John R. Burton
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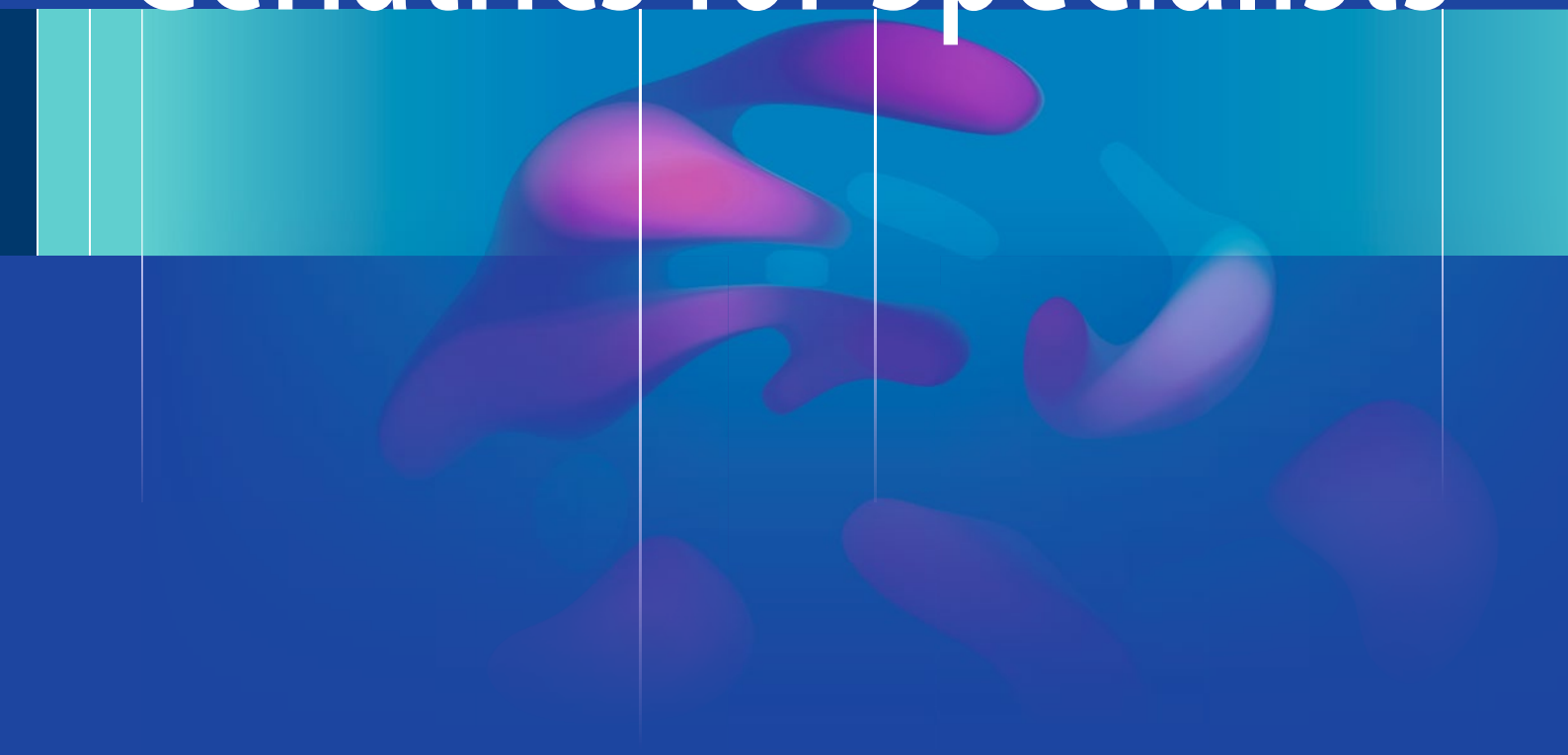
Jane F. Potter
Editors

Geriatrics for Specialists



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Geriatrics for Specialists

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ISBN 978-3-319-31829-5 ISBN 978-3-319-31831-8 (eBook)
DOI 10.1007/978-3-319-31831-8

Library of Congress Control Number: 2016941325

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This book is dedicated to the many scholars and teachers who launched this effort to develop on sound principles the field of specialty geriatric practice and those who continue its growth.

John R. Burton dedicates this book to all of his mentors and colleagues in geriatrics and the specialties who so profoundly inspired him to spread geriatric concepts broadly to all health professionals.

Andrew G. Lee dedicates this book to his children, Rachael and Virginia Lee, who will hopefully one day become part of the next generation of Lee physicians to care for elderly patients, and he also recognizes and thanks his wife, Hilary A. Beaver, MD, who has been a constant source of inspiration, love, patience, wisdom, and grounding.

Jane F. Potter dedicates this book to Dennis Jahnigen who provided her with encouragement to pursue a career as a mentor to students, David Solomon who provided her the opportunity to join the Geriatrics for Specialists Initiative, and Jeff Silverstein whose wit and wisdom made this project fun as well as rewarding.

Preface

Reasons for This Book

Over the last two decades, medical and surgical specialists have collaborated to bring together individual advances for geriatric populations within their specialties. This has resulted in a robust body of knowledge that now guides the standards of care for older people, the research agenda for the future, and the innovations in geriatric education among specialty trainees. This book is intended to fill the void of a single source of knowledge concerning these advances in specialty care.

Intended Audience

This book is designed to be a resource to the following major audiences:

(a) Specialty clinicians caring for seniors.
(b) Researchers with interest in the geriatric aspects of specialty fields. Chapters include description of the limits on knowledge and propose next research questions.
(c) Academicians who create and deliver content on aging within the clinical graduate and postgraduate specialty training programs.
(d) Geriatricians seeking in-depth knowledge of specialty care for older patients.
(e) Members of the interprofessional teams that are so critical to clinical care and research within geriatrics, including nursing, social work, pharmacy, physical and occupational therapies, and others.
(f) Policy makers seeking to understand the strength of evidence concerning quality care for older patients provided by specialists and their associates.

The Approach Used in Developing the Book

This text is divided into three parts: crosscutting issues, medical specialties, and surgical and related specialties.

Part I: The first part deals with the crosscutting issues and addresses concepts of critical importance to all specialist providers who conduct research for and about and who also care for older patients. These chapters are cross-referenced heavily throughout Parts II and III. This has reduced repetition within individual chapters on critical concepts such as frailty, assessment tools, delirium, dementia, pharmacology, perioperative care, etc., while allowing authors to describe in detail where these concepts fit specifically within that discipline and relevant related literature.

Parts II and III: The surgical (Part II) and medical (Part III) sections of the text are a series of chapters addressing the major selected surgical and medical disciplines; important related specialties (e.g., rehabilitation) are included in the surgical section.

The editors developed the table of contents reflecting the state of knowledge and then recruited specialty authors who are active in clinical care, teaching, and research in geriatrics. At least two editors and often all three reviewed each chapter and worked with the authors to ensure that the focus of the text was practical, timely, and clear so it could be a reliable resource in everyday practice.

Background

The editors acknowledge the work of many over two decades and in particular the inspiration of the late Drs. Dennis Jahnigen and T. Franklin Williams. Dr. Jahnigen initiated the geriatric surgical and related specialties movement in the 1990s, and Dr. Williams inspired much of the work to embed geriatric principles into the subspecialties of internal medicine. Both of these individuals were prominent geriatricians: Dr. Jahnigen was a past president of the American Geriatrics Society (AGS), and Dr. Williams was a past director of the National Institute on Aging. While Drs. Jahnigen and Williams initiated this work, the major developments that followed fell to their successors. The surgical and related specialty work was initiated within the AGS and was led by the late Dr. David Solomon and Dr. John Burton who was joined by Dr. Andrew Lee and others including Dr. Jane F. Potter, both of whom serve in leadership positions in the program. The work related to the development of geriatrics in the medical specialties was led by Drs. William Hazzard and Kevin High and became a program of the Association of Specialty Professors (ASP). The editors are grateful to Dr. High who participated fully as an editor in the early development of this book before other professional demands precluded his continuing involvement.

The strategy behind this collaborative effort was to recruit and nurture promising young faculty and trainees in the geriatric aspects of their specialty. This investment over the last two decades in medical and surgical specialists is a unique national success and has resulted in a robust body of knowledge related to specialty care of seniors.

Critical to the success of this effort was the AGS staff (including Janis Eisner succeeded by Marianna Drootin and Erin Obrusniak and others) and leadership (notably Nancy Lundebjerg, whose dedication and hard work have moved the inspiration of its founders into a growing focus within the American Geriatrics Society and in American medicine). None of this work would have been possible without the continuing encouragement and support of the John A. Hartford Foundation and its president until 2015, Corinne H. Rieder, EdD. The program director, Christopher Langston, and senior project officers (Laura Robbins, Donna Regenstrief, and Marcus Escobedo) of the John A. Hartford Foundation for the two programs (surgical and related specialties within the AGS and the medical specialties within the ASP) were full partners throughout the development and operation of these programs. Their dedication, vision, and commitment ensured success and inspired all involved in the projects. Collectively they formed a critical force behind the work that made this book possible. Within the AGS, the effort became known as the Geriatrics for Specialists Initiative (GSI). The GSI has evolved into an active group of physician specialists, geriatricians, and health professionals from other disciplines. The GSI fosters geriatric principles in education and research broadly in medical centers and within specialty societies and governing and regulatory bodies. The sustained effort within the AGS of the GSI has evolved into the Section for Enhancing Geriatric Understanding and Expertise Among Surgical and Medical Specialists (SEGUE). The leadership of SEGUE is now entirely specialists. This book is a natural succession of the work of the GSI and SEGUE within the AGS and the geriatrics program of the ASP. The career development programs, originally sponsored by the specialty organizations, were subsumed by the National Institute on Aging with the initiation of their program in 2011: Grants

for Early Medical and Surgical Specialists Transitioning to Aging Research (GEMSSTAR). Many of the chapters are written by the new cohort of geriatric specialty scholars and their mentors and trainees associated with the GSI/SEGUE program of the AGS and the geriatrics program of the ASP.

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Part I

Cross-Cutting Issues

Frailty

1

Jeremy D. Walston

1.1 Introduction

Frailty is a condition frequently observed in older adults that is a warning sign for high risk of adverse health outcomes. Although exact definitions and screening methods vary, approximately 15 % of the US population over age 65 and living in the community are considered frail, and therefore at significantly higher risk of adverse health outcomes and mortality than more resilient older adults. Clinicians from surgical and medical specialties are increasingly interested in frailty because of its potential to identify those individuals at highest risks for complications related to procedures and medical interventions. This chapter provides an overview of frailty definitions, epidemiology, etiologies, and consequences. In addition, the chapter is meant to provide guidelines as to how best identify and mange frail older adults, and highlight how frailty research can lead to better health care guidelines for the future.

1.2 Conceptualizing and Defining Frailty

Frailty is often conceptualized as a condition of late life decline characterized by weakness, weight loss, fatigue, decline in activity, and accumulating comorbidities [1–4]. It is considered a geriatric syndrome that is associated with aging and characterized by loss of biologic reserve that results in increased vulnerability to a host of adverse outcomes including disability, hospitalization, and death [5, 6]. A 2004 American Geriatrics Society/National Institute on Aging conference on frailty in older adults gave this definition further specificity as it describes frailty as "a state of increased vulnerability to stressors due to age-related declines in physiologic reserve across neuromuscular, metabolic, and immune systems" [7].

Although many frailty measurement tools have been developed over the past 20 years, two commonly cited conceptual approaches have emerged that have greatly informed and facilitated the development of additional assessment tools (Fig. 1.1). Fried et al proposed a physical/phenotypic approach that conceptualized frailty as a deeply biologic process that results in a syndrome of weakness, weight loss, and slowness [1, 8]. A cycle of physiological decline was hypothesized that included interrelated and reinforcing declines in metabolism, nutrition utilization, and skeletal muscle that in sum drove worsening vulnerability. Triggers of this cycle of decline included acute illnesses, some medications, and aging related biological changes. Importantly, the authors maintain that although this cycle is often related to disability and disease, it can develop independently from disease states and disability because of its hypothesized biological origin. This model was operationalized into a clinical assessment tool for ambulatory older adults that included measures of weight loss, energy levels, muscle strength walking speed, and physical activity. Those who met cut-off criteria in 3, 4, or 5 of these measurements were considered frail. This methodology was validated in many large population cohorts as highly predictive of adverse outcomes. This conceptual basis and assessment approach has been widely adapted by many investigators to develop other physical frailty screening or assessment tools. In addition, many components of the biological underpinnings of frailty have been identified, and intervention strategies have been developed based on this assessment methodology.

Another major theoretical construct for frailty comes from Rockwood et al., who conceptualized frailty as an aggregate of illnesses, disability measures, cognitive and functional declines that has been termed deficit-driven frailty [9]. According to this model, the more deficits or conditions that an individual has, the more frail the individual is. In this

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J.R. Burton et al. (eds.), *Geriatrics for Specialists*, DOI 10.1007/978-3-319-31831-8_1

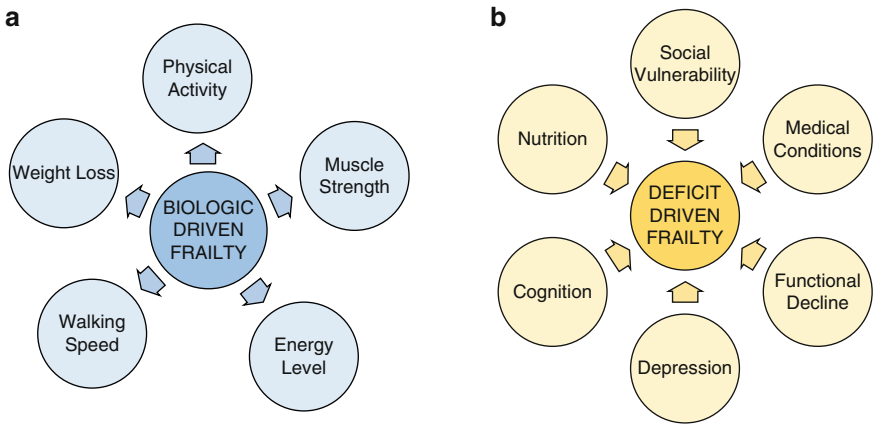

Fig. 1.1 Two conceptualizations of frailty. (**a**) Phenotypic frailty. Phenotypic frailty is conceptualized as a clinical syndrome driven by age-related biologic changes that drive physical characteristics of frailty and eventually, adverse outcomes. (**b**) Deficit accumulation frailty. The deficit model of frailty proposes that frailty is driven by the accumulation of medical, functional, and social deficits, and that a high accumulation of deficits represents accelerated aging. An important distinction between these two conceptualizations of frailty is that biologic driven frailty causes the physical characteristics of frailty (*arrows pointed outward*). In contrast, deficit accumulation frailty is caused by accumulated abnormal clinical characteristics (*arrows pointed inward*) (Adapted from Journal of the American College of Surgeons, Volume 221, Issue 6, Robinson TN, Walston JD, Brummel NE et al., Frailty for Surgeons: Review of a National Institute on Aging Conference on Frailty for Specialists, 1083–1092, Copyright 2015, with permission from Elsevier.)

agnostic approach, almost any conditions or deficits are interchangeable in index tools. This conceptual basis has also been widely utilized to develop risk assessment tools that tally a broad range of comorbid illnesses, mobility and cognitive measures, and environmental factors to capture frailty. Although this concept of deficit-driven frailty has been utilized in many population studies to assess risk for mortality and other adverse health outcomes, biological and intervention studies have been more difficult because of non-specificity in the hypothetical origin in this measure of frailty [10].

Beyond these two approaches, over 70 frailty measurement tools have been cited in the literature [11]. Most have been developed and validated in research population databases. Many have been developed through adaptations to either the phenotypic/physical frailty approach or the index/deficit approach or combinations of the two. Others have been developed to have a cognitive focus. Despite the proliferation of assessment tools in the literature, acceptance of a standardized definition for frailty in clinical practice has been slowed by the broad heterogeneity in measures that include medical, social, cognitive, psychological, and educational factors [12, 13]. Considerations related to chronological age, comorbidities, and disability, while associated with frailty, have also led to lack of consensus of frailty measurement [1, 13–15]. Despite this, many tools are usable for risk assessment and many are being developed for use in disease specific populations such as chronic kidney disease, transplantation candidates, or vascular surgery.

Finally, given the high prevalence of cognitive decline later in life, it is important to consider its potential role in frailty. Frailty is highly associated with an increased risk of mild cognitive impairment and an increased rate of cognitive decline with aging [16, 17]. Conversely, the presence of cognitive impairment increases the likelihood of adverse health outcomes in older adults who meet criteria for physical frailty. Hence, it may be considered an additive risk factor to frailty in those older adults with both conditions.

1.3 Frailty Prevalence, Epidemiology, and Risk

Dozens of population studies of frailty have been developed in the past 15 years [11]. Many have used physical/syndromic frailty or index/deficit type of frailty measures or derivatives to determine the demographics and epidemiology of frailty. Although the prevalence of frailty varies with the tool used to define frailty and with the population studied, most population studies performed in the USA and Canada have estimated that the prevalence of frailty lies between 4 and 16 % in men and women aged 65 and older [1, 18–21]. A large review study using physical frailty measured in 15 studies that included 44,894 participants identified a prevalence of frailty of 9.9 %; when psychosocial aspects were included in the definition, prevalence was 13.6 % among eight studies that included 24,072 participants [22]. Prefrail individuals, generally identified with a physical frailty type tool, are more common in these population studies, with prevalence ranging from 28 to 44 % [1, 20, 21].

As to clinical transition towards frailty, most of the studies have been performed using the physical frailty phenotype.

For example, in a study in the USA of nearly 6000 community-dwelling men aged 65 and older, at an average follow-up of 4.6 years, 54.4 % of men who were robust at baseline remained robust, 25.3 % became prefrail, and 1.6 % became frail. The remaining subjects were accounted for by 5.7 % mortality and the remaining 13 % were lost to follow-up [21]. Of those individuals who were prefrail, over 10 % went on to become frail over the next 3 years.

Demographic associations with frailty include older age [20], lower educational level [20], smoking, unmarried status, depression, and African American or Hispanic ethnicity [10, 21, 23]. A number of chronic disease states, including most especially congestive heart failure, diabetes mellitus, hypertension, and peripheral artery disease [14, 24, 25] are also significantly associated with physical frailty.

Frailty has been widely utilized as a mortality risk assessment tool. Several studies have compared the most commonly utilized screening tools and found that these indices were comparable in predicting risk of adverse health outcomes and mortality [18, 26, 27]. A 2013 consensus conference also referenced tools that can be easily utilized to diagnose frailty [28]. In most studies of physical frailty, the increasing mortality in models adjusted for disease, age, and socioeconomic factors ranges from 2.24 at 3 years in the Cardiovascular Health Study to 6.03 in the Women's Health and Aging Studies 1 and II [1, 19]. In the longitudinal Women's Health Initiative Observational Study, mortality risk was increased over 3 years in those with baseline frailty (HR 1.71; 95 % CI 1.48–1.97) [20]. In a study in men, mortality was twice as high for frail, compared with robust, men (HR 2.05; 95 % CI 1.55–2.72) [21]. Mortality prediction was demonstrated to be similar across 8 scales of frailty developed within previously collected data in the Survey of Healthy, Aging and Retirement in Europe (SHARE), with death rates three to five times higher in cases classified as frail compared with those not classified as frail in all tools studied [29]. This collective evidence suggests that those who are frail have a 2–6 fold risk of mortality in the subsequent 3 years compared to their robust counterparts.

In addition to mortality, frailty status is predictive of a host of adverse health outcomes. After adjustment for comorbidities, frailty predicted hip fractures (HR 1.74 (1.37–2.22) and disability (HR 5.44 (4.54–6.52) over 3 years in the participants of the Women's Health Initiative [20]. Frailty also predicted adverse outcomes related to renal transplantation, general surgery interventions, and trauma [30, 31].

In surgical populations, frailty predicts adverse outcomes as well. Using a frailty phenotype tool to ascertain frailty, this group measured frailty in a preoperative assessment and found that the frail individuals were at increased risk of postoperative complications (OR 2.54; 95 % (I 1.12–5.77), increased length of stay (incidence ratio 1.69; 95 % (I 1.28–2.23), and a markedly increased risk of discharge to an institutional care setting such as rehabilitation or nursing home (OR 20.48; 95 % (I 5.54–75.68).

1.4 Pathophysiology

There is increasing evidence that dysregulated immune, endocrine, stress, and energy response systems are important to the development of physical frailty. The basis of this dysregulation likely relates to molecular changes associated with aging, genetics, and specific disease states, leading to physiologic impairments and clinical frailty (Fig. 1.2) [7]. Sarcopenia, or age-related loss of skeletal muscle and muscle strength, is a key component of physical frailty. Decline in skeletal muscle function and mass is driven in part by age-related hormonal changes [32–35] and increases in inflammatory pathway activation [36].

Multiple age-related hormonal changes have been associated with frailty. Decreased growth hormone and insulin-like growth factor-1 levels in later life (IGF-1) [32, 37, 38] are associated with lower strength and decreased mobility in a cohort of community-dwelling older women [39]. Decreased levels of the adrenal androgen dehydroepiandrosterone sulfate (DHEA-S) [32] are also lower in frail older adults. DHEA-S plays an important role in maintaining muscle mass and indirectly prevents the activation of inflammatory pathways that also are a component of frailty [40]. Chronically increased cortisol levels [41], especially in the afternoon, are common in frailty and likely impact skeletal muscle and immune system function. Evidence is mixed that lower levels of the reproductive hormones estrogen and testosterone contribute to frailty [42–45]. However, there is stronger evidence that links decreased 25(OH) vitamin D [46] levels to frailty [47, 48].

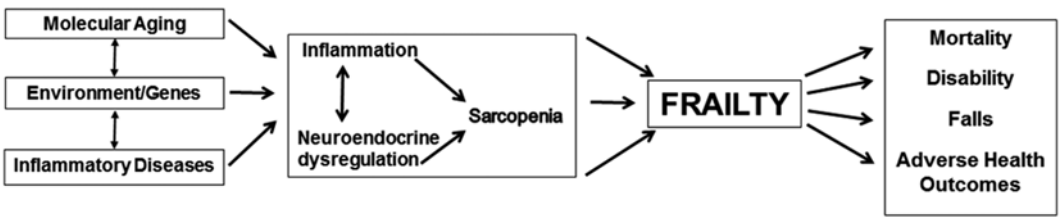

Fig. 1.2 Potential biological etiologies that drive physical frailty and the vulnerability to adverse health outcomes

There is strong evidence linking chronic inflammatory pathway activation to frailty. Serum levels of the proinflammatory cytokine IL-6 and C-reactive protein (CRP), as well as white blood cell and monocyte counts, are elevated in community-dwelling frail older adults [32, 46, 49, 50]. IL-6 acts as a transcription factor and signal transducer that adversely impacts skeletal muscle, appetite, adaptive immune system function, and cognition [51] and contributes to anemia [52, 53]. Immune system activation may trigger the clotting cascade, with a demonstrated association between frailty and clotting markers (factor VIII, fibrinogen, and D-dimer) [49]. Further, there is evidence linking a senescent immune system to chronic CMV infection and frailty [54]. Frail older adults are also less likely to mount an adequate immune response to influenza vaccination, suggesting a biological driver of frailty [55].

Vaccine failure may contribute to the increased vulnerability to influenza and higher levels of influenza infection observed in frail older adults. Finally, there is increasing evidence linking dysregulation in stress response systems to frailty beyond the inflammatory and cortisol component detailed above. For example, dysregulation of the autonomic nervous system [56] and age-related changes in the renin-angiotensin system and in mitochondria likely impact sarcopenia and inflammation, important components of frailty [57]. This dysregulation in stress response systems may be especially relevant to patients undergoing stress surgical procedures, and likely contributes to markedly increased risk of adverse outcomes in frail patients.

1.5 Clinical Assessment of Frailty

Clinical practitioners are increasingly interested in frailty, its definitions, and most importantly how it can be utilized to reduce risk of adverse outcomes and to improve the healthcare of older adults. Although no gold standard has emerged to measure frailty or on how best to use information on frailty once it is obtained, many research and clinical practice groups are moving toward incorporation of frailty measurements into clinical practice. Indeed, the identification of frailty in any clinical practice settings may be helpful in highlighting the need for additional assessment and the need for individualized treatment plans that reduce risk. As part of a movement to incorporate frailty measures into clinical practice, a consensus group of delegates from international and United States societies related to Geriatrics and Gerontology recently recommended that all persons over age 70, those adults with multiple chronic disease states or weight loss exceeding 5 % over a year should be screened for frailty. No one tool was recommended for frailty screen, although several currently available tools described below were highlighted for potential use [58].

1.6 Choosing a Specific Frailty Tool

Few guidelines exist on how to best choose a frailty assessment tool, although a recent publication outlines how most tools have been utilized to date [11]. This is in part because most frailty assessment tools have not been extensively validated or utilized across populations, and few comparison studies have been done that show clear benefit of using one tool over the other. In addition, different tools may or may not be good matches to the intended use. For example, a brief screening tool may be appropriate for risk stratification and decision making related to whether or not to pursue a treatment option. However, a more formal frailty assessment tool that includes physical measurements such as walking speed or grip strength might be required to better define potentially helpful preoperative interventions.

Given the wide array of tools and the wide variety of populations in which the tools may need to be implemented, the choice of which assessment tool to use should be tailored to a clinical situation and clinical need. Choosing a tool that has been previously used in a variety of populations and that has demonstrated predictive validity in several settings should also influence the choice of tools. Considerations of available time in a busy clinical practice may also drive the decision process.

Although not yet available, the development of discipline-specific frailty assessment tools, along with specific clinical guidelines of how best to manage frail older adults after they are identified is of crucial importance as older and more frail individuals are considered for medical and surgical interventions. A recent NIA conference on frailty in clinical practice has helped to formalize recommendations in a variety of clinical settings. The following list of frailty measurement tools, used mostly in the past for risk assessment in population studies, and rationale for their use was recently reviewed by Robinson et al. [59].

1.6.1 Single Item Surrogate Frailty Assessments (2–3 min)

Because of the need for quick and efficient frailty ascertainment in a busy clinical setting, single item measurement tools have been proposed to stand in for a more formal frailty measurement. For example, gait speed measured over a 4 m distance, one of the five measured factors in the physical frailty phenotype assessment discussed below, is recognized as a highly reliable single measurement tool that predicts adverse outcomes [60, 61]. The inability to rise from a chair, walk 10 feet, turn around, and return to sitting in the chair in ≥15 s, often termed the timed up and go test, is closely related to both postoperative complications and 1-year mortality [59]. Some of these single measures are components of

Table 1.1 Frail scale questions[a]

Fatigue	Are you fatigued?
Resistance	Can you climb 1 flight of stairs?
Ambulation	Can you walk 1 block?
Illnesses	Greater than 5
Loss of weight	Greater than 5 %

[a]Each question is assigned one point if affirmative. Frailty is considered with three or more points

both the frailty index and frailty phenotype approaches, and although they can be easy to use and predictive of adverse outcomes, they lack sensitivity and specificity of the full frailty assessment tools.

1.6.2 Frail Scale and Study of Osteoporotic Fractures (SOF) Frailty Tool (<5 min)

The Frail Scale was developed as a quick screening tool for frailty and is loosely based on the physical frailty phenotype construct with an additional comorbidity question [62–64]. The Geriatric Advisory Panel of the International Academy of Nutrition and Aging advocates this approach for develop frailty as a case-finding tool [60]. It requires asking five questions and scoring a one for each yes (Table 1.1). Those who are frail score 3, 4, and 5; those who are robust score 0 [63]. The assessment is easy to perform and score, requires no extra measuring device, and has been found to identify those at most risk for adverse outcomes in populations.

Another easy to use screening tool for quick risk assessment is the Study of Osteoporotic Fractures (SOF) frailty tool [26]. Frailty is determined when individuals have two of the following three components.

- Weight loss of 5 % in the last year
- Inability to rise from a chair five times without the use of arms, or
- A "no" response to the question "Do you feel full of energy?"

Both of these tools can be readily deployed in a clinical setting as a way to find high risk patients who may need further assessment.

1.6.3 Physical or Phenotypic Frailty (10 min)

Phenotypic or physical frailty is widely used by frailty researchers and has been widely adapted to measure frailty in many clinical and research settings. As described above in the conceptual basis of frailty, it was designed around the concept of an aggregate loss of function across physiological systems, which is in turn manifested by specific signs and symptoms in frail older adults [1, 8]. This was then operationalized into a clinical exam described below. The tool has been widely validated to predict risk for adverse health outcomes as well as most frailty assessment tools in many different research and clinical settings. It has been especially prominent in the study of the biological basis of frailty, and in the development of interventions focused on the specific components of frailty [65, 66]. This frailty assessment tool was 1 of 2 strategies recognized by the American College of Surgeons/American Geriatric Society's optimal preoperative assessment of the older adult [67]. Although the tool requires a questionnaire, a hand-held dynamometer, and a stopwatch in order to assess for frailty, it takes less than 10 min to perform by a trained clinician/technician. The recent development of comprehensive instructions and a web-based calculator for this tool has made it easier to use and has further reduced the time that it takes to get a frailty score. Access to needed measurement equipment, training guides, and the web-based calculator is available at http://hopkinsfrailtyassessment.org (December 23, 2015).

This clinical phenotype has five components that can be assessed using readily available measurement equipment and a web-based frailty calculator as described below. The score is determined on a 0–5 scale with 0 being not frail; 1–2 prefrail; and 3–5 frail. The severity of the risk is linear.

The major measurement domains include:

1. *Shrinking* (greater than 5 % loss of body weight in the last year).
2. *Weakness* (grip strength of the dominant hand in the lowest 20 % of the age and body mass index (BMI).
3. *Poor endurance* (self-reported exhaustion).
4. *Slowness* (lower 25 % of population average measures 4 m walking time).
5. *Low activity* (assessed by activity questions that identify weekly energy expenditure of less than 383/270 Kcals for males and females, respectively).

1.6.4 Deficit Accumulation or Frailty Index

The most widely recognized deficit accumulation method to measure frailty was developed from the Canadian Health and Aging Study [68].

Between 21 and 70 deficits or comorbidities have been published and recommended for use in this assessment [68, 69]. Although considerable time may be needed to gather information on individual patients and set up an algorithm in a medical record, a frailty index score can be quickly and automatically generated once the electronic record is in place. The frailty index score is calculated as the number of characteristics that are abnormal (or "deficits") divided by

the total number of characteristics measured. Scoring has mostly been done by summing the total deficits and comparing to a published cut-off score, or by calculating a ratio between deficits and total number of characteristics. This tool can be accessed in a series of references [69–71] or through the link biomedgerontology.oxfordjournals.org/content/62/7/722.long (December 23, 2015).

1.6.5 Frailty Index Adaptations

Recent adaptations of index-type tools for risk assessment in a variety of clinical settings have been developed. These uses include risk assessment in older trauma patients and in HIV infected individuals [72, 73]. Given that no physical measurements are necessary to calculate an index score, hospitalized and non-ambulatory patients can be assessed using historical data gathered from medical records and perhaps family members. This makes these tools especially valuable for prognostication, and risk assessment for outcomes. Strength of these types of tools includes the fact that each is more specificity related to the condition than other more general tools, which in turn may allow for improved risk assessment and eventually guideline development. However, screening for frailty after acute illness or injury does not facilitate prehabilitation or other risk reduction techniques that may predate hospitalization.

1.6.6 Additional Tools

There are many additional published measures of frailty but to date are not as well studied or as broadly validated [74]. A recent review article identifies dozens and articulates their specific uses over the past decade [11]. Some of these validated tools with specific purposes (clinical risk assessment, intervention prevention) may be identified in select situations.

Chapter 8—Office Tools for Geriatric Assessment contains information on many commonly used instruments.

1.7 Management of Frail Older Adults

Once a frail or prefrail patient is identified there are no succinct guidelines on how to best mange them. However, tenets of the practice of Geriatric Medicine, which include comprehensive geriatric assessment, risk mitigation, advanced planning and delirium prevention should be put in place. Building on these recommendations, and on the frail patient history should focus on energy levels and excessive fatigue, the ability to perform or maintain physical activities like stair climbing, and the ability to get out of the home and walk at least one block.

When considering the diagnosis of frailty, it is crucial to develop a differential diagnosis list and rule out underlying medical or psychological issues that may be driving signs and symptoms of frailty. There are many conditions to be considered in older patients with signs and symptoms of frailty that may in fact be driving the frailty phenotype (Table 1.2).

In addition to the usual tenets of disease focused physical examination, a frailty focused assessment may include an assessment of the patient's ability to rise from a stable, heavy chair five times without the use of arms, and the ability to walk across the room.

1.7.1 Laboratory Testing

When evaluating a frail patient for the first time, laboratory testing should be undertaken in order to rule out treatable conditions. A suggested initial screen, based on the differential diagnosis, might include:

Complete blood count, basic metabolic panel, liver biochemical tests, including albumin, vitamin B12, vitamin D, and TSH.

1.7.2 Establishing Goals of Care

Once a frail older adult is identified goal setting with patients and their families is crucial in providing care, establishing individual priorities, weighing risks and benefits of interventions

Table 1.2 Diseases with symptoms consistent with frailty phenotype that must be ruled out when evaluating a frail patient

Depression	
Cognitive decline	
Malignancy	Lymphoma, multiple myeloma, occult solid tumors
Rheumatologic disease	Polymyalgia rheumatica, vasculitis, rheumatoid arthritis
Endocrinologic disease	Thyroid abnormalities, diabetes mellitus
Cardiovascular disease	Hypertension, heart failure, coronary artery disease, peripheral vascular disease
Renal disease	Renal insufficiency
Hematologic disease	Myelodysplasia, iron deficiency, and pernicious anemia
Nutritional deficits	Vitamin D and other vitamin deficiencies
Neurologic disease	Parkinson disease, vascular dementia, serial lacunar infarcts

and making decisions regarding aggressiveness of care. As the older adult progresses along the frailty spectrum and develops more severe disease and/or disability, it becomes increasingly important to tailor medical care and interventions to the needs of these most vulnerable patients. Potential interventions (see below) that might be beneficial along the continuum of frailty are exercise, nutritional supplementation, comprehensive geriatric assessment, prehabilitation, and reduction treatments.

For robust older patients, the medical practitioner should appropriately treat known chronic diseases, manage intermittent acute illness and events, and assure age-appropriate screening measures and preventive care [75]. In the moderately-to-severely frail patient, a less aggressive approach is often indicated as aggressive screening or intervention for non-life-threatening conditions may be rife with complications. Procedures or hospitalizations may bring about unnecessary burden and decreased quality of life to a patient who already has a high risk of morbidity and mortality [76]. Hence careful conversation and very clear articulation of potential risk is in order for frail patients and their families.

1.8 Interventions

While it is believed that interventions to maximize functional status for older adults in general, such as exercise, can reasonably be applied to patients with frailty, data on specific exercise interventions designed to improve outcomes in patients with frailty are limited. In one trial conducted in community-dwelling frail and prefrail individuals, interventions aimed at cognitive skills (weekly training for 12 weeks followed by fortnightly "booster" sessions for 12 weeks), physical exercise (supervised group exercises 2 days per week for 12 weeks), and nutrition (supplemental iron, calcium, vitamins, and calories), individual or combination interventions improved frailty scores at 3 and 6 months, but did not impact patient-meaningful secondary outcomes (hospitalizations, falls, or performance of activities of daily living) [65]. Another study showed that frail older adults may benefit from interventions targeting specific components of their physical frailty exam. Finally, frail older adults may benefit from an additional comprehensive geriatric assessment where social, psychological, cognitive, functional, and medical issues are identified and proactively addressed [66, 77].

1.8.1 Prehabilitation

In surgical settings, prehabilitation is being developed in order to reduce adverse outcome risk for all patients. Frail patients may benefit the most given their high risk status. Exercise is believed to be the most effective intervention in older adults to improve quality of life and functionality. The demonstrated benefits of exercise in older adults include increased mobility, enhanced performance of activities of daily living (ADL), improved gait, decreased falls, improved bone mineral density, and increased general well-being. Studies suggest that even the frailest oldest adults are likely to benefit from physical activity at almost any level that can be safely tolerated. For example, a program of resistance training in octogenarian nursing home residents doubled muscle strength, and increased lower extremity muscle size and gait velocity [78] as well as increased mobility and spontaneous physical activity. In another study of resistance training, benefit was reported for exercise activity on as few as 2 days per week [79]. Even simple interventions can be helpful. For example, walking as little as a mile in a 1-week period was associated with a slower progression of functional limitations over a follow-up period of 6 months [80].

While functionally limited or frail individuals may never be able to meet minimum recommended activity levels, even modest activity and muscle strengthening can impact the progression of functional limitations. For these individuals a recommendation of walking for 5 min twice a day as a starting point is reasonable. The identification of a set of key activities the patient feels capable of doing helps incorporate self-efficacy into the physical activity recommendation and makes it more likely to succeed [81].

1.8.2 Nutritional Supplementation

For patients with weight loss as a component of frailty, attention should be focused on medication side effects, depression, difficulties with chewing and swallowing, dependency on others for eating, and the use of unnecessary dietary restrictions (low salt/low fat). In treatment of weight loss, oral nutritional supplements between meals (low-volume, high caloric drinks or puddings) may be helpful in adding protein and calories. A meta-analysis of studies of nutritional supplements showed that providing nutritional supplements to older undernourished adults yielded small gains in weight (2.2%) [82]. Vitamin D supplementation for those with low serum vitamin D levels is effective for fall prevention, improving balance, and preserving muscle strength [83] and may play a role in preventing or treating frailty. In one report, lower serum levels of 25-hydroxyvitamin D (<20.0 ng/mL) were associated with a higher prevalence of frailty at baseline in a group of 1600 men over age 65, but did not predict greater risk for developing frailty at 4.6 years [84]. Given that vitamin D appears to play an important role in both muscle and nervous tissue maintenance with aging, assessment and supplementation are often indicated. In a recent intervention study that combined protein and vitamin D supplementation, those taking leucine-enriched whey protein plus vitamin D had significant improvement in physical frailty related measurements [85].

1.8.3 Medication Review

Periodic evaluation of a patient's drug regimen is especially important for patients who are prefrail or frail. Such a review may indicate the need for eliminating certain prescription drugs that may be contributing to symptoms of frailty. Changes may include discontinuing a therapy prescribed for an indication that no longer exists, discontinuing therapy with side effects that may be contributing to frailty symptoms, substituting a therapy with a potentially safer agent, changing drug dosage, or adding a new medication. In reviewing medications, it is important to focus on the established goals of care with the patient and caregivers. Chapter 5—Medication Management, provides details on the subject.

1.9 Summary

Frailty is an increasingly recognized clinical state of vulnerability with inherent increased risk for adverse health outcomes, including functional decline and mortality. Although there is no gold standard for diagnosing frailty, there are many tools that are validated and can be used for screening depending on the purpose. The physical frailty and deficit accumulative frailty tools are predominate in the literature. An international consensus group has recommended that all persons over age 70 and adults with chronic disease or weight loss exceeding 5 % over a year be screened for frailty. The Frail Scale is one tool that can be readily incorporated into history-taking and used for a quick risk assessment. However, multiple other validated screening tools have been developed and may be better for subspecialties and for biologic or intervention research. Physical examination should include assessment of the patient's ability to rise from a firm chair five times without the use of arms, and the ability to walk across the room.

Goal setting with patients and their families is crucial in providing care for the frail individual, establishing individual priorities, weighing risks and benefits of interventions and making decisions regarding aggressiveness of care. Exercise and activity interventions have been shown to have a positive impact on even the frailest older adults. To date, no biological or pharmaceutical interventions are recommended for frailty per se, although biologically targeted interventions may play a role in the future.

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Delirium

2

Nicole T. Townsend and Thomas N. Robinson

2.1 Introduction

Delirium is a common medical condition that healthcare providers will encounter while caring for older adults, especially in the hospitalized patient. On a general medical service, rates of delirium range from 10 to 40 % [1–3]. Further, up to a quarter of hospitalized patients over age 65 will present with delirium [4]. An additional 30 % of hospitalized patients in this age group will develop delirium acutely during their hospitalization [5]. Familiarity with the clinical syndrome of delirium, identification of which patients are at risk, and knowledge on how to prevent, diagnose, and treat delirium are critical to healthcare professional's ability to provide high quality care of hospitalized older adults.

Delirium is critical to prevent and, should it occur, to recognize early because of its close association with increased morbidity and mortality in the hospitalized patient. Patients who experience delirium have long-term loss of cognitive function, higher complication rates, increased hospital length of stay, and higher mortality. Delirium has recently been recognized as a complex phenotype in older patients that shifts the prevalence focus from chronologic age and medical comorbidities to the functional impact of comorbidities especially frailty (discussed fully in a separate chapter) and disability. While the frail older adult is at higher risk for delirium in the hospitalized setting, any hospitalized patient can develop delirium.

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2.2 Delirium Definition

Delirium is defined as a disturbance in attention and awareness, with a change in cognition that occurs over a short period of time (hours to days) and fluctuates during the course of the day. Differentiating preexisting dementia from delirium is critically important. Clinically, delirium presents with inattention, disordered thinking, and loss of orientation, with a component of both agitation and hyperactivity, or, especially in the elderly, with depressed affect and hypoactivity. Patients can appear confused, have hallucinations, be somnolent, or present with all of these symptoms during the course of delirium. Unlike dementia, delirium waxes and wanes over the course of the day, so patients may have normal behavior during one assessment, and be agitated or somnolent the next. Thus, a high level of clinical suspicion is necessary in order to recognize and diagnose a patient with delirium. The hypoactive delirium subtype is widely recognized as the most under-diagnosed presentation of delirium.

2.3 Delirium Risk Factors

The risk of developing delirium following surgery is best described as a relationship between a physiologic stressor, predisposing patient risk factors, and iatrogenic conditions (see Fig. 2.1) [6]. A multitude of risk factors have been identified that increase the chances of the development of delirium; this multiplicity includes both intrinsic patient factors and external precipitating factors during a hospital stay. Risk factors for delirium are multifactorial, and there is a dose-response to the number of risk factors and the odds of developing delirium [7]. Dementia is the most closely associated intrinsic patient vulnerability that increases risk of delirium [8, 9]. The greater the severity of dementia, the greater the risk of developing delirium [10]. Patients with underlying medical conditions associated with frailty such as poor mobility, fatigue, a high level of co-morbid medical conditions [11], and malnutrition [12] also place patients at

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J.R. Burton et al. (eds.), *Geriatrics for Specialists*, DOI 10.1007/978-3-319-31831-8_2

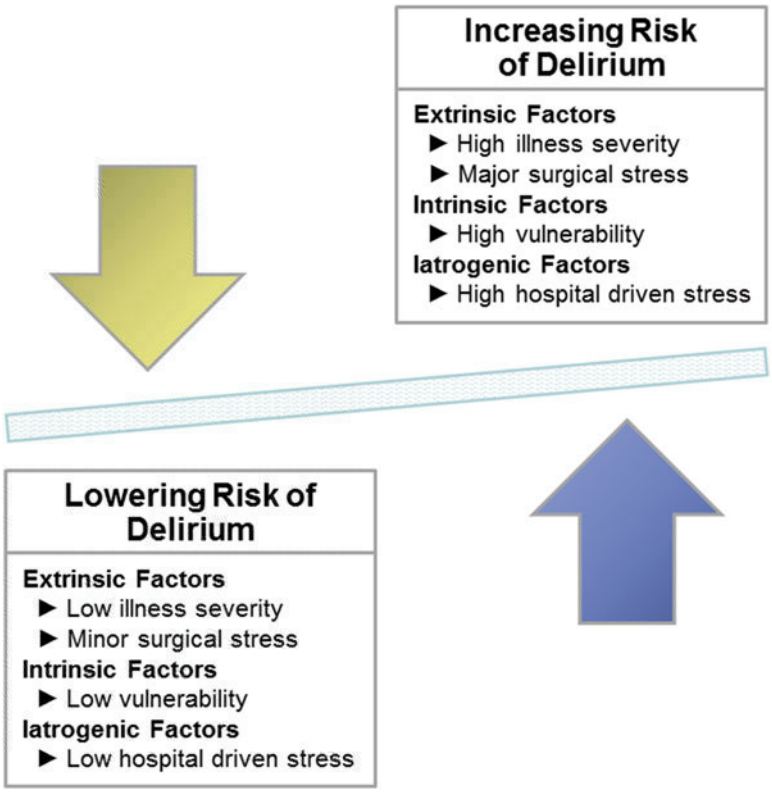

Fig. 2.1 Multifactorial model of delirium. The risk of a delirium is a combination of extrinsic factors to the patient (e.g., severity of medical illness, stress of surgical intervention), intrinsic factors to the patient (e.g., cognitive impairment, advanced age), and iatrogenic factors (e.g., sleep disruption, pain control)

risk for development of delirium [13]. Frail patients can have rates of delirium of up to 60 % [4]. Other intrinsic risk factors include increased age and sensory impairment (visual or hearing) [7].

Routine hospital care introduces external iatrogenic risk factors, including polypharmacy (discussed fully in a separate chapter), disruption of sleep–wake cycles, infection, psychoactive medication prescription (specifically benzodiazepines and anti-cholinergic drugs), physical restraints, use of bladder catheters, and iatrogenic adverse events have all been identified as risk factors for delirium [14]. See Table 2.1 for a summary of delirium risk factors.

Various specialty-specific rates of delirium have been reported that further identify groups of hospitalized patients who are more at risk for the development of delirium. Patients who present to the emergency department or are in the intensive care unit, oncology patients, and patients for multiple surgical specialties (e.g., vascular or orthopedic surgery) can have higher rates of delirium than the average hospitalized adult. Ten percent of patients present to the emergency department with delirium, although this number may under-represent the true incidence [13, 15]. Orthopedic injuries and operations also carry high risk, with 40 % of patients developing delirium after bilateral knee replacement [16] and up to 60 % following hip fracture [17]. Patients undergoing coronary artery bypass grafting have rates of postoperative delirium of 33–50 % [18, 19].

Table 2.1 Risk factors for delirium

Advancing age
Impaired cognition (e.g., dementia)
Severe illness or comorbidity burden
Functional dependence
Infection or sepsis
Hearing or vision impairment
Sleep disturbance
Depression
Poor nutrition
Anemia
Alcohol use
Hypoxia or hypercarbia
Dehydration
Electrolyte abnormalities
Inappropriate medication prescription • >5 new medications • benzodiazepines • anticholinergics • antihistamines • antipsychotics

Intensive care unit (ICU) patients, both medical and surgical, are at extremely high risk of delirium. The prevalence of delirium has been reported to be as high as 80 % [20]. There is, however, dramatic variability in the incidence of delirium in the ICU. Recently, because of the recognition of the risk of delirium, many ICUs have specific pathways for delirium prevention, which can significantly reduce the

occurrence of delirium [21, 22]. ICU care is associated with disruption of sleep–wake cycling, high severity of illness, and use of many drugs that are associated with increased risk of delirium, so it is unsurprising these patients are more vulnerable to developing delirium.

2.4 Presentation of Delirium

Delirium is exceptionally heterogeneous in its presentation. The fact that the course of delirium waxes and wanes makes the diagnosis of delirium clinically challenging. This has led to a wide variety of diagnostic tools which can be used to diagnose delirium (see "Diagnostic Tools" section below and Chap. 8, Screening Tools for Geriatric Assessment by Specialists).

While there are several ways to define subtypes of delirium, one of the most commonly used strata is by motor activity, known as hyperactive, hypoactive, and mixed subtypes of delirium (see Fig. 2.2) [23]. The primary distinction between these motor subtypes is the presence of agitation versus lethargy in the patient's clinical presentation. Patients with evidence of both hyperactive and hypoactive delirium are described as having mixed delirium.

There are several checklists (see section below) that identify psychomotor symptoms that are associated with delirium, and when present in combination, increase the specificity of these symptoms to delirium [24]. Hyperactivity in delirium may be associated with increased involuntary movements, restlessness, wandering, increased speed, amount, or volume of speech, inability to sleep, distractibility, combativeness, hallucinations, or tangential thoughts (among others). Hypoactive delirium may present as apathy, decreased activity, decreased speed, amount, or volume of speech, somnolence, or decreased alertness. A mixed subtype presentation occurs when patient symptoms fluctuate between these two categories of agitation and lethargy.

Hypoactive delirium may be under-represented in the epidemiology of delirium because it is difficult to diagnose [25, 26]. A high level of clinical vigilance and suspicion of the diagnosis of delirium is especially necessary to diagnose hypoactive delirium. Hypoactive symptoms may be easy to attribute to other patient health conditions without a high clinical suspicion to monitor for delirium. Further, some studies have demonstrated that postoperative patients with hypoactive delirium have worse prognosis when monitoring 6-month mortality rate [27], although other studies have demonstrated improved outcomes for patients with hypoactive delirium [28].

2.5 Diagnostic Tools for Delirium

There are many diagnostic tools to identify delirium. They can be specifically designed for the ICU patient or other clinical settings, and may focus on certain diagnostic criteria, such as motor subtype. Below are brief descriptions of some commonly used diagnostic tools and comments about specific indications or limitations.

The confusion assessment method (CAM) is the most widely recognized tool to assess delirium and can be completed in under 5 min. [29] It uses four criteria: (1) acute onset of symptoms with fluctuating course, (2) inattention, (3) disorganized thinking, and (4) altered level of consciousness. The first 2 criteria must be present with either the 3rd or the 4th criteria. It has high inter-rater reliability with high accuracy compared to psychiatrist assessment for delirium.

The Delirium Rating Scale-Revised-98 (DRS-R98) is a 16-item scale, of which 13 items score for severity of symptoms. It has high inter-rater reliability, sensitivity, and specificity, including use in patients who have concomitant neurologic disease, such as dementia [30]. It is designed for use by any healthcare professional.

The cognitive test for delirium (CTD) is a diagnostic test specifically designed to assess critically ill hospitalized patients, including patients unable to communicate, such as those who are intubated and sedated [31]. It particularly emphasizes nonverbal domains, specifically visual and auditory symptoms. It is also able to reliably distinguish the difference between delirium and other psychiatric disorders.

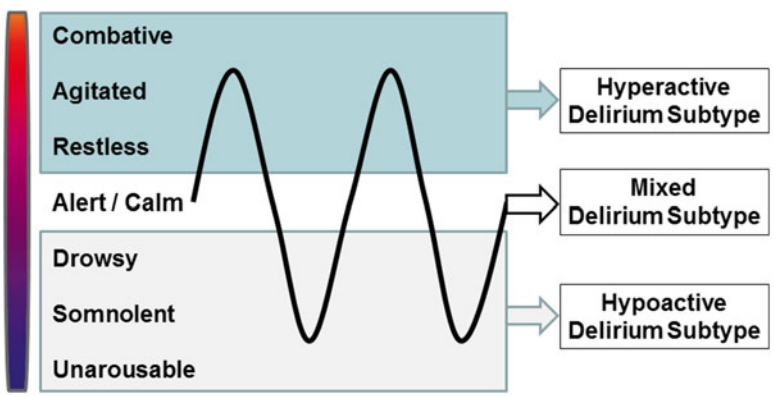

Fig. 2.2 The motor subtypes of delirium. The motor subtypes of delirium include hyperactive (pure overactive state represented in *blue*), hypoactive (pure underactive state represented in *gray*), and mixed (fluctuation between over- and underactive represented by *black line*)

The Delirium Motor Subtype Scale (DMSS) is used specifically to identify features of hyperactive and hypoactive delirium [24]. It is an 11-point scale any healthcare provider can use to assess patient behaviors, and includes 7 hypoactive features and 4 hyperactive features. Two symptoms must be present in order to classify delirium in a specific subtype.

The CAM for the Intensive Care Unit (CAM-ICU) was developed from the CAM assessment to better diagnose patients who are mechanically ventilated [32]. It uses nonverbal assessments to identify the same criteria of acute onset of symptoms with fluctuating course, inattention, and disorganized thinking or altered level of consciousness. It has high levels of sensitivity and specificity for delirium in ventilated patients, although the traditional CAM is more effective in patients able to fully participate in the assessment [20].

The intensive care delirium screening checklist is another test for patients in the ICU setting. It is a brief checklist of eight items based off of DSM criteria of delirium [33]. While it also has high sensitivity for delirium in the ICU, it is less specific than the CAM-ICU method. It is designed for use for all healthcare professionals.

The Memorial Delirium Assessment Scale was specifically developed to monitor development of delirium in ill patients enrolled in clinical trials [34]. It involves a 10-item checklist which was validated in patients with AIDS and metastatic cancer. It is well suited for use in repeated assessments over time for patients being seen longitudinally in trials.

The important issue is that a clinician should be very familiar with one or two of these screening tools and use them in daily practice.

2.6 Medical Evaluation of Delirium

Given the heterogeneous presentation of the clinical syndrome of delirium in combination with the complex intrinsic and iatrogenic precipitating factors, a structured, thorough, and routine approach to evaluation of the patient with delirium is necessary. A hospitalized patient may have presented at admission with delirium or develop it during their hospital course. While it is not only important to recognize the clinical syndrome, it is also important to identify correctable conditions which contributed to the state of delirium. Acute onset of delirium may have developed secondary to a single provocative factor (such as a symptomatic urinary tract infection (UTI), myocardial infarction (MI)), multiple medications (polypharmacy), admission to ICU, and others).

The appropriate workup of delirium involves methodical evaluation of the patient to identify treatable causes as well as initiate behavioral interventions. Table 2.2 outlines a comprehensive workup for patients with acute delirium which should supplement bedside examination. While many of these tests should be considered to be routine in an acute clinical change, others should only be considered if clinically indicated.

2.7 Prevention of Delirium

Although recognition and treatment of delirium once the patient develops the syndrome is essential, interventions to prevent delirium occurrence are essential for all patients at risk for delirium. Identification of individuals with multiple

Table 2.2 Medical evaluation of delirium

	Routinely ordered	Ordered if indicated
Laboratory tests	Complete blood count (infection, anemia) Basic metabolic panel (electrolyte disturbances, acid base status, renal function) Glucose (hypo- or hyper-glycemia) Arterial blood gas (hypoxia or hypercarbia) Urine analysis (infection but asymptomatic bacteriuria is not thought to cause delirium and is very common in older patients, especially women	Troponin (myocardial infarction) Thyroid levels (hypo- or hyper-thyroidism) ESR (inflammation) Viral titers or bacterial cultures (infection) Urine or blood drug screen (intoxication) Thiamine and Vitamin B12 (vitamin deficiency) HIV (infection) Sputum culture Blood culture
Imaging	Chest X-ray (infection)	Head CT (dementia, stroke) Brain MRI (dementia, stroke)
Clinical evaluation	Physical examination Medication review (BEERs list) [52] Social history (alcohol or benzo use)	Remove un-needed catheters
Ancillary tests	EKG (myocardial infarction) Pulse oximetry (hypoxia)	EEG (seizures, metabolic disturbance) Lumbar puncture (meningitis)

risk factors (e.g., frail, elderly, multiple comorbidities) allows the clinician to target preventive interventions to the at-risk population. Interventions such as making sure the patient has full use of their sensory aids, orientation protocols, early mobilization measures, minimization of sleep disturbance, and avoidance or discontinuation of high risk medications can all create an environment that will lower the risk of delirium for the at-risk patient [35]. Daily rounds that address these non-pharmacologic interventions utilize a multidisciplinary care team and plan that creates consistent assessment of these issues. Up to 40 % of hospitalized patients may have preventable delirium [14, 28]. Both of the current clinical practice guideline statements strongly recommend the implementation of multi-component delirium prevention protocols for patients at risk for delirium [35, 36],

Educational programs concerning delirium in every medical center are essential. These programs should be considered a system-level prevention tool. Education of healthcare providers about recognition, prevention, and treatment of delirium consistently reduces episodes of and duration of delirium, regardless of the specific intervention or protocol. [37–39] Further, educational interventions are cost-effective and associated with no patient harm [40–42].

2.8 Treatment of Delirium

When a patient does develop acute delirium, management of a potential underlying reversible cause of the delirium is essential. Appropriate treatment of identifiable causes will improve the patient's clinical condition. However, risks and benefits of aggressive or interventional therapies should be considered when treating a delirious patient, and weighed in the context of their clinical condition and goals of care. See Table 2.3 for modifiable causes of delirium with a proposed intervention. Behavioral modifications have been described above in the section regarding prevention of delirium. Interventions such as encouraging use of sensory aids, establishing day–night cycling, and the other interventions described in the previous section are effective in treating delirium in addition to their role in prevention.

Multiple pharmacologic interventions have been explored both as prophylaxis of delirium and as treatment. At this time, pharmacologic prophylaxis of delirium is not recommended. There are very few randomized, controlled trials exploring pharmacologic prophylaxis. Prophylactic use of epidural anesthesia, donepezil, and tryptophan administration has not been associated with a significant change in incidence or duration of delirium [43–45]. Prophylactic haloperidol is associated with no difference in the incidence of delirium, but has been associated with shorter duration of delirium and hospital length of stay in patients who were identified as being high risk for delirium [46]. Prophylactic haloperidol, however, is not recommended as this drug has its own serious side effects. Melatonin has been found to reduce delirium in both medical and surgical hospitalized patients but these data are not robust enough to recommend its routine use [47, 48].

Pharmacologic treatment of delirium should be reserved only for patients who have failed behavioral interventions and are at significant harm to themselves or others. Pharmacologic treatment typically is an antipsychotic, such

Table 2.3 Factors that cause delirium which can be clinically addressed

Modifiable delirium trigger	Clinical intervention
Immobility	• Ambulate in hallway three times daily • Early physical therapy consultation
Sensory impairments	• Glasses accessible at beside • Hearing aids accessible at beside
Impaired cognition	• Orientation three times daily • Family/friends at bedside
Medications	• Avoid high risk medications/polypharmacy • Daily medication review
Dehydration	• Assess and manage volume status • Adequate hydration
Pain	• Proactively assess and manage pain • Use non-opioid meds if possible
Nutrition	• Proactively encourage nutrition • May require swallowing evaluation
Sleep enhancement	• Allow overnight sleep without interruption • Reduce nighttime noise
Respiratory status	• Assess and manage hypoxia • Assess and manage hypercarbia
Infection	• Recognize delirium as presentation of infection • Work-up infection in delirium evaluation
Iatrogenic causes	• Remove unnecessary catheters/lines • Avoid dark daytime room

as haloperidol, but this treatment should not be universal and is not without risk. There is significant heterogeneity in the study designs and interventions observed in studies on the pharmacologic treatment of delirium. Antipsychotics are associated with adverse outcomes such as an increase in mortality and motor side effects, including the neuromalignant syndrome. Nonetheless, haloperidol or other antipsychotics have been used for severe agitated delirium only when behavioral interventions have failed and there is concern for patient safety or that of others [35]. Antipsychotic use in the treatment of delirium may improve the symptoms of agitation but does nothing for underlying delirium pathophysiology. If ever prescribed, the clinician should have a plan for tapering and discontinuing antipsychotics as soon as possible and typically within a few days. Benzodiazepines are contraindicated in treatment of the delirious patient and can actually exacerbate and prolong an acute episode of delirium [49].

2.9 Outcomes of Delirium

Delirium is not only a common condition in the hospitalized and elderly patient, it is associated with significantly worse long-term clinical outcomes for patients. Delirium has been associated as an independent predictor of increased morbidity and mortality across multiple patient groups, including postoperative patients (gastrointestinal, cardiac, and orthopedic), ICU patients, and cancer patients.

In a broad variety of surgical patients, delirium is associated with significant increases in 30-day mortality [50, 51]. It has also been associated with increased 6-month mortality in general surgery and thoracic surgery patients [27]. ICU patients similarly have worsened 6-month survival if they suffered from delirium, independent of other conditions [20].

Delirium is also associated with increased morbidity in addition to increased mortality. Delirium is independently associated with increased ICU length of stay, hospital length of stay, and rate of discharge to an institutional facility [27, 50, 51]. These outcomes, especially the loss of independence with institutional discharge, may be of critical importance to patients and families when discussing prognosis and goals of care in the hospitalized patient with delirium.

2.10 Conclusion

Delirium is a common clinical syndrome in the hospitalized patient, with increasing rates in vulnerable populations, such as the frail, patients with multiple comorbidities, and those in the ICU. Delirium is a clinically heterogeneous condition, with psychomotor changes that can range from extreme agitation that endangers patient and provider safety, to subtle lethargy that can be difficult to clinically detect. The most effective prevention and treatment of delirium involves multifactorial and multidisciplinary behavioral modifications and medical optimization of underlying conditions. There is no consensus about uniformly effective pharmacologic prophylaxis or treatment. Delirium is a high risk condition, which is associated with increased morbidity and mortality, and is a critical syndrome for all healthcare providers to recognize.

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