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Skin Integrity in Critically Ill Obese Patients

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More than 400 million adults worldwide were classified by the World Health Organization (WHO) as obese in 2005, with a projected increase to 700 million by 2015.[1] Obesity is the fastest growing chronic condition in the United States, affecting greater than 30% of the adult population.[2] For the age group of 40–59 year olds, the obesity prevalence is over 40%.[3] Minority women are disproportionately affected, with greater than 50% of non-Hispanic black women and Mexican-American women ages 40–59 being obese.[4] In critical care, these statistics are replicated, with almost one-third of intensive care unit (ICU) patients being obese.[5,6] Obese patients are more likely to have increased lengths of stay, higher morbidity, and increased likelihood of discharge to nursing home facilities.[6–9] Obese patients also pose a unique challenge for preventing skin breakdown, healing wounds, and preventing complications of surgery and prolonged immobility. Yet little research to date has been done to study the effects of obesity on skin integrity and wound healing in this patient population.

Many challenges are presented with care of the obese patient in the intensive care unit. Difficulties with mobilization and re-positioning, unpredictability of pharmacokinetic effects,[7] and lack of appropriate diagnostic equipment to monitor hypotension, hypoxia, and hypoperfusion put these patients at increased risk for skin breakdown and wound healing problems. There are many associated diseases that go along with being overweight and obese.[3]

These co-morbidities – especially diabetes, hypertension, cardiovascular disease, and pulmonary dysfunction – not only make obese patients sicker when they come to the ICU, they also may make them more prone to skin breakdown and wound healing complications while they are there.[6]

Critical care patients who are overweight or obese are at much higher risk of systemic inflammatory response syndrome (SIRS) leading to multiple organ dysfunction syndrome (MODS).[5,10,11] Hypotension, hypoxia, and hypoperfusion are endpoints of MODS that decrease tissue perfusion and increase a patient's risk of skin breakdown. Newell and colleagues (2007) stratified risk of pressure ulcer development in critically ill patients by body mass index (BMI) and found that risk for pressure ulcer compared with patients of normal BMI was more than 1.5 times greater for patients with BMI 30 to 39.9, and almost threefold greater for patients with BMI greater than or equal to 40. Factors that influence skin breakdown, such as sedation, use of paralytics, fluid overload, fever, incontinence, and mechanical trauma are especially important to assess in the obese critical care patient.

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Obese patients often have a history of previous discrimination or embarrassment when seeking health care. As a result they may delay seeking care until they are very sick. Impaired body image also makes them less likely to perform recommended self-examinations. A recent study found that obese women with poor body satisfaction were less likely to perform skin examinations for melanoma detection.[8] Therefore, presenting disease states may be more advanced than patients of normal weight.

During skin assessments and wound care, it is especially important that staff be aware of the potential for the patient to feel exposed. Care should be taken not to make the patient feel as if they are a spectacle or on display. Staff attitude about caring for obese patients can be easily transmitted to the patient, and it can be detrimental to a patient's care if the patient feels like the staff resents caring for them or is repulsed by their body habitus.

Common Skin Conditions and Chronic Wounds Associated with Obesity

There are many skin conditions and chronic wounds associated with obesity.[9,12] Patients who are critically ill may present to the ICU as a result of complications of these skin conditions, or they may be coincidentally treated for them while hospitalized for another medical problem.

Diabetic Foot Ulcers

Almost 24 million adults in the United States have diabetes, and obesity is one of the main risk factors for Type II diabetes.[10] Diabetic foot ulcers occur in about 15% of patients with diabetes.[11] Foot ulcers and infections are one of the top reasons for diabetic patient admission to the hospital.[13] Osteomyelitis, amputation, or death can occur from a diabetic foot ulcer.[14–16] Aggressive treatment of a diabetic foot ulcer including surgical debridement and systemic antibiotics is required in a patient with signs of decreased perfusion and/or sepsis.[17]

Venous Insufficiency Ulcers

Chronic venous insufficiency or venous hypertension of the lower limbs is common in obese people. Danielsson, and colleagues (2002)[18] showed that there was a significant association between BMI and increased clinical severity of chronic venous disease. Patients who were overweight were much more likely to have skin changes and ulceration. The authors concluded that being overweight appears to be a separate risk factor for increased severity of alterations in skin integrity in patients with chronic venous disease. The “gold standard” for treatment of lower limb venous insufficiency is compression via either garments or dressings.[19,20] In the critical care unit, ace wraps are easy to apply and remove and can be used to decrease edema by promoting venous return. Elevation of the lower extremities also aids venous return.

Lymphedema

Lymphedema is caused by dilation of lymph tissue channels when lymph drainage is impaired. Lymphatic fluid accumulates and causes swelling, decreased tissue perfusion and leakage of protein-rich lymphatic fluid into surrounding tissue Bacterial infections are common and permanent tissue changes are manifested by hyperkeratosis (skin thickening). Treatment for lymphedema while the patient is in the critical care unit should be directed at reducing limb size, promoting lymph drainage, and preventing infection. Cellulitis and skin breakdown in the critical care patient with lymphedema can be avoided by daily cleansing with mild soap and water, using compression stockings or ace wraps, and elevating the affected limb.

Intertrigo

Intertrigo is caused by friction between skin surfaces, and usually presents as mild erythema. Frequent sites of intertrigo are skin folds and areas that retain heat and moisture such as: posterior neck, axilla, under breasts, under pannus, perineal area, and inner thighs.[9,21] More

severe intertrigo shows signs of inflammation, maceration, and erosion. Secondary bacterial and fungal infections such as candidiasis are common and should be treated by keeping skin folds dry and with topical antimicrobials. Barrier ointments that contain zinc oxide can aid the drying process. Bulky dressings or linen should not be placed in skin folds, since they may contribute to pressure necrosis of the skin.

Psoriasis

Psoriasis is a chronic inflammatory skin condition that has been associated with the secretion of proinflammatory cytokines.[22] Rapid cell turnover causes plaques to form anywhere on the body. Multiple studies have shown an increased correlation between obesity, metabolic syndrome, cardiovascular risk and psoriasis.[23–26] Setty, and colleagues (2007)[23] used prospective data from the Nurses' Health Study II to show the increased incidence of psoriasis in women with higher BMI. Relative risk for psoriasis in nurses with a BMI ≥ 30 was 1.73 (95% CI, 1.24–2.41) compared with 0.76 (95% CI, 0.65–0.90) for nurses with a BMI < 21. There are many topical and systemic treatments for psoriasis. Psoriasis is a lifelong disorder, so patients will typically have a history of what has worked for them when they have a flare up.

Perineal Dermatitis

Incontinence of bowel and bladder in obese patients is a common cause of perineal dermatitis which can increase tissue friability and place patients at higher risk for skin breakdown.[27,28] Gentle cleansing after each incontinent episode and the use of barrier creams to protect skin is recommended.[21,29,30]

Pressure Ulcers

According to research by the National Pressure Ulcer Advisory Panel (NPUAP), up to 40% of patients will develop a pressure ulcer while in critical care units.[27] Risk assessment scales for skin breakdown such as the Braden Risk Assessment Scale have been validated in many different patient populations, yet none specifically have been tested in obese patients.[28] The Braden Scale assesses risk for pressure ulcer development based on six patient characteristics: sensory perception, moisture, activity, mobility, nutrition, and friction/shear – with total score ranging from 6 to 23. A score of 16 or less indicates risk for pressure ulcer development. Interventions to prevent skin breakdown should address specific characteristics that put the patient at risk. Risk assessment should be performed on admission to the ICU and at least every 48 hours, or according to changes in the patient's condition.[31,32]

According to the NPUAP definition, “a pressure ulcer is localized injury to the skin and/or underlying tissue usually over a bony prominence, as a result of pressure, or pressure in combination with shear and/or friction.”[33] Pressure ulcers in obese patients can also occur in uncommon areas. The weight of adipose tissue can cause enough pressure to occlude capillaries and lead to decreased tissue perfusion and injury. Careful attention should be given to patient skin folds areas such as under breasts (for both genders), beneath the pannus, in perineal and gluteal folds, lumbar and mid-back areas, and posterior neck. Small equipment and tubing used on patients should be carefully monitored to prevent skin breakdown. Pressure ulcer development from foley catheter tubing, tracheostomy ties, endotracheal tube holders or other equipment left under patients can occur.

Pressure ulcers are staged according to depth of injury.[29] The increased tissue load of obesity can lead to more serious tissue injury.[24,25] Kraemer-Aguiar and colleagues[30] (2008) studied skin microcirculatory dysfunction in diabetic patients with increased body mass index. They found that patients with increased BMI had smaller afferent, efferent, and apical capillary diameters; lower functional capillary density; less capillaries per square millimeter; and less

red blood cell velocity; all leading to longer time to reach post-occlusive reactive hyperemia. Tissue perfusion is decreased for longer periods of time in obese patients when their tissue is subjected to pressure. As a result, obese patients may be more susceptible to pressure-related tissue injuries related to their size.

Elsner and Gefen (2008) studied the development of deep tissue injury (DTI) in patients with spinal cord injury (SCI) who are obese. Their study observed average increases of 1.5 times of stresses on internal soft tissues (muscle, fat) over bony prominences with a rise in BMI from 25.5 to 40 kg/m^2.[34] The authors also noted that muscle atrophy associated with SCI combined with the increased bodyweight led to increased tissue loads that increased the likelihood of deep tissue injury.

Several studies in critical care have shown that guideline concurrent care for prevention and treatment of pressure ulcers can impact their prevalence and incidence.[35–38] However, implementation of pressure ulcer prevention and treatment guidelines in the critically ill obese population is often difficult.

Ability to turn - given the patient's clinical condition, appropriate equipment, and adequate staffing levels - can affect the ability to assess, prevent, and treat pressure ulcers. Tissue injury in skin folds or on posterior surfaces of the body may be difficult to assess in larger patients. Consequently, progression of tissue injury to necrosis may occur more frequently in obese patients. In critical care, there are also conflicting priorities of positioning the patient for optimal ventilation versus. preventing shearing injuries. By keeping the head of the bed greater than 30 degrees, as is required by most guidelines to prevent ventilator acquired pneumonia (VAP),[39] intubated patients are at higher risk for sliding down in bed, thus subjecting them to shearing forces on their posterior skin.[19] Gatching the knees of the bed frame before elevating the head of the bed may prevent some sliding and reduce potential for shearing injuries.

Guideline concurrent care also indicates that patients at risk for developing pressure ulcers should be placed on pressure reduction surfaces.[21,29,30] However, access to size-appropriate pressure reduction surfaces may be limited. In addition, staff knowledge about suitable mattress selections for the obese patient is often lacking. Several companies now offer for sale or rent pressure reduction mattresses and overlays that can accommodate patients up to 1,000 pounds. It is often more cost-effective for hospitals to purchase these surfaces, given the growing population of critically ill obese patients.

Poor nutrition is another risk factor for skin breakdown and pressure ulcer development.[31–33] Obese patients are frequently malnourished since their weight may be due to increased ingestion of high-density energy foods that are high in fat and sugars but low in vitamins, minerals and other micronutrients.[1,29] To promote wound healing and prevent complications from protein depletion, it is imperative to prevent catabolic states. To estimate calorie requirements, energy expenditure must be assessed. Anthropometric assessment of caloric requirements using indirect calorimetry is one way to assess calorie requirements, but it is expensive, and the equipment is not readily available in some hospital settings. Estimation of metabolic rates can also be done using caloric calculations. The Penn State equation for estimating energy expenditure has been validated in critically ill obese patients under age 60.[20] It is calculated using the patient's basal metabolic rate, minute ventilation, and maximum temperature. Based on these calculations, patients should be fed early or have parenteral or enteral feeding started to prevent catabolic states.

Wound healing involves anabolic metabolism and will not occur without adequate protein stores. Infections, wounds, and stress all increase metabolic requirements.[40] Immune mediators are protein based and quickly depleted by protein malnourishment and healing demands. Protein stores can be evaluated by assessing the patient's serum albumin, pre-albumin, and/or

transthyretin levels.[19,20] Nitrogen balance to assess for catabolic metabolism can also be evaluated by a 24 hour urine collection.

Surgical Wound Complications in Obese Patients

Post-surgical wound complications are also very common in obese patients. In a retrospective study of a cohort of patients receiving post-bariatric surgery, Arthurs, and colleagues (2007) [41] found that patients with a BMI > 25 kg/m^2 were three times as likely to have post-operative wound complications. Another study of patients undergoing bariatric surgery found that very obese patients were at risk for post-operative necrosis of their gluteal muscles, with subsequent renal failure and death, related to their BMI.[42]

Infections

There is inadequate information about dosing antibiotics in the obese patient and limited data on pharmokinetic differences.[43,44] Data that we do have are from small case-based studies. [12,45] As a result, obese patients may be more prone to surgical infections due to sub-therapeutic antibiotic levels. Pinsolle and colleagues (2006)[14] analyzed records over a 12-year period of women receiving breast reconstruction. They found that surgical infections were more likely to occur in obese women, and for that reason they recommended that reconstruction be delayed or contraindicated in patients that were obese.

Fournier's gangrene is a necrotizing soft tissue infection of the perineum that can occur in either gender. Predisposing risk factors for these infections include diabetes, obesity, and immunocompromise.[15] Patients often are admitted to the hospital ICU with advanced infections, sepsis, and shock. Treatment includes systemic antibiotics and supportive therapy, serial surgical debridement, and daily wound care.

Graft Failure

Skin grafting is usually required for definitive wound closure of large tissue defects caused by conditions such as Fournier's gangrene and other post-surgical wounds. However, graft failure in the obese patient is common,[16] and patients are often left with huge chronic wounds healing via secondary intention.

Incision Dehiscence and Seroma Formation

Other common post-surgical sequelae in obese patients that complicate wound healing include incision dehiscence[46,47] and seroma or hematoma formation.[48] Incisional dehiscence is often due to mechanical failure caused by increased tension on tissue at the incision site, infections, and inadequate nutrition. Use of supportive garments such as abdominal binders, systemic treatment of infection, and nutritional interventions may improve incisional wound healing and decrease incidence of dehiscence.

Seroma formation in patients post skin excision is associated with the amount of tissue removed.[48] Seroma and hematoma development under surgical sites can also lead to incision wound failures, but can be effectively treated with aspiration of fluid and/or proper placement of wound drains.[49]

Wound Management

While guidelines for general wound management are not specifically targeted to obese patients in the ICU, the evidence-based principles for prevention and wound healing should be followed when caring for critically ill obese patients with wounds.[31,50–53]

Pain Control

Pain control during wound care is important, but dosing of pain medication in obese patients can be unpredictable due to variations in absorption rates.[31] Increased adipose tissue in obese patients makes the use of lipophilic drugs for pain control problematic. Lipophilic analgesics may be sequestered in adipose tissue and cause re-sedation syndrome with subsequent respiratory depression.[54] Hydrophilic drugs that are water soluble and distributed in lean tissue (calculated using ideal body weight) should be the drugs of choice for pain control during wound care to prevent post-procedural sedation and respiratory depression.[43] Less lipophilic analgesics such as fentanyl or morphine should be used. Titration of dose to effect should be monitored closely.[44] Administration of analgesia should be via oral or intravenous routes, since drugs given via transdermal, subcutaneous, and intramuscular routes all have unpredictable absorption in patients with excess adipose tissue.

Dressing Selection

Wound management protocols for obese patients often involve pre-planning and multidisciplinary coordination of care.[52–54] Access to the affected area of the body often present challenges for wound assessment and dressing changes. Appropriate staffing and equipment can facilitate wound care and decrease injury to staff and patients. Limb slings for use with lift equipment are available for caring for wounds of the lower extremities. Wound dressings in appropriate size selections for larger patients should be readily accessible.

Palliative Wound Care

According to guidelines on palliative care in the intensive care unit from the American College of Critical Care Medicine (2008) iatrogenic sources of pain such as wound care should be minimized or eliminated.[45] Patients who are at end-of-life often have wounds. Focus should shift from healing the wounds to providing comfort and symptom management by controlling pain and managing infection, odor, bleeding, and drainage.[55,56]

Other Considerations

Mobilizing Obese Patients in the ICU

A recent nationwide survey of physical therapists who work in critical care areas noted that only 10% of critical care units have established criteria for the initiation of physical therapy, and that 89% of the hospitals required a physician order to initiate therapy.[57] Mobilizing obese critical care patients can be especially difficult due to their size. Specialized equipment and additional staffing is often required for patients over 250 pounds. Yet complications of immobility such as lost muscle mass, atelectasis and pneumonia, and skin breakdown are especially critical to course of the hospital stay for the obese ICU patient.

Utilizing appropriate equipment and interdisciplinary protocols when caring for obese patients can improve mobility and decrease skin breakdown.[58,59] Representatives from departments across the continuum of care should provide input on protocol development.[58] A patient or family representative should also contribute their perspective to promote patient-centered care.

Equipment Needs

Traditionally, most hospital equipment was not built to hold patients greater than 250 pounds. Wall-mounted toilets have broken off walls when used by patients over that weight limit – sometimes injuring the patient in the process. Emergency room staff has resorted to tying gurneys together to accommodate obese patients. Obese patients have been crammed into regular sized hospital beds that make re-positioning impossible. It is important to know the weight limits for all patient use equipment in clinical areas, and to have appropriate equipment

available to care for obese patients. With the growing population of obese patients, hospitals must proactively purchase or rent appropriately sized equipment across the continuum.

Attaching stickers with weight limits to all equipment is one way to visually remind staff. Knowing weight limits applies to all care areas, from the emergency room, to the OR, to the ICU, to the diagnostic suites (ie, angiography, CT, MRI), to the clinics. When considering equipment weight limits, it is also important to factor in the weight of additional equipment that a patient requires such as IV pumps, monitors, and oxygen tanks. In addition, extra weight allowance in the event of cardiopulmonary resuscitation (CPR) - with additional weight from staff performing CPR - should be included.

Transfer equipment and beds are often the first necessary equipment required when an obese patient is admitted via the emergency room to the critical care area. Gurneys, wheelchairs, and beds need to be appropriately sized, and have adequate weight limits to support a patient's weight. Beds that are wide enough to adequately turn the patient side-to-side are necessary to prevent skin breakdown.[60] Recliner-type “big boy” beds limit the ability to re-position obese patients, and they often make transition to rehab difficult. Patients who work with physical therapy to transition to discharge must be able to exit from the side of their bed as they would at home. Utilizing an overhead trapeze encourages bed mobility in patients who are able to re-position themselves independently. Bariatric bedside commodes and walkers or bariatric bedpans should be used for maintaining toileting programs and promoting continence in obese patients. If a patient is incontinent, appropriate sized incontinence briefs and/or pads are required to wick away moisture and maintain skin integrity.

Lift equipment for transferring or turning obese patients is essential. Etiology of staff injury has shown that the majority of injuries are caused by repetitive movements over time.[61] Overhead ceiling lifts or free-standing lifts should be readily available for staff use.

Best practice in safe patient handling has been implemented in many care areas, and state regulations now are mandating “no lift” policies for patient care providers.[61,62] To reduce staff injury and promote patient safety, many hospitals are using specially trained roving lift teams to turn and mobilize patients. These teams often work with physical therapy to receive training on body mechanics and proper lifting technique to avoid injury.

Post-Hospitalization Planning

There is an increased incidence of discharge to nursing home post-discharge for obese patients for wound care.[7] Skilled nursing homes and rehabilitation centers often have limits on number of obese patients that they can admit due to staffing, equipment, and reimbursement restrictions.[63] Coordination of discharge planning should begin soon after admission to the ICU to prevent delays in transfer or placement.

Summary

Data on skin care of critically ill obese patients is rare. Studies that assess risk factors for patients of normal weight may not apply to this patient population. Based on recommendations for normal weight patients, the following guidelines can be used until further research on the critically ill obese patient is completed.

General Treatment Guidelines for Preventing Skin Breakdown

- Use a validated pressure ulcer risk assessment tool such as the Braden scale to assess patient risk for pressure ulcer development. Assess on admission to ICU, and with any changes in patient condition.

- Prevention and treatment plans should be evidence-based and tailored to an individual's needs, taking into account patient preference and cost-effectiveness
- Treat any underlying conditions that may contribute to hypoperfusion, hypoxia, hypotension, or hyperglycemia
- Assess nutrition and feed early to prevent catabolism and malnutrition
- Perform perineal care with each episode of incontinence
- Apply barrier creams to all moist areas. (Products with ingredients: zinc oxide, dimethicone, or petrolatum)
- Patients at risk for pressure ulcer development should be placed on pressure reduction surfaces appropriate for their size
- Enhance early mobility using appropriately-sized equipment and adequate staffing
- Encourage independent bed mobility using assistive devices such as overhead trapeze and bedrails
- Decrease friction and shear using lift equipment and anti-shear sheets
- Carefully inspect all skin folds daily
- Develop interdisciplinary protocols to care for obese patients across the care continuum
- Work with supply chain managers to order appropriately-sized beds, linens, and patient-care equipment
- Work with clinical engineering to obtain correct diagnostic equipment (long and/or wide blood pressure cuffs, extra long instruments and needles, wide tracheostomy ties)
- Begin discharge planning on admission to prevent unnecessary delays in discharge and to facilitate transition to rehabilitation

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