Perioperative Medicine in the Hospital Setting

Definition and Epidemiology

Perioperative medicine encompasses the medical care of patients before, during, and after surgery to optimize outcomes and minimize complications. It involves risk assessment, optimization of comorbidities, and management of postoperative issues.

- Prevalence Over 300 million surgeries are performed globally annually; ~20% of patients experience major complications (e.g., MI, AKI). High-risk surgeries (e.g., cardiac, vascular) have 10-15% complication rates.
- Risk Factors Age >65, CAD, DM, COPD, frailty, emergency surgery.
- Rare Demographics Pediatric congenital surgery, transplant recipients, patients with rare genetic disorders (e.g., malignant hyperthermia).

Pathophysiology

- Mechanisms Surgery induces a stress response, activating the hypothalamic-pituitary-adrenal axis and sympathetic nervous system, leading to catecholamine and cortisol release. This increases myocardial oxygen demand, promotes hypercoagulability, and impairs immune function.
- Effects Elevated cytokines (IL-6, TNF-α) cause systemic inflammation, risking organ dysfunction (e.g., cardiac ischemia, pulmonary edema). Hypoperfusion from anesthesia or blood loss exacerbates AKI or delirium.
- Molecular Pathways Surgical trauma upregulates NF-κB, driving inflammation. Hyperglycemia from stress hormones impairs wound healing. Platelet activation (TXA2, P2Y12) increases thrombotic risk.
- Key Pathway Surgical stress → Neuroendocrine activation (catecholamines, cortisol) → Inflammation and hypercoagulability → Organ dysfunction or thrombosis.

Causes

Category	Common Risk Factors	Rare Risk Factors	Notes
Cardiac	CAD, CHF, arrhythmias	Takotsubo cardiomyopathy, HOCM	RCRI score predicts cardiac risk
Pulmonary	COPD, asthma, OSA	Pulmonary hypertension, ILD	Smoking cessation critical

Category	Common Risk Factors	Rare Risk Factors	Notes
Renal	CKD, DM nephropathy	Hepatorenal syndrome	AKI risk doubles with Cr >1.5 mg/dL
Hematologic	Anemia, DVT history	Factor V Leiden, TTP	VTE prophylaxis mandatory
Neurological	Stroke, delirium history	Myasthenia gravis, Parkinson's	Delirium risk high in elderly
Metabolic	DM, obesity	Malignant hyperthermia, porphyria	DM: HbA1c >8% increases infections

Clinical Presentation

Symptoms

- Pre-op Asymptomatic or known comorbidities (e.g., dyspnea, chest pain)
- Intra-op Hypotension, arrhythmias, hypoxia
- Post-op Fever, confusion (delirium), wound pain
- Rare Malignant hyperthermia (tachycardia, hyperthermia), serotonin syndrome (post-op meds)
- Exam
- Pre-op Murmurs (AS, MR), crackles (CHF), frailty (gait speed)
- Intra-op Low SpO2, irregular pulse, bleeding
- Post-op Wound erythema, reduced urine output, altered mental status
- Rare Rigidity (malignant hyperthermia), clonus (serotonin syndrome)

Red Flags

Syncope (pre-op), lactate >2 mmol/L (intra-op), delirium or AKI (post-op)

Labs and Studies

Labs

- CBC Anemia (Hgb <10 g/dL), leukocytosis (infection)
- CMP Cr >1.5 mg/dL (AKI risk), glucose >180 mg/dL (DM), K+ (arrhythmia)
- Coagulation INR, aPTT for bleeding risk; D-dimer (VTE)
- Advanced BNP (>300 pg/mL, CHF), HbA1c (>8%, infection risk), TEG (coagulopathy)

Imaging

- EKG Pre-op baseline; ischemia, QT prolongation

- CXR Pulmonary edema, pneumonia
- Echocardiogram EF <40%, valvular disease (e.g., severe AS)
- Advanced Cardiopulmonary exercise testing (CPET, VO2 max <15 mL/kg/min), coronary CTA

Other

- PFTs FEV1 <1 L (pulmonary risk)
- Stress Testing Pharmacologic (dobutamine) for CAD if RCRI ≥2
- Advanced Frailty index (handgrip, gait), metabolomics (stress response profiling)

Diagnosis

- Criteria Perioperative risk stratification using validated tools (e.g., RCRI, NSQIP) to predict cardiac, pulmonary, or other complications, followed by targeted optimization and monitoring.
- Differential MI, PE, sepsis, delirium, VTE, malignant hyperthermia, anesthetic complications.

Flowsheet

- Step 1 History/Exam Comorbidities (CAD, DM), functional status, surgical urgency
- Step 2 Risk Scores RCRI (cardiac), NSQIP (overall), STOP-BANG (OSA)
- Step 3 Labs EKG, CBC, CMP, BNP; tailor to comorbidities
- Step 4 Studies Echo (if CHF), PFTs (COPD), stress test (RCRI ≥2)
- Step 5 Optimization Beta-blockers, statins, smoking cessation, DM control

Treatment

General Principles Optimize comorbidities pre-op, maintain hemodynamic stability intra-op, and prevent complications post-op.

Supportive Care

- Pre-op Smoking cessation (4-8 weeks), pulmonary rehab (COPD)
- Intra-op Balanced anesthesia, normothermia, glucose control (140-180 mg/dL)
- Post-op Pain control (acetaminophen, avoid NSAIDs in CKD), early ambulation

Specific Therapies

- Cardiac Beta-blockers (metoprolol 25 mg PO BID, titrate HR <70), statins (atorvastatin 40-80 mg/day)

- VTE Prophylaxis Enoxaparin 40 mg SC daily, mechanical (SCDs) for high bleeding risk
- Pulmonary Bronchodilators (albuterol), incentive spirometry
- Advanced High-dose insulin (DM with HbA1c >8%), erythropoietin (anemia, Hgb <8)
- Rare Conditions Malignant hyperthermia (dantrolene 2.5 mg/kg IV), porphyria (avoid barbiturates)

Post-op Complications

- Delirium Haloperidol 0.5-1 mg IV q6h, non-pharmacologic (reorientation)
- VTE Apixaban 5 mg BID, treat for 3 months
- Infection Vancomycin 15 mg/kg IV q12h (MRSA), cefazolin 2 g IV q8h (SSI)

Monitoring

- Pre-op Weekly HbA1c, lipid panel for optimization
- Intra-op Arterial line, BIS monitor (anesthesia depth)
- Post-op Daily CMP, wound checks, delirium screening (CAM)
- Complications

Acute

- MI 1-5% in high-risk surgeries; troponin elevation, EKG changes
- VTE DVT/PE in 2-5% without prophylaxis
- AKI Cr rise >0.3 mg/dL in 10% of major surgeries

Long-Term

- Chronic Pain Post-thoracotomy syndrome, nerve injury
- Wound Complications Seroma, dehiscence (1-3%)
- Rare Malignant hyperthermia (1:100,000), post-op serotonin syndrome, TTP (anesthetic trigger)

Clinical Scenarios

Case 1 High-Risk Cardiac Patient

- Presentation 70 y/o M with CAD, CHF (EF 35%) scheduled for CABG. Vitals BP 140/90, HR 80, SpO2 96%. Exam S3 gallop, mild crackles.
- Labs/Studies BNP 400 pg/mL, EKG LVH, echo Severe AS. RCRI 3.
- Interpretation High cardiac risk, needs optimization.

- Management Metoprolol 25 mg PO BID, atorvastatin 80 mg/day, lisinopril 10 mg/day. Pre-op stress test negative. Intra-op arterial line, TEE. Post-op telemetry, VTE prophylaxis. Discharge day 7, stable.

Case 2 Frail Elderly Patient

- Presentation 80 y/o F with frailty, DM (HbA1c 8.5%) for hip replacement. Vitals BP 130/80, HR 75, SpO2 94%. Exam Slow gait, grip strength <20 kg.
- Labs/Studies Hgb 9.5 g/dL, Cr 1.6 mg/dL, NSQIP risk 15% complications. PFTs Normal.
- Interpretation Frail, high complication risk.
- Management Pre-op nutrition (protein 1.5 g/kg/day), enoxaparin 40 mg SC daily. Intra-op normothermia, glucose control. Post-op early PT, delirium screening. Discharge day 5 with home PT.

Case 3 Malignant Hyperthermia (Rare)

- Presentation 25 y/o M for appendectomy develops intra-op hyperthermia (39.5°C), tachycardia. Vitals BP 160/100, HR 140, SpO2 90%. Exam Muscle rigidity.
- Labs/Studies Lactate 6 mmol/L, CK 2000 U/L, ABG pH 7.2. Genetic test RYR1 mutation.
- Interpretation Malignant hyperthermia, anesthetic-triggered.
- Management Stop volatile anesthetics, dantrolene 2.5 mg/kg IV q6h, cooling. ICU transfer. Recovery by day 3, genetic counseling.

Expert Tips

- Use RCRI for cardiac risk; NSQIP for overall complications; tailor workup to scores
- Continue beta-blockers peri-op in CAD; start 7 days pre-op if high risk, titrate slowly
- Screen for OSA with STOP-BANG; untreated OSA doubles pulmonary complications
- Optimize DM pre-op (HbA1c <7.5%); use insulin infusion intra-op if >180 mg/dL
- Suspect malignant hyperthermia in hyperthermia + rigidity; dantrolene is life-saving
- Pitfall Overusing fluids intra-op; use goal-directed therapy (stroke volume variation)
- Advanced CPET (VO2 max <15 mL/kg/min) predicts poor outcomes; frailty scores guide shared decision-making

Key Pearls

- RCRI ≥2 warrants cardiac workup; NSQIP predicts overall surgical risk
- Beta-blockers and statins reduce cardiac events; continue peri-op
- VTE prophylaxis (LMWH, SCDs) is mandatory for moderate/high-risk surgeries
- Delirium screening post-op prevents prolonged hospital stays
- Rare complications like malignant hyperthermia require rapid recognition

References

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