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Perspectives
Recovery Strategies from the OR to Home

In This Issue

The increasing population of older adults will result in an increased amount of surgical procedures being performed on geriatric patients. The number of elderly (> 65 years) patients who undergo noncardiothoracic surgery is projected to increase from 7 million to 14 million over the next 30 years. Surgery can potentially be debilitating for older adults. While survival may be the ultimate goal, improving quality of life and functional capacity may be far more important to the elderly. Ms. Sorenson outlines in her article how many of the postoperative pulmonary complications can be prevented with advances in medicine, technology, and risk stratification.

Unplanned extubation (UE) can be a devastating event for critically ill patients, with potentially life threatening complications including airway trauma, bronchospasm, severe hypoxemia, and cardiac arrest. UE can lead to an increased number of ventilator days, resulting in excessive resource use for patients, and increased risk of litigation for healthcare professionals. Dr. Foster describes methods to protect against UE including education, quality improvement processes, sedation protocols, physical restraints, and tube securing methods.

Postoperative recovery in elderly patients: *Implications for respiratory care*

CONTINUING EDUCATION FOR NURSING

by Helen M. Sorenson, MA, RRT, CPFT, FAARC

Surgical intervention for a variety of medical conditions has a role in treating geriatric patients. Cardiopulmonary disease, cancer, gastrointestinal disorders, and age-associated diseases can be effectively treated or alleviated with surgery. Given the increased population of older adults and newer technology available in hospitals, attitudes toward subjecting the elderly to surgical procedures have become more liberal. While survival may be the ultimate goal, improving quality of life and functional capacity may be far more important to the elderly. Preoperative screening can identify potential age-associated problems, allowing a plan to be put in place to address them should they arise during or after surgery. Attention to some of the details covered in this article may make a difference in the percentage of older adults who both survive and thrive after an operation.

Assessing risk before surgery

Awareness in the preoperative period of potential hazards can make a difference in the incidence of morbidity and mortality in elderly patients following surgical procedures. A systematic literature review[1] for the American College of Physicians, published in 2006, focused on clinical risk factors for the development of postoperative pulmonary complications. Risk factors were classified as either patient-related or procedure-related. The following patient-related risk factors for the development of postoperative pulmonary complications were supported with good evidence: advanced age, American Society of Anesthesiologists (ASA) class-II or higher morbidity, functional dependence, chronic obstructive pulmonary disease (COPD), and congestive heart failure (CHF). Other studies have implicated smoking as a risk factor for impaired postoperative pulmonary function.[2,3]

The American College of Physicians review[1] also considered procedure-related risk factors. Good evidence supports an increased risk of developing postoperative pulmonary complications with the following procedures: abdominal aortic aneurysm (AAA) repair, nonresective thoracic surgery, abdominal and vascular surgery, neurosurgery, head and neck surgery, emergency surgery, general anesthesia, and prolonged surgery. A recent report[4] of a case-control study revealed that older (≥ 70 years) patients who underwent right-sided pneumonectomy for lung cancer had about three

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Supported by an educational grant from Dale Medical Products Inc.

Using an Evidence-Based Framework for Preventing Unplanned Extubation

by Jan Foster, PhD, RN, CNS, CCRN

Unplanned extubation (UE) can be a devastating event for critically ill patients, with potentially life threatening complications including airway trauma, bronchospasm, severe hypoxemia, and cardiac arrest. UE can lead to an increased number of ventilator days, resulting in excessive resource use for patients, and increased risk of litigation for healthcare professionals. Methods to protect against UE include education, quality improvement processes, sedation protocols, physical restraints, and tube securing methods.

Background

Unplanned extubation occurs through several ways, including accidental patient self-extubation (ASE), deliberate self-extubation (DSE), and extubation by the caregiver without the involvement of the patient. The overall incidence of UE ranges from 0.3% to 16% in studies reported from the 1980s and 1990s[1-5] with the incidence leveling to 6.6-8.7% in more recent studies.[6,7] The wide variation in UE rates is explained by differences in the definitions and methods of reporting. For example, UE episodes may be calculated according to the number of patients intubated over a period of time. This can be a large figure, resulting in relatively low UE rates compared to the number of days intubated, which may be few. The result is a high rate of UE, even if a limited number of UEs occur. The timing of UE varies in relation to duration of intubation; some patients are more likely to self-extubate within 24 hours of intubation, whereas others do not initiate extubation until the tube has been in place for up to 7 days.[7] Mortality rates are higher, intensive care unit (ICU) and hospital lengths of stay are longer, and infection rates are greater for patients who experience UE.[6,7] As many as 69% of patients experiencing UE may require reintubation which can cause airway trauma, vocal cord damage, aspiration, and bronchospasm.[8] Additionally, during the time between extubation and reintubation, patients may suffer hypoxemia, cardiac dysrhythmias, and other sequelae of oxygen deficit.[9]

Risk factors

Tube securing methods

Many factors increase the risk of UE. One of the most commonly cited factors is ineffective tube securing methods.[10,11] Use of various types of tape, nonstandardized and inadequate taping methods, and stretched and moistened tape have all been associated with UE. Often the tube comes away from the tape during oral care, when the tube is repositioned, and when the patient is turned or positioned for procedures. When fabric ties are used, the material stretches, catches on tubing and catheters, and loses its effectiveness in protecting endotracheal tube placement. Improper length of the endotracheal tube and excess weight and traction of the ventilator tubing also interfere with tube stability.

Agitation

Agitation is another major risk factor for UE. Restlessness, delirium, combativeness, and lack of recent sedative administration contribute to DSE.[12-14] Additionally, agitation is associated with repeated DSEs.[15] Even when no real agitation is observed, low levels of sedation are associated with UE.[16,17] Often, these patients are ready for extubation but the care providers delay in making the decision or delay the weaning and extubation process. The validity of extubation criteria, therefore, warrants evaluation.

Interestingly, control of agitation is not enough to prevent DSE but the type of sedative bears on the likelihood of patients extubating themselves. Studies have shown that patients who self-extubated were more likely to have received benzodiazepines (midazalom and lorazepam).[14,18] Also, continuous intravenous infusion of opiates in higher doses may contribute to DSE.[14]

Restraints

Contrary to conventional wisdom, use of restraint actually contributes to UE. One of the most difficult decisions faced by clinicians when working with agitated, intubated patients is whether or not to physically restrain the patient. The temptation to tie down the hands of a delirious, agitated patient can be irresistible. Logic holds that when a patient's hands are secured, the pulling out of tubes is impossible. However, there is much evidence to dispute this. Studies have shown that 41-91% of patients who self-extubated had wrist restraints in place.[19] Physical restraints may actually increase agitation and restlessness due to the patient's inability to communicate feelings of powerlessness. Such powerlessness, along with altered cognition associated with critical illness, drives patients to behaviors that are beyond reason and DSE is the result. However, as discussed below, there may be situations where restraints are necessary.

Staffing patterns

Various aspects of staffing patterns are linked to UEs. Most happen when nurses are not in the patient's room so one can only speculate whether these incidents are deliberate or accidental.[17,20] Not surprisingly, when nurse workload increases, more UEs take place.[16] With fewer available nurses for a given patient census, nurses will be in patients' rooms less frequently and/or for shorter time periods, and thus increase the risk of DSE. Although many people think the majority of UEs take place at night, for the most part the time of day has no bearing on UEs. Several researchers report that UEs are fairly equally distributed across day and night shifts.[8,10,17,19,21]

Research based strategies for preventing unplanned extubation

Nurses, respiratory therapists, physicians, and other caregivers can prevent UE using a combination of research based methods. Close assessment and careful attention to the tube and patient

response beginning with the time of insertion throughout the duration of intubation and ventilator support facilitate tube maintenance and achievement of therapeutic goals. Strategies include tube fixation, attention to emotional and cognitive responses and pain, staff education, and an effective quality improvement program.

Tube securing methods

Securing the tube in order to avoid accidental or self-extubation is key. A commercial tube securing device is superior to tape or twill ties in securing the endotracheal tube.[22] Other advantages to commercial devices include the facilitation of oral care, allowing removal of hypopharyngeal secretions that collect above the endotracheal tube cuff and reducing the incidence of ventilator acquired pneumonia.[23] Lip and facial skin breakdown is averted with a commercial device because repeated applications of adhesive tape are unnecessary. Cleanliness of the tube securing device is maintained with the ability to wipe away secretions, a solution to the problem of moisture and stretching problems associated with tape use. The tube holder fits securely to the face, and supports the weight of the ventilator tubing without causing skin breakdown. Figures 1-3 illustrate an example of a commercially available tube holder. The base of the holder has adhesive backing on one side and is applied directly to the face above the lip; the other side has a hook-and-loop fastener strip (e.g. Velcro®). The neckband has a tube channel that fits over the endotracheal tube. The strap circles the neck and attaches to the hook-and-loop strip on the base, anchoring the tube in place. During oral care, full access of the oral cavity is accessible. This device also provides an easier and safer method of preventing lip necrosis than removing and replacing tape. Because the strap is easily detached and reattached, the device allows for more frequent assessment of the oral cavity and lip and skin assessment. In general, the adhesive backed base requires changing every three days.

Sedation

Many patients who are given endotracheal intubation describe the experience as traumatic, and often experience negative emotions such as fear, frustration, and anger.[24] Their compromised ability to communicate verbally creates feelings of helplessness and powerlessness. Thus, patients must receive some form of sedation "to take the edge off" the experience, even if they are not in pain. Gauging the proper level of sedation is as much an art as a science – oversedation can interfere with successful extubation and undersedation can risk premature removal of the tube by the patient. Clinical practice guidelines have been developed for use in managing sedatives and analgesics in critically ill patients.[25] The algorithm includes assessment of comfort and pain, anxiety and agitation, and delirium, all using validated numeric scales to promote consistency and communication between patients and caregivers. Physical and metabolic causes of obvious discomfort must first be addressed and corrected whenever possible.

Nonpharmacological interventions such as therapeutic touch, presence, verbal support and coaching, along with environmental optimization should be employed initially and throughout the intubation period. Intravenous opiates such as fentanyl, hydromorphone, and morphine are recommended for pain control. Acute agitation may be treated with midazolam, followed by continuous sedation with propofol or lorazepam. The lowest effective doses should be used to guard against the potential of oversedation or development of delirium. Doses should be titrated according to a specified goal agreed upon by the critical care team and quantified by a numerical sedation scale. A daily drug holiday is practiced in many critical care units, which assists the clinician in determining whether or not agitation is declining, warranting a reduction in sedation dosage. Delirium is best treated with haloperidol intravenously as a scheduled drug every six hours (versus "as needed").[25]

Figures 1-3. ET Tube Holder (Dale Medical Products

Use of Restraints

Wrist restraints may be a marker of inadequate sedation or delirium. Therefore, when initiating wrist restraints, the clinician is urged to step back and reconsider; an assessment for adequacy of sedation and presence of delirium is indicated. Better management of patient behavior with proper medications may preclude application of restraints and prevent a DSE. Clinical practice guidelines have been developed for use of physical restraints in critically ill adult patients.[26] Because of what is known about increased incidence of UEs when physical restraints are in place, and to maximize dignity, comfort, and ethical practice, restraints should be reserved for patients who are at highest risk of injury due to agitation and/or delirium and should be used only as a temporary means of control. Underlying causes of agitation should be addressed and corrected whenever possible. Often, simple measures such as repositioning the patient to relieve chronic back pain, wedged linens or catheter pressure can relieve restlessness and preclude the use of restraints. Sedatives, analgesics, and neuroleptics should be initiated and maintained as needed. Reducing environmental stimulation, encouraging the presence of family members at the bedside, and promoting sleep-wake cycles may mitigate sustained use of restraints.[26]

Education

Staff education is an effective strategy for reducing UEs. One hospital was able to reduce their UE rate by nearly two-thirds in one unit and one-half in another unit.[10, 27] Multiple disciplines such as respiratory therapists, anesthesia personnel, physicians, nurses, and paramedics employed in various hospital units and departments need to participate in the education as they are all involved in intubation and management of the intubated patient. The education program should address tube securing methods such as the procedure for application of the endotracheal tube holder or a standardized taping method. This promotes uniformity among practitioners as patients travel through the hospital from the emergency department, surgery suite, and other units. Sedation, pain, and delirium scales should be part of the program to promote reliability in interpretation of the numerical scoring systems and continuity in goal setting with administration of sedatives, analgesics, and neuroleptics. Earlier recognition and treatment of delirium will also be enhanced with more caregivers skillful in the use of the scoring systems, which will contribute to lower UE rates.

Quality improvement and risk management

Vigilant assessment of UE rates together with identification of associated factors is critical to improving patient outcomes with mechanical ventilation.[27] In the author's own experience, variance reports of UE incidents have been found without details surrounding the event. Reasons for this may be explained by the fact that no one witnessed the patient self-extubate, there was no follow-up investigation, reporting tools were unavailable, and there was no formal quality program to address the issue. A database to include all UEs and extenuating circumstances is vital for evaluating processes and outcomes when caring for mechanically ventilated patients. Once the issues are identified, evidence-based interventions can then be implemented with follow-up re-evaluation to determine successes and areas needing further attention.

Conclusion

Unplanned extubation is a serious concern in the ICU. Implementation of research based approaches can assist the caregiver in the identification of patients at risk for DSE, and incorporation of methods that prevent all types of UEs. A comprehensive plan that includes tube stabilizing techniques, recognition and treatment of agitation and delirium, proper use of restraints, staff education, and a rigorous quality improvement program are all effective means of reducing the incidence of UE. Because many patients are undersedated at the time of DSE and do not require reintubation, better ways of determining readiness for extubation are needed; this is an area ripe for research. In the meantime, clinicians have access to research based strategies that provide multiple methods for preventing UE and the potentially catastrophic outcomes.

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Postoperative recovery in elderly patients – Continued

times greater risk for postoperative mortality when compared to younger (approximately 59 years) patients with comparable disease and comorbidities.

Many laboratory test results have been considered as markers of risk for postoperative pulmonary complications, but good evidence exists only for a serum albumin level of < 35 g/L.[5] A low serum albumin level indicates poor nutritional status, which increases risk for complications.

While pulmonary function, specifically the ratio of forced expiratory volume in one second (FEV_1) to forced vital capacity (FVC), has been studied as a marker of increased risk,[6,7] insufficient evidence supports the use of preoperative spirometry as a risk-stratification tool.[1]

Preoperative planning

While not directly related to postoperative pulmonary complications, failure to initiate preoperative planning

would be a mistake. Planning in addition to risk assessment can ultimately reduce or eliminate the development of major postoperative pulmonary complications. Some things to consider:

Risk increases with age. Operative mortality for patients ≥ 80 years is more than twice that for patients 65 to 69 years old.[8]

Elective surgery, though not always possible, is associated with better outcomes than emergency surgery in older patients.[8,9]

The type of surgery performed stratifies the risk. Carotid endarterectomy and nephrectomy would be considered low-risk procedures, while mitral-valve replacement, esophagectomy, and pneumonectomy place patients at higher risk.[8]

The location of the surgical procedure, be it at an ambulatory surgical center, outpatient hospital, or physician office, is also a factor; risk increases with surgery at a physician's office or outpatient hospital.[10]

For elderly patients, risk increases with prior hospitalization and the invasiveness of the surgery.[10]

Surgical site infections (SSI) can delay postoperative recovery. One of the independent risk factors in the development of SSI is COPD as comorbidity.[11]

Knowing other independent risk factors associated with an increased incidence of SSI in older adults may be beneficial in developing interventions to prevent wound infections.[11] Preoperative antibiotic use is controversial. It has been recommended that clinicians reserve preoperative antibiotic therapy for patients with infection suggested by a change in the character and amount of sputum.[1] A recent article[12] looked at preoperative antibiotics and mortality in the elderly; it noted that, when patients underwent general surgery, the odds of dying within 60 days were less than half in those treated with preoperative antibiotics within 2 hours of incision.

Figure 2. Tracheostomy tube holder (courtesy of Dale Medical): Padded neck band circles the neck. Velcro® hook-and-loop fasteners hold the neck band to the tracheostomy tube.

Table 1. **Factors that increase risk of postoperative pulmonary complications in the elderly patient**

Preoperative
- Poor nutritional status (albumin < 35 g/L)
- Advanced age
- Comorbid disease (COPD, CHF)
- Functional dependence
- History of smoking
- ASA class-II or higher morbidity

Perioperative
- Type of surgery (AAA repair; thoracic, abdominal, vascular, or head/neck surgery; neurosurgery)
- Prolonged (> 3 hours) surgery
- Emergency surgery
- General anesthesia
- Inadequate perfusion, fluid management, temperature regulation, or oxygenation

Postoperative
- Hypothermia
- Hypoxemia
- Hypovolemia
- Poor pain control
- Surgical site infections
- Nasogastric tube placement
- Long-acting neuromuscular blockade

Perioperative (intraoperative) monitoring

What happens during surgery is going to affect patients in the postoperative period. Potential intraoperative risk factors include temperature regulation, perfusion, type of anesthesia, duration of anesthesia, duration of surgery, fluid management, and oxygenation.

All patients undergoing major surgery are routinely monitored. For older patients, electrocardiogram (ECG), blood pressure, and oxygen saturation should be monitored during any procedure. Blood pressure measurements are recommended every 5 minutes.[13] For frail individuals, a thin layer of padding may be used under the cuff to protect the skin. The ECG should be configured to observe both p waves and the lateral wall of the left ventricle.[13] Pulse oximetry may not be easy due to poor perfusion and/or cold extremities. Using probe sites other than fingers and toes is possible with newer technology and should be considered. Anesthesia/sedatives should not be administered unless there is a satisfactory pulse oximeter reading.[13]

Maintaining adequate body temperature in elderly patients during surgery is challenging. Significant hypothermia may develop during a long surgical procedure, dropping core temperatures to between 32.25°C and 35.03°C. Older adults have a lower baseline temperature to begin with, and mechanisms used to increase body temperature are often blunted in the elderly. Severe hypothermia is associated with cardiac arrhythmias. Even hypothermia in the range of 31.69°C to 32.25°C can lead to ventricular fibrillation and subsequent death.[14] Measures that can be taken to maintain a reasonable body temperature in older surgical patients include warming all fluids, maintaining the operating room at a reasonable temperature, keeping abdominal viscera in the abdominal cavity as long as possible, and, if needed, using warm normal saline for lavage.

Choice of anesthetic agents and techniques has been the topic of many articles. In general, older adults require less medication to achieve the same level of sedation.[14,15] Pain perception is altered with aging,[14] but pain is not less common or less important and must still be addressed. Muscle relaxants are often used by anesthesiologists to control muscle tone. All of the agents available may result in an increased duration of action, but doses are not significantly altered.[14] General versus regional versus neuraxial (blocking spinal-cord nerves) anesthesia in older patients has also been debated in many publications. Spinal anesthesia is the most easily mastered and is often selected for older patients.[13] The belief that regional anesthetics should be safer for older patients is not supported by most major studies. According to Roy, there is a developing consensus that overall perioperative care, not just the choice of anesthetic technique, is more likely to have a positive impact on the elderly surgical patient.[16] Surgical procedures that require general anesthesia, are prolonged (> 3 hours) with the patient supine, and involve an abdominal incision can result in a reduced functional residual capacity

(FRC) and increased airway resistance.

Combining the aging pulmonary physiology with pulmonary consequences of surgery can result in hypoventilation, small airway closure, hypoxemia, secretion retention, and pulmonary infections.[17] Oxygenation must be addressed. Patients with clinically significant cardiac or pulmonary disease should receive oxygen during surgery. Hypoxia may impair wound healing and cognitive functioning, especially in the elderly.[18]

Fluid management is also important. Patients on preoperative fluid restrictions are more likely to be underhydrated when they come into surgery, but overhydration is just as problematic. Excess fluid in an elderly patient, when renal failure is present, can result in pulmonary edema. Dehydration, on the other hand, can precipitate renal failure. Intraoperative blood loss places older adults at increased risk for postoperative delirium; such delirium is noted most frequently when the hematocrit has dropped to < 30%.[19]

Postoperative care

Normal age-related pulmonary changes such as reduced lung elasticity, decreased vital capacity, loss of diaphragmatic strength (up to 25% in adults > 70 years),13 and increased chest-wall resistance tend to hasten the development of ventilatory failure in elderly postoperative patients. The use of anesthetic and analgesic agents during and after surgery further depresses the respiratory drive, often resulting in the need for mechanical ventilation in the postoperative period. Because hypothermia can depress respiration and the cough reflex, elderly patients should not be extubated until their body temperature is within 0.5°C of their baseline core temperature.[14]

While data related to the effect of age on outcomes of mechanical ventilation are inconclusive, evidence does suggest that patients over age 70 years are more likely to become ventilator dependent.[20] Although not always a desired procedure, placement of a tracheostomy may allow the ventilator-dependent patient to live outside the hospital, or in some cases may facilitate liberation from the ventilator. Documented[21] benefits of tracheostomy include reduction of dead space, decreased work of breathing, enhanced secretion removal, oral hygiene, reduced laryngeal damage, decreased glottic and tracheal ulceration, the potential for oral nutrition, and better communication with family and caregivers. On the downside, not all elderly patients enjoy a lengthy survival post-procedure. A small retrospective case review of 19 elderly patients who underwent tracheostomy for long-term mechanical ventilation revealed that 14 died within 40 days of surgery.[22] It is important to note that many patients were excluded from the study, including those undergoing tracheostomy for upper-airway obstruction or in conjunction with head and/or neck cancer.

The complications following a tracheostomy may also be problematic for the elderly. Studies show that 50% to 70% of older patients develop a significant infection after a tracheostomy[23] and as many as 77% aspirate secretions.24 It has been demonstrated that obese older adults had improved survival after placement of a tracheostomy; however, patients between the ages of 70 and 75 years with bullous emphysema were poor candidates for permanent tracheostomies.[22] Tracheostomy ties should be longer and wider to prevent trauma within skin folds. Commercially available tube holders incorporate stretch material to accommodate any edema around the neck (Figure 1). An extension piece can help obese patients and helps to prevent pressure ulcers from occurring under the tracheostomy tie.[25]

Careful consideration must be given to pain management in the postoperative period. Consequences of untreated pain are tachycardia, increased oxygen consumption, and possible myocardial ischemia.[14] Anticipated pain can lead to splinting and poor inspiratory effort, increasing the risk of atelectasis and postoperative pneumonia.

Morphine is a pain reliever commonly used outside the operating room and is often administered via patient-controlled analgesia (PCA). PCA is useful in elderly patients who can understand instructions and know how to use the button before the pain becomes intense. In a randomized trial[26] comparing conventional intramuscular injections and PCA in frail elderly men, PCA gave better pain control with fewer complications, less sedation and better patient satisfaction.

Of interest is a small study[27] examining the effect that warm blankets had on pain perception. Based on the assumption that adequate rest in postoperative patients promotes healing and reduces length of stay, 49 older adults who were complaining of pain, discomfort, cold, and anxiety were assessed for their level of discomfort before and 1 hour after application of a warmed blanket. The level of discomfort after receiving the blanket was significantly less ($p < 0.001$).

Adequate pain management and adequate oxygenation have been shown in two independent studies to reduce the incidence of postoperative delirium.[27,28] Because postoperative hypoxia can result in both transient and long-term cognitive dysfunction after both cardiac and non-cardiac surgery, oxygen therapy should not be withheld. Research[29,30] indicates that a normal PaO_2 for a healthy older adult is about 83 mm Hg with a lower limit of SpO_2 at about 94%. Patients should not be discharged from the recovery room until their corrected arterial saturation is similar to their preoperative level.[14]

For decades, respiratory therapists have been delivering hyperinflation therapy to postoperative patients. Good evidence[31] indicates that lung-expansion interventions (e.g., incentive spirometry, deep-breathing exercises, continuous positive airway pressure) reduce the risk of postoperative pulmonary complications. Fair evidence[32] suggests that selective, rather than routine, use of nasogastric tubes after abdominal surgery reduces pulmonary complications associated with aspiration, and short-acting rather than long-acting neuromuscular blockade reduced postoperative pulmonary edema.

Conclusion

The ever-expanding population of older adults will result in an increased amount of surgical procedures being performed on geriatric patients. The number of elderly (> 65 years) patients who undergo noncardiothoracic surgery is projected to increase from 7 million to 14 million over the next 30 years.33 Surgery can potentially be debilitating for older adults. The good news is that many postoperative pulmonary complications are preventable. With advances in medicine, technology, and risk strati-

fication, the future looks good for older surgical patients.

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After reading this article, the learner should be able to:

1. Recognize risk factors for unplanned extubation in critically ill patients.
2. Describe strategies for prevention of unplanned extubation.
3. List at least 5 postoperative pulmonary complications in the elderly.
4. Identify the risks of a trachesotomy in the elderly.

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1. **Risk factors for projecting which patients will develop post-operative complications can be classified as either patient-related or procedure-related. Which of the following risk factors would be considered patient-related?**
   a. The need to do emergency surgery on the patient
   b. The amount of time the patient spent in surgery
   c. The patient's level of functional dependence prior to surgery
   d. The type of anesthesia given to the patient during surgery
2. **There is good evidence to support the use of which laboratory test as a marker of an increased risk for developing post-operative pulmonary complications?**
   a. Arterial blood gases
   b. Serum albumin
   c. FEV1/FVC
   d. Serum potassium
3. **An independent risk factor for the development of a surgical site infection in older adults is a diagnosis of;**
   a. Diabetes
   b. Asthma
   c. Arthritis
   d. COPD
4. **The use of preoperative antibiotics (2 hours prior to surgery) in older adults has been associated with;**
   a. An actual increase in post-operative mortality
   b. No significant change in post-operative mortality rates
   c. A reduction in post-operative mortality by about 10%
   d. A reduction in post-operative mortality by almost 50%
5. **An oxygen saturation (SpO_2) of 90% is adequate for the majority of elderly patients recovering from surgery.**
   a. True
   b. False
6. **Incentive spirometry as a means of preventing postoperative pulmonary complications;**
   a. Should be considered in all elderly postoperative patients
   b. Has not been found to be effective in postoperative care
   c. Is too difficult for older adults to perform
   d. Is only useful if preoperative inspiratory capacity has been established
7. **The routine use of nasogastric tubes in elderly patients is an effective means of preventing aspiration.**
   a. True
   b. False
8. **What is/are advantage(s) to utilization of an endotracheal tube securing device?**
   a. Ease of oral hygiene, reduction in lip necrosis
   b. Families are better able to participate in hygiene measures
   c. Reduces oral and skin infections
   d. Facilitates communication, reduces discomfort
9. **When securing an endotracheal tube, what is an important consideration?**
   a. Using consistent length of cloth ties
   b. A device that supports the weight of the ventilator tubing
   c. The ability to remove adhesive from the face on a daily basis
   d. A device that provides nasogastric suction
10. **Use of physical restraints reduces the risk of unplanned extubation.**
    a. True
    b. False
11. **Most patients who self-extubate do not require re-intubation.**
    a. True
    b. False
12. **What are the key benefits to an education program designed to reduce unplanned extubations?**
    a. Nurses can earn necessary education contact hours
    b. Respiratory therapists can learn from nurses
    c. Consistency in endotracheal tube securing methods
    d. Reduced dosages of sedatives
13. **What should be done when a patient self-extubates?**
    a. Immediately reintubate and draw arterial blood gases
    b. Administer a topical anesthetic into the vocal cords
    c. Evaluate the sedation level
    d. Investigate extenuating circumstances and enter into a database
14. **How is delirium best treated in critically ill patients to prevent extubation?**
    a. Administration of haloperidol intravenously
    b. Application of physical restraints
    c. Assessment with a select sedation scale
    d. Providing a bedside sitter

What is the highest degree you have earned (circle one) ? 1. Diploma 2. Associate 3. Bachelor's 4. Master's 5. Doctorate

Indicate to what degree you met the objectives for this program: Using 1 = strongly disagree to 6 = strongly agree rating scale, please circle the number that best reflects the extent of your agreement to each statement.

	Strongly Disagree					Strongly Agree
1. Recognize risk factors for unplanned extubation in critically ill patients.	1	2	3	4	5	6
2. Describe strategies for prevention of unplanned extubation.	1	2	3	4	5	6
3. List at least 5 postoperative pulmonary complications in the elderly.	1	2	3	4	5	6
4. Identify the risks of a trachesotomy in the elderly.	1	2	3	4	5	6

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Mark your answers with an X in the box next to the correct answer

	A	B	C	D
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2	☐	☐	☐	☐
3	☐	☐	☐	☐
4	☐	☐	☐	☐
5	☐	☐		
6	☐	☐	☐	☐
7	☐	☐		
8	☐	☐	☐	☐
9	☐	☐	☐	☐
10	☐	☐		
11	☐	☐		
12	☐	☐	☐	☐
13	☐	☐	☐	☐
14	☐	☐	☐	☐
15	☐	☐	☐	☐
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