

## Preoperative Evaluation of the Elderly Surgical Patient

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*Family physicians are often requested to provide preoperative evaluation of elderly patients. Age independently increases the risk of morbidity and mortality in the perioperative period. In addition, the altered physiology of the older patient, in combination with the increased number of disease processes, increases the potential for complications. A comprehensive preoperative assessment includes an evaluation of the patient's present physiological functioning and attempts to detect the presence and status of any disease processes. Evaluation includes a thorough history, physical examination, and laboratory testing. Special considerations in preoperative assessment of the elderly patient include the assessment of nutrition, functional capabilities, and evaluation of the cognitive and emotional status of the patient. Special concerns include prophylaxis for deep vein thrombosis and pulmonary embolus, and antibiotic prophylaxis for endocarditis and for patients with joint prostheses.*

As a consequence of their role as primary health care providers, family physicians are often requested to provide "medical clearance" for elderly patients about to undergo a surgical procedure. As the population of individuals aged 65 years and older in the United States increases in the next 20 years, family physicians can expect to function with increasing frequency as consultants to their surgical colleagues.<sup>1,2</sup> The purpose of this review is to address the current status of preoperative evaluation with a special emphasis on the unique problems posed by the elderly surgical candidate.

There are two major reasons for preoperative assessment and evaluation of the surgical patient. The first reason is to gather information about the patient's present physiological functioning so as to assess operative risk and minimize postoperative complications. The process of aging results in anatomic and physiologic changes in the geriatric patient. That these metabolic and structural variations from the young adult can affect operative risk is reflected in the American Society of Anesthesiologists' Physical Status Scale, which categorizes an individual into a higher operative risk group solely on the basis of age greater than 75 years.<sup>3</sup> Knowledge of these age-related changes is important to the systematic process of assessing operative risk in this age group.

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The second purpose of preoperative assessment is to detect the presence and to assess the status of any disease process that may influence the outcome of the surgical procedure. The elderly surgical patient is likely to have a number of medical problems that require evaluation and management prior to surgery. In addition, this patient is subject to a special set of disease processes and host responses unique to this age group.

The ultimate goal of preoperative evaluation is to decrease the risk of intraoperative and postoperative morbidity and mortality and to improve the chances of a successful surgical intervention. For the family physician called upon to evaluate the geriatric surgical patient, knowledge of the physiological changes of aging provides essential information necessary for anticipating changes in organ system function that increase perioperative risk. Knowledge of the unique characteristics and special medical problems of the elderly patient provides the clinical basis for developing a plan for patient management during the perioperative period.

### SPECIAL CHARACTERISTICS OF THE ELDERLY SURGICAL CANDIDATE

#### Physiologic Changes of Aging

The net effect of aging is to decrease the physiologic reserve of the elderly individual, a consequence of the decreasing functional reserve that occurs in various organ systems with increasing age. In addition, the effects of a physiologic

change or a pathologic process on one organ system is likely to result in an alteration in the functioning of other components of the system. The net result is a general decrease in physiologic reserve. One outcome of this process is a decreased ability of the elderly individual to buffer the effects of a physiologic stress such as a surgical procedure.<sup>4</sup> Understanding the functional and structural changes that occur in key organ systems with increasing age provides the theoretical basis for systematic preoperative assessment and management.

Age-related changes in the cardiovascular system are characterized by decreases in cardiac output and response to stressors.<sup>5</sup> Recent studies have pointed to a decrease in response to sympathetic stimulus rather than a general decrease in cardiac output as the explanation for these effects in the elderly patient without cardiovascular disease.<sup>6</sup> Structural changes in the heart include ventricular hypertrophy and calcification of mitral and aortic annuli.<sup>7</sup> In the vascular tree, resilience is decreased and peripheral vascular resistance is increased.<sup>8</sup> As a consequence of these changes, organ perfusion is decreased, and the capacity of the cardiovascular system to tolerate and buffer insults is limited. The elderly patient becomes more vulnerable to iatrogenic problems, such as fluid overload, or pathologic processes, such as septic shock or renal failure.

An age-related decrease in nephron numbers, renal blood flow, and glomerular filtration rate contributes to the general decrease in renal function found in the elderly patient.<sup>9,10</sup> These changes are often not reflected in serum creatinine because of its dependence upon muscle mass (which is lower in this population) and relative insensitivity to moderate changes in glomerular filtration rate. Creatinine clearance decreases by 30 percent from the fourth to the eighth decades of life. The mean creatinine clearance in individuals aged 35 to 44 years is 132.7 mL/min/m<sup>2</sup> compared with 97 mL/min/m<sup>2</sup> for individuals aged 75 years.<sup>11</sup> Tubular function as seen in renal concentrating ability and the tubular maximum for excretion decreases with increasing age.<sup>12,13</sup> Such stressors as volume overload and fluid loss secondary to evaporation in warm environments are less easily handled by the kidney as a consequence of these changes.

Age-related variations in the pulmonary system include thoracic cage changes reflected by increased rigidity and decreased volume as well as changes in the lung parenchyma.<sup>14,15</sup> The flexibility of lung parenchyma decreases with increasing age.<sup>16</sup> Respiratory muscle strength and endurance decrease.<sup>17</sup> Measures of pulmonary function show an increase in functional residual capacity, residual volume, and dead space as well as a decrease in forced expiratory volume and the peak expiratory flow rate.<sup>15,18</sup> Arterial oxygen tension also decreases with increasing patient age.<sup>19</sup> Finally, the numbers and activity of respiratory cilia are decreased.<sup>20</sup> The net effect of these changes is to

decrease the pulmonary reserve, increasing the elderly patient's sensitivity to the effects of general anesthetics and increasing the risk of postoperative complications such as pneumonia.

Effects of aging on the nervous system include decreases in cerebral blood flow, coordination, problem-solving, and short-term memory.<sup>21-24</sup> Nerve conduction is slower with advancing age, and vision and hearing show progressive deterioration.<sup>5,25,26</sup> In the postoperative period delirium is more common than in younger age groups. Sensory deprivation secondary to decreased hearing and vision compounded by the foreign environment of the hospital can affect the elderly patient's ability to cooperate with preoperative and postoperative instructions and treatments.

Body composition varies significantly with increasing age.<sup>27-29</sup> Lean body mass decreases and the percent of total body fat increases. Plasma volume and total body water decrease and plasma albumin decreases. These variations in body composition affect drug metabolism in the elderly individual by altering the volume of distribution and reservoirs for deposition of drugs.<sup>30</sup>

### Pharmacodynamics and Pharmacokinetics

During the perioperative period the elderly patient may receive multiple medications. These medications are most commonly given to the patient as preoperative medications, anesthetics, and in the course of postoperative treatment. An understanding of the age-related variations in drug metabolism is useful to assure proper pharmacological management of the elderly surgical patient.

Absorption, though not well studied, is generally a passive process and appears not to change significantly with age.<sup>31,32</sup> Factors that may influence absorption in the elderly patient include decreased blood flow to abdominal viscera, increased gastric pH, and delayed gastric emptying.<sup>33-35</sup> The absorption of some drugs does show significant variation with age. For example, the absorption of cimetidine and propranolol increases with age, while absorption of quinidine decreases.<sup>36-38</sup>

Changes in body composition can change the distribution of some drugs. Decreases in total body water and plasma volume in the elderly patient result in a smaller volume of distribution for water-soluble drugs. As a result, the proportion of drug in plasma to the total body concentration increases, leading to higher blood levels of water-soluble drugs per dose. This result necessitates the use of lower doses for hydrophilic drugs such as phenytoin.<sup>39,40</sup>

The decrease in lean body mass and relative increase in percentage of body fat yield an increased volume of distribution and storage reservoir for lipophilic drugs. Lipophilic drugs such as diazepam and lidocaine have an increased half-life largely because of this phenomenon.<sup>41,42</sup>

Finally, the relative decrease in albumin and other plasma-binding proteins may increase the free fraction of highly bound drugs, such as warfarin, resulting in a decreased toxic and therapeutic range.<sup>43</sup>

Excretion and clearance of some drugs may be significantly altered in the elderly patient.<sup>44-47</sup> Drug clearance occurs primarily through two mechanisms, hepatic metabolism or transformation, and renal excretion. As drugs are delivered to the liver via the hepatic circulation, they may pass unaltered or may be changed into active or inactive metabolites. In the elderly individual, this process may be altered through two mechanisms. First, a decrease in hepatic blood flow will decrease the rate of hepatic metabolism. Second, the activity of enzymes involved in hepatic drug transformation and metabolism decreases with age. Drugs with significant hepatic metabolism such as digoxin have a longer half-life in the elderly patient.<sup>37</sup> In addition, drugs such as cimetidine, which decrease hepatic blood flow, can further decrease the metabolism of digoxin and other hepatically transformed drugs.<sup>37,48</sup>

Decreased renal blood flow, decreased nephron numbers, and the resultant decrease in the glomerular filtration rate result in decreased excretion of drugs by the kidneys.<sup>13,47</sup> Decreased tubular function can actively affect secreted drugs such as penicillins, resulting in an increased level for a given dose.<sup>47</sup>

There is a significant variation in the end-organ effects of aging. Decreased receptor sensitivity and a decreased number of end-organ receptor sites have been found in some cases.<sup>49</sup> Alternatively, increased sensitivity to such drugs as diazepam and warfarin have been documented.<sup>50,51</sup>

The consequence of these complex changes in perioperative use of medications is fairly simple. As a general rule, most medications ordered for the elderly patient should be prescribed in a decreased dose. Psychoactive drug use in the perioperative period should be kept to a minimum. Routine sleep medications, such as benzodiazepines or barbiturates, should be avoided. Doses of narcotic drugs for pain relief postoperatively should be given judiciously, as needed, and in one-half the dose given to a younger individual.

Accounting for the effects of altered physiology on specific drugs is also important. For example, to avoid complications, doses of nephrotoxic drugs and medications having major renal clearance, such as the aminoglycoside antibiotics and digoxin, require lower doses as well as the careful monitoring of blood levels.

### Special Characteristics of the Elderly Patient

The geriatric patient presents a unique set of clinical characteristics as a result of the anatomic and physiologic effects of aging. In addition, other factors contribute to the

unique problems of the elderly surgical patient. It is likely that the physician will find evidence of multiple pathological processes at the time of surgery.<sup>52</sup> Consequences of the presence of a number of disease processes are an alteration in the functioning of the involved organ systems and a highly complex medical treatment regimen.<sup>53</sup> The prescribed treatment, especially if pharmacologic, can itself impair or alter organ system functions. The elderly patient reflects the results of a lifetime of pathologic and iatrogenic insult; evidence of previous active diseases, now quiescent; and new active disease processes.

An entire set of unique disease processes accompanies advancing age. Hypothermia and dehydration, not commonly seen since childhood, once again appear as important clinical problems.<sup>54</sup> Dementia, Parkinson's disease, and stroke increase in incidence with advancing age.<sup>55-57</sup> In men, prostatic cancer, benign prostatic hypertrophy, and secondary urinary obstruction increase in prevalence. Polymyalgia rheumatica, multiple myeloma, non-ketotic hyperosmolar coma, and herpes zoster all occur more frequently in the elderly individual.

The presentation of symptoms related to a disease may also differ significantly from symptoms in younger individuals.<sup>58</sup> A well-known example is that of the so-called silent myocardial infarction.<sup>59</sup> In this case, symptoms are either absent or not sufficiently stressful to elicit an office visit. Diseases such as pneumonia may present with symptoms of lethargy or mental status change.<sup>60,61</sup> Apathetic hyperthyroidism is another example of a clinical presentation that is different from the textbook presentation of this disorder in a younger individual.<sup>62</sup>

The physiologic and pharmacodynamic variations between the young and old patient and the special qualities of the elderly patient have implications in preoperative assessment and evaluation. Knowledge of physiology is important in estimating the patient's reserve and capacity for buffering the effects of the surgical procedure. Fluid shifts secondary to third space loss may place the patient at risk for hypovolemia. Alternatively, intraoperative fluid replacement may overwhelm cardiac reserves, leading to postoperative heart failure.

Detecting the presence of pathologic processes that increase the surgical risk is a second step in preoperative assessment. This step is essential in estimating the effect on the patient's reserves and in planning therapeutic interventions to decrease the surgical risk. Since the perioperative period is a time of multiple drug exposure, knowledge of pharmacodynamics in the elderly allows the consulting physician to carefully monitor the use and effects of medication in the elderly patient. For example, knowledge of the increased sensitivity of elderly patients to central nervous system depressants requires careful prescribing and monitoring in the preoperative and postoperative periods.

### Age and Surgical Risk

Chronologic age is an independent risk factor for surgical mortality. As a result, perioperative risk increases in each decade of life over the age of 60 years.<sup>63</sup> Medical advances in the last 20 years have significantly decreased surgical mortality for the elderly patient. For example, the overall surgical mortality has decreased from 20 percent in the 1960s to 10 percent in the 1980s for individuals over the age of 80 years.<sup>64</sup> Emergency surgery has a greater morbidity and mortality than elective surgery in this population.<sup>65-67</sup>

Factors other than age also influence morbidity and mortality for the elderly patient. Medical problems and disease states can influence surgical risk. In a series of elderly general surgical patients, mortality was increased in the presence of cardiovascular disease, diabetes mellitus, and dementia. Cardiac disease increased mortality over the general elderly surgical population by 17 percent; diabetes increased this risk by 26 percent; dementia increased mortality by 45 percent.<sup>66</sup>

For the elderly surgical patient, risk also varies with the type of procedure being considered. Highest levels of physical risk are for procedures that are complex, have a higher risk of infectious complications, or are the result of a debilitated state. Thus, highest mortality occurs in bowel resection, repair of ulcer perforation, and wound dehiscence as well as in procedures such as total cystectomy, nephrectomy, and removal of arterial thrombus.<sup>67</sup> In the case of thoracic procedures, mortality is increased with increasing age with the possible exception of individuals with good pulmonary function.<sup>68</sup>

Perioperative complications for elderly patients include cardiopulmonary problems such as myocardial infarction, heart failure, pneumonia, and pulmonary embolus.<sup>69</sup> Other complications occurring in the perioperative period include urinary tract infections, renal failure, and metabolic problems.

### Physical Status and Operative Risk

Physical status is also an important factor in assessing surgical risk.<sup>70</sup> The most well-known system for physical status assessment is the American Society of Anesthesiologists' Physical Status Scale.<sup>3</sup> This system is a subjective scale with five classes:

*Class 1.* No evidence of physiologic, biochemical, or psychiatric disturbance; the pathologic process necessitating surgery is not systemic

*Class 2.* Mild to moderate systemic disturbance resulting from the problem requiring surgery or from other processes

*Class 3.* Severe systemic disorders

*Class 4.* Severe systemic disorders that are life threatening and not necessarily correctable with surgery

*Class 5.* The moribund patient with minimal chance of survival

Individuals aged 80 years and older are classified as class 2, and thus are at higher risk in this scale based solely on age. In a study of 500 consecutive patients over 80 years of age, overall mortality within a month of surgery was 6.2 percent.<sup>64</sup> As expected, mortality increased with increasing physical status class. One patient of a group of 187 patients in class 2 died within one month of surgery (5.3 percent). In class 4, 14 of a group of 56 patients died within one month of surgery (25 percent).

The use of invasive monitoring by means of Swan-Ganz heart catheterization and measurement of arterial blood gas values, pulmonary wedge pressure, pulmonary resistance, cardiac output, and mixed venous oxygen saturation can be used to identify patients at high risk of mortality.<sup>70</sup> Identification is based upon the ability to correct any physiologic abnormalities. Perioperative mortality for individuals with correctable physiologic conditions was 8.5 percent. All patients undergoing surgery with irreversible conditions died perioperatively.

## PREOPERATIVE EVALUATION AND MANAGEMENT

Preoperative assessment requires a systematic review of the physiologic and pathologic factors that may contribute to increased perioperative risk. The design of the assessment process must include clinical measures of physiology and the effects of pathology on the individual patient's ability to tolerate the planned procedure and to cooperate with postoperative rehabilitation measures. History, physical examination, laboratory, and radiologic data all serve to provide the information upon which to develop a plan to maximize the opportunity for a successful outcome.<sup>71-74</sup>

Preoperative evaluation requires six steps: (1) definition of the patient's present physiological status; (2) determination of all pathological processes and their degree of activity; (3) assessment of the patient's nutritional status; (4) delineation of the present level of the individual's physical, cognitive, and emotional functioning; (5) identification of specific surgical risk factors and factors increasing the risk of postoperative complications; and (6) development of a plan of action to minimize risk and maximize the opportunity for a successful outcome. This process involves methodical accumulation of information that can be used to develop an understanding of the patient's status. Sources of information include, history and physical examination, information from family, friends, or caretakers, and laboratory values.

### Physiologic Status

An understanding of the physiologic changes of aging provides the basis for estimating the degree of reserve available in the face of the stresses of surgery. For example, knowledge of the age-related decrease in renal blood flow and glomerular filtration rate dictates discretion when using drugs that are cleared primarily by the kidneys, such as digoxin, or that are nephrotoxic, such as the aminoglycoside antibiotics. The decrease in hepatic clearance occurring with age and increased central nervous system sensitivity to depressants suggests that preoperative narcotics should be used judiciously or not at all. Postoperative doses should be one half of those used in younger individuals.<sup>75</sup>

### Pathologic Processes and Disease States

Detection of the presence and activity of disease is the second step in the process of preoperative evaluation. Pathologic processes in the patient may be due to the problem necessitating the surgical procedure. Alternatively, they may be different processes that affect the potential outcome of the surgery by impairing organ system functioning and decreasing reserve. Careful assessment and delineation of all abnormal processes requires a careful history, physical examination, and laboratory evaluation. Diligent attention to the detection of pathologic problems is important for maximizing patient function prior to surgery by correction of problems and decreasing the effects of noncorrectable problems. Examples include electrolyte imbalances secondary to the use of diuretics, previously undetected pulmonary disease, anemia, and cardiovascular problems.<sup>76</sup> Hematologic values may be altered either through a chronic process, such as myeloma or pernicious anemia, or an acute process such as blood loss into a fracture site. Preoperative correction of anemia increases oxygen carrying capacity and improves the hemodynamic reserve of the elderly patient. The presence of pulmonary disease or chronic smoking indicates the need for more aggressive laboratory evaluation with pulmonary function testing and arterial blood gas testing prior to surgery. In smokers, preoperative smoking cessation has been correlated with improved respiratory outcomes.<sup>77</sup> The use of smoking cessation, aggressive pulmonary toilet, bronchodilators, aerosols, and incentive spirometry instruction during the preoperative period will decrease the risk of postoperative pulmonary complications.<sup>78,79</sup>

Iatrogenic problems in the preoperative period include the effects of medications used to treat medical problems such as hypertension and heart failure.<sup>76</sup> Electrolyte imbalances and volume depletion secondary to the effects of diuretics are common and should be sought through clinical examination, preoperative monitoring of serum

electrolytes, blood urea nitrogen, and creatinine, as well as urine output. The use of aspirin and nonsteroidal anti-inflammatory drugs is associated with significant drug-induced illness.<sup>80</sup> These medications can be discontinued and a stool for occult blood obtained preoperatively to evaluate occult bleeding. Digoxin is a medication frequently associated with significant toxicity. Blood levels of this medication should be obtained preoperatively to assure appropriate dosage in patients using this medication. A preoperative electrocardiogram is especially important in evaluating drug-related rhythm disturbances in these patients.

Hypertension is a common medical problem in the elderly population. A stable diastolic blood pressure of 110 mmHg or less is not associated with increased risk.<sup>81-83</sup> Because patients with unstable or severe hypertension are at increased risk, these patients should be treated preoperatively if surgery can be safely delayed. Antihypertensive medications can be continued up to and including the day of the surgery. To avoid potential rebound effects, however,  $\beta$ -blocking drugs should be continued to the day of surgery.<sup>72,81</sup>

Elderly patients with cardiac disease are at greater risk than patients without cardiac disease.<sup>66,84</sup> Increased risk is associated with the following factors: (1) myocardial infarction, especially within six months of surgery, (2) unstable angina or moderate to severe stable angina, (3) history of pulmonary edema, (4) critical aortic stenosis, (5) the presence of arrhythmias on electrocardiogram, and (6) poor general medical status.<sup>72,81,85</sup> Strategies to decrease cardiac complications in the surgical patient include controlling uncompensated congestive heart failure without depleting vascular volume, recognizing postoperative symptomatic and silent myocardial infarction, controlling angina, evaluating the significance of aortic stenosis by echocardiogram or catheterization, and correcting metabolic and electrolyte abnormalities and anemia preoperatively.<sup>72</sup> Elective surgery should be delayed until six months following a myocardial infarction because of the increased risk of reinfarction.<sup>72,86</sup>

### Functional Status

Postoperative rehabilitation begins with preoperative evaluation of the elderly surgical patient's ability to perform tasks. Information about the patient's present abilities can be obtained from questioning and from direct observation of the patient prior to surgery. In some cases it is useful to speak with family and others who know the individual to obtain a clear view of the person's abilities in their home environment. Potential for recovery of function will depend upon the patient's preoperative abilities as well as the particular pathological problem necessitating the surgery. For example, the postoperative ex-

**TABLE 1. GUIDELINES FOR FUNCTIONAL ASSESSMENT: ACTIVITIES OF DAILY LIVING**

<i>Can the patient independently perform each activity? If not, what level of assistance is required?</i>	
Function	Activity
Care of self	Feeding Bathing Toileting
Mobility	Ability to ambulate (is assistive device necessary?) Ability to transfer (bed to chair or standing)
Continence	Continent of urine Continent of feces

*Adapted from Katz S, Ford AB, Moskowitz RW, et al.<sup>87</sup>*

**TABLE 2. GUIDELINES FOR FUNCTIONAL ASSESSMENT: INSTRUMENTAL ACTIVITIES OF DAILY LIVING**

<i>Can the patient independently perform each activity or is assistance required from others?</i>	
Area of Function	Activity
Inside the home	Cooking Cleaning Laundry Medications Telephone
Outside the home	Shopping Transportation

*Adapted from Lawton MP, Brody EM.<sup>88</sup>*

Expectations for the patient with a hip fracture will depend upon the type, location, and severity of the fracture as well as the patient's ability to ambulate prior to incurring the fracture. The individual's ability to follow instructions and to perform other activities less directly necessary for rehabilitation can also be assessed and problems anticipated preoperatively. Design of postoperative physical, respiratory, and occupational therapy can then be tailored to the individual patient.

Many scales exist for the purpose of measuring a patient's physical functioning. The Katz Activities of Daily Living (ADL) Scale measures the ability of the patient to eat, bathe, dress, transfer, and toilet and also includes a measure of continence. Broader measures include instrumental activities of daily living such as shopping, house-keeping, transportation, and management of finances.<sup>87,88</sup> Factors to include in preoperative functional assessment are listed in Tables 1 and 2.

**Nutritional Status**

Inadequate nutrition can affect surgical outcome and increase the potential for complications.<sup>89,90</sup> Caloric needs postoperatively are generally increased.<sup>91</sup> The rate of wound healing is also directly related to proper nutrition in the recovery period.

A large variety of nutritional patterns occur in elderly individuals.<sup>92</sup> Problems in this age group can include vitamin and mineral deficiencies as well as protein-calorie malnutrition.<sup>92,93</sup> The purpose of preoperative nutritional assessment is to detect those patients with malnutrition so that the effect on surgical risk and complications is decreased.<sup>94</sup>

An assessment of the patient's dietary patterns and preoperative nutritional state is important to increasing the opportunity for a successful surgical outcome. A brief history of the patient's eating habits, an assessment of body habitus, and serum levels of total protein, prealbumin, albumin, and transferrin can provide clues to inadequate nutritional status. Other significant factors include absolute weight loss of more than 10 percent in the previous six months, delayed hypersensitivity response to skin test antigens, and a total lymphocyte count of less than  $1.5 \times 10^9/L$  ( $1.5 \times 10^3/\mu L$ ).<sup>94,95</sup> If serious malnutrition is detected, and surgery can be safely postponed until the individual's nutritional state can be improved, this course should be followed. Current recommendations include a minimum of seven to ten days of preoperative nutritional repletion in the moderately malnourished patient.<sup>95</sup> If surgery cannot be delayed, and a prolonged interval without nutrition is entertained, parenteral or enteral hyper-alimentation should be instituted.

**Emotional and Cognitive Status**

Given the high potential for mental status impairment in the form of postoperative delirium or acute toxic confusional state in the elderly patient, knowledge of baseline cognitive functioning is important in evaluating any acute deterioration in the postoperative period.<sup>96</sup> An assessment of the patient's cognitive function can be easily performed preoperatively. This assessment can be accomplished by using the standard techniques for mental status assessment in the neurological examination.<sup>97</sup> Instruments for assessment of cognitive status include the Mini-Mental State<sup>98</sup> and the Short Portable Mental Status Questionnaire.<sup>99</sup> These instruments offer the advantage of a standardized instrument, but the time required for implementation limits their use in the perioperative period.<sup>98,99</sup> Simple clinical strategies for assessing mental status include (1) orientation to person, place, and time, (2) the ability to list five items, eg, cities, fruits, vegetables, and (3) the ability to remember and recall three objects after a short period (Table 3).

TABLE 3. GUIDELINES FOR COGNITIVE AND EMOTIONAL ASSESSMENT

Cognitive Assessment	Emotional Assessment
Orientation to self—Ability to state full name (first, middle, last) Orientation to time—Season, year, month, date, day of the week Orientation to place—State, county, city, facility or building Remote memory—Date and place of birth, grade-school teacher Intermediate memory—Recall of breakfast, lunch, or dinner Ability to name five items in a class—For example, fruits, vegetables, cities Ability to remember and recall three objects—For example, apple, table, penny	Understanding of problem requiring surgery Expectations of postoperative course Understanding of rehabilitation process Level of anxiety regarding surgery Personal approach to coping with stress Previous history of depression requiring treatment History of depressive symptoms (sleep problems, mood swings, appetite changes) History of psychotropic drugs and alcohol use Systems of personal and family support

Emotions and feelings are much more difficult to measure, but their importance as a factor in patient motivation during the recovery and rehabilitation period provides the reason for their inclusion in preoperative assessment.<sup>100</sup> Assessment should include the patient's understanding of the proposed surgical procedure and the reason for this particular method of treatment. Developing an understanding of the patient's perceptions or explanatory model of the illness can help with preoperative preparation of the patient for postoperative changes.<sup>101</sup>

Affective domains to be included in preoperative assessment include the clinician's opinion of the levels of anxiety and fear, depression and sadness, and hostility and anger.<sup>102</sup> Should a significant affectual disorder be detected, a review of medications may provide a clue to the cause of the problem. For example,  $\beta$ -blockers have been associated with depression. Finally, if significant emotional problems are detected, a psychiatric evaluation can be helpful in developing strategies for assisting the patient through the surgical period.

**Laboratory Evaluation**

Many articles have been written regarding routine laboratory testing.<sup>103-107</sup> The focus of these articles has been on cost-effectiveness and the low yield of this routine. The elderly patient, by virtue of altered physiology, increased pathology, and potential effects of treatments, has a high yield of abnormalities with routine laboratory evaluation.<sup>76</sup> Preoperative laboratory evaluation in the elderly patient should include a complete blood count, serum electrolytes, glucose, blood urea nitrogen, creatinine and albumin, and urinalysis. Other tests should be performed if the history and physical examination suggest potential problems. Examples include coagulation studies in the case of suspected liver disease, arterial blood gas mea-

surement in the patient with significant pulmonary dysfunction, prealbumin and transferrin in the patient suspected of malnutrition. Laboratory abnormalities, including electrolyte disturbances and significant anemias, should be corrected prior to surgery.<sup>108</sup>

The chest x-ray examination is a high-yield procedure in an elderly population. In a recent study of 100 patients 70 years of age or older, abnormalities were detected in 47 percent of chest films.<sup>109</sup> Twenty-seven of these abnormalities occurred in individuals not suspected of the problem from their medical background. Findings included cardiomegaly, pulmonary disease, and pleural effusion. Preoperative chest x-ray examination can add important clinical information by detecting unsuspected problems at minimal cost to the patient, and by directing preoperative interventions to the management of these problems.<sup>109-111</sup>

The electrocardiogram can provide additional information about the patient's cardiovascular status that can be added to the data already acquired through the history, physical examination, and laboratory evaluation. The electrocardiogram is a good tool for detecting cardiac problems, and its relatively low cost and high yield lead to its inclusion in preoperative assessment.<sup>111,112</sup> Yet, in a study of the impact of newly detected electrocardiographic abnormalities on clinical decision making, the detection of an abnormality on the preoperative electrocardiogram affected patient management in only two of 165 cases.<sup>113</sup> The information from the electrocardiogram, when combined with other clinical data, can be used to decide whether further cardiac evaluation should be considered preoperatively. For example, the elderly patient with an aortic stenosis murmur on examination and left ventricular hypertrophy with a strain pattern on the electrocardiogram would benefit from a further assessment of valve function and cardiac output. An echocardiogram with Doppler studies and a cardiology consultation may be beneficial preoperatively.

TABLE 4. ESSENTIALS OF PREOPERATIVE EVALUATION

**Disease Processes and Physiologic Status**

- History and physical examination
- Complete blood count with differential
- Chemistry panel (including electrolytes, glucose, blood urea nitrogen, creatinine)
- Urinalysis
- Chest x-ray examination
- Electrocardiogram
- If indicated
  - Coagulation studies
  - Liver function tests
  - Serum levels of medications (ie, digoxin, quinidine)
  - 24-hour urine for creatinine clearance
  - Pulmonary function tests and arterial blood gases
  - Echocardiogram
  - Swann-Ganz catheterization
  - Other tests that may be indicated by the specific patient's disease processes

**Functional Status**

- Performance of Activities of Daily Living
- Performance of Instrumental Activities of Daily Living

**Nutritional Status**

- Dietary history
- Weight loss of 10% or more in past six months
- Body habitus
- If evidence of malnutrition
  - Measurement of total protein, albumin, prealbumin, transferrin, calcium, phosphorus, magnesium, vitamin B-12, and folic acid

**Cognitive and Emotional Status**

- Assessment of cognitive functioning
- Assessment of patient's understanding and expectations of the procedure, postoperative course, and rehabilitation requirements
- Level of anxiety and depressive symptoms

**Prophylactic Measures**

- Prophylaxis for deep vein thrombosis and pulmonary embolus
- Preoperative instruction in incentive spirometry and chest physiotherapy
- If indicated
  - Prophylactic antibiotics for endocarditis prevention
  - Prophylactic antibiotics for patients with artificial grafts and joint prostheses

**PROPHYLAXIS AND PREVENTION**

If the patient's history, examination, and chest x-ray studies indicate moderate to severe pulmonary disease, if there is a history of cigarette smoking, or if thoracic and upper abdominal surgery are to be performed, pulmonary function and arterial blood gas testing are indicated. Pulmonary function testing and arterial blood gas measurement should also be considered in the patient who is obese, malnourished, and for whom prolonged anesthesia time is anticipated.<sup>72,77,78,114</sup> These tests can define specifically the degree of impairment of the respiratory system and are useful in predicting pulmonary complications.<sup>73</sup> A forced expiratory volume in one second (FEV<sub>1</sub>) of less than 15 cc/kg (approximately 1,000 cc) is predictive of pulmonary complications.<sup>73</sup> The patient's responsiveness to bronchodilators can be determined, and if bronchospastic disease is detected, function can be improved preoperatively through the use of aerosols and pulmonary

toilet. Other indications for arterial blood gas determination include electrolyte abnormalities or an increased bicarbonate level. Clinical strategies that are indicated to decrease pulmonary morbidity include (1) smoking cessation, (2) preoperative and postoperative use of bronchodilators in the patient with bronchospastic disease, (3) preoperative and postoperative chest physiotherapy including incentive spirometry, coughing, and deep breathing, (4) preoperative instruction in physiotherapy techniques, (5) preoperative treatment of pulmonary infection and purulent sputum, and (6) early postoperative ambulation.<sup>72</sup>

The patient's risk for pulmonary embolus as a postoperative complication should be reviewed preoperatively. Factors in the surgical patient that predispose to deep vein thrombosis include age older than 40 years, surgery time longer than 30 minutes, a previous deep vein thrombosis or pulmonary embolus, prolonged immobilization, paralysis, malignancy, obesity, varicose veins, and estrogen



use.<sup>115</sup> The incidence of deep vein thrombosis has been estimated at 40 to 55 percent for total hip replacement and hip fracture and 20 to 30 percent for general surgical procedures.<sup>115</sup> Strategies to decrease risk include exercise and early ambulation, elastic stockings, low-dose heparin, heparin plus dihydroergotamine, warfarin, aspirin, dextran 70, and external pneumatic compression.<sup>115,116</sup> Standard heparin prophylaxis and the use of aspirin are not recommended for prophylaxis in orthopedic patients. The National Institutes of Health Consensus Development Conference recommends that the physician select warfarin, dextran 70, adjusted low-dose heparin, or external pneumatic compression in this situation.<sup>117</sup>

Prophylactic use of antibiotics may be indicated in the elderly surgical patient. Antibiotic prophylaxis to prevent endocarditis is indicated in patients with valve disease, such as aortic or mitral stenosis and insufficiency, common problems in elderly individuals. Other indications include idiopathic hypertrophic subaortic stenosis, congenital cardiac malformations, mitral valve prolapse, prosthetic valves, surgically constructed systemic-pulmonary shunts, and a history of previous infective endocarditis. Antibiotic prophylaxis is indicated for any procedure involving gingival bleeding, surgical procedures and biopsies of the respiratory mucosa (including endoscopic biopsy), procedures involving gastrointestinal and genitourinary instrumentation or surgery, and incision and drainage of infected tissue.<sup>118</sup> The choice of antibiotic used depends upon the site of the procedure, potential pathogens, antibiotic sensitivity, drug allergy history, toxicity, and pharmacokinetics.<sup>119</sup> The prophylactic use of antibiotics is also indicated in the elderly patient with a joint prosthesis who will undergo surgery.

Patients with evidence of functionally significant cardiovascular or pulmonary problems resulting from altered physiology or disease processes should be considered for Swan-Ganz catheterization to maximize cardiovascular functioning prior to major abdominal and thoracic procedures.

Table 4 summarizes the approach to preoperative evaluation in the elderly patient.

## CONCLUSIONS

Preoperative assessment is aimed at maximizing the elderly patient's chances of a successful surgical outcome. Diligent physical assessment in conjunction with judicious laboratory assessment provide the basis for this process in the elderly patient. The older patient poses significant challenges to the clinician due to the increased numbers of pathological processes seen with increasing age and due to the alterations in physiology that affect pharmacodynamics and system reserves. The cardinal principles of preoperative evaluation are: (1) assessment of the patient's

physiological status, (2) detection and definition of the presence and degree of pathological processes, and (3) assessment of the patient's nutritional, cognitive, and emotional status. The purpose of the assessment is to design appropriate interventions to maximize the elderly surgical patient's overall functioning so that the best possible surgical outcome is achieved.

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**Oxford Textbook of Medicine (2nd Edition) (Volumes I and II).** *Weath-erall DJ, Ledingham JGG, Warrell DA (eds).* Oxford University Press, New York, 1987, \$135.

This monstrous textbook of medicine, two 3-inch volumes of over 3300 pages, is largely disappointing. The organization and emphasis are classic: diseases by organ system and pathophysiology. The information on the biological mechanisms of diseases and the physiologic foundations of laboratory testing and drug therapy is very detailed and useful for readers in search of such comprehensive coverage. The ample figures, roentgenograms, scans, etc, provide the complementary visual information necessary to comprehend fully the written material. As a reference source on what is known about disease processes and what is possible diagnostically and therapeutically, this text is very acceptable and does belong in every medical library.

This textbook does not belong in every physician's library, however, for it has major weaknesses. Despite its focus and detail, it has not been helpful in several unusual clinical situations. For example, it provides no useful guidance for the clinical and laboratory distinction between atrial myxoma and vegetations or for the differential diagnosis of isolated elevation of GGTP. Even more disturbing is the complete omission of probabilistic data. Bayes's theorem is mentioned in passing with only one figure on the general relationship between prevalence and predictive value. The section on cardiology in particular ignores all of the extensive work in that field on test performance measures, clinical prediction tools, and decision analysis. The virtually complete lack throughout the book of any information on prevalence, relative risks, sensitivity, specificity, and likelihood of outcomes is striking for a modern textbook of medicine. Even though an individual reader may not choose to use probabilistic data in his or her decision making, a text that provides little or none of this information is not fully state of the art.

The book's suggestions for clinical evaluation and treatment of specific conditions are typically general in nature and reflective of subspecialty, referral practice. This is not a practical how-to book for primary care physicians; rather, in explaining the scientific basis of our options, it is more of a "why" book. It is also nearly exclusively a textbook of biological disease, for the chapters on nutrition, reproduction (pregnancy), and psychiatry are only 60 pages each, and those on sports medicine, old age, and terminal care are only about 10 pages each.

Considering its cost and the volume of material it contains, this book has been remarkably unhelpful and unused through several months of clinical problem-solving.

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**Current Medical Diagnosis & Treatment 1988.** *Steven A. Schroeder, Marcus A. Krupp, Lawrence M. Tierney, Jr. (eds).* Appleton & Lange, Norwalk, Connecticut, 1988, 1123 pp., \$32.50 (paper). ISBN 0-8385-1344-1.

This book represents the 27th annual edition of a well-known and widely utilized general adult medicine text that emphasizes practical, day-to-day clinical management issues. The current edition features specific chapter revisions, updated drug information and bibliographies, and an expanded, although still brief, section on AIDS.

The first few chapters provide general information on patient care, including health screening and disease prevention, pain management, geriatric medicine, and fluid or electrolyte management. Sixteen chapters cover virtually all aspects of internal medicine, by organ system, in addition to obstetrics and gynecology. The essentials of specific diseases or disorders, including diagnosis, general considerations, clinical findings, differential diagnosis, treatment, and prognosis, are presented in a format that clearly highlights each section. Other chapters feature discussions of nutrition,

infectious diseases and their treatment, poisoning, medical genetics, and malignant and immunologic disorders.

Although the volume has well-organized and appropriate tables in various sections, there are no photographs or reproduced diagnostic tests such as x-ray studies or magnetic resonance imaging scans. The appendix, in addition to a listing of normal laboratory values, offers especially useful information regarding the interpretation of abnormal values.

This text, given its breadth and organizational format, is an excellent ready reference in the immediate management of adult patients for a range of individuals, including medical students, family medicine residents, practicing family physicians, and allied health professionals. Readers, particularly students and house-staff, should supplement this volume with readings indicated in the bibliographies as well as a general medicine text, eg, Harrison's *Principles of Internal Medicine*, which provides more extensive information regarding disease epidemiology and pathophysiology.

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**Comprehensive Gynecology.** *William Droegemueller, Arthur Herbst, Daniel Mishell, Jr., Morton Stenchever. C. V. Mosby Company, St. Louis, 1987, 1149 pp., price not available.*

*Comprehensive Gynecology* is just that. Its comprehensiveness results from covering the content of gynecology, emphasizing a sensitive approach to the individual patient, and synthesizing the diverse backgrounds and experiences of the authors. Nothing appears to be left out, be the topic anatomy or menopause. This thoroughness is undoubtedly due to the scholarly pursuit of the authors and their demanding agreement with each other as to the final presentation of each section of the text. Conversely, very little extraneous or redundant information creeps in because of the authors' fine attention.

The text makes liberal use of figures, tables, and pictures, which lend clarity to the topics of discussion. The bibliography is current and adequate. The index is much larger than observed in texts of comparable size and focus.

Two unique features make this text of interest to residents and medical students. First, at the beginning of each chapter there is a list of key terms and definitions, typically confined to one page. They facilitate reading and comprehension of the chapter. Second, there is a list of key points at the end of each chapter. These points are comparable to the summaries seen in other texts. I like this format, however, since it serves as a self-test for comprehension of the chapter. Furthermore, the key points could serve as a rapid review for tests or ward rounds.

The text is easy reading. This book is a jewel for any clinician who provides care for the female patient. Its teaching aids are particularly useful in helping the student master the complexities of gynecology. The primary physician will find sufficient detail to be contemporary in making diagnoses and offering treatment.

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**Interpretation of Arrhythmias: A Self-Study Program.** Emanuel Stein. Lea & Febiger, Philadelphia, 1988, 160 pp., \$14.50 (paper). ISBN 0-8121-1143-5.

This book is an elementary study guide to the interpretation of arrhythmias as seen on a monitor strip. It begins with a rudimentary explanation of the electrophysiology underlying electrocardiography. Wave nomenclature and rate and interval measurement are next explained. Common rhythm patterns are then defined, generally using a five-part scheme for rhythm identification based on the P wave, PR interval, QRS complex, rhythm, and rate. The final chapter contains 12 practice recordings for analysis.

The book is mostly set in very large type with large illustrations on more

than one half of the pages. With only 160 pages, the content is quite limited. There is scarcely any clinical correlation presented, and 12-lead recordings, even in the context of arrhythmia analysis, are not dealt with. Several rhythm problems commonly encountered, including analysis of paced rhythms and differentiating ventricular from aberrantly conducted supraventricular rhythms, are not discussed.

This book would be most helpful for students of nursing or allied health professions (especially any with visual impairments) wanting a fundamental understanding of rhythm interpretation. Medical students encountering difficulties with more rigorous texts of electrocardiography may also find this book to be a useful primer.

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**Office Gynecology (3rd Edition).** Robert H. Glass (ed). Williams & Wilkins, Baltimore, 1988, 362 pp., \$47.95.

Before reading *Office Gynecology* I wrote down a series of questions from my recent practice experience. Among them, those concerning the following issues were addressed in this text in a clear and concise fashion: dysfunctional uterine bleeding, in different age groups, dyspareunia, the role of pH testing for vaginitis, and problems surrounding the menarche and menopause. Still obscure are answers to my remaining questions about techniques in pediatric gynecology, management of the atypical Papanicolaou smear, use of the morning-after pill, diethylstilbestrol screening guidelines, and management of vulvar lesions.

*Office Gynecology* shows the inconsistency of many multiauthor textbooks in that it contains excellent discussions of dysfunctional uterine bleeding, amenorrhea, vaginitis, sexual counseling, and hirsutism, but weak discussions of Papanicolaou smear management, pediatric gynecology, urinary tract infections, and osteoporosis. I was particularly surprised by the recommendation

that postmenopausal women receive yearly screening with dual photon densitometry, which is a controversial issue at best.<sup>1</sup> Finally, as happens in many textbooks, some of the guidelines for treatment of sexually transmitted diseases are already out of date.

*Office Gynecology* would be a useful addition to the office for the specified areas of practice mentioned above, but cannot be relied upon as a comprehensive adjunct to gynecologic care.

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**Nutrition, Weight Control, and Exercise (3rd Edition).** Frank I. Katch, William D. McArdle. Lea & Febiger, Philadelphia, 1988, 342 pp., \$23.50 (paper).

In *Nutrition, Weight Control, and Exercise*, the authors present the very close interrelationship between the three elements in the title through an appealing combination of multiple graphs and illustrations. For the family physician who has a particular interest in this area, it is an extremely useful and relatively inexpensive textbook.

The organization and readability of this textbook are excellent. The authors present in an oftentimes simplified form the basic concepts of exercise physiology that make it an extremely readable textbook. The numerous illustrations are not only excellent, but pertinent to the flow of the manuscript.

Because of its format, family physicians interested in sports medicine, nutritionists, and exercise physiologists will enjoy having this textbook in their own personal library.

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