ANAESTHETIC MANAGEMENT OF IHD PATIENTS FOR NON CARDIAC SURGERY

Successful 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. The term non cardiac surgery is exceedingly broad in its definition; it embarrasses aging patients with complex technical problems as well as younger patients scheduled for straight forward surgical procedures.

In assessing the risks and benefits of a perioperative intervention strategy, risks associated with non cardiac surgery must be individualized. Therefore the anesthesiologist must exercise judgment to correctly asses perioperative surgical risks and the need for further evaluation.

PATHOPHYSIOLOGY

Ischemic heart disease is a condition where the myocardial demand outstrips the O2 supply from coronary vessels. The increase in stress during perioperative period causes

1, An adrenergic surge leading to an imbalance in myocardial o2 supply – demand ratio. This in turn causes ischemic myocardium.

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.

All these increase in perioperative morbidity & mortality

CAUSES OF MYOCARDIAL O2 IMBALANCE

1) Decreased o2 supply
   A)decreased coronary flow
      -tachycardia (decreased diastolic perfusion time)
      -hypotension (esp diastolic BP)
      -increased preload (decreased perfusion pressure)
      -hypocapnia (coronary vaso constriction) coronary vasospam

B)decreased o2 content & availability

-anemia

-hypoxia

-reduced release from Hbi.e ODC shift to left

2) increased o2 demand
    1. tachycardia
    2. increased wall tension
    3. increased preload
    4. increased after load
    5. increased myocardial contractility

IMPORTANCE

1. **TACHYCARDIA:**

-Increased o2 demand through increased myocardial work

-Also shortens diastolic filling time thee by reducing time for optimal coronary perfusion

2. DIASTOLIC BP - in the absence of left ventricle volume overload , a diastolic arterial pressure of 60 mmHg should be sufficient to maintain coronary perfusion in most patients with CAD . In patients with critical uncorrected stenosis (or higher left ventricular diastolic pressures) it may be wise to maintain higher diastolic arterial pressures. But above 90 mmHg is counterproductive as this level invariably requires a higher left ventricular wall tension, thereby increasing o2 demand as well. Diastolic arterial pressure should err on the higher side in patients with LVH, because coronary perfusion travels from epicardium to endocardium. Hence these patients have increased susceptibility to subendocardial ischemia.

3. Hb: Hb concentration below 9 gm %. Is linked to myocardial ischemia esp. in presence of tachycardia. (intensive care – med1993. 21. 860 -866 -)there is no compelling reason to push it higher than 10 gms%.

4. On the demand sides ,the ideal situation is empty LV ,zero intracavitary pressure,absent myocardial contractility and an aortic diastolic pressure of 60mmhg or higher. Seen only in CB bypass or death?.

Avoiding high systolic pressures and LV preload reduces wall tension.

HR: heart doesn't care how much o2 it uses per minute. All it cares about is that the o2 used during each systolic cycle is fully replaced during the very next diastole.

he reduced diastole during tachycardia is untenable for patients with IHD because they need maximum diastolic duration to replace the o2 utilized in previous systole. Only patients with critical CAD &severe anemia typically experience myocardial ischemia a resting pulse rate below 90/mt.

PREOPERATIVE CLINICAL EVALUATION.

This includes history, physical examination, investigation, clinical risk predictors, risk assessment, functional capacity.

I) HISTORY OF ANGINA:

NYHA GRADING

1. Angina at unaccustomed work. No limitation of physical activity
2. Angina on moderate exertion. Mild limitation of physical activity
3. Angina on mild exertion. Marked limitation of physical activity
4. Angina at rest.2)H/o Dyspnoea3) oedema 4)H/o of M.I ,cardiomegaly

5)F/H/O CAD60comorbid conditions 7)current medications

ii) PHYSICAL EXAMINATION

Look for cyanosis, pallor, dyspnea during conversation, nutritional status, skeletal deformities, tremors & anxiety, assessment of vital signs , JVP pulsation, carotid bruit, odema.

Cardio vascular, pulmonary &abdominal examination.

iii) INVESTIGATIONS

1. Haemogram
2. Cardiac specific tests – ecg, echo
3. Blood glucose levels
4. Blood urea creatinine
5. LVT

IV) SUPPLEMENTAL EVALUVATION

Done in specific situations.

It includes

1. Resting LV function
2. Exercise/pharmacological stress testing
3. Ambulatory ecg monitoring
4. Coronary angiography
5. In patients with abnormal resting ecg (LBBB,LVF)
   Exercise echo
   Exercise myocardial perfusion imaging
6. In patients who cannot exercise
   Dobutamine stress echo
   Thallium scinitigraphy
7. Preoperative coronary angiography indicated in certain conditions like patients with proven CAD, unstable angina, angina resistant to medical therapy in class 1, urgent surgery in a patient resolving from acute MI,.perioperative M.I. etc.

RISK ASSESMENT

Several cardiac indices are present to predict postoperative cardiac complicatios in patients with IHD

A.GOLDMAN MULTIFACTORIAL CARDIAC RISK INDEX

CRITERIA	**POINTS**
HISTORY	
-A-ge >70 yr	5
-MI in previous 6 months	10
PHYSICAL EXAMINATION	
-S3 gallop or increased jugular venous pressure	11
-Valvular aortic stenosis	3
ECG	
-Rhythm other than sinus or PACs on last preoperative ECG	7
->5 PVCs/min documented at any time before operation	7

GENERAL STATUS

-PO, <60 or Pco, >50 mm Hg; K c3.0 or HCO, <20 mEq/L; BUN >50 or Cr >3.0 mg/dL; abnormal SGOT,	3
OPERATION	
Intraperitoneal, intrathoracic, or aortic surgery	3
Emergency operation	4
TOTAL	53

Class 1-0-5 points -1 -7% risk
Class2-6-12 points -7-11% risk
Class 3 -13 points-14-38% risk
Class 4-> 26 points -30-100% risk.

B.DETSKY MODIFIED MULTIFACTORIAL CARDIAC INDEX

CRITERIA	RISK
Age >70 yr	5
MI within 6 mo	10
MI more than 6 mo	5
Class III angina	10
Class IV angina	20
Unstable angina	10
Alveolar pulmonary edema	
Within 1 wk	10
Ever	5
Suspected critical aortic stenosis	20
Rhythm other than sinus or sinus / PAC	5
More than five PVCs/min at any time prior to surgery	5
Poor general medical status	5
Emergency operation	10

CLASS 1	6-15 POINTS - LOW CARDIAC RISK
CLASS 2	16-30 POINTS - INTERMEDIATE

CLASS 3 31 + - HIGH

Although these cardiac indices provide useful clinical information about risk, their overall accuracy is still considered limited.

C.CLINICAL PREDICTORS

MAJOR

1. Severe valvular disease
2. Unstable coronary syndrome
3. Recent MI (7-30 days)
4. Unstable severe angina (class 3,4)
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

D.STRATIFICATION OF CARDIAC RISK FOR NON SURGICAL PROCEDURES

CARDIAC RISK	NON CARDIAC PROCEDURES
1) High risk >5 % surgery	.emergency major .aortic and vascular procedures .PVD .Anticipated prolonged surgery
2) Intermediate risk	.carotid endarterectomy .head & neck procedures .intraperitoneal /intra thoracic surgery .orthopaedic surgeries .prostatic surgeries
3) Low risk	.endoscopic procedures .superficial procedures .catract surgeries .breast surgeries

E.FUNCTIONAL CAPACITY

FUNCTIONAL STATUS has been shown to be a reliable predictor of future cardiac events.it is measured in metabolic equivalents (METS)

1 MET =BMR

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 sternous sports – swimming, single tennis, foot ball

SCORES

EXCELLENT >7 METS

MODERATE >4-7 METS

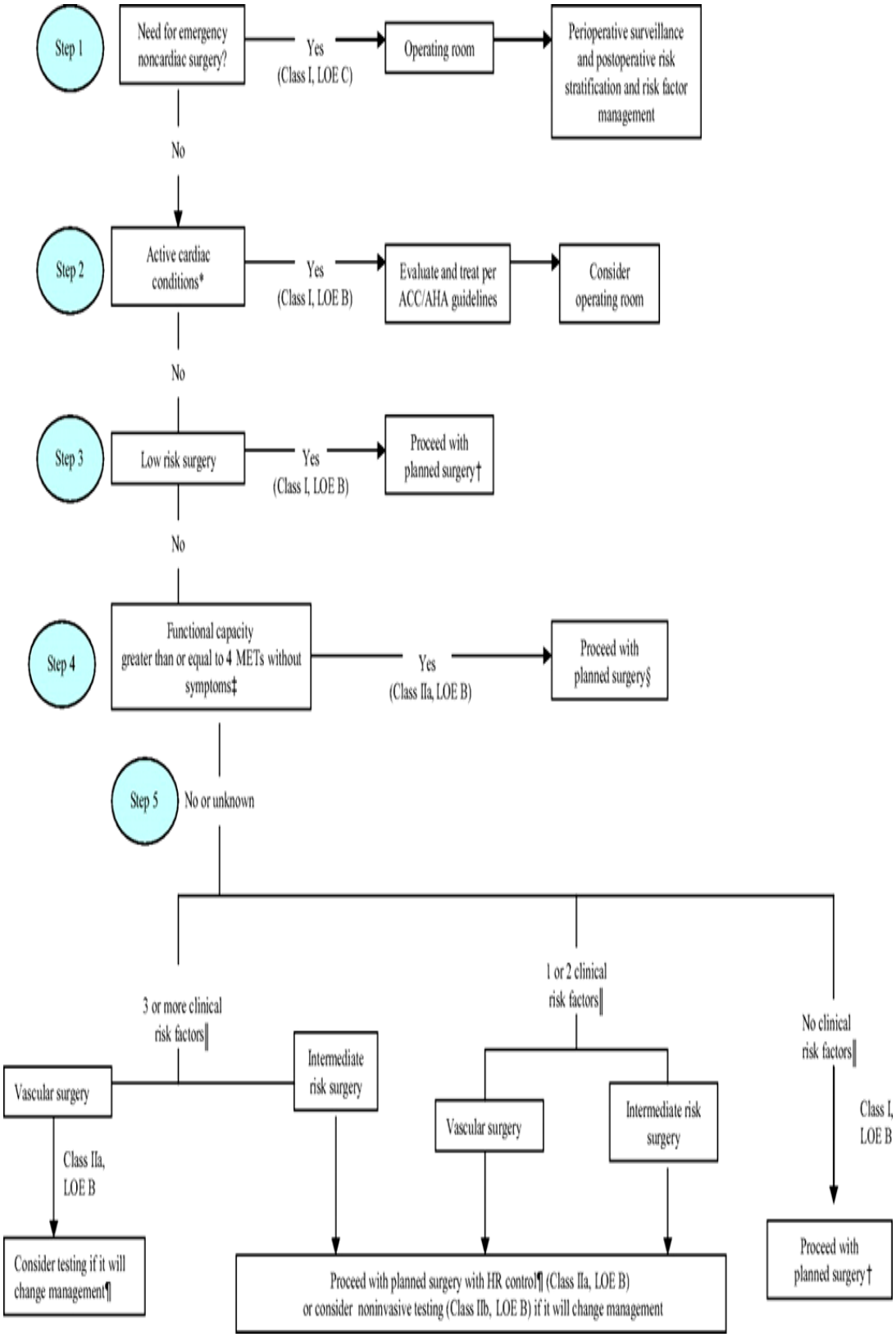
POOR <4 METS

When functional capacity is high. The prognosis is excellent even in presence of stable IHD or risk factors. Using functional capacity ,prior to surgery,ability to climb two flight of stairs or run a distance indicates a good functional capacity.

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

1. Clinical risk predictors
2. Functional capacity
3. The surgical risk

CARDIAC EVALUATION AND CARE ALGORITHM FOR NON CARDIAC SURGERY



ANAESTHETIC MANAGEMENT

i. PREOPERATIVE MANAGEMENT

At risk patients need to be managed with pharmacologic and other perioperative interventions that can ameloriate perioperative cardiac events.

Three therapeutic options are available before elective non cardiac surgery

1. Optimisation of medical management
2. Revascularisation by PCI
3. Revascularisation by CABG

1.OPTIMISATION OF MEDICAL MANAGEMENT

Decrease (Dutch echocardiographic cardiac risk evaluation applying stress echocardiography). And other randomized controlled trials provide a firm foundation for the use of beta blockers to prevent perioperative ischemic events in high risk and intermediate risk patients

TRIAL	RISK CATEGORY	CONCLUSION
DECREASE I	HIGH	Peri operative beta blockade with bisoprolol significantly reduces cardiac death & MI – short & long term
DECREASE II	LOW,INTERMEDIATE	With tight L-V control (60-69) non invasive cardiac testing is unnecessary
DECREASE III	HIGH	Fluvastatin XL significantly reduces myocardial ischemia death & MI
DECREASE IV	INTERMEDIATE	Bisoprolol significantly reduces cardiac death & MI. statin did not modify beneficial effect of B.B
DECREASE V	HIGH	With tight HR control

		,preoperative revascularisation is not necessary in these patients

To summarise,

1. To add or continue, beta blockers in high risk and intermediate risk patients titrated to HR of 50 – 60/mt
2. Alpha 2 agonists by virtue of their sympatholytic effects can be useful in patients where beta blockers are contraindicated.
3. Other agents like calcium channel blockers, ACE inhibitors, aspirin insulin &statins prove to be beneficial perioperatively
4. To continue drugs like beta blockers ,antihypertensivas (except ACE inhibitors) digitalis ca+ blockers till the day of surgery
5. NSAIDS should be discontinued 1 week prior to elective procedures. Most surgeries can be performed safely at an INR <1.5
6. Stop warfarin 5 days before . stop LMWH 12-24 hours prior . stop clopidogrel 5 days before surgery.

CONCLUSION:

1. Tight heart rate control with beta blockade dispenses the need for routine non invasive preop testing (intermediate grade & prophylactic coronary revascularisation in high risk patients.
2. To achieve 24 efficacy with once daily dosing beta selective agent with long life (bisoprolol) or a formulation providing extended plasma conc. (metaprolol succinate) is suggested.
3. There is a protective effect of perioperative statins on cardiac complications during non- cardiac surgery. (2007 AHA/ACC)

4. It is reasonable to start bisoprolol 2.5 mg daily or metaprolol 25-50 mg daily. Should be started 30 days prior to surgery.

2.PREOPERATIVE CORONARY REVASCULARISATION:

Indicated in high risk CAD and in whom long term would likely be improved by CABG (AHA/ACC 2007)

3.PERCUTANEOUS CORONARY INTERVENTION :

Between PCI & medical theraphy there is no comparative study on the outcome.

After balloon angioplasty to wait for 1 week for non cardiac surgery. & it is 4 – 6 weeks after coronary stent.

ANAESTHESIA GOALS

The primary goal of the anaesthetic management of a patient with IHD for non cardiac surgery is avoidance of myocardial ischemia and infarction. This is accomplished by preventing ischemia through measures that improve the myocardial o2 supply demand balance , primarily by controlling the patient haemodynamics and by detecting and treating myocardial ischemia when it occurs.

PREMEDICATION

Preoperative visit to the patient is important .A good rapport should be made with the patient and written consent obtained. Patient should be explained the risk of surgery & anaesthesia.

The premedication should prevent increase in B.P and H.R which can disturb myocardial o2 supply and demand and can

induce ischemia . Any combination of benzodiazepine and opoid like morphine should be given an hour prior to arrival in O.T

INTRAOPERATIVE MANAGEMENT

Incidence of ischemia is low in the intraoperative period as compared with pre and post operative period.

MONITORING

1.ECG : 5 lead ECG will be useful.

*V5 leads detects M.I in the distribution of LAD

*.Lead II detects M.I in the distribution of RCA and also arrhythmias.

* the ST regment trending also helps in the detection of ischemia.

2. Pulse oximetry, ETCO2, urine output, temp monitoring
3. NIBP
4. Non invasive hemodynamic monitoring:
   a. Intra arterial cannulation
   b. CVP – essential in all except minor procedures
   c. Pulmonary artery catheter and cardiac output
      *. indicated in intrathoracic or abdominal vascular surgeries as a guide for fluid management
      *if EF < 40%
      *if PHT is present.

5.OESOPHAGEAL STETHOSCOPE : To auscultate breath sounds &heart sound (to detect bronchospasm , pulmonary odema)

6.TEE

Helps to assess regional wall motion abnormalities ever before ECG changes of ischemia are seen.However not advocated for routine use.

Choice of anaesthesia :

The anaesthesiologist should select drugs with the object of minimising demand and supply of oxygen. Along with the anaesthetic agent some cardiac drugs should be readily available to maintain haemodynamics to prevent and treat ischemia if it occurs.

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

GENERAL ANAESTHESIA:

Preoxygenation for 3-5 mts

1.INDUCTION:

Induction should have minimal hemodynamic effects

No ideal anaesthetic agent

In patients with good LV function,

Induction with fentanyl and thiopental or propofol

Fentanyl is given 2-3 mcg/kg 3-4 mts prior to induction with propofol or etomidate. Propofol 2-2.5 mg/kg is preferred if SBP more than 125 mmhg and etomidate 0.2 mg – 0.3mg/kg if SBP is 110 or less.

For SBP between 110-125 mmhg either low dose propofol or combination of propofol and etomidate or etomidate alone is preferred.

THIOPENTONE- reduces myocardial contractility, preload and blood pressure.

Slight increase in HR

Administer slowly with caution.

PROPOFOL- reduces BP & HR

Dose dependent decrease in myocardial contractility

Not a good agent for patients with CAD

ETOMIDATE - Excellent for patients with poor cardiac reserve

IN PATIENTS WITH LV DYSFUNCTION

High dose opoids

MUSCLE RELAXANTS

Choice would be succinyl choine 1-1.5 mg/kg or rocuronium 0.6mmg/kg for intubation.

OBTUNDATION OF INTUBATION RESPONSE:

Achieved with 2% 1.5 mg/kg lignocaine 90 seconds before intubation . Laryngoscopy has to be done after good relaxation of jaw muscles. Cords are sprayed with 2 cc of 2% lignocaine and intubated with well lubricated endotracheal tubes.

2.MAINTENANCE OF ANAESTHESIA

*. in patients with normal LV function : o2, N2O,muscle relaxants, with volatile anaesthetics

.* in patients with impaired LV function: short acting opoids

*. muscle relaxant of choice is vecuronium – produces minimal haemodynamic alterations.

.* 0.5 MAC or higher dose of volatile agent limits the extent of myocardial injury if MI occurs.

.* sevoflurane / desflurane is preferable . isoflurane is acceptable.

*. choice of narcotics can be morphine , fentanyl, alfentanyl or sufentanyl.

.The ideal haemodynamic status include,

.a low heart rate

. adequate coronary perfusion pressure

. normal ABP

.normal ionotropic state

REVERSAL : Accomplished with neostigmine & glcopyrolate

D.INTRAOPERATIVE ISCHEMIA

ECG criteria for diagnosis of ischemia in anaesthestised patients

- Upsloping ST segment : 2mm depression, 80 msec after J point
- Horizontal ST segment : 1mm depression 60 – 80 m sec after J point
- Downloading ST segment : > 1mm from top of curve to PQ junction
- ST elevation
- T wave inversion

TREATMENT

* SINUS TACHYCARDIA – proponolol 1mgm (or) esmolol 100 – 500 mcg/kg -1mg/kg (intermittent or continous) (or) metaprolol upto 15 mg

* HYPERTENSION - deepening anaesthesia

Vasodilators – NTG 1mcg/kg/mt

Labetolol – (intermittent) 5-10 mg bolus

*HYPOTENSION – Vasocostrictor

Volume ingestion

Ionotropes

* ISCHEMIA –a) stable – beta blockers

IV NTG

Heparin

a)Unstable- Inotropes

IABP

Earliest possible cardiac catheterisation

E.POST OPERATIVE MANAGEMENT:

1. Prevent ischemia
2. Monitor for MI
3. Treat M.I

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

   1. Continous ECG monitoring – for the first 36 – 72 hours.
   2. Temperature control
   3. Supplemental o2
   4. Adequate post OP pain relief
   5. Maintainance of haemodynamic status

F.GA VS RA

. RA is a good choice in intermediate and low risk surgeries and in procedures involving extremeties, the perineum and lower abdomen.

RA is acceptable as it causes low filling pressures and reduces myocardial wall tension.

However the hypotension which follows the regional anaesthesia if severe and rapid may reduce the coronary perfusion pressure & blood flow. Any fall in BP below 20% baseline should be promptly treated with fluid infusion or vasopressors like ephedrine (if associated with brady) or phenylephrine.

Trying to cover for a patchy or incomplete RA with excessive sedation or other methods defeats .very purpose of selecting regional anaesthesia. In such cases it is to convert to GA & proceed

ADVANTAGES OF RA: (esp epidural)

1. better post operative pain relief
2. decreases the incidence of M.I
3. decrease respiratory complication esp. in patients for abdominal surgeries
4. lower opiate doses
5. better ablation of catecholamine response
6. less hypercoagulable state

CONCLUSION:

Meticulous pre op screening & therapy with beta blockers or alpha 2 agonist and careful maintenance of intraoperative haemodynamics monitoring, postoperative analgesia with epidural or PCA and continous post op monitoring are key for better outcome in these patients.

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