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STATEMENT OF FINANCIAL DISCLOSURE

To reveal any potential bias in this publication, and in accordance with Accreditation Council for Continuing Medical Education guidelines, Dr. Dietrich (editor in chief), Dr. Murano (author), Dr. Ravi (author), Dr. Springer (peer reviewer), Ms. Behrens (nurse planner), Ms. Mark (executive editor), and Ms. Coplin (editorial group manager) report no relationships with companies related to this field of study.



Airway Management in Older Adult Trauma Patients

Older adult trauma patients present unique challenges for the emergency care provider. Airway anatomic and physiologic changes associated with age may pose difficulties in the setting of trauma and may impact the overall care of the patient. Understanding the geriatric variations and developing alternative strategies is critical in the acute care setting.

— Ann M. Dietrich, MD, Editor

Introduction

According to the 2010 U.S. Census, 14% of the current U.S. population is older than 65 years of age, and this number is estimated to increase to one in five by the year 2050.¹ Although the older adult population comprises a relatively small percentage of trauma patients presenting to the emergency department (ED), they are associated with considerably worse outcomes and higher care costs.² Advanced age clearly correlates with a high morbidity and mortality in trauma.³ Geriatric patients are also five to six times more likely to die from trauma than younger patients with a similar mechanism and degree of injury.^{4,5}

Patients who are older than 74 years of age and experience traumatic injuries are at a higher risk for mortality than the younger geriatric group (age 65 to 74 years). In addition, extremely severe injuries and low systolic blood pressure at presentation among geriatric trauma patients are significant risk factors for mortality.⁶

Older adult trauma patients presenting to the ED in respiratory distress pose a unique set of challenges because of altered anatomy, pathophysiologic changes, and associated comorbidities. These factors affect various components of airway management, including intubation, ventilation, oxygenation, and aspiration risk. Specific strategies are required for the successful management of the airway in this group of patients.

Anatomic Changes in the Geriatric Airway

Providers need to understand the anatomic and physiologic changes associated with normal aging so they can best diagnose and treat the airway of geriatric trauma patients. With age, organ systems deteriorate and lose the underlying ability they once had at a younger age. These changes result in significant implications that must be considered when managing the airway of the geriatric trauma patient.

EXECUTIVE SUMMARY

- With increasing age, a reduction in the elasticity of the perioral skin, reduced musculature, mandibular resorption, and alveolar retraction contribute to the challenges of airway management, particularly when trying to obtain a seal while using bag-valve-mask (BVM) ventilation.
- Protective pharyngeal reflexes are impaired with age, which predisposes older individuals to upper airway collapse. Parapharyngeal fat accumulation occurs with aging that is independent of body mass index. This predisposes the elderly to obstructive sleep apnea and may predispose them to an increased risk of desaturation events, in addition to making intubation technically challenging.
- Age-related changes to the intervertebral discs lead to limitations in the movement of the neck and the back. These include a decrease in the diameter of the nucleus pulposus, an increase in hydrostatic pressure within the annulus, and a narrowing of the intervertebral space. This results in kyphosis and limited atlanto-occipital joint movement, which are factors for difficult intubation.
- Elderly patients experience free radical injury and deposition of free collagen that lead to the loss of elasticity, stiffening of the arteries, and decreasing compliance of the myocardium. Stiffening of arteries leads to an increase in blood pressure and systemic vascular resistance. The elderly are prone to hypoxemia because of increased residual volume and decreased diffusing capacity.
- Data suggest that comorbid conditions, such as oropharyngeal cancer, head and neck cancers, goiters, chronic obstructive pulmonary disease, or obstructive sleep apnea, play the most important role in determining patient outcome following respiratory failure in geriatric patients.
- Elderly patients frequently use anticoagulant and antiplatelet agents, which increase the incidence of intracranial bleeds and mortality.
- According to the Eastern Association for the Surgery of Trauma guidelines, indications for endotracheal intubation in trauma include airway obstruction, hypoventilation, severe hypoxemia, severe cognitive impairment (Glasgow Coma Scale score of ≤ 8), cardiac arrest, and severe hemorrhagic shock.
- Endotracheal intubation may induce a transient hypertensive and tachycardic response, particularly when multiple attempts are needed. Video laryngoscopy has been shown to prevent cardiovascular stress responses and should be the modality of choice in these patients.

Nasal Cavity

Despite apparent enlargement of the nasal cavities in the elderly, there is a decrease in the elasticity of tissues within the nose that leads to a relative narrowing.⁷ Nasal polyps secondary to chronic rhinosinusitis are more prevalent in the elderly and may make the placement of a nasal airway or nasopharyngeal intubation difficult.⁸ In addition, the incidence of oropharyngeal tumors increases with age, which may compromise the ability to perform orotracheal intubation successfully. Alternate strategies, such as nasotracheal intubation or surgical airway, may need to be considered when confronted with these abnormalities.⁹ Nasotracheal intubation must be used with care in patients who have facial trauma since it is associated with catastrophic complications when basilar skull fractures are present.¹⁰

Oral Cavity

Anatomic changes to the oral cavity often lead to challenges

with ventilation and intubation of older adult patients. With increasing age, elasticity of the perioral skin and musculature are reduced as a result of atrophy. In addition, there is a loss of or lack of dentition in the elderly population. These factors contribute to the challenges of airway management, particularly when trying to obtain a seal while using bag-valve-mask (BVM) ventilation.¹¹ Other facial changes that are predictors of difficult mask ventilation in the elderly are mandibular resorption and alveolar retraction, which cause cheek retraction and drooping.¹² The aging process leads to a loss of elasticity and an increase in frailty of the lips, predisposing elderly patients to lacerations from the laryngoscope blade during intubation.

The prevalence of dental caries increases with age and leads to loose teeth, which are at risk for dislodgement into the trachea during intubation.¹³

Adequate mouth opening

is essential to most airway procedures. The rotation and subluxation of the temporomandibular joint in a hinge movement controls mouth opening.¹⁴ The majority of patients older than 65 years of age have some degree of temporomandibular joint arthritis.¹⁵ Changes with age also are noted in the oral mucosa, which becomes thin, smooth, and dry.¹² These factors limit mouth opening, which in turn may lead to difficulties with intubation.

Pharynx/Larynx

Changes in the epiglottis and loss of protective reflexes also predispose the elderly to aspiration events during airway management. The epiglottis of an elderly patient is floppy and harder to manipulate anteriorly during direct laryngoscopy because of the loss of collagen and elastin fibers with age.¹⁶ Changes in the vocal cords (presbylarynx) include bowing, prominence of the vocal processes, vocal fold edema, and

Figure 1. Presbylarynx

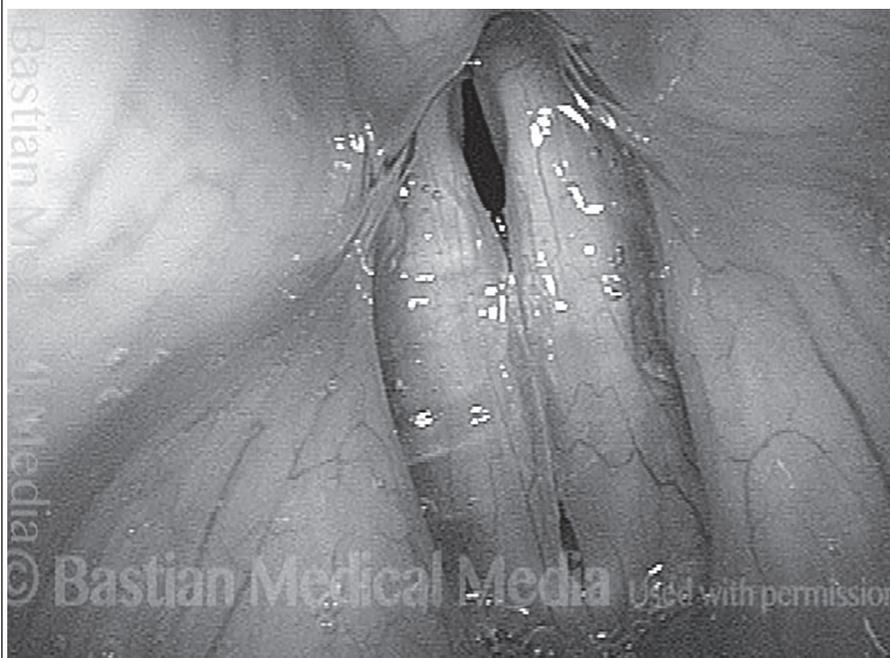


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development of a glottal gap.¹⁷ (See Figure 1.)

Protective pharyngeal reflexes are impaired with age, which predisposes older individuals to upper airway collapse. Parapharyngeal fat accumulation occurs with aging that is independent of body mass index (BMI). This predisposes the elderly to obstructive sleep apnea and may predispose them to an increased risk of desaturation events, in addition to making intubation technically challenging.¹⁸

Neck

Age-related changes to the intervertebral discs lead to limitations in the movement of the neck and the back. These include a decrease in the diameter of the nucleus pulposus, an increase in hydrostatic pressure within the annulus, and a narrowing of the intervertebral space. This results in kyphosis and limited atlanto-occipital joint movement, which are factors for difficult intubation.¹²

Physiologic Changes Affecting Geriatric Airway Management

Cardiovascular System

Vascular responses to endotracheal intubation in the elderly are labile and exaggerated when compared to middle-aged patients.¹⁹ Several cardiovascular physiologic changes that occur in the elderly contribute to these vascular responses. Free radical injury and deposition of free collagen lead to the loss of elasticity, stiffening of arteries, and decreasing compliance of the myocardium. Stiffening of arteries leads to an increase in blood pressure and systemic vascular resistance (affecting afterload). Therefore, the heart must pump harder to overcome the greater impedance to flow, resulting in left ventricular hypertrophy and diastolic dysfunction (affecting preload).²⁰

Changes to the autonomic nervous system also are observed in the elderly population. A

decrease in the vagal tone and an increase in the sympathetic activity, as well as the circulating levels of catecholamines, lead to labile hemodynamic responses.²¹ Laryngotracheal manipulation during airway management commonly leads to increases in heart rate and blood pressure. These responses often are exaggerated in the elderly and in patients with preexisting conditions, such as diabetes, renal disease, and cardiovascular disease. Trauma provides additional sympathetic stimulation, leading to further increases in the heart rate and blood pressure. Additionally, sympathetic surges in the elderly can lead to pulmonary edema and myocardial ischemia.

Pulmonary System

Structural changes to the lung itself, as well as to the supportive extrapulmonary structures (chest wall, respiratory muscles, spine), occur with aging. These alterations lead to unfavorable respiratory mechanics as a result of decreased expiratory volume, increased air trapping, and decreased gas exchange. Chest wall compliance decreases because of stiffening of the intercostal muscles and costovertebral joints. Airway resistance also increases as a result of a decrease in the diameter of small airways with age.²² These changes make assisted and mechanical ventilation challenging.

Elderly patients also are prone to hypoxemia because of increased residual volume and decreased diffusing capacity. Although opioid administration generally is not preferred in the elderly, it may be unavoidable in the setting of trauma. Careful preoxygenation and ventilatory support must be provided to these patients since they can develop an unexpected degree of hypoxemia because of dysfunctional chemoreceptors.⁹

Gastrointestinal System

A decrease in the motility of the esophagus and the lower

Table 1. Airway Management Strategies in Older Adult Patients

Anatomic Site	Age-Related Changes	Consequences	Recommendations
Nasal cavity	<ul style="list-style-type: none"> Nasal polyps 	<ul style="list-style-type: none"> Obstruction, bleeding 	<ul style="list-style-type: none"> Use lubrication when nasal airway needed Avoid nasotracheal intubation on the affected side if unilateral
Oral cavity	<ul style="list-style-type: none"> Loose teeth or dental appliances Loss of dentition Loss of lip elasticity TMJ arthritis 	<ul style="list-style-type: none"> Risk of dislodgement/aspiration Inadequate seal with BVM Lip lacerations Inadequate mouth opening 	<ul style="list-style-type: none"> Remove dental appliances prior to intubation Use VL to reduce force Retain dentures in place when using BVM, remove prior to intubation Use VL to minimize damage to lips Use smaller laryngoscope blade
Pharynx/larynx	<ul style="list-style-type: none"> Impaired cough reflex Floppy epiglottis Friable pharyngeal tissue Laryngeal mass 	<ul style="list-style-type: none"> Increased risk of aspiration Difficult to manipulate Obstruction of view when traumatized Inability to visualize vocal cords 	<ul style="list-style-type: none"> Use supraglottic devices to reduce airway pressure Use a portable suction apparatus Use a Miller instead of a Macintosh blade to facilitate anterior manipulation Insert laryngoscope blade carefully Use VL and bougie-assisted intubation
Neck	<ul style="list-style-type: none"> Kyphosis, limited atlanto-occipital joint movement 	<ul style="list-style-type: none"> Inability to adequately hyperextend neck 	<ul style="list-style-type: none"> Use flexible fiberoptic laryngoscopy

VL = video laryngoscope, BVM = bag-valve-mask, TMJ = temporomandibular joint

esophageal sphincter contributes to the development of gastro-esophageal reflux disease in older adults. Underlying disease states, such as diabetes mellitus, also decrease esophageal motility, further increasing the risk of aspiration during intubation.²³

Renal System

An increased risk of chronic kidney disease exists among the elderly because of changes in the aging kidney. These changes include stiffening of the arteries, leading to a decrease in the glomerular filtration rate. Renal

disease strongly correlates to the development of hypertension, particularly under acute stress. The physiological stresses of traumatic injury and airway manipulation can induce an exaggerated hypertensive response in older patients.²⁴

Central Nervous System

Aging results in a reduced responsiveness of brain respiratory centers to hypoxemia and hypercarbia. Age-related cognitive impairment or delirium may interfere with the patient’s ability to cooperate during airway

management, rendering preoxygenation ineffective. For the same reason, awake fiberoptic intubation is challenging and associated with the risk of aspiration. The majority of elderly patients have some degree of neurogenic dysphagia or dystussia (impaired cough reflex), which also is associated with an accentuated risk of pulmonary aspiration.²⁵

Preexisting Conditions Affecting the Airway

Although anatomic and physiologic factors contribute to difficulties in airway management

(see Table 1), data suggest that comorbid conditions play the most important role in determining patient outcome following respiratory failure in geriatric patients.²⁶

Oropharyngeal cancer is common in elderly people. Patients older than 65 years of age comprise the largest group of patients with oropharyngeal squamous cell carcinoma.²⁷ The most common site of these tumors is the base of the tongue.²⁸ This can obscure identification of anatomical landmarks during intubation. Head and neck tumors also may present as neck masses that decrease the range of motion of the neck and decrease the thyromental distance, making direct laryngoscopy challenging.⁹ These masses may be friable and cause bleeding during intubation. Goiters increase in frequency with age. The presence of retrosternal goiter and tracheal deviation seen in these cases may pose a challenge during endotracheal intubation.²⁹

Many older patients have intrinsic pulmonary diseases, such as chronic obstructive pulmonary disease (COPD), obstructive sleep apnea, and lung cancer, which may increase the difficulty in preoxygenation because of intrapulmonary shunting.

Long-term smoking is another factor that is associated with intrinsic lung disease. Patients who smoke often have a lower baseline oxygen saturation and a shorter safe apnea period, making them more prone to desaturation during intubation.³⁰ Up to 16% of patients older than 65 years of age have COPD and decreased pulmonary reserve as a result of tobacco use.³¹

Age is an independent factor in the development of cardiovascular disease.³² More than 50% of individuals older than 65 years of age have coronary artery disease.³³ The prevalence of chronic hypertension among individuals older than 60 years of age is 63%.³⁴ The ability of the cardiovascular system to tolerate trauma decreases with age,

and acute hypotension is not tolerated well by the elderly. Despite appearing hemodynamically stable, patients may have underlying hypoperfusion and collapse rapidly without obvious warning signs.³³ Misleading vital signs also are encountered frequently in this population, and hypotension may be masked by the presence of chronic hypertension.³⁵

Parkinson's disease is prevalent in the elderly population.³⁶ Parkinsonian symptoms, such as rigidity, may pose difficulties with BVM ventilation and direct laryngoscopy. Vocal cord bowing also tends to occur in these patients, which may give rise to leaks during ventilation because of the presence of a gap between the endotracheal tube and the cords.⁹

Lastly, elderly patients are more prone to drug interactions since they may be taking several medications. Age-related decline in renal and hepatic clearance may increase their sensitivity to sedatives, such as etomidate, resulting in hypotension.³⁷ Relative contraindications to succinylcholine, such as hyperkalemia and prolonged immobility, may be present. Therefore, care must be taken when selecting appropriate drugs and doses for rapid sequence intubation.

Mechanism of Geriatric Trauma and Effect on Airway Management

Blunt trauma accounts for the majority of geriatric trauma injuries.³⁸ Falls are the most common mechanisms in older adults, followed by motor vehicle accidents and pedestrian injuries.

Several factors complicate trauma in the elderly. One-fourth to one-half of falls are caused by underlying medical problems.^{5,39} The patient's medical history and medications may not be readily available since many older individuals live independently and their family members or caretakers may not be present at the time of their arrival in the emergency

department. The number of elderly patients using anticoagulant and antiplatelet agents is increasing. Pre-injury use of these agents increases the incidence of intracranial bleeds and mortality.⁴⁰ Studies indicate that elderly trauma patients are undertriaged twice as frequently as their younger counterparts, resulting in the delayed identification of the extent of their injuries and unanticipated need for advanced airway management.⁴¹⁻⁴³ With aggressive resuscitation and treatment, the majority of elderly trauma patients can return to independent living.³ Therefore, advanced age must heighten our concern and should not be used as a triage tool to limit care in the appropriate clinical scenario and based on the availability of resources.³

Management of the airway is more challenging in the presence of head trauma, facial injuries, and chest wall trauma. Head trauma occurs three times more frequently in the elderly trauma population compared to their younger counterparts.⁵

Airway management in the setting of facial trauma is complex and challenging since many facial injuries preclude the use of orotracheal intubation. In a study of facial fractures in patients older than 60 years of age, approximately 30% of patients required a surgical airway.⁴⁴ Another study conducted at the same site found that 23% of all patients older than 18 years of age with facial trauma required a surgical airway.⁴⁵ Awake intubation, which often is used in facial trauma to reduce the risk of losing the airway, may not be available as an option in patients with dementia or delirium.

Indications for Endotracheal Intubation

Establishing a definitive airway is a priority in all trauma patients. The goals of endotracheal intubation are to provide adequate oxygenation, maintain ventilation,

Table 2. Indications for Endotracheal Intubation in Trauma

- Airway obstruction
- Hypoventilation
- Severe hypoxemia
- Severe cognitive impairment (Glasgow Coma Scale score of ≤ 8)
- Cardiac arrest
- Severe hemorrhagic shock

Source: Eastern Association for the Surgery of Trauma guidelines

and reduce the risk of aspiration. Early airway intervention, aggressive resuscitation, and expedited definitive management of injuries is essential to improve outcomes in these patients.⁴⁶ Higher complication rates have been reported with delays in intubation.^{47,48}

According to the Eastern Association for the Surgery of Trauma (EAST) guidelines, indications for endotracheal intubation in trauma include airway obstruction, hypoventilation, severe hypoxemia, severe cognitive impairment (Glasgow Coma Scale [GCS] score of ≤ 8), cardiac arrest, and severe hemorrhagic shock.⁴⁸ (See Table 2.) Discretionary indications include facial injury, altered mental status, combativeness, respiratory distress, intoxication, and preoperative management.⁴⁷

In a study of trauma patients, Sise et al noted that nearly two-thirds of patients intubated for agitation or intoxication had a significant head injury.⁴⁷ Given the increased incidence of intracranial bleeding in the elderly, the threshold for definitive airway management to expedite imaging should be lower in agitated older patients.⁴⁰

Airway Management Strategies

Early intubation and mechanical ventilation are considered imperative in cases of impending respiratory failure. Because of poor physiologic reserve, even a simple pneumothorax or hemothorax can result in poor outcomes. Admission to the intensive

care unit should be considered in all cases of elderly trauma to monitor for respiratory failure.

Elderly patients are more susceptible to hypoxic insults. Periods of hypoxia are not tolerated well and can result in permanent cardiac and neurologic damage. Therefore, supplemental oxygen should be initiated for all elderly trauma patients, since it replenishes their otherwise low oxygen reserve in the event that rapid sequence intubation is needed. Adequate preoxygenation may be achieved with the use of early adjuncts, such as oropharyngeal or nasopharyngeal airways, particularly in confused or obtunded patients.

Since BVM ventilation is more challenging in edentulous patients, dentures may be left in place when using the BVM to maintain anatomic landmarks, but they may be removed prior to attempts at intubation. Loose dental appliances or teeth must be removed prior to intubation since they can be aspirated. The use of a device that requires less force, such as a video laryngoscope, minimizes the risk of dislodgement of loose teeth into the trachea during intubation. Damage to the lips during intubation also may be minimized by using video laryngoscopy.¹¹ A smaller laryngoscope blade may be necessary because of microstomia and temporomandibular joint arthritis.

Impaired cough reflex and dysphagia may be present in elderly patients with neurologic conditions.⁴⁹ In such patients in whom an increased risk of

aspiration is present, supraglottic devices (e.g., laryngeal mask airway, laryngeal tube, esophageal-tracheal Combitube) are preferred. Supraglottic devices have relatively reduced insufflation of the stomach and are associated with lower airway pressures. Supraglottic devices also are helpful when ventilation using BVM is difficult because of excessive stiffness of the chest wall. A good portable suction apparatus should be available because elderly patients are more likely to have multiple factors that impair normal swallowing and lead to a buildup of secretions in their oropharynx.

Patient positioning also is important. Several studies have endorsed placing the patient in a position in which the torso is elevated by flexion at the hip approximately 25 degrees from the horizontal, citing improvement of preoxygenation, particularly in morbidly obese patients.⁵⁰⁻⁵⁴ In this 25-degree, back up position, one study showed that ancillary maneuvers (such as cricoid pressure and external laryngeal manipulation) were required less frequently.⁵⁵ However, more recent studies have called this practice into question, showing that there was no difference in first pass success between supine vs. non-supine groups, with more adverse events in the non-supine group.⁵⁶

In older adult patients, pharyngeal tissue is friable and prone to bleeding. Careful insertion of the laryngoscope blade is required to avoid trauma to the posterior pharynx, which may obstruct the view of the vocal cords. If a mass limiting the view of the vocal cords is noted during direct laryngoscopy, video laryngoscopy and bougie-assisted intubation potentially are helpful strategies. Using a Miller blade instead of a Macintosh blade is recommended to facilitate anterior manipulation of a floppier epiglottis in the elderly.¹⁶ Inability to hyperextend the neck adequately, resulting

Table 3. Rapid Sequence Induction Medications and Suggested Dose Adjustments

Medication	Adjustment
Succinylcholine 1.5 mg/kg IV	No change
Etomidate 0.1 mg/kg to 0.2 mg/kg IV	Decreased from 0.3 mg/kg IV
Midazolam	Decrease 20% to 40%
Fentanyl	Decrease 20% to 40%
Ketamine	Avoid secondary to cardiac effects

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in a limited view during intubation, may be overcome by using flexible fiberoptic laryngoscopy. This also allows for maintenance of in-line cervical stabilization without hyperextending the neck since these patients are prone to cervical spinal injury during instrumentation.³

Clinicians should choose induction agents carefully, paying close attention to their effect on the patient's hemodynamic status. Endotracheal intubation may induce a transient hypertensive and tachycardic response, particularly when multiple attempts are needed. Video laryngoscopy has been shown to prevent cardiovascular stress responses and should be the modality of choice in these patients.⁵⁷

Dose adjustment often is required with medications used in rapid sequence intubation given the age-related decline in renal and hepatic clearance. (See Table 3.) Relative contraindications to succinylcholine, such as prolonged immobility and hyperkalemia, are more frequent in elderly patients.³ The use of a non-depolarizing neuromuscular agent is recommended in these cases. Hemodynamically stable induction agents should be used to avoid hypotension or hypertension.

An increased residual volume and decreased diffusing capacity predispose the elderly to hypoxemia. Opioid administration may be required in an elderly trauma patient for pain control. Naloxone, a competitive mu opioid-receptor antagonist, may be administered to reverse the ill effects of iatrogenic opioid use, particularly respiratory depression.⁵⁸ Careful preoxygenation and ventilatory support must be provided to these patients since they can develop an unexpected degree of hypoxemia due to dysfunctional chemoreceptors.⁹

Ethical Considerations

When compared with younger trauma patients, treatment of geriatric trauma patients is complicated more often by preexisting medical problems, more severe injuries for the given mechanism, and impaired healing capacity, resulting in a prolonged length of hospital stay, and increased morbidity and mortality.³³ Elderly trauma patients who are discharged have an increased risk of death in the first two months following hospital discharge.⁵⁹

According to a study on patient perspectives, elderly patients noted that quality end-of-life care includes adequate pain control and symptom relief, avoidance

of inappropriate prolongation of dying, achievement of a sense of control, relieving burden, and strengthening of relationships with loved ones.⁶⁰ Therefore, emergency and trauma providers must develop methods to incorporate these preferences in cases of unfavorable prognoses following injury. Highly invasive, life-prolonging supportive care in intensive care units may not always be desirable to patients with preexisting comorbidities and extremely poor quality of life who experience a serious trauma.

It is essential that ED providers inquire about the patient's code status and advance directives and attempt to determine their wishes regarding invasive airway management, such as endotracheal intubation or a surgical airway. Early, frank discussions regarding the severity of the trauma and prognosis with the patient and their surrogate decision makers is imperative. However, if the patient is hemodynamically unstable or has impending airway compromise and advance directive information is not readily available, it is best to proceed with resuscitation and intubation in the ED. Advanced age of the patient must not be taken as an indication to withhold care in the context of an acute illness.

Summary

The elderly population in the United States is increasing. Although they represent a relatively small percentage of trauma patients who present to the ED, elderly patients have a significantly higher morbidity and mortality rate. One of the challenges in the elderly trauma patient is airway management because of the numerous physiologic and anatomic changes that occur with age. Comorbid illnesses are more prevalent in elderly patients and also contribute to challenges with airway management. A careful and thorough assessment of the airway, the use of appropriate airway

devices, and appropriate dosing of medications are key elements in successfully managing the airway while avoiding complications. In all geriatric trauma patients, the patient's code status and advance directives must be considered before implementing advanced airway measures with focus on restoring quality of life.

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- c. Increase in heart rate and decrease in blood pressure
 - d. Increase in heart rate and increase blood pressure
 3. Changes to the mechanics of pulmonary function in the elderly include which of the following?
 - a. Decreased expiratory volume
 - b. Decreased airway resistance
 - c. Decreased air trapping
 - d. Increased chest wall compliance
 4. Which of the following entities has an increasing incidence with age?
 - a. Nasal polyps
 - b. Oropharyngeal cancer
 - c. Goiter
 - d. All of the above
 5. Which of the following factors contributes to difficulty in preoxygenation?
 - a. Intrapulmonary shunting
 - b. Increase in safe apnea period
 - c. Increase in pulmonary reserve
 - d. Higher baseline oxygen saturation

CME/CE QUESTIONS

1. Anatomic changes in the airway in the elderly population include which of the following?
 - a. Increase in the elasticity of tissues within the nose
 - b. Increase in the elasticity of the perioral skin
 - c. Decrease in the stiffness of the epiglottis
 - d. Parapharyngeal fat loss
 2. Laryngotracheal manipulation during airway management commonly leads to which of the following?
 - a. Decrease in heart rate and decrease in blood pressure
 - b. Decrease in heart rate and increase in blood pressure
6. What is the most common mechanism of injury in the elderly?
 - a. Motor vehicle collision
 - b. Burns
 - c. Falls
 - d. Assault
 7. Which of the following is an indication for intubation according to the Eastern Association for the Surgery of Trauma guidelines?
 - a. Cardiac arrest
 - b. Glasgow Coma Scale score \leq 8
 - c. Shock
 - d. All of the above

TRAUMA REPORTS

CME/CE Objectives

Upon completion of this educational activity, participants should be able to:

- discuss conditions that should increase suspicion for traumatic injuries;
 - describe the various modalities used to identify different traumatic conditions;
 - cite methods of quickly stabilizing and managing patients; and
 - identify possible complications that may occur with traumatic injuries.
8. Which of the following is a method to prevent cervical spinal injury during the intubation of elderly trauma patients?
 - a. Use flexible fiberoptic laryngoscopy.
 - b. Use direct laryngoscopy.
 - c. Place the patient in Trendelenburg position.
 - d. Avoid hyperflexion of the neck.
 9. Which of the following is a benefit from the use of supraglottic devices?
 - a. Reduction in gastric insufflation
 - b. Improvement in ventilation in the setting of a stiff chest wall
 - c. Reduction in airway pressures
 - d. All of the above
 10. Which of the following adjustments to the dose of induction agents is suggested in the rapid sequence intubation in elderly patients?
 - a. Decrease dose of ketamine 20% to 40%
 - b. Decrease dose of fentanyl 20% to 40%
 - c. Increase dose of succinylcholine 20% to 40%
 - d. Increase dose of midazolam 20% to 40%

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