Appendix F

The Effect of Normal Aging on the Assessment of Nutritional Status

Introduction

Dietary histories, anthropometric, biochemical, and hematologic measurements, and measurements of immune response are used to assess nutritional status in individuals of all ages. Changes in body composition and metabolism associated with normal aging affect many of the indices of nutritional status used in these assessment methods and may alter the nutritional standards needed to interpret findings for an individual patient. Some of these effects were discussed in chapter 8. Others are discussed below.

Dietary Histories

Dietary histories provide information about total caloric intake and fat, carbohydrate, protein, vitamin, and mineral components of the diet. The interpretation of this information requires a standard with which to compare findings for an individual patient. At present, no comprehensive standard for elderly patients is available.

In the absence of information about ideal dietary requirements for elderly people, the results of surveys of the actual dietary intake of healthy elderly individuals are sometimes used as a standard with which to compare dietary findings for an individual. The most comprehensive information about the nutritional status of healthy Americans was obtained from the Ten State Survey, conducted from 1968 to 1970 and the National Health and Nutrition Examination Surveys, conducted from 1971 to 1974 and from 1976 to 1980 (12).

There are several problems with the use of these survey findings as a nutritional standard, however. First, although the survey data provide information about actual average intake for healthy individuals over age 65, they may not accurately reflect average intake for subgroups of the elderly population, such as people with different ethnic and socioeconomic background than the surveyed population. Second, persons over 74 were not included in some surveys, and findings from other surveys were not broken down by age-defined subgroups of the elderly population (i.e. age 75 to 84 and 85+) (12,20). Finally, the use of findings based on the dietary intake of healthy elderly people as a standard for chronically or acutely ill elderly people may be inappropriate. Research on the dietary intake of older people in hospitals and nursing homes may provide a more appropriate basis for the development of nutritional standards for these populations (12).

Use of dietary histories for elderly people has been questioned because of the possibility that for some individuals declining memory may affect accurate recall. Dietary recall for the past 24 hours and prospective l-week dietary histories have been shown to be relatively accurate in healthy older people who are living at home. Prospective l-week dietary histories were found to be more accurate than retrospective reports of 24-hour food consumption for these individuals (14, 18). For critically and terminally ill patients, accurate dietary histories may be more or less difficult to obtain depending on the patient's mental status and whether the caregivers have recorded food and fluid intake consistently.

Anthropometric Measurements

Measures of weight, lean body mass, and fat stores provide important information about nutritional status, but analysis of these measurements for elderly patients is complicated by changes in physiological characteristics and body composition associated with normal aging. Lean body mass decreases, resulting in an increase in the proportion of body weight as fat. In addition, a redistribution of fat occurs, particularly in females (12), Thus measurements that are abnormal for younger patients may be normal in elderly people.

Interpretation of anthropometric measurements is further complicated by the reduction in height that is associated with normal aging. Height is commonly used as a reference for other anthropometric measures, such as weight, but loss of height in elderly people, averaging 2.9 cm in men, and 4.9 cm in women, makes its use as a reference standard difficult. Moreover, accurate heights are often difficult to obtain in persons who are bedfast or confined to a wheelchair. Some experts have suggested the use of total arm length or knee to ankle measurements instead of height for elderly people because these characteristics are less affected by aging and easier to measure in a bed or chairfast patient (6,16). Assessment of height remains an important area of research in nutritional assessment of elderly people (12,17).

Accurate standards for weight in elderly people are also needed (7). The best weight-for-height information is that described by Master, et al. (15). This information was developed from a relatively small population of older, white Americans, however, and does not represent other ethnic and socioeconomic subgroups of the elderly population (12). New standards of ideal weight for height in elderly people have been proposed but remain controversial (1).

Weight loss as an indicator of malnutrition is discussed in chapter 8. Dramatic weight gain in elderly patients can also indicate disease-related nutrient deficiencies that are causing fluid retention (4).

As discussed in chapter 8, skinfold thickness is often used as a measure of fat stores. However, research indicates that alterations in fat distribution, altered skin turgor and elasticity, and other characteristic changes of the aging skin make skinfold measurements difficult to interpret after age 60. The tricep skinfold is used to estimate body composition, and, with a measure of midarm circumference, can be used to calculate midarm muscle circumference and midarm muscle area. Studies have confirmed the ability of midarm muscle area to predict lean body mass and formulas have been developed that allow the calculation of corrected arm muscle area for adults (3,10). Although standards for midarm muscle area have been reported for elderly subjects (9), they are limited by the fact that the oldest subject examined was age 75.

Creatinine excretion is another frequently used measure of lean body mass. Twenty-four-hour excretion of urinary creatinine varies directly with muscle mass of the body with reasonable accuracy. Creatinine excretion related to height has been used as an indicator of lean body mass in the diagnosis of nutritional deficiencies in hospitalized patients (2,19). The normal values for creatinine excretion were developed on the basis of a small sample of young adults, and there are no standards for elderly people. Moreover, some experts believe that creatinine excretion maybe affected by age-related changes in renal function and that its usefulness in assessing nutritional status of older subjects may therefore be limited (12).

Biochemical Measurements

Serum albumin level is the most frequently used biochemical index of nutritional status, and low serum albumin levels often indicate poor nutritional status **in patients of all ages. However, many factors alter the serum concentration. For example, marked reductions in serum albumin occur in kidney** and liver disease, cancer, congestive heart failure, and other diseases that cause excessive urinary or gastrointestinal loss of protein. These conditions must be ruled out before malnutrition is diagnosed on the basis of low serum albumin concentration (8,12).

Most surveys show that the range of serum albumin levels in elderly people is broader than in younger people, but the majority still fall within the normal range. Significant reductions outside the lower limits of normal are rare in the healthy elderly. Thus, this measure is one of the most reliable indices of nutritional status in the elderly (5,12),

Serum transferring is another biochemical index of nutritional status, but there are difficulties with its interpretation. Iron deficiency anemia increases transferrin concentration, whereas the anemia of infection and inflammatory diseases decreases transferring concentration. Transferring levels also vary inversely with tissue iron stores. Since iron stores are higher in the elderly than in younger subjects, their transferring levels are lower. Thus, many apparently healthy elderly subjects have serum transferring levels in the range usually described as deficient, not because of nutritional deficiencies but because of an increase in tissue iron stores. For this reason, serum transferring levels for elderly patients must be interpreted with caution (12).

Other biochemical measurements, such as pre-albumin and retinol binding protein, have been suggested as protein status indicators, but these measurements have rarely been used in the elderly. Further work will be required to determine the importance of these measurements in detecting nutritional deficiencies **in older people (12).**

Hematologic Measurements

Low hemoglobin levels generally indicate poor nutritional status, but low hemoglobin levels are more common among healthy elderly people, particularly elderly men, than among younger individuals. The decrease in hemoglobin that occurs with aging is generally not due to the commonly recognized causes of anemia, such as iron deficiency, folate deficiency, or chronic disease, but instead is probably due to a reduction in the production of blood cells that may be related to normal aging. Thus, a mild decrease in hemoglobin levels may not indicate nutritional deficiency in elderly people. A severe decrease, however, usually does indicate a hematologic or nutritional abnormality that requires diagnosis and treatment (12, 13)

Immunologic Assessment

Malnutrition causes changes in immune functioning of the individual, and tests of immune function are frequently used to assess nutritional status (11). Two commonly used tests of cell-mediated immunity are total lymphocyte count and delayed cutaneous hyper-

sensitivity. While total lymphocyte count is not affected by normal aging, the proportion of certain types of lymphocytes is changed. Moreover, 50 percent of healthy persons over the age of 50 have impaired delayed cutaneous hypersensitivity (21). Since the changes in immune function that occur as a result of aging are almost identical to those caused by malnutrition, findings from immunologic measures for elderly patients must be interpreted with caution (8,12).

Appendix F References

1. Andres, R., "Effect of obesity on Total Mortality," *Advanced Pathobiology* 7:238-246, *1980.*
2. Bistrian, B. R., Blackburn, G. L., Sherman, M., et al., "Therapeutic Index of Nutritional Depletion in Hospitalized Patients, " ***Surgery, Gynecology, and Obstetrics*** 141:152, *1975.*
3. Blackburn, G. L., Bistrian, B. R., Maini, B. S., et al., "Nutritional and Metabolic Assessment of the Hospitalized Patient," *Journal of Parenteral and Enteral Nutrition* 1:11-22, *1977.*
4. Chernoff, R., Associate Director, GRECC for Education and Evaluation, John L. McClellan Memorial Veterans Hospital, Little Rock, AR, personal communication, Sept. 4, 1985.
5. Chernoff, R., and Lipschitz, D. A., "Total Parenteral Nutrition: Considerations in the Elderly," *Clinical Nutrition, Vol II: Total Parenteral Nutrition,* J.L. Rombeau and M.D. Caldwell (eds.) (Philadelphia, PA: W.B. Saunders, in press).
6. Chumlea, W.C., Roche, A.F., and Mukherjee, D., *Nutritional Assessment of the Elderly Through Anthropometry* (Columbus, OH: Ross Laboratories, 1984).
7. Clark, N.G., and Bistrian, B. R., "Recognition of ProteinCalorie Malnutrition in the Hospitalized Elderly," ***Geriatric Medicine Today*** 3(10):45-59, *1984.*
8. Cooper, J. K., "Does Nutrition Affect Surgical Outcome?" ***Journal of the American Geriatrics Society*** 35(3):229-232, *1987.*
9. Frisancho, A.R., "Triceps Skinfold and Upper Arm Muscle Size Norms for Assessment of Nutritional Status," ***American Journal of Clinical Nutrition*** 27:1052-1058, *1974.*
10. Gray, G. E., and Gray, L. K., "Validity of Anthropometric Norms Used in the Assessment of Hospitalized Patients, " ***Journal of Parenteral and Enteral Nutrition*** 3:366-368, *1979.*
11. Kaminski, M. V., Pinchofsky-Devin, G.D., and McCormick, D.C., "DCH Testing as a Nutritional Assessment Tool," ***Nutritional Support Services*** 5(3):21-23, *1982.*
12. Lipschitz, D.A., and Chernoff, R., "Nutritional Support and Hydration for Critically and Terminally Ill Elderly," prepared for the Office of Technology Assessment, U.S. Congress, Washington, DC, December 1985.
13. Lipschitz, D.A., Mitchell, C. O., and Thompson, C., "The Anemia of Senescence," ***American Journal of Hematology*** II:47-54, *1981.*
14. Madden, J.P., Goodman, J. S., and Guthrie, H. A., "Validity of 24-Hour Recall," ***Journal of the American Dietetic Association*** 68:143, *1978.*
15. Master, A. M., Lasser, R. P., and Beckmen, G., "Tables of Average Weight and Height of Americans Aged 65 to 94 Years," ***Journal of the American Medical*** Association 172:658-662, 1960.
16. Mitchell, C.O., and Lipschitz, D. A., "Arm Length Measurement as an Alternative to Height in Nutritional Assessment of the Elderly, " ***Journal of Parenteral and Enteral Nutrition*** 6(3):226-229, *1982.*
17. Morley, J. E., Silver, A.J., Fiataroni, M., et al., "Geriatric Grand Rounds: Nutrition and the Elderly, " ***Journal of the American Geriatrics Society 34(11): 823-832, 1986.***
18. O'Hanlon, P., and Kors, M. B., "Dietary Studies of Older Americans," ***American Journal of Clinical Nutrition*** 31(7):1257, *1978.*
19. Rowe, J. W., Andres, R., Tobin, J.D., et al., "The Effect of Age on Creatinine Clearance in Man: A Cross-Sectional and Longitudinal Study," ***Journal of Gerontology*** 31:155-163, *1976.*
20. Sherman, M.N., Lechich, A., Brickner, P.W., et al., "Nutrition] Parameters in Homebound Persons of Greatly Advanced Age)" ***Journal of Parenteral and Enteral Nutrition*** 7(4):378-380, *1983.*
21. Whittinham, S., and McKay, I. R., "Depression of Cell-Mediated Immunity in Old Age and The Immunopathic Diseases, Lupus Erythrematosis, Chronic Hepatitis, and Rheumatoid Arthritis, ***Clinical Experimental Immunology*** 14:193-202, *1973.*