BJA Education, 21(8): 314–320 (2021)

doi: 10.1016/j.bjae.2021.03.005
Advance Access Publication Date: 4 May 2021

Revalidation FOR ANAESTHETISTS RCA Revalidation matrix
Matrix codes: 1A01, 2A03, 3I00

Preoperative assessment of the older patient

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Keywords: comprehensive geriatric assessment; frailty; perioperative medicine; preoperative assessment; shared decision-making

Learning objectives

By reading this article, you should be able to:

- Describe key age-related physiological changes.
- Discuss what is meant by frailty and how it can be assessed.
- Outline the key components and impact of a comprehensive geriatric assessment.

Key points

- Age-related multi-morbidity is associated with adverse outcomes in older people.
- It is important to identify and assess multi-morbidity and frailty at preoperative assessment.
- Comprehensive geriatric assessment determines and optimises a person's medical, psychosocial and functional capabilities and limitations.
- Comprehensive geriatric assessment improves outcomes, including mortality and morbidity.
- Individualised assessment, using the principles of shared decision-making, informs the discussion of risks.

The population of the UK is ageing; 25% of the population will be aged ≥65 yrs by 2050, compared with 16% in 1998.[1] This has resulted in greater numbers of older people undergoing elective and emergency surgery. The impact of this has been examined in a number of reports, which show that older patients present across surgical specialties.[2] This burden of age-related comorbidity or multi-morbidity observed in older patients is independently associated with adverse outcomes, including mortality and discharge to institutional care.[3] There is therefore a need for comprehensive preoperative assessment to inform shared decision-making, ensuring that surgery is undertaken safely for patients with multi-morbidity.

Despite evidence to show that multidisciplinary models of assessment and care improve outcomes, such as mortality, traditional preoperative assessment pathways remain established in clinical practice.[4] Traditional models of nurse-led pre-assessment in the outpatient setting can have disadvantages for older or frail patients. Firstly, there is a focus on optimising intraoperative and immediate postoperative care, with less focus on measures to improve long-term outcomes. Secondly, it can be difficult to coordinate care amongst multiple specialties, which has the potential to disrupt a patient's perioperative care and delay surgery. Finally, there is a lack of screening for previously undiagnosed comorbidities and geriatric syndromes relevant to the shared decision-making process. These issues include undiagnosed cardiorespiratory disease, cognitive impairment and frailty, all of which may improve outcomes if optimised. As a result, recent guidance advocates incorporating specialist comprehensive geriatric assessment (CGA) and optimisation into the care of the older patient with multiple morbidities.[5]

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Accepted: 5 March 2021

Physiology of the older person

Ageing refers to time-dependent post-maturity changes that take place at a cellular level. These changes may lead to a decline in physiological reserve and functional status.[6]

Cardiovascular system

Effects on cardiac output

Over time, large- and medium-sized arterial vessels become less compliant, increasing systemic vascular resistance. Hypertension may cause left ventricular strain and hypertrophy. Increased collagen and fibrous tissue deposition can further impair diastolic filling. To maintain cardiac output, preload is increased. Whilst cardiac output is preserved initially, the heart now functions on a flatter part of the Frank–Starling curve with reduced physiological reserve. The decreased compliance of the vascular system also reduces the efficacy of vasoconstrictors, such as ephedrine and metaraminol. These changes can result in more pronounced intraoperative fluctuations in blood pressure and cardiac output.

Effects on myocardial conductivity

Myocardial catecholamine receptors are downregulated. This results in decreased responsiveness to catecholamines and sympathomimetic agents despite an increased basal level of sympathetic activity. This causes a decrease in maximal heart rate and cardiac output with age. Because of the ageing process, fat infiltration and fibrosis of the cardiac conducting pathways can lead to issues, such as heart block, atrial fibrillation, ectopic beats and arrhythmias.

Effects on cardiac structure

Progressive calcification of the cardiac valves is commonly seen in older people. This is most likely to affect the aortic valve, causing sclerotic disease and aortic stenosis.

Respiratory system

Effects on lung mechanics and volumes

Structural changes to the lung parenchyma, spine and chest wall occur with age. These changes result in a reduction in airway elastance, lung compliance and chest wall compliance. Total lung capacity, forced vital capacity, forced expiratory volume in 1 s and vital capacity all reduce with age; closing capacity (CC) increases with age. However, residual volume and hence functional residual capacity decrease. This leads to an increased tendency of the alveoli and the terminal conducting airways to collapse. Gas exchange is impaired across the alveolar membrane. Smoking and the development of obstructive airways disease accelerate this process. However, even in non-smokers, CC encroaches onto the tidal volume when supine by the age of 65 yrs.

The upper airway becomes increasingly susceptible to collapse from the loss of elastic tissue around the oropharynx. The incidence of sleep apnoea increases with age, and this condition should be screened for in older patients presenting for surgery.

Effects on ventilatory responses

Declining chemoreceptor function causes a marked impairment in the ventilatory response to hypoxia or hypercarbia. There is a linear decrease in the arterial partial pressure of oxygen with age and an increase in the arterial partial pressure of carbon dioxide.

Renal system

Reduction in renal function

Healthy adults lose 50% of their nephrons between the ages of 18 and 75 yrs, resulting in a reduction in renal cortical mass. Cortical blood flow and glomerular filtration rate are reduced because cardiac output is decreased. As there are fewer nephrons, the sodium load per nephron is greater. However, the ability to excrete sodium is reduced because of a deterioration of the countercurrent multiplier system in the loop of Henle. There is also reduced activity along the renin–angiotensin–aldosterone axis, which further compromises the body's ability to manage fluid and electrolyte balance. Older patients are therefore less able to tolerate hypo- or hypervolaemia in the perioperative setting.

There are often other contributors to the progressive decline in renal function. These contributors include an increased burden of diseases, such as diabetes and hypertension, and the use of nephrotoxic drugs, such as angiotensin-converting enzyme inhibitors. In male patients, benign prostatic disease is extremely prevalent (up to 60% at 90 yrs) and can contribute to obstructive renal impairment.

Neurological system

Baseline cognitive function

The risk of cognitive dysfunction and dementia increases with age, with 17% of people aged >80 yrs affected by cognitive decline, as defined by significant decline in one or more cognitive domains on history and cognitive assessment.[7] Decreased neurotransmitters such as acetylcholine and dopamine, loss of neuronal cells and demyelination have been demonstrated in animal studies. This causes slower nerve conduction speeds and increased latency. Overall, this leads to a general decline in performance and increased risk of cognitive dysfunction.

Visual impairment is more prevalent in older patients. This is largely attributable to age-related cataract formation, macular degeneration and glaucoma. Moreover, sensorineural hearing loss is common in the elderly. These impairments can cause significant difficulties with communication and can contribute to cognitive impairment, particularly during acute illness.

Autonomic neuropathy is more prevalent with age and other conditions, particularly diabetes. Impaired baroreceptor responses can cause perioperative cardiovascular instability, and delayed gastric emptying is linked with an increased risk of aspiration.

Delirium

Delirium is a common (14–56%) postoperative clinical syndrome amongst older inpatients. Risk factors, such as admission to the ICU, sensory impairment, intercurrent illness, surgery, dementia and pain, are all more likely in surgical inpatients.[8]

Musculoskeletal system

Sarcopenia

Muscle mass decreases with age. Skin changes also occur with thinning of the epidermis, dermis and subcutaneous

fat. Older patients therefore are at a higher risk of bruising and pressure-related injuries. The reduction in subcutaneous fat also increases the rate of heat loss, and shivering is less effective because of the reduced muscle mass. Consequently, thermoregulation can be significantly impaired, and temperature monitoring should be routine intraoperatively.

Osteoarthritis

Osteoarthritis and osteoporosis are extremely common and can cause significant pain and reduced mobility whilst impacting on quality of life and cardiorespiratory reserve. Older patients are at an increased risk of fragility fractures and have issues with reduced bone healing because of a reduction in osteoblast activity.

Introduction to the principles of CGA

Given that one of the major predictors of mortality and morbidity for older patients is frailty, screening and assessment for frailty syndromes are imperative in improving outcomes. Comprehensive geriatric assessment is a 'multidisciplinary diagnostic process intended to determine a frail older person's medical, psychosocial and functional capabilities and limitations to develop an overall plan for treatment and long-term follow-up'. It comprises a multidimensional, holistic assessment, and results in the formation of an evidence-based yet individualised plan.[9] After assessment and optimisation, the process of shared decision-making can then be undertaken in an informed manner.

Comprehensive geriatric assessment is undertaken by a multidisciplinary team and generally includes review by a geriatrician, a specialist nurse and allied healthcare professionals, including occupational therapists, physiotherapists and social workers. In perioperative care, this team works synchronously with the teams preparing patients for surgery in pre-assessment and surgical clinics. Comprehensive geriatric assessment takes place in a community, outpatient or inpatient setting. One such example within the UK is the Peri-operative care of Older People undergoing Surgery service established in 2003. This geriatrician-led multidisciplinary service uses CGA methodology in older or multimorbid patients having elective and emergency surgery. This model has been successfully implemented in other trusts within the NHS.[10] Similar models for community and acute care are described in the British Geriatrics Society (BGS) HoW-CGA Service Level Toolkit.

The comprehensive nature of CGA allows for the identification, assessment and optimisation of risk factors that contribute to perioperative mortality and morbidity. These risk factors include baseline cognitive impairment, cardiorespiratory disease, frailty and poor functional status. These multidimensional assessments provide patients, families and clinicians with an opportunity to engage in discussions about risk management and facilitate shared decision-making.

Evidence for CGA

In medical inpatients, evidence supports the use of CGA-based care to improve longer-term outcomes, including mortality and institutionalisation.[11] For patients in the community, the Ambulatory Geriatric Evaluation–Frailty Intervention Trial demonstrated that at 2 yrs, CGA assessment and optimisation, as provided by an ambulatory geriatric unit, resulted in a reduction in inpatient bed days and a gain of 0.54 quality-adjusted life years.[12]

Comprehensive geriatric assessment is also of demonstrable benefit in patients undergoing both elective and emergency surgery. In patients admitted to a hospital with a hip fracture, CGA was cost-effective and improved mortality and mobility.[4,13] In pre-assessment, introducing a nurse-led focused evaluation with optimisation resulted in a reduced length of stay, postoperative complications and delays secondary to cancellations.[14] In patients undergoing elective vascular surgery, CGA reduced length of stay and postoperative complications, such as delirium, cardiac complications and bladder/bowel complications, and showed trends towards fewer delayed discharges from hospital.[15]

The heterogeneity in models of CGA care makes for relative difficulty in carrying out systematic reviews of the current literature. A recent systematic review identified that most of the published literature in surgical patients focuses on the assessment component of CGA alone, rather than both assessment and optimisation.[16] Nonetheless, the narrative synthesis concludes that CGA is likely to have a positive impact on postoperative outcomes, such as medical complications and length of stay, in older patients undergoing elective and emergency surgery. In the emergency surgical setting, a Cochrane review, including literature in hip fracture and one cancer surgery paper, shows the benefit of CGA on mortality, length of hospital stay and financial cost.[4]

Components of CGA and practical applications

Useful resources describing the components of CGA include the BGS CGA toolkit for primary care practitioners and the BGS good practice guide for CGA. Evidence for individual components of CGA has been studied in a wide variety of settings. Ideally, CGA should target patients most likely to benefit from intervention and optimisation using a combination of criteria, including age, degree of functional impairment, comorbidities, high-risk social conditions (such as living alone) and the presence of geriatric syndromes.

Physical assessment

Medical assessment: history and examination

A comprehensive medical history should be taken and document the person's comorbid conditions and their impact on daily life. In addition to focusing on pre-existing morbidity, new medical conditions may be diagnosed: these conditions can then be optimised. Managing multiple coexisting conditions can be complicated by nuanced decisions about the benefits of initiating treatment and the risk profile posed by a patient's frailty or comorbid disease. Examples include initiation of anticoagulation in a patient at risk of falls, or cardiac secondary prevention in a patient at risk of postural hypotension secondary to Parkinson's disease.

The assessment should also seek to be proactive in the diagnosis of geriatric syndromes: identifying, ameliorating or eliminating common issues. Examples include difficulties with hearing and vision, which impact on communication and therefore may complicate the consent process. Other common issues include poor balance, frequent falls, poor appetite, urinary incontinence and constipation.

Physical assessment is closely tied to functional assessment, which relies more heavily on non-specific markers. As such, a systematic and thorough general examination is

indicated, which covers often missed issues, such as posture, skin integrity, dentition, gait, foot hygiene and mobility.

Mobility

Assessment of mobility also overlaps with functional assessment and can be undertaken by different members of the multidisciplinary team. The assessment should include objective measures, such as gait speed or 'Timed Up & Go', and may also involve appraisal of balance and the use of any mobility aids.

Timed Up & Go measures, in seconds, the time taken to stand up from a standard chair, walk a distance of 3 m, turn, walk back to the chair and sit down.[9] It is a routine part of the Edmonton Frail Scale (EFS) assessment. Independently of this, gait velocity can be assessed. A slow velocity is independently associated with postoperative mortality and an increased risk of falls.[17] Interventions related to mobility risk factors that are likely to be beneficial in reducing the risk of falls include muscle strengthening and balance retraining and a home hazard assessment.[18]

Weight and nutrition

Weight and BMI should be recorded routinely. In addition, other screening questions or observations, such as changes in clothing size, should be noted. Nutritional screening using validated tools, such as the Malnutrition Universal Screening Tool, can highlight any potential possible improvements. A typical dietary history includes screening questions to ascertain recent weight loss, daily caloric intake and risk of vitamin and mineral deficiencies. Preoperative nutritional supplementation should be considered, particularly in patients with cancer, as part of a prehabilitation programme.[19] Severe deficiencies may require referral to a dietician.

Continence

Continence is a particularly important factor to consider, particularly as other issues, such as pain and intercurrent illness, can increase the risk of urinary retention and constipation. Urinary incontinence can be assessed and potentially treated by the use of frequency/volume charts and bladder scanning after voiding. Patients with pain on micturition, haematuria, vaginal prolapse or prostatic hypertrophy may warrant onward referral.

Frailty

The cumulative effects of multiple deteriorating organ systems are an equally important consideration in the assessment of older patients. *Frailty* is defined as a state of increased vulnerability to poor resolution of homoeostasis after a stressor event. In the surgical setting, it is clearly associated with postoperative morbidity and mortality, such as living in an institutionalised setting and death.[3,20] Different models of frailty exist, and routine screening and intervention in the form of a 'frailty toolkit' are advocated to support patients with frailty and multiple morbidities.[21]

Fried model

Fried and colleagues described a frailty 'phenotype', which uses five physical and functional characteristics to define frailty: unintentional weight loss, self-reported exhaustion, low physical activity, slowness of gait and weakness (defined by grip strength) (see Supplementary material). Patients who display three or more of these characteristics are deemed frail.

Rockwood model

A second model proposed by Rockwood and colleagues views frailty as a syndrome of 'cumulative accrued deficits'.[22] This is usually measured by dividing the number of deficits a patient displays by the number of deficits measured, giving a ratio or frailty index. Based on this model, the pictorial Clinical Frailty Scale (Fig. 1) was devised and is recommended for use in screening for frailty.

Objective tools, such as the EFS, can be used to explore the diagnosis of frailty.[23] The EFS is a valid, reliable, multidomain tool that evaluates muscle strength, mood, functional independence, medication use, social support, nutrition, health attitudes, continence, burden of medical illness and quality of life.

Regardless of which model is used, frailty is significantly associated with morbidity and mortality in surgical patients, across all surgical disciplines and irrespective of the urgency of surgery.[2]

Aerobic capacity is an area for potential optimisation. In sedentary individuals, maximal oxygen consumption (V_{O2MAX}) decreases linearly with age. Preoperative exercise programmes have been shown to be feasible and safe. These programmes improve physical fitness, and there is some evidence that exercise reduces postoperative complications and inpatient stays.[24]

Medication review

A review of medication includes an appraisal of adherence and a balanced assessment of the risk/benefit profile of regular medications. Perioperatively, there should be a focus on identifying medications that may precipitate issues, such as falls or delirium. This includes anti-muscarinics, sedative medication, opiates, donepezil and antihypertensives.

Ideally, a clinician competent in medicines management or a pharmacist should review medication changes and dose alterations. Decision-making tools, such as the Screening Tool of Older Persons' Prescriptions/Screening Tool to Alert to Right Treatment or the Medication Appropriateness Index, can be used in conjunction with the patient to determine ongoing treatment. These tools provide prompts and specific circumstances with which to review the prescriptions of older patients.

Functional, social and environmental assessments

Functional assessments are carried out by combining history taking and clinical assessment. Objective tools, such as the modified Barthel Index of instrumental activities of daily living or the Nottingham Extended Activities of Daily Living scale, can be used as an adjunct to clinical assessment.

Within the perioperative setting, it is important to consider the impact that surgery or postoperative complications may have on functional status. Surgery in frail patients is associated with an initial increase in disability, but a net decrease in long-term disability.[25] As such, social circumstances and support networks should be identified with a view to recognising how this may potentially change after surgery. Family and social support networks should be explored, and patients should be counselled about the potential risk of requiring additional help, which may involve a period of institutionalisation. Moreover, timely identification and planning of issues related to social care reduce inpatient bed days and should be prioritised in the preoperative clinic.

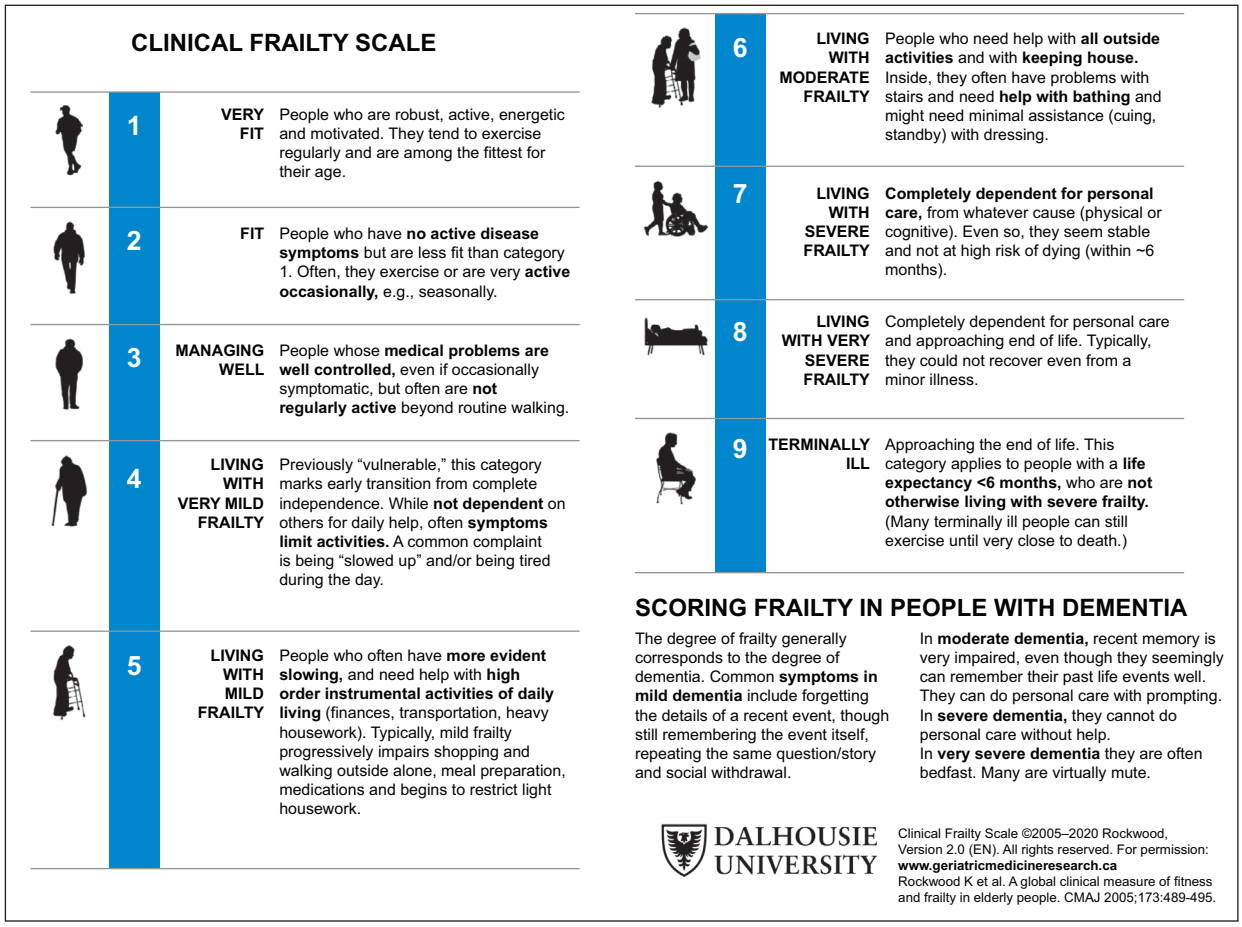

Fig 1 Clinical Frailty Scale. Used with permission from Geriatric Medicine Research, Dalhousie University.

Psychological components

Cognition

Cognitive impairment is common in older patients. Mild or previously undiagnosed cognitive impairment exists in around 20–24% of patients undergoing elective surgery.[26] In patients having emergency general surgery, the prevalence of mild cognitive impairment (MCI) is as high as 80%. Mild cognitive impairment is associated with adverse post-operative outcomes, including increased length of stay and postoperative delirium or cognitive decline.[27]

Postoperative delirium is an independent predictor of postoperative mortality and morbidity at up to a year after surgery, and should be screened for and managed by a multidisciplinary team in hospital.[28,29] It is important that older patients presenting for surgery are screened for pre-existing cognitive impairment. One tool commonly used to screen for MCI is the Montreal Cognitive Assessment tool.[30] The test assesses cognitive domains, such as short-term memory recall, visuospatial ability, executive function, phonemic fluency, attention, concentration and working memory. Patients with impaired function may need ongoing memory clinic referral.

Mood

The prevalence of depression in older people is 5–10%.[12] A screening process for anxiety and depression should also be put in place using a tool, such as the Hospital Anxiety and Depression Scale. This test may be useful to identify the level of support required by the patient and if further support from mental health services may be necessary.

Individualised risk assessment

The information gathered from pre-assessment can be used to generate an individualised risk assessment. Whilst there are limits to the accuracy of any individual system, commonly used scores, such as the Portsmouth Physiological and Operative Severity Score for the Enumeration of Mortality (P-Possum), Surgical Outcome Risk Tool (SORT) and the National Surgical Quality Improvement Program (NSQIP) risk-scoring tool, can be used along with objective markers of fitness, such as cardiopulmonary exercise testing. When combined, these systems give the physician an indication of the likely morbidity and mortality for the proposed surgery. These results can inform decisions and discussions with patients regarding surgical choices, for example, open abdominal

aortic aneurysm repair *vs* endovascular repair. It also provides context to the likely perioperative course, including discussions around intensive and high-dependency care. Finally, part of the CGA framework involves an assessment of functional status and discussion around advanced care planning. These discussions allow clinicians to identify outcomes and complications that are important to individual patients and are a key component of the shared decision-making process.

Conclusions

The care of older surgical patients frequently requires assessment and management of multiple medical conditions, geriatric syndromes and functional status involving collaboration between different specialties and disciplines. Comprehensive geriatric assessment is an interdisciplinary, holistic, diagnostic and therapeutic process that facilitates the assessment and optimisation of the older surgical patient perioperatively. The very nature of the model involves and informs the patient and their relatives of their perioperative risk, and is intrinsically aligned with the principles of shared decision-making. The development of pathways that involve a multidisciplinary approach to the older surgical patient should be welcomed.

Declaration of interests

The authors declare that they have no conflicts of interest.

Supplementary material

Supplementary data to this article can be found online at https://doi.org/10.1016/j.bjae.2021.03.005.

MCQs

The associated MCQs (to support CME/CPD activity) will be accessible at www.bjaed.org/cme/home by subscribers to *BJA Education*.

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