Perioperative Implications

Preoperative Preparation

- NPO status:
  - Adults: 6-8 h for solids depending on fat content and 2 h for clear liquids
  - Infants: 6 h for formula, 4 h for breast milk, and 2 h for clear liquids
- Pharmacologic prophylaxis in selected pts:
  - Increase gastric pH: Nonparticulate antacid, H_2 blockers, and proton pump inhibition
  - Decrease GI contents: prokinetics
  - Increase lower esophageal sphincter pressure: β-antagonists and metoclopramide
- Preinduction gastric emptying:
  - Preexisting orogastric or nasogastric tube to wall suction; might not remove particulate matter but will empty liquid contents
  - Proven not to cause/worsen gastroesophageal reflux

Monitoring

- Routine

Airway

- Protect airway with cuffed ETT or maintain protective reflexes.
- Awake intubation in difficult airway.
- LMA not protective against aspiration.

Preinduction/Induction

- Regional anesthesia can result in aspiration if seizures or hypotension decrease alertness.
- GA: Risk at induction and extubation.
- Denitrogenation with 100% O_2.
- Check optimal pt position, table height, drugs and tools available, and suction at hand.
- Rapid-sequence induction; cricoid pressure until ETT placement assured by $ETCO_2$.

Maintenance

- Care with depth of sedation during sedation/regional cases

Extubation

- Return of muscular strength/coordination/consciousness adequate to protect airway if emesis occurs.
- If emesis occurs, position pt with head-down or right-side tilt and thoroughly suction the oropharynx and trachea.

Postoperative Period

- If no symptoms in 2 h, significant aspiration extremely unlikely.
- If pneumonitis occurs, initial postop CXR may be normal, proceeding to white-out in a few to 24 h.
- PEEP redistributes lung water and improves oxygenation; higher PEEP may decrease cardiac output and ventilation.
- Maintaining low cardiac filling pressures may limit lung fluid accumulation but may worsen negative effects of PEEP.

Adjuvants

- Muscle relaxants must be dependably rapid acting.
- Regional anesthesia in high-risk pts: Avoid oversedation (loss of protective airway reflexes) hypotension (can cause nausea and vomiting).
- Drug interactions between anesthetic drugs and 1 or 2 doses of aspiration prophylaxis not significant.

Anticipated Problems/Concerns

- Must balance concern for aspiration risk against airway quality, cardiopulmonary reserve, and feasibility of regional techniques

Asthma, Acute

Puneet Sayal | T. Anthony Anderson

Risk

- Prevalence in USA: 25 million people; nearly 5% for persons age 5-34 y
- Increased prevalence and severity in African Americans, adult females, and atopic individuals

Perioperative Risks

- Risk related to degree of preop control of symptoms and optimization of medication regimen
- Morbidity due to bronchospasm and laryngospasm

Worry About

- Bronchospasm
- Hyperinflation of lungs
- Medication side effects (e.g., β-agonists causing tachycardia and hypokalemia)
- Adrenal insufficiency (chronic corticosteroid use)

Overview

- Characterized by chronic bronchial wall inflammation, reversible expiratory airflow obstruction, airway hyperreactivity, wheezing, dyspnea, and cough.
- Type I exacerbation: "slow-onset, late arrival," slow and progressive obstruction.
  - Inadequate asthma control, treatment, and/or compliance; preventable with better preoperative control (e.g., adding an inhaled corticosteroid).
  - Often overusing bronchodilators, maximally relaxed smooth muscle, inflammation undertreated, and airway edema present.
  - Additional beta-2 agonists not helpful, present with secretions and mucous plugging and eosinophilic infiltration; slower response to treatment.
  - Majority of asthma fatalities.
- Type II exacerbation: "Sudden-onset, fatal asthma," rapid and in response to an allergen.
  - Little airway inflammation, predominantly neutrophilic infiltration.
  - Reaction is typically in response to a specific allergen.
  - Rapidly respond to bronchodilators.
  - Respiratory arrest, acidemia, and altered mental status more likely than with type I.
  - More likely to improve with appropriate treatment

Etiology

- Pathophysiology is a combination of the release of inflammatory mediators by IgE antibody activation and the abnormal autonomic nervous system regulation of airway function.

Usual Treatment

- Manual bag-mask ventilation, bronchodilators, anti-inflammatories, deepen anesthesia, and alter ventilation settings (I:E ratio).

Assessment Points

System	Effect	Assessment by Hx	PE	Test
CV	Tachyarrhythmias, possible pulm Htn	Palpitations, HR	Tachycardia, irregular rhythm, loud P_2	ECG, ECHO
RESP	Airflow obstruction, decreased lung elastance, hyperinflation, hypoxemia, hypercapnia, variations in peak flow	Dyspnea, cough, wheeze, chest tightness, nighttime awakenings, symptoms induced by exercise, allergens	Prolonged I:E, decreased breath sounds, wheezing, pulsus paradoxus	PFT, CXR, ABG
ENDO	Steroid-induced hyperglycemia; adrenal insufficiency (prior <1 y steroid users)	Polyuria, polydipsia, weakness	Hypotension in adrenal insufficiency	Glucose, lytes, cortisol, ACTH, stimulation test
MS	Steroid myopathy; steroid-paralytic myopathy	Difficulty climbing stairs or rising from chair; difficulty weaning mechanical ventilation	Proximal muscle weakness in steroid myopathy; possible quadriplegia in steroid-paralytic myopathy	Measurement of inspiratory muscle force, CPK, EMG, muscle biopsy

Key References: Applegate R, Lauer R, Lenart J, et al: The perioperative management of asthma, *J Aller Ther* S11:007, 2013; Bateman ED, Hurd SS, Barnes PJ, et al: Global strategy for asthma management and prevention: GINA executive summary, *Eur Respir J* 31(1):143–178, 2008.

Perioperative Implications

Preoperative Preparation

- History: Inquire about Hx and degree of control of asthma symptoms, any recent flare requiring corticosteroids, increased use of β_2-agonist medication (or continued use through the periop period), emergency room or hospital visit for asthma, allergies, recent URI, history of periop bronchospasm/pulm complication, and tobacco use or environmental exposure
  - Consider rescheduling elective procedures for 2-3 wk after resolution of URI
  - Consider course of oral corticosteroids in poorly controlled asthmatic pts before operation
- Physical examination:
  - Lung auscultation may reveal wheezing
  - Visual inspection may demonstrate accessory muscle use
  - Assess vital signs (hypercapnia, hypoxemia, hypotension, and tachyarrhythmias)
- Testing: Usually unnecessary; consider arterial blood gas, spirometric evaluation, or eosinophilic cationic protein in patients with severe asthma; measure and compare the peak expiratory flow rate to prior data points during an exacerbation

Perioperative Management
- Ensure adequate premedication and consider benzodiazepines.
- Airway instrumentation: Important trigger for bronchospasm; avoid unnecessary airway instrumentation (e.g., consider supralaryngeal airway and deep extubation).
- Consider IV medication (e.g., IV lidocaine) to depress airway reflexes.
- Avoid histamine-releasing medications (e.g., atracurium, mivacurium, morphine), and when possible consider avoiding muscle relaxant reversal agents that cause increased airway hyperreactivity (e.g., neostigmine, physostigmine).

Intraoperative Signs/Symptoms of Airway Hyperreactivity
- Wheezing: Auscultation of lungs can provide qualitative information regarding amount of airflow.
- Air trapping/Auto-PEEP: Secondary to decreased expiratory airflow → dynamic hyperinflation, reduced dynamic compliance of lungs → hypotension by decreased venous return, pneumothorax, subcutaneous emphysema, and cardiac arrest secondary to right ventricular failure; consider a 30- to 60-sec apnea trial.
- Hyperinflation: Signified by increased plateau pressure (goal: P_{plat} <30 cm H_2O), can be reduced by decreasing minute ventilation and shortening inspiratory time/lengthening expiratory time.
- Hypercapnia: Secondary to increased dead-space ventilation, made worse by hyperventilation.
  - Acute rise in Pco_2: Increases cerebral blood flow, increases intracranial pressure, decreases intracellular pH, and decreases cardiac contractility.

Differential Diagnosis
- Ventilator malfunction
- Endotracheal tube obstruction
- Endobronchial intubation
- Pneumothorax
- Pulmonary embolus

Treatment
- Switch to manual bag ventilation; allows direct qualitative assessment of pulmonary compliance and release of trapped gas.
- Remove trigger.
- Bronchodilators (e.g., β_2-agonist), consider combining with anticholinergic (e.g., ipratropium).
- Anti-inflammatories (e.g., corticosteroids, cromolyn, leukotriene inhibitors).
- Deepen anesthetic to depress airway reflexes, reduce bronchospasm, and resultant bronchodilation: inhalational anesthetic, intravenous anesthetic (e.g., propofol, ketamine), and neuromuscular blocker (e.g., rocuronium).
- Consider epinephrine, magnesium sulfate, heliox, bronchoscopy to remove mucus plug, noninvasive positive pressure ventilation to decreased work of breathing (if not intubated), and extracorporeal life support.

Postoperative Period
- Pain may trigger bronchospasm/laryngospasm: Prevent pain and treat promptly; consider regional anesthesia when possible.
  - Neuraxial blockade improves postop lung function due to improved pain therapy and diaphragmatic function.
- Close observation for postop bronchospasm/laryngospasm.

Atherosclerotic Disease

Marc B. Royo

Risk
- Over 100 million USA adults age 20 y or older have a total cholesterol >200 mg/dL.
- Cardiovascular disease accounts for approximately 1 of every 3 deaths in USA (31.3%).

Perioperative Risks
- Cardiovascular disease increases risk of periop major adverse cardiac events (cardiac death, nonfatal myocardial infarction, and nonfatal cardiac arrest).
- Approximately 3% of pts undergoing noncardiac surgery will experience a periop cardiac complication.

Worry About
- Increased risk of end-organ hypoperfusion (e.g., myocardial, cerebral, renal)
- Increased risk of embolic events from unstable plaque rupture
- Association with aneurysm formation and increased risk of dissection
- Coexisting diseases and behaviors such as Htn, DM, and tobacco smoking
- Possible link with increased risk of postop delirium

Overview
- Lipid deposition and eventual calcification of coronary, cerebral, and peripheral arteries
- Integral in the pathogenesis of coronary artery disease, carotid artery disease, peripheral arterial disease, and some forms of chronic kidney disease

Etiology
- Multifactorial
- Risk factors: dyslipidemia, Htn, DM, endothelial dysfunction, smoking, and male sex

Usual Treatment
- Primary prevention include modification of risk factors (diet, physical activity, and smoking)
- Pharmacologic options for prevention includes antithrombotics (e.g., aspirin) and lipid-lowering agents
- Coronary artery disease: Antianginal treatment (nitrates, β-blockers, and calcium channel blockers), angioplasty, stenting, and CABG surgery
- Carotid artery disease: carotid endarterectomy or stenting
- Cerebrovascular insufficiency: extracranial-intracranial bypass is sometimes performed
- Peripheral vascular insufficiency: angioplasty, stenting, or revascularization

Assessment Points

System	Effect	Assessment by Hx	PE	Test
CV	Htn, ventricular dysfunction (systolic and/or diastolic), coronary artery stenosis, myocardial ischemia	Angina, exercise intolerance, dyspnea, usually asymptomatic	Split S_2, S_3 and/or S_4; murmur; cardiomegaly	Vital signs, ECG, treadmill exercise testing, pharmacologic stress test, coronary angiography, and ECHO; may consider perioperative troponin screening in high-risk individuals
RESP	COPD (many are smokers)	Smoking history, dyspnea on exertion, sputum production	Decreased breath sounds, prolonged expiration, wheezing, signs of right heart failure	ABG, PFTs, CXR
CNS	Cerebrovascular insufficiency/infarction	History of syncope, TIA, CVA	Carotid bruit; focal neurologic deficits	Carotid US ultrasound or angiogram
PERIPH ARTERIES	Limb blood flow supply/demand imbalance, aneurysm formation	Claudication; may be asymptomatic; rest pain	Decreased pulses, pulsatile abdominal mass, nonhealing peripheral wounds	Ankle-brachial systolic pressure index, angiogram, and MRI
GI	Intestinal ischemia	Abdominal pain; occult blood in stool/gastric contents	Abdominal exam may be paradoxically normal	CBC, amylase, and mesenteric angiography

Key References: Hansson GK, Libby P, Tabas I: Inflammation and plaque vulnerability, *J Intern Med* 278(5):483–493, 2015; Halub ME, Sidwell RA: Cardiac risk stratification and protection, *Surg Clin North Am* 95(2):217–235, 2015.

Perioperative Implications

Preoperative Preparation
- Consider risk stratification tool (RCRI) and AHA/ACC clinical practice guideline to direct preop evaluation.
- Optimize cardiac symptomatology.
- Continue antianginal Rx (nitrates, β-blockers, calcium channel blockers, aspirin, and statins).
- Attention to and stabilization of coexistent diseases (HTN, DM, and COPD).

Monitoring
- Cardiovascular
  - ECG with appropriate lead placement; ST trending.
  - Consider intra-arterial catheter.
  - Consider CVP catheterization to monitor volume status.
  - Consider TEE in high-risk pts (cardiac surgery, recent MI, CHF, and unstable angina).