



Anesthetic Considerations and Perioperative Management for Pulmonary Aspiration



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Introduction

Pulmonary aspiration is an emergent complication during anesthesia, taking place when gastric contents or saliva enters the lungs. Anesthesia impairs the body's natural protective mechanisms, increasing the risk of aspiration during surgical procedures. Although the incidence of aspiration is statistically low (1 in 2,000 to 3,000 surgeries), severe complications may develop in patients, including respiratory distress, pneumonia, and even death. The acidity and volume of aspirated material are the primary factors influencing severity. Inhalation of acidic gastric contents (pH < 2.5) may result in acute lung injury or chemical pneumonitis, while aspiration of large volumes (greater than 1.5 mL/kg) may result in airway obstruction. Assessment of aspiration-related malpractice claims found 57% of cases resulted in death, with 59% of these incidents involving substandard anesthetic care (Warner et.al, 2021).Prevention of pulmonary aspiration requires thorough preoperative patient risk assessment, aspiration prophylaxis (involving preoperative starvation and pharmacological agents), vigilant airway management, and steadfast action in occurrence of an intraoperative event. Strategies to minimize risk of perioperative aspiration and improve patient outcomes are detailed in this poster through updated anesthetic techniques and protocols.

Risk Factors for Aspiration

Proper preoperative planning and patient assessment by anesthetists can drastically reduce the chance of pulmonary aspiration occurrences perioperatively. There are six primary risk factors predisposing a patient to pulmonary aspiration (Kosutova & Mikolka, 2021).

- 1.Gastrointestinal Issues:** conditions such as bowel obstruction, acid reflux, and gastroparesis increase aspiration risk due to high gastric pressure and delayed emptying. Suctioning of gastric contents by NG/OG tube insertion helps to reduce volume.
- 2.Alterd Consciousness:** depressed neurological status stemming from traumatic brain injury, sedation, and seizures weaken protective airway reflexes such as coughing.
- 3.Dysphagia:** compromised gag reflex and swallowing dysfunction is a prevalent side effect seen with conditions such as Parkinson's disease and COPD.
- 4.Pregnancy:** there is a heightened risk of aspiration present during the third trimester of pregnancy due to delayed emptying, relaxed sphincter tone, and increased gastric pressure in combination with airway swelling.
- 5.Obesity:** patients with an elevated BMI tend to have increased gastric pressure, difficult airways, and delayed emptying.
- 6.Provider Expertise:** negligence to initiate necessary precautions or improper technique by the anesthetist influence pulmonary aspiration events. (Nason, 2015)

Emerging Tools for Aspiration Prevention

Point of Care Ultrasound: tool utilized to visualize the volume of gastric contents in an individual, particularly useful for patients suspected of delayed gastric emptying (Zdravkovic et al., 2023).

- Volume >1.5 ml/kg = full stomach risk
- Optimal positioning required for accurate results with POCUS: lateral, head up 45 degrees

Mathematical Models: Quantification of gastric pressure, volume, and acidity level consistent with increased risk of pulmonary aspiration aids anesthetists in developing optimal RSI positioning and proper patient assessment (Zdravkovic et al., 2023).

Global Data Reporting Platform: Aims to improve management of perioperative pulmonary aspiration through anonymous worldwide data submission by anesthetists, featuring evidence-based practices and techniques (Zdravkovic et al., 2023).

Pharmacological Prophylaxis

Guidelines instituted by the American Society of Anesthesiologists (ASA) detail recommendations for pharmacological agent administration during the perioperative period to prevent aspiration. A "multimodal approach", results in a synergistic effect to prevent aspiration in high- risk patients (American Society of Anesthesiologists, 2017).

•Gastric Acid Secretion Blockers:

- Proton Pump Inhibitors (PPI's): include Esomeprazole (Nexium), Omeprazole (Prilosec)
- Histamine (H2) Antagonists: include Cimetidine (Tagamet), Famotidine (Pepcid)
- Both PPIs and H2 antagonists increase pH to limit gastric acidity
- H2 antagonists > PPIs at similar dosages (Nason, 2015)

•Gastrointestinal Stimulants

- Metoclopramide (Reglan) is a prokinetic agent which speeds stomach emptying

•Antacids

- Basic medications, such as Tums, Alka-Seltzer, and Pepto-Bismol help to neutralize gastric contents.

•5-HT3 Antagonists:

- Ondansetron (Zofran) is a common antiemetic which blocks serotonin receptors, preventing PONV.

•Anticholinergics

- Atropine and Glycopyrrolate prevent acetylcholine binding to muscarinic receptors to reduce secretions and salivation.

A. Fasting Recommendations*	
Ingested Material	Minimum Fasting Period†
• Clear liquids‡	2h
• Breast milk	4h
• Infant formula	6h
• Nonhuman milks§	6h
• Light meal**	6h
• Fried foods, fatty foods, or meat	Additional fasting time (e.g., 8 or more hours) may be needed
B. Pharmacologic Recommendations	
Medication Type and Common Examples	Recommendation
Gastrointestinal stimulants:	
• Metoclopramide	May be used/no routine use
Gastric acid secretion blockers:	
• Cimetidine	May be used/no routine use
• Famotidine	May be used/no routine use
• Ranitidine	May be used/no routine use
• Omeprazole	May be used/no routine use
• Lansoprazole	May be used/no routine use
Antacids:	
• Sodium citrate	May be used/no routine use
• Sodium bicarbonate	May be used/no routine use
• Magnesium trisilicate	May be used/no routine use
Antiemetics:	
• Ondansetron	May be used/no routine use
Anticholinergics:	
• Atropine	No use
• Scopolamine	No use
• Glycopyrrolate	No use
Combinations of the medications above:	No routine use

Chart 1. Preoperative Fasting and Pharmacological Aspiration Prophylaxis (American Society of Anesthesiologists, 2017)

Preoperative Starvation

Updated preoperative fasting guidelines outline in [Chart 1] from the American Society of Anesthesiologists aim to ensure empty stomachs before surgical procedures, reducing pulmonary aspiration risk.

- Patients with comorbidities associated with gastroparesis (ex: Diabetes, Pregnancy, Obesity) may classify as "full stomach" despite following preoperative starvation guidelines. One study found that 6.2% of elective surgery patients had substantial gastric volume despite NPO compliance (Hayashi, et al., 2020). All emergency surgery and trauma patients are considered full stomach since the last time they ate/drank is unknown.
- Usage of GLP-1 agonist agents (ex: Ozempic, Wegovy) for diabetes and weight loss result in prolonged fullness due to decreased gastric motility. Employment of orogastric suctioning or visualization of gastric volume through ultrasound should be considered for patients taking GLP-1 agonists (Klein & Hobai, 2023). These medications should be stopped 2 weeks before surgery, and if not, a rapid sequence induction (RSI) should be done.

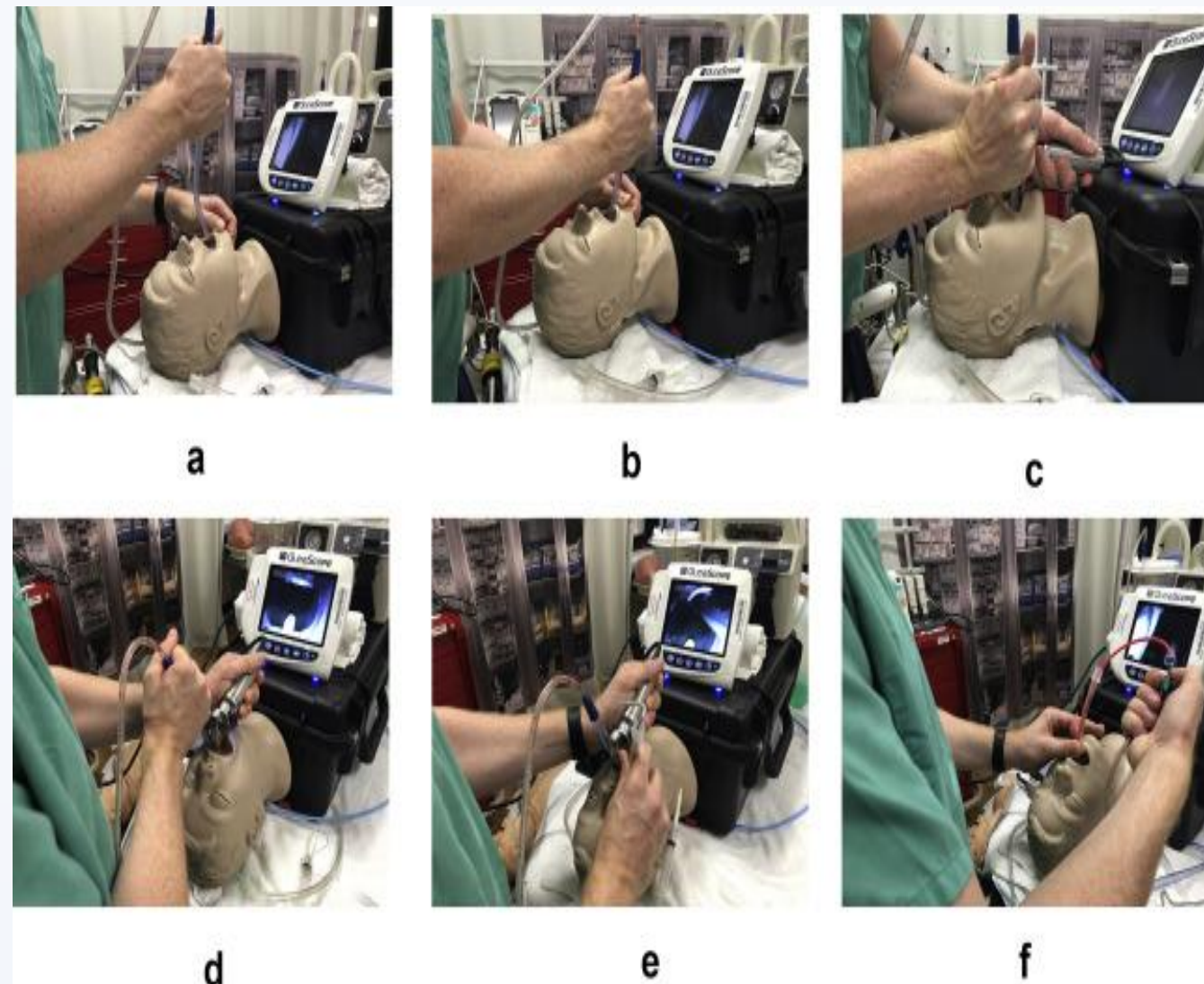


Image 1. SALAD Technique for Airway management (Root, et al. 2020)

Airway Management Techniques

SALAD (Suction Assisted Laryngoscopy and Airway Decontamination):

Utilization of a Rigid suction catheter (RSC) parked in the hypopharynx to clear the airway continually during laryngoscopy, allowing for vocal cord visualization and freeing of the anesthetist hands for ETT placement. Technique employed for high-risk patients and massively contaminated airways. SALAD technique resulted in higher success rate, suitable intubation time, and smaller volume of bronchial aspirate in one study (Root et al., 2020).

Two ETT Technique: Placement of one ETT into the esophagus with the cuff inflated to block further aspiration of gastric content into the airway, paired with continual suctioning in the hypopharynx to accommodate tracheal intubation utilizing a McGrath video laryngoscope. This technique should only be employed during active aspiration events due to the risk of esophageal perforation (Sivakumar et al., 2022).

Intraoperative Management

Majority of Aspiration events occur during induction due to laryngoscopy and usage of pharmacological agents which decrease LES tone (Nason, 2015). Rapid Sequence Induction (RSI) should be utilized for high-risk patients. For an RSI cricoid pressure is instituted before propofol administration and isn't released until confirmation that the tube is secured. Bag-mask ventilation is avoided during an RSI to prevent increased gastric pressure. Cardiopulmonary arrest may occur in severe cases of pulmonary aspiration, requiring the institution of CPR and ECMO to improve oxygenation.

Intraoperative Aspiration Management: (Nason, 2015)

- 1.Recognize aspiration of gastric or oropharyngeal material
- 2.Clinical signs: abnormal breath sounds, hypoxia, bronchospasm, high airway pressures
- 3.Suction regurgitated material from the oropharynx and endotracheal tube
- 4.Administer 100% oxygen to the patient and provide optimal ventilation parameters
- 5.Collection of material stuck in the lungs by Rigid bronchoscopy

Aspiration Syndromes

Identification of Aspiration syndromes by the anesthesia provider is critical to ensure the patient receives appropriate care in PACU. Left untreated, aspiration syndromes can progress to fever, cyanosis, persistent hypoxia, and ultimately death.

Aspiration Pneumonia is a prevalent condition developing in older populations, characterized by the breakdown of pulmonary parenchyma from bacterial oropharyngeal secretions in the lung. Prominent signs of acute pulmonary inflammatory response include tachypnea, cough, and pneumonia symptoms (Kosutova & Mikolka, 2021). Treatment for Aspiration pneumonia involves Antibiotic therapy (ex: amoxicillin, clindamycin, vancomycin), and close patient monitoring to prevent worsening infection.

Aspiration Pneumonitis is common amongst the younger population, involving acute lung injury due to macro aspiration of sterile gastric contents into the lungs. Chemical burn occurs to the trachea, bronchi, and lung mucosa due to the low acidic pH of the aspirate (Kosutova & Mikolka, 2021). Treatment for aspiration pneumonitis includes supplementary oxygen and non-invasive positive pressure ventilation, shown to alleviate symptoms in 24-48 hours (Jung, 2023). Antibiotic therapy is contraindicated for aspiration pneumonitis, unless there are signs of developing bacterial infection.

Conclusion

To conclude, protection against pulmonary aspiration occurs perioperatively. Patients presenting risk factors for aspiration (e.g. non-NPO, pregnancy, emergency procedures, diabetes) warrant enhanced protective measures before surgery including pre-medication and gastric emptying. Oftentimes, aspiration events occur undetected and unreported if gastric content isn't visible to a provider. Recognition of common signs and symptoms- including decreased oxygen saturations, apnea, reduced tidal volumes- is imperative for rapid treatment of an event, especially to minimize the severity of negative outcomes that can result post-operatively. As an anesthetist, confidence and vigilance are key when dealing with pulmonary aspiration, which can be avoided easily with proper precautions in place.

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