

## Perioperative care of the elderly patient: special considerations

DONNA L. MILLER, DO

**SUMMARY** Unlike older studies, which cited age as an independent risk factor for surgical mortality, recent studies indicate that the presence of underlying diseases and the type, duration and urgency of surgery are better predictors of outcome than age alone. A preoperative assessment that defines medical, functional, and psychosocial problems of elderly patients can lead to interventions to improve surgical outcomes.

**KEY POINTS** Before any surgery, the patient, family, and physician should discuss its potential risks and anticipated benefits within the context of the patient's value system. ■ Older patients vary widely in their response to illness, even if they are the same age. Thus, every older patient must be evaluated as an individual, taking into account the physiologic changes of aging and any underlying diseases. ■ A thorough medication history is an essential component of the preoperative assessment, as older Americans use an average of 4.5 prescription medications and 3.5 over-the-counter drugs. ■ Because length of stay is decreasing, discharge planning needs to be initiated early as part of the preoperative assessment by an interdisciplinary team. ■ Recognition of neuropsychiatric problems, such as dementia, delirium, and depression, is crucial. ■ Postoperative management includes specific measures to minimize functional decline, malnutrition, and pressure ulcers.

■ INDEX TERMS: AGED; PERIOPERATIVE CARE; RISK ASSESSMENT  
■ CLEVE CLIN J MED 1995; 62:383-390

From the Department of Internal Medicine, Section of Geriatric Medicine, The Cleveland Clinic Foundation.

Address reprint requests to D.L.M., Department of Internal Medicine, Section of Geriatric Medicine, A72, The Cleveland Clinic Foundation, 9500 Euclid Avenue, Cleveland, OH 44195.

**A**GE ALONE should not preclude a surgical procedure. Multivariate analysis has shown that underlying medical diseases and the type, duration, and urgency of surgery are more important predictors of outcome than chronological age.<sup>1</sup> Comprehensive preoperative assessment enables generalists to identify significant medical problems that could negatively affect surgical outcome in 80% of patients older than age 75. One third of this age group has three or more confounding diseases.<sup>2</sup> However, refinements in anesthesia and surgical technique have reduced operative mortality rates, making surgery possible even for patients of advanced age.<sup>3</sup> Octogenarians who undergo major surgery enjoy long-term survival rates that equal or exceed those of the general elderly population.<sup>4</sup>

By understanding the physiology of aging and perioperative issues, the generalist will be able to anticipate problems and intervene to improve outcomes and reduce morbidity. This article reviews how older patients differ from younger ones, and what internists can do to lessen their risk.



**TABLE 1**  
AVERAGE REMAINING YEARS  
OF TOTAL AND ACTIVE LIFE AT GIVEN AGES\*

Age	Men		Women	
	Total life	Active life	Total life	Active life
65	14.44	11.87	18.57	13.61
75	8.97	6.44	11.70	6.97
85	5.15	2.55	6.44	2.25
95	3.22	0.64	3.65	0.35

\*From current population reports. Washington, DC: National Center for Health Statistics Life Tables; 1984 Series P-25, No. 952, Table B-4A, p. 148; Vital Statistics of the United States, 1983. Vol. II, Section 6, Table 6-2, p. 10.

#### ASSESS QUALITY OF LIFE AND DISCUSS ADVANCE DIRECTIVES

Before any surgery, the patient, family, and physician should discuss its potential risks and anticipated benefits within the context of the patient's value system. Total cure is not always achievable, but pain relief and improved quality of life may be realistic goals. The discussion should include an accurate assessment of the patient's life expectancy and period of remaining life likely to be free of disabilities that affect activities of daily living (active life expectancy). Although a 75-year-old woman can expect to live to age 87, approximately 7 of her remaining years are likely to be marked by at least partial loss of functional independence (*Table 1*). Thus, the patient's views of disability, quality of life, and spirituality must be explored as part of the preoperative assessment.

The patient's wishes regarding cardiopulmonary resuscitation (CPR) and advance directives should also be explored. Most elderly patients greatly overestimate the efficacy of CPR and the likelihood of recovering their previous level of function after a cardiac arrest.<sup>5</sup> Patients and their families can make more thoughtful decisions about CPR and health care if their physicians give them accurate information. The "Living Will" and a document granting Durable Power of Attorney for Health Care can be completed in a physician's office if witnessed by two independent and unrelated persons. Advance directives and preferences for end-of-life treatment should be documented in the medical record and made known to family members and other involved physicians before surgery. The patient's wishes are always paramount and should be honored if known.

#### PHYSIOLOGIC EFFECTS OF "NORMAL AGING" VS UNDERLYING DISEASE

The physiologic and anatomic changes of "normal aging" (*Table 2*) can lead to perioperative complications in older patients. For example, decreases in lean body mass and total body water, coupled with impaired renal or hepatic function, predispose to drug toxicity. Diminished cardiac compensatory mechanisms can lead to volume overload. Physiologic reserve and homeostatic control mechanisms also decline with advancing age, and these changes are likely to become clinically apparent during the stress of acute illness or surgery.

Old age is also associated with a higher prevalence of comorbid disease. However, severity of illness has been shown to be a better predictor of surgical outcome than chronological age,<sup>6</sup> challenging older studies that cited age as an independent risk factor for surgical mortality. Studies that carefully assessed and controlled for specific concurrent diseases did not find that age per se significantly affected surgical outcome.<sup>3,7,8</sup> On the other hand, age can be viewed as a surrogate marker for underlying chronic diseases, which are likely to greatly influence outcomes if undetected or poorly managed.

Older patients vary widely in their response to illness, even at the same chronological age. Thus, every older patient must be evaluated as an individual, taking into account the physiologic changes of aging and any underlying diseases. Some habits such as cigarette smoking or lack of exercise exacerbate these factors and contribute to a higher risk of perioperative complications.

#### CARDIOVASCULAR COMPLICATIONS

Congestive heart failure and myocardial infarction (MI) account for approximately one fourth of all cardiac complications and perioperative deaths in older patients. However, it has yet to be determined what is the best strategy for preoperative cardiac risk assessment in this age group.<sup>9</sup> For the internist, a major challenge is to identify patients with significant coronary artery disease that has not been diagnosed.

Active elderly patients with good exercise tolerance are generally at low risk for cardiac complications.<sup>10</sup> Likewise, a nondiabetic candidate for non-vascular surgery who can comfortably walk two



blocks without angina is probably also at low risk and usually does not require additional testing.<sup>11</sup> High-risk patients with known cardiac disease or active symptoms and those with diseases such as severe arthritis or peripheral vascular disease that limit activity should be considered for pharmacologic stress testing to assess cardiac performance.<sup>12</sup>

Age-related changes in the myocardium and systemic vascular resistance predispose the elderly to diastolic dysfunction. Especially during the first 48 hours after surgery, excess intravenous fluid given intraoperatively and fluid that is mobilized back into the circulation from third spaces can lead to volume overload and congestive heart failure.

Postoperative MI is most likely to occur within 3 days after surgery. Compared with younger patients, older patients with MI are more likely to manifest atypical presenting symptoms such as dyspnea, mental status changes, or syncope.

For a more complete review of preoperative assessment of cardiac risk, see "Evaluating cardiac risk in noncardiac surgery patients" by Bronson and associates<sup>12</sup> on page 391 of this issue of the *Cleveland Clinic Journal of Medicine*.

#### PULMONARY COMPLICATIONS

Pulmonary complications such as pneumonia, pulmonary embolism, and prolonged mechanical ventilation account for about 40% of all postoperative morbidity in elderly patients. Pre-existing pulmonary disease, smoking, prolonged anesthesia, and upper abdominal surgery greatly increase the risk of postoperative problems. However, advanced age alone is not an independent risk factor for respiratory complications.<sup>13</sup> Routine pulmonary function testing is probably unnecessary except in candidates for lung resection.<sup>14</sup> In one study, routine chest roentgenograms revealed abnormalities in 49% of

**TABLE 2**  
PHYSIOLOGIC CHANGES OF AGING  
AND THEIR POTENTIAL FOR PERIOPERATIVE PROBLEMS

Organ system	Age-related change	Possible complications
General	Decreased total body water Decreased lean body mass Impaired thermoregulation	Drug toxicity Hypothermia
Cardiac	Impaired diastolic filling Decreased arterial compliance Degeneration and fibrosis of the conduction system Decreased baroreceptor sensitivity	Heart failure Orthostatic hypotension
Pulmonary	Decreased mucus clearance Impaired cough reflexes Chest wall stiffening Loss of elasticity Increased ventilation-perfusion mismatch	Aspiration Infection Ventilatory failure
Renal	Decreased glomerular filtration rate Decreased creatinine production	Drug toxicity
Hepatic	Decreased blood flow Decreased microsomal oxidation	Drug toxicity
Endocrine	Decreased secretion and action of insulin	Hyperglycemia

all patients over age 70, and the incidence of postoperative pulmonary complications was significantly higher in this age group than in patients 60 to 70 years old ( $P < .01$ ).<sup>15</sup>

A more complete discussion of this topic is included in "Postoperative pulmonary complications: risk assessment, prevention, and treatment" by Hayden and associates<sup>16</sup> on page 401.

#### MEDICATIONS AND THE EFFECTS OF AGING

Physicians need to determine what medications their elderly patients are taking. On the average, older Americans use 4.5 prescription medications and 3.5 over-the-counter drugs at any given time.<sup>17</sup> The likelihood of an adverse drug reaction increases with the number of medications a person takes. A thorough medication history is therefore an essential component of the preoperative assessment and may be facilitated by asking the patient to bring all of his or her medications to the office for review.

In addition to potential interactions between multiple medications, age-related physiologic changes can alter the pharmacokinetics of many drugs (Table 3). Older hospitalized patients may have reduced serum albumin levels due to chronic diseases and immobility, necessitating lower dosages



**TABLE 3**  
AGE-RELATED CHANGES THAT AFFECT PHARMACOKINETICS

Pharmacokinetic process	Age-related change	Possible effect
Drug absorption	Decreased gastric acid secretion Decreased gastrointestinal tract perfusion Increased gastrointestinal transit time	Little clinical effect
Volume of distribution	Decreased total body water  Decreased lean body mass Increased body fat  Decreased serum albumin concentration Increased alpha-1-acid glycoprotein levels	Higher concentration of water-soluble drugs  Increased half-life and distribution of fat-soluble drugs  Increased plasma fraction of protein-bound acidic drugs
Hepatic drug clearance	Decreased hepatic blood flow Decreased hepatic mass Decreased metabolic capacity	Decreased clearance of high-clearance drugs Decreased phase 1 microsomal oxidation
Renal drug clearance	Decreased renal blood flow Decreased renal mass Decreased glomerular filtration rate Decreased creatinine clearance	Decreased drug and metabolic elimination

72 × serum creatinine concentration in mg/dL. In women, the result is multiplied by 0.85. Frequent monitoring of serum levels of drugs such as aminoglycosides, vancomycin, lithium, and digoxin improves the dosing of drugs to decrease toxicity.

Certain classes of drugs are more likely to cause problems in older patients than in younger ones. For example, benzodiazepines, antipsychotics, and psychotropic drugs have been associated with an increased rate of falls due to impaired balance. Nonsteroidal anti-inflammatory drugs (NSAIDs) increase blood pressure and cause azotemia by inhibiting renal prostaglandins.

Before prescribing any medication, the clinician should weigh its expected benefit against the risk of an adverse drug reaction. As a general principle, oral and intravenous drugs should be started at the lowest possible therapeutic dosage and titrated slowly upward with frequent monitoring for problems.

Essential medications that should be given on the day of surgery are determined on an individualized basis. Most antihypertensives are given preoperatively. Diuretics are usually discontinued to minimize hypotension during the induction of anesthesia. To avoid intraoperative hypoglycemia, oral agents for diabetes are not given before surgery. Insulin regimens are generally halved and administered with 5% glucose intravenous fluids. Instructions for discontinuation of analgesics and anticoagulants should be based upon the surgical procedure.

#### NEUROPSYCHIATRIC PROBLEMS

##### Dementia

The incidence of dementia increases with age, and cognitive impairment may be overlooked if a formal test of mental status such as the Folstein Mini-Mental State Examination is not part of the

of protein-bound drugs such as phenytoin or warfarin. Lipid-soluble drugs such as hypnotics and analgesics tend to be more widely distributed throughout the body than in younger patients, leading to a prolonged duration of action. The elderly also require lower dosages of digoxin because they have a reduced volume of distribution.

Hepatic drug metabolism is variable in older patients. Drugs metabolized by microsomal oxidation require dosage adjustment when given with other drugs metabolized in the liver. For example, concentrations of lidocaine and propranolol greatly increase when these are combined with cimetidine.

Because lean body mass declines in the elderly, the serum creatinine concentration is a poor indicator of renal function. As lean body mass decreases, so does creatinine production. This effect is especially pronounced in frail elderly patients, who may have normal serum creatinine concentrations despite markedly impaired renal function. The Cockcroft-Gault equation<sup>18</sup> is useful to calculate creatinine clearance in elderly patients and aids in more appropriate medication dosing: the creatinine clearance in mL/min =  $(140 - \text{age}) \times \text{body weight in kg} /$



routine preoperative assessment (Table 4).<sup>19</sup> This test can also serve as a baseline for comparison if cognitive changes develop later.

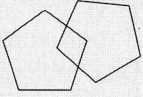
In one series, demented patients had a 52% higher surgical mortality rate than nondemented patients.<sup>20</sup> Patients who are cognitively impaired may be unable to fully participate in rehabilitation and are at a higher risk of postoperative complications, especially delirium.

### Delirium

Delirium occurs in 10% to 50% of all elderly patients after surgery and is three times more likely to occur in patients older than age 75 than in patients age 65 to 74.<sup>21</sup> Delirium is associated with increased morbidity and mortality, longer hospital stays, increased charges, and higher discharge rates to nursing homes. Unfortunately, acute confusional states are often slow to be recognized because delirium may present as either agitated or quiet behavior. The key diagnostic features of delirium that distinguish it from dementia are rapid onset, problems with attention span, frequent hallucinations or delusions, and tremor or asterixis. Speech is often incoherent and disorientation is pronounced.

Unlike dementia, delirium is usually of brief duration and reversible once the underlying cause is identified and treated. Potential causes of postoperative delirium such as drugs, infection, fluid and electrolyte abnormalities, hypoxemia, acute neurological events, and MI should be systematically

**TABLE 4**  
THE FOLSTEIN MINI-MENTAL STATE EXAMINATION\*

Questions	Points
<b>Orientation</b>	
1. Ask the patient what is the:	
Year?	1
Season?	1
Date?	1
Day?	1
Month?	1
2. Where are we?	
State?	1
County?	1
Town or city?	1
Hospital?	1
Floor?	1
<b>Registration</b>	
3. Ask the patient to listen while you name three objects, taking 1 second to say each. Then ask the patient to repeat all three after you have said them.	3
<b>Attention and calculation</b>	
4. Ask the patient to count backward from 100 by sevens. Give one point for each correct answer. Stop after five answers. Alternate: spell "world" backwards.	5
<b>Recall</b>	
5. Ask the patient to recall the three objects named in question 3. Give one point for each correct answer.	3
<b>Language</b>	
6. Point to a pencil and a watch. Have the patient name them as you point.	2
7. Have the patient repeat the following: "no ifs, ands, or buts."	1
8. Have the patient follow a three-stage command: "Take a paper in your right hand. Fold the paper in half. Put the paper on the floor."	3
9. Have the patient read and obey the following: "Close your eyes." (Write it in large letters.)	1
10. Have the patient write a sentence of his or her choice. (The sentence should contain a subject and a verb and should make sense. Ignore spelling errors when scoring.)	1
11. Have the patient copy the design shown here. (Give one point if all sides and angles are preserved and if the intersecting sides form a quadrangle.)	1
	
Total	30 <sup>†</sup>

\*From Folstein et al, reference 19

<sup>†</sup>In validation studies using a cutoff score of 23 or less, this test has a sensitivity of 87%, a specificity of 82%, a false-positive ratio of 39.4%, and a false-negative ratio of 4.7% in distinguishing patients with clinically diagnosed dementia or delirium from patients without these syndromes

investigated and corrected. Very low doses of a short-acting benzodiazepine such as lorazepam (0.5 mg twice a day) or an antipsychotic such as haloperidol (0.5 mg daily or twice a day) may be necessary for sedation. The hospital environment should be made more "friendly," since sensory deprivation and unfamiliar surroundings contribute to this problem.

Family members or a bedside sitter may obviate the need for restraints, and familiar objects, orienting devices, and night-lights may decrease disorientation.

Some drugs can precipitate episodes of delirium in the elderly. Older patients are more sensitive to medications with central nervous system effects, owing to decreased levels of neurotransmitters. Acetylcholine synthesis is markedly reduced in neurodegenerative diseases such as Alzheimer's disease, and medications with anticholinergic effects can exacerbate this deficit and precipitate delirium. Therefore, drugs with anticholinergic effects such as diphenhydramine should not be used in this age group.

### Depression

Up to 45% of hospitalized elderly patients develop depressive symptoms as a reaction to physical illness, especially when accompanied by a loss of functional abilities.<sup>22</sup> Detection of depression in frail older adults may be enhanced by using screening tests such as the Geriatric Depression Scale, a list of 30 yes-or-no questions that delve into the symptoms of depression. Scores of 11 or more indicate a high probability of depression.<sup>23</sup>

A history, physical examination, and laboratory studies are indicated to exclude medical illnesses such as delirium, hypothyroidism, or a neoplasm that may present with depression.

Questions should be asked to quantify alcohol use, as unsuspected alcohol overuse may accompany depression. Patients at high risk for alcohol withdrawal should receive thiamine prophylactically and short-acting benzodiazepines such as lorazepam around the clock until the acute danger has passed. In postoperative patients, prolonged effects of anesthesia and pain medications may mask the early warning signs of alcohol withdrawal such as tachycardia and mild blood pressure elevations (see "Postoperative confusion in a 42-year-old man" by Isaacson<sup>24</sup> on page 370).

Supportive psychotherapy may be effective if depressive symptoms are mild. However, pharmacotherapy is usually necessary if symptoms are moderate or severe and do not respond to behavioral techniques. The class and dose of antidepressant should be thoughtfully considered to avoid side effects. Tricyclic antidepressants (such as nortriptyline) and the selective serotonin reuptake inhibitors (fluoxetine, paroxetine, sertraline) may require several weeks to produce a therapeutic effect, but

may benefit a hospitalized patient in the long term. Electroconvulsant therapy is the treatment of choice for psychotic depression or for depression resistant to medications.

### SPECIAL CONSIDERATIONS IN THE ELDERLY

#### Malnutrition

Approximately 5% of community-dwelling people over age 70 and up to 60% of institutionalized elderly patients are malnourished.<sup>25</sup> A history of weight loss precedes malnutrition and is predictive of death after discharge from the hospital.<sup>26</sup>

Temporal muscle wasting, decreased lean body mass, glossitis, muscle atrophy, and generalized weakness are consistent with protein-calorie malnutrition. Biochemical markers (eg, a serum albumin concentration less than 3.0 g/dL, a serum cholesterol concentration less than 150 mg/dL, normocytic anemia) may be insensitive in mild malnutrition.

Oral high-calorie protein supplements and assistance with meals may improve caloric intake. Early enteral or parenteral supplementation should be considered if a patient has decreased protein stores and is unlikely to eat adequately for some time. Vitamin supplementation may also be appropriate. Delmi et al<sup>27</sup> showed that elderly patients who received oral high-calorie supplements after hip replacement surgery had better short-term outcomes and shorter length of stay compared with patients who did not receive nutritional supplements.

#### Functional assessment and immobility

The preoperative geriatric assessment should include a determination of baseline functional status and abilities. By observing the gait, ability to arise independently from a chair, and turning balance, a clinician can predict which older patients are likely to need aggressive physical therapy in the hospital. The Katz Activities of Daily Living Scale is useful in assessing a patient's ability to independently bathe, dress, toilet, transfer, remain continent, and eat.<sup>28</sup> The Instrumental Activities of Daily Living focuses on more complex activities that allow a person to live independently in the community (shopping, using the telephone, preparing food, handling finances, housekeeping, taking medications, using transportation).<sup>29</sup> These scales identify problem areas preoperatively and help determine the need for support services after discharge.



Prolonged bed rest leads to altered thermoregulation, cardiovascular deconditioning, impaired balance, orthostatic hypotension, decreased albumin, sleep changes, psychiatric disturbances, and suppression of urinary and fecal urges. Getting patients out of bed and starting physical therapy soon after surgery should mitigate these changes. Physicians and nurses can promote mobility by encouraging early ambulation, providing assistive devices such as walkers and canes, and not using physical or pharmacologic restraints. Patients and family members can be taught bedside range-of-motion exercises to maintain muscle strength and joint flexibility. Although dependence in one or more activities of daily living is likely to develop during an older person's hospital stay,<sup>30</sup> early and aggressive interventions may mitigate problems.

### Pressure ulcers

Elderly patients, especially those with hypoalbuminemia, immobility, dementia, or incontinence, are at high risk of developing pressure ulcers after surgery. In-hospital death rates are consistently higher in older patients with pressure ulcers,<sup>31</sup> but this association is most likely related to severe, underlying disease burden.

Prolonged pressure, friction, shearing forces, and moisture all contribute to pressure-sore development; various measures (Table 5) have been shown to prevent them.<sup>32</sup>

### STARTING DISCHARGE PLANNING SOONER

As hospitalization rates and the average length of hospital stay decrease in response to changes in medical reimbursement, older patients are likely to be discharged from the hospital "quicker and sicker."<sup>33</sup> Discharge planning needs to be started as part of the preoperative assessment, and available family and home resources should be explored. If the home setting is unlikely to provide an adequate level of care after discharge, a short-term nursing home stay could be the therapeutic bridge to a return to community living. An interdisciplinary team that includes the physician, primary care nurse, nurse specialist, social worker, physical therapist, occupational therapist, dietitian, and home care coordinator is essential for comprehensive medical, functional, and social assessment of the older patient and for implementation of an

**TABLE 5**  
SKIN CARE AND EARLY TREATMENT  
RECOMMENDATIONS BASED ON CLINICAL  
PRACTICE GUIDELINES FOR PRESSURE ULCERS\*

Systematically inspect all skin daily
Keep skin clean and dry after soiling and at routine intervals
Use mild cleansing agents and avoid hot water
Treat dry skin with moisturizers; minimize exposure to low humidity and cold
Massaging over bony prominences may be harmful and should be avoided
Minimize skin exposure to incontinence, wound drainage, or perspiration
Proper positioning, transferring and turning techniques will minimize skin injuries resulting from friction and shearing
Protective films, pastes and dressings may be appropriate for some patients
Assess bed surfaces and utilize other pressure-relieving devices when appropriate
Correct nutritional deficiencies and ensure adequate caloric intake
Rehabilitative efforts should concentrate upon mobility and range of motion

\*From reference 32

individualized treatment and discharge plan.

### SUMMARY

Decisions about surgery should be individualized in the elderly by balancing potential benefits against predicted risks. Older patients and their families should be well informed about the planned procedure, and preferences about resuscitation should be ascertained before hospitalization, if feasible.

A preoperative assessment that defines medical, functional, and psychosocial problems can improve surgical outcomes in older patients by identifying medical diseases that may negatively affect outcome, especially when compounded by age-related physiological changes. Postoperative management includes specific measures to minimize complications such as delirium, functional decline, and malnutrition. Discharge planning commences with the preoperative assessment. Comprehensive assessment and interdisciplinary collaboration can improve outcomes for older patients while attenuating the potential adverse effects of hospitalization.<sup>34</sup>

## REFERENCES

1. Johnson JC. Surgery in the elderly. In: Goldman DR, editor. Medical care of the surgical patient. Philadelphia: JB Lippincott, 1982.
2. Vaz FG, Seymour DG. A prospective study of elderly general surgical patients. I. Pre-operative medical problems. *Age Aging* 1989; 18:309–315.
3. Milamed DR, Hedley-Whyte J. Contribution of the surgical sciences to a reduction of the mortality rate in the United States for the period 1968 to 1988. *Ann Surg* 1994; 219:94–102.
4. Hoskings MP, Warner MA, Lobdell CM, Offord KP, Melton LJ 3rd. Outcomes of surgery in patients 90 years of age and older. *JAMA* 1989; 261:1909–1915.
5. Miller DL, Jahnigen DW, Gorbien MJ, Simbardt L. Cardiopulmonary resuscitation: how useful? Attitudes and knowledge of elderly population. *Arch Intern Med* 1992; 152:578–582.
6. Dunlop WE, Rosenblood L, Lawrason L, Birdsall L, Rusnak CH. Effects of age and severity of illness on outcome and length of stay in geriatric surgical patients. *Am J Surg* 1993; 165:577–580.
7. Thomas DR, Ritchie CS. Preoperative assessment of older adults. *J Am Geriatr Soc* 1995; 43:811–821.
8. Djokovic JL, Hedley-Whyte J. Prediction of outcome of surgery and anesthesia in patients over 80. *JAMA* 1979; 242:2301–2306.
9. Francis J. Perioperative management of the older patient. In: Hazzard WR, editor. Principles of geriatric medicine and gerontology. New York: McGraw-Hill, 1994.
10. Foster Ed, Davis KB, Carpenter JA, Abele S, Fray D. Risk of noncardiac operation in patients with defined coronary disease: The Coronary Artery Surgery Study (CASS) registry experience. *Ann Thorac Surg* 1986; 41:42–50.
11. Wong T, Detsky AS. Perioperative cardiac risk assessment for patients having peripheral vascular surgery. *Ann Intern Med* 1992; 116:743–753.
12. Bronson DL, Halperin AK, Marwick TH. Evaluating cardiac risk in noncardiac surgery patients. *Cleve Clin J Med* 1995; 62:391–400.
13. Mohr DN, Jeff JR. Preoperative evaluation of pulmonary risk factors. *J Gen Intern Med* 1988; 3:277–287.
14. Zibrak JD, O'Donnell CR, Marton K. Indications for pulmonary function testing. *Ann Intern Med* 1990; 112:763–771.
15. Boghosian SG, Mooradian AD. Usefulness of routine preoperative chest roentgenograms in elderly patients. *J Am Geriatr Soc* 1987; 35:142–146.
16. Hayden SP, Mayer ME, Stoller JK. Postoperative pulmonary complications: risk assessment, prevention, and treatment. *Cleve Clin J Med* 1995; 62:401–407.
17. Beers MH, Ouslander JG. Risk factors in geriatric drug prescribing: a practical guide to avoiding problems. *Drugs* 1989; 37:105–112.
18. Cockcroft DW, Gault MH. Prediction of creatinine clearance from serum creatinine. *Nephron* 1979; 16:31–41.
19. Folstein MF, Folstein SE, McHugh PR. "Mini-mental state"—a practical method for grading the mental state of patients for the clinician. *J Psychiatr Res* 1975; 12:189–198.
20. Bernstein GM, Offenbarse SK. Adverse surgical outcomes among patients with cognitive impairments. *Am Surg* 1991; 57:682–690.
21. Francis J. Delirium in older patients. *J Am Geriatr Soc* 1992; 40:829–838.
22. Koenig HG, Meador KG, Cohen HJ, Blazer DG. Screening for depression in hospitalized elderly patients: taking a closer look. *J Am Geriatr Soc* 1993; 41:464–465.
23. Yesavage JA, Brink TL, Rose TL, et al. Development of a geriatric depression screening scale: A preliminary report. *J Psychiatr Res* 1983; 17:37–49.
24. Isaacson JH. Postoperative confusion in a 42-year-old man. *Cleve Clin J Med* 1995; 62:370–371.
25. Morley JE, Silver AJ, Fiatarone M, Mooradian AD. Geriatric grand rounds: nutrition and the elderly. *J Am Geriatr Soc* 1986; 34:823–832.
26. Sullivan DH, Patch JA, Walls RC, Lipschitz DA. Impact of nutrition status on morbidity and mortality in a select population of geriatric rehabilitation patients. *Am J Clin Nutr* 1990; 51:749–758.
27. Delmi M, Rapin CH, Bengoa JM, Delmas PD, Vase H, Bangor JP. Dietary supplementation in elderly patients with fractured neck of the femur. *Lancet* 1990; 335:1013–1016.
28. Katz S Ford A, Moskowitz RW, Jackson BA, Jaffe MW. Studies of illness in the aged. The index ADL: a standardized measure of biological and psychosocial function. *JAMA* 1963; 185:914–919.
29. Lawton MP, Brody EM. Assessment of older people: self-maintaining and instrumental activities of daily living. *Gerontologist* 1969; 9:179–186.
30. Warshaw GA, Moore JT, Friedman SW, et al. Functional disability in the hospitalized elderly. *JAMA* 1982; 248:847–850.
31. Allman RM, Laprade CA, Noel LB, et al. Pressure ulcers among hospitalized patients. *Ann Intern Med* 1986; 105:337–342.
32. Panel for the Prediction and Prevention of Pressure Ulcers in Adults. Pressure ulcers in adults: prediction and prevention. Clinical Practice Guideline. No 3. AHCPR Publication No. 92-0047. Rockville, MD; Agency for Health Care Policy and Research, Public Health Service, U.S. Department of Health and Human Services, May 1992.
33. Kosecoff J, Kahn KL, Rogers WH, et al. Prospective payment system and impairment at discharge. The "quicker and sicker" story revisited. *JAMA* 1990; 264:1980–1983.
34. Palmer RM. Acute hospital care of the elderly: minimizing the risk of functional decline. *Cleve Clin J Med* 1995; 62:117–128.