Pre-operative Cardiac Evaluation for Non-cardiac Surgery

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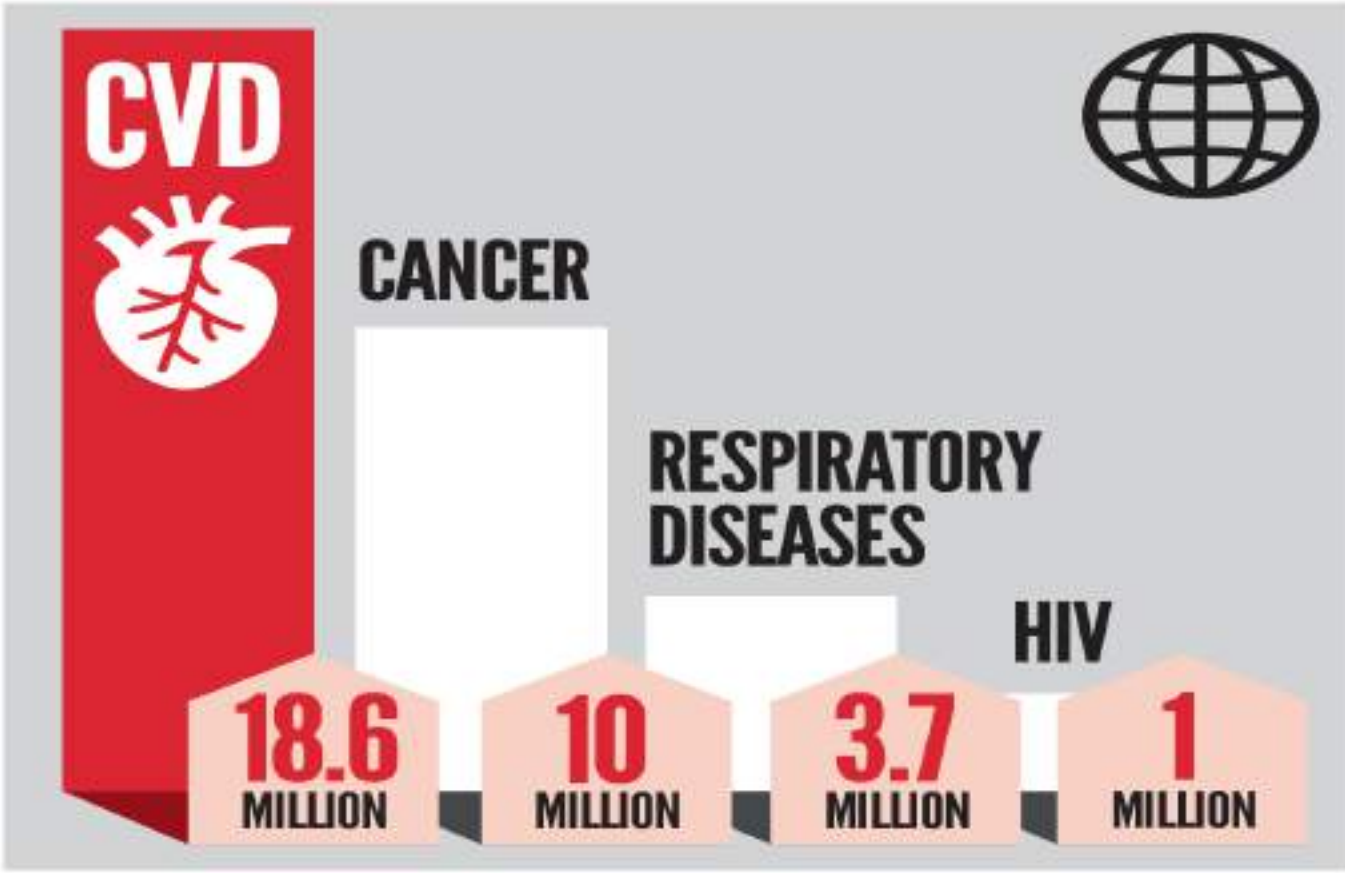
Contents

- Over all cardiac mortality rate
- Different short case scenario
- Priority between Cardiac intervention vs non cardiac surgery
- How to calculate cardiac risk before operation
- Non cardiac surgery specific risk
- Functional assessment of patient
- Safe way of non cardiac surgery after PCI
- Safe way of non cardiac surgery after PPM

Some Key Factors

GLOBAL CAUSES OF DEATH



RISK FACTORS FOR CVD

- High Blood Pressure
- Unhealthy Diet
- High Cholesterol
- Diabetes
- Overweight & Obesity
- Tobacco
- Air Pollution
- Kidney Disease
- Physical Inactivity
- Harmful use of alcohol

- In Bangladesh, heart attacks are a major health issue, with the **Bangladesh Bureau of Statistics** reporting 17.45% of total deaths were attributed to heart attacks in 2022.

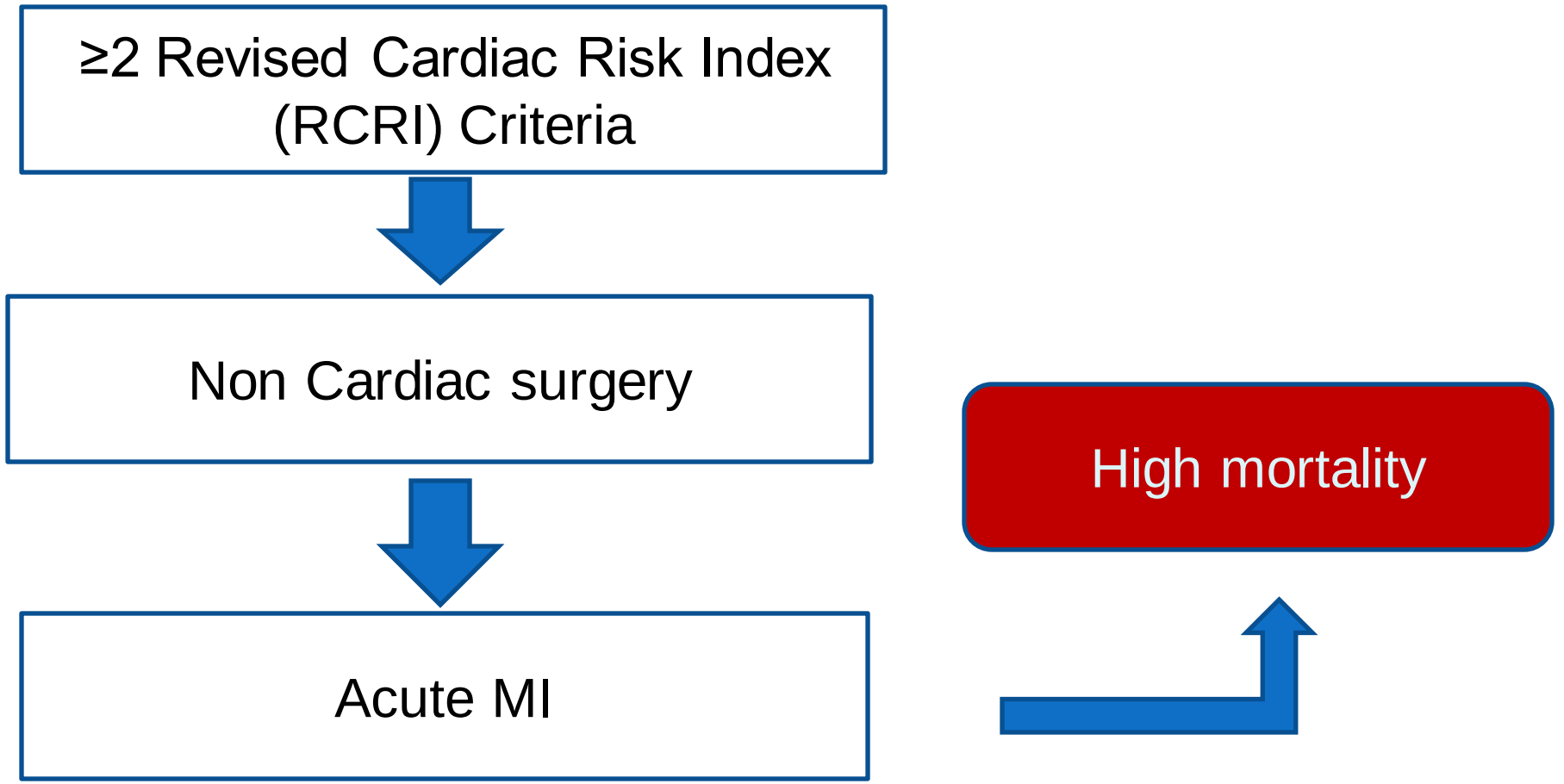
- **World Health Organization (WHO)** states that Bangladesh records 917,300 deaths annually, of which 283,800 are from cardiovascular disease.

- This means the country sees an average of 777 daily deaths from cardiovascular diseases.

- Patients who experience a perioperative myocardial infarction have a higher mortality risk compared to those who do not.

- The risk of perioperative MI is higher within first 48-72 hours and carries higher incidence of mortality and morbidity.

Cardiac risk of non cardiac surgery



Case scenerio

59 Y
Lady

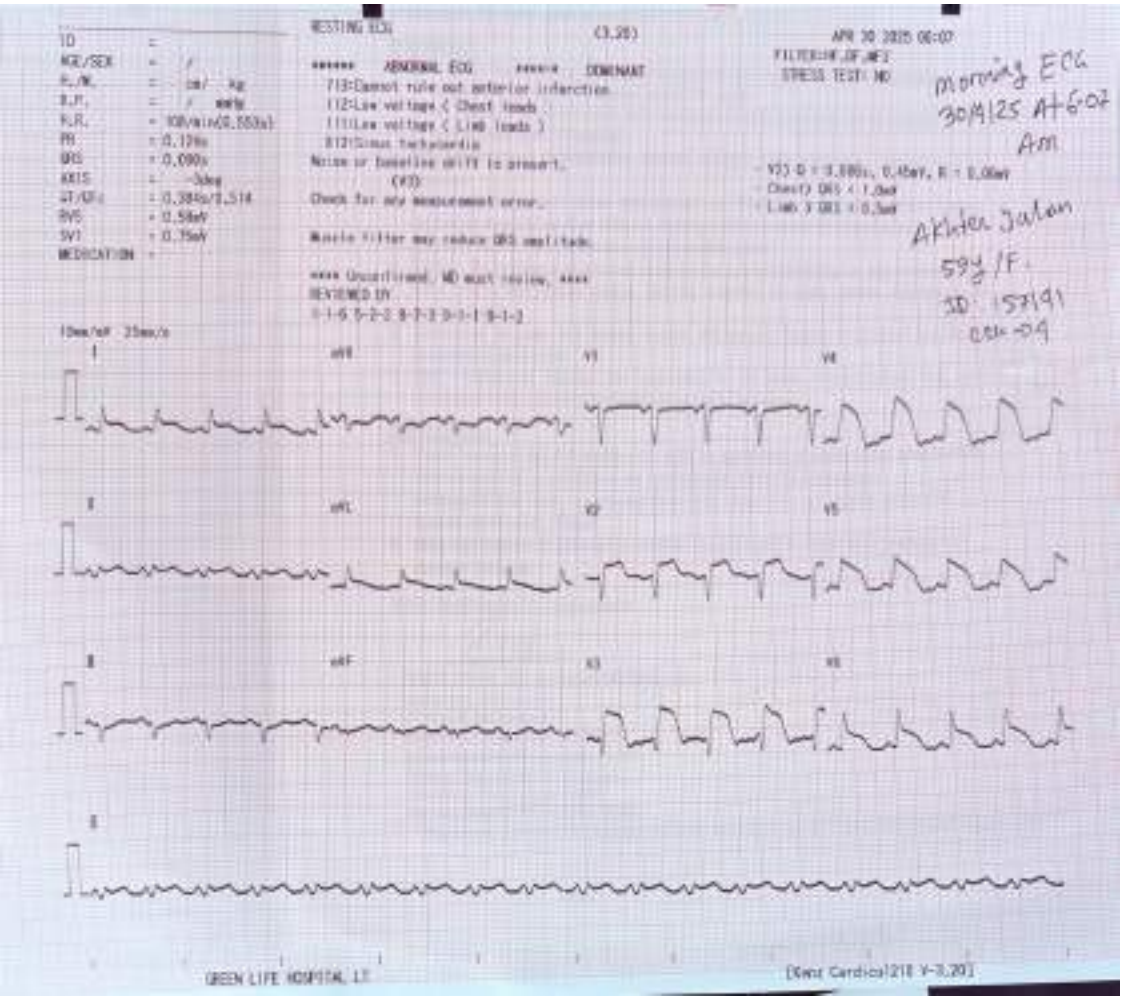
DM,HTN

Brain
ICSOL

ECG and
Echo was
normal

Surgical
removal

Acute MI
with ALVF


RESTING ECG
ABNORMAL ECG
713:Cannot rule out anterior infarction
112:Low voltage (Chest leads)
111:Low voltage (Limb leads)
812:Sinus tachycardia
Noise or baseline drift is present.
(#3)
Check for any measurement error.
Muscle filter may reduce QRS amplitude.
**** Uncertified. MD must review. ****
REVIEWED BY
APR 30 2025 08:07
STRESS TEST: NO
Morning ECG
30/4/25 At 6:07 Am
After Jalan
59y/F.
ID: 157191
GREEN LIFE HOSPITAL LT.


PHILIPS


PHILIPS

Acute STEMI anterior,ALVF

- Primary PCI (Very risky, High risk of intracranial haemorrhage)
- Thrombolysis (Contraindicated, High risk of intracranial haemorrhage)
- Loading dose of antiplatelets and statin (Risk of bleeding but given)
- Heparin (Risk of bleeding but given)
- Patient was on inotrope support

Expired on 2nd POD

Objective

- Safety of patient first
- Drug adjustment before operation
- Assess cardiac risk
- Cardiac intervention vs Non cardiac surgery which one should do first?

Preoperative drug adjustment

A 64-year-male, DM, HTN, DL,current smoker; planed for Cholecystectomy.

Medcations: Metformin 500mg,Empagliflozin 10 mg, lisinopril 20mg, Hydrochlorothiazide 25mg daily**.**

Currently he has no active cardiac symptoms

Labs:Baseline investigations, ECG, Echo:normal**.**

What medication adjustments would you recommend for this patient?

ACC/AHA Guidelines

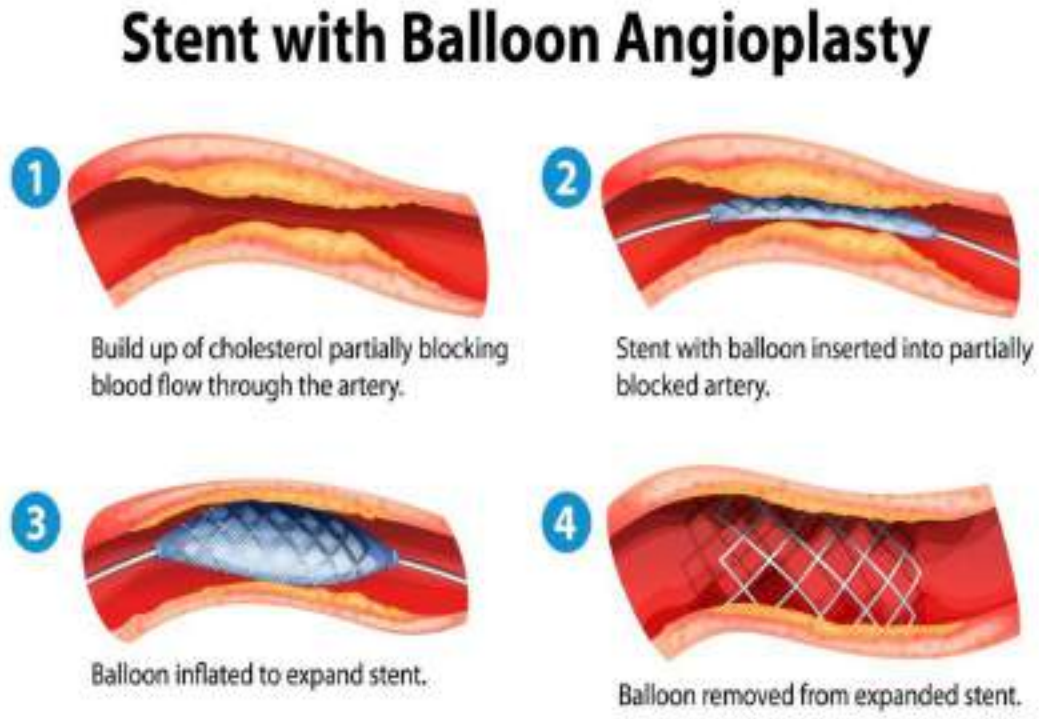
- Continue ACEI/ARB, or restart as soon as clinically feasible postoperatively
- Continue or start statins if patient has moderate/high ASCVD risk
- Avoid diuretics to prevent postoperative dehydration except current evidence of heart failure
- Start beta blocker if HR and BP allowed
- Stop Metformin and empagliflozin to prevent euglycemic DKA, If needed use insulin

A 57-year-old lady came for total hip replacement complaining increasing angina. She underwent CAG with PCI with drug-eluting stent in RCA. When should her elective total hip replacement be rescheduled?

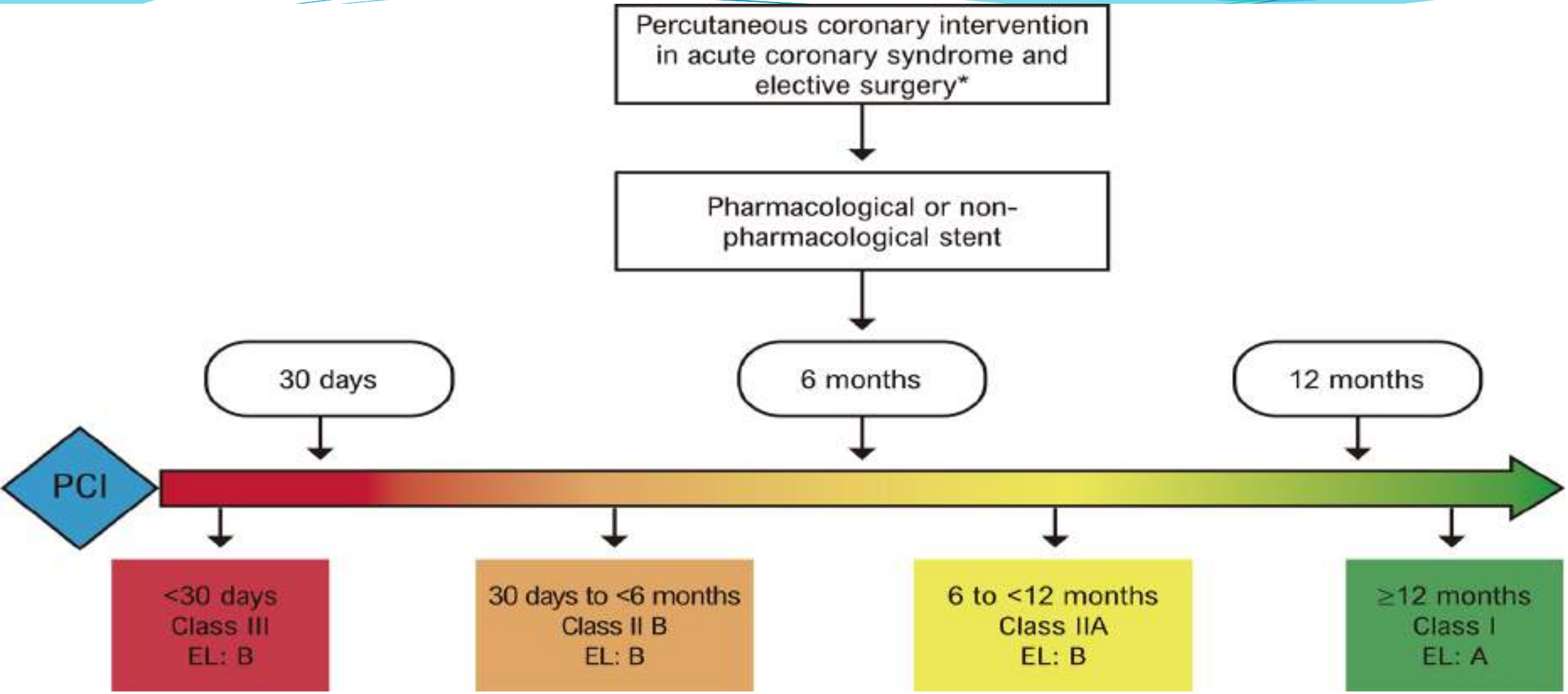
- In 4-6 weeks
- In 3 months
- In 6 months
- In 1 year

Routine non cardiac surgery re-schedule

Procedure	Recommendations
Balloon angioplasty	• Delay surgery for 14 days
Bare-metal intracoronary stent	• Delay surgery for 30 days
Drug-eluting stent	• Delay surgery 1 year



Always try to continue dual antiplatelet.
If bleeding risk high continue aspirin



REF:Update of the Brazilian Society of Cardiology's Perioperative Cardiovascular Assessment Guideline: Focus on Managing Patients with Percutaneous Coronary Intervention – 2022

Indication of PCI before non cardiac surgery

- Routine PCI in stable patient before non cardiac surgery should be avoided

- Acute coronary syndrome
  - -Unstable angina
  - -NSTEMI
  - -STEMI

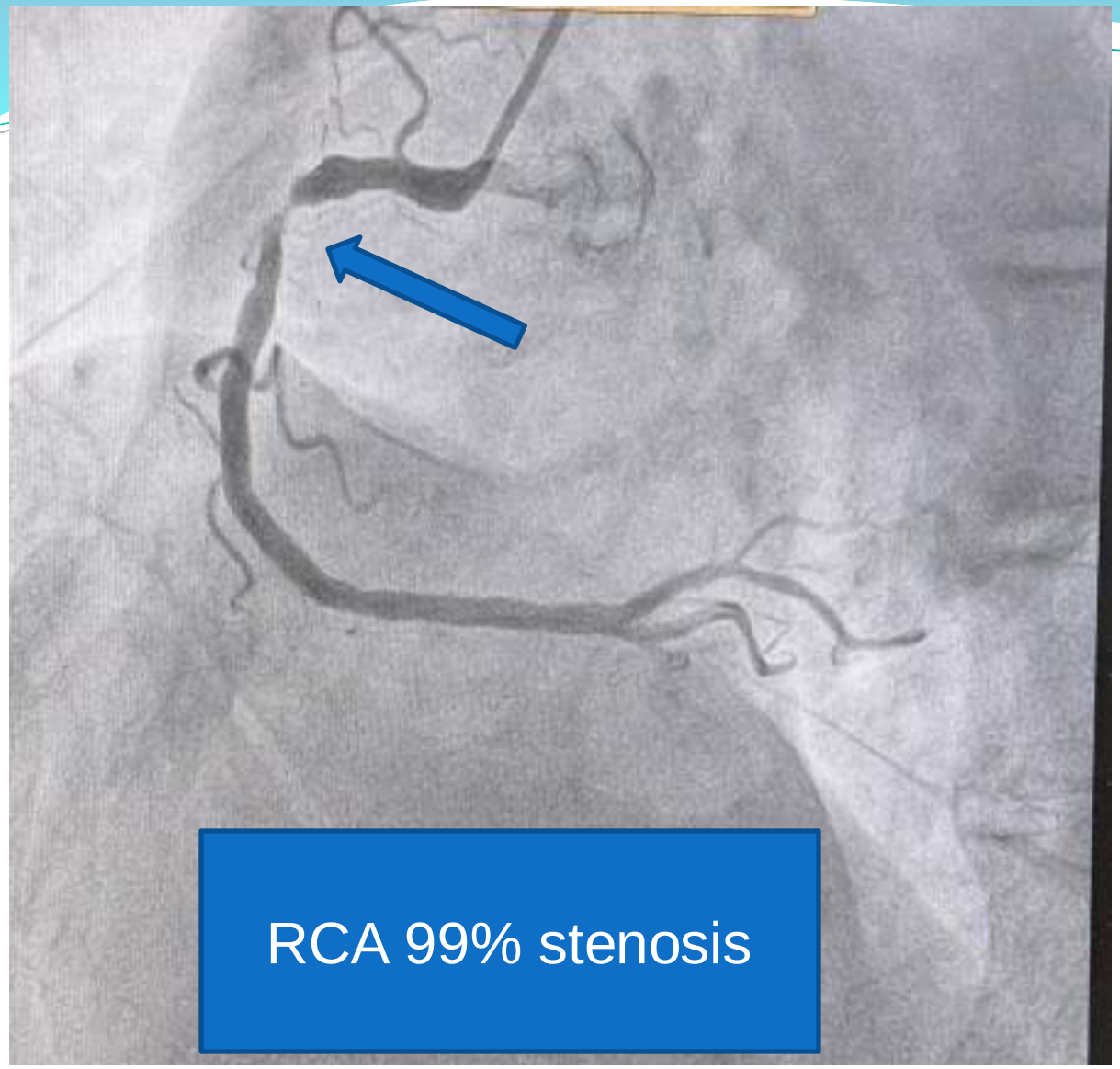
- Any Critical block in coronary with symptoms of IHD

A 65-Year-Old lady was admitted for total abdominal hysterectomy

- She was non diabetic, normotensive, no F/H of IHD
- Complained chest pain with chest heaviness on minimal exertion relieved by S/L nitrate and rest
- All baseline investigations, ECG, Echo, S. troponin I were normal
- Surgeon and patient party were waiting for operation

Next?

CAG


RCA 99% stenosis


After stenting

Preoperative cardiac specific testing

- ECG
- Echocardiogram
- ETT
- Coronary angiogram (CAG)
  - -CT CAG
  - -Conventional CAG

Normal ECG,Echo,ETT does not exclude CAD

Clinical Risk Assessment

- Type of non cardiac surgery (Low/ Intermediate/ High risk)
- Detailed history, symptoms analysis, co-morbidities.
- Functional status of patient
- Current cardiac status

Of the following patients with cardiac conditions, which one may proceed with elective surgery?

- Patient with severe aortic stenosis with chest pain
- Patient with mitral stenosis with dyspnea on exertion
- Patient with angina at rest
- Patient with myocardial infarction 3 months ago

Treat cardiac condition first in following conditions:

- Unstable angina
- Class III or IV angina
- Myocardial infarction < 60 days ago
- Moderate to severe valvular stenosis with symptoms
- Heart failure
- Uncontrolled hypertension
- Arrhythmia with symptoms (Bradyarrhythmia/ Tachyarrhythmia)

Hypertension

- No specific recommendations, but reasonable to keep it controlled
- ACEi/ARB and beta blocker has mortality benefit and can prevent perioperative MI

Arrhythmias

- Atrial fibrillation: no adjustments (other than anticoagulation) if clinically stable
- Ventricular arrhythmias do not require special therapy if clinically stable

Surgery Specific Risk

Surgical Risk

- Overall perioperative mortality: 0.3%
- Cardiac etiologies are the most common cause of death
- *3rd POD is the most common day for perioperative MI*

Of the operations listed, which one has the lowest operative risk?

- Simple mastectomy
- Cholecystectomy
- Total abdominal hysterectomy (TAH)
- Total knee replacement

Low-risk: < 1%	Intermediate-risk: 1–5%	High-risk: > 5%
• Superficial surgery • Breast • Dental • Endocrine: thyroid • Eye • Reconstructive • Carotid asymptomatic (CEA or CAS) • Gynaecology: minor • Orthopaedic: minor (meniscectomy) • Urological: minor (transurethral resection of the prostate)	• Intraperitoneal: splenectomy, hiatal hernia repair, cholecystectomy • Carotid symptomatic (CEA or CAS) • Peripheral arterial angioplasty • Endovascular aneurysm repair • Head and neck surgery • Neurological or orthopaedic: major (hip and spine surgery) • Urological or gynaecological: major • Renal transplant • Intra-thoracic: non-major	• Aortic and major vascular surgery • Open lower limb revascularization or amputation or thromboembolectomy • Duodeno-pancreatic surgery • Liver resection, bile duct surgery • Oesophagectomy • Repair of perforated bowel • Adrenal resection • Total cystectomy • Pneumonectomy • Pulmonary or liver transplant

CAS = carotid artery stenting; CEA = carotid endarterectomy.

[a]Surgical risk estimate is a broad approximation of 30-day risk of cardiovascular death and myocardial infarction that takes into account only the specific surgical intervention, without considering the patient's comorbidities.

[b]Adapted from Glance *et al.*[11]

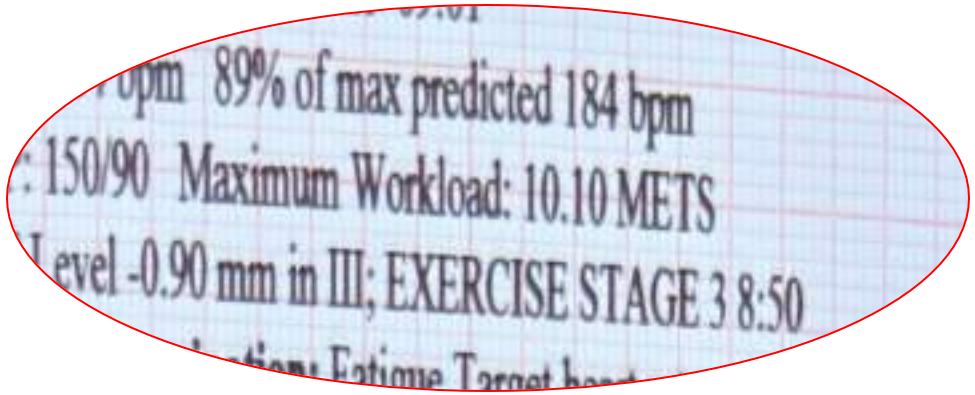
Ref:Manual of Cardiovascular Medicine 5th Edition

Functional assessment

METs (Metabolic equivalents)

- Functional assessment is done by METs (Metabolic equivalents)
- Metabolic equivalent (MET) is a measure of the energy cost of physical activity
- Poor functional status: METs less than 4

1 METs= 3.5 ml O2/kg/m



A 73-year-old lady diabetic, hypertensive waiting for total knee replacement.

She has been limited in physical activity because of her knee, but she can walk up 1 flight of stairs without difficulty. How many metabolic equivalents (METs) is she demonstrating?

- 0 METs
- 1 METs
- 4 METs
- 10 METs

1 MET	≥4 METs	>10 METs
• Take care of self	• Climb 1 flight stairs or walk up a hill	• Participate in strenuous sports including below:
• Eat/dress/use toilet	• Walk on level ground at 4 mph	• Singles tennis
• Walk indoors around house	• Run a short distance	• Football
• Walk 1-2 blocks on level ground at 2-3 mph	• Scrubbing floors/moving heavy furniture	• Basketball
• Dusting/wash dishes (some classify this as 1-4 METs)	• Golf, bowl, dance, doubles tennis, throw baseball or football	• Skiing

A 70-year-lady waiting for duodeno-pancreatic operation

- No past or current symptoms of IHD
- Known diabetic on Insulin
- Known CKD, S.Creatinine 2.5 mg/dl
- How can we calculate her cardiac risk?

RCRI criteria

Revised Cardiac Risk Index

SIX independent predictors,1999

Clinical variable	Points
High-risk surgery	1
H/o Ischemic heart disease	1
H/o Congestive heart failure	1
H/o cerebrovascular disease	1
Insulin treatment for diabetes mellitus	1
Pre-operative serum creatinine level >2.0 mg/dl (180 mcgmol/L)	1

Interpretation of risk score

Risk class	Points	Risks of complications (%)
I. Very low	0	0.4 %
II. Low	1	0.9 %
III. Moderate	2	7.0 %
IV. High	3+	11.0 %

Ref:Manual of Cardiovascular Medicine 5th Edition

A 70-year-lady waiting for duodeno-pancreatic operation

- No past or current symptoms of IHD
- Known diabetic on Insulin
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- How can we calculate her cardiac risk?

RCRI score

3

Perioperative risk

11%

Perioperative beta blockers

- Proven to reduce risk of perioperative MI in certain populations
- If used, long-acting beta blockers preferable over short-acting
- Continue if already on them
- Consider starting them if 3 or more Revised Cardiac Risk Index (RCRI) factors
- Start at least 1 day preoperatively

Perioperative statin

- Proven to reduce risk of perioperative MI in certain population
- Consider starting them if 3 or more Revised Cardiac Risk Index (RCRI) factors
- Continue or start statins if patient has moderate / high ASCVD risk

How statin can prevent perioperative MI?

Will it act by reducing LDL-C?

No

Statin will act by fixing many factors others than reducing LDL-C which is called

pleutropic effects

Pleotropic effects of statin

- Stabilize atherosclerotic plaque
- Improve endothelial dysfunction
- Antiinflammatory effect
- Inhibit platelet activation and aggragation
- Reduces oxidative stress

A 50-year-lady known CKD came for repair of umbilical hernia

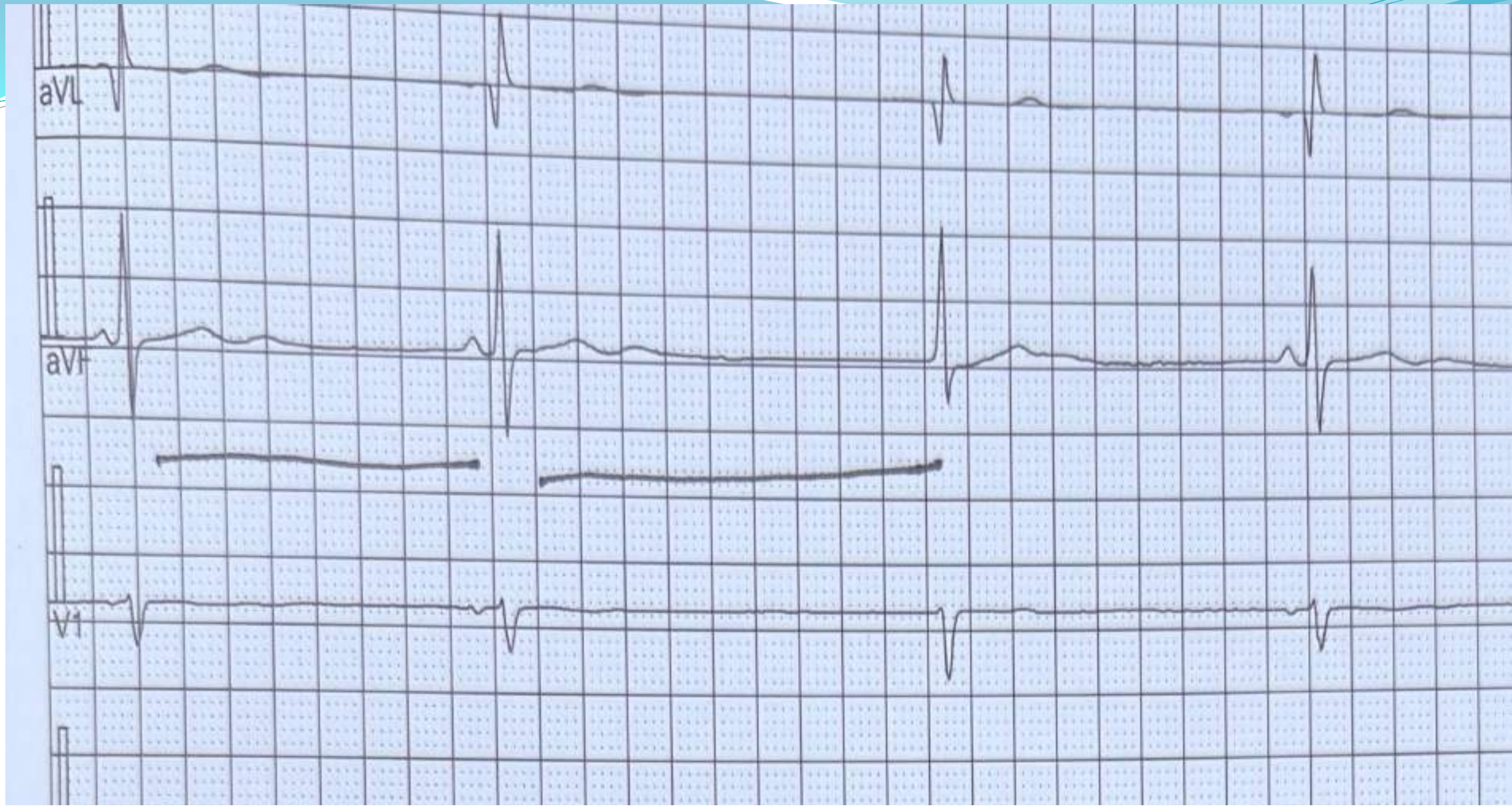
- ECG : Sinus bradycardia, heart rate 44/min
- Came for cardiac evaluation before surgery
- On query she had syncopal attack for 3 times and now feels dizziness on standing
- Echocardiogram was normal

Holter monitoring

KRITESH ENTERPRISES

Holter Monitoring

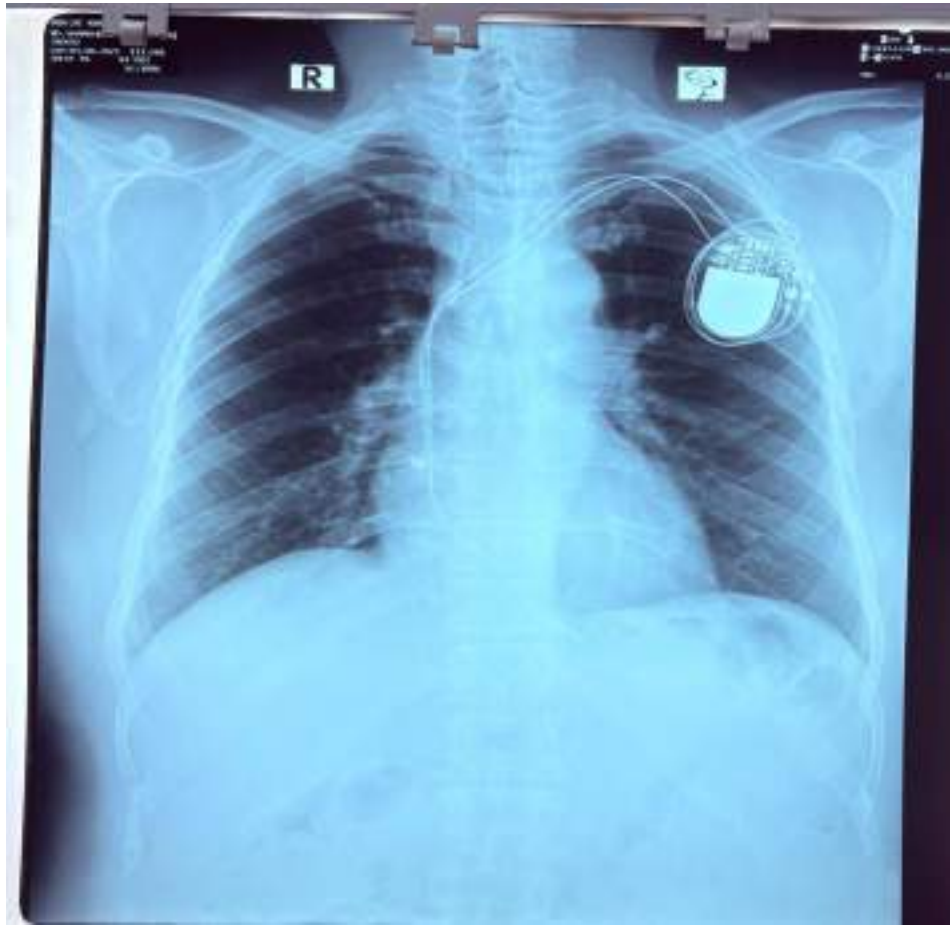
We Do 24 Hrs/48Hrs Holter Monitoring


aVL
aVF
V1

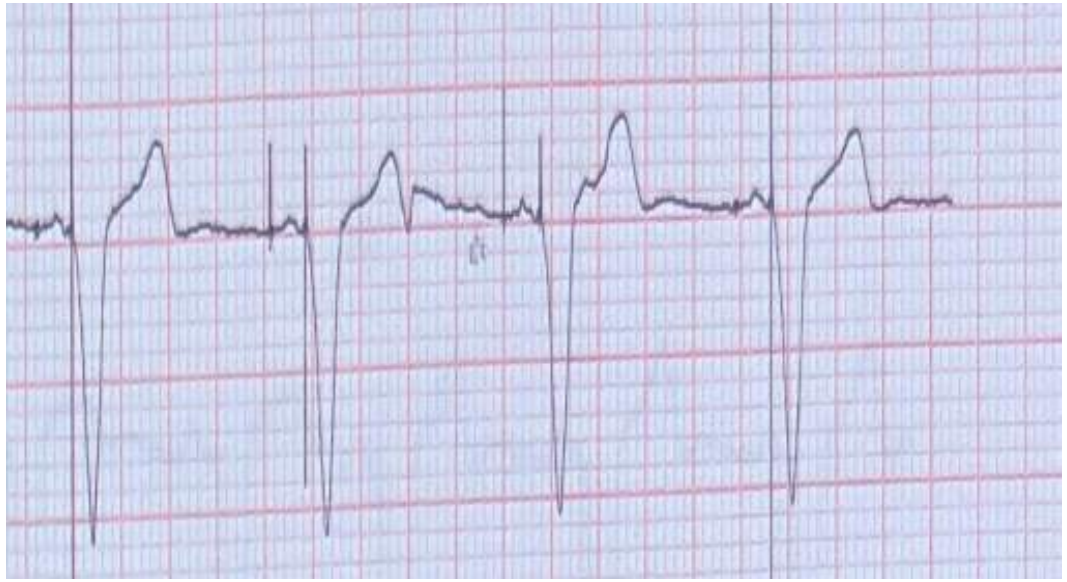
This patient is indicated for

Permanent pacemaker (PPM)

- This patient was treated with dual chamber PPM
- Discharged after 5 days
- Planned for non cardiac surgery after 1 month

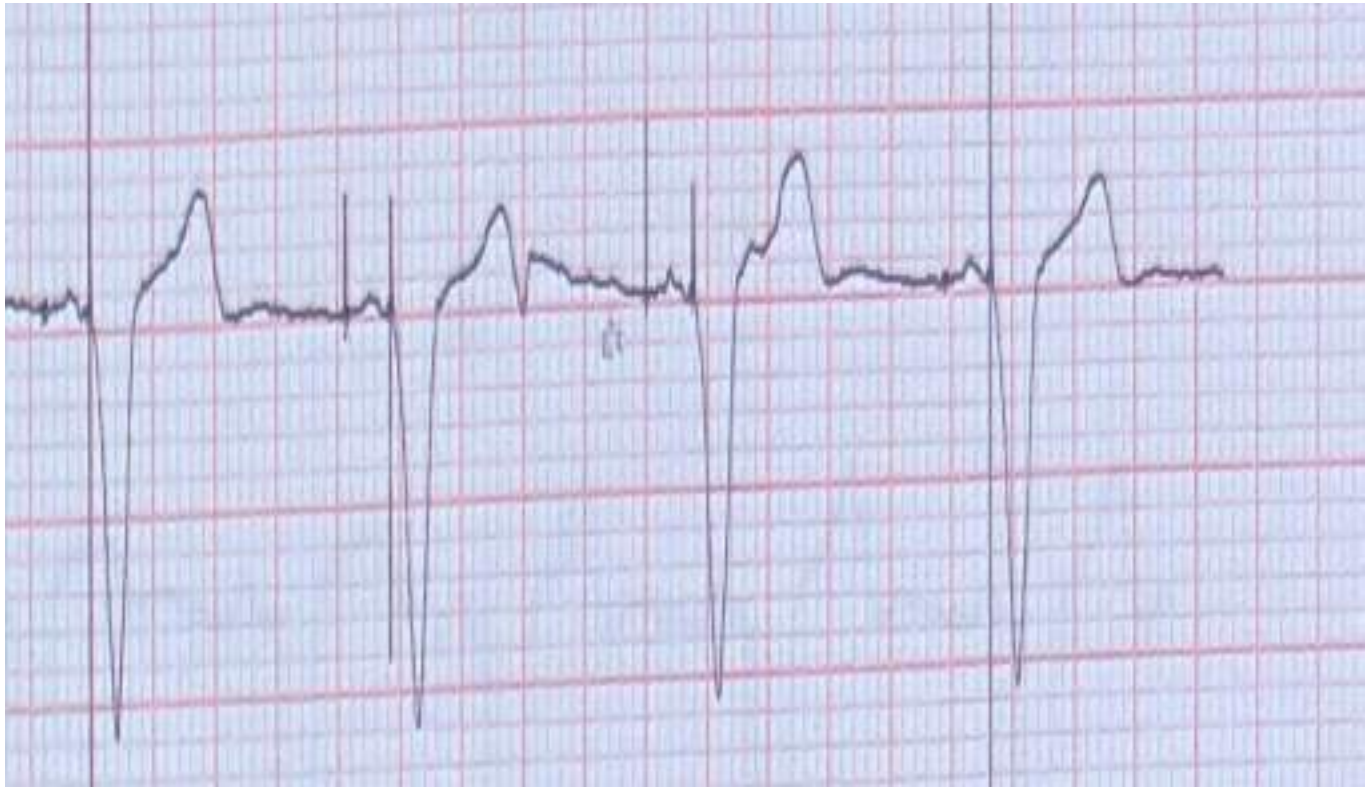



Paced
Unspecified
Department
Mr. Shamsuddin
On Morning ECG
25-05-25
@ 6:04 am
QRS Duration 172 ms
QT/QTc Interval 468/469 ms
P/QRS/T Axes 49/-89/93 deg
RV5/SV1 0.000/0.000 mV
RV5+SV1 0.000 mV
QTc:Hodges
Abnormal ECG
Unconfirmed Diagnosis
I
II
III
aVR
aVL
aVF
II
V1
V2
V3
V4
V5
V6



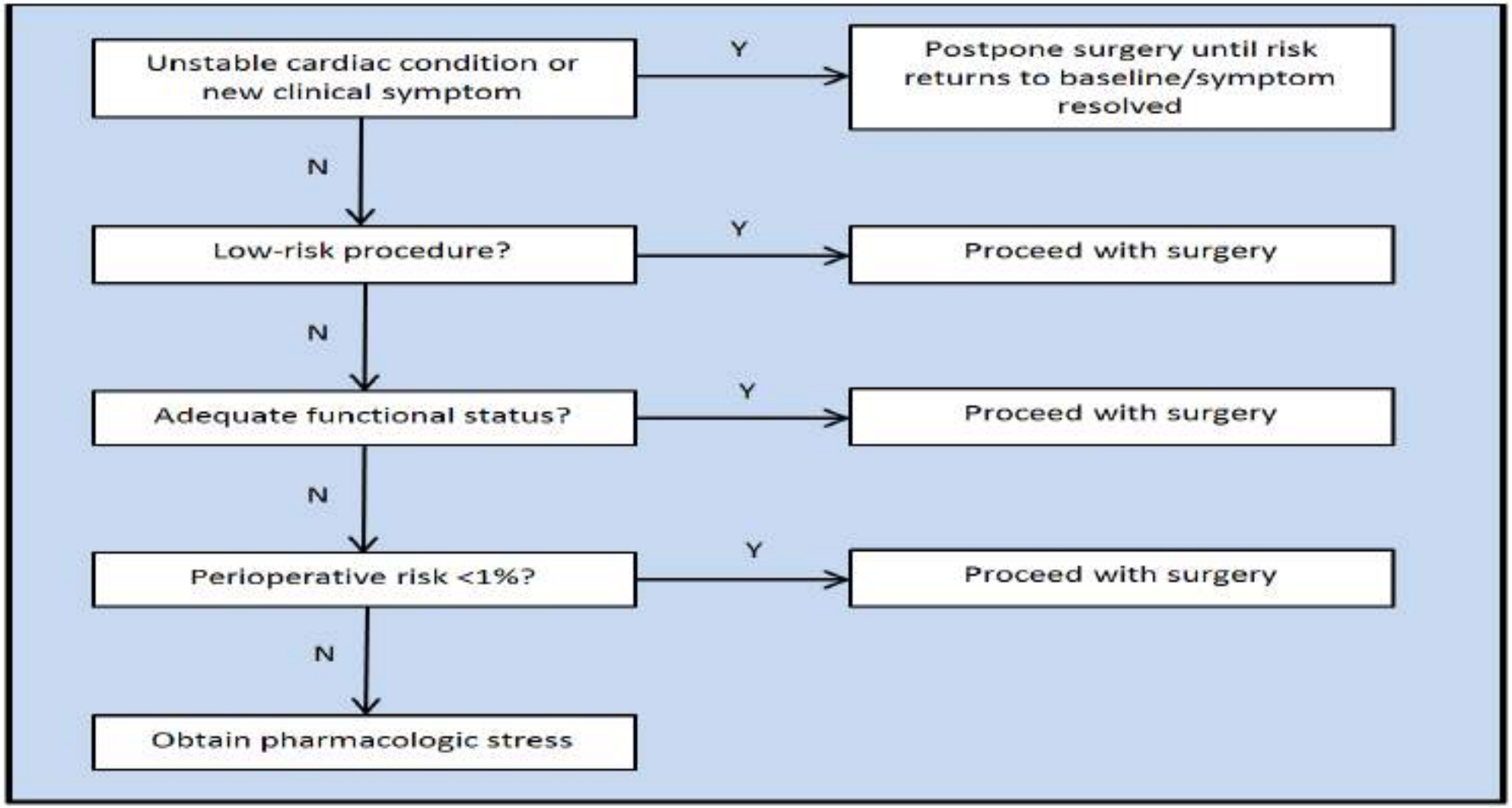
Now how safely hernia repair can be done after PPM?

- Is she on own rhythm?
- Battery longevity?
- Apply short period for diathermy
- Use bi-polar diathermy



- Can put magnet over PPM generator to prevent interference.

Cardiac interventions vs non cardiac surgery



Know your risk and control it

HTN

- Proper control of BP can prevent
- CAD 20-25%,Stro

DM

- Ensure pri
- Proper con

DL

- Reduction of LDL-C by 40 mg/dl can reduce ASCVD mortality by 20%

Well controlled HTN, DM, DL can prevent all cause mortality and morbidity by 50%

Take home message

- Perioperative MI is not uncommon and carries significant morbidity and mortality
- Control all potential co-morbidities particularly DM,HTN,Dyslipidaemia
- Assess functional status (METS)
- Calculate risk score (RCRI criteria is very simple, only 6 variable needed)
- Avoid perioperative fluid overload in valvular disease which can precipitate heart failure
- Avoid hypotension and hypoxia in IHD which can precipitate MI.

Reference

- ESC guideline 2025
- AHA/ACC guideline 2025
- Manual of Cardiovascular Medicine,5th edition (Brian P. Griffin)

Best wishes from Cardiologist

Thank you!

44 M waiting for cholecystectomy.

PMH: DCM from viral myocarditis 6 month ago

Meds: lisinopril and furosemide.
PE: BP 118/68; P 66.

Now: Dyspnea on lying flat, bibasilar creps and mild pedal edema . What should be ideal approach?

- Postpone surgery
- Increase dose of furosemide
- Repeat echo (EF< 40%)
- Add Fantastic four (BB,ARNI/ACEi/MRA/SGLT2i)

- Metabolic equivalent (MET) is a measure of the energy cost of physical activity as a multiple of the resting metabolic rate.

- One MET is defined as the rate of energy expenditure while sitting at rest, equivalent to 3.5 ml O2 per kg body weight per minute or 1 kcal/kg/hour

- METs are used to classify activities by intensity (e.g., light, moderate, vigorous) and to estimate calorie expenditure.

- **How METs are used**
- **Measuring energy cost:** METs represent how many times more energy an activity requires compared to resting. For example, a 6 MET activity means the activity requires six times the energy of sitting quietly.

- **Classifying activity intensity:**

  - **Light:** Less than 3.0 METs
  - **Moderate:** 3.0 to 6.0 METs
  - **Vigorous:** Greater than 6.0 METs

- **Estimating calorie burn:** You can estimate calories burned using the formula: METs x 3.5 x Body Weight (kg) / 200 = Kcal/min.

- **Examples of activities by MET value**
- **Light (<3.0 METs):**
  - Sitting at a desk: ~1.3 METs
  - Strolling (slowly): ~2.0 METs
  - Hatha yoga: ~2.5 METs
- **Moderate (3.0-6.0 METs):**
  - Housekeeping: ~3.5 METs
  - Brisk walking (3.5-4 mph): 5.0 METs
  - Swimming laps (leisurely): ~6.0 METs
- **Vigorous (>6.0 METs):**
  - Brisk walking (4.5 mph): ~6.3 METs
  - Singles tennis: ~8.0 METs
  - Running at 7 mph: ~11.5 METs
- **Important considerations**
- **Individual variation:** The 1-MET value is an average, and an individual's actual resting metabolic rate can vary based on age, fitness level, and body composition.
- **Intensity varies:** The MET value for a single activity can change depending on the specific intensity. For example, leisurely cycling is about 3.5 METs, while competitive mountain biking can be 16 METs.

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3.5 ml O2 per kg body weight per minute3.5 ml cap O sub 2 per kg body weight per minute
3.5 ml *O*2 per kg body weight per minute
or

1 kcal/kg/hour1 kcal/kg/hour
1 kcal/kg/hour
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