Nutritional Considerations in Wound Care

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Statistics show that malnutrition among older adult patients is a widespread problem in US health care facilities. The 2002 Nutritional Screening Initiative, a multidisciplinary coalition led by the American Dietetic Association and the American Academy of Family Physicians, has reported rather alarming facts on the nutritional status of this patient population: 40% to 60% of hospitalized older adults are either malnourished or at risk for malnutrition; 40% to 85% of nursing home residents are malnourished; and 20% to 60% of home care patients are malnourished.[1]

This is a serious problem. Lack of proper nutrition can have a significant impact on a patient's ability to recover from illness, disease, or surgery. Malnourished patients are prone to diminished muscle strength; development of pressure ulcers, infection, or postoperative complication; and poor wound healing.[2] In addition, malnourished older adults tend to be frail or fail to thrive,[3] increasing their risk for skin breakdown.

Body Response in Wound Healing

Having a major wound or infection increases the body's energy and protein needs as a result of pathologic processes and stress-induced changes. The body's protective inflammatory response precipitates a cascade of events, including increased blood flow to the site and an increase in metabolic rate (hypermetabolism). Glycogen and protein stores are mobilized by the increased metabolism to meet the needs for glucose and stress factors (cytokines and interleukin-1 and interleukin-6).

With stress, hormonal changes cause a shift in insulin and counter-regulatory hormones, such as cortisol, glucagons, and catecholamines. This results in a greater increase in counter-regulatory hormones than in insulin. Because insulin assists in carbohydrate and lipid storage and protein synthesis, metabolic and energy rates increase and deplete body protein stores.

Hormonal changes also lead to increased glycogen breakdown and mobilization of free fatty acids. The breakdown of glucagons increases glucose production from amino acids, ultimately resulting in a reduced storage of glucose, fatty acids, and proteins. Fat is used as an energy source, albeit improperly.[4]

Cytokines, or cell-mediated proteins, enhance the immune system but can also cause anorexia and fever.[5] Cytokines also accelerate protein breakdown or catabolism, which can occur quickly.[5,6]

As a result of the stress-induced depletion of body protein stores, the gastrointestinal and immune systems trigger impaired bowel function, immunosuppression, impaired wound healing, loss of skeletal muscle mass, and weakness. Individuals with compromised gut function suffer from anorexia, diarrhea, decreased nutrient absorption, and increased intestinal gut permeability. Increased permeability allows for microbial transformation and, at times, sepsis.[7,8] When bowel absorption is compromised, diarrhea can be expected.[9-11] Prolonged diarrhea can result in further nutrient depletion.

When lean body mass (LBM) is lost and protein-energy malnutrition (PEM) results, or when catabolism exceeds anabolism, a wound or pressure ulcer may develop and delay healing. It has been reported in the literature that PEM occurs in 30% to 50% of hospitalized patients.[12,13] The hallmark of PEM is involuntary weight loss with depletion of functional protein stores.[11,14] PEM results in the loss of body weight and subcutaneous fat, muscle wasting, peripheral edema, poor healing of wounds and pressure ulcers, glossitis, chronic infections, and fatigue.[4]

As the percentage of LBM decreases, wound healing is less likely. With less than a 20% loss of LBM, wound healing is a priority; at a 20% or greater LBM loss, the wound and muscles compete for nutrients; and at a 30% or greater LBM loss, available protein is often used to rebuild body mass at the expense of wound healing.

In summary, if the patient has a greater than 10% body weight loss, wound healing is impaired. With a greater than 20% to 30% body weight loss, wound healing ceases and new wounds have the potential to develop.[15,16]

Assessing Visceral Protein

Serum measurement of visceral protein levels can help estimate the adequacy of the individual's nutritional intake. Serum albumin, however, may not be a good indicator of an individual's nutritional status because it has a long half-life

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of 21 days. Albumin levels are affected by many factors, such as hydration, stress, liver disease, infection, sepsis, renal disease, and cytokine-induced inflammatory states. However, albumin may be helpful in identifying chronic undernutrition.[17,18]

The range of normal albumin is generally 3.5 to 5.0 g/dL, and a level below 3.5 indicates nutritional risk or malnutrition. Because serum albumin levels are inversely related to hydration, practitioners must use clinical judgment when interpreting these results.[2]

Prealbumin has a half-life of 72 hours and is a useful nutritional status indicator, particularly in acute or subacute settings. It is also used to assess response to refeeding. The normal range of prealbumin levels is 19.5 to 35.8 mg/dL.

Transferrin has a 7-day half-life and acts as an iron-transporting protein. It is a somewhat unreliable indicator of nutritional status, however, because of its relationship to iron levels. Normal transferrin levels are between 230 and 390 mg/dL.[2,17,18]

Dietary Supplementation

A variety of supplemental products are available to promote cell production and assist in collagen synthesis and wound contraction and remodeling. Arginine, for example, is incorporated into several supplemental products. It contains 32% nitrogen and glutamine-conditional amino acids, which enhance the immune system and protein synthesis in the face of stress.[15,19-24] Another substance found in many nutritional supplements is cysteine, an essential amino acid and antioxidant for enhancing healing and homeostasis.

The nutritional supplements that are used most often in therapeutic regimens are vitamins A, C, and E and zinc. Although the supplements of vitamins A and C and zinc are widely used, research to substantiate their effectiveness is limited.[25] Vitamin E, a fat-soluble antioxidant vitamin, is supplemented far less frequently.[26]

If a nutrient deficiency is suspected in a patient, a multivitamin is usually recommended.[27] In cases of a confirmed deficiency, a vitamin/mineral supplement is generally recommended.[27] Several liquid supplements offer high-protein values (15 to 18 g/30 to 45 mL) and incorporate arginine and/or glutamine. High-protein liquid supplements are available in the form of milkshakes, clear liquid juice-type drinks, and puddings.

Vitamin C

Vitamin C is a water-soluble, essential vitamin that is responsible for the synthesis of connective tissue/collagen. It promotes fibroblast proliferation and must be present in adequate amounts within leukocytes for phagocytosis when bacteria are present within wounds.[28] It is not considered clinically cost-effective, however, to measure serum vitamin C levels.[29]

Therapeutic doses of vitamin C vary from 200 mg/day to 4 g/day.[30] Smokers require more vitamin C than nonsmokers because of the added oxidative effects of cigarette smoke.[30] Research supports the relationship between vitamin C supplementation and the promotion of pressure ulcer healing[31,32]; it also documents that malnutrition increases an individual's susceptibility to pressure ulcer formation.[32-39] Vitamin C is generally recommended for short-term supplementation (500 to 1000 mg/day).[40]

Zinc

Zinc is a trace mineral that is present in small amounts in the body. It is a key component of many enzymes, a cofactor for protein synthesis, and a peptidase component responsible for protein digestion in the gastrointestinal tract.

Zinc is transported by the protein albumin and has a key role in tissue growth and healing as well as collagen synthesis and immune function, and it assists in transporting vitamin A from the liver.[41,42]

Although true zinc deficiency is quite rare, one study found that 88% of nursing home residents who ate independently consumed less than 50% of the recommended daily allowance.[43] Zinc deficiency can also occur from excess wound drainage.[20,44,45] Individuals with larger nonhealing wounds often receive 25 to 50 mg of zinc daily; however, a 14-day limit is suggested[46] because excess zinc can interfere with wound healing and copper metabolism.[45,47,48] Zinc is often used for nonhealing pressure ulcers in a dose of 15 mg/day or 220 mg zinc sulfate daily.[40] Re-evaluation within 4 to 6 weeks is recommended.

Vitamin A

Vitamin A is a fat-soluble vitamin that is responsible for the maintenance of epithelium. It also stimulates cellular differentiation for fibroblasts and for collagen formation. When vitamin A levels are low, delayed wound healing and susceptibility to infection can occur.[49] Vitamin A deficiency is not common, but when supplementation is needed, use caution because there is a risk for toxicity with fat-soluble vitamins.[49] The recommended dose is 700 to 3000 IU (with the higher range for males) when a deficiency is suspected.

More information is available on the Dietary Reference Intakes at http://www.nap.edu.[26]

Medical Nutrition Therapy

Medical nutrition therapy is imperative for the prevention and treatment of wounds, including pressure ulcers, because malnutrition, dehydration, and weight loss all play a role in

the development and healing of wounds. Risk factors for pressure ulcer development include:

- albumin level below 3.5 g/dL
- serum transferrin level below 180 mg/dL
- hemoglobin below 12 g/dL
- total lymphocyte count less than 1800 per microliter
- dehydration
- poor food and/or fluid intake
- unintentional weight loss.[27,50,51]

These factors also inhibit wound healing.

Clinicians should screen residents and patients on a regular schedule to identify those at risk for skin breakdown and/or at nutritional risk. Each patient should be screened on admission or readmission, when any significant change in health status occurs, on a weekly basis in acute care, and on a monthly basis in long-term care. One example of a significant change in status is a 5% to 10% weight loss.

For home care providers, assess patients for their risk of skin breakdown on entry into home health care, and then weekly for the first 4 weeks. Follow-up assessments should be performed every other week until day 62 on home health care, dependent on patient condition and frequency of the home visits.[52]

Conclusions

Significant nutritional deficits can develop quickly. Therefore, clinicians should adjust preventive nutritional measures immediately. Dietary professionals must review the medical records, assess nutritional needs, and make the appropriate recommendations. Primary care practitioners will establish a prescribed diet for the health care team to implement,[25,27] in addition to long-term treatment and follow-up plans.

A single poster on support surfaces was presented at the 2005 Clinical Symposium on Advances in Skin & Wound Care.

Pressure Ulcer Healing with A Concentrated, Fortified, Collagen Protein Hydrolysate Supplement: A Randomized Controlled Trial

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OBJECTIVE: Compare the PUSH Tool scores of pressure ulcer healing.

DESIGN: Randomized, prospective, controlled multicenter trial at 23 nursing homes in 4 states.

SUBJECTS: A total of 90 patients with Stage II, III, or IV pressure ulcers were entered into the trial and 72 completed the protocol.

INTERVENTION: Patients were randomized to receive either standard care plus a concentrated, fortified, collagen protein hydrolysate (n = 56) or standard care plus placebo (n = 33) 3 times daily for 8 weeks. Wound healing was assessed biweekly using the PUSH Tool 3.0. The PUSH Tool categorizes ulcers by surface area, exudates, and type of wound tissue.

PRIMARY OUTCOME MEASURE: Change in PUSH scores in each group at 8 weeks.

RESULTS: After 8 weeks of treatment, patients who received standard care plus the concentrated, fortified, collagen protein hydrolysate had significantly better (3.55 ± 4.66, $P < 0.05$) PUSH scores compared with those who received standard care plus placebo.

CONCLUSION: Pressure ulcer healing shown by PUSH score was significantly better in patients which received standard care plus a concentrated, fortified, collagen protein hydrolysate compared with those who received standard care plus placebo for 8 weeks. ●

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