Written Case Study - Pressure Ulcers

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Introduction

Pressure ulcers result from pressure, shear force, friction, moisture or a combination of these factors over bony prominences causing localized damage to the skin or underlying tissue. According to the Agency for Healthcare Research and Quality (AHRQ), there has been a reported 80% increase in pressure ulcer-related hospitalizations from 1993 to 2006 (AHRQ, 2008). As a result, an estimated 1 to 3 million people in the United States develop pressure ulcers and 60,000 will die from complications of pressure ulcers each year. The prevalence of pressure ulcers occurs in all settings with 2.3-28% of cases in long term care, 18% in acute care, and 0-29% in home care (Russo, Steiner, & Spector, 2008). Unfortunately, pressure ulcers come at a high cost. For a 13-14 day pressure ulcer related hospitalization, the cost ranges from $16,755 to $20,430 (Dorner, Posthaurer, & Thomas, 2009). It is estimated that future costs for U.S. healthcare facilities could be as high as $15.6 billion each year if there are 3 million pressure ulcer patients. Due to the growing rate and financial burden attached to pressure ulcers, early recognition and proper treatment is imperative. The following will discuss pressure ulcer pathophysiology, nutritional treatment, current research, and a relevant nursing home patient case.

Patient Profile

This case study and research is in reference to a 75 year old, Caucasian female who was readmitted to a long term care facility after being hospitalized with pyelonephritis. She is widowed and a former Registered Dietitian. She returned to the nursing home with a stage II pressure ulcer at her coccyx, which she acquired at the hospital. She is bedfast, with an

extensive medical history, and oral motor dysphagia requiring a pureed diet with nectar thick liquids. Her case will be discussed in detail after the following pressure ulcer context.

Pressure Ulcer Background

When blood flow is reduced to the skin due to force, pressure ulcers may arise. Different types of force include pressure, shear force and friction. Pressure against the skin is typically caused by the force of a bony prominence when in a decubitus position for a long period of time; most commonly occurring at the sacrum, coccyx, heals, hips, ankles, elbows, shoulders, back, and back of cranium. The pressure can result in decreased tissue perfusion, causing ischemia and tissue necrosis. Shear force results when a patient slides down in bed, while the skin stays in the same location, and muscle and deep fascia slide. This can create ischemia by occluding blood vessels. Friction is not a direct cause of pressure ulcers, but can hasten skin breakdown. Friction occurs when kinetic energy converts to heat (rough sheet against human skin). The heat generated results in degradation of epidermal layers. Ultimately, pressure, force, friction or the combination of these synergistically working together can impede blood supply, cause ischemia, which may then lead to tissue damage or necrosis. If pressure is high enough, deep tissue damage arises by damaging the cell membrane of muscle cells, which can also become necrotic (Dorner et al., 2009).

The National Pressure Ulcer Advisory Panel created four different stages to appropriately classify pressure ulcer severity. Before stage 1, a deep tissue injury may be suspected. A suspected deep tissue injury appears purple or maroon on intact skin due to damage of underlying soft tissue. A stage 1 pressure ulcer occurs when there is non-blanchable redness of a localized area on intake skin. Stage 2 presents a partial thickness loss of the dermis. The wound is shallow and open with a red-pink coloration, without slough. A stage 2 pressure ulcer appears

as an intact or open serum filled blister and can be shiny or dry, without slough. A full thickness tissue loss is classified as a stage 3 pressure ulcer. In stage 3, subcutaneous fat may be visible; however, bone, tendons or muscles are not visible. There could be undermining and tunneling, and slough may be present. A stage 4 pressure ulcer presents with full thickness tissue loss with bone, tendon or muscle exposed. Undermining and tunneling could appear, and slough and eschar may be present. A Stage 4 pressure ulcer could lead to osteomyelitis due to exposed bone. If there is full thickness tissue loss and slough or eschar is obscuring the depth of the ulcer, then the pressure ulcer is classified as unstagable. (Dorner et al., 2009.)

Under the right conditions, pressure ulcers can occur on anyone, but certain conditions can place individuals at a higher risk for developing a pressure ulcer. People who are immobile are at an increased risk for developing pressure ulcer. By sitting in the same position for an extended period of time, bony prominences will put constant pressure on the skin. Within 2 hours, blood flow can be occluded, causing ischemia and the start to a pressure ulcer.

Immobility is most frequently seen in elderly, which is a population at very high risk for pressure ulcers. As skin ages the epidermis thins and cell turnover slows, creating skin that is more fragile and vulnerable to ulceration; another factor placing elderly at an increased risk.

Additionally, malnourished individuals are at an increased risk for pressure ulcer development. Malnutrition puts stress on the body, increases infection risk, decreases collagen formation, and slows epitheliazation. Individuals with gastrointestinal disorders, dysphagia, cognitive deficits, hypermetabolic states, receiving treatment with immunosuppressive drugs, unable to feed oneself, or have advanced age are at risk for malnutrition, and secondarily pressure ulcers. With advanced age, absorption function in the GI tract decreases, more muscle mass is lost, cognitive

function decreases, appetite decreases, and swallowing/chewing difficulties arise, all which increase the risk for malnutrition, thus pressure ulcers as well.

Literature

For pressure ulcers to heal, it is imperative to address nutrition at every stage. Without adequate calories, protein, vitamins and minerals, a negative impact will occur on healing. A study by Takehiko, Toshio, Shingo, Kenji, and Kayoko (2011) revealed patients with stage IIIIV pressure ulcers had an enhanced healing process when provided calories in the range of Basal Energy Expenditure (BEE) x active factor 1.1 x stress factor 1.3-1.5. The BEE intervention group received approximately 37.9 kcal/kg/day and 1.62 g/kg/day of protein compared to the control group which received approximately 29.1 kcal/kg/day and 1.24 g/kg/day of protein. After 12 weeks, there was a significant difference in the size of pressure ulcers between the intervention and control group, with the intervention group having a greater reduction in size. Patients with larger pressure ulcers (>25.5 cm^2) had statistically significant greater benefits of faster healing from the prescribed nutritional intervention compared to those with smaller ulcers ($p<0.001$). The quicker reduction in size can be warranted by nutrition intervention and the need for increased energy for fibroblast collagen synthesis and for new cell growth during the healing process of pressure ulcers.

In addition to high energy intake, oral nutritional supplements high in energy and protein, and enriched with arginine, vitamin C, vitamin E and zinc have also shown to enhance the healing process of grade II-IV pressure ulcers in long term care residents, when compared to patients who do not receive nutritional support. In a study conducted by Heyman, Looverbosch, Meijer, and Schols (2008), 245 patients over the span of 9 weeks received an oral nutritional supplement consisting of 575 kcal, 46 grams protein, 6.9 grams arginine, 575 mg vitamin C, 87

mg vitamin E and 21 mg zinc per day in addition to their regular diet. After 9 weeks, there was a significant reduction by 53% in the size of pressure ulcers when compared to the baseline (*p <0.0001*). The oral nutritional supplement is beneficial due to arginine's stimulation of insulin secretion and promotion of amino acid transport into tissue cells, vitamin C's action during hydroxylation of proline and lysine in collagen production (as a cofactor), and zinc's function during collagen formation and protein synthesis. The role of vitamin E in wound healing occurs by synergistically working with vitamin C to prevent oxidative cell damage.

Some research shows that arginine supplementation could possibly reduce healing time of pressure ulcers, but data is still inconclusive and controversial. Arginine is a conditionally essential amino acid functioning as a substrate for protein synthesis, cell proliferation, and collagen production, and promotes positive nitrogen balance to possibly aid in pressure ulcer healing. According to Champan, Mills, Pearce, and Crowe (2011), arginine supplementation had a statistically significant 2.5 fold greater rate of pressure ulcer healing in 20 patients consuming a specialized arginine containing nutritional supplement until full wound healing occurred, compared to 14 patients who ceased taking the supplement (8.5 ±1.1 weeks vs 20.9 ±7.0 weeks; *p = 0.04*). In comparison to expected healing rates from medical literature, there was a statistically significant reduction in healing time (grade III: 6.5 ± 0.8 weeks vs 18.2; grade IV 11.4 ± 2.0 weeks vs 22.1 weeks; *p < 0.001*). The subjects had spinal cord injuries with grade IIIV pressure ulcers and the specialized wound healing supplement contained 18 g protein, 9 g arginine, 500 mg vitamin C and 30 mg zinc. Since the supplement also contained vitamin C and zinc, it is not probable to pinpoint arginine as the source of wound healing promotion.

Current Recommendations

The current recommendations for nutrition intervention vary depending on the pressure ulcer stage. For stage 1, ≥25 kcal/kg, 1.0-1.2 gm/kg protein, ≥30 ml/kg fluid, 1 multivitamin and 250 mg vitamin C is recommended. The recommendation for stage II is 30-35 kcal/kg, 1.25-1.50 gm/kg protein, ≥30 ml/kg fluid, 1 multivitamin, 500 mg vitamin C, 220 mg zinc sulfate (ZnSO4) x 10 days, and 10,000 International Units (IU) vitamin A x 10 days. Stage III requires 30-35 kcal/kg, 1.5-1.8 gm/kg protein, 30-35 ml/kg fluid, 1 multivitamin, 500 mg twice daily (BID), 220 mg ZnSO4 x 10 days, 10000 IU vitamin A x 10 days, 14 grams arginine, 14 grams glutamine, and 2.4 grams Beta-hydroxy-Beta-methlybutyrate (HMB). With stage IV, 30-35 kcal/kg, 1.5-2.0 gm/kg protein, 30-35 ml/kg fluid, 1 multivitamin, 500 mg vitamin C BID, 220 mg ZnSO4 x 10 days, 10,000 IU vitamin A x 10 days, 14 grams arginine, 14 grams glutamine, and 2.4 grams HMB is needed. For obese and underweight patients, adjustments are necessary to meet their needs adequately (Gottshlich, 2007).

Patient Application

Proper nutrition intervention with increased calories and protein for healing of pressure ulcers was witnessed in a 75 year old, Caucasian female residing in a long term care facility. She has lived in a long term care facility for the past 6-7 years, and was readmitted back to the facility on 10/03/2012 after a stay from 09/27/2012-10/02/2012 at the hospital with pyelonephritis. Upon arrival back to the long term care facility, she presented with a stage II pressure ulcer on her coccyx measuring 3.2 cm x 3.0 cm, red in color, with scant serous exudate. She has a history of hypertension, dyslipidemia, type 2 diabetes mellitus, morbid obesity, obstructive sleep apnea, osteoarthritis, chronic gastroesophageal reflux, aortic stenosis, left

ventricular hypertrophy, iron-deficiency anemia, vascular dementia with progressive psychotic features, oxygen-dependent chronic obstructive pulmonary disease, and congestive heart failure.

She also has oral motor dysphagia, requiring a pureed diet with nectar thickened liquids. According to the nurses, she has a good appetite and has no problem consuming her entire meal with some queuing. On 10/12/2012, her labs showed a low albumin of 1.9, low red blood cells (RBC) of 2.93 and low Hemoglobin of 8.6, with no significant medications that might cause nutritional interactions. Since May, she had been receiving 500 mg vitamin C. With a height of 61", her ideal body weight (IBW) was 47.7 kg, but she weighed 66.4 kg at the time, giving her a BMI of 27.7 and classification of overweight. With a stage II pressure ulcer at her coccyx, her estimated needs for adequate healing are 1990-2250 kcal (30-35 kcal/kg), 81-97 grams protein (1.25-1.50 g/kg), and 1900 ml fluid (30 ml/kg).

In the case of this patient, she was given the following PES (Problem, Etiology, Signs & Symptoms) statement: Increased nutrient needs related to wound healing promotion as evidenced by stage II pressure ulcer at coccyx. To treat her pressure ulcer, her intervention was to meet the caloric, protein and fluids needs, provide a large meat portion three times daily (TID), Pro-Stat liquid protein 30 ml per day, and continue vitamin C at 500 mg per day. She was also prescribed Niserex 150 mg BID when she returned to the hospital. Since she has a history of iron-deficiency anemia, with a respective low RBC count and hemoglobin, it was necessary for her to be given an iron supplement. Niserex will ensure the wound receives oxygen needed to repair and make new, healthy tissue. The expected outcome was to promote wound healing. As a result of her intervention, her pressure ulcer was monitored and evaluated, and steadily reduced in size. On 11/19, a week before healing occurred, she was provided with an additional 10,000 IU vitamin A per day x 10 days and $ZnSO_4$ at 220 mg per day x 10 days. On 10/29, the

wound measured 2 cm x 2 cm and was red with scant serous exudate. On 11/5, the wound measured 2 cm x 2 cm and appeared red. By 11/13, the wound reduced to 0.5 cm x 0.5 cm and was pink in color. By 11/27, the wound was healed. Her labs on 11/5 also indicated a low albumin of 2.4, but it was an increase from her previous 1.9 albumin lab reading. Her RBC and Hemoglobin also increased to 3.86 and 11.6.

In this patient's case, the arrival of the pressure ulcer could have been exacerbated by different underlying conditions. She obtained the pressure ulcer while combating and recovering from an episode with pyelonephritis. Therefore, her immune system was weakened and under stress, putting her in a hypermetabolic state in which she would need additional calories. However, according to her weight records, she experienced an 8.2% weight loss in 62 days. The nursing home nurses were aware that she requires queuing and assistance with eating, but she likely did not receive the same treatment at the hospital, and probably consumed an inadequate amount of calories during her hospital stay. Due to her decreased intake and hypermetabolism, she was in a state of undernutrition, which put her at high risk for pressure ulcer development since she was immobile and bedfast. Also with her advanced age of 75 years, her skin was in a state of fragility and more prone to ulceration.

Conclusion

Ultimately, her pressure ulcer steadily improved with the aid of increased calories, protein and vitamin C at 500 mg per day. Her case is representative of the current research on the need for additional nutritional treatment for wound healing promotion. Based on research, vitamin A, vitamin C and zinc have sufficiently shown to be beneficial in wound healing; but in this patient's case, vitamin A and zinc was not a necessity for healing to occur (since she did not

receive these until one week before healing). However, her case is supportive of nutritional intervention research with the use of increased calories, protein and vitamin C.

Personal Impression

If I had done the initial assessment, I would have provided the recommendation of a multivitamin with minerals once a day, 500 mg vitamin C per day, 220 mg zinc per day x 10 days, and 10,000 IU vitamin A per day x 10 days upon first notice of the pressure ulcer to assist and increase the rate of healing. Since she was likely malnourished, I would also have kept the regimen she was prescribed of large protein servings TID and Pro-Stat liquid protein 30 cc per day. In regards to arginine supplementation, I think there needs to be more research, but I don't think there is harm unless the patient is in renal or liver failure. The healing of pressure ulcers is directly correlated to the nutritional state of the patient and it is imperative that a Registered Dietitian be aware of the significant impact they can have on the healing process.

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