The Old and Ill: Influence and Impact on the Reconstructive Effort

O. Koray Coşkunfirat, M.D.,¹ and Ömer Özkan, M.D.¹

ABSTRACT

Head and neck reconstruction is often mandatory in elderly and ill patients, especially after tumor ablation. Even complex reconstructive procedures can be done in the elderly population after careful evaluation. The morbidity and mortality rates increase with age, thus the risks and benefits of surgical intervention must be weighed precisely. The functional capacities of the vital organs and the limitations should be assessed. The only significant preoperative guide for the risk of the operation is the American Society of Anesthesiologists (ASA) score. According to this scoring system, ASA 3 and 4 patients are more prone to complications. For a successful reconstructive procedure in old and ill patients, detailed preoperative evaluation is mandatory. Based on this evaluation, the type and duration of the surgery can be properly selected, and postoperative monitoring can be handled individually.

KEYWORDS: ASA score, elderly patients, operative risk, preoperative assessment

The defects requiring head and neck reconstruction can be summarized into three main types: congenital, traumatic, and oncologic. Congenital and traumatic defects are usually seen in children and young adults; however, in the majority of cases, oncologic defects are seen in patients of advanced age. Old age is not a hindrance to surgical treatment of head and neck defects, but the functional status of the patient may affect the quality of the reconstruction. In the elderly, perioperative morbidity rates are higher than in younger patients, with significant increases in mortality observed after the age of 80 years.¹ Despite the fact that advanced age itself is a significant risk factor for increased perioperative morbidity and mortality, it does not mean that these patients cannot benefit from surgery. Elderly patients must be evaluated carefully, and the risks and benefits of the surgery must be

weighed. Assessment of the elderly is best performed using a multidisciplinary approach, and the nature of the surgery should be discussed in detail. Preoperative preparation of the elderly patient is of utmost importance for the success of the treatment and outcome. Only after thorough preoperative preparation can the proper surgical approach and postoperative management be achieved. Although there are standard protocols for the treatment of these patients, treatment protocols should be individualized, especially in medically compromised patients. With adequate attention and precautions, major surgeries such as free tissue transfers can be performed successfully and optimal results can be achieved. Nevertheless, unnecessary heroic attempts should be avoided to reduce the incidence of unwanted complications, which may be life-threatening.

¹Department of Plastic and Reconstructive Surgery, Akdeniz University School of Medicine, Antalya, Turkey.

Address for correspondence and reprint requests: O. Koray Coşkunfirat, M.D., Associate Professor, Department of Plastic and Reconstructive Surgery, Akdeniz University School of Medicine, Dumlupınar Bulvarı, 07059 Antalya, Turkey (e-mail: coskunfirat@superonline.com).

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RISK FACTORS

Increased life-expectancy is paralleled by an increased number of the elderly undergoing surgical procedures. As the functional capacity of all organ systems begins to decline as early as 30 years of age, depending on personal and environmental factors, age therefore becomes a predictor of outcome for major operations.^{2,3} The incidence of serious chronic illnesses such as hypertension, diabetes mellitus, and atherosclerosis are higher in the elderly population and contribute to functional decline and difficulties in the management of this patient population.

Recent studies have shown that the most helpful criterion that can help guide the outcome of head and neck reconstructive surgery is the American Society of Anesthesiologists (ASA) score (Table 1).⁴⁻⁸ After a careful medical examination and surgical planning, the case must be discussed with the anesthesiologist to describe the patient from the perspective of basic risk banding and appropriate changes made in the surgical plan. ASA 3 and 4 patients are more prone to postoperative complications; thus, if the operation is of higher risk for that patient, either the surgical plan must be changed or the necessary precautions taken.

Cardiac complications are important causes of morbidity after major nonemergency, noncardiac surgery in the elderly. The Cardiac Risk Index⁹ is a well-known tool for clinical risk stratification in the preoperative period. A recent study reported the Revised Cardiac Risk Index for major noncardiac operations. Six independent predictors of complications were identified¹⁰:

- High-risk type of surgery.
- History of ischemic heart disease.
- History of congestive heart failure.
- History of cerebrovascular disease.
- Preoperative treatment with insulin.
- Preoperative serum creatinine >2.0 mg/dL.

Older age (>60 years) is the strongest predictor of postoperative atrial fibrillation.¹¹

Table 1 Physical Status Classification of the American Society of Anesthesiologists

Status*	Description
1	Healthy patient
2	Mild systemic disease
3	Severe systemic disease, not incapacitating
4	Severe systemic disease that is constant threat to life
5	Not expected to live 24 hours irrespective of operation

*An "E" is added to the status number to designate an emergency operation.

The most important risk factor for the elderly is the need for emergency surgery, when the patient cannot be evaluated and prepared for the surgery and the postoperative outcome cannot be estimated. Fortunately, most head and neck surgeries are performed electively. Diabetes in later life imposes an excess mortality risk, which may be as great as twofold, a level similar to that found in young type 1 diabetic patients.¹²

Care for the "elderly patient" should take into account the age-related changes in the elderly population: electrophysiologic properties of the heart slow down with age, and elderly patients have decreased β -adrenergic responsiveness; baroreceptor-mediated heart rate control also reduces with advanced age; the maximal heart rate of older adults is slower than that of younger adults, and they experience an increased incidence of conduction abnormalities and bradyarrhythmias. In a recent study, the age of 70 years or older was a preoperative correlate of supraventricular arrhythmia.¹³

The incidence of systemic hypertension increases with advanced age. As a result of fibrosis within the heart and vascular system, vascular and ventricular compliance decreases. The progressive decrease in elasticity of the arteries is accompanied by an increase in systolic blood pressure and higher peripheral vascular resistance. These pressure changes result in reduction of coronary artery perfusion in the elderly. In response to increased afterload, progressive ventricular hypertrophy develops and increases both wall stress and myocardial oxygen demand. The myocardium becomes more vulnerable to ischemia in the elderly.¹⁴ Loss of elasticity of the cardiovascular system, including ventricular hypertrophy, limits the ability of the heart to adjust its stroke volume, again resulting in a decreased cardiac output. Diastolic myocardial function and passive filling during diastole are also decreased by ventricular hypertrophy. The noncompliant heart's compensation for both hypovolemia and overhydration is blunted. Small changes in venous return may result in large changes in ventricular preload and cardiac output. Eventually, the older heart becomes prone to failure and insufficiency.¹⁵

Even in the healthy elderly, pulmonary function deteriorates with advancing age. Decreased lung elasticity and chest wall compliance with weakened respiratory muscles and diaphragm further contribute to the deterioration in pulmonary function. Forced expiratory volume (FEV₁) and forced vital capacity (FVC), maximal inspiratory pressure (P_{I_{max}}), and maximal expiratory pressure (P_{E_{max}}) all progressively decline with age. In the elderly, there is a concurrent increase in dead space, so that total lung capacity does not change appreciably. Ventilatory responsiveness to hypoxia and hypercapnia also diminishes with advancing age. Expiratory flow rates decrease, and premature airway closure and anatomic shunt lead to ventilation-perfusion mismatching and gas-exchange impairment. The diffusing capacity of

the senescent lung declines with impaired oxygenation and reduction in carbon dioxide elimination. In addition, the alveolar-arterial oxygen gradient increases and PaO_2 decreases with aging.¹⁶

No liver diseases are specific to elderly patients. The decrease in liver size and volume with age due to the decreased blood flow to the liver does not result in a worsening of liver function tests, unless size loss becomes significant. Hepatic filtration, detoxification, and conjugation functions are also preserved. The cholinesterase activity in the elderly is lower than that in younger adults. Hepatic synthesis of clotting factors can be reduced but without significantly impairing function. Coagulation is almost normal in elderly persons who have no additional coagulation problem.¹⁷

The senescent kidney reduces its mass primarily as a result of cortical tissue loss.¹⁸ Cortical loss becomes evident as senescent glomerulosclerosis decreases cortical blood flow and as reduced cardiac output decreases renal blood flow. Despite the significantly reduced glomerular filtration rate (GFR), serum creatinine levels remain normal due to a concomitant decrease in muscle mass, which is the major determinant of creatinine production. Tubular length decrease, interstitial fibrosis, and anatomic tubular basement membrane changes are the results of tubular senescence, which blunts the reabsorption and secretion capacity of the kidney.¹⁹ Renin production from the juxtaglomerular apparatus is decreased, and the response to antidiuretic hormone and aldosterone is blunted in the elderly.²⁰

Progressive impairment of glucose tolerance, which seems to result from increased insulin resistance, occurs in nondiabetic elderly patients, independent of obesity.²¹

There is evidence that anatomic and functional changes are associated with the aging thyroid, such as mild atrophy, increased fibrosis, decreased follicle size, reduction in thyroid hormone secretion, and a decline in serum T3 concentration.²²

Although most elderly individuals maintain a normal red blood cell count, hemoglobin, and hematocrit, anemia is more common in older patients, and its incidence increases with aging. The etiology of anemia in elderly patients is often confounded by chronic disease, and anemia should not be accepted as a consequence of the aging process.

Aging induces dysregulation of the immune system and defense mechanisms, resulting in increased susceptibility to infections.²³

Aging changes normal physiologic homeostatic mechanisms for fluid and electrolyte balance, and increases the likelihood of fluid and electrolyte disorders in the elderly surgical patient. The elderly cannot tolerate water deprivation and water boluses. These mechanisms can further be disrupted by the stress of surgical illness,

resulting in added morbidity to the elderly surgical patient.²⁴

Decrease in skin thickness and loss of subcutaneous fat, together with decreased saliva, gastric acid, and mucous secretions in the gastrointestinal tract result in slower motility throughout the gastrointestinal tract of the aging patient. Deteriorating or absent dentition, hypertrophy of the bladder muscle, decreased estrogen secretion in women and prostatic hypertrophy in men, decreased synthesis and degradation of bone, and diminished muscle size and strength are some other changes characteristic of advancing age.

PREOPERATIVE MANAGEMENT

The preoperative evaluation of an elderly patient differs from that of the young in that a heightened awareness of the medical status is needed for the older patient. Depending on the medical history and physical examination, a systemic and systematic audit, including detailed laboratory examinations, should be tailored individually. Any slight abnormalities in the overall health of the patient must be further evaluated in detail, and the patient's case should be discussed with other specialists to clarify the accompanying diseases and the surgical risks, as necessary. Advance assessment and risk factor reduction before any surgical operation optimizes the result of surgery and avoids complications. Pathophysiology and diagnosis and treatment of diseases may be different from those for younger adults. The ability of an individual to compensate for illness and surgery may be age-dependent, and thus functional deficits and diseases that cannot be managed may ultimately need to be adapted to the surgical plan in the elderly.

After proper evaluation, some elderly patients may need special preparations for surgery. Undertreatment or overtreatment of conditions or illnesses and multiple drug use are concerns in geriatric patients. Preoperative evaluation and preparation indicate appropriate postoperative precautions, such as the need for intensive-care facilities after surgical procedures. The potential need for tracheostomy for postoperative maintenance of airway security and the associated optimal timing of tracheostomy to avoid emergency tracheostomy must also be considered preoperatively. The most common form of fluid and electrolyte disorder in older adults is dehydration, which must be corrected before surgery. As a result of renal, cardiac, and hormonal changes, elderly patients are limited in their ability to tolerate dehydration and volume loads. The aging kidney is less effective at sodium and water conservation and excreting hydrogen and potassium ion loads rapidly, so the elderly are more susceptible to electrolyte and acid-base disturbances. All these abnormalities should be recognized and corrected before elective operations. Surgery with tissue breakdown and the tendency to

accumulate potassium due to renal aging results in decreased renal secretion of potassium and may lead to frank hyperkalemia, which can be compounded by acute renal insufficiency. On the other hand, hypokalemic elderly patients undergoing surgery are more likely to experience serious tachyarrhythmias. Malnutrition and any catabolic states must also be corrected before elective head and neck reconstructive surgeries, especially for flap coverage procedures. Adequate protein intake, essential for maintaining the healing of surgical wounds, and effective functioning of the immune system both affect flap survival.

PERIOPERATIVE MANAGEMENT

The most important principle in the elderly surgical patient is to pay close attention to fluid balance, which constitutes a critical aspect of the perioperative period. Electrolytes and acid-base status must also be monitored, and any abnormality should be corrected.²⁵ In the face of surgery, elderly patients may be more symptomatic for any burden of disease; for example, an increased serum creatinine in the elderly compared with that in younger patients implies more risk of frank symptoms of uremia during surgery. Urine output monitoring or more invasive methods of monitoring central hemodynamics and cardiopulmonary performance should be chosen individually, depending on the nature of the surgery and the medical status of the patient. Hemodynamic monitoring is used to guide fluid therapy to optimize cardiac output and renal perfusion. Reduced renal blood flow due to decreased cardiac output has the most deleterious effects on GFR during surgery.

Hemoglobin is an important factor for oxygen delivery, and elderly patients are more vulnerable to impaired oxygenation-related cardiac events. It is generally accepted to administer perioperative transfusions to keep the hemoglobin level at 9.5 to 10 mg/L in the elderly with known cardiac disease. Blood transfusions to this threshold should be considered in elderly patients who have risk factors for ischemia, but a threshold of 8 mg/L can be justified for patients who are not considered at risk.²⁶ Several studies show an association between hemoglobin concentrations below this level and increased mortality in noncardiac surgical patients with cardiovascular disease.^{27,28} The decision for a blood transfusion should be made on an individual basis, taking into account the underlying cardiopulmonary disease, expected blood loss, and hemoglobin concentration.

POSTOPERATIVE MANAGEMENT

Maintenance of the airway is of critical importance during the postoperative period of head and neck surgery. Elderly patients should be transported to the postanesthesia care unit with 2 to 4 L/min of oxygen

through a nasal cannula.²⁹ Patients who are not tracheostomized should stay intubated for airway safety, and extubation may be delayed until the airway is safe. This period is very critical, as with early extubation the patient can experience airway obstruction and breathing problems, and reintubation can be very difficult or even impossible because of airway edema and mechanical obstruction. On the other hand, this period should be as short as possible to avoid the risks of prolonged endotracheal intubation such as increased need for sedation, infection, inadvertent extubation, and laryngeal injury. The gag reflex is also weaker in the elderly, increasing aspiration risk in the surgical patient. Older patients with age-associated functional changes and diseases may easily become ventilator-dependent, and they are prone to pneumonia and other mechanical ventilation-related complications. Chronic obstructive pulmonary disease prevalence, risk of pneumonia and its severe consequences, as well as the risk of venous thromboembolism rises with age. Early pulmonary physiotherapy is of the utmost importance in preventing pulmonary complications. The patients must be mobilized as early as possible.

Elderly patients may have a blunted pain response. Effective analgesia is essential to minimize the risk of adverse outcome by blocking pain that contributes to cardiac ischemia, tachycardia, hypertension, and pulmonary complications. Analgesia also accelerates recovery, promotes early mobilization, and shortens hospital stay.³⁰

Elderly patients may experience more frequent, pronounced, and prolonged perioperative hypothermia, as the febrile response is blunted in the elderly, and their ability to control thermoregulation is compromised.^{31,32} Adverse consequences of postoperative hypothermia include cardiac ischemia, arrhythmias, and increased blood loss. Maintaining normothermia may decrease cardiac morbidity by as much as 55%.³³ Postoperative hypotension, hypoxia, hypothermia, and malnutrition carry a greater risk for the elderly compared with younger adults, and it may take longer for the elderly patient to return to baseline functionality.

Postoperative atrial arrhythmias and atrial fibrillation and flutter are seen in 6.1% of elderly patients undergoing non-cardiothoracic surgery.³⁴ A recent investigation estimated that a preoperative heart rate of >74 beats per minute is independently associated with postoperative atrial fibrillation.³⁵

Older patients may also experience problems with respect to adverse drug reactions, drug interactions, and compliance. The old kidney with low reserve is more vulnerable to ischemic and nephrotoxic insults. Older people are prone to acute renal failure after surgical operations, and drugs that are cleared via the kidneys must be given at doses based on creatinine clearance.

CONCLUSION

Age itself is not a contraindication for any kind of surgery, and there is no place for agism in modern medicine. Nevertheless, it is well known that elderly patients face higher surgical mortality rates within the adult surgical population. The decision to perform surgery should be made on the basis of need and comorbidity rather than age. The increased surgical risk and complications in the elderly are due to the higher incidence and prevalence of associated disease, in addition to baseline physiologic changes in elderly persons. The only significant preoperative guide for the risk stratification is the ASA score: ASA 3 and 4 patients are more prone to perioperative and postoperative complications. The site of the surgery and emergency surgeries are other risk factors. Although duration of surgery was found to be a risk factor, some studies did not support this evidence.⁷ When major surgery is needed in "the old and ill," the surgeon who is aware of the critical physiologic changes of systems in the elderly will be able to foresee the possible problems and take the necessary precautions to prevent and manage them successfully. With preventive measures in place, the surgeon will not be reluctant to treat the patient and perform major surgeries. The key to surgical success in the elderly is the preoperative evaluation of organ function and reserve, and appropriate intraoperative control and postoperative monitoring, pain control, and follow-up.

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