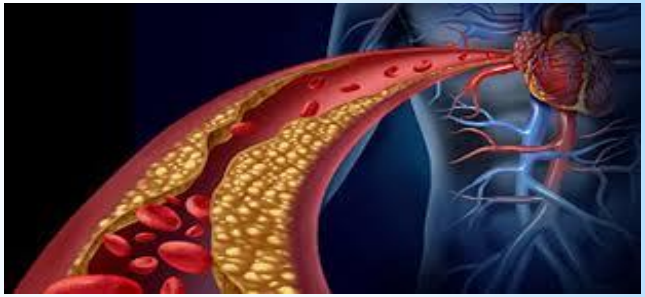
In The Name of God

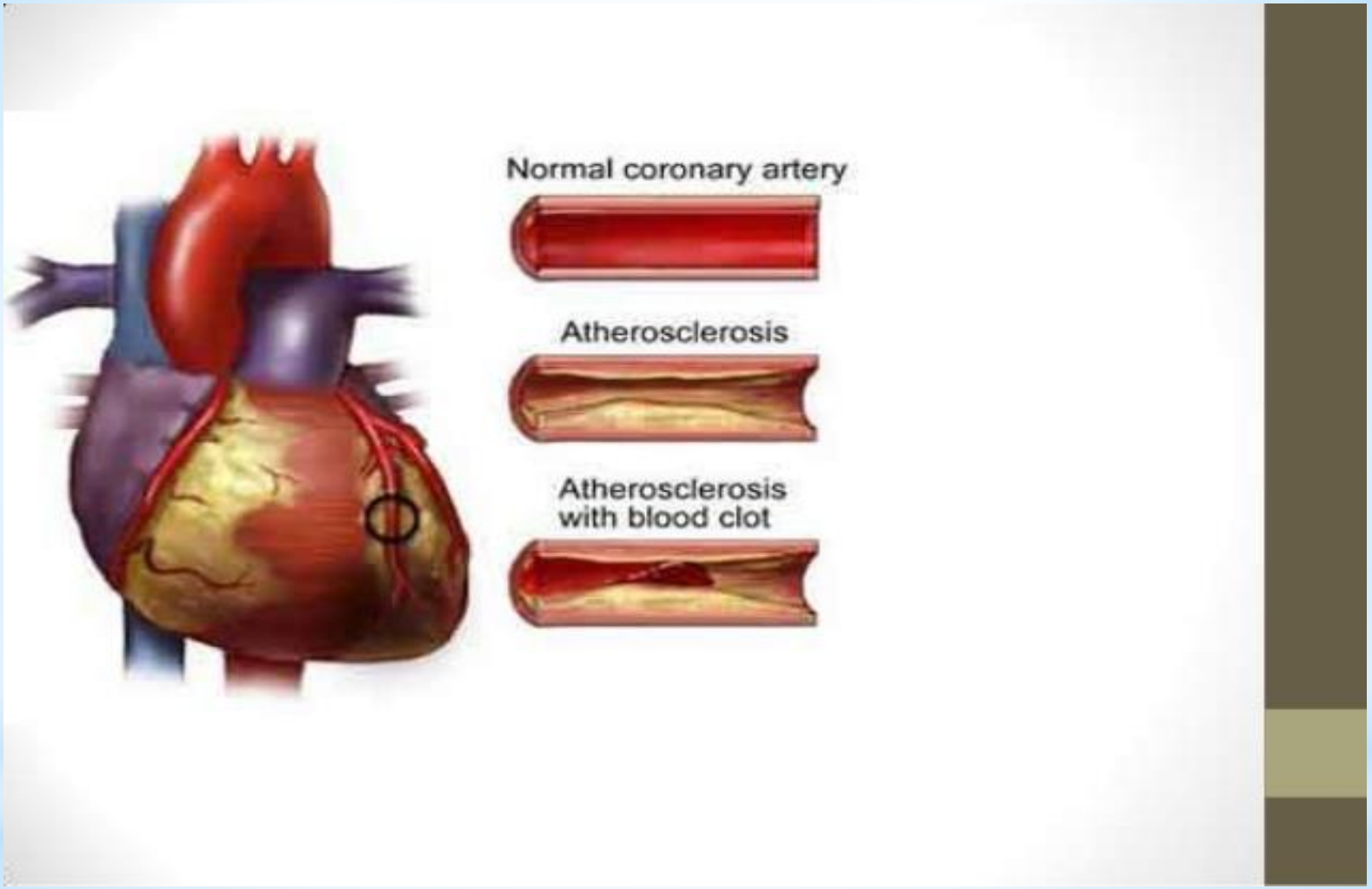


MANAGEMENT OF ANESTHESIA IN PATIENTS WITH ISCHEMIC HEART DISEASE UNDERGOING NONCARDIAC SURGERY

By: Prof.A.Sedighinejad

Fellowship of Anesthesia in Cardiac Surgery

Guilan University of Medical Sciences


Normal coronary artery
Atherosclerosis
Atherosclerosis with blood clot

PATHOPHYSIOLOGY

Ischemic heart disease is a condition where the myocardial demand outstrips the O2 supply

1. An adrenergic response leading to an imbalance in myocardial o2 supply – demand ratio.

2. Surgery also causes alterations in the balance between prothrombotic and fibrinolytic factors resulting in hypercoagulability and possible coronary thrombosis.

3. Fluid shift in the perioperative period add to surgical stress.

Prevention of myocardial ischemia during surgery decreases the incidence of perioperative myocardial infarction (MI).

Optimizing oxygen delivery to the myocardium is equally important for hemodynamic management.

Changes in ***heart rate and blood pressure*** as a result of the stress response can develop endothelial damage. *

In combination, these factors can precipitate ***thrombus*** formation in an atherosclerotic coronary artery and lead to the development of ***STEMI***. *

Newer analysis suggests that myocardial oxygen supply-demand imbalance predominates as the cause of cardiac injury ***during the first 3 to 4 postoperative days***. *

TABLE 5.7 Intraoperative Events That Influence the Balance Between Myocardial Oxygen Delivery and Myocardial Oxygen Requirements

Decreased Oxygen Delivery

Decreased coronary blood flow
Tachycardia
Hypotension
Hypocapnia (coronary artery vasoconstriction)
Coronary artery spasm
Decreased oxygen content
Anemia
Arterial hypoxemia
Shift of the oxyhemoglobin dissociation curve to the left

Increased Oxygen Requirements

Sympathetic nervous system stimulation
Tachycardia
Hypertension
Increased myocardial contractility
Increased afterload
Increased preload

PREOPERATIVE ASSESSMENT OF PATIENTS WITH Known OR Suspected IHD

The goals of preoperative evaluation

(1) Determining the extent of ischemic heart disease and any previous interventions (CABG, PCI)

(2) Reviewing medical therapy and noting any drugs that can increase the risk of surgical bleeding or contraindicate use of a particular anesthetic technique.

(3) Identity opportunities for reducing perioperative risk related to IHD

Patients with coronary artery diseases undergoing non-cardiac surgery are at an increased risk for peri-operative complications:

*Myocardial ischemia

*Cardiac failure

* Arrhythmias

*Cardiac arrest

*Increased morbidity and mortality

These complications are much higher in patients with recent MI or unstable angina who require urgent or emergency cardiac surgery

TABLE 5.4 Recommended Time Intervals to Wait for Elective Noncardiac Surgery After Coronary Revascularization

Procedure	Time to Wait for Elective Surgery
Angioplasty without stenting	2–4 weeks
Bare-metal stent placement	At least 30 days; 12 weeks preferable
Coronary artery bypass grafting	At least 6 weeks; 12 weeks preferable
Drug-eluting stent placement	At least 6 months; at least 12 months after acute coronary syndrome

On the whole perioperative management of ischemic heart disease patients undergoing non cardiac surgery requires ***careful team work*** and communication between patient, primary care physician, anesthesiologist and surgeon.

PHYSICAL EXAMINATION

Cyanosis,

Pallor,

Dyspnea during conversation,

Nutritional status,

Skeletal deformities,

Tremors & anxiety,

Assessment of vital signs ,

JVP pulsation,

Carotid bruit,

Edema.

Cardio vascular, pulmonary &abdominal examination

Recent recommendations by the ACC/AHA regarding perioperative cardiac evaluation is based on

1-Clinical risk predictors

2-Functional capacity

3-The surgical risk

TABLE 5.6 Cardiac Risk Factors in Patients Undergoing Elective Major Noncardiac Surgery

1. High-risk surgery
   - Abdominal aortic aneurysm
   - Peripheral vascular operation
   - Thoracotomy
   - Major abdominal operation
2. Ischemic heart disease
   - History of myocardial infarction
   - History of a positive finding on exercise testing
   - Current complaints of angina pectoris
   - Use of nitrate therapy
   - Presence of Q waves on ECG
3. Congestive heart failure
   - History of congestive heart failure
   - History of pulmonary edema
   - History of paroxysmal nocturnal dyspnea
   - Physical examination showing rales or S_3 gallop
   - Chest radiograph showing pulmonary vascular redistribution
4. Cerebrovascular disease
   - History of stroke
   - History of transient ischemic attack
5. Insulin-dependent diabetes mellitus
6. Preoperative serum creatinine concentration >2 mg/dL

CLINICAL PREDICTORS

MAJOR

1-Severe valvular disease

2-Unstable coronary syndrome

3-Recent MI (7-30 days)

4-Unstable severe angina

5-Decompensated heart failure

6-Significant arrhythmias

INTERMEDIATE

1.Angina class 1,2

2. Prior MI /patho Q waves

3. Prior CHF

4. DM

5. Renal insufficiency

MINOR

1.Advanced age

2. Abnormal ECG

3. Rhythm other than sinus

4. Low functional status

5. H/o stroke

6. Uncontrolled SHT

STRATIFICATION OF CARDIAC RISK FOR NON SURGICAL PROCEDURES

High-risk surgery ===> cardiac risk **> 5%.**

- Emergency major surgery
- Aortic and other major vascular surgery
- Peripheral vascular surgery
- Prolonged surgery associated with large fluid shifts and/or blood loss

Intermediate-risk surgery ===> cardiac risk **< 5%.**

- Endovascular aortic surgery
- CEA
- Head & Neck surgery
- Intraperitoneal & Intrathoracic surgery
- Orthopedic surgery
- Prostate surgery

Low-risk procedures ===> cardiac risk **< 1%**

- endoscopic surgery
- superficial surgery
- cataract surgery
- breast surgery
- ambulatory surgery

TABLE 31.5 Components of the Revised Cardiac Risk Index and Expected Cardiac Event Risk

Components of Revised Cardiac Risk Index*	Points Assigned
High-risk surgery (intraperitoneal, intrathoracic, or suprainguinal vascular procedure)	1
Ischemic heart disease (by any diagnostic criteria)	1
History of congestive heart failure	1
History of cerebrovascular disease	1
Diabetes mellitus requiring insulin	1
Creatinine > 2.0 mg/dL (176 μmol/L)	1

Revised Cardiac Risk Index Score	Risk of Major Cardiac Events†,‡
0	0.4%
1	1.0%
2	2.4%
≥3	5.4%

FUNCTIONAL CAPACITY

1 MET represents metabolic demand at rest

1-4 METS eating ,dressing, walking around house

4-10 METS climbing a flight of stairs,

Walking level ground at 6.4 km/hr

Running a short distance

Scrubbing floors, playing a game

>10 METS strenuous sports – swimming, tennis, foot ball

SCORES

EXCELLENT >7 METS

MODERATE >4-7 METS

POOR <4 METS

Prior myocardial infarction

The ACC/AHA guidelines recommend deferring non-urgent surgery until 60 days after a recent myocardial infarction.

Patients who have undergone coronary revascularization procedure within 5 years and are asymptomatic have low perioperative risk surgery and can undergo surgery without any further evaluation

Management After Risk Stratification *

Three therapeutic options are available prior to elective * non-cardiac surgery:

* (1) Revascularization by cardiac surgery
* (2) Revascularization by PCI
* (3) Optimal medical management

Patients who present for elective surgery and have any of the unstable * clinical risk factors ***(unstable coronary syndrome, decompensated heart failure, significant dysrhythmias, severe valvular heart disease)*** may require delay of elective surgery, cardiologic evaluation, and optimization prior to elective surgery.

Intensive preoperative management is necessary if surgery is urgent or * emergent

* **According to the AHA/ACC guidelines, patients stratified into the elevated-risk category but with a good functional capacity (METs higher than 4) can proceed to surgery without further testing**

* **Patients stratified into the elevated-risk category but with a low functional capacity or in whom functional capacity cannot be determined can be referred for pharmacologic stress testing if the testing will impact further management. If such testing is negative, this elevated-risk patient can proceed to surgery**

* **If the stress test is abnormal, coronary angiography and revascularization can be considered**
* **Preoperative coronary angiography is most suitable for patients with stress test results suggesting significant myocardium at risk.**

*Special Conditions**

Coagulation disorders

If a coagulation disorder is suspected based on patient's history and/or clinical examination, hematological evaluation should be done prior to the procedure.

Correction of hemostasis decreases peri-operative bleeding

Anemia and pre-operative blood conservation strategies

Hemoglobin 10mg/dl

Anemia and pre-operative blood conservation strategies

Pre-operative supplementation of iron corrects anemia.

Diabetes mellitus

Routine pre-operative blood sugar testing is not necessary in established well-monitored diabetic patients when they properly maintain their glycemic status/glycated hemoglobin (HbA1c).

Patients at high risk of disordered glucose homeostasis should be identified as needing specific attention to peri-operative glucose control

Obesity

A Pre-operative assessment of obese patients includes clinical evaluation, electrocardiogram (ECG), polysomnography, oximetry, glucose/HbA1c concentrations and haemoglobin measurement.

Respiratory disease, smoking and obstructive sleep apnea syndromes

* Routine pre-operative diagnostic spirometry and chest X-ray are not recommended.

*Patients with obstructive sleep apnea syndrome should be evaluated carefully for a potential difficult airway.

* Continuous positive airway pressure use in the pre-operative period in such patients may be helpful in reducing hypoxic events.

*Smoking should be stopped at least 4 weeks prior to surgery, and preferably for 6-8 weeks prior

Concurrent medication

One should inquire about herbal medicines, particularly those (ginseng, garlic and gingko) which may cause increased bleeding in the peri-operative period or have other unwanted interaction/side effects.

Herbal medicines should be discontinued 2 weeks before surgery.

Psychotropic medication

Patients on antidepressants, selective serotonin reuptake inhibitors and antipsychotic medications should not discontinue their treatment.

Patients treated with tricyclic antidepressants should have cardiac evaluation.

Monoamine oxidative inhibitors should be discontinued at least 2 weeks before anesthesia. Lithium administration should be discontinued 72 h before surgery.

Recommendations for peri-operative coronary angiography

1.Evidence for high risk of adverse outcome based on non-invasive test results

2.Angina pectoris unresponsive to medical therapy

3.Unstable angina, particularly when facing intermediate- or high-risk non-cardiac surgery

4.Patients with proven CAD

5.Urgent surgery in a patient resolving from acute MI

Coronary revascularization before non-cardiac surgery to enable the patient to "get through" the non-cardiac procedure *

Inappropriate*

However, in a high-risk subset of patients: *

Left main coronary artery disease *

Severe multi-vessel coronary artery disease *

Severe aortic stenosis *

Ejection fraction less than 20%, *

Coronary revascularization/valve replacement ***might*** be indicated. *

Pre-operative tests

12-lead electrocardiogram

It is useful to detect myocardial ischaemia, MI, cardiac rhythm and/or conduction disturbances, ventricular hypertrophy and electrolyte abnormalities specially in moderate to high surgeries in patients with risk factors.

In low risk surgeries and asymptomatic patient no need for routine ECG

A normal ECG within last 3 months and no clinical changes is acceptable

MEDICAL MANAGEMENT

Peri-operative beta-blockers

Patients already receiving beta blockers should continue taking them preoperatively and throughout the perioperative period

Perioperative β-blockade started within 1 day or less before non-cardiac surgery prevents nonfatal MI but increases risks of stroke, death, hypotension, and bradycardia

1.Alpha 2 agonists by their sympatholytic effects can be useful in patients where beta blockers are contraindicated.

2.Other agents like calcium channel blockers, insulin &statins prove to be beneficial peri-operatively

3.To continue drugs like beta blockers ,anti-hypertensive (except ACE inhibitors) digitalis ca+ blockers till the day of surgery

5.Stop warfarin 5 days before . stop LMWH 12-24 hours prior . stop clopidogrel 5 days before surgery

Since ACEI and ARB administration within 24 hours before surgery is associated with increased risks of hypotension and myocardial injury, it is reasonable to withhold these medications for 24 hours before surgery, provided that they are restarted postoperatively

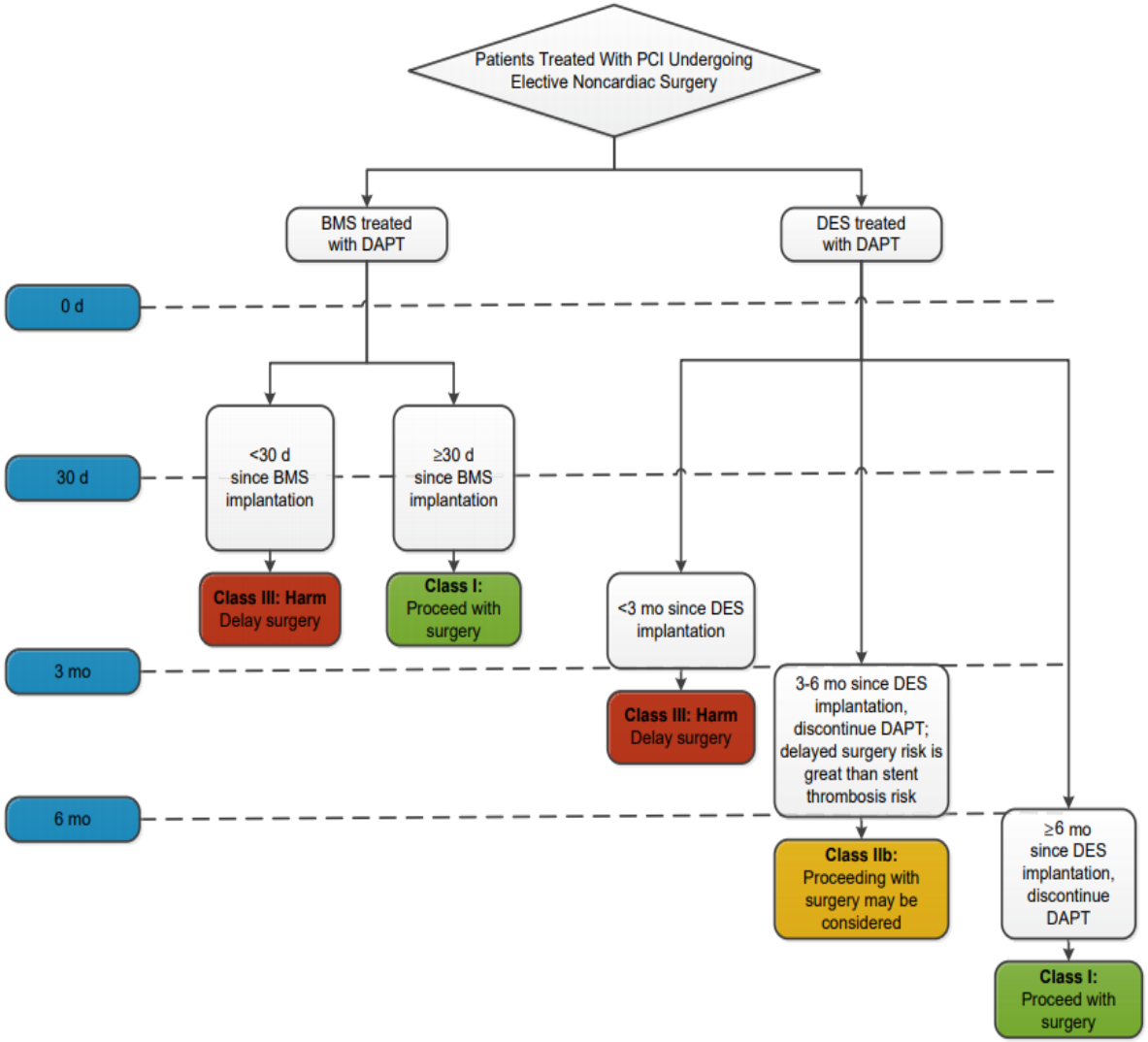
NSAIDs

* NSAIDS (Naproxen,Diclofenac,Ibuprofen,…)should be discontinued 1 week prior to elective procedures.
* Specific instructions regarding NSAIDs and surgery should be discussed with the clinician who prescribed the NSAIDs
* Administration of aspirin before surgery and throughout the early *postsurgical period had no significant effect on the rate of a composite of death or nonfatal MI but increased the risk of major bleeding.*
* *Based on these data, a reasonable strategy is to only continue aspirin selectively in patients where the risk of cardiac events is felt to exceed the risk of major bleeding.*

Patients after PCI Undergo Major Non-Cardiac Surgery

***PCI has not been shown to convincingly improve survival in stable IHD**

* Major non-cardiac surgery is defined as any surgery for which the surgeon might recommend the discontinuation of DAPT due to a concern for an increase in bleeding risk
* For patients taking dual antiplatelet therapy (DAPT) with aspirin and a P2Y12 inhibitor (e.g., Clopidogrel, Ticagrelor, Prasugrel), after PCI who need to undergo major non-cardiac surgery, continuation of DAPT may increase the risk of major bleeding, while discontinuation of one or both agents may increase risk of a thrombotic event.


Patients Treated With PCI Undergoing Elective Noncardiac Surgery
BMS treated with DAPT
DES treated with DAPT
0 d
30 d
3 mo
6 mo
<30 d since BMS implantation
≥30 d since BMS implantation
Class III: Harm Delay surgery
Class I: Proceed with surgery
<3 mo since DES implantation
Class III: Harm Delay surgery
3-6 mo since DES implantation, discontinue DAPT; delayed surgery risk is great than stent thrombosis risk
Class IIb: Proceeding with surgery may be considered
≥6 mo since DES implantation, discontinue DAPT
Class I: Proceed with surgery

Preoperative cardiac risk assessment algorithms ACC/AHA guidelines

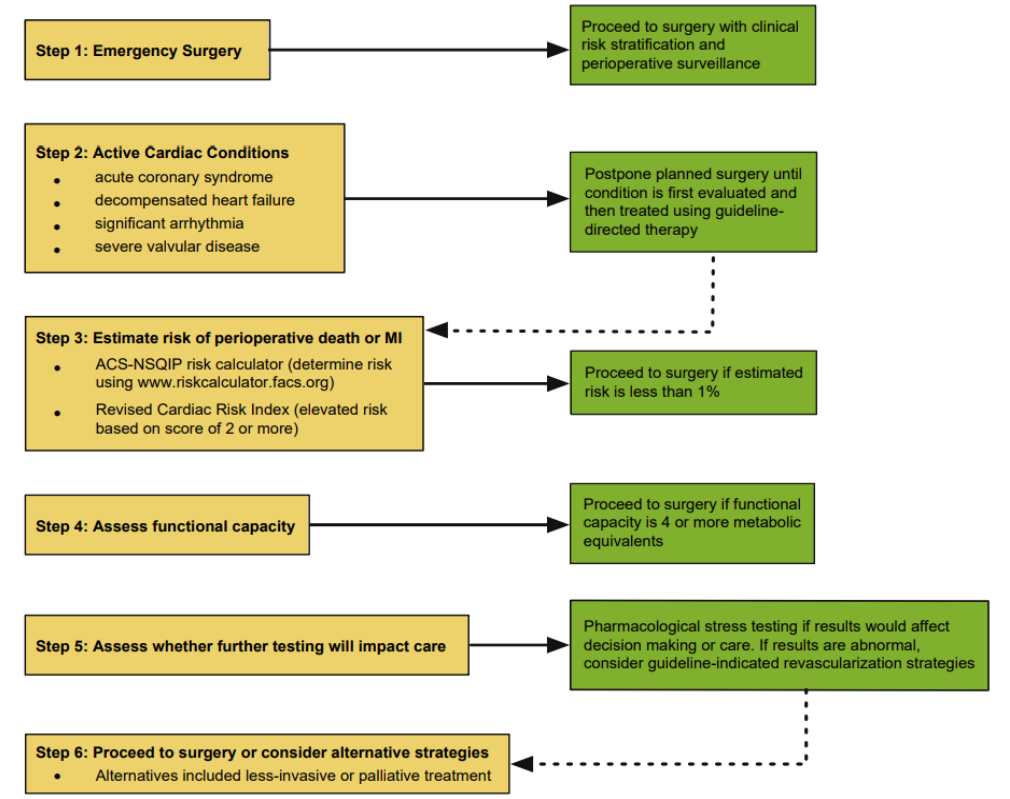


Fig. 31.5 Simplified cardiac evaluation algorithm for noncardiac surgery proposed by the 2014 American Heart Association and American College of Cardiology guidelines. *ACS-NSQIP*, American College of Surgeons National Surgical Quality Improvement Program; *MI*, myocardial infarction. (From Fleisher LA, Fleischmann KE, Auerbach AD, et al. 2014 ACC/AHA guideline on perioperative cardiovascular evaluation and management of patients undergoing noncardiac surgery: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines. *Circulation*. 2014;130:e278–e333.)

* Emergency procedure as one where life or limb would be threatened if surgery did not proceed within 6 hours or less

* An urgent procedure as one where life or limb would be threatened if surgery did not proceed within 6 to 24 hours

* A time-sensitive procedure as one where delays exceeding 1 to 6 weeks would adversely affect outcomes (e.g., most oncology surgery)

ANAESTHESIA MANAGEMENT

Anesthetic goals

The primary goal of the anesthetic management of a patient with coronary artery disease for non-cardiac surgery is the avoidance of perioperative myocardial ischaemia and MI.

This is by avoiding the factors which impair myocardial oxygen supply-demand balance.

Anything which increases cardiac work such as, emotional stress, surgical and anesthesia stress increases myocardial oxygen demand

Choice of Anesthesia:

All anesthetic techniques must aim to keep myocardial oxygen supply greater than demand and thus avoid ischemia.

The anesthesiologist should select drugs with the object of minimizing demand and supply of oxygen.

Along with the anesthetic agent some cardiac drugs should be readily available to maintain hemodynamics to prevent and treat ischemia if it occurs.

There is no conclusive evidence that one technique is superior to other

Must Be Avoided:

The factors which decrease myocardial oxygen supply are decreased coronary blood flow, Tachycardia, Hypotension, Increased preload, Hypoxia, Coronary artery spasm, Decreased oxygen content

Premedication

Patient should be explained the risk of surgery & anesthesia.

Anxiolytics such as short-acting benzodiazepines can be prescribed to these patients as anxiety can cause tachycardia and hypertension.

ANAESTHESIA TECHNIQUE

General or regional anesthesia can be chosen alone or in combination as parts of balanced technique depending on the surgery and patient requirements.

1.INDUCTION: Pre-oxygenation for 3-5 minutes

Most of the induction agents are myocardial depressants and cause decrease in systemic vascular resistance with increased venous pooling. Induction should have minimal hemodynamic effects

A meta-analysis of more than 6000 patients undergoing non-cardiac surgery failed to demonstrate a difference in PMI rates between patients who received volatile anesthesia and patients who received total IV anesthesia.

The current AHA guidelines state that "use of either a volatile anesthetic agent or total intravenous anesthesia is reasonable for patients undergoing non-cardiac surgery, and the choice is determined by factors other than the prevention of myocardial ischemia and MI."

In patients with normal left ventricular function*

Tachycardia and hypertension are likely to develop in response to * intense stimulation, such as during direct laryngoscopy or painful surgical stimulation.

Achieving controlled myocardial depression using a volatile * anesthetic may be useful in such patients to minimize the increase in sympathetic nervous system activity.

Overall, volatile anesthetics may be beneficial in patients with ischemic heart disease because they decrease myocardial oxygen requirements and may precondition the myocardium to tolerate ischemic events, or they may be detrimental because they lead to a decrease in blood pressure and an associated reduction in coronary perfusion pressure. *

IN PATIENTS WITH LV DYSFUNCTION

Patients with severely impaired left ventricular function may not tolerate anesthesia-induced myocardial depression.

Opioids may then be selected as the principal anesthetic. The addition of nitrous oxide, a benzodiazepine, or a low dose of volatile anesthetic may be needed to supplement the opioid because amnesia cannot be insured with an opioid anesthetic.

The use of nitrous oxide in patients with coronary artery disease is not contraindicated

OBTUNDATION OF INTUBATION RESPONSE:

Direct laryngoscopy should be less than 15 seconds.

If the duration of direct laryngoscopy is not likely to be brief or if hypertension already exists, it is reasonable to consider administering drugs to minimize the sympathetic response.

Dexmedetomidine, Esmolol, Remifentanyl, Laryngotracheal lidocaine, Lidocaine IV

Laryngoscopy has to be done after good relaxation of jaw muscles.

Muscle relaxants with minimal or no effect on HR and systemic blood pressure like Cisatracurium are preferred.

Atracurium→→→Histamine release

Pancronium →→→Tachycardia

2.MAINTENANCE OF ANAESTHESIA

Maintenance

Volatile agents or by total intravenous anesthesia with propofol, analgesics (opioids) and using muscle relaxants.

Volatile anesthetics have cardio protective effects but may not be significant in non-cardiac surgical patients.

Maintenance of Anesthesia

Patients with Normal LV function;

O2+ •N2O+Volatile anesthetics and muscle relaxants

Patients compromise LV function-

Short acting opioids are preferred Ideal Hemodynamic status include a lower •heart rate, normal blood pressure

Reversal of neuromuscular blockade

Sugammadex, with its better risk profile, may be a superior choice in patients with ischemic heart disease.

Glycopyrrolate, which has much less chronotropic effect and central effect than atropine, is preferred in these patients

Extubation

It should be smooth by avoiding sympathetic stimulation.

This can be achieved using opioids and beta-blockers.

Regional anesthesia

Either spinal or epidural anesthesia can be good choices in intermediate- and low-risk surgeries

Guidelines have to be followed for those who are on anticoagulant drugs.

Central neuraxial blockade can cause hypotension which should be treated with adequate preload and vasopressors such as phenylephrine.

Any fall in BP below 20% baseline should be promptly treated with fluid infusion or vasopressors like ephedrine or phenylephrine.

ADVANTAGES OF RA:

1. Excellent pain control
2. Decreased incidence of deep venous thrombosis
3. Opportunity to continue the block into the postoperative period.

However, the incidence of perioperative cardiac morbidity * *and mortality does not appear to be significantly different for general and regional anesthesia*

The current guidelines recommend that the choice of anesthesia is best left to the discretion of the anesthesia care team, who will consider the need for : *

Postoperative mechanical ventilation *

Pulmonary/neuromuscular comorbidities *

Cardiovascular effects (including myocardial depression), *

The consequences of sympathetic blockade *

The dermatomal level of the procedure. *

MONITORING

Monitoring is very important to detect ischaemia, arrhythmias and hemodynamic instabilities.

The most important goal in selecting monitoring methods is to select those that allow early detection of myocardial ischemia

Essential monitors are as follows:

*Pulse oxymetry, capnography, urine output, temperature and non-invasive blood pressure

*ECG : **Traditionally, monitoring of two leads (leads II and V5) has been the standard, but it appears that monitoring three leads (leads II, V4, and V5 [or V3, V4, and V5]) may improve the ability to detect ischemia*Computerised ST-segment analysis is superior and multiple lead monitoring is more sensitive.**

*.***Invasive arterial pressure:*** Direct measurement of blood pressure is more reliable than indirect methods, especially in major surgeries and when large fluid shifts are expected

*.***Central venous catheters:*** essential in all except minor procedures are indicated when significant blood loss, large fluid shifts and/or vasopressor infusions are expected

****Pulmonary artery catheters:*** Usually not indicated unless patients requiring cardiac output monitoring

*

Trans-esophageal echocardiography:

The development of new regional ventricular wall motion abnormalities * seen on is the accepted standard for the intraoperative diagnosis of myocardial ischemia.

These regional wall motion abnormalities can occur before ECG changes * are seen.

The limitations of TEE include its cost, the need for extensive training in * interpreting the images, and the fact that the transducer cannot be inserted until after induction of anesthesia.

The AHA/ACC guidelines recommend the use of TEE intraoperative * or peri-operatively to determine the cause of an acute, persistent, and life-threatening hemodynamic abnormality.

*Perioperative myocardial infarction is an anesthetic emergency

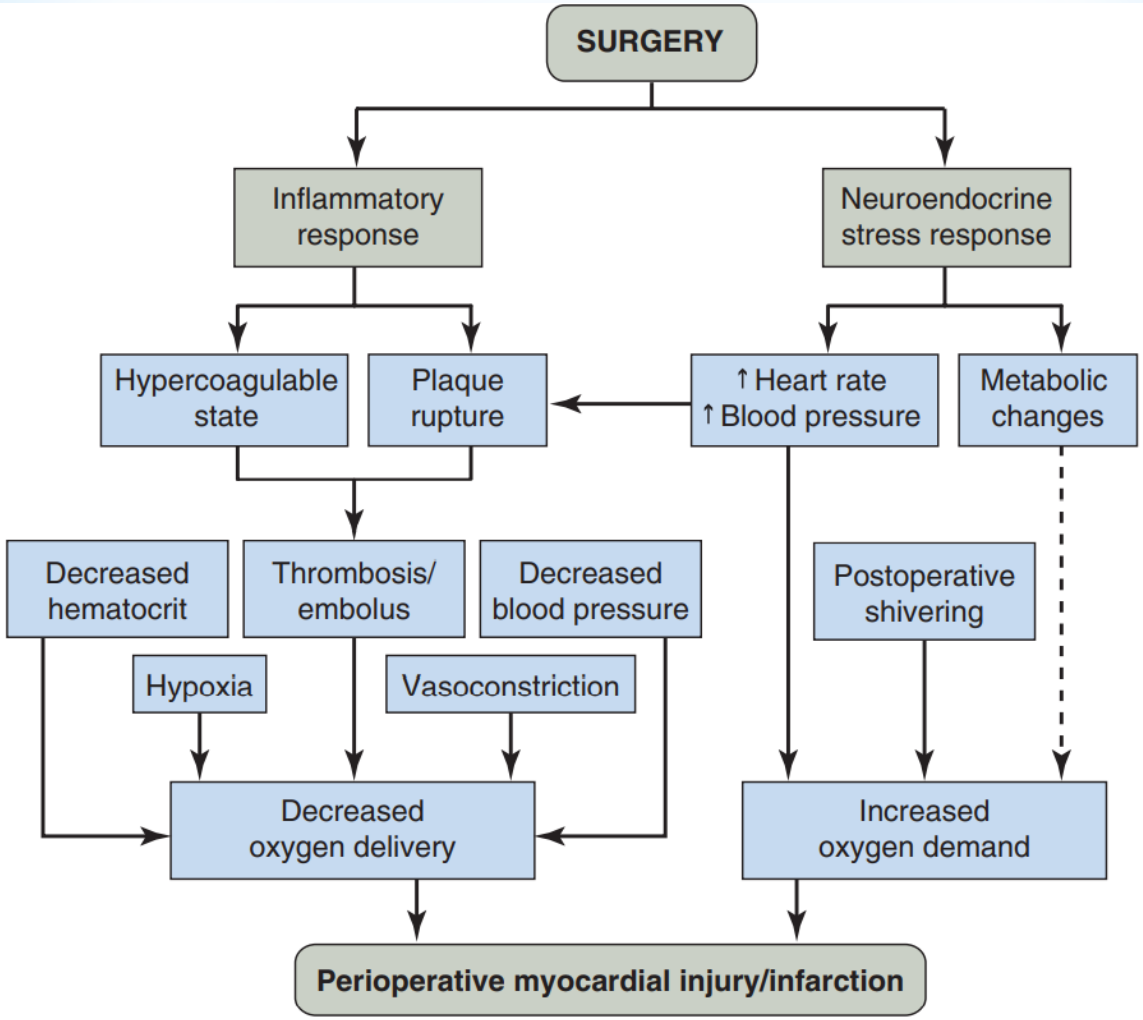


Fig. 5.4 Factors that can contribute to perioperative myocardial infarction. ↑, Increased.

Intraoperative Management of Myocardial Ischemia

Treatment of myocardial ischemia should be instituted when there are 1-mm ST-segment changes on ECG.

Tachycardia and hypertension caused by pain and inadequate anesthesia should be corrected by deepening of anesthesia

If ST-segment changes still exist, vasodilators such as nitroglycerine can be used.

Hypotension can be treated with fluid and vasopressors such as phenylephrine.

Persistent hypotension can be treated with vasopressor infusion.

Hypothermia has to be treated.

NITROGLYCERIN:

Nitroglycerin is an appropriate choice when myocardial ischemia is associated with a normal or modestly elevated blood pressure.

Clinically indicated as initial therapy for most types of myocardial ischemia

NTG therapy decreases the incidence of angina attacks.

If BP drops and ischemia dose not relived → phenylephrine

If reflex increase in heart rate → contractility → add β adrenergic blockers.

Combination therapy: Calcium channel blockers and Nitrate may be an effective anti-ischemia regime in selected patients. *

* ISCHEMIA

*–a) stable – beta blockers

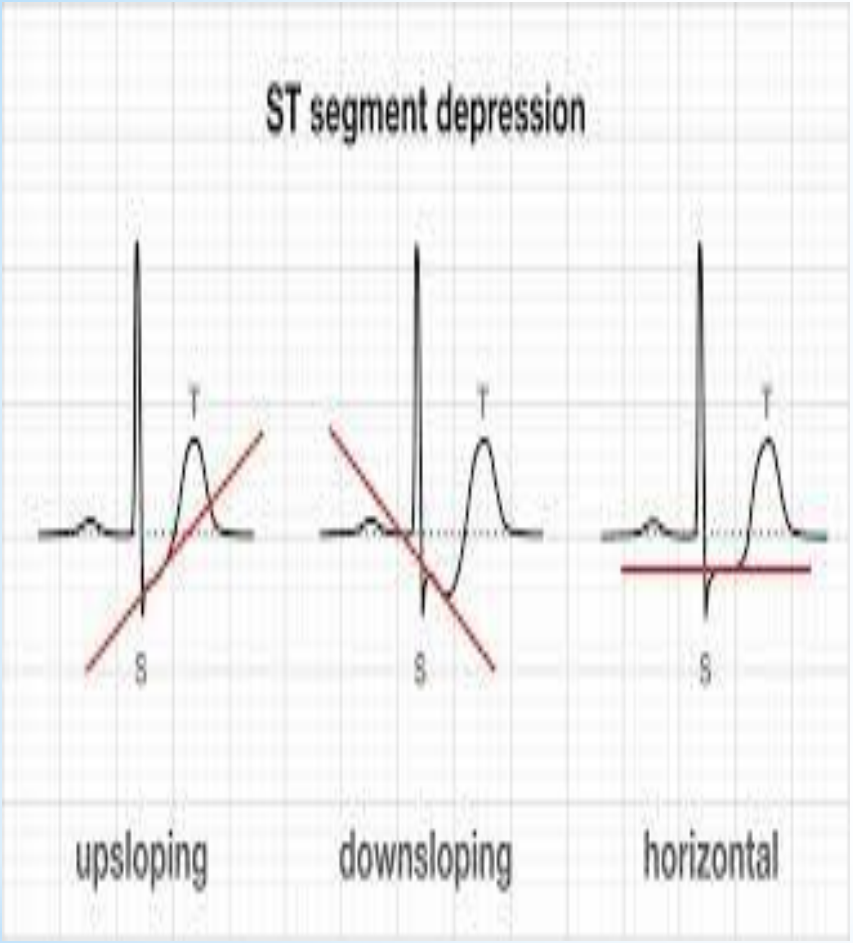
IV NTG

Heparin

b)Unstable- Inotropes

IABP

Earliest possible cardiac catheterization


ST segment depression
T
S
upsloping
downsloping
horizontal

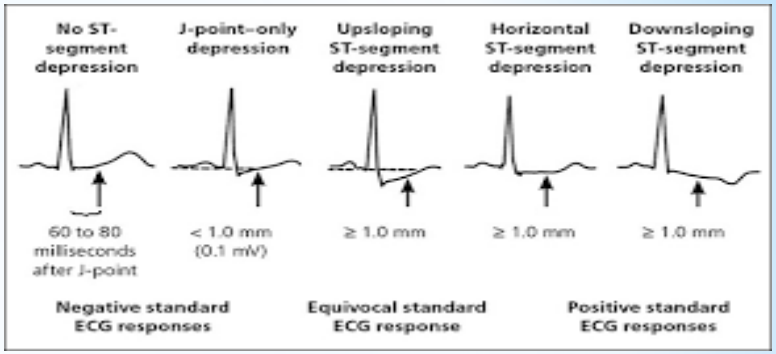

No ST-segment depression
J-point–only depression
Upsloping ST-segment depression
Horizontal ST-segment depression
Downsloping ST-segment depression
60 to 80 milliseconds after J-point
< 1.0 mm (0.1 mV)
≥ 1.0 mm
≥ 1.0 mm
≥ 1.0 mm
Negative standard ECG responses
Equivocal standard ECG response
Positive standard ECG responses

TABLE 1-12 Relationship of electrocardiogram (ECG) leads to areas of myocardial ischemia

ECG lead	Coronary artery responsible for ischemia	Area of myocardium that may be involved
II, III, aVF	Right coronary artery	Right atrium Right ventricle Sinoatrial node Inferior aspect of left ventricle Atrioventricular node
I, aVL	Circumflex coronary artery	Lateral aspect of left ventricle
V_3-V_5	Left anterior descending coronary artery	Anterolateral aspect of left ventricle

TREATMENT OF ARRHYTHMIAS

Arrhythmias are common in patients with IHD.

Ventricular fibrillation, atrial fibrillation and bradycardia are some of the life-threatening arrhythmias and should be treated with drugs or DC shock accordingly.

Fluid therapy

Excess salt and fluid in perioperative period :

* Dramatic increase in mortality.
* Air way edema
* Increased lung water tissue edema
* Cardiac failure

Preoperative fluid excess over-aggressive fluid restriction

* Hypovolemia leading to:
* Hypotension
* Tachycardia
* Organ ischemia,
* Vital organ failure

POST-OPERATIVE MANAGEMENT

Although significant advances have been made in researching and refining preoperative evaluation and risk management strategies, evidence-based strategies that can be adopted in the postoperative period to improve outcome have not yet been developed

The patient should be monitored for ischemia by continuous ECG Serial 12-lead ECG and troponin measurements are useful in patients suspected to have ischemia

Effective pain management is important to reduce stress, adverse hemodynamics and hyper coagulate states

Although most cardiac events occur within first 48 hours, delayed (within 30 days) events till happen.

Maintenance of hemodynamics status

Prevention of shivering

Patients with ischemic heart disease can become ischemic during emergence from anesthesia and/or weaning from mechanical ventilation. *

Any increase in heart rate and/or blood pressure must be managed promptly. *

Pharmacologic therapy with a b blocker or a combined a and b blocker (e.g., labetalol) or a calcium channel blocker (e.g., nicardipine) can be very helpful. *

Prevention of hypovolemia and hypotension is necessary * postoperatively, and not only an adequate intravascular volume but also an adequate hemoglobin concentration must be maintained

7 g/dL [.8 g/dL in patients .80 years]). *

Oxygen content and oxygen delivery depend significantly on the * concentration of hemoglobin in blood.

CONCLUSION

As the incidence of IHD increases in the population, the number of patients coming for non-cardiac surgery will also increase.

As these patients are prone for myocardial ischemia, infarction and arrhythmias during peri-operative period, a thorough evaluation has to be done regarding history and tests.

Since this is a team effort, we have to involve cardiologists, surgeons, treating physicians and patients.

Anti-failure medications, beta-blockers and statins have to be continued throughout peri-operative period.

And finally ,factors which alter myocardial oxygen supply-demand ratio are to be taken care of.

Thanks for Your Attention