Nutrition PEARLS: The Latest Nutrition Hot Topics

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This month’s Nutrition 411 column is based on Dr. Collins’ presentation at the 23rd Annual Symposium on Advanced Wound Care on April 18, 2010 in Orlando, FL.

Nutrition pearls are small nuggets of information that convey some of the most important and newest information related to wound healing. The pneumonic PEARLS is easily remembered because it represents six important concepts where nutrition and wound healing intersect. PEARLS stands for:

P: Protein
E: Energy
A: Amino acids
R: RDAs/RDIs
L: Laboratory data
S: Sarcopenia

Protein
Protein is important because it is the only nutrient that contains nitrogen. Protein is responsible for the synthesis of enzymes involved in wound healing as well as collagen synthesis; it is needed at every step of the wound healing process. When a patient does not consume an adequate supply of protein and calories over time, protein-energy malnutrition (PEM) results. Often, this manifests as unintended weight loss (UWL), which is one of the reasons it is so important to monitor each patient’s body weight on a regular basis.

The issue of how much protein is required each day permeates the literature with both pro-protein and anti-protein camps. According to US government standards, the recommended daily allowance (RDA) of protein for an adult is 0.8 g/kg (2.2 pounds) of ideal body weight. Persons who believe the RDA is sufficient point out that too much protein may lead to various ailments such as osteoporosis, cancer, kidney disease, and cardiovascular problems related to the high saturated fat content of certain high-protein meats. Persons who believe the RDA is woefully inadequate believe that although the RDA may be sufficient for the average sedentary adult, it is not enough for optimal health and well-being in many populations — eg, athletes, elderly persons, and sick and infirm people — who may require much greater amounts.

Patients with chronic and nonhealing wounds are routinely given additional protein in order to promote a positive nitrogen balance. Most clinicians recommend between 1.2 and 1.5 g/kg. For a 140-lb patient, this means between 11 and 14 oz of protein each day. To reach this level, most patients require supplementation. A modular protein supplement is an easy solution. Table 1 lists factors to consider when selecting a protein supplement.

Energy
Energy is another word for calories. If a patient consumes an inadequate amount of energy over a period of time, the result is UWL. The problem with UWL is that often, metabolically active lean body mass, not fat, is lost.

UWL in the wound population is frequently driven by a stress response to the wound. In a body responding to physical or psychological stress, the fight-or-flight mechanism is amplified. The initial insult leads to local and generalized inflammation and an increase in the level of stress hormones, particularly catecholamines and cortisol. At the same time, the body experiences a decrease in the level of anabolic hormones (human growth hormone and testosterone). This hormonal imbalance leads to a catabolic state in which the body breaks down lean body mass to release energy to meet increased demands. Working harder and faster than usual to fight off the stressor and regain homeostasis elevates body temperature and metabolic rate — the hypermetabolic state. This leads to an increased demand for glucose, which may...
Amino Acids

A polypeptide chain is comprised of three categories of amino acids. Indispensable amino acids (IAAs), also known as essential amino acids, are not synthesized by humans and must come from the diet. Dispensable amino acids (DAA), also known as nonessential amino acids, are produced by the body in sufficient amounts under normal, healthy conditions. Conditionally indispensable amino acids (CIAA) are produced in sufficient amounts by healthy individuals. However, in the presence of certain disease states or underlying physiological stress such as nonhealing wounds, supplementation often is required to achieve an adequate supply of CIAAs. Two CIAAs that are often supplemented are arginine and glutamine.

Some of the latest information about amino acids explores the relationship between arginine, glutamine, and leucine and a cellular protein called target of rapamycin (TOR) that is involved in the cell signaling for protein synthesis and wound healing. TOR is protein kinase that functions as a central element in signaling pathways involved in cell growth and proliferation as well as in pathways of protein breakdown. mTOR, mammalian target of rapamycin, was discovered when rapamycin was tested as a cell growth inhibitor and a potential anti-cancer agent. Amino acids are involved because arginine, glutamine, and leucine all activate mTOR signaling. This is consistent with what is known about the roles of these amino acids in promoting anabolic processes, such as in wound healing. Evidence is accumulating to show that when the mTOR pathway is somehow disrupted, wound healing is altered. An unplanned medical experiment first demonstrated a link between the mTOR pathway and wound healing. A study by Buhaescu et al1 showed that transplant patients given an anti-rejection medication experienced an unexpected adverse side effect — impaired wound healing. The drug was found to inhibit mTOR. Normal mTOR function is vital for normal wound healing. Excessive mTOR activity leads to excessive scarring, such as keloids. Inhibition or underexpression of mTOR is associated with poor wound healing. The amino acids arginine, glutamine and leucine can each activate mTOR.

RDAs/RDIs

Owing to vague guidelines and little grade A evidence, the topic of vitamin and mineral supplements for patients with wounds elicits many opinions and questions. The recommendation offered by most clinical practice guidelines is to provide vitamin and mineral supplements when dietary intake is poor or deficiencies are confirmed or suspected. The issue is further complicated when one considers that deficiencies run the gamut from subclinical to severe. A nutrition-focused clinical exam can be utilized by a trained professional to identify symptoms of many deficiencies. This type of thorough physical assessment combined with clinical judgment and a complete diet history can shed light on the supplementation issue.

Vitamin C and zinc are perhaps the two most common individual micronutrients associated with wound healing. Vitamin C is water-soluble — ie, the body does not store it so it must be supplied each day. Vitamin C is needed for the hydroxylation of proline and lysine during collagen synthesis. It is also needed for carnitine production for fatty acid metabolism and to give tensile strength to newly built collagen. Symptoms of vitamin C deficiency may develop rapidly but reverse quickly with treatment. Some of the consequences of a vitamin C deficiency state include lack of secretion of procollagen chains, wrong amino acids sequences, and increased blood cell fragility.

Zinc is needed for all enzymatic reactions; in a deficiency state, there may be a low rate of epithelialization and decreased wound and collagen strength. Urinary losses of zinc increase with stress and weight loss. Body stores may be depleted in patients with malnutrition, chronic diarrhea, and chronic corticosteroid use. Before supplementing, consider that excess zinc above 40 mg day may interfere with wound healing via affecting lysyl oxidase, an enzyme involved in collagen synthesis. Excessive zinc also interferes with copper and iron absorption and metabolism. It is important to remember that there is no magic combination of supplements that will make up for generalized poor nutrition and inadequate oral intake.

Laboratory Data

When evaluating laboratory or biochemical data, it is important to note the date on which the labs were drawn. If the labs are several months old, they may not reflect the patient’s current situation. However, the reverse is also true. Daily labs may be too frequent to detect any true changes in nutritional status; small daily changes are often the result of hemocencentration fluctuations. It is also important to note whether the patient had a recent blood transfusion; in that situation, some labs may be more reflective of the donor rather than the patient.

Historically, serum proteins — albumin, prealbumin, transferrin, and retinol-binding protein — were used to measure malnutrition. C-reactive protein (CRP), total lymphocyte count, and serum total cholesterol are not serum proteins but sometimes are used as indicators of malnutrition. Normal ranges for these lab tests are listed in Table 2. Despite the standard use of lab tests to help diagnose malnutrition, experts

\[\text{RDAs/RDIs}\]

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have no consensus about which, if any, biochemical markers identify malnutrition, especially in the frail, elderly population. Current thinking suggests that hepatic proteins are not indicators of nutritional status but rather indicators of morbidity, mortality, and recovery from acute and chronic disease. Changes in albumin, prealbumin, or transferrin should not be used to suggest changes in protein status in individuals with acute or chronic inflammatory states.2

Although laboratory values taken singly or together may provide some clues to nutritional status, they probably do not provide sufficient information to identify malnutrition or evaluate the success of nutrition interventions. Not surprisingly, according to the American Dietetic Association, a diagnosis of malnutrition is based on tried-and-true physical assessment rather than biochemical tests. Potential indicators of malnutrition include anthropometric measurements, such as a body mass index (BMI) <18.5, failure to thrive, significant weight loss, physical signs of malnutrition, poor meal intake resulting in decreased intake of nutrients, or client history of medical or socioeconomic conditions that could lead to malnutrition.3

Sarcopenia

Sarcopenia often is defined as an age-related shift in body composition, specifically the loss of muscle mass. The word sarcopenia has Greek origins and literally means “poverty of flesh.” As we age, we naturally lose muscle mass and replace it with fat — anyone over the age of 45 years can tell you how the body changes. Nearly 3.6 million people in the US have sarcopenia, putting them at increased risk for physical disability and frailty.4 People who are obese also can suffer this loss of muscle mass. In this case, we term it sarcopenic obesity. Although sarcopenia is seen mostly in physically inactive individuals, it is also evident in individuals who remain physically active throughout their lives. This finding suggests that physical inactivity is not the only contributing factor to sarcopenia. Current research is finding that the development of sarcopenia is a multifactorial process generally attributed to three factors: motor unit restructuring, protein deficiency, and changes in hormone concentrations.5

Stemming sarcopenia is important because patients with wounds often also are affected by a cytokine-driven stress response, which causes additional losses of lean body mass. In combination, there may be a critical loss of lean body mass and, in turn, delayed healing or chronic wounds. Interventions focus on progressive resistance exercise to turn on the body’s own anabolic drive, provision of adequate protein at each meal, and amino acids supplements. Several other therapies are currently being explored.

Putting It All Together

You are now in possession of six nutrition pearls.

Make sure your patients consume adequate protein, energy and amino acids each day.

Meet the RDAs/RDIs and monitor labs, but remember, there is no magic vitamin supplement or laboratory test.

Sarcopenia doesn’t have to be inevitable. Keep patients moving!

This is only a brief look at each topic. More detailed information is provided in each issue of this journal. Past issues are available at www.o-wm.com and each new issue explores a new nutrition topic.

Coming next month:

Exploring multivitamin supplements

Table 2. Normal laboratory values of selected nutrition indicators

<table>
<thead>
<tr>
<th>Lab test</th>
<th>Normal range</th>
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<tbody>
<tr>
<td>Albumin</td>
<td>3.5–5.0 g/dL</td>
</tr>
<tr>
<td>Prealbumin</td>
<td>16–36 mg/dL</td>
</tr>
<tr>
<td>Retinol binding protein</td>
<td>2.6–7.6 mg/dL</td>
</tr>
<tr>
<td>C-reactive protein</td>
<td>&lt;0.8 mg/dL</td>
</tr>
<tr>
<td>Cholesterol</td>
<td>&lt;200 mg/dL</td>
</tr>
<tr>
<td>Transferrin</td>
<td>212–360 mg/dL</td>
</tr>
<tr>
<td>Total lymphocyte count</td>
<td>≥1,800 cubic millimeter (mm³)</td>
</tr>
</tbody>
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Sources:

References