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Geriatric anaesthesia

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Introduction

Elderly is defined as anyone over 65 years of age.[1] This definition was created more than 100 years ago by Prince Bismarck of the German Empire who chose this date as being just out of reach for the average citizen to achieve and become eligible for a state pension.[1] Presently a further distinction is made into "young old" from 65–74 years, "middle old" from 75–84 years and "old old" from 85 years and up.[1] Healthy life expectancy has increased significantly over the last century, particularly in developed countries. This has prompted gerontologists to call for a new definition of elderly as being people over 75 years.[1] There is massive pushback against this though from unions and social groups, who fear that people will lose social benefits such as financial support, bus ticket discounts, etc. Another current school of thought suggests creating an "ageless" society where the elderly are defined according to health status alone, which would allow healthy chronologically older people to continue working as long as they are willing and able.

The World Health Organization (WHO) defines healthy ageing as *"The process of developing and maintaining the functional ability that enables wellbeing in older age"*.[2] This functional ability is the composite of an individual's own physical and mental status as well as characteristics dictated by their environmental and socio-economic circumstances.[2] Therefore not all elderly people are equal, bringing in the concept of an individual's chronological vs their physiological age. This makes a standard approach to the geriatric patient complex, necessitating an individualised, multidisciplinary plan for each patient.[3] A successful perioperative outcome goal is to return the geriatric patient to their same preoperative functional ability following their perioperative journey.[3] It is not enough to simply have a patient survive a procedure; targeting optimal quality of life is also very important for these patients.[4]

According to the WHO, the global elderly population is growing faster relative to all other age groups. The WHO predicts that the global elderly population (age > 60 years) will be greater than the global adolescent population (age 10–24 years) by the year 2050.[2] In Africa it is estimated that the elderly population will triple from 46 million in 2015 to approximately 150 million by 2030.[5] In addition, elderly patients are presenting for increasingly complicated surgeries later in life.[6]

Geriatric syndromes

Ageing causes a cluster of conditions which are labelled the geriatric syndromes.[9]

These include:

- Frailty
- Delirium
- Urinary incontinence
- Dizziness
- Falls
- Sleep disturbance
- Depression
- Malnutrition
- Pain
- Pressure ulcer
- Polypharmacy
- Poor self-care

The presence of any of these syndromes and their severity must be assessed preoperatively. Several may be modifiable or reversible, and must be addressed as far as possible in the preoperative optimisation process.

Frailty is defined as *"An age-associated biological syndrome which is characterised by a decrease in biological reserves, due to dysregulation of several physiological systems, putting an individual at risk when facing minor stressors."* [9]

While frailty is common in the elderly ("*an age-associated geriatric syndrome*"), it does not necessarily occur in all older people or only in older people, and can also occur in relatively young individuals.[10,11] In a South African study, Leopold-George found a prevalence of frailty in patients below 65 years of age between 4–37%.[15] These young frail patients in South Africa predominantly suffered communicable and non-communicable diseases such as HIV, tuberculosis and traumatic injuries.[12] The prevalence of frailty among elderly South Africans is estimated

Table I: Pathophysiology of geriatric patients[6-8]

System	Changes	Effect
General	• General decrease in all physiological functions	
Cardiovascular	• Arterial sclerosis with increased peripheral vascular resistance and decreased vessel elastance • Less compliant heart with decreased stroke volume and diastolic dysfunction because myofibrils are replaced with collagen and fat • Conduction tissue is replaced with fibrotic tissue, calcification, and amyloid deposits • Downregulated myocardial catecholamine receptors • Aortic valve sclerosis	• Hypertension • Decreased efficacy of vasoconstrictor agents • Ischaemic heart disease • Congestive cardiac failure more prevalent • Poor cardiac reserve and tolerate tachycardia and dysrhythmias poorly • Increased conduction abnormalities, with a greater likelihood of requiring pacing • Decreased response to catecholamines and sympathomimetic agents • Varying degrees of aortic stenosis
Respiratory	• Reduced pulmonary elasticity • All lung volumes except residual volume are decreased • Closing capacity approaches functional residual capacity from 44 years supine and from 66 years erect	• Decreased lung compliance • V/Q mismatch with hypoxaemia and increased work of breathing • Greater chance of postoperative pneumonia due to decreased ability to cough • PaO2 decreases by 0.3% per year until 75 years, when it settles at about 83 mmHg
Hepatic	• Reduced liver size (50% by 80 years) and reduced liver blood flow (10% per decade) • Albumen and cholinesterase production decreased • Alpha 1 acid glycoprotein synthesis increased	• Delayed clearance of liver metabolised drugs • Altered plasma protein binding
Renal	• Renal blood flow, glomerular filtration rate, tubular function, concentrating ability and elimination functions are decreased • Synthetic function reduced • Creatinine clearance decreases but levels remain relatively normal because muscle bulk decreases	• Decreased ability to clear drugs and other substances • Anaemia more likely due to erythropoietin deficiency • Creatinine level cannot be used to accurately describe creatinine clearance
Central nervous system	• General central nervous system function deterioration • Increased cerebrovascular disease • Increased autonomic neuropathy	• Greater likelihood of perioperative delirium and cognitive dysfunction • Orthostatic hypotension and haemodynamic lability
Peripheral nervous system	• Reduced number of spinal cord neurons • Number and diameter of myelinated dorsal and ventral nerve root fibres decreased • Decreased peripheral nerve inter-Schwann cell distance	• The elderly are more sensitive to neuraxial and peripheral nerve blocks
Endocrine	• Increased insulin resistance	• Increased type II diabetes mellitus (prevalence up to 25%)
Haematology	• Decreased erythropoietin • Iron deficiency (due to malnutrition or chronic bleeding)	• Anaemia (only transfuse if Hb < 7 g/dl or < 8 g/dl in a patient with cardiac disease)
Musculoskeletal	• Decreased muscle, increased fat (with altered distribution) • Arthritic changes, kyphosis, flexion deformities • Thin skin	• Pharmacokinetic changes • Prone to hypothermia due to reduced fat and shivering ability • Positioning difficult • Technical issues with lines and regional techniques • Care with tapes, line adhesives and pressure points to prevent pressure sores

to be between 38–45%.[12] It is also important to note that frailty is a separate condition to chronic comorbidities or a chronic disability.[10] Frailty doubles the risk of morbidity, mortality and the number of patients requiring readmission, and is a strong predictor of adverse perioperative outcome.[10,11] Frailty also reduces the chance of a previously independent person from returning to their independent lifestyle by up to 50%.[10]

Two models are used to describe and assess frailty:[13]

1. The **phenotype model** which is based on the concept of an internal lack of energy leading to self-reported exhaustion, slow gait speed, poor grip strength, weight loss and falls. Cognitive and psychosocial components of frailty are not considered. This model is assessed using measures of grip strength, gait speed, etc.[10,13] An example of a phenotype model assessment tool is the FRAIL scale. Measuring frailty using phenotype alone does tend to underestimate the prevalence

of frailty. (< 10% estimate in elective surgery cases compared to an actual prevalence of up to 50%.)[10,14]

2. The **accumulated deficits model** aims to estimate physiological age by adding the number of deficits present in a patient over more than 30 domains, which describe 70 potential deficits. The frailty index is then calculated by dividing the number of deficits present in the patient by the number of deficits assessed. This calculation produces a score on a scale between 0 and 1, where 0 represents no frailty and 1 complete frailty.[14] A score of 0.25 and above is considered frail, with 0.4 being severely frail.

Because both models are time-consuming and clinically cumbersome, neither is commonly used in practice.[8] The Clinical Frailty Scale (CFS) is based on the frailty index and is the most used clinical frailty scoring system.[13] The scale uses a rubric of nine clinical descriptors. Patients described by descriptor 5 and above are frail with descriptor 9 describing the terminally ill patient as the most extreme case.[13]

Frailty is important to recognise because it is potentially modifiable if addressed by a multimodal team targeting nutrition, exercise, muscle gain and mental health optimisation.[10,11,15]

Delirium may present acutely as a deterioration in the ability to pay attention and a deterioration in cognitive function. Acute delirium may be life-threatening and is considered a medical emergency. It is important to first recognise delirium and to then manage any reversible causes as soon as possible.[6,9] Infection and neurological disease are the most common causes, followed by sleep deprivation, polypharmacy, an unfamiliar environment and then not having access to vision and hearing aids.[9] Hypoxia, hypoglycaemia, metabolic and electrolyte disturbances must also be excluded.[11] Underlying depression and substance abuse, especially alcohol abuse, could also be a cause.[11]

Polypharmacy can significantly worsen perioperative morbidity and mortality risk. It is estimated that up to 50% of geriatric patients are taking at least one or two medications which are not indicated. Many geriatric patients may also be self-medicating with herbal remedies, vitamins and other substances.[9]

Poorly managed chronic pain may be prevalent in up to 75% of the geriatric population.[9] The impact is a decreased functional ability with decreased mobility, increased frailty and depression.[9]

COVID-19

Geriatric, and in particular, frail geriatric patients, are especially vulnerable to COVID-19 infection.[16] Of note is that COVID-19 infection in these patients often presents atypically with falls, delirium or malaise.[16] Apart from the direct effects of COVID-19 infections, it is now recognised that there have also been significant indirect effects of the pandemic on the geriatric population.[11] These include the impact of social isolation, decreased physical activity and the accompanying increase in malnutrition. All of these indirect effects have recently caused a surge in the geriatric frailty rate.[16] Social isolation has previously been shown to be an independent risk factor for an increase in physical frailty four years after the isolation period, implying that we may yet see a future spike in physical frailty among these people.[16]

Perioperative approach to the geriatric patient

Preoperative

Geriatric patients commonly have at least one comorbidity. The level of control, current medication and target organ damage must be elucidated and, if possible, optimised.

Patient autonomy must be remembered and always respected, meaning that patients require all information to provide fully informed consent.[6] When the patient is incapable of making their own decisions or of giving consent, a healthcare proxy must be contacted. It is advisable to document if the patient has an advance directive and who their healthcare proxy will be should their cognitive ability deteriorate perioperatively.[8] If an advance directive is not in place, then the issue should be discussed with the patient, especially if major surgery is planned.[8]

Assessment tools

The comprehensive geriatric assessment tool (CGA) is the gold standard assessment tool for the geriatric medical patient.[11] This assessment requires a geriatrician-led multidisciplinary team, i.e. it is not practical for everyday anaesthesia but would likely be especially useful for specific cases and for patients > 85 years of age.[9] Components of the CGA are listed in Table II.

Table II: CGA components[8]

Domain	Items assessed
Medical	• Comorbid conditions and severity • Medication review • Nutritional status
Mental health	• Cognitive function • Mood • Decision-making ability • Delirium risk factors present
Functional capacity	• Activities of daily living (ADL) • Gait • Balance • Activity status • Use of hearing aids, visual aids, dentures, mobility aids
Social situation	• Family and friend support structure • Social network (clubs, etc.) • Eligibility for home care
Environment	• Home facilities and safety features • Transport facilities • Access to local resources
Risk score	• Pathology specific, e.g. Nottingham hip fracture score • Frailty score

Multiple other assessment tools are available to assess specific organ systems.

The clinical frailty scale has already been described above and is the most practical frailty scale for everyday clinical use.[7]

The mini-mental state examination or the similar, and freely available, abbreviated mental test (AMT) should be performed to identify underlying cognitive impairment, which may at times not be overt. A score of less than 7/10 on the AMT denotes cognitive impairment.[6]

The timed up and go (TUG) test is where an individual is asked to get up from a chair, walk 3 m and return to sit on the chair again as quickly as possible. If they cannot do this in under 20 seconds, then they are considered at an increased risk of falls and reduced mobility.[7,8] Individuals who are too frail to achieve the TUG test in under 20 seconds are also at an increased risk of postoperative morbidity.[8]

The elderly patient often presents with underlying cardiac disease and should be assessed according to the standard cardiac for non-cardiac surgery guidelines.[7]

Underlying depression should be considered in all elderly patients. The prevalence is quoted at 5–10%.[8] Depression needs to be managed appropriately because it is an independent risk factor for postoperative delirium, increased postoperative pain perception and has implications for the development of chronic pain syndromes.[7]

Optimisation

Any chronic medication which could exacerbate delirium should be reduced or stopped if possible preoperatively.[15] These include benzodiazepines, insomnia medication, anticholinergic agents, opioids, other psychotropic agents and antispasmodic agents.[15]

Cardiorespiratory and nutritional optimisation must be done as much as possible, time permitting. Frailty needs to be addressed in a multidisciplinary team.[7]

Preoperative fasting time must be kept as short as possible.[8] A carbohydrate beverage given according to ERAS guidelines preoperatively, improves patient wellbeing, psychological ability to cope and glucose homeostasis.[7]

Intraoperative

As explained under pathophysiology, elderly patients have very limited physiological reserves and, unlike younger patients, will tolerate a clumsy anaesthetic poorly. This means that whatever technique is chosen, the emphasis must be on paying strict attention to detail. It is imperative to maintain the elderly patient within a range as close to their normal parameters as possible.

Pharmacokinetic changes in the elderly include delayed drug absorption, a greater volume of distribution and reduced metabolism and elimination.[6] In general, this means that elderly patients require similar doses to younger patients to achieve optimal effect initially, but all agents take longer to reach their effect and require less topping up. Care must be taken to not overdose the elderly patient by being too impatient with initial loading.[6]

Pharmacodynamic differences in the elderly patient include a greater sensitivity to central nervous system depressant agents, which necessitates a reduced MAC in elderly patients.[6] (MAC decreases by 6–7% per decade). Overdose can predispose to postoperative delirium (POD) and postoperative cognitive deficit (POCD). Ideally, volatile agents should be titrated against a depth of anaesthesia monitor.[7]

Day-case surgery and minimally invasive surgical techniques may make it possible to achieve the goal of returning the elderly patient to their pre-hospital state as soon as possible.[6,8]

Analgesia can be very tricky due to analgesic agent side effects. Paracetamol, tramadol, patient-controlled analgesia and regional techniques cause the least morbidity and mortality.[6]

General vs regional techniques

There is no evidence to specifically choose either general or regional techniques to prevent postoperative cognitive dysfunction.[7,13] The choice of technique is best made considering the cost-benefit ratio to the patient, across all organ systems. Keeping the patient haemodynamically stable and within their usual physiological parameters is the current wisdom. The use of depth of anaesthesia monitoring in combination with cerebral perfusion monitoring and the avoidance of hypotension has shown benefits in reducing early postoperative cognitive dysfunction.[13]

Postoperative

Postoperative delirium and postoperative cognitive deficit

Postoperative cognition disorders follow a spectrum from delirium to postoperative cognitive deficit. POD usually resolves, but POCD may remain permanently.[8] A high index of suspicion must be maintained to avoid missing the patient with mild features.[10] Treatable causes and non-pharmacological preventative measures (hearing aids, etc.) must be addressed as far as possible before resorting to sedative pharmacotherapy.[13]

Postoperative analgesia is again a challenging topic in the elderly patient. Opiate side effects can be especially deleterious to these patients. In general, multimodal analgesia and patient-controlled analgesia are advocated.

Conclusion

As the world's population ages, it will become more common to encounter elderly patients presenting for surgery, and for more complex surgery. Perioperative care of the elderly patient demands particular attention to detail and an awareness of the issues specific to this group.

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