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GERIATRIC Your Monthly Guide to Caring for Elderly Patients in the Emergency Department

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*Malnutrition and dehydration are two common and under-recognized conditions in the geriatric patient. Currently, there are more than 32 million senior citizens living in the United States.[1] While many are highly functional and live independently, an estimated 5% require either assisted living or nursing home care.[2] A decline in the ability to provide for one's self with regard to the activities of daily living (ADLs) is associated with an increase in malnutrition and dehydration. While both are more common in nursing home residents, they also occur in community-dwelling elders. The astute clinician recognizes the potential for prolonged hospitalization and increased mortality when a patient presenting to the emergency department with acute illness or injury is already malnourished. Assessment of each geriatric patient presenting to the emergency department with suspected, recent weight loss should include a thorough physical exam, laboratory evaluation, and review of prior inpatient admissions. A simple physical examination and history of recent, involuntary weight loss can usually assess malnutrition.*

*In addition, many older patients who present to the emergency department with acute confusional episodes, weakness, dizziness, constipation, or fever are likely to be dehydrated. Clinical signs and symptoms, such as classic changes in postural vital signs and skin turgor, may be absent or nonspecific in the elderly patient. The emergency physician should be familiar with laboratory abnormalities that are associated with dehydration, be able to recognize the potential causes of dehydration, and understand that management varies depending on the etiology of dehydration. This issue will review the etiologies and assessment of both malnutrition and dehydration in the elderly. The utility of screening instruments and laboratory evaluation also will be reviewed.*

*— The Editor*

# Malnutrition and Dehydration in the Geriatric Adult

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## Malnutrition

Malnutrition includes a variety of conditions that reflect over- or undernutrition of protein, energy, or nutrient status. In general, most clinicians associate malnutrition with dietary deficiencies. The two classic extremes of protein-energy malnutrition, marasmus, a deficiency of calories resulting in poor growth and loss of adipose and lean mass, and kwashiorkor, a primary deficiency of protein manifested by edema and ascites, are rarely observed in this country. Many individuals who are malnourished have elements of both protein and calorie deficiencies. Patients with protein-energy malnutrition, in which protein and carbohydrate/fat intake is inadequate for cellular metabolism, appear cachetic and have muscle wasting in the advanced stages of this condition. Protein deficiency alone can result from a protein deficient diet or hepatic insufficiency, such as occurs in cirrhosis. Malnutrition is often not considered in these patients since they are often edematous and do not look thin or have a history of weight loss. Micronutrients, which include fat and water-soluble vitamins and minerals and their clinical effects and deficiency syndromes, are included in Table 1.[3] A calcium deficient diet, low vitamin D intake, steroid use, low body weight, inactivity, and smoking are major

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causes of osteoporosis.[4] Deficiencies of ultra-trace metals, such as chromium, selenium, and molybdenum, are rarely an issue except in patients that are on prolonged total parenteral nutrition.

Stages in the sequence of malnutrition have been defined, beginning with: 1) risk factors, which progress to; 2) inadequate intake relative to nutritional needs; 3) preclinical symptoms, anthropometric changes, and biochemical markers; and, finally, 4) measurable health outcomes.[5,6] Importantly, the process along these stages is not predictably linear, and time-frames from deficiencies to health outcomes may be extremely variable. For example, insufficient calcium and vitamin D intake may not result in osteoporosis and fracture for decades, while protein-calorie malnutrition may result in pressure sores in only several weeks.[6]

## Prevalence and Impact of Malnutrition

The disease states, social situations, functional limitations, and economic plight of the elderly often place them at risk for malnutrition. Managed care organizations are demanding more outpatient treatment of elderly patients. Hospitalists are encouraged to release patients from the hospital environment as soon as possible. Emergency physicians must be aware of these risk factors, initiate therapy, and recommend referral.

The prevalence of malnutrition in older persons is generally high. It is estimated that nutritional impairment is present in 0-15% of ambulatory outpatients, 35-65% of patients hospitalized for acute illness, and 25-60% of nursing home residents.[7] In a study of geriatric case-finding in the emergency department, one group found that 40% of older patients had evidence of undernutrition.[8] Other definitions and study populations yield different estimates. Another study identified 3% of older patients who had weights of less than 45 kg (100 lbs), and almost 60% of these patients were considered to have severe malnutrition.[9] The prevalence of malnutrition is considerably higher in hospitalized patients than in community-based samples. A study involving Veterans Administration (VA) inpatients found 61% had measures consistent with malnutrition.[10] A more recent study using a validated measure of nutritional status in hospitalized patients older than 70 years found 24% were moderately malnourished and 16% were severely malnourished.[11] Malnutrition affects both patient outcomes and health care utilization and costs. Complications of poor nutrition include death, sepsis, infection, poor wound healing, and respiratory failure. These "nutrition-associated complications" are thought to result more from functional impairment than changes in body composition.[12] In general surgery patients, the incidence of major nutrition-associated complication, such as sepsis and poor wound healing, increases from a baseline rate of 10% to 67% in those who were assessed to be severely malnourished preoperatively.[13]

Nutritionally deprived patients also have higher hospital costs and longer lengths of stay. One group retrospectively studied the records of 771 patients in two acute care hospitals.[14] They sought to determine the likelihood of malnutrition (LOM) and its effect on the hospital cost and outcome. While the patient population was not comprised of only the elderly, the mean age of this population was 58.7 years. These authors determined that approximately 50% of the patients included in the study were likely to be malnourished. When compared by diagnostic-related group (DRG), the risk of death was 3.8 times greater in the malnourished than in the appropriately nourished patients. The morbidity or complication rate was 2.6 to 3.4 times greater in the malnourished group as well. The mean length of stay and costs per hospitalization were much higher in the malnourished group. LOM patients cost an average of $1,700 more than well nourished patients with the same DRG. When complications developed, there was an increase of $3,000 per admission in the LOM group compared with patients without LOM.

One study found that severely malnourished older patients were more likely to die within one year of discharge, be dependent in ADLs three months after discharge, and more likely to spend time in a nursing home during the year following their hospitalization.[11] Other markers of poor nutritional status, including low body mass index (BMI) and low serum albumin, have been associated with increased mortality in older persons.[15-18]

**Etiologies.** Risk factors for poor nutrition in older adults include low income, social isolation, loneliness, chronic and acute disease states, compromised functional status, and polypharmacy.[19] These common etiologies of malnutrition in the elderly are most easily remembered by the pneumonic DETERMINE. It stands for: Diseases that effect appetite and gastrointestinal (GI) function;[4] Eating poorly, lack of fruits and vegetables and excess alcohol consumption are common problems; Tooth loss/pain, poor dentition reduces

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## Table 1. Vitamin Sources, Functions, and Signs of Deficiency

| Vitamin | Source | Physiologic Function | Deficiency Symptoms |
|---|---|---|---|
| FAT-SOLUBLE VITAMINS | | | |
| *Vitamin A* | Beta-carotene widely distributed in green vegetables; retinol in milk, butter, cheese | Constituent of rhodopsin (visual pigment). Maintenance of epithelial tissues. Role in mucopolysaccharide synthesis | Xerophthalmia (keratinization of ocular tissue), night blindness, permanent blindness |
| *Vitamin D* | Cod liver oil, eggs, dairy products | Promotes growth and mineralization of bones, increases calcium absorption | Rickets (bone deformities) in children, osteomalacia in adults |
| *Vitamin E* | Seeds, green leafy vegetables, shortening | Antioxidant to prevent cell membrane damage | Possibly anemia |
| *Vitamin K* | Green leafy vegetables; small amount in cereals, fruits, meats | Formation of active prothrombin, important in blood clotting | Conditioned deficiencies associated with severe bleeding, internal hemorrhages |
| WATER-SOLUBLE VITAMINS | | | |
| *Thiamine* | Pork, organ meats, whole grains | Coenzyme (thiamine pyrophosphate) | Beriberi (peripheral nerve changes, edema, heart failure) |
| *Riboflavin* | Widely distributed | Constituent of flavin coenzymes (FAD, FMN), involved in energy metabolism | Reddened lips, cracks at corner of mouth, lesions of eye |
| *Vitamin $B_6$* | Meats, vegetables, whole-grain cereals | Coenzyme (pyridoxal phosphate), involved in amino acid metabolism | Irritability, convulsions, muscular twitching, dermatitis near eyes |
| *Niacin* | Liver, lean meats, grains (also formed from tryptophan) | Constituent of coenzymes (NAD, NADP), involved in oxidation-reduction reactions | Pellagra (skin, gastrointestinal lesions, nervous disorders) |
| *Folic acid* | Green vegetables, whole-wheat products | Coenzymes involved in nucleic acid and amino acid metabolism | Anemia, gastrointestinal disturbance, diarrhea, red tongue |
| *Vitamin $B_{12}$* | Meats, eggs, dairy products | Coenzyme involved in nucleic acid metabolism | Pernicious anemia, neurologic disorders |
| *Biotin* | Vegetables, meats | Coenzyme for fat synthesis, amino acid metabolism, glycogen formation | Fatigue, depression, nausea, dermatitis, muscular pains |
| *Ascorbic acid* | Citrus fruits, tomatoes, green peppers, salad greens | Maintains intercellular matrix of cartilage, bone, and dentine; involved in collagen synthesis | Scurvy (degeneration of skin, teeth, blood vessels, epithelial hemorrhages) |
| *Pantothenic acid* | Widely distributed | Coenzyme A constituent, involved in energy metabolism | Fatigue, sleep disturbances, impaired coordination |
| *Choline* | Egg yolk, liver, grains | Constituent of phospholipids, precursor of acetylcholine | None reported |

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food intake; Economic hardship, 40% of elderly have poverty level incomes; Reduced social contacts, people who live alone don't eat properly; Multiple medications, which can cause gastrointestinal upset with reduced food intake; Involuntary weight loss/gain, more than 10 pounds in six months is highly significant; and Elder, age older than 80 years increases the risk of the above and is associated with impairments in independent ADLs (i.e., shopping, cooking, etc.). Malnutrition in institutionalized elders has been associated with dysphagia, slow eating, low protein intake, poor appetite, presence of feeding tube, and increasing age.[20]

## ED Assessment of the Malnourished Patient

One of the most important interventions from an emergency department visit for a geriatric patient is further assessment of the patient's life situation and identification of additional medical needs. Emergency department interventional screens need to be brief, predictive, and ideally, have the potential to improve outcomes. Screens that are either self-administered or administered by nursing or ancillary personnel are also ideal in the busy emergency department setting.

**Nutritional History.** The common etiologies for poor nutri-

## Table 1 *Cont*. Trace Mineral Sources, Functions, and Signs of Deficiency

| MINERAL | SOURCE | PHYSIOLOGIC FUNCTION | DEFICIENCY SYMPTOMS | COMMENTS |
|---|---|---|---|---|
| *Iron* | Meats, egg yolk, fish, nuts, poultry, green vegetables | Constituent of hemoglobin and enzymes involved in energy metabolism | Iron deficiency anemia | Deficiency may be common in the elderly due to reduced intakes, especially in the institutionalized elderly |
| *Copper* | Shellfish, organ meats, nuts, legumes, drinking water | Constituents of enzymes involved in iron metabolism, connective tissue, and central nervous system development | Anemia, neutropenia, bone disease | Deficiencies have been reported in patients on total parenteral nutrition (TPN) |
| *Zinc* | Meat, liver, eggs, seafood, nuts | Constituent of enzyme systems involved in nucleic acid and protein metabolism | Growth failure, loss of appetite, impaired immunity and wound healing, skin changes, decreased taste acuity | Deficiencies have been reported in patients on TPN |
| *Manganese* | Nuts, whole cereals, dried fruits, tea | Constituent of enzymes involved in fat synthesis | Impaired growth, skeletal abnormalities, ataxia, disturbed carbohydrate and lipid metabolism | Deficiency associated with vitamin K-deficient diet |
| *Iodine* | Fish, shellfish, dairy products, some vegetables, iodized salt | Constituent of thyroid hormones | Thyroid enlargement (goiter) | |

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tion listed above have been included in the DETERMINE checklist.[4] *(See Figure 1.)* It is a simple, weighted 10-item self-administered questionnaire that can be used to screen patients at risk for malnutrition.[4] Checklist scores range from 0 (lowest risk) to 21 (highest risk). If the patient's score is less than 2, no further screening is needed. Patients with scores of 3-5 are considered at moderate risk and need follow-up and repeat screening in three months. A score of 6 or more is considered high-risk and an indication that further evaluation is needed as described below. Although useful and widely adopted, the checklist has been shown to have low sensitivity and positive predictive value for detecting inadequate nutritional intake.[21] This screening tool is a means to identify those patients who need further evaluation, but it does not establish that a patient is malnourished.

In summary, a nutritional history should include several elements. First, it should include a history of weight loss/anorexia; a weight loss of 5 lbs. is significant and a loss of 10 lbs. in six months is highly correlated with malnutrition.[22,23] An involuntary weight loss should be confirmed by caregivers or significant others. The majority of patients with significant weight loss will have a treatable etiology.[22] Second, difficulty in chewing and swallowing should be assessed; difficulty is most commonly caused by decayed or absent teeth or broken or ill-fitting dentures. Dysphagia can also be due to neurologic, physiologic, and anatomic etiologies—the most significant of which are tumors of the esophagus and mediastinum. Next, the number of meals the patient consumes per day should be determined; many elders who live alone skip meals or are unable to prepare them. Also, whether the patient has any chronic illnesses should be documented (e.g., prior known malignancy, GI dysfunction, and depression are significant causes of malnutrition). The physician should also establish whether the patient lives alone. He or she should determine if the patient has GI dysfunction, including anorexia, pain, diarrhea, and constipation. The patient's functional status should be assessed (i.e., are they able to live independently). Finally, the physician should determine the patient's level of consumption of alcoholic beverages (i.e., how much and how often).

**Physical Examination.** A physical examination should include the following elements: general appearance; examination of the mouth and dentition; a pulmonary exam for signs of consolidation or effusion; an abdominal exam, including palpating for masses, hepatomegaly, and a rectal exam to check for occult blood and neoplasms; and determination of of the patient's height and weight (this information can be used to calculate the patient's BMI).[4]

The BMI can be assessed by using the following formula: BMI $kg/m^2$ = weight (kg)/height $(m)^2$, or the nomogram shown in Figure 2.[4] BMI can be used to evaluate nutritional status as is shown in Table 2. A general rule is that a BMI of less than 22 is consistent with nutritional impairment.[15]

Another important item of the physical examination of the elderly patient is the anthropometric measurements, such as mid-arm and mid-thigh circumference. Unfortunately, nomograms are not available for patients older than 75 years, but these measurements are useful to establish trends for follow-up. Average height-weight tables have also been developed for men and women ages 65 to 94 years, as are shown in Table 3.[24]

**Laboratory Tests.** There are many potential biochemical indicators of nutritional status, however, few markers have clearly established associations with malnutrition in older persons, and criteria for their interpretation in this age group is not always clear.[25] Complete blood counts (CBC) are useful for detecting anemia and leukopenia. Total lymphocyte counts of less than 1500 cells per millimeter are associated with a higher risk of mortality.[26] It has been

## Figure 1. Patient's Nutritional Checklist

**DETERMINE Your Own Nutritional Health**

What you eat does affect your health. Use this checklist to find out if you or someone you know is at nutritional risk.

*Instructions:* For each question, answer "yes" or "no." Then circle the number that appears in the appropriate column. Add the circled numbers to determine your total score.

| NUTRITION CHECKLIST | YES | NO |
|---|---|---|
| Have you made changes in the way you eat because of an illness or medical condition? | 2 | 0 |
| Do you eat fewer than two (2) meals a day? | 3 | 0 |
| Do you skip any of these foods daily: fruits, vegetables, and/or dairy products? | 2 | 0 |
| Do you have three (3) or more drinks of beer, liquor, or wine almost every day? | 2 | 0 |
| Do you have tooth or mouth problems that make it hard for you to eat? | 2 | 0 |
| Are there times when you do not have enough money to buy the food you need? | 4 | 0 |
| Do you eat most meals alone? | 1 | 0 |
| Do you take three (3) or more prescribed and/or over-the-counter medicines each day? | 1 | 0 |
| Have you lost or gained ten (10) or more pounds in the last six (6) months without wanting to? | 2 | 0 |
| Are there times when you are not physically able to do one or more of the following: shop for food, cook, or eat on your own? | 2 | 0 |
| **Total Score Today** | | |

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observed that the lymphocyte count is reduced with age, but it is unclear if these studies accounted for nutritional states.[27] A comprehensive metabolic profile is also useful to evaluate for electrolyte imbalance, diabetes, renal insufficiency, liver disease, and dehydration. Thyroid function studies are useful to rule out occult hyperthyroidism, especially in the older patient who may manifest weight loss and otherwise lack typical signs of thyrotoxicosis. The most useful serum indicator as a screen for chronic protein energy malnutrition is serum albumin. However, cardiac, hepatic, and renal diseases, trauma, sepsis, and auto-inflammatory processes can alter albumin concentrations.[28] These diseases usually cause a fall in albumin levels, and in settings of acute inflammatory states, low serum albumin may be regarded as a negative acute-phase reactant.

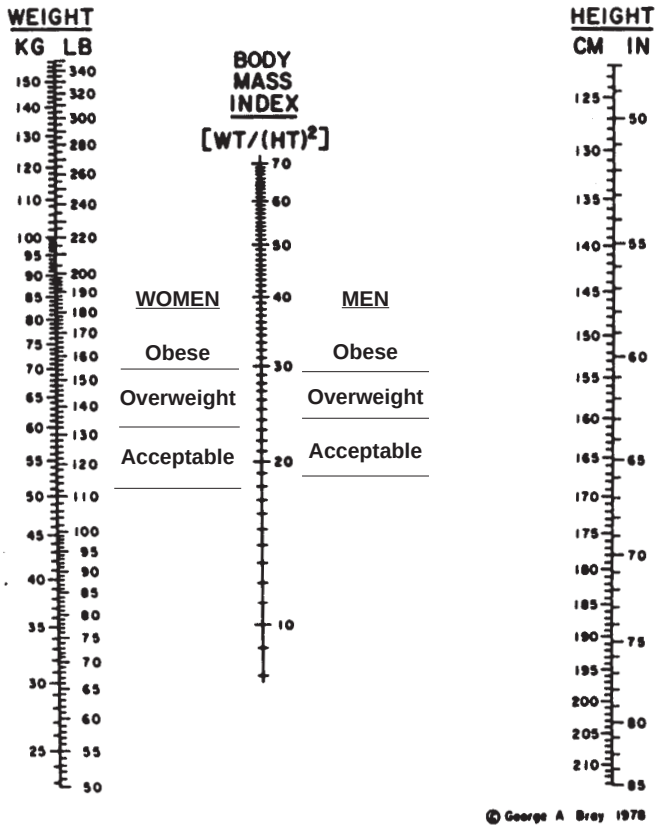
An albumin level of 3.5 gm/dL is abnormal and protein deficiency may be categorized as follows: mild protein deficiency is indicated by an albumin level of 2.9-3.2 gm/dL; moderate deficiency is indicated by 2.6-2.8 gm/dL; and severe deficiency by less than 2.5 gm/dL. Albumin has a half-life of 21 days and is not reliable in the evaluation of acute changes in nutritional status. Prealbumin is a better indicator of short-term nutritional status changes;[29] it has a half-life of only two days, and increasing levels are associated with nutritional repletion. As a marker of malnutrition it also has limited utility in the presence of acute inflammation and hepatic or renal disease. Pre-albumin is measured in mg/dL, and generally accepted levels are as follows: mild nutritional impairment,14-16 mg/dL; moderate impairment, 11-13 mg/dL; and severe impairment, less than 11 mg/dL. Prealbumin levels are often not immediately available and have generally high costs, both of which limit its utility in the emergency department setting.

**Nutritional Screens.** A simple and reliable screen for malnutrition is the Subjective Global Assessment (SGA).[12] Components include a history of weight change, dietary intake, gastrointestinal symptoms, and functional capacity and physical findings of muscle wasting, loss of subcutaneous fat, ankle and sacral edema, and ascites. Although these estimates are scored subjectively, interrater agreement has been surprisingly high. The SGA has been shown to accurately predict nutrition-associated complications and clinical outcomes in hospitalized older patients.[11,30] Although utility in emergency department patients has not been assessed, useful characteristics of this screen include simple historical and physical features that are routinely and readily obtained. Completion takes, on average, only five minutes.[11]

An additional tool that can be used in the emergency department for assessing malnutrition is the Living Environment and Functional Status Screen from the Nutrition Screening Initiative, shown in Figure 3.[4] This second tier screen assesses BMI, weight loss, and known risk factors for malnutrition. A nutrition screening is intended to provoke further evaluation and, as with most screens is intended to be more sensitive than specific. One group, however, found another screen, the Mini Nutritional Assessment (MNA), to be both 96% sensitive and 98% specific and concluded that it could identify patients who are at risk for malnutrition before biochemical markers become positive and weight loss occurs.[31] The MNA consists of four items: anthropometric assessments (BMI, mid-arm and calf measurements, and weight loss); a global evaluation; dietetic assessment and; a subjective assessment. While the MNA has been shown to be predictive of nutrition-related health problems and mortality in the elderly, others have noted it's poor sensitivity and specificity compared to a detailed nutritional screen.[32,33] Both the complexity and the uneven performance of the MNA make it less useful in the emergency department setting.

Although nutrition checklists and anthropometric measurements are helpful, a simple combination of functional ability, low albumin, and subjective assessment may be just as accurate and more applicable in the emergency department. One group studied 307 geriatric patients with a mean age of 79 ± 6 years.[34] They found that an inability to perform ADLs, subjective assessment that the patient was malnourished by the physician, and serum albumin of less than 3. 5 gm/dL identified 75% of the malnourished geriatric patients at risk for death. This study and others suggest that general clinical assessment is a reproducible and valid technique for evaluating nutritional status.[11,35] Most importantly, physicians and nursing staff should incorporate some aspect of nutritional screening into the emergency department care of the

## Figure 2. Nomogram for Body Mass Index

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older person. One group was able to perform a nutritional assessment by screening older emergency department patients (using BMI, mid-arm circumference, and history of weight loss) in less than three minutes.[8] A geriatric nurse practitioner program would be especially helpful in departments with a large geriatric population. Social services, dietary services, and home care nurses can be used to follow-up at-risk patients who are discharged to ensure appropriate intervention and monitoring of the patients' status.

## Dehydration

Dehydration is a common problem in the elderly patient, and accounts for significant morbidity and hospitalization. Assessing hydration status in older patients can be difficult since physical exam findings may be absent or nonspecific and laboratory analysis must take the patient's baseline status into account.

**Definitions.** No absolute definition of dehydration exists. One useful definition is the rapid weight loss of greater than 3% of body weight.[36] Serum osmolality can be quantitated and is useful for both defining and categorizing dehydration. Different types of dehydration occur and should be distinguished since the type dictates treatment.[36] Isotonic dehydration results from a balanced loss of water and sodium. Vomiting and diarrhea typically result in isotonic dehydration. Hypertonic dehydration occurs when water losses are greater than sodium losses. Fever, which increases insensible water loss, combined with an inability to increase oral fluid intake, is a common cause of this type of dehydration. Hypernatremia (serum sodium levels > 145 mmol/L) and hyperosmolality (serum osmolality > 300 mmol/kg) are characteristic. Hypotonic dehydration occurs when sodium loss exceeds water loss. Serum sodium levels (< 135 mmol/L) and serum osmolality (< 280 mmol/kg) are decreased. This type of dehydration commonly occurs with diuretic overuse.

## Table 2. Using BMI to Evaluate Nutritional Status

| PARAMETER | MALE (kg/m$^2$) | FEMALE (kg/m$^2$) |
|---|---|---|
| Underweight | Less than 20.7 | Less than 19.0 |
| Acceptable | 20.7 - 27.8 | 19.1 - 27.3 |
| Overweight | 31.1 - 45.3 | 27.3 - 32.3 |
| Obese | More than 45.4 | More than 45.0 |

Additionally, the term *volume depletion* needs to be distinguished from *dehydration*.[37] Volume depletion describes the loss of sodium from the extracellular space (intravascular and interstitial fluid) that occurs after gastrointestinal hemorrhage, vomiting, diarrhea, and diuresis. Dehydration refers to losses of intracellular water that elevate the serum sodium levels and osmolality. Volume depletion should be referred to as *extracellular* volume depletion to avoid confusion. This distinction is important to clinicians since patients with volume depletion exhibit circulatory instability and need prompt infusions of normal saline (0.9% NS) solution, while those with pure dehydration often lack this finding and should receive 5% dextrose and water more slowly. Most patients presenting with dehydration, however, also have volume depletion. The term hypovolemia may be used to collectively refer to both conditions.[37]

## Prevalence and Impact of Dehydration

Dehydration is the most common fluid and electrolyte disorder in both the nursing home setting and at-risk community-dwelling elders.[38] In 1991, it was estimated that 189,000 elders were discharged from acute care hospitals with a primary diagnosis of dehydration, at a cost of $1.16 billion.[36] Approximately 1.5% of community dwelling elderly will be hospitalized with dehydration annually.[39] Dehydration is one of the six most frequent discharge diagnoses in older patients who develop progressive disability one year following hospitalization, with a cumulative percentage similar to that of pneumonia and diabetes.[40]

## Risk Factors for Dehydration

Two general factors place older persons at risk for dehydration: decreased fluid intake and increased fluid loss. Underlying physiological changes that increase the risk of dehydration include decreased ability of the aged kidney to concentrate urine and altered thirst sensation of the elderly. The total body water requirement for older persons is 1500-2500 mL per day, which can be provided with a variety of fluids and foods high in water content.[36] In general, it is recommended that adults drink between six and eight 8-ounce cups of water or liquid per day to maintain adequate hydration.[41] In addition, solid food consumption can add an additional 2-4 cups of water (e.g., fruits and vegetables can contain up to 95% water by weight).[41] Elderly patients should be advised that the best sources of fluid replace-

## Table 3. Average Weight for Height: Persons Age 65 to 94 Years

| Height (in.) | Age (years) 65-69 | 70-74 | 75-79 | 80-84 | 85-89 | 90-94 |
|---|---|---|---|---|---|---|
| | | | **Men** | | | |
| 61 | 156-128 | 153-125 | 151-123 | | | |
| 62 | 158-130 | 155-127 | 153-125 | 148-122 | | |
| 63 | 161-131 | 157-129 | 155-127 | 150-122 | 146-120 | |
| 64 | 164-134 | 161-131 | 157-129 | 152-124 | 148-122 | |
| 65 | 166-136 | 164-134 | 160-130 | 155-127 | 153-125 | 143-117 |
| 66 | 169-139 | 167-137 | 163-133 | 158-130 | 156-128 | 146-120 |
| 67 | 172-140 | 170-140 | 166-136 | 162-132 | 160-130 | 150-122 |
| 68 | 175-143 | 174-142 | 169-139 | 165-136 | 163-133 | 154-126 |
| 69 | 179-145 | 178-146 | 174-142 | 169-139 | 167-137 | 158-130 |
| 70 | 184-150 | 182-148 | 178-146 | 175-143 | 172-140 | 164-134 |
| 71 | 189-155 | 186-152 | 183-149 | 180-148 | 176-144 | 169-139 |
| 72 | 195-159 | 190-156 | 188-154 | 187-153 | 182-148 | |
| 73 | 200-164 | 196-160 | 192-158 | | | |
| | | | **Women** | | | |
| 58 | 146-120 | 138-112 | 135-111 | | | |
| 59 | 147-121 | 140-114 | 136-112 | 122-100 | | 121-99 |
| 60 | 148-122 | 142-116 | 139-113 | 130-106 | 124-102 | |
| 61 | 151-123 | 144-118 | 141-115 | 133-109 | 128-104 | |
| 62 | 153-125 | 147-121 | 144-118 | 136-112 | 132-108 | 131-107 |
| 63 | 155-127 | 151-123 | 147-121 | 141-115 | 136-112 | 131-107 |
| 64 | 158-130 | 154-126 | 151-123 | 145-119 | 141-115 | 132-108 |
| 65 | 162-132 | 158-130 | 154-126 | 150-122 | 146-120 | 136-112 |
| 66 | 166-136 | 162-132 | 157-128 | 154-126 | 152-124 | 142-116 |
| 67 | 170-143 | 166-136 | 161-131 | 158-130 | 156-128 | |
| 68 | 175-143 | 170-140 | | | | |
| 69 | 180-148 | 176-144 | | | | |

*Note:* All subjects in this survey were healthy, noninstitutionalized individuals.

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ment are water, fruit and vegetable juices, milk, and caffeine-free beverages. The sensation of thirst already means the body has lost between 1 and 2 cups of water.

Specific risk factors for dehydration in the elderly include female gender, age older than 85 years, having more than four chronic medical conditions, taking more than four medications, and being confined to bed.[38] Confusion and dementia may cause or contribute to decreased fluid intake because of impaired communication and feeding disorders. Depression also may result in poor fluid and food intake. Immobility, including the use of patient restraints, also may contribute to decreased fluid intake and dehydration. Because of these multiple factors, many long-term institutionalized elders are potentially mildly dehydrated at baseline. Acute illness, such as infection, then results in more significant hypovolemia. Additional conditions and risk factors that should trigger an assessment for dehydration are shown in Table 4. In the community setting, risks for dehydration include medication use (diuretics, laxatives), poor dietary and fluid intake because of the lack of a caregiver, limited or absent air conditioning during periods of hot weather, and poor or no access to regular medical care.[36]

## ED Assessment of the Dehydrated Patient

Signs and symptoms of dehydration and volume depletion in geriatric patients may be absent, misleading or nonspecific. Constipation, weakness, and acute functional impairment (e.g., change in ADLs) may be manifestations of dehydration in this age group. An acute confusional state (delirium) also may be a presentation of dehydration. Acute confusional state represents a transient dysfunction precipitated by physiologic, psychological, or environmental factors and increases morbidity, mortality, and length of hospitalization.[36,42] Risk factors for developing an acute confusional state include: fluid/electrolyte imbalance, infection, hypoxia, kidney dysfunction, and multiple medication usage.[36]

Abnormal declines in orthostatic blood pressure (BP) may be a sign of dehydration. Orthostatic hypotension (OH) is considered significant if the systolic BP declines 20 mmHg or more after standing from a supine or sitting position for 1-3 minutes. Orthostatic pulse rate increases of 10-20 beats per minute are also suggestive of hypovolemia. OH, however is not specific for volume depletion. Prevalence of OH in the elderly ranges from 5% to 30% and is even higher in nursing home residents, occurring in more than half.[43-45] One study also demonstrated that OH was highly variable over time and most prevalent in the morning and in those on antihypertensives.[45]

Caution should be used in interpreting supine and sitting vital signs, as the sensitivity of the test is greatly diminished if the patient cannot or does not stand.[37] In addition, the general decrease in sensitivity to adrenergic stimulation and hypotension, use of β-blockers, and pacemaker dependence limit the utility of pulse rate changes in assessing volume depletion in this age group. Finally, the presence of mild or moderate postural dizziness is a poor predictor of OH.[37]

The bedside diagnosis of hypovolemia can also be misleading in the elderly. Physical examination findings most consistent with dehydration include a dry axilla, dry mucous membranes and a dry furrowed tongue.[46,47] A combination of the physical signs of confusion, weakness, nonfluent speech, sunken eyes and dry mucous membranes and tongue, is more helpful than individual signs alone.[47] The most predictive negative signs, indicating absence of dehydration, are moist mucous membranes, and lack of sunken eyes or tongue furrows. Capillary refill time and skin turgor appear to have limited diagnostic value for hydration status.[37]

**Laboratory Tests.** Laboratory parameters that are frequently used to determine hydration status include electrolytes, osmolal-

## Figure 3. Functional Status Screen

A physician should be contacted if the individual has gained or lost **10** pounds unexpectedly or without intending to during the past **6** months. A physician should also be notified if the individual's body mass index is above **27** or below **22**.

LIVING ENVIRONMENT

- ❏ Lives on an income of less than $6,000 per year (per individual in the household)
- ❏ Lives alone
- ❏ Is housebound
- ❏ Is concerned about home security
- ❏ Lives in a home with inadequate heating or cooling
- ❏ Does not have a stove and/or refrigerator
- ❏ Is unable or prefers not to spend money on food (< $25-30 per person spent on food each week)

FUNCTIONAL STATUS

Usually or always needs assistance with (check all that apply):

- ❏ Bathing
- ❏ Dressing
- ❏ Grooming
- ❏ Toileting
- ❏ Eating
- ❏ Walking or moving about
- ❏ Traveling (outside the home)
- ❏ Preparing food
- ❏ Shopping for food or other necessities

If you have checked one or more statements on this screen, the individual you have interviewed may be at risk for poor nutritional status. Please refer this individual to the appropriate health care or social service professional in your area. For example, a dietitian should be contacted for problems with selecting, preparing, or eating a healthy diet, or a dentist if the individual experiences pain or difficulty when chewing or swallowing. Those individuals whose income, lifestyle, or functional status may endanger their nutritional and overall health should be referred to available community services: home-delivered meals, congregate meal programs, transportation services, counseling services (alcohol abuse, depression, bereavement, etc.), home health care agencies, day care programs, etc.

Please repeat this screen at least once each year—sooner if the individual has a major change in his or her health, income, immediate family (e.g., spouse dies), or functional status.

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ity, creatinine, blood urea nitrogen (BUN) and BUN/creatinine ratios, urinalysis, and hematocrit.

A BUN/creatinine ratio of 25 or greater, in the absence of known renal disease or gastrointestinal hemorrhage, is highly suggestive of dehydration. Serum osmolality should be measured if hypertonic or hypotonic dehydration is suspected. Measured osmolality is affected by azotemia (elevated BUN), glucose, mannitol, and ethanol and must be adjusted accordingly.[36] Serum osmolalities greater than 295 mOsm indicate that a significant percent of body water has been lost.

The presence of hypernatremia (> 148 mmol/L) is indicative of hypertonic dehydration. In older adults, this is frequently encountered in febrile illnesses and is secondary to increased insensible water losses and inability to increase fluid intake.[36] In the setting of isotonic or hypotonic dehydration, however, significant hypovolemia may be present with normal or low serum sodium levels.

Although hematocrit does not provide a direct measure of water deficit, an elevated hematocrit in conjunction with hypernatremia or hyperosmolality is strong evidence of sodium deficit.[48] Urine specific-gravity, although commonly measured, is a poor correlate with other laboratory measurements of dehydration.[36]

These simple serum chemistries are useful and readily available in the ED setting. Although absolute values are helpful (i.e., a serum osmolality > 300 mmol/kg), interpretation should also consider any changes in value from the patient's baseline.

## ED Management

Patients with hypertonic dehydration often have osmolalities greater than 300 mmol/kg and hypernatremia. Serum sodium values greater than 160 mmol/L often result in CNS disturbances. A goal should be to correct one-half the free water deficit in the first 24 hours.[49] Most cases are caused by loss of salt and water; therefore, appropriate replacement choices should initially be normal saline or ringer's lactate. Both will be hypotonic relative to the patients' serum.

Hypotonic dehydration can occur when sodium loss exceeds water loss.[36] CNS symptoms also occur with significant hyponatremia (serum sodium levels < 120 mmol/L). Emergency department management must be tailored to each individual case. If the hyponatremia is mild and asymptomatic, water restriction may correct the problem. If the patient has evidence of hypovolemia, the appropriate fluid choice is normal saline. Patients with significant clinical manifestations of hyponatremia, such as seizures, should have their sodium deficit more rapidly corrected at a rate of 2 meq/L/hr, with a goal of a serum sodium level of 125 meq/L. This can be accomplished by giving 3% NaCl at a rate of 75-100 mL/hr and administering a loop diuretic such as furosemide (1 mg/kg).[49] Caution should be used with aggressive correction of sodium levels, since circulatory overload and central pontine myelinolysis can occur.

Isotonic dehydration reflects a balanced loss of water and sodium and is usually accompanied by significant volume loss.[36] Replacement should be made with isotonic saline. The aggres-

**Table 4. Dehydration Triggers and Risk Factors**

- Change in cognitive status or functional abilities
- Diarrhea or vomiting
- Fever
- Weight loss (> 5% in the last 30 days)
- Insufficient fluid intake
- Diuretic use
- Uncontrolled diabetes mellitus
- Swallowing difficulties
- Purposeful fluid restriction
- Need for enteral feeding
- History of dehydration

Adapted from: Weinberg AD, Minaker KL. Dehydration. Evaluation and Management in Older Adults. *JAMA* 1995;274:1552-1556.

siveness of replacement and the extent of monitoring this replacement should be tailored to each patient depending on his or her circulatory instability. Over aggressive replacement can result in congestive heart failure and even death in the elderly population.[36]

Making the diagnosis of dehydration/volume depletion in the elderly can be a difficult proposition. Clinical signs and symptoms of increased thirst or postural hypotension can be misleading or nonexistent. Laboratory values with the measurement of serum urea nitrogen, osmolality, and sodium concentration are the most reliable indicators, and ordering these should be common practice upon admission.

## Summary

Malnutrition and dehydration are common findings in elderly patients. The lack of recognition and treatment results in significant morbidity, increased mortality, and additional costs and duration of hospital stays. Clinicians should assess hydration status in the nursing home residents and the older patient who presents with acute change in mental status, fever, new functional impairments, or with the complaint of weakness or dizziness. As our population ages, emergency physicians will also need to recognize patients who are malnourished, begin appropriate evaluations for those who require immediate admission, and arrange close out-patient follow-up for those who are discharged. Screening tools, calculation of BMI, and a targeted history, physical, and laboratory investigation will provide the patient's primary care physician with a valuable database to begin intervention.

Each emergency department should adopt guidelines for fluid and nutritional assessment of its elderly patients based upon volume of geriatric patients seen and resources. Ongoing education of physician and nursing staffs about these important conditions will benefit our older patients.

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## Physician CME Questions

25. It has been estimated that what percentage of hospitalized patients have nutritional impairment?
    A. 15%
    B. 60%
    C. 75%
    D. 90%

26. Protein-energy malnutrition is caused by:
    A. inadequate protein and carbohydrate/fat intake.
    B. protein deficiency alone.
    C. loss of ultra-trace minerals.
    D. calcium deficiency.

27. When using the simple nutritional check list:
    A. a score of 1 indicates malnutrition.
    B. a score of 6 or more indicates the need for immediate evaluation.
    C. the results can be ignored.

28. Calculating the body mass index (BMI) is useful to:
    A. assess the likelihood of nutritional impairment.
    B. assess the patient's albumin level.
    C. determine if the patient is overweight or underweight.
    D. both A and C are correct.

29. Adequate water intake to replace daily fluid loss is:
    A. 4-6 cups/d.
    B. 2-4 cups/d.
    C. 12-16 cups/d.
    D. 6-8 cups/d.

30. Postural hypotension can be found in what percentage of *normovolemic* patients older than age 65?
    A. 5-30%
    B. 0-5%
    C. 40-50%
    D. 75-85%

31. Risk factors for hypovolemia in the elderly include all of the following *except*:
    A. age older than 85.
    B. four or more chronic medical conditions.
    C. male gender.
    D. bed confinement.

32. Caution should be used when aggressively replacing sodium, as complications can include:
    A. circulatory overload and central pontine myelinolysis.
    B. falsely elevated CBC.
    C. diuresis.
    D. respiratory arrest.

**In Future Issues:** Congestive Heart Failure