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Providing general anesthesia for elderly patients during planned procedures — main differences compared to younger adults

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Abstract

Introduction

The aging population has increased the number of older adults undergoing elective surgery, making safe, individualized general anesthesia essential. Age-related physiological changes - such as reduced cardiac, pulmonary, hepatic, and renal reserve, multimorbidity, frailty, and altered body composition - affect drug metabolism, pharmacodynamics, and tolerance to perioperative stress, resulting in higher rates of cardiovascular, respiratory, and cognitive complications compared with younger adults.

Results

Older patients require careful dose adjustments due to reduced drug clearance and increased sensitivity to anesthetics. Propofol-based total intravenous anesthesia (TIVA), EEG-guided depth monitoring, and agents like etomidate or dexmedetomidine improve hemodynamic stability and reduce postoperative cognitive dysfunction (POCD) and delirium.
Comprehensive preoperative evaluation—including frailty screening, cognitive and functional assessment, and medication review—helps identify high-risk patients.

Postoperative vigilance is needed to manage respiratory depression, inadequate pain control, and prolonged recovery. Telemedicine has proven effective for pre-anesthetic assessment, enabling early detection of cognitive impairment and reducing time, cost, and travel burden.

Discussion

Personalized anesthesia considering frailty, comorbidities, and altered drug metabolism improves safety. Minimizing anesthetic duration, selecting safer agents, EEG guidance, and TIVA support better outcomes, while telemedicine enhances patient-centered care.

Conclusion

General anesthesia in older adults requires tailored strategies addressing age-related changes and increased perioperative vulnerability. Individualized dosing, careful agent selection, structured preoperative assessment, postoperative monitoring, and telemedicine support can enhance safety and outcomes, highlighting key differences from younger patients and emphasizing a holistic, evidence-based perioperative approach.

Materials and methods

Scientific papers published between 2018 and 2025 were analyzed from databases such as PubMed, Dove Press Medical, and Google Scholar, focusing on the topic Providing general anesthesia for elderly patients during planned procedures—main differences compared to younger adults.

Keywords: elderly patients, general anesthesia, frailty, anesthetic pharmacology, cardiovascular complications, respiratory complications, preoperative assessment, telemedicine

Introduction

With the progressive aging of the population, an increasing number of older adults undergo elective procedures requiring general anaesthesia. Compared with younger patients, they experience a higher incidence of perioperative complications [1]. According to the American Society of Anesthesiologists, the decision to proceed with elective anaesthesia in individuals aged ≥65 years should be preceded by an extended preoperative assessment that accounts for age-related risks [2]. Older adults are characterised by frailty, multimorbidity and reduced physiological reserve, all of which significantly affect their tolerance of perioperative stress [3].

Preparation of the geriatric patient for elective general anaesthesia requires a broad and multidimensional evaluation, including functional status, comorbidities, cognitive function, nutritional status, mental health and current pharmacotherapy, including anticoagulation [4,5].

In this population, anaesthetic strategies must be adjusted — both in terms of technique and dosing — due to altered pharmacokinetics and pharmacodynamics, as well as increased vulnerability to disturbances of homeostasis [5].

The postoperative period similarly demands heightened vigilance, as older adults are at increased risk for poorly controlled pain, cognitive disturbances including delirium, and complications that may impair functional capacity or independence [4,5]. Consequently, perioperative care in this group should involve intensified monitoring and the engagement of an interdisciplinary team throughout the entire perioperative pathway [4].

Recognition of frailty is an essential component of planning elective general anaesthesia. Frailty acts as an independent predictor of adverse outcomes, and its early identification, together with a comprehensive geriatric assessment, allows for optimisation and appropriate planning of perioperative care [1].

Elective general anaesthesia may be undertaken when a thorough risk assessment and adequate preoperative optimisation indicate that the expected benefits outweigh potential risks [6]. In older adults, careful management of comorbidities and proper preparation for anaesthesia are key determinants of safe perioperative care [7].

In recent years, telemedicine has gained an increasingly important role in the preoperative evaluation of older patients. Studies have demonstrated that in adults aged ≥70 years, remote telephone-based cognitive screening can be performed effectively and acceptably, facilitating access to anaesthetic consultation and supporting standardised perioperative pathways for seniors [8].

This review aims to summarise the principles of providing elective general anaesthesia in older adults, highlight the key differences compared with the younger population, and present current directions in perioperative practice, including the growing role of telemedicine in anaesthetic assessment.

Results

1.Anesthetic Considerations in the Elderly

1.1. Pharmacological considerations for anesthesia

The process of aging is characterized by a gradual and progressive decline in physiological function across multiple organ systems. Age-related physiological alterations in elderly individuals influence anesthetic requirements and responses. Therefore, anesthetic management in this population must be carefully adjusted to account for these changes [9]. Notable age-related transformations in body composition and organ function influence the pharmacodynamics and pharmacokinetics of anesthetic drugs. Reductions in skeletal muscle mass and total body water, along with increases in adipose tissue, modify the volume of distribution for both lipophilic and hydrophilic drugs. Medications that are more lipophilic such as propofol and fentanyl tend to distribute more widely in the body, often resulting in a longer duration of action, whereas hydrophilic drugs usually reach higher peak plasma levels. In

addition, declines in hepatic and renal function prolong the elimination half-life of numerous drugs.[10,11]

Alterations in pharmacokinetics and pharmacodynamics and drug clearance in older adults undergoing anesthesia require the administration of reduced anesthetic dosages during perioperative period. [9,12] A study conducted on 80 surgical patients evaluated the influence of age on propofol requirements for induction of loss of consciousness. Compared with patients aged 45–64 years, the propofol dose required decreased by 25.2% in individuals aged 75–84 years and by 38.5% in those aged ≥85 years. The authors further demonstrated that age remains an independent predictor of propofol requirement, even after adjusting for variables such as body mass index, serum albumin levels, and renal function. Therefore, propofol dosages should be further reduced in older patients during anesthetic induction [13]. Another noteworthy aspect is that propofol induces significant suppression of hemodynamic and respiratory function. In contrast, etomidate is considered a suitable alternative in geriatric population, as it is associated with greater hemodynamic stability. One study involving 200 elderly patients undergoing gastroscopy aimed to compare the outcomes of anesthesia with etomidate versus propofol. Among patients induced with propofol, 42% experienced apnea, and 88% exhibited a significant reduction in systolic blood pressure (>30%). In contrast, the study reported only a 14% incidence of apnea and a 12% incidence of hypotension following the administration of etomidate. Moreover, patients who received a combination of propofol and etomidate demonstrated a 14% incidence of apnea and a 12% incidence of hypotension [14].

A further consideration in the selection of an anesthetic agent is its impact on the nervous system. Preservation of cognitive function is particularly important in elderly patients. Postoperative cognitive dysfunction (POCD) is a recognized term for describing cognitive impairment following surgery. It plays a crucial role in predicting a patient's postoperative recovery [8]. Dexmedetomidine, an anesthetic agent, has been shown to exert beneficial effects on cognitive outcomes. To investigate this further, a meta-analysis was performed to evaluate the impact of dexmedetomidine on postoperative cognitive dysfunction. The findings indicate that dexmedetomidine is associated with a significant reduction in the incidence of POCD and improved postoperative cognitive performance, as measured by Mini-Mental State Examination (MMSE) scores [15].

Analgesia management represents another critical component of anesthetic care in elderly patients. Physiological changes in elderly patients alter morphine pharmacokinetics and pharmacodynamics, including reduced volume of distribution, clearance, and prolonged elimination half-life. Moreover, studies indicate increased central nervous system sensitivity to morphine among elderly. These changes result in greater and more prolonged analgesic effects at standard doses in geriatric population. Moreover, impaired renal function in elderly patients limits morphine clearance, elevating the risk of respiratory depression. Fentanyl, which has no active metabolites and a short, rapid-acting profile, may be a safer alternative.

Evaluating creatinine clearance is critical when considering morphine in geriatric population. Research highlights that age-related changes in pharmacokinetics, pharmacodynamics, and drug clearance support careful consideration of anesthetic dose adjustments in older adults during the perioperative period [9,16]

1.2. Cardiovascular system

Cardiovascular events represent the most frequent anesthesia-related complications in elderly surgical patients. This increased incidence is driven by age-related structural and functional changes, including reduced cardiac reserve, increased arterial stiffness, and impaired autonomic regulation [8]. A retrospective study of 8,441 patients undergoing general and vascular surgery was conducted to assess the incidence of perioperative cardiac complications The findings

indicated that age over 65 years was an independent predictor of postoperative cardiac events [17]. Therefore, careful preoperative cardiac evaluation, continuous intraoperative hemodynamic monitoring, and targeted fluid management are crucial to reducing perioperative cardiovascular risks and improving outcomes [8,17].

1.3.Pulmonary system

Respiratory complications are a crucial concern in elderly patients undergoing anesthesia. Age-related declines in pulmonary function include reduced lung and chest wall compliance and impaired oxygen diffusion. These changes markedly increase the risk of respiratory complications, particularly in smokers. Furthermore, the presence of chronic obstructive pulmonary disease (COPD) has been shown to further increase the risk of perioperative respiratory complications. [4, 8]. Pulmonary function should also be considered in terms of pharmacology. For instance, impaired renal function in elderly patients reduces morphine clearance, increasing the risk of respiratory depression [18].

1.4.Cognitive function

Postoperative cognitive dysfunction (POCD) is a frequent complication in elderly patients following general anesthesia, manifesting as deficits in memory and executive function. POCD is associated with increased mortality, delayed postoperative recovery and prolonged hospital stay. [15]. A meta-analysis of ten randomized controlled trials, including 4,367 patients aged ≥65 years, evaluated the impact of intraoperative EEG-guided anesthesia. The analysis demonstrated that EEG-guided anesthesia reduced the incidence of POCD by 22%. [19]. Cognitive preservation is also an important consideration when selecting anesthetic agents. In this context, perioperative dexmedetomidine administration has been shown to significantly reduce the incidence of POCD [20]. Therefore, strategies such as EEG-guided anesthesia and the selection of appropriate anesthetic agents may contribute to improved cognitive outcomes.

1.5.Frailty

Frailty is a term used to describe a state of decreased physiological reserve and increased vulnerability to stressors, which predisposes older adults to adverse health outcomes. It is of particular importance perioperative period, as it is associated with an elevated risk of postoperative complications and prolonged recovery. A variety of frailty assessment tools are employed in clinical practice to identify vulnerable older adults. Principal frailty indicators include reduced muscle strength, slowed gait speed, low levels of physical activity, unintentional weight loss, fatigue, cognitive impairment, and diminished capacity to perform activities of daily living. Frailty is particularly prevalent among older individuals undergoing anesthesia, and its assessment plays a critical role in the perioperative period by facilitating the identification of high-risk patients and guiding targeted interventions to minimize adverse outcomes [4, 11].

2.Recent Research on Anesthesia in Elderly Patients

In recent years, there has been growing attention to the safety of anesthesia in elderly patients, driven by an aging population and the increasing number of seniors undergoing surgical procedures [21]. Numerous studies have explored how different anesthetic techniques affect

cognitive function, the risk of postoperative delirium, long-term neurological outcomes, overall mortality, and perioperative complications.

2.1.Types of Anesthetics:

Evidence suggests that geriatric patients (≥65 years) receiving total intravenous anesthesia (TIVA) with propofol tend to achieve better cognitive outcomes compared to those administered inhalational anesthetics. Propofol is associated with a lower incidence of postoperative cognitive dysfunction (POCD; RR≈0.37), higher Mini-Mental State Examination (MMSE) scores, and reduced levels of inflammatory markers such as IL-6 and TNF-α [22].

2.2.Risk of Complications:

Among elderly patients, the most frequently reported anesthesia-related complications include cardiovascular events (~35%), respiratory complications (~20%), adverse drug reactions (~15%), and postoperative delirium (~10%) [3]. Up to 65% of patients aged ≥65 years may experience postoperative delirium, and around 10% may develop persistent cognitive impairments following surgery [23]. These complications contribute to prolonged hospitalization and increased mortality [24].

2.3.Impact on Cognitive Function:

The aging brain possesses reduced neurological reserve, making it more vulnerable to anesthetic insults. Factors such as prolonged hypotension during surgery can cause greater injury in older adults. Consequently, minimizing anesthetic depth and duration, while avoiding excessive sedative medications, is critical [25]. Frailty, defined as a clinical syndrome of reduced physiological reserve, has emerged as an important predictor of perioperative risk in this population. Current literature emphasizes that careful selection of anesthetic agents, vigilant monitoring of anesthetic depth, and assessment of cognitive and physical status can significantly improve surgical outcomes in elderly patients [26].

2.4.Differences Compared to Younger Patients:

Older patients often require more conservative anesthetic strategies [25]. Cottrell and Hartung recommend limiting anesthetic doses and duration and, whenever possible, favoring regional anesthesia over deep sedation [25]. Findings from the ISPOCD study indicate that approximately 10% of patients over 59 years develop POCD three months postoperatively, compared with a lower incidence in younger cohorts [25]. Key risk factors in elderly adults include advanced age, extended surgical time, infections, and pulmonary comorbidities [25,27].

2.5.Individualized Anesthetic Care:

Recent research highlights the importance of tailoring anesthetic care to geriatric patients [26]. In clinical practice, this involves comprehensive preoperative evaluation including internal medicine and geriatric assessment, stabilization of chronic comorbidities, and close intraoperative and postoperative monitoring. Individualized approaches help reduce the risk of complications, support cognitive preservation, and improve overall surgical outcomes.

3. Telemedicine as the Future of Pre-Anesthetic Evaluation

The COVID-19 pandemic has accelerated the adoption of telemedicine across healthcare, including preoperative care. Prior to elective surgical procedures, every patient undergoes a pre-anesthetic evaluation (PAE) to determine their fitness for anesthesia. In recent years, telemedicine has increasingly become an integral part of this process [20].

Telemedicine, particularly via video or telephone consultations, is being used more frequently for preoperative preparation of older adults. A systematic review of 15 studies found that virtual preoperative assessments resulted in a similar rate of surgical cancellations (~2%) as in-person evaluations, while also achieving high patient satisfaction (~90%) and reducing both time and costs [18].

In a separate retrospective study, tele-anesthesia consultations were associated with improved appointment adherence: patients in the telemedicine group completed more visits and had fewer cancellations compared to those attending in person [28]. Similarly, a multicenter study in France confirmed the high quality of anesthesia teleconsultations (95% meeting requirements), excellent patient satisfaction (median 10/10), and lower costs relative to in-person visits [29].

Early detection of cognitive impairment is particularly important in the elderly population. Cooper et al. proposed a telephone-based cognitive assessment (T-MoCA) for patients aged ≥70 prior to surgery, which demonstrated high feasibility and a completion rate of 92.5% [30].

Furthermore, life cycle assessment analyses have shown that shifting multiple anesthesia visits to teleconsultations can significantly reduce CO_2 emissions, providing environmental benefits, especially when many older patients would otherwise need to travel to a clinic [31].

Telemedicine is also being incorporated into anesthesiology education. Pilot training programs allow residents to conduct simulated preoperative assessments via virtual platforms, gaining experience in remote patient evaluation, risk assessment, and telecommunication with patients. This approach not only enhances practical skills but also prepares trainees for integrating telemedicine into routine clinical practice, particularly when caring for older patients with limited access to in-person care [32].

Discussion

General anesthesia in older adults, especially in elective procedures, remains a topic of significant concern due to the increased vulnerability of this population. As highlighted in recent literature, age-related physiological changes, such as reduced cardiovascular reserve, decreased renal and hepatic function, and alterations in body composition, notably influence how older patients respond to anesthetics. These factors make the elderly more prone to perioperative complications, particularly in terms of cardiovascular events, respiratory issues, and cognitive disturbances.

From the data gathered in the reviewed studies, it is clear that the approach to anesthesia in older patients should not be uniform. The pharmacokinetics of anesthetic agents are significantly altered in this population, necessitating precise dose adjustments. For example, the reduced clearance of drugs due to decreased renal and hepatic function can lead to prolonged effects, making the elderly more susceptible to side effects such as hypotension and respiratory depression. This necessitates careful titration of anesthetic agents, as highlighted by studies showing a need for dose reductions of agents like propofol.

Specifically, the doses of propofol required for general anesthesia in individuals aged 75–84 years can be significantly lower compared to younger adults, suggesting that age itself is an independent factor influencing anesthetic needs.

Interestingly, while anesthetics like etomidate and dexmedetomidine may offer better hemodynamic stability and lower risks of postoperative cognitive dysfunction (POCD), their use still requires careful consideration of the individual patient's comorbidities and frailty. This nuanced approach underscores a key takeaway from the reviewed studies: while there are safer anesthetic alternatives for elderly patients, these alternatives should be considered in conjunction with a comprehensive geriatric assessment, which includes evaluating the patient’s frailty, cognitive function, and overall physical status.

The issue of frailty, which is shown to act as an independent predictor of poor postoperative outcomes, further complicates the decision-making process. Frail individuals—those with diminished physical reserves, reduced muscle strength, cognitive impairment, and limited ability to perform daily activities—are at heightened risk of complications. Recent evidence demonstrates that frailty should not be an afterthought but an essential factor in preoperative

assessment, as frail patients are more prone to prolonged recovery and postoperative complications. In this context, a thorough preoperative assessment, including frailty screening, can help tailor the anesthesia plan and prevent adverse outcomes. The literature also stresses the importance of using multimodal anesthetic techniques and minimizing the duration of anesthesia to reduce strain on frail patients.

One particularly promising aspect discussed in recent studies is the growing role of telemedicine in pre-anesthetic evaluations for older adults. Telemedicine allows for remote consultations and cognitive screening, helping to identify potential risks before the patient even arrives at the hospital. By improving accessibility and reducing the burden on patients—particularly those with mobility issues—telemedicine can serve as an effective tool to optimize the preoperative process. Moreover, it offers the opportunity to detect early signs of cognitive impairment, which may influence the decision to proceed with anesthesia or suggest modifications in the anesthesia plan.

Overall, while general anesthesia in elderly patients does present significant challenges, the reviewed literature highlights that with careful planning, individualized dosing, and comprehensive preoperative assessments, anesthesia can be safely administered. It is clear from the findings that anesthesia should not be viewed as an absolute last resort for older adults but rather as a carefully considered option that requires close attention to age-related factors, frailty, and comorbid conditions. The use of telemedicine to support these assessments further emphasizes the importance of an integrative, patient-centered approach to the care of older patients.

Conclusion:

Considering that the population is getting older, the issue of performing general anesthesia in seniors in elective procedures, and the differences compared with younger patients is becoming increasingly important. Physiological changes connected with the aging process in the human body result in different pharmacodynamics, pharmacokinetics and elimination of anesthetic drugs. For that reason dosage of the medication should be adjusted with heightened attention and duration of anesthesia should be minimised in comparison to the younger population. Selection of agents with more favorable safety profiles, such as etomidate or dexmedetomidine may be also beneficial. Growing evidence shows that strategies such as EEG-guided anesthesia, the use of propofol-based TIVA, and thorough assessment of organ function and frailty can

substantially reduce the risk of perioperative complications such as cardiovascular events, respiratory complications, and cognitive disfunctions. A holistic approach to the geriatric surgical patients is equally important. Frailty, comorbid conditions and reduced physiological reserves require comprehensive preoperative evaluation and close intraoperative and postoperative monitoring. Moreover, the rapid expansion of telemedicine provides additional tools to improve the accessibility of pre-anesthetic assessment in older adults simultaneously reducing time, costs and providing environmental benefits.

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