Cardiovascular Considerations During Weaning

All patients with obesity, with or without a history of coronary disease, must be monitored for indications of ischemia, infarction, and pulmonary edema during times of increased activity such as physical therapy and weaning trials. During trials with a T-piece or a tracheostomy mask, as positive pressure (positive end-expiratory pressure or continuous positive airway pressure) is removed, venous return increases. In some patients, this increase in volume may exceed the heart’s ability to compensate, resulting in ischemia and/or pulmonary edema. Scrupulous attention to optimization of cardiac function should be undertaken throughout a patient’s illness.

Pharmacological Considerations in Obesity

Predicting the pharmacokinetics of drugs in persons with obesity is difficult because their body composition differs from that of persons who are not obese. Typical doses of medication may not be appropriate for patients who are obese, and few guidelines for use of medications in patients with obesity are available.
Many variables affect medications in patients with obesity. Patients with obesity who are malnourished because of chronic illness may have low protein stores. This change may result in decreased drug binding and an increase in the levels of free, circulating drug, increasing the risk of toxic effects due to drugs.

Patients who are obese have a high fat-to-muscle ratio. Muscle tissue holds more water than does fat tissue. As a result, drugs with hydrophilic distribution properties, for example, many of the antimicrobials, may be distributed into part, but not all, of the adipose tissue. Wurtz et al recommend basing final dosage adjustments for antimicrobial agents with a narrow toxic-therapeutic window on the serum concentrations of the agents.

Critically ill patients must be assessed frequently for anxiolytic, analgesic, and antidepressant needs. Many drugs in these categories are lipophilic and are taken up by adipose tissue and released slowly.

Propofol (Diprivan) is a lipophilic sedative-hypnotic agent commonly used in critical care. During infusion, propofol is distributed between fat and muscle tissue and plasma. During prolonged infusion, the drug accumulates in tissue and fat. As a result, when the infusion is discontinued, the drug is reabsorbed into the plasma, resulting in the potential for delayed awakening. Adjustments in dosage according to the clinical response and daily evaluation of sedation levels are important when propofol is used for long-term sedation in critically ill patients.

Metabolism of lorazepam is increased in patients with obesity. For adjustments in dosages and for weaning from the drugs, the dosages of anxiolytics such as lorazepam needed to reach a desired effect should be determined by using a sedation scale. Caution during administration of opioids is also prudent. However, analgesics and sedatives should not be withheld when needed. Patients should be assessed frequently for pain intensity, by using standardized pain assessment scales, and should be given doses that produce the desired effect. Consultation with specialists in management of acute and chronic pain can help clinicians establish an effective analgesic regimen.

The intravenous and enteral routes are preferred for administration of medications in patients with obesity. Adipose tissue has a decreased blood supply, and drugs given by the subcutaneous route have a delayed onset of action and an unpredictable duration of action. Drugs routinely administered subcutaneously (eg, insulin, heparin) may not have a therapeutic effect when given via this route. Intramuscular injection can inadvertently result in subcutaneous administration and should be avoided. Similarly, cutaneous patches are a poor choice for delivery of medications in patients who are obese. Pharmacokinetics of cutaneously delivered medications (eg, fentanyl, nicotine, nitroglycerin) is based on the tissue perfusion of an average person. Onset of action of cutaneously delivered medications will be delayed in patients who are obese, and duration of drug action will be erratic and unpredictable.

It is unclear whether drug dosages for patients with obesity should be calculated on the basis of ABW, IBW, or adjusted body weight (AdjBW). Measuring desired clinical end points and effects and serum drug levels may be a better guide for determining dosages. The expertise of a clinical pharmacist is valuable making decisions about dosages for patients who are obese.

Deep Venous Thrombosis and Pulmonary Embolism

Obesity is a clinical risk factor for venous thromboembolism. Blaszyk et al found that morbid obesity is an independent risk factor in cases of sudden death due to acute pulmonary thromboembolism. Critically ill patients with obesity are at high risk for deep venous thrombosis and pulmonary embolism due to venous stasis and immobility. However, little evidence is available on the choice or dosages of anticoagulants for patients who are obese.

Subcutaneously administered heparin is routinely used for prophylaxis for deep venous thrombosis. However, recommended subcutaneous dosages are based on persons of average weight. Few studies have been done on the efficacy of subcutaneous heparin in the prevention of deep venous thrombosis and pulmonary embolism in persons who weigh more than 100 kg.

Choices for anticoagulation in critically ill patients include warfarin, low molecular weight heparin, and intravenous heparin. Treatment with warfarin requires meticulous monitoring and dosage adjustments, and the effects of the drug can be difficult to reverse in an emergency. Treatment with low molecular weight heparin requires adjustments in patients with renal insufficiency. Laboratory monitoring (via the anti–factor Xa assay) has been rec-
ommended in patients with morbid obesity or renal failure.28 Use of intravenous heparin also requires monitoring and dosage adjustments. Use of weight-based heparin-dosing nomograms can result in overdosing in patients who are obese. Yee and Norton29 proposed a modification to weight-based heparin dosing for patients with obesity.

The American College of Chest Physicians has issued guidelines for the prevention of venous thromboembolism in high-risk medical, surgical, and intensive care unit patients.26 As with any treatment, the choice of agent and the dosage for thromboembolism prophylaxis or anticoagulation must include a careful consideration of risks and benefits.

**Nutrition**

Contrary to popular belief, obesity and malnutrition are not mutually exclusive. Because of changes brought on by stress, critically ill patients with obesity cannot efficiently mobilize fat stores for energy and instead often use protein as a primary energy source. Therefore, despite what appears to be abundant energy stores, these patients are at high risk for malnutrition, especially for marked loss of muscle and lean body mass. The hypermetabolism and hypercatabolism of critical illness deplete nutrient stores if proper nutrition, especially adequate protein, is not provided.30

Malnutrition is associated with increased morbidity and mortality. However, overfeeding critically ill patients who are obese can also cause complications, including volume overload, which can result in congestive heart failure and pulmonary edema; glucose intolerance; and excess carbon dioxide production (a byproduct of glucose metabolism), which can lead to increased respiratory work and respiratory failure. These problems can occur with both parenteral and enteral feeding.

Like any critically ill patient, patients who are morbidly obese should be provided nutritional sup-

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**Case Study**

E.W. was a 36-year-old man with obesity (actual body weight 248 kg [550 lb]) and a history of restrictive lung disease. He was transferred from another institution for treatment of dyspnea, hypoxia, hypercapnia, and back and flank pain. At the time he was admitted to our institution, treatment with warfarin was started empirically for a presumed pulmonary embolus, because his weight prevented definitive diagnosis via a ventilation-perfusion scan or pulmonary angiography.

Obstructive sleep apnea and obesity hypoventilation syndrome were diagnosed. A tracheostomy was performed to relieve upper airway obstruction and to facilitate mechanical ventilation.

E.W. was admitted to the medical intensive care unit after surgery. He was rested on intermittent mandatory ventilation with pressure support for the first 24 hours postoperatively. Ventilator adjustments were based on plateau pressure and the results of arterial blood gas analysis. As E.W. emerged from anesthesia, his ventilator mode was changed to pressure support alone.

On postoperative day 3, trials with a tracheostomy mask were begun. Trials initially lasted for 1 to 2 hours, with careful monitoring to prevent overtiring. After 30 days of weaning, prolonged by urinary tract infections and bacteremia, E.W. was weaned to nocturnal ventilation, which he required for 5 months before he was totally weaned from mechanical ventilation.

Plans were made to maintain the tracheostomy stoma until E.W. could lose 113 to 135 kg (250-300 lb). The tracheostomy tube was plugged during the day, making it possible for E.W. to communicate and eat, and was left open with humidified air provided by the tracheostomy collar at night.

Physical therapy was begun on postoperative day 2, with bed exercises and assistance to a sitting position. Daily physical therapy continued for the duration of E.W.’s admission. It was necessary to lease oversized equipment to facilitate his care. A Mighty Bed (SIZEwise Rentals, Las Vegas, Nev) was chosen to facilitate ease and comfort of positioning. The bed was equipped with an air mattress to help prevent pressure sores. In order to safely get E.W. out of bed, an electric lift (SIZEwise Rentals) was used, and a wheelchair 91-cm (36 in) wide (SIZEwise Rentals) was obtained.

Enteral nutrition was started within the first postoperative day. A small-bore nasogastric feeding tube was placed, and tube feedings were increased slowly. Prealbumin levels were measured weekly to assess E.W.’s nutritional status. When a swallowing study indicated that he was able to protect his airway, oral feedings were gradually added. With guidance from the nutrition support staff, protein intake was kept at 1.6 g/kg
port in a timely manner, as soon as 24 to 48 hours after admission, generally when hemodynamic stability has been achieved. When possible, the enteral route is the best choice for feeding, because of favorable effects on immune and metabolic function, protection and maintenance of the gut mucosa, improved nitrogen balance, and improved wound healing.1

The best way to determine the nutritional needs of patients with obesity is a subject of great debate. Methods to predict nutritional needs include indirect calorimetry or the use of predictive equations. However, for obese patients, the 2 traditional predictive equations, the Harris–Benedict equation and the calories-per-kilogram approach, often produce either a gross overestimation of energy expenditure if ABW is used, or a gross underestimation of energy expenditure if IBW is used. Therefore, some experts recommend estimating nutritional needs by using the AdjBW (AdjBW = 0.25[ABW – IBW] + IBW) to account for the part of excess weight that is metabolically active. Cutts et al3 recommend using AdjBW with the calories-per-kilogram method for patients whose ABW exceeds 130% IBW.

Use of hypoenergetic, protein-sparing feeding in patients with obesity has been examined. Several investigators31-33 found that obese patients fed a hypoenergetic, high-protein (2 g/kg of IBW) parenteral formula maintained a nitrogen balance similar to that of patients fed normoenergetic formulas.

Limitations of hypoenergetic, high-protein regimens include the fact that patients with renal failure, hepatic failure, and conditions requiring protein restriction have generally been excluded from investigations of this nutritional strategy. In addition, the results of a recent study34 supported the use of this regimen in younger patients, but the authors questioned the optimal energy and protein levels for patients more than 60 years old.

In a recent retrospective study,35 critically ill patients with obesity were fed a hypoenergetic (<84 kJ/kg [20 kcal/kg] of AdjBW per day) or a normoenergetic (≥84 kJ/kg [20 kcal/kg] of AdjBW per day) enteral formula. Both groups received similar protein intake of 2 g/kg of IBW. The group fed the hypoenergetic formula had a shorter length of stay in the intensive care unit, a shorter duration of antibiotic therapy, and a trend toward shorter duration of mechanical ventilation.

Regardless of the nutritional regimen chosen, nutritional status should be monitored and adjustments made if necessary. Monitoring alternatives include use of nitrogen balance studies, body weight, wound healing, and overall clinical progress. Laboratory values such as prealbumin levels may be helpful in patients in more stable conditions but most likely will remain low during critical illness.

Using data from the Third National Health and Nutrition Examination Survey, Must et al36 found a sharp increase in the prevalence of type 2 diabetes in overweight and obese men and women. Numerous
cross-sectional and longitudinal studies established abdominal obesity as a major risk factor for type 2 diabetes.

Hyperglycemia is related to an increase in the number of infections, delayed wound healing, decreased utilization of nutrients, and fluid imbalance. Esau and Charlebois reported delayed weaning from mechanical ventilation in patients with diabetes. They recommend managing hyperglycemia with an insulin infusion if the blood glucose level cannot be kept less than 11.1 mmol/L (200 mg/dL) after 24 to 48 hours of therapy with a sliding-scale insulin regimen.

In a study of critically ill patients in a surgical intensive care unit, van den Berghe et al found that patients given intensive insulin therapy to maintain the blood glucose level between 4.4 and 6.1 mmol/L (80-110 mg/dL) had significantly less morbidity and mortality than did patients in whom the blood glucose level was maintained between 10 and 11.1 mmol/L (180-200 mg/dL). In addition, critical illness polyneuropathy, which can result in prolonged duration of mechanical ventilation, was reduced by 44% in the group given intensive insulin therapy. Monitoring and controlling blood glucose levels are important management considerations in patients with obesity.

Psychological Considerations

Western society has historically associated obesity with psychological abnormalities. In the 1960s, it was thought that psychological maladjustment led to obesity. Research in the 1970s and 1980s negated this misconception and indicated that the social stigma of being obese often led to psychological abnormalities such as low self-esteem, depression, and social isolation.

Research suggests that persons who are obese are targets for negative social attitudes by healthcare professionals. In a survey of patients preparing to undergo gastric bypass surgery for morbid obesity, 55% of the respondents reported being treated disrespectfully by healthcare providers because of the respondents’ weight. Obese women are less likely to seek preventative healthcare services than are women who are not obese. Healthcare professionals must treat patients with obesity with compassion and respect. As patients recover from an acute illness, they should be included as partners in goal setting. Periodic meetings should be scheduled with patients’ families to discuss progress, obstacles, and goals.

Skin Care

The skin of persons who are obese is at high risk for breakdown and delayed wound healing. Persons with obesity have many intertriginous folds that become moist and harbor bacteria and yeast. Because of the poor vascular supply to adipose tissue, these skin folds are prone to breakdown and can quickly ulcerate. The use of powders in skin folds is discouraged. The weight of the overlying skin fold in conjunction with the abrasive particles of powder can lead to breakdown and ulceration.

The best skin care is prophylaxis with daily inspection of the skin and frequent, scheduled turning. Skin inspection must include every fold, especially the abdominal, midback, and perineal areas. When lifts and slings are used to move and weigh patients with obesity, caregivers must guard against increased pressure, shearing, or pinching of skin. Chest tubes, Foley catheters, and other drainage tubes must be positioned so that they are not hidden in skin folds where they can cause skin erosion and ulceration. The use of specialized bariatric equipment is recommended to enhance patients’ comfort.

Mobility and Rehabilitation

Early mobility is the key to successful rehabilitation in obese persons. Early mobilization is important in the management of obesity because it helps to maintain muscle mass and bone density. In addition, early mobility can prevent complications such as pressure ulcers and joint contractures. Physical therapy is an important component of the rehabilitation process for persons with obesity. Physical therapists can help patients to improve their strength, endurance, and flexibility.

Table 2 Sources of bariatric equipment*  

<table>
<thead>
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<th>Source, name and address</th>
<th>Telephone</th>
<th>Web address</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIZEwise Rentals</td>
<td>800-814-9389</td>
<td><a href="http://www.sizewise.net">http://www.sizewise.net</a></td>
</tr>
<tr>
<td>Wheelchairs of Kansas</td>
<td>800-537-6454</td>
<td><a href="http://www.wheelchairsofksas.com">http://www.wheelchairsofksas.com</a></td>
</tr>
</tbody>
</table>

*Specialized bed, lifts, commodes, wheelchairs, walkers, and so on.
patients. A physical therapist should be consulted within the first 24 to 48 hours after admission for recommendations on body positioning of patients with obesity. The physical therapy team assists in the selection of a specialty bed and other special equipment such as lifts, oversized wheelchairs, and commodes (Table 2). A physical therapist is valuable in providing healthcare staff with education related to correct body mechanics to follow when moving or positioning an obese patient, to avoid injuries and muscle strains to the patient as well as to the staff.

**Conclusion**

Obesity is a comorbid condition that complicates the care of many critically ill patients. As the incidence of obesity continues to increase, nurses will be called on to be part of interdisciplinary teams that will develop and implement clinical plans for patients who are obese. Knowledge of the unique pathophysiology of obesity and of the impact that obesity has on all organ systems will assist critical care nurses in providing knowledgeable and sensitive care to this group of patients.

**Acknowledgments**

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**References**


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