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Geriatric Anesthesiology

Second Edition

Springer

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To my Grandparents, Regina and David Silverstein and Blanche and Daniel Klein, MD. Their love and their sufferings provided endless opportunities and insights. I hope, and believe, they would have liked this result.

—JHS

To my Children, Douglas and Linnea.

—GAR

To Margaret Cathcart and her late Husband, Dr. John W. Cathcart.

—JGR

To my Parents, Marion and Hamilton McLeskey, who encouraged care and consideration for our elderly.

—CHM

Preface to the Second Edition

Do not go gentle into that good night,
Old age should burn and rave at close of day;
Rage, rage against the dying of the light.
Dylan Thomas

The goal of getting older is to age successfully. Unfortunately, the majority of our older patients will have acquired one or more chronic medical conditions as they age, and, even if a perfectly healthy older patient presents for surgery, that patient's ability to handle physiologic stress will be diminished, including the stress of surgery. Nearly half of all surgical procedures involve patients older than age 65, and that percentage is likely to increase as the U.S. population ages. Thus, the perioperative care of the older patient represents one of the primary future frontiers of anesthetic practice. Even though perioperative mortality has diminished for the elderly, as well as for the population in general, the growing number of cases spotlights perioperative morbidity and mortality as an important issue for patients and health care systems alike. The vision set forward by the first edition (i.e., to apply the growing body of knowledge in this subspecialty area to the everyday practice of anesthesiology) remains the mission and vision of this second edition. The editors believe that the updated contents of this edition represent an important opportunity to consolidate and organize the information that has been acquired since 1997 and to apply that knowledge to the current practice of anesthesiology.

Part I contains several new chapters on topics that may not always seem to be directly involved with anesthetic care, but are important to the future of medical and anesthesia care. An understanding of the aging process may lead to methods of slowing its progression, or at least of ameliorating some of its consequences, including the development of chronic disease. Most anesthesiology residency programs provide limited formal teaching of geriatric anesthesia. The editors believe the incorporation of relevant subspecialty material in the anesthesiology curriculum is needed to improve care for this patient population. The realities of reimbursement for services rendered to the older patient, either by Medicare or other payers, warrant the attention of all anesthesiologists who provide care for older patients. Ethics as applied to treatment of the older patient is also addressed. The medical management of this population is often complicated by issues such as patient goals that differ from physician expectations, physician "ageism," patient cognitive impairment, and the physician's failure to recognize the true risk of surgery and attendant recovery time. The last chapter of Part I reviews current knowledge and suggests research areas where the greatest impact on patient outcomes might be realized.

Parts II and III review the physiology of aging and the basic anesthetic management of the geriatric patient, and Part IV examines selected surgical procedures

frequently performed in older patients. Not all of these chapters are specific to anesthetic management. Geriatric medicine is a broad field with many relevant topics. Wound healing is a perfect example. The reality is that anesthesiologists can likely have a positive impact on patient care by being better able to recognize conditions that may compromise skin when other medical professionals may fail to and, as a result, can improve protection of the skin, especially during long operating room cases. In contrast, polypharmacy and drug interactions, major topics in geriatric medicine, have direct relevance to anesthetic management. The cardiac surgery chapter is an example of how age affects outcomes after a specific type of surgical procedure. The unusual aspects of anesthetic management for cardiac surgery revolve mostly around the patient's underlying disease status rather than there being anything specific to cardiac anesthesia in the older patient beyond the principles delineated in Parts II and III.

For chapters similar to those in the first edition, an effort has been made to update content and incorporate studies that examine outcome. Such work helps us challenge conventional wisdom and sometimes test novel ideas that prove beneficial. Even the most casual reader of this textbook will recognize huge gaps in our present knowledge. It is not sufficient, for example, to take an understanding of the physiology of aging and draw conclusions regarding anesthetic management from that information. Oftentimes, however, we are forced to do just that when making anesthetic management decisions. The editors hope the future will provide better research and answers that advance the field of geriatric anesthesiology.

The editors thank the many authors of this text. In addition to their hard work, they responded to entreaties for revisions and updates with admirable patience and promptness. Their contributions expand our knowledge and will improve the care of elderly patients.

Lastly, the editors thank Stacy Hague and Elizabeth Corra from Springer. Without their vision and determination, this book would not exist.

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Preface to the First Edition

Approximately 14% of the current U.S. population is 65 years of age or older. By the year 2020, it is predicted that 20% or 60,000,000 Americans will reach this milestone. Further, if today's statistics continue unchanged, at least half of these individuals will undergo anesthesia and surgery, likely of increasing complexity, prior to their eventual demise. The geriatric patient population represents a huge and growing challenge for anesthesia providers the world over.

My interest in the anesthetic management of geriatric patients was kindled 15 years ago while on the faculty at Bowman Gray. One of our surgeons asked me to anesthetize his healthy 72-year-old father. All went well in the intraoperative and postoperative periods and he was discharged home in the customary time frame. However, my colleague later reported that he had observed subtle psychomotor changes in his father which persisted postoperatively for 7 weeks. It dawned on me that perhaps the geriatric patient is not simply an older adult, but rather, a truly different physiologic entity. What could explain the relatively commonly observed delayed postoperative return of normal mentation in the geriatric surgical patient? It is this and other unanswered questions regarding the anesthetic management of the elderly that stimulated the development of this text.

Geriatric Anesthesiology is designed to be a comprehensive text that methodically addresses the aging process while emphasizing important clinical anesthetic considerations. The first two sections of the text define the demographics of our aging population and describe age-related physiologic changes that occur in each major organ system. The third section addresses the multitude of factors that contribute to a safe and successful anesthetic with suggested adjustments in technique that may improve anesthetic management of the elderly. Topics range from preoperative evaluation and risk assessment to the altered effects of various classes of drugs with further discussion regarding positioning, thermoregulation, perioperative monitoring, and postoperative recovery. In addition, issues such as management of pain syndromes, outpatient anesthesia, medicolegal implications, and even special CPR techniques in this age group are considered. The fourth section identifies the ten most commonly performed surgical procedures in the elderly, and for each, offers recommended anesthetic techniques. The text ends with an intriguing exploration into future research opportunities in the field, including molecular mechanisms of aging.

Considerable energy has gone into the creation of this text. I am grateful for the significant efforts made by all the contributing authors and especially appreciate contributions made by the editors from Williams & Wilkins. The text would have been impossible to complete without the encouragement, dogged determination, and professionalism of Ms. Tanya Lazar and Mr. Carroll Cann. Tim Grayson was innovative and supportive during the original design and formulation of this project.

I am optimistic that this text will heighten the awareness of the very real clinical differences presented by the geriatric patient population. Perhaps by referring to appropriate sections in this text, anesthesia providers will be armed with a better understanding of the physiologic changes of aging and the recommended considerations and modifications of anesthetic technique, which we hope will contribute to an ever-improving outcome for the geriatric surgical patient population.

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Part I
Introduction to Clinical Geriatrics

1
The Practice of Geriatric Anesthesia

Jeffrey H. Silverstein

The approach to and management of surgery and anesthesia in geriatric patients is different and frequently more complex than in younger patients. In caring for the elderly in the operating room, recovery room, and intensive care unit, the members of the perioperative medical team should be aware of the nature of aging physiology, the interaction of these alterations with pathologies, and the likelihood of multiple diagnoses and polypharmacy. The context of geriatric care encompasses multiple levels, stretching from primary care, through acute hospitalization, acute and subacute rehabilitation, nursing home care, and hopefully back to sufficient function to require additional primary care. By the nature of their practices, anesthesiologists and geriatricians have different approaches to patient care and the time frame over which such care occurs. In communicating with patients and geriatricians, one should understand that expectations for recovery are frequently different than in younger patients, marked by issues of maintenance of function and independence. There is an evolving understanding that specific approaches taken in the perioperative period have an impact that remains apparent months to years following surgery. Integrating care across this continuum can be difficult but invariably improves patient outcomes.

Geriatric medical care has evolved from an empiric specialty in the 1950s and 1960s to a largely evidence-based practice today. An excellent short reference guide called *Geriatrics at Your Fingertips* is available in a small pocket edition as well as on the Internet[1] (http://www.geriatricsatyourfingertips.org/). Perioperative geriatrics, however, is very much at the beginning of the process of developing sufficient primary data on which to base practice guidelines. There are few randomized controlled trials that provide class I evidence regarding perioperative care of the elderly, leaving the practitioner to extrapolate data from literature that has accumulated on geriatric care in other contexts, from retrospective reviews, and from the nonoperative geriatric literature.

This introductory chapter presents some of the common concepts of geriatrics and a general approach to caring for geriatric patients presenting for anesthesia and surgery. Virtually every chapter in this book elaborates on this foundation chapter. In approaching the elderly as patients, the anesthesiologist must understand that there is tremendous heterogeneity or variability in aging, both in the body as a whole as well as in individual systems. Thus, the alterations described in this and the following chapters are likely, on average, to be present in geriatric surgical patients. However, each individual patient will manifest these changes differently. The reader is encouraged to develop expertise and judgment and to identify those areas in need of improved approaches with the goal of developing an evidence-based practice for perioperative geriatrics.

Demography

As a result of nationwide improvements in health care, nutrition, education, and general living standards, the elderly account for an increasing percentage of the United States population (Figure 1-1). One in eight Americans were elderly (age 65 and older) in 1997. By 2030, according to the United States Bureau of the Census, one in five could be elderly. Between 2010 and 2030, as the baby boom generation reaches age 65, anesthesiologists will face a variety of challenges. The fastest-growing segment of the population is that aged 85 and older.

The average life expectancy in the United States is almost 72 years for men and 79 years for women. However, those who reach the age of 65 can expect to live 17.4 more years; a life expectancy of 82.4 years. There are racial disparities in longevity. In the United States, white men who reach age 65 can expect to live 15.7 more

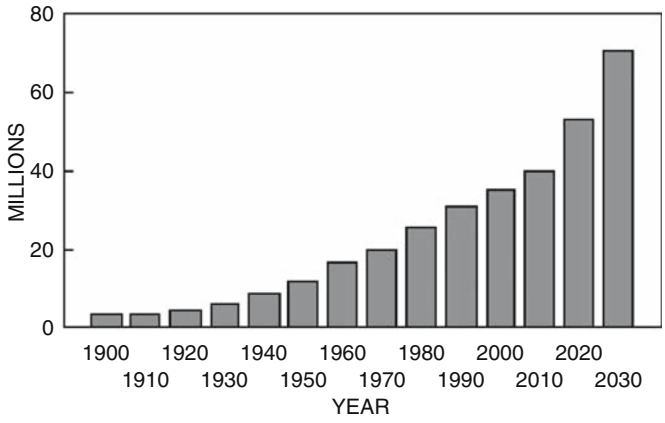

FIGURE 1-1. Growth of the Elderly Population, 1900–2030. (Reprinted from He W, Sengupta M, Velkoff VA, DeBarros KA. U.S. Census Bureau. Current Population Reports, P23-209, 65+ in the United States: 2005. Washington, DC: U.S. Government Printing Office; 2005.)

years whereas black men who reach 65 can expect to live 13.6 more years. Women are generally longer lived than men; however, the racial discrepancy is similar, with 19.4 and 17.6 additional years, respectively, of additional life expected for white and black women who reach age 65.

In 2004, 7.9 million patients over the age of 65 underwent a surgical procedure.[2] The number of patients over the age of 65 years who undergo noncardiac surgery has been projected to increase to 14 million over the next three decades[3] with similar increases expected for cardiac surgery. Seventy years ago, surgery was considered a desperate measure for patients older than 50 years of age, who were thought to be incapable of sustaining the rigors of even an inguinal hernia repair.[4] Advances in anesthesia during the past century have allowed surgeons to develop an extraordinary array of procedures with excellent outcomes in an increasingly aged population. Recent estimates confirm that the amount of surgical activity in the aging population is increasing.[5] Bolstered by the evolving demographics noted above, anesthesiologists can expect an ever-increasing portion of their overall workload to involve geriatric patients.

Definitions of Aging

Aging is a process of gradual and spontaneous change resulting first in maturation and subsequently decline through middle and late life. Senescence is the process by which the capacity for growth, function, and capacity for cell division are lost over time, ultimately leading to death. Aging comprises both a positive component of development (e.g., wisdom and experience) along with the negative component of physiologic and often cognitive decline.

Researchers and clinicians have found advantages in differentiating normal aging from age-related disease processes. Normal aging is those changes measured, on average, across the population. Some of these changes, for example, decrease in muscle mass, occur even in the well-conditioned, exercising elderly. In order to distinguish aging from disease, researchers have had to carefully screen patients for disease processes. This process has allowed gerontologists to determine that many long-held truisms concerning aging were not accurate. For example, it is now clear that aging per se does not involve neuronal loss in the brain, and cognitive decline is not an inevitable aspect of aging. Although it is evident to clinicians that diseases progressively accumulate in aging, many of these processes are no longer considered synonymous with increased age. That is not to suggest that aging is an innocent bystander, that is, that age-related disease accumulation could occur simply as a function of time. Lakatta and Levy,[6] in their studies of cardiac physiology, explained that age-related changes alter the substrate upon which disease processes evolve. In this conception, age affects the severity of disease manifestations for a given time at risk.

In contrast to normal aging, Rowe and Kahn[7] described the idea of successful aging. In successful aging, the deleterious effects of senescence are minimized such that the individuals suffer few of the unwanted features of aging. These individuals are vibrant and active into late age, with limited impairment. The combination of genetic and environmental status that leads to longevity is discussed in the chapter Theories of Aging (Chapter 3). The distinction between normal and successful aging highlights one of the principal phenomena in gerontology: that there is tremendous variability in aging between individuals of a given species. Although it is extremely convenient to categorize and even stereotype

patients by age, chronological age is a poor predictor of physiologic aging.

Currently, morbidity, mortality, and recovery times for elderly patients undergoing surgery are substantially greater than those for younger patients.[8] (See also the section Surgical Outcomes and Functional Decline later in this chapter.) Age frequently alters the presentation of surgical illness. Symptoms of disease may be diminished, ignored, or inappropriately attributed to old age. Obtaining an accurate history can be challenging in the elderly. One of the results of the complexity of the patient population is an increased likelihood of preventable adverse events and consequences.[9] Thus, improving anesthetic care for geriatric patients represents the primary challenge of anesthesiology in the next few decades.

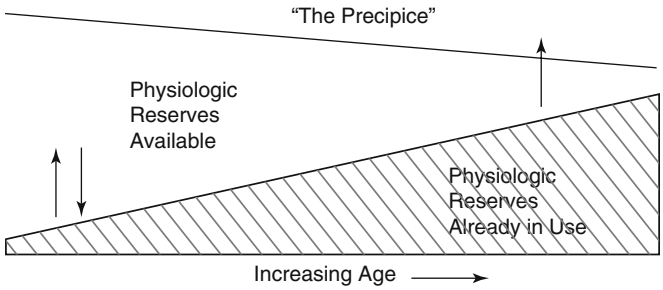

FIGURE 1-2. Schematic of homeostenosis. This diagram shows that maintaining homeostasis is a dynamic process. The older person uses or consumes physiologic reserves just to maintain homeostasis, and therefore there are fewer reserves available for meeting new challenges. (Reprinted with permission from Taffet GE. Physiology of aging. In: Cassel CK, Leipzig R, Cohen HJ, Larson EB, Meier DE, eds. Geriatric Medicine: An Evidence-Based Approach. 4th ed. New York: Springer; 2003.)

General Physiology of Aging

A homeostatic system is an open system that maintains its structure and functions by means of a multiplicity of dynamic equilibriums rigorously controlled by interdependent regulatory mechanisms.[10] Such a system reacts to change through a series of modifications of equal size and opposite direction to those that created the disturbance. The goal of these modifications is to maintain the internal balances. The term homeostenosis has been used to describe the progressive constriction of homeostatic reserve capacity. Another common means of expressing this idea is that aging results in a progressive decrease in reserve capacity. Diminishing reserve capacity can be identified at a cellular, organ, system, or whole-body level. As an example, glomerular filtration rate (GFR) progressively decreases with aging, limiting the capacity to deal with any stress on this excretory mechanism, be that a fluid load or excretion of medications or other toxic substances. Once again, the variability associated with aging is a key modifier of the decrease in physiologic function. So, although in general GFR decreases 1 mL/year, 30% of participants in a large study that defined this change had no change in GFR whereas others showed much greater decrements.[11] The concept of reserve has also been used in describing cognitive function.[12] Taffet has expanded the general interpretation of the decrease in physiologic reserve to emphasize that the reserve capacity is not an otherwise invisible organ capacity but the available organ function that will be used to maximal capacity by the elderly to maintain homeostasis (Figure 1-2). When the demands exceed the capacity of the organ or organism to respond, pathology ensues. This is ever more likely as aging decreases the capacity of any system to respond. The concept of organ reserve will be invoked in many chapters of this textbook.

Frailty

A term frequently applied to elderly patients is "frail." One would expect the frail elderly to be at higher risk for functional decline following surgery. Unfortunately, much like Justice Potter Stewart's 1964 definition of obscenity, most physicians can identify frailty when they see it, but a clinically relevant scientific definition has been elusive. Linda Fried and colleagues[13] have defined frailty, focusing primarily on muscle loss, or sarcopenia, as a clinical syndrome in which three or more of the following criteria are present: unintentional weight loss (10 lbs. in past year), self-reported exhaustion, weakness (grip strength), slow walking speed, and low physical activity. In the initial evaluation of the participants from the Cardiovascular Health Study (5317 men and women 65 years and older), the overall prevalence of frailty was 6.9%.[13] Frailty is perceived, in this context, as a cyclical decline that perpetuates itself (Figure 1-3). Frailty has been described as a form of predisability, which is distinct from functional impairment.[14] However, in the setting of sarcopenia, further muscle loss associated with surgical illness could be functionally disastrous. Indeed, Wolfe[15,16] has recently shown that the catabolic response to the stress of surgery and the subsequent loss of muscle mass is of even greater concern in the elderly. Frailty as a specific measure has not been prospectively characterized as a preoperative risk factor. The American Society of Anesthesiologists physical status score does not easily capture frailty, although clinicians may factor significant frailty into their assessment of a patient's physical status. Current research efforts should help define the relevance of frailty in the assessment and management of elderly patients.

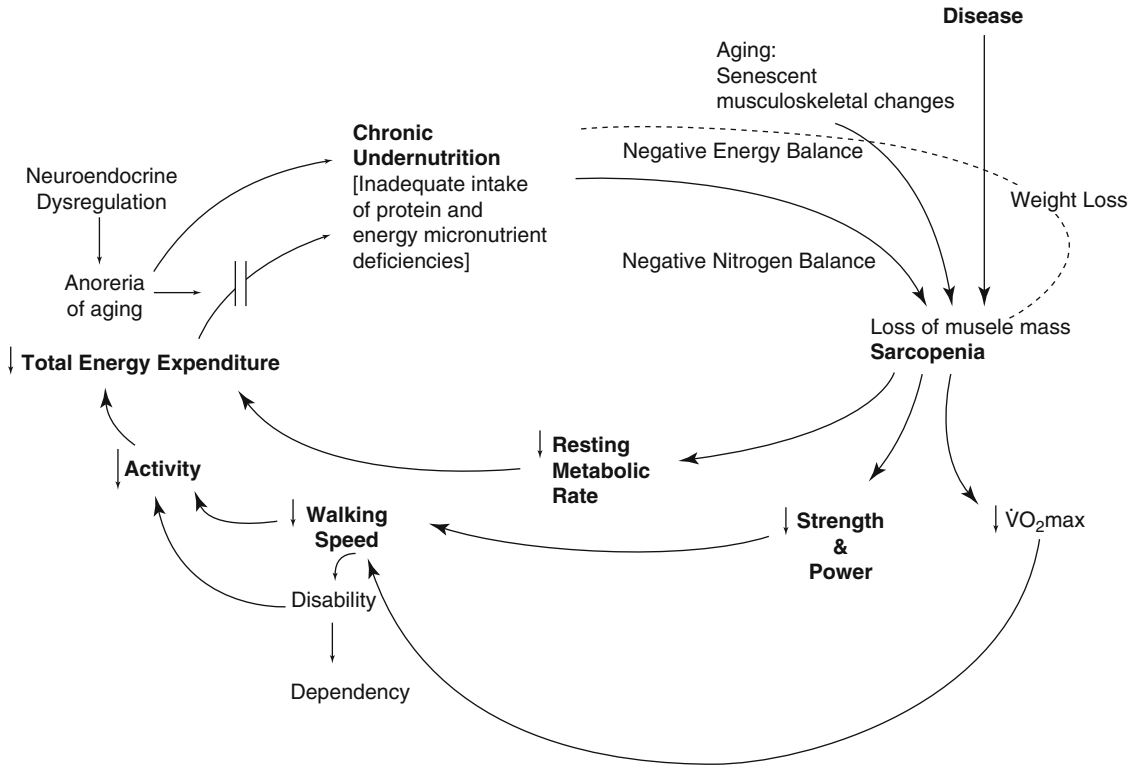

FIGURE 1-3. Cycle of frailty hypothesized as consistent with demonstrated pairwise associations and clinical signs and symptoms of frailty. (Reprinted with permission from Fried LP, Tangen CM, Walston J, Newman AB, Hirsch C, Gottdiener J, Seeman T, Tracy R, Kop WJ, Burke G, McBurnie MA; Cardiovascular Health Study Collaborative Research Group. Frailty in older adults: evidence for a phenotype. J Gerontol A Biol Sci Med Sci. 2001 Mar; 56(3):M146–56.)

Surgical Outcomes and Functional Decline

Traditional surgical outcomes include morbidity and mortality within a defined period following a procedure, frequently 30 days. Data from the Veterans Administrations National Surgical Quality Improvement Program (NSQIP) provides the most current insight into surgical outcomes for elderly patients. Hamel et al.[17] reported on 26,648 patients aged ≥80 (median age 82) and 568,263 patients <80 (median age 62) from the NSQIP database. Thirty-day mortality varied by procedure but was always higher for patients >80 (Table 1-1). Mortality was low (<2%) for many common procedures (transurethral prostatectomy, hernia repair, knee replacement, carotid endarterectomy, vertebral disc surgery, laryngectomy, and radical prostatectomy). The incidence of complications increased, but probably more important was that the impact of complications on mortality and functional recovery increased with age. Twenty percent of patients >80 had one or more complications, and the presence of a complication increased mortality from 4% to 26%. Respiratory and urinary tract complications were the most common.

For the mid- to late-life patient, symptoms and disability are the principal outcomes of most disease processes. They may become the focus of protracted care. In order to conceptualize disability in a format that supports medical and survey research, Verbrugge and Jette[18] elucidated The Disablement Process. The pathway to disability (Figure 1-4) begins with a disease or pathology. Impairments occur at the organ-system level and are dysfunctional and structural abnormalities in specific body systems, such as cardiovascular or neurologic. Functional limitations subsequently occur at the organism, or entire

TABLE 1-1. Thirty-day mortality for operations.

	<80 years	>80 years
General surgery	4.3	11.4
Vascular surgery	4.1	9.4
Thoracic surgery	6.3	13.5
Urologic surgery	0.7	1.9
Neurosurgery	2.4	8.6
Otolaryngological surgery	2.5	8.8
Orthopedic surgery	1.2	8.3

Source: Hamel et al.[17]
Note: Median age for the <80 group = 62 years, median age for >80 = 82 years.

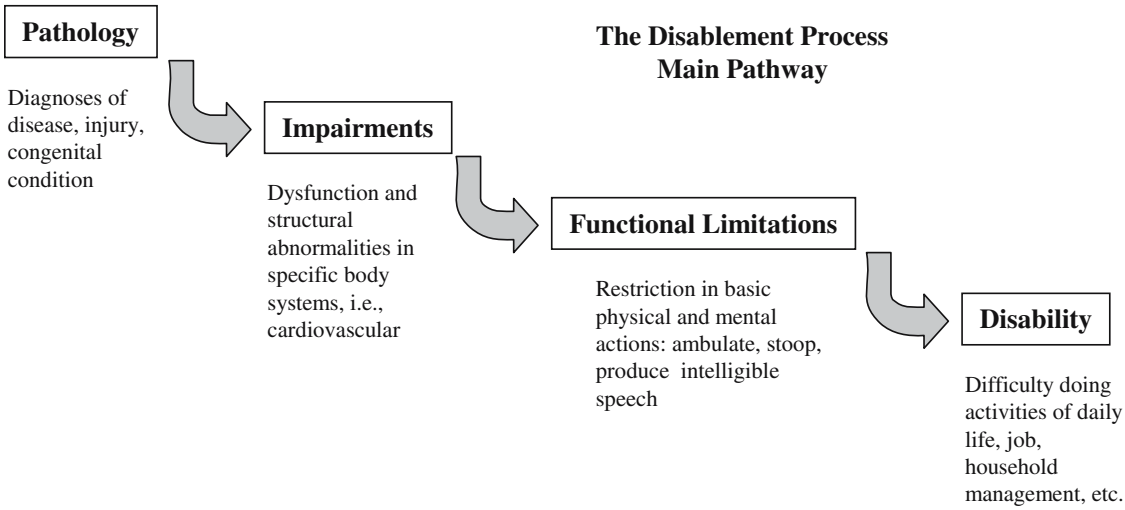

FIGURE 1-4. The disablement process: main pathway. (Adapted with permission from Verbrugge and Jette.[18])

being, level and comprise restrictions in basic physical and mental abilities such as ambulation, reaching, bending, and communicating intelligibly. Disability occurs when there is an insurmountable gap between an individual and environmental demands such that their expected social role is compromised. Intra-individual (e.g., age, socioeconomic status) and extra-individual (e.g., acute medical events, preventive interventions) factors can influence the Disablement Process in either direction. These factors may be preexisting or new occurrences.

The goals of therapy for a geriatric patient are frequently motivated by a desire to avoid disability and preserve or perhaps improve functional status. The most common measures of functional status are called activities of daily living (ADL) and instrumental activities of daily living (IADL)[19] (Tables 1-2 and 1-3). ADLs are those basic activities fundamental to self-care whereas IADLs are those functions necessary to live independently. ADLs and IADLs are subjective reported measures. In a research context, it is common to include objective measures of function to assess strength, time to perform specific activities, or distance covered in a fixed period of time. Measurement of cognitive function by neuropsychologic tests is analogous to measures of physical function. In general medical patients, there has been extensive research regarding both the basis for functional decline as well as approaches to improving outcomes in elderly patients hospitalized for acute illness. Many of the published clinical trials studied variations of the comprehensive geriatric assessment, described below.

The disablement process model is the theoretical basis for a model of elements that influence functional recovery after elective major surgery (Figure 1-5). There are two types of preexisting factors or determinants: 1) variable elements of function that may be modifiable or amenable to interventions; 2) relatively fixed elements in the context of daily living, which shape function and the roles of the variable elements, but may not be feasible targets for improving recovery. Variable elements are a comprehensive array of psychosocial, behavioral, and preoperative biomedical factors that can influence the evolution of function directly or indirectly through their influences on, and/or interaction with, other determinants. These elements are potentially amendable to intervention prior to an elective surgical procedure. Fixed elements are a separate constellation of contextual factors of daily living in which determinants and functional evolution interact and unfold. Anesthesia incorporates pharmacologic techniques to eliminate pain and the stress response attendant to surgical procedures. Within the acute event, there are surgical options (e.g., laparoscopic procedures) that may decrease the stress of the surgical procedure as well as the potential for anesthetic choices that may impact the trajectory of recovery. The model is qualitatively similar to a model for acute medical illness developed by Palmer et al.[20] and provides a framework for the identification of potential interventions to enhance postoperative recovery, prevent disability, and prolong independence in elders undergoing surgery.

The impact of surgery on functional outcomes in elderly patients has been most clearly described by Lawrence et al.[21] in their report on a prospective cohort of 372 patients, 60 years or older, undergoing abdominal surgery by surgeons in private practice and two university-affiliated hospitals in the San Antonio area. The participants were assessed preoperatively and postoperatively at 1, 3, and 6 weeks, 3 and 6 months, using self-report and performance-based measures ADL, IADL, the Medical Outcomes Study Short Form-36 (SF-36) Physical Component and Mental

TABLE 1-2. Activities of daily living. In each category, circle the item that most closely describes the person's highest level of functioning and record the score assigned to that level (either 1 or 0) in the blank at the beginning of the category.

A. Toilet	_____
1. Care for self at toilet completely; no incontinence	1
2. Needs to be reminded, or needs help in cleaning self, or has rare (weekly at most) accidents	0
3. Soiling or wetting while asleep more than once a week	0
4. Soiling or wetting while awake more than once a week	0
5. No control of bowels or bladder	0
B. Feeding	_____
1. Eats without assistance	1
2. Eats with minor assistance at meal times and/or helps with special preparation of food, or in cleaning up after meals	0
3. Feeds self with moderate assistance and is untidy	0
4. Requires extensive assistance for all meals	0
5. Does not feed self at all and resists efforts of others to feed him or her	0
C. Dressing	_____
1. Dresses, undresses, and selects clothes from own wardrobe	1
2. Dresses and undresses self with minor assistance	0
3. Needs moderate assistance in dressing and selection of clothes	0
4. Needs major assistance in dressing but cooperates with efforts of others to help	0
5. Completely unable to dress self and resists efforts of others to help	0
D. Grooming (neatness, hair, nails, hands, face, clothing)	_____
1. Always neatly dressed and well-groomed without assistance	1
2. Grooms self adequately with occasional minor assistance, e.g., with shaving	0
3. Needs moderate and regular assistance or supervision with grooming	0
4. Needs total grooming care but can remain well-groomed after help from others	0
5. Actively negates all efforts of others to maintain grooming	0
E. Physical ambulation	_____
1. Goes about grounds or city	1
2. Ambulates within residence or about one-block distance	0
3. Ambulates with assistance of (check one) a ( ) another person, b ( ) railing, c ( ) cane, d ( ) walker, e ( ) wheelchair 1. _____ Gets in and out without help. 2. _____ Needs help getting in and out	0
4. Sits unsupported in chair or wheelchair but cannot propel self without help	0
5. Bedridden more than half the time	0
F. Bathing	_____
1. Bathes self (tub, shower, sponge bath) without help	1
2. Bathes self with help getting in and out of tub	0
3. Washes face and hands only but cannot bathe rest of body	0
4. Does not wash self but is cooperative with those who bathe him or her	0
5. Does not try to wash self and resists efforts to keep him or her clean	0

Source: Lawton and Brody.[19]

Scoring interpretation: For ADLs, the total score ranges from 0 to 6. In some categories, only the highest level of function receives a 1; in others, two or more levels have scores of 1 because each describes competence at some minimal level of function. These screens are useful for indicating specifically how a person is performing at the present time. When they are also used over time, they serve as documentation of a person's functional improvement or deterioration.

Component Scales (PCS, MCS), Geriatric Depression Scale (GDS), Folstein Mini-Mental State Exam (MMSE), timed walk, functional reach, and hand-grip strength. The mean recovery times were: MMSE, 3 weeks; timed walk, 6 weeks; ADL, SF-36 PCS, and functional reach, 3 months; and IADL, 6 months (Figure 1-6). Mean grip strength did not return to preoperative status by 6 months. This result, that most functional recovery takes 3 to 6 months or longer, provides an indication of the impact that surgery makes on an elderly population. It should be noted that this cohort was accumulated before the popularity of laparoscopic procedures, so the stress of surgery and the recovery period may now be, on average, shorter.

In preparing a patient for surgery, informing him or her regarding the prolonged time that it will take to recover to preoperative status or better can be extremely important. Patients who understand that recovery is a prolonged process are less likely to become discouraged and more likely to continue prolonged efforts to regain strength and endurance.

Approach to the Patient

Although a variety of investigations in elderly patients have explored specific issues in geriatric care, a comprehensive evidence-based approach to the perioperative care of the elderly is not available in 2007. Therefore, the current approach is based on the few studies that have addressed these issues directly, extrapolation from studies

TABLE 1-3. Instrument (independent) activities of daily living. In each category, circle the item that most closely describes the person's highest level of functioning and record the score assigned to that level (either 1 or 0) in the blank at the beginning of the category.

A. Ability to use telephone	_____
1. Operates telephone on own initiative; looks up and dials numbers	1
2. Dials a few well-known numbers	1
3. Answers telephone but does not dial	1
4. Does not use telephone at all	0
B. Shopping	_____
1. Takes care of all shopping needs independently	1
2. Shops independently for small purchases	0
3. Needs to be accompanied on any shopping trip	0
4. Completely unable to shop	0
C. Food preparation	_____
1. Plans, prepares, and serves adequate meals independently	1
2. Prepares adequate meals if supplied with ingredients	0
3. Heats and serves prepared meals or prepares meals but does not maintain adequate diet	0
4. Needs to have meals prepared and served	0
D. Housekeeping	_____
1. Maintains house alone or with occasional assistance (e.g., domestic help for heavy work)	1
2. Performs light daily tasks such as dishwashing, bedmaking	1
3. Performs light daily tasks but cannot maintain acceptable level of cleanliness	1
4. Needs help with all home maintenance tasks	1
5. Does not participate in any housekeeping tasks	0
E. Laundry	_____
1. Does personal laundry completely	1
2. Launders small items; rinses socks, stockings, etc.	1
3. All laundry must be done by others	0
F. Mode of transportation	_____
1. Travels independently on public transportation or drives own car	1
2. Arranges own travel via taxi but does not otherwise use public transportation	1
3. Travels on public transportation when assisted or accompanied by another	1
4. Travel limited to taxi or automobile with assistance of another	0
5. Does not travel at all	0
G. Responsibility for own medications	_____
1. Is responsible for taking medication in correct dosages at correct time	1
2. Takes responsibility if medication is prepared in advance in separate dosages	0
3. Is not capable of dispensing own medication	0
H. Ability to handle finances	_____
1. Manages financial matters independently (budgets, writes checks, pays rent and bills, goes to bank); collects and keeps track of income	1
2. Manages day-to-day purchases but needs help with banking, major purchases, etc.	1
3. Incapable of handling money	0

Source: Lawton and Brody.[19] Copyright by the Gerontological Society of America.
Scoring interpretation: For IADLs, from 0 to 8. In some categories, only the highest level of function receives a 1; in others, two or more levels have scores of 1 because each describes competence at some minimal level of function. These screens are useful for indicating specifically how a person is performing at the present time. When they are also used over time, they serve as documentation of a person's functional improvement or deterioration.

that provide some insight into the broader care of elderly surgical patients, and some general suggestions derived from the experience of the author and his colleagues.

Stanley Muravchik nicely delineated the approach to the preanesthetic assessment of the elderly by specifying an organ-based vertical approach, as opposed to the horizontal approach of traditional diagnostic medicine (Figure 1-7). The specific age-related changes to major organ systems as well as the interaction between aging and disease processes are each covered in individual chapters in this book. For each organ system, the anesthesiologists should determine the functional status and attempt to assess the reserve capacity. In some cases, reserve capacity can be directly tested, as in a cardiac stress test. Many systems, particularly many of the homeostatic mechanisms of concern in the elderly, e.g., the autonomic nervous system, immune system, or even thermoregulatory control, remain difficult to assess. Neither baseline function nor reserve capacity have easily administered tests with reliable results for these systems. Maintenance of intraoperative normothermia can be a challenging goal in some elderly patients, although it is difficult to predict which will be particularly resistant.[22] (See Chapter 8.) The clinician should be attempting to distinguish age-related changes from disease, acknowledging that there are important interactions between the two, and that it can

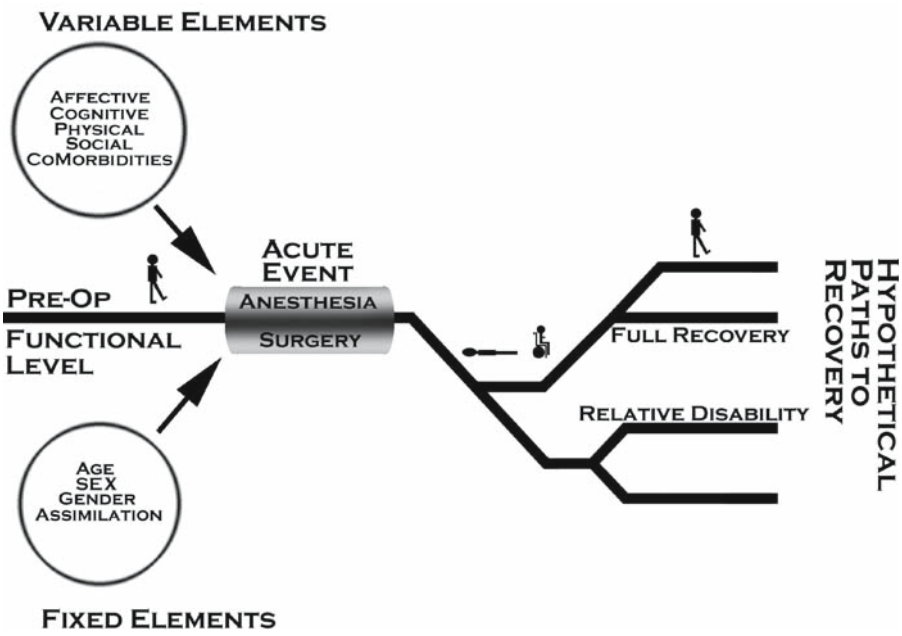

FIGURE 1-5. This model, developed by Valerie Lawrence, MD, from the University of Texas Medical Center at San Antonio, Texas, and Jeffrey H. Silverstein, MD, from the Mount Sinai School of Medicine in New York, divides preoperative elements into those that are potentially variable and those that are not amenable to preoperative alteration. An important aspect is the management of the acute event. The combination of these factors determines the functional outcomes of patients undergoing surgery.

be difficult to determine what is aging and what is actual disease.

In addition to a focus on senescent physiology of standard organ systems, proper evaluation in elderly patients requires attention to areas that are not frequently evaluated in younger patients (Table 1-4). Sometimes it is difficult to imagine an anesthesiologist evaluating a patient's pressure points for early skin breakdown or specifically asking a patient about incontinence. The thrust of this chapter is that *someone* on the perioperative team must be cognizant of these issues. The team taking care of the patient has to have both the acute event and the recovery period as their focus of cooperation.

The skin and musculoskeletal system can undergo tremendous alterations. Up to 10% of elderly patients develop serious skin breakdown during prolonged operations in which pressure is exerted over debilitated areas.[23] Patients with severe arthritis, other limitations of range of motion, or prosthetic joints should, to the extent possible, be positioned on an operating room table in a position they find comfortable before the induction of anesthesia. This avoids severe strain on ligaments and joints that can be severely painful in the postoperative period.

The elderly take a large percentage of the medications prescribed in the United States. Patients frequently consume multiple medications. The management of these medications is frequently chaotic. The patient may present a bag full of prescription bottles and is not totally sure which one they take, or, somewhat more likely, convey a few of the many medications that they have been prescribed. Many of these medications have interactions with drugs used by anesthesiologists in the perioperative period. These issues are presented in some detail in Chapter 14.

Acquiring information can be challenging and may involve discussion with not only the patient, but also their immediate caregiver as well as reference to previous medical records. A comprehensive approach to caring for the geriatric surgical patient may assign some of the assessment goals to the geriatrician, anesthesiologist, or surgeon. Additional time should be scheduled to accomplish an appropriate preoperative assessment. The area in which the preoperative assessment is conducted should be relatively quiet and well lit.

Hearing loss is a common complaint and should be generally understood by the anesthesiologist. Presbyacusia generally involves impaired sensitivity, particularly to higher pitched sounds, a derangement in loudness perception, impaired sound localization, and a decrease in time-related processing tasks. The summary behavior is frequently expressed as "I can hear you, but I can't understand you." The examiner can maximize the potential for communicating effectively with the patient by placing themselves 3–6 feet away, directly facing the patient. Use deliberate, clear speech at a somewhat slower (not comically or sarcastically) rate. The general tendency to speak louder needs to be tempered by the realization that shouted speech is often perceived as distorted by the elderly who are hard of hearing. Hearing aid technology has expanded dramatically and includes a variety of both external and surgically implantable technologies.[24] In general, patients should always be interviewed with their hearing aids in

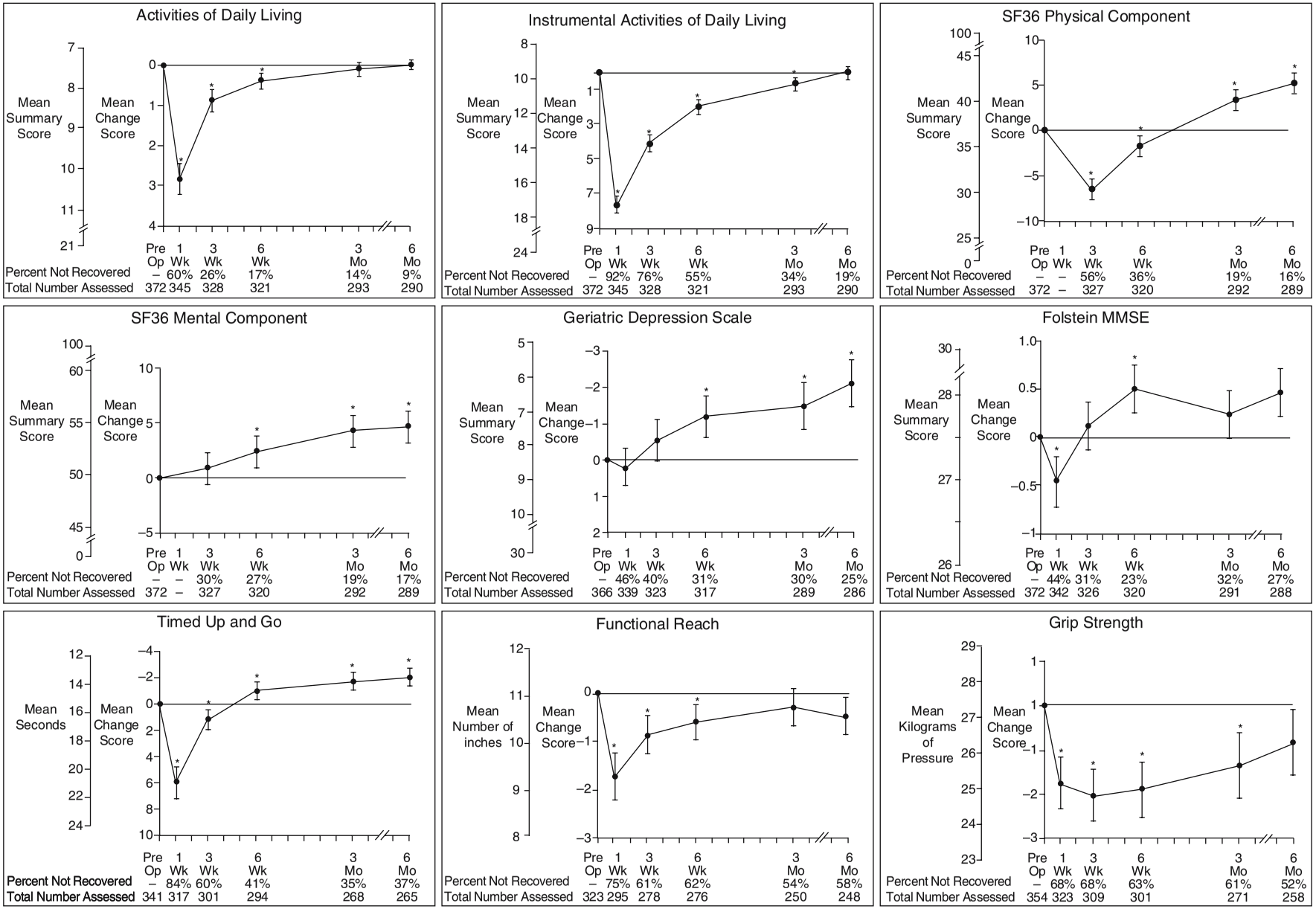

FIGURE 1-6. Functional recovery after major abdominal operation. Recovery is shown as mean individual change from preoperative baseline and 95% confidence intervals, with worsened function below a zero line representing preoperative status; a score of –1 indicates a one-point worsening relative to the preoperative baseline. An additional "shadow" *y*-axis is shown for orientation to mean summary or total scores. Asterisks indicate statistically significant differences from preoperative baseline, adjusted for multiple comparisons. MMSE, Mini-Mental State Exam; SF36, Medical Outcomes Study Short Form-36. (Reprinted with permission from Lawrence et al.[21])