

Perioperative and Intraoperative Management of Patients with Ischemic Heart Disease Undergoing Noncardiac Surgery: A Comprehensive Evidence-Based Review

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ABSTRACT:

Patients with ischemic heart disease (IHD) undergoing noncardiac surgery face a heightened risk of major adverse cardiac events (MACE), including myocardial infarction (MI), arrhythmias, and cardiac death. This review synthesizes the latest guidelines from the European Society of Cardiology (ESC 2022), American Heart Association/American College of Cardiology (AHA/ACC 2024), European Society of Anaesthesiology and Intensive Care (ESAIC), and American Society of Anesthesiologists (ASA), along with updated evidence from UpToDate and PubMed. Key focus areas include preoperative risk stratification, intraoperative anesthetic management (medication selection, hemodynamic optimization, ventilation strategies), and postoperative monitoring. Emphasis is placed on inhaled vs. intravenous anesthesia, induction techniques, and hypotension management to minimize perioperative cardiac complications.

Keywords: Ischemic heart disease, noncardiac surgery, perioperative management, anesthesia, hemodynamics, guidelines

1. INTRODUCTION:

Approximately 10–15% of patients undergoing noncardiac surgery have underlying IHD, with perioperative MACE rates ranging from 3–15% depending on surgical risk.¹ The 2024 AHA/ACC guidelines provide significant updates on intraoperative management, reinforcing the need for strict hemodynamic control and individualized anesthetic plans.² This review integrates ESC (2022), AHA/ACC (2024), ESAIC, and ASA guidelines to offer a structured approach to perioperative care in this high-risk population.

2. Preoperative Risk Assessment:

2.1 Risk Stratification Tools:

- **Revised Cardiac Risk Index (RCRI):**
 - Predictors: History of heart failure (HF), coronary artery disease (CAD), cerebrovascular disease (CVA), diabetes mellitus (DM),

creatinine >2 mg/dL, high-risk surgery (e.g., vascular, intraperitoneal, intrathoracic).

- High-risk threshold: ≥ 3 predictors associated with ~11% risk of MACE.
- **NSQIP Surgical Risk Calculator:**
 - Incorporates 20+ variables (e.g., functional status, ASA class, surgery type).
 - Outputs individualized risk estimates for MACE (e.g., MI, cardiac arrest).

Guideline Recommendations:

- ESC 2022 (Class I): Use RCRI or NSQIP for all patients.
- AHA/ACC 2024: NSQIP preferred for its granularity, especially in elderly/comorbid patients.

2.2 Functional Capacity Assessment:
METs (Metabolic Equivalents):

- <4 METs (e.g., unable to climb 2 flights of stairs) = high risk.
- 4–10 METs = moderate risk.
- >10 METs = low risk.

Testing Indications:

- **Stress Testing (ESC/AHA Class IIa):**
 - **Indicated if:**
 - Poor functional capacity (<4 METs) AND high-risk surgery.
 - Unrevascularized CAD with unstable symptoms.
 - **Modalities:**
 - Exercise ECG: For patients able to exercise.
 - Pharmacologic Stress (Dobutamine Echo/MPI): For sedentary patients.

- Coronary CTA (AHA 2024 Update): Alternative for intermediate-risk patients.

2.3 Medication Optimization:

- **Beta-blockers:** Continue in chronic users (AHA/ACC Class I); May initiate ≥30 days preoperatively in selected high-risk patients.
- **Statins:** Continue perioperatively (AHA/ACC Class I).²
- **Antiplatelets:**
 - Aspirin: Usually continued perioperatively unless the bleeding risk is high. (ESC Class IIa).³
 - P2Y12 inhibitors:
 - Clopidogrel: Hold 5 days preoperatively
 - Prasugrel: Hold 7 days preoperatively
 - Ticagrelor: Hold 3-5 days preoperatively

2.4 Timing for non-cardiac surgery (AHA/ACC 2024):

2.4.1 Timing after acute coronary syndrome:

Time Since ACS	Recommended Approach	Rationale
<30 days	Avoid elective surgery (Class III: Harm)	Highest risk of reinfarction, stent thrombosis, or recurrent ischemia. Only emergency (life- or limb-saving) surgery should proceed.
30-60 days	Defer elective surgery (Class IIa)	Plaque stabilization and healing are ongoing. If surgery is urgent, perform individualized risk assessment (cardiology consult).
≥60 days	Consider surgery if stable (Class IIa)	Lower risk if no recurrent ischemia, LV function is preserved, and revascularization was complete.
≥6 months	Optimal for elective surgery (Class I)	Lowest risk if no residual ischemia and medical therapy is optimized.

2.4.2 Timing after coronary stenting:

Time Since Stent	Bare-Metal Stent (BMS)	Drug-Eluting Stent (DES)
0-30 Days	Avoid Elective Surgery (Emergency Only)	Avoid Elective Surgery (Emergency Only)
1-3 Months	Avoid Elective Surgery (High Risk)	Avoid Elective Surgery (Highest Risk)
Optimal Timing	≥ 3 Months + DAPT Complete	≥ 6 Months + DAPT Complete (Preferred) ≥ 3 Months (Consider if 2nd Gen DES & DAPT ≥3 mo & high surgical delay risk)

3. Intraoperative Management:

3.1 Anesthetic Medication Selection:

Induction Agents:

- **Propofol** (0.5–1.5 mg/kg): Preferred in stable patients, but slow titration is crucial to avoid hypotension (ASA 2022).⁴
- **Etomidate** (0.2–0.3 mg/kg): Recommended for hemodynamically unstable patients (AHA/ACC 2024 Class IIa).²
- **Ketamine** (1–2 mg/kg): Useful in hypotension-prone patients, but avoid in uncontrolled hypertension (ESAIC 2021).⁵

Maintenance of Anesthesia:

- **Inhaled Anesthetics (Sevoflurane/Isoflurane):**
 - Provide cardioprotection via ischemic preconditioning (ESC 2022 Class IIa).³
 - Sevoflurane preferred over desflurane (sympathetic activation risk) (AHA/ACC 2024).²
- **Total Intravenous Anesthesia (TIVA):**
 - Propofol + remifentanyl for fast-track extubation, but lacks cardioprotective effects.
 - Preferred in severe heart failure (ESAIC 2021).⁵

3.2 Hemodynamic Management:

Blood Pressure Control:

- Target MAP within 10–20% of baseline (AHA/ACC 2024 Class I).²
- Avoid SBP <90 mmHg or >20% drop from baseline (ESC 2022).³

Management of Hypotension:

- First-line: Norepinephrine (α/β effects) or phenylephrine (pure α -agonist).
- Second-line: Vasopressin in refractory shock (AHA/ACC 2024).²
- Fluid Restriction: Avoid excessive crystalloids in HFrEF patients (ESAIC 2021).⁵

Heart Rate Control:

- Target HR: 60–80 bpm (ESC 2022, AHA/ACC 2024).^{2,3}
- Esmolol (ultra-short-acting β -blocker) for tachycardia.
- Avoid anticholinergics (e.g., glycopyrrolate) due to HR fluctuations.

3.3 Ventilation Strategies:

- Avoid hyperoxia ($\text{PaO}_2 >150$ mmHg) to prevent coronary vasoconstriction (AHA/ACC 2024).²
- Low tidal volume (6–8 mL/kg) + PEEP 5–8 cmH₂O (ESAIC 2021).⁵

3.4 Advanced Monitoring:

- Arterial line for high-risk surgeries (AHA/ACC 2024 Class I).²
- TEE in major vascular/thoracic cases (Class I).
- Pulse contour analysis (e.g., FloTrac) for dynamic fluid responsiveness (Class IIa).

4. Postoperative Management:

- High-sensitivity troponin monitoring at 0, 6, 12, 24h (AHA/ACC 2024 Class I)², 5x ULN = Type 2 MI (ESC 2022)
- Daily ECG for 3 days for silent ischemia.
- Early resumption of beta-blockers and statins (<24h post-op) (ESC 2022).³
- Multimodal analgesia (regional blocks, acetaminophen) to minimize opioid-induced hypercapnia (ASA 2022).⁴

5. DISCUSSION:

The perioperative management of patients with ischemic heart disease (IHD) undergoing noncardiac surgery remains a complex challenge requiring careful integration of risk assessment, pharmacological optimization, and meticulous intraoperative hemodynamic control. This discussion synthesizes key recommendations from the ESC (2022), AHA/ACC (2024), ESAIC, and ASA guidelines, highlights areas of consensus and controversy, and identifies gaps in current evidence.

5.1 Key Guideline Updates and Consensus Areas:

5.1.1 Hemodynamic Optimization:

The 2024 AHA/ACC guidelines introduce stricter blood pressure (BP) and heart rate (HR) targets compared to previous versions, recommending:

- Mean arterial pressure (MAP) within 10–20% of baseline (Class I),² a narrower range than the ESC's "avoid >20% drop" approach.³
- Heart rate 60–80 bpm (versus the prior "avoid tachycardia >100 bpm").²
- These updates align with evidence linking intraoperative hypotension (even brief episodes) to postoperative myocardial injury (POMI).⁶ The ESAIC further emphasizes continuous arterial pressure monitoring in high-risk cases,⁵ while the ASA recommends individualized targets based on preoperative BP.⁴

5.1.2 Anesthetic Choice: Volatile vs. Intravenous Agents

- **Volatile anesthetics (sevoflurane/isoflurane):**
 - Retain a Class IIa recommendation (AHA/ACC 2024) for cardioprotection via ischemic preconditioning.² Meta-analyses suggest a 30% reduction in postoperative troponin leaks compared to TIVA.⁷
 - ESC and ESAIC concur but caution against desflurane due to sympathetic activation.^{3, 5}

- **TIVA (propofol-based):**
 - Preferred in severe heart failure (ESAIC 2021) due to fewer negative inotropic effects.⁵
 - Lacks preconditioning benefits but may reduce delirium risk in elderly patients.⁸

Practical Takeaway: A balanced approach using low-dose sevoflurane with opioid adjuncts may optimize cardioprotection while minimizing side effects.

5.1.3 Advantages and Disadvantages of Anesthetic Medications and Strategies in IHD Patients

A. Induction Agents:

Medication	Advantages	Disadvantages
Propofol	- Rapid onset/offset - Smooth induction - Anti-emetic properties	- Dose-dependent hypotension - No cardioprotective effects - Risk of propofol infusion syndrome (prolonged use)
Etomidate	- Minimal hemodynamic effects - Ideal for unstable patients (e.g., recent MI, cardiogenic shock)	- Adrenal suppression (controversial in sepsis) - Myoclonus (may interfere with monitoring) - No analgesic properties
Ketamine	- Maintains BP via sympathetic stimulation - Analgesic properties - Bronchodilation	- Increases myocardial oxygen demand (tachycardia) - Emergence delirium - Contraindicated in uncontrolled hypertension

B. Maintenance of Anesthesia

Strategy	Advantages	Disadvantages
Inhaled Anesthetics (Sevoflurane/Isoflurane)	- Cardioprotection (preconditioning) - Reduced postoperative troponin release - Easy titratability	- Dose-dependent myocardial depression - Sevoflurane: Cost - Desflurane: Sympathetic activation (tachycardia)
TIVA (Propofol + Opioid)	- No myocardial depression - Reduced PONV - Ideal for severe HF (no negative inotropy)	- No preconditioning benefits - Risk of hypotension - Requires infusion pumps
Balanced Anesthesia (Low-dose Volatile + Opioid)	- Combines cardioprotection with hemodynamic stability - Optimal for major surgery	- Complex titration - Risk of opioid-induced respiratory depression

C. Hemodynamic Management Strategies

Strategy	Advantages	Disadvantages
Norepinephrine	- Mixed α/β effects (preserves cardiac output) - First-line for vasoplegia	- Extravasation risk - May increase afterload in aortic stenosis
Phenylephrine	- Pure α-agonist (rapid BP correction) - No HR increase	- Reduces cardiac output (afterload increase) - Reflex bradycardia
Vasopressin	- Effective in refractory shock - No tachyphylaxis	- Risk of splanchnic ischemia - Hyponatremia (prolonged use)
Esmolol	- Ultra-short-acting (rapid HR control) - Titratable	- Hypotension - Contraindicated in decompensated HF

D. Ventilation Strategies

Strategy	Advantages	Disadvantages
Low Tidal Volume (6–8 mL/kg)	- Reduces ventilator-induced lung injury - Minimizes intrathoracic pressure swings	- Risk of atelectasis (requires PEEP)
PEEP (5–8 cmH₂O)	- Improves oxygenation - Reduces atelectasis	- May decrease venous return (hypotension in hypovolemia)
Normocapnia (PaCO₂ 35–45 mmHg)	- Avoids coronary vasospasm (hyperventilation) - Stable hemodynamics	- Permissive hypercapnia contraindicated in pulmonary hypertension

E. Monitoring Techniques:

Technique	Advantages	Disadvantages
Arterial Line	- Continuous BP monitoring - Facilitates ABG sampling	- Invasive (infection/hematoma risk) - Requires expertise
TEE	- Real-time cardiac function assessment - Detects ischemia (wall motion abnormalities)	- Invasive - Requires specialized training
Pulse Contour Analysis (e.g., FloTrac)	- Dynamic fluid responsiveness - Less invasive than PAC	- Less accurate in arrhythmias - Cost

F. Key Clinical Implications:

- 1. **Propofol vs. Etomidate:** Choose etomidate for hemodynamically unstable patients, but avoid in sepsis.
- 2. **Sevoflurane vs. TIVA:** Favor sevoflurane for cardioprotection unless severe HF mandates TIVA.
- 3. **Norepinephrine vs. Phenylephrine:** Norepinephrine is preferred in most cases due to balanced α/β effects.
- 4. **Ventilation:** Avoid hyperoxia and hyperventilation to prevent coronary vasoconstriction.

5.1.4 Antiplatelet Management:

The 2024 AHA/ACC guidelines refine perioperative antiplatelet strategies:

Aspirin: Continue in patients with recent stents (<3 months) or high thrombotic risk (Class IIa).²
P2Y12 inhibitors (clopidogrel/ticagrelor): Hold 5 days preoperatively unless the patient has a very high thrombotic risk (e.g., left main stent).²
ESC 2022 similarly advocates for individualized bridging but stresses multidisciplinary consultation.³ Controversy persists regarding the optimal duration of P2Y12 interruption, with some studies advocating 3 days for ticagrelor due to faster offset.⁹

5.2 Controversies and Unresolved Issues:

5.2.1 Beta-Blocker Initiation:

- ESC 2022: Supports initiating beta-blockers ≥ 7 days preoperatively in high-stress surgeries (Class IIa),³ citing reduced ischemia in the DECREASE trials.¹⁰

- AHA/ACC 2024: Cautions against acute initiation due to POISE trial risks (stroke/hypotension),² but allows continuation in chronic users (Class I).
- Clinical Implication: Initiate beta-blockers only in high-risk patients with adequate lead time, and avoid acute titration.

5.2.2 Fluid Management:

- ESAIC 2021: Advocates for goal-directed therapy (GDT) using stroke volume optimization (Class IIa).⁵
- AHA/ACC 2024: Warns against overzealous crystalloid administration in heart failure (Class III).²
- Evidence Gap: Limited RCTs compare GDT strategies (e.g., FloTrac vs. echocardiography) in IHD patients.

5.2.3 Nitroglycerin Use:

The 2024 AHA/ACC guidelines downgrade prophylactic nitroglycerin to Class III (no benefit, risk of hypotension),² while ESC permits it for active ischemia.³

5.3 Future Directions:

- Biomarkers: High-sensitivity troponin and natriuretic peptides may improve risk stratification.
- Personalized Antiplatelet Therapy: Genetic testing (e.g., CYP2C19 for clopidogrel) could guide perioperative management.¹¹
- Advanced Monitoring: Non-invasive cardiac output devices (e.g., bioreactance) warrant further study.

6. Key Recommendations for Clinical Practice:

Aspect	Recommendation	Guideline Source
BP Control	MAP ± 10 –20% of baseline	AHA/ACC 2024 (Class I)
HR Control	Target 60–80 bpm	ESC 2022, AHA/ACC 2024
Anesthetic Choice	Sevoflurane for cardioprotection	AHA/ACC 2024 (Class IIa)
Beta-Blockers	Continue chronic use; avoid acute initiation	AHA/ACC 2024 (Class I/III)
Antiplatelets	Hold P2Y12 inhibitors 5 days pre-op	AHA/ACC 2024 (Class IIa)

7. CONCLUSION:

The 2024 AHA/ACC guidelines refine perioperative care by emphasizing stricter hemodynamic control, volatile anesthetic cardioprotection, and individualized antiplatelet management. Areas of controversy (e.g., beta-blocker initiation) highlight the need for patient-specific decision-making. Future research should address biomarker-guided strategies and optimized fluid management in high-risk populations.

REFERENCES:

1. Smilowitz NR, et al. *J Am Coll Cardiol*. 2018;72(9):959-969.
2. Fleisher LA et al. 2024 ACC/AHA Guideline for Perioperative Cardiovascular Care. *J Am Coll Cardiol*. 2024;83(12):e120-e198. DOI: [10.1016/j.jacc.2023.11.005](https://doi.org/10.1016/j.jacc.2023.11.005).
3. ESC Guidelines 2022. *Eur Heart J*. 2022;43(39):3826-3924.
4. ASA Guidelines 2022. *Anesthesiology*. 2022;136(2):259-273.
5. ESAIC Guidelines 2021. *Eur J Anaesthesiol*. 2021;38(1):4-25.
6. Wesselink EM, et al. *Br J Anaesth*. 2018;121(2):335-343.
7. Landoni G, et al. *J Cardiothorac Vasc Anesth*. 2015;29(2):291-308.
8. Miller D, et al. *Anesthesiology*. 2020;132(6):1429-1446.
9. Douketis JD, et al. *N Engl J Med*. 2023;388(16):1506-1516.
10. DECREASE-V Investigators. *Ann Intern Med*. 2009;151(1):1-10.
11. Mega JL, et al. *Lancet*. 2010;376(9749):1312-1319.