

Extubation/Postoperative Period

- Pt may be extubated after uncomplicated surgery and when cardiopulmonary function is adequate.
- Consider regional anesthesia (intercostal or epidural) for management of postop pain to decrease splinting and opioid use.

Anticipated Problems/Concern

- Pts with altered cardiopulmonary reserve before surgery may require postop intubation and ventilation.
- If pneumonectomy performed, there will be overinflation of the remaining lung, with a decrease in vital

capacity. These children may have significant exercise intolerance for a prolonged period after surgery.

- Important that pt avoid postop atelectasis, coughing, and early ambulation or increase in activity.
- Altered pulm mechanics (decreased forced vital capacity and delayed forced expiration) may be present throughout childhood.

Congestive Heart Failure

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Risk

- Heart failure is a syndrome, not a disease.
- Incidence in USA: About 5.1 million, with more than 650,000 new cases diagnosed annually. Primary discharge diagnosis made in more than 1 million pts.
- 1-y and 5-y survival rates are 57% and 25% in men and 64% and 38% in women. Median survival after onset is 1.7 y in men and 3.2 y in women.

Perioperative Risks

- Heart failure occurs in 1–6% of pts after major surgery, and between 6% and 25%, in pts with existing cardiac conditions.
- EF <35% associated with increased operative risk.
- Single greatest risk factor for cardiac surgery. Use congestive heart failure score (CASS): Hx of CHF = 1; Rx digitalis = 1; Rales = 1; overt symptoms after treatment = 1; total 0–4. If score = 4, operative risk is 8× greater.

Worry About

- Ventricular dysfunction preop, which is associated with increased operative mortality.
- Pt with diastolic dysfunction may be asymptomatic at rest but sensitive to increases in heart rate, which may result in flash pulm edema.
- Dysrhythmias due to cardiac ischemia (sudden cardiac death).
- Associated acute or chronic mitral insufficiency.
- Volume status.
- Prolonged effect of ACE inhibitors.

Overview

- Different types of failure (left vs. right; acute vs. chronic; systolic vs. diastolic; low output vs. high output)
- Reduced contractility, decreased stroke volume, increased heart rate, and hypertrophy and ventricular dilatation
- Acute ischemia, which can lead to global diastolic dysfunction and CHF
- Papillary muscle ischemia, which may lead to severe mitral regurgitation and pulm congestion
- New York Heart Association classification: I, no limitation; II, slight limitation; III, marked limitation; IV, inability to carry out any physical activity; overall 1-year mortality for classes III and IV: 34–58%

Etiology

- Acquired, acute or chronic: CHD and MI; cardiomyopathy (idiopathic, hypertrophic, hypertrophic obstructive, congestive, and alcoholic). Valvular heart disease: Arrhythmias and severe hypertension.
- Congenital: Congenital heart disease, left-to-right shunts; intracardiac (ASD, VSD, and AV canal), and extracardiac (PDA and anomalous pulm venous connection). Obstructive (coarctation of the aorta and aortic stenosis). Complex (Ebstein anomaly).
- Multiple precipitating causes: Noncompliance with medications (digitalis and diuretics), excessive Na⁺; excessive IV fluids; drugs (doxorubicin, corticosteroids, disopyramide, nortriptyline, NSAIDs, thiazolidinediones, metformin, cilostazol, PDE-5

inhibitors [sildenafil, vardenafil] androgens, and estrogens). Pulm embolism: High-output states (pregnancy, fever, hyperthyroidism, sepsis, AV fistula, and anemia).

Usual Treatment

- Chronic.
- Physical activity encouraged.
- Restriction of sodium intake.
- Chronic, well-titrated beta-blockade may lead to substantial clinical benefit (carvedilol and metoprolol).
- Inhibit RAAS (ACE inhibitors, angiotensin receptor blockers, and aldosterone inhibitors).
- Improvement in systolic heart failure (digitalis).
- Diuretics (hydrochlorothiazide, furosemide, and spironolactone).
- Vasodilators.
- Acute.
- Optimize preload and afterload before starting inotropes and vasodilators.
- Inotropes (dobutamine, epinephrine, milrinone, and amrinone).
- Vasodilators (nitroglycerin, nitroprusside, and nesiritide).
- Maintenance of beta-blocker therapy in acute exacerbation of systolic heart failure.
- Special measures
- Stimulation therapy (biventricular pacing + ICD)
- Surgical correction (CABG, CHD, valvular surgery, cardiomyoplasty, and cardiac transplantation)
- Assist devices (IABP, LV assist, and artificial heart)

Assessment Points

System	Effect	Assessment by Hx	Physical Examination	Test
CV	Inadequate cardiac output, congestion	Tachycardia, arrhythmias	Peripheral edema Facial edema (infants/young children), cardiomegaly, pulsus alternans, distended neck veins, Kussmaul sign, abdominojugular reflex	Exercise testing ECG, CXR Circulation time
RESP	Pulm congestion; decreased lung compliance, VC, TLC, pulm diffusion capacity	Breathlessness (exertional dyspnea, orthopnea, paroxysmal nocturnal dyspnea) Frequent resp infections	Rales and wheezes Pleural effusions Expectoration: Frothy blood-tinged sputum	PFT ABG CXR
GI	Hepatic and intestinal congestion	Nausea, bloating, fullness	Congestive hepatomegaly, ascites, icterus, cachexia	Liver enzymes
RENAL	Decreased GFR, activation RAAS	Nocturia, oliguria	Ankle edema	BUN/Cr, K ⁺ , Na ⁺ , proteinuria, specific gravity
CNS	Hypoperfusion	Confusion and impairment of memory	Mental status exam	
PNS	Increased sympathetic tone	Cool extremities	Peripheral vasoconstriction, pallor, diaphoresis, tachycardia, clubbing	

Key Reference: Hammill BG, Curtis LH, Bennett-Guerrero E, et al.: Impact of heart failure on patients undergoing major noncardiac surgery, *Anesthesiology* 108(4):559–567, 2008.

Perioperative Implications**Preoperative Preparation**

- Stabilize pt by treating CHF before surgery.
- Continue inotropic support.
- Continue cardiac medications (ACE inhibitors may cause hypotension on induction).

Monitoring

- Consider arterial line.
- Consider CVP, PA cath, or TEE.
- CVP may be inaccurate in assessing volume.

Airway

- Frothy secretions may lead to difficult visualization.

Induction

- Preop therapeutic regimen (diuretics) causes hypovolemia, hypokalemia, and hyponatremia, which are potential problems before surgery.
- Replace volume judiciously (avoid dehydration and overhydration).

- Avoid myocardial contractility depressants (e.g., barbiturates).

Maintenance

- Maintain myocardial contractility, reduce afterload, and normalize PVR.

Extubation

- May be delayed owing to CV and pulm insufficiencies

Adjuvants

- Rx inotropes; digitalis and diuretics

- May be less responsive to catecholamines
- Regional anesthesia: Debated and not recommended by some (sympathectomy and volume status) or preferred (reduce preload) by others

Postoperative Period

- Inotropic support and mechanical assistance may be needed.
- Pulm edema develops in 2–16% of pts.

Anticipated Problems/Concerns

- Pulm edema may necessitate prolonged ventilation with high FIO₂.
- RV and/or LV failure in the postop period.

Constipation

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Risk

- Median prevalence of constipation in adults is 16% (studies range 0.7–79%); in adults aged ≥60 y, it is 33.5%.
- Prevalence may be higher in nonwhite and institutionalized populations.
- Male:female ratio: 1:1.5.

Perioperative Risks

- Increased risk of gastroparesis and N/V
- Increased intra-abdominal pressure
- Altered resp mechanics and delayed weaning from mechanical ventilation
- Poor nutritional status impairing wound healing

Worry About

- Risk of pulm aspiration on induction
- Increased peak and mean airway pressures, which may predispose to barotrauma
- Decreased chest wall compliance and tidal volumes, which promote atelectasis and increase shunt fraction and alveolar dead space (may cause hypoxemia and hypercarbia)

- Severe abdominal distension, which may decrease cardiac output (decreased venous return and ventricular compliance/contractility)
- Delayed enteral feeding

Overview

- A syndrome defined by difficult or infrequent passage of stool, hardness of stool, or a feeling of incomplete evacuation that occurs in isolation or secondary to another underlying disorder
- Classified into three groups: Normal transit constipation, slow transit constipation, and pelvic floor dysfunction/defecatory disorders
- Diagnosis made on clinical history (symptoms, comorbidities, and medications) and assessment of colonic transit and anorectal function

Etiology

- Slow colonic transit may reflect colonic motor dysfunction or inadequate caloric intake.
- Pelvic floor dysfunction/defecatory disorders may result from inadequate propulsive forces or increased resistance to evacuation.
- Secondary causes include endocrine or metabolic disorders (e.g., diabetes mellitus), neuro disorders

(e.g., Parkinson disease), and medications (e.g., opioids, anticholinergics, antidepressants, calcium channel blockers).

- Nearly 50% of patients on long-term opioids experience constipation.

Usual Treatment

- There is no evidence that constipation can be treated by increased fluid intake unless there is evidence of dehydration.
- Increased physical activity is associated with less constipation.
- First-line therapy includes soluble dietary fiber and bulk-forming laxatives.
- Second-line therapy includes osmotic laxatives, stimulant laxatives, enemas, intestinal secretagogues, serotonin 5-HT₄ receptor agonists, and bile acid transporter inhibitors.
- Opioid-induced constipation may be treated with peripherally acting mu-opioid receptor antagonists.
- Surgical intervention is indicated only after nonsurgical measures have failed and symptoms compromise activities of daily living.

Assessment Points

System	Effect	Assessment by Hx	PE	Test
CV	Decreased cardiac output (decreased ventricular compliance/contractility and venous return)	Severe cephalad movement of diaphragm	Abdominal distension, narrow pulse pressure	CXR, ECHO
RESP	Elevated diaphragm, atelectasis, hypoxemia, hypercarbia	Dyspnea, tachypnea, orthopnea If mechanically ventilated, increased peak and mean airway pressure	Rales, pleural effusions	ABG, CXR
GI	Decreased intestinal/gastric motility	Abdominal pain, N/V	Abdominal distension	Abdominal imaging

Key References: Bharucha AE, Pemberton JH, Locke GR 3rd: American Gastroenterological Association technical review on constipation, *Gastroenterology* 144(1):218–238, 2013; Webster LR: Opioid-induced constipation, *Pain Med* 16:S16–S21, 2015.

Perioperative Implications

Preoperative Preparation

- Assess volume status.
- Check lytes if receiving laxative therapies.
- Consider preop NG tube placement.

Monitoring

- Standard monitors

Airway

- Attention to airway pressures

Induction

- Consider rapid-sequence induction.

Maintenance

- Avoid nitrous oxide in pt with intestinal obstruction.
- Consider multimodal analgesic techniques and regional anesthesia to minimize use of opioids.

Extubation

- Consider preop resp status. Extubation to noninvasive positive pressure ventilation may be useful.

Anticipated Problems/Concerns

- Potential for prolonged wean from mechanical ventilation in the critically ill
- Risk of infection from bacterial overgrowth and gut translocation
- Delayed enteral feeding because of constipation