Undernutrition in older adults

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Undernutrition in older persons usually presents as weight loss and is predominantly due to protein energy wasting. The presentation of undernutrition is often subtle in older persons and there is a need to utilize screening tools and increasing physician awareness. There are multiple treatable causes of undernutrition in older persons. The major causes are anorexia, cachexia, sarcopenia, dehydration, malabsorption and hypermetabolism. This article also provides an overview of the use of nutritional supplements and an approach to managing protein energy wasting.

Keywords. Ageing, nutrition, weight loss.

Introduction

Undernutrition can be considered to be either protein energy wasting (classically called kwashiorkor and marasmus) or due to individual nutrient deficiencies. In older persons, weight loss is the primary sign of protein energy nutrition. The understanding of undernutrition in the developed world is changing. Worldwide, nearly a billion people suffer from hunger. These are predominantly women and children. Undernutrition in the developed world limits children from developing fully, both physically and mentally. Over 10% of child deaths are due to hunger-related causes. Individual nutrient-related deficiencies are still common in Africa and Asia but only occasionally seen in developed countries, most commonly in older persons (Table 1).

In contradistinction to the picture in the developing world, undernutrition in the developed world is seen mainly in older persons and in those with a variety of cachexia-producing diseases. While in the USA, 25% of households with children still experience some degree of food insecurity, this rarely leads to frank undernutrition. These children do, however, experience disadvantages in cognition and psychosocial development. Food insecurity often leads to poor food choices that can predispose to the development of obesity.

This review will concentrate on undernutrition in the older population. There are many treatable causes of undernutrition in this population, which are frequently overlooked by physicians. Frank undernutrition occurs in 5–10% of older persons in nursing homes and up to 50% of older patients when discharged from hospital. Numerous studies have shown that when older persons lose weight, they have a doubling in their risk of death, even when they are overweight. This is true even in persons who have diseases due to obesity such as diabetes mellitus. Weight loss also increases the chance of an older person having a hip fracture or being institutionalized. There are six major causes of weight loss, namely anorexia, cachexia, malabsorption, hypermetabolism, dehydration and sarcopenia.

Why does weight loss lead to death?

Most obviously, anorexia and severe weight loss lead to protein energy malnutrition, which is associated with a panoply of ill effects (Table 2). Weight loss leads to an increase in circulating toxins such as insecticides that have been stored in fat, and triglycerides, which increase the formation of the highly atherogenic small dense low-density lipoprotein. Loss of weight leads to not only loss of fat but also loss of muscle and bone. This increases the propensity to fall, fracture a hip or develop frailty. Loss of fat increases the potential toxicity of fat-soluble drugs and a decrease in albumin has a similar effect on protein-bound drugs. Finally, weight loss is often a harbinger of occult disease, which, if detected early, may be treatable.

Screening tests for undernutrition

A number of screening tests for undernutrition have been developed. The Simplified Nutritional Assessment Questionnaire (SNAQ) is a simple questionnaire that has high sensitivity and specificity to detect weight loss over the next 6 months (Table 3). The mini-nutritional assessment (MNA) has been validated in multiple settings. Its major drawback is that it also identified
persons with frailty and its short form fails to distinguish between frailty and those at risk for malnutrition. The Malnutrition Universal Screening Tool (MUST) is a simple tool using body mass index, weight loss and an acute disease effect score. It has been validated for persons who are acutely hospitalized. In hospital, it predicts mortality and length of stay.

A number of serum proteins such as albumin, transthyretin (prealbumin) and retinol binding protein 4 have been utilized to detect malnutrition. Unfortunately, the major factors lowering these proteins are pro-inflammatory cytokines. Thus, these proteins are a better indicator of illness than they are of nutritional status.

Anorexia

Anorexia has been shown to independently predict mortality. There is a decline in food intake over the lifespan. Food intake in males declines by ~30% and in females by 20%. This has been termed the physiological anorexia of ageing.

The causes of this anorexia of ageing are multifactorial. The decrease in both taste and olfaction that occurs with ageing decreases the enjoyment of food. This is often exaggerated in persons who smoke or who are receiving medications. With ageing, there is an increase in the rate with which food reaches the antrum coupled with a decrease in the rate of gastric emptying. This leads to an increase in early satiation signals. Older persons have an increase in the release of cholecystokinin (CCK) in response to food in the duodenum and are more responsive to the satiating effects of CCK. The role of ghrelin, a hormone that is produced by the fundus of the stomach and stimulates food intake, in the anorexia of ageing is unknown. Numerous antral regulators of feeding are altered with ageing.

Depression is the most common cause of pathological anorexia, both in older community dwellers and in nursing home residents. Medications, particularly in the case of polypharmacy, is the other common cause of weight loss in older persons. Therapeutic diets are also a major cause of weight loss and clearly should be avoided in frail older persons. Cancer accounts for 10% of the causes of undernutrition in older persons.

Table 4 gives the ‘Meals on Wheels’ mnemonic for the common treatable causes of weight loss.

Cachexia

Cachexia is a severe wasting disorder, characterized by both loss of muscle and fat. It is caused by a variety of illnesses that produce pro-inflammatory cytokines. These cytokines activate the ubiquitin-proteasome system which results in degradation of protein in muscle. They produce lipolysis that increases circulating triglycerides and free fatty acids. Cytokines also result in anorexia, decreased gastric emptying and intestinal motility, anaemia, increased resting metabolic rate and a decrease in serum albumin. Cachexia is associated with an increase in acute phase reactants, such as C-reactive peptide and a reduced serum albumin protein.

Table 5 compares cachexia with undernutrition due to anorexia and sarcopenia. It should be recognized that in most older patients, there is an overlap in these three conditions; it is rare to see older persons with only one of these syndromes.

Malabsorption and hypermetabolism

The common reasons for malabsorption in older persons are celiac disease and pancreatic insufficiency. Measurement of Vitamin A and beta-carotene, and in the serum, can be used to diagnose fat malabsorption. Celiac disease can be screened for by measuring immunoglobulin A antigliadin antibodies and tissue transglutaminase antibodies or anti IgG-endomysial antibodies.

The common causes of hypermetabolism are hyperthyroidism and pheochromocytoma. In older persons, apathetic hyperthyroidism can present with weight loss as the major symptom along with atrial fibrillation,
proximal muscle weakness and blepharoptosis (instead of exophthalmos). Pheochromocytoma should be considered in older persons who remain hypertensive while losing weight.

Management of undernutrition

An algorithm for managing undernutrition has been developed. It focuses early on in offering food choices and high calorie food after which caloric supplements can be considered. It highlights the need to focus on diagnosing and treating treatable causes of protein energy wasting.

The basis of the management of undernutrition is to provide adequate food. The Cochrane Database has found that caloric supplementation decreased mortality and length of hospitalization. Even cachexia due to conditions such as chronic obstructive pulmonary disease have been shown to be responsive to protein-calorie supplementation with an increase in the 6-minute walk and decreased hospitalization. A leucine enriched essential amino acid supplementation increases muscle protein synthesis and muscle function. Oral calorie supplements should be given between meals. When given with meals, they result in a reduction in food intake and no net increase in total caloric ingestion. Improving food taste, dining ambiance and time spent feeding impaired individuals can all play a role in reversing undernutrition.

Two major orexigenic drugs are available. These are megestrol acetate and dronabinol. Megestrol acetate clearly increases food intake and produces weight gain. It does this in part because it is a progestational agent. It also has corticosteroid and mild testosterone-like activity. It is more effective in females than in males. It reduces cytokine activity. Megestrol acetate is poorly absorbed when not given with food. A nanoparticle form is better absorbed during starvation. The major side effect is the potential of deep vein thrombosis. It is not recommended that megestrol acetate is used in persons confined to bed and it should not be used for >3 months at a time. It appears to be more effective when combined with olanzapine.

Dronabinol is a tetrahydrocannabinol extract. It produces a small increase in appetite and in weight gain. It is an excellent palliative care drug as it also decreases nausea, increases enjoyment of food and increases enjoyment of life.

Testosterone together with a caloric supplement produces weight gain and decreases hospitalization in frail older persons. Selective androgen receptor molecules, such as ostarine, may prove to have a role in the treatment of cachexia. Other drugs under

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**TABLE 3** The simplified nutrition assessment questionnaire (SNAQ) (Wilson et al. with copyright held by US Government)

1. My appetite is
   A. very poor
   B. poor
   C. average
   D. good
   E. very good

2. When I eat
   A. I feel full after eating only a few mouthfuls
   B. I feel full after eating about a third of a meal
   C. I feel full after eating over half a meal
   D. I feel full after eating most of the meal
   E. I hardly ever feel full

3. Food tastes
   A. very bad
   B. bad
   C. good
   D. average
   E. very good

4. Normally I eat
   A. less than one meal a day
   B. one meal a day
   C. two meals a day
   D. three meals a day
   E. more than three meals a day

Instructions: complete the questionnaire by circling the correct answers and then tally the results based upon the following numerical scale: A = 1, B = 2, C = 3, D = 4 and E = 5. Scoring: if the mini-SNAQ is <14, there is a significant risk of weight loss.

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**TABLE 4** The ‘Meals on Wheels’ mnemonic for treatable causes of weight loss (table developed by JEM with copyright held by US Government)

<table>
<thead>
<tr>
<th>Medications</th>
<th>Emotional (depression)</th>
<th>Alcoholism, anorexia tardive, abuse (elder)</th>
<th>Late life paranoia</th>
<th>Swallowing problems</th>
<th>Oral problems</th>
<th>Nosocomial infections, no money (poverty)</th>
<th>Wandering/dementia</th>
<th>Hyperthyroidism, hypercalcemia, hypoadrenalism</th>
<th>Enteric problems (malabsorption)</th>
<th>Eating problems (e.g. Tremor)</th>
<th>Low salt, low cholesterol diet</th>
<th>Shopping and meal preparation problems, stones (cholecystitis)</th>
</tr>
</thead>
</table>

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**TABLE 5** Comparison of the characteristics of undernutrition due to anorexia, cachexia and sarcopenia

<table>
<thead>
<tr>
<th></th>
<th>Anorexia</th>
<th>Cachexia</th>
<th>Sarcopenia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anorexia</td>
<td>+</td>
<td>++</td>
<td>–</td>
</tr>
<tr>
<td>Weight loss</td>
<td>+</td>
<td>++</td>
<td>+/-</td>
</tr>
<tr>
<td>Fat loss</td>
<td>++</td>
<td>++</td>
<td>0</td>
</tr>
<tr>
<td>Muscle loss</td>
<td>+</td>
<td>+++</td>
<td>+</td>
</tr>
<tr>
<td>Proteolysis</td>
<td>–</td>
<td>++</td>
<td>+</td>
</tr>
<tr>
<td>Hypertriglyceridemia</td>
<td>–</td>
<td>++</td>
<td>+</td>
</tr>
<tr>
<td>Anaemia</td>
<td>+</td>
<td>++</td>
<td>–</td>
</tr>
<tr>
<td>Insulin resistance</td>
<td>–</td>
<td>++</td>
<td>+</td>
</tr>
<tr>
<td>Elevated cytokines</td>
<td>+/-</td>
<td>++</td>
<td>+/-</td>
</tr>
<tr>
<td>Increased C-reactive protein</td>
<td>–</td>
<td>++</td>
<td>–</td>
</tr>
</tbody>
</table>

+, present; –, absent.
Focused nutritional problems

25-hydroxy vitamin D levels fall with age. Values are <30 ng/ml in many older persons with illness. Low vitamin D is associated with fractures, muscle loss, falls and an increased mortality. Replacement with 800–1000 IU vitamin D daily would seem to be appropriate in many older persons.

Anaemia is commonly due to nutritional causes in older persons. Iron deficiency anaemia is the most common, but folate and vitamin B12 deficiency are not rare. Iron deficiency anaemias are recognized by persons having a low iron and ferritin. In cases where the distinction from anaemia of chronic disease is difficult, measuring transferrin receptors may help. In persons with borderline low levels of vitamin B12, methylmalonic acid levels should be measured. Elevated homocysteine levels are seen both in folate and vitamin B12 deficiency. Treatment of vitamin B12 deficiency is either injections of 1000 IU of vitamin B12 weekly for 4 weeks, the monthly or 1000 IU of vitamin B12 orally daily. Iron replacement is oral iron once a day for 6 weeks with a reticulocyte count being measured after 1 week. If the reticulocyte count is not increasing, malabsorption is a possibility and parenteral iron may be necessary.

Zinc deficiency is not rare in persons receiving diuretics or those with diabetes mellitus and cancer. The role of zinc replacement in these individuals remains uncertain.

Conclusion

In the developing world, undernutrition is primarily due to food insecurity. In the developed world, undernutrition presentations are more subtle and are primarily seen in older persons. Undernutrition in these populations is primarily due to underlying disease. An algorithmic approach to managing undernutrition in older persons has been published.

Declaration

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References

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