



## Review Article

## Considerations in Geriatric Anesthesia - An overview

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## ABSTRACT

Summary- Geriatric population is estimated to be 12.4% of population in India by the year 2026. As the population continues to age, the number of surgical interventions in the elderly ( $\geq 65$ yr) also continues to rise. Two important principles that makes the elderly more vulnerable is that first aging is associated with a progressive loss of functional reserve in multiple organ systems and secondly the extent and onset of these changes are highly variable on an individual basis. This article reviews the perianesthetic considerations for geriatric population emphasizing the need for utmost care and concern in the following three categories: preoperative evaluation and considerations, intra-operative management, and postoperative concerns. Due to the increased incidence of adverse events in geriatric population a meticulous risk stratification of these patients undergoing various surgical procedures preoperatively may help guide decisions on adequate perioperative management as well as reduce untoward complications.

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## 1. Introduction

Geriatric population is estimated to be 12.4% of population in India by the year 2026.<sup>1</sup> The number of “elder” people in India ( $\geq 60$  years) has increased by 54.77% in the last 15 years.<sup>2</sup> As the population continues to age, the number of surgical interventions in the elderly ( $\geq 65$  yr) also continues to rise. Surgeries in geriatric population that were rare previously have become a routine nowadays with advancements in surgical techniques and perioperative care.<sup>3</sup> Two important principles that makes the elderly more vulnerable is that first aging is associated with a progressive loss of functional reserve in multiple organ systems and secondly the extent and onset of these changes are highly variable on an individual basis.<sup>4,5</sup> This article reviews the perianesthetic considerations for geriatric population emphasizing the need for utmost care and concern in the following

three categories: preoperative evaluation and considerations, intra-operative management, and postoperative concerns. While patients and surgeons worry about their treatment plan and future prognosis, anesthesiologists are concerned about patient’s age, complexity of the underlying comorbidities and the physiological status of the patient at the time of surgery with an eye to anticipate any perioperative critical or adverse events and its management. Thus a multidisciplinary approach will contribute to a better management of these high risk population and help in successful safe completion of their surgical procedure.

## 2. Preoperative geriatric evaluation and considerations

A detailed pre-anesthesia evaluation has been established as an effective tool to improve long term outcomes.<sup>6</sup> A comprehensive geriatric evaluation aims at determining the physical, psychosocial and environmental factors that can have a significant impact on the health of the elderly.<sup>4</sup> Preoperative evaluation of a geriatric patient should include

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an assessment of activities of daily living and also incorporate an in-depth evaluation process focused on specific organ systems.<sup>7</sup> Knowledge about the underlying co morbidities, the medications, nutritional status and substance abuse can have a positive impact on postoperative outcomes in older patients undergoing elective surgery.<sup>6</sup>

### 2.1. Medical co-morbidities

Assessment of co-morbid conditions with disease severity is important.

### 2.2. Cardiac evaluation

Older patients are more vulnerable to perioperative cardiac adverse events. A retrospective study conducted in 2018 showed age > 65 years as an important predictor of cardiac events after surgery (OR 4.9, 95% CI 3.4–6.9,  $P < 0.01$ ).<sup>7</sup> Prevalent in this age group are varying cardiac illnesses and hence may require detailed risk stratification with cardiac tests for evidence-based optimization strategies applied before surgery.<sup>8</sup> The concept of METS (metabolic equivalent of activities of daily living) has been integrated into the cardiac evaluation to evaluate the functional activity.<sup>9</sup> Induction of general anesthesia (GA) in elderly patients with an already compromised cardiac reserve often results in severe hemodynamic instabilities such as exaggerated drop in blood pressure. This associated with functional reductions in the responsiveness of beta-receptors caused by a beta-blocked state further limits patients' ability to respond adequately and normalize the cardiac output. Reduced responsiveness to angiotensin II and baroreceptor dysfunction further restricts appropriate response to hypovolemia.

### 2.3. Pulmonary evaluation

Age has been identified as one of the reliable risk factors for postoperative pulmonary complications (PPC). In elderly patients of ages  $\geq 65$  years and  $\geq 70$  years undergoing non-cardiac surgery, the rates of PPC has been reported as high as 14% and 15% respectively.<sup>10</sup> It is an established fact that age related decline in both lung and chest wall compliance leads to an increased work of breathing. Decreased cough reflex and ciliary clearance more so in long term smokers further compromises the pulmonary function. This can manifest intra-operatively under GA as various complications like desaturation, bronchospasm, laryngospasm etc leading to an overall difficulty in ventilation. Thus various studies have similarly shown that pulmonary complications were an independent predictor of mortality in elderly patients.<sup>11</sup>

### 2.4. Neuro-cognitive status and depression

Dementia is very common in the elderly having a prevalence of 5% to 8% among people  $\geq 65$  years old and may affect more than one third of population > 85 years.<sup>12</sup> A retrospective study in 2014 conducted on 45,602 aged patients who had a hip fracture revealed that dementia was associated with an increased risk of long-term care (hazard ratio [HR] 2.49, 95% CI 2.38–2.61,  $P < 0.001$ ), higher mortality (HR 1.47, 95% CI 1.41–1.52,  $P < 0.001$ ) and poor prognosis.<sup>13</sup> Detailed evaluation of patient's preoperative cognitive status is crucial for diagnosing and anticipating postoperative complications like postoperative delirium (POD) or postoperative cognitive dysfunction (POCD). Preexisting cognitive dysfunction to known to predict POD. Postoperative cognitive impairment is associated with longer hospital stay causing a high risk of developing postoperative complications such as cerebrovascular accident, neurologic deficit, pneumonia, deep vein thrombosis etc.<sup>14,15</sup> Studies reveals cognitive deficits are very often associated with poorer rehabilitation outcomes, functional decline and higher surgical mortality.<sup>16,17</sup> Whether anesthesia contributes to postoperative cognitive impairment still remains a controversial area of investigation, studies reveal after coronary artery bypass grafting there is a 42% incidence of cognitive decline 5 years postoperatively.<sup>18</sup>

### 2.5. Assessment and optimization of nutritional status

The prevalence of malnutrition ranges from 15% to 26% among the hospitalized geriatric population.<sup>19,20</sup> Malnourished aged patients undergoing surgical interventions have increased morbidity and mortality.<sup>21</sup> Preoperative history taking with adequate physical and laboratory tests aid the diagnosis of malnutrition. A review study in 2016 that included 41 trials on 3,881 participants revealed that oral multinutrient supplements started before or soon after surgery might prevent complications within the first 12 months after a hip fracture. The study however did not reveal any significant effect on mortality.<sup>22</sup>

### 2.6. Depression

In aged population with hip fracture the prevalence of depression has been reported to be as high as 13%.<sup>23</sup> Depression is an important issue because it may not only prolong the duration of hospital care and the expenditure but may also significantly impair the quality of life postoperatively.<sup>23,24</sup>

### 2.7. Pre-operative counseling, decision-making and informed consent

Several recommendations about patient counseling has been provided in the best practices guideline 2016 from the ACS and the AGS on optimal perioperative management of elderly patients.<sup>5</sup> Risk tools like the ASA classification and mortality risk calculator can help and guide in decision making.<sup>25</sup> However a recent study showed that although more than half of the patients over the age of 60 years desired to make independent decisions regarding medical care, more than 70% of these patients lacked the decision-making capacity.<sup>26</sup>

### 2.8. Pre-operative investigations and polypharmacy

The requirements of preoperative laboratory testings broadly depend on the associated co-morbid illnesses and the functional reserve of the patients. Although low-risk surgeries like cataract surgery may not require elaborate testing but selected routine preoperative testing based on the history and physical examination maybe advised for intermediate risk or high risk procedures.<sup>27</sup> Elderly patients are more likely to be on numerous medications based on multiple co-existing diseases. The brain is more sensitive to drugs in the elderly. The risk of adverse drug reactions increases with the number of drugs taken and age directly leading to prolonged hospital stays and expenses.<sup>28</sup>

## 3. Intra-operative management

Data suggest that co-existing disease is a greater determinant as compared to anesthetic management in predicting postoperative complications.<sup>29</sup> Most studies show that there is no significant difference in outcome between administration of general versus regional anesthesia(RA) in the elderly patients.<sup>30</sup> The type of anesthesia administered may only play a secondary role in immobilization, rehabilitation and prolonged duration of hospital stay.<sup>31</sup> A retrospective study done in 2014 on 6,135 age-matched adult pairs with dementia undergoing hip fracture surgery revealed that both GA and RA were associated with identical rates of perioperative complications and adverse events (GA, 11.3%; RA, 10.8%,  $P = 0.44$ ).<sup>32</sup> However regional anesthesia may have certain beneficial role such as reducing the incidence of deep vein thrombosis and achieving better hemodynamic control associated with reduced intra-operative bleeding.<sup>33–35</sup> Regional anesthesia also avoids unnecessary instrumentation of the airway allowing patients to maintain patency of their own airway with better pulmonary function. Several studies suggest that elderly are highly susceptible to hypoxemic episodes and the use of regional anesthesia have known to lower this risk.<sup>36</sup> The use of peripheral blocks in the elderly may be of some advantage without compromising the airway or risking major

hemodynamic effects. However the anatomic difficulties in geriatric age group and peripheral nerve blocks showing prolonged duration of action should be considered before planning the type of anesthesia.<sup>37</sup> Although evidence to support a single best anesthetic plan to produce the best surgical outcome for elderly patients still remains a controversy, adequate monitoring techniques with good hemodynamic control and fluid management should continue to remain as primary intra-operative goals for anesthesiologists. Several studies have validated that goal-directed hemodynamic therapy (GDHT) significantly reduces postoperative mortality and morbidity in high-risk surgical patients.<sup>38,39</sup> Although liberal RBC transfusion and its role in increasing the chances of infection still remains unclear, studies like TRIFE-The Transfusion Requirements In Frail Elderly conducted on 284 patients showed that a more liberal RBC transfusion strategy (Hb < 11.3 g/dl; 7 mmol/L) when compared to the restrictive RBC strategy (hemoglobin [Hb] < 9.7 g/dl; 6 mmol/L) was not associated with higher infection risk in patients undergoing hip fracture surgery.<sup>40</sup> Invasive intra-arterial blood pressure monitoring for beat to beat variations and central venous catheterization for additional route of venous access and for administration of vasoactive drugs can be considered in complex surgeries of long duration.<sup>31</sup> Electroencephalogram (EEG) neuromonitoring including a bispectral index or entropy monitor is recommended for assessing the depth of anesthesia to avoid excessive depth thereby preventing the development of POD or POCD in geriatric patients.<sup>41,42</sup> Neuromuscular monitoring is also strongly recommended as it permits an adequate degree of neuromuscular blockade as well as its safe reversal.<sup>43,44</sup> It is very important to maintain a normal range of body temperature throughout the perioperative period as advanced age and general anesthesia are known to be associated with hypothermia. Hypothermia has been related to hypoxemia and myocardial ischemia during the postoperative period in high-risk patients undergoing lower extremity vascular surgery.<sup>45</sup> Perioperative normothermia has shown to reduce incidence of cardiac adverse events and ventricular tachycardia in patients with cardiovascular illness undergoing non-cardiac surgeries.<sup>46</sup> Use of warmed intravenous fluids, various active or passive warming devices like forced-air warming blanket or heated humidifier circuit is highly recommended.

### 3.1. Geriatric Pharmacology

Reduced proportions of muscle and fat, as well as a reduced neural mass and organ dysfunctions, can alter drug pharmacodynamics and pharmacokinetics considerably meaning that the usual drug dosages can have toxic effects in the elderly.<sup>47</sup> Short acting drugs with minimum hepatic and renal effects are advisable. Careful titration of drugs is also essential.<sup>48</sup> Lower dosages are required for

propofol, remifentanyl and ropivacaine. Adequate titration of desflurane is advisable. Special attention should be given to hypnotic agents, as the dose requirement is much lower and the drugs can have prolonged duration of action.<sup>49,50</sup>

#### 4. Postoperative care

A vigilant postoperative care is essential for early recovery and mobilization. A study conducted on 517 patients of more than 70 years of age undergoing non-cardiac surgery showed that 31.7 percent of patients were deceased at the time of follow-up and age (HR 1.42 per decade, 95% CI 1.11–1.81,  $P = 0.005$ ), postoperative pulmonary complication (HR 2.41, 95% CI 1.30–4.48,  $P = 0.005$ ), and renal complication (HR 6.07, 95% CI 2.23–16.52,  $P < 0.001$ ) were all significant independent predictors of reduced long-term survival.<sup>51</sup>

##### 4.1. Post-operative analgesia

Physiological frailty, medical co-morbidities compounded with cognitive impairment makes pain assessment and management very difficult in the elderly. Hence elderly remains largely untreated for pain.<sup>31</sup> A 2014 review showed that multimodal drug therapy and regional analgesic techniques can be very useful tools for adequate pain management in elderly.<sup>52</sup>

##### 4.2. Post-operative pulmonary complications

Age is a significant predictor of risk for pulmonary complications which is known to considerably increase the risk of mortality after surgery.<sup>10,53</sup> A large retrospective study on 8,920 elderly patients with hip fracture repair showed that pulmonary and cardiac complications were most frequent (4% and 8% of patients, respectively).<sup>54</sup> Strategies to prevent aspiration precautions along with bedside evaluation of any patient with signs, symptoms or history of dysphagia should be implemented. Patients should be educated and motivated about use of incentive spirometer and chest physical therapy. Regular deep breathing exercises are vital. Techniques like epidural analgesia can also help in early mobilization.<sup>5</sup>

##### 4.3. Post-operative delirium

Delirium is one of the most dreadful age-related postoperative complications and can be responsible for an acute decline in cognitive function and attention that can be related to any physiologic derangement, medications or multifactorial.<sup>55</sup> The best treatment for delirium is prevention hence routine delirium screening in all patients is suggested as evidences suggest that there are considerable benefits in terms of earlier detection and management.<sup>55</sup> A study conducted on 144 patients of above 50 years of age undergoing a surgical intervention requiring a postoperative

intensive care unit (ICU) showed that 44 percent of patients developed delirium.<sup>56</sup>

##### 4.4. Post-operative nausea and vomiting

Post-operative nausea and vomiting (PONV) is a well established complication of general anesthesia.<sup>5</sup> PONV can cause a great deal of anxiety and discomfort for the patients leading to delayed discharge from post-anesthesia care unit (PACU) and poor patient satisfaction.<sup>57,58</sup> Hence all elderly patients undergoing a surgical procedure should be thoroughly assessed for risks of PONV and those found to have moderate or high risk should receive prophylactic interventions.<sup>5</sup>

##### 4.5. Post-operative Urinary tract infections

Urinary tract infections representing 32% to 40% of all nosocomial infections are among the most common postoperative complications. Elderly patients are more vulnerable especially owing to the prolonged immobilization and can result in heavy health care costs. A good nursing care and encouraging self voiding can help prevent this complication.<sup>59–63</sup> A 2014 study conducted on 72 elderly female patients undergoing elective surgery, to determine the risk factors for urinary retention showed that the early removal of the urethral catheter (per 1-day indwelling period increase, OR 0.33, 95% CI 0.11–0.96,  $P = 0.04$ ) and preoperative dementia and/or delirium (OR 10.4, 95% CI 1.21–89.2,  $P = 0.03$ ) had significant correlations with postoperative urinary retention.<sup>64</sup>

It is found that approximately 30% of elderly adults in the community fall every year.<sup>65</sup> Hence universal fall precautions are highly recommended in all elderly patients; however it should not interfere with early mobilization or delay ambulation. Good vision and hearing aids, scheduled toileting, early physical/occupational therapy and assistive walking devices all can help in preventing fall in elderly.

##### 4.6. Post-operative Nutrition

Resuming oral diet at earliest with supplements if indicated maybe helpful. Maintaining adequate nutrition and wound care to minimize pressure ulcers in the postoperative setting should all be a part of the multicomponent interventions in the care of the elderly.<sup>5</sup>

## 5. Conclusion

Due to the increased incidence of adverse events in geriatric population a meticulous risk stratification of these patients undergoing various surgical procedures preoperatively may help guide decisions on adequate perioperative management as well as reduce untoward complications. Close collaboration between the surgeon, geriatrician and anesthesiologist is essential for a safe

anesthesia experience in these high risk patients as they all aim to create a safe environment in the operating room and post-operative unit with maximum efficacy.

## 6. Conflict of Interest

None.

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None.

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