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Aspiration Pneumonitis

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Introduction

- Anesthesia is an essential element of healthcare today, however, it is not without its complications. One major complication of anesthesia is aspiration pneumonitis.
- Inflammation of the lung tissue caused by aspiration of a foreign substance, such as, food, meconium, or secretions, can be referred to as aspiration pneumonitis (McCance, Huether, Brashers, & Rote, 2014).
- Anesthetic agents can cause reduced cough and gag reflexes, which in turn interferes with an individual's ability to handle oropharyngeal secretions and refluxed gastric contents (Metheny, 2016).
- "Anesthesia-related aspiration occurs when patients without sufficient laryngeal protective reflexes passively or actively regurgitate gastric contents" (Nason, 2015).
- Anesthesia-related aspiration occurs in as many as 1 in every 2-3,000 surgical procedures requiring anesthesia, and consequently, approximately half of those patients who aspirate during their operation develop a lung-related injury such as aspiration pneumonitis or pneumonia (Nason, 2015).
- Complications stemming from aspiration pneumonitis can range in severity based on the content, quantity, and acidity of the aspirate, in addition to certain characteristics of the patient, such as host defense mechanisms. Severity can range from mild and subclinical pneumonitis to progressive respiratory failure and death (Son, Shin, & Ryu, 2017).
- In order to reduce the occurrence of anesthesia-related aspiration pneumonitis, education on prevention and treatment is essential.

Presentation of Process

Signs and Symptoms

- The primary sign of intraoperative aspiration is visualization of gastric contents in the oropharynx or passing into the airway during intubation (Nason, 2015).
- Other signs of intraoperative aspiration include persistent hypoxia, high airway pressures, bronchospasm, and abnormal breath sounds (Nason, 2015).
- According to DiBardino& Wunderlink (2015), additional clinical features that can be seen with aspiration pneumonitis:
  - Fever
  - Tachycardia
  - Abnormal chest radiograph

Risk Factors

- "Causes of aspiration pneumonia during the perioperative period can be divided into anesthesia-, surgery-, and device- related factors. The most consistent risk factors related to anesthesia are light anesthesia, residual neuromuscular blockade after anesthesia, and prolonged anesthesia." (Deguchi, Komasawa, Ueno, Omori & Minami, 2016).
- Medications:
  - Anesthesia itself puts patients at risk for aspiration by reducing level of consciousness and by causing loss of protective reflexes (Nason, 2015).
- Additional medications routinely used during anesthesia that are known to decrease lower esophageal sphincter tone include: propofol, β-agonists, opiods, atropine, thiopental, tricyclics, glycopyrrolate (Nason, 2015).
- Predisposing conditions: gastroesophageal reflux disease (GERD), esophageal dysmotility, difficulty swallowing, diabetes, delayed gastric emptying, gastrointestinal obstruction, need for emergent surgery, previous esophageal surgery, lack of coordination of swallowing, esophageal cancer, hiatal hernia, obesity (Nason, 2015)
- Lack of provider experience and expertise (Nason, 2015):
  - "In the retrospective review of anesthesia-related aspirations by Sakai and colleagues, 10 of the 14 cases were attributed to improper anesthesia technique " (Nason, 2015).

Diagnosis

- Is typically presumptive based on the clinical feature noted above (Bartlett, 2018)
- Chest radiography abnormalities may appear within two hours after suspected aspiration (Bartlett, 2018).
- If a bronchoscopy is obtained, it may show erythema of the bronchi, indicating acid injury (Bartlett, 2018).

Figure 1. A patient undergoing anesthesia ("Types of Anesthesia," n.d.)

Underlying Pathophysiology

As Bartlett (2018) explains, there are many extensive experimental animal studies on the pathophysiology of aspiration pneumonitis. In these test animals, the inoculum used must have a pH of ≤2.5, and a large amount must be used – approximately 1-4ml/kg. This converts to an amount 25 mL of gastric acid in human adults. Bartlett (2018) states that it is likely that when lesser amounts of gastric acid are aspirated in humans, the process of pneumonitis is more subtle to where is escapes clinical detection or causes a less severe form. This concept supports the notion that patients with GERD may suffer from bouts of recurrent pneumonitis more frequently than those who do not have GERD (Bartlett, 2018).

According to Bartlett (2018), in the above-mentioned test animals, the pathophysiologic changes that occur in aspiration pneumonitis occur rapidly. In as little as three minutes of aspirating, pathologic processes such as atelectasis, peribronchial hemorrhage, pulmonary edema, and degeneration of bronchial epithelial cells begin to take place. The alveolar sacs become filled with polymorphonuclear leukocytes and fibrin by hour four. At this point, alveolar consolidation occurs due to the lung's gross edema and hemorrhage. Causing further injury to lung tissue, proinflammatory cytokines, including tumor necrosis factor (TNF)-alpha and interleukin (IL)-8 are released. These findings have also been found on autopsy of patients have died from aspiration pneumonia. (Bartlett, 2018).

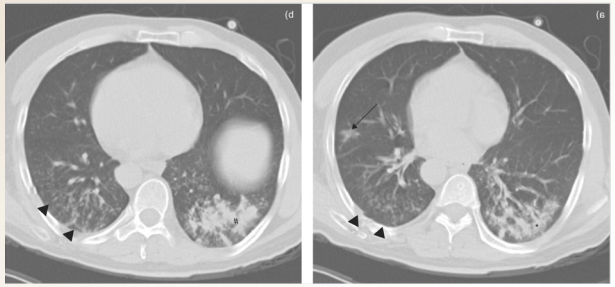

Figure 2. CT scan from an individual with aspiration revealing nodular airspace infiltration (#), focal ground-glass opacification (arrow) and centrilobular nodules with tree-in-bud changes (arrowheads) (Morehead, 2009).

Significance of Pathophysiology

- Understanding the pathophysiology behind anesthesia-related aspiration will aid in the prevention of its occurrence and minimization of its harmful effects.
- If a patient has aspirated during surgery, the anesthesia provider will rely on his or her knowledge of pathophysiologic processes to decide whether or not to proceed with the case (Nason, 2015).
- One major element that will influence this decision is the severity of pathophysiologic processes that may have occurred such as atelectasis, peribronchial hemorrhage and pulmonary edema (Bartlett, 2018).
- Additional factors that will influence the provider's decision include: the necessity of the surgery, the patient's oxygen saturation and lung compliance, and how well the patient responds to interventions such and bronchodilators and positive end-expiratory pressure (Nason, 2015).
- Antibiotics are not typically recommended as they are not usually effective for aspiration pneumonitis, however, they are often given because it is hard to distinguish chemical pneumonitis from bacterial aspiration pneumonia (Sethi, 2017).
- Depending on the volume of aspirated contents, mechanical ventilation should be considered when there is concern for the development of acute respiratory distress syndrome (ARDS) (Nason, 2015).

Implications for Nursing Care

- The certified registered nurse anesthetist (CRNA) plays a large role in preventing anesthesia-related aspiration pneumonitis.
- The CRNA should always conduct a preoperative risk assessment so that they are aware of any conditions that the patient has that may increase their risk of aspirating, such as GERD, esophageal dysmotility, difficult swallowing, diabetes, delayed gastric emptying, obstructing cancer (Nason, 2015).
- The CRNA must educate their patients on the importance of fasting before surgery to reduce their risk of aspirating. According to Nason (2015), the American Society of Anesthesiologists Committee on Standards and Practice Parameters currently allow:
  - Consumption of a light meal up to 6 hours prior to surgery
  - Clear liquids up to 2 hours prior to surgery
- The CRNA should utilize current preoperative medication recommendations such as the use of H2 blockers, proton pump inhibitors and prokinetics, which are effective in increasing the pH and reducing the volume of gastric contents, as well as promoting gastric emptying (Nason, 2015).
- The CRNA may utilize the rapid sequence induction technique on patients who are considered high-risk cases to minimize the risk of aspirating during intubation (Nason, 2015). This technique includes:
  - Preoxygenation, rapid administration of induction and paralytic agents, cricoid pressure, avoidance of bag and mask ventilation, and transoral insertion of an endotracheal tube using direct or video laryngoscopy (Nason 2015).
- In cases where cricoid pressure during intubation is contraindicated, other options to reduce the risk of aspiration during intubation include awake intubation and the use of 40° head-up positioning during induction (Salem, Khorasani, Zeidan & Crystal, 2017)

Conclusions

Anesthesia-related aspiration pneumonitis is a potentially fatal perioperative complication that is preventable in many cases. Understanding the pathophysiologic process of aspiration pneumonitis is essential in preventing and treating its occurrence. In order to reduce its associated morbidity and mortality, anesthesia providers must be aware of the risk factors and utilize the most current prevention and treatment strategies.

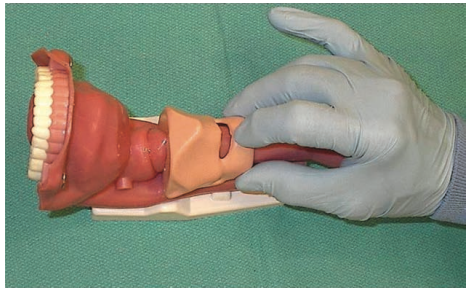

Figure 3. Cricoid pressure application (Salem, et al., 2016).

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