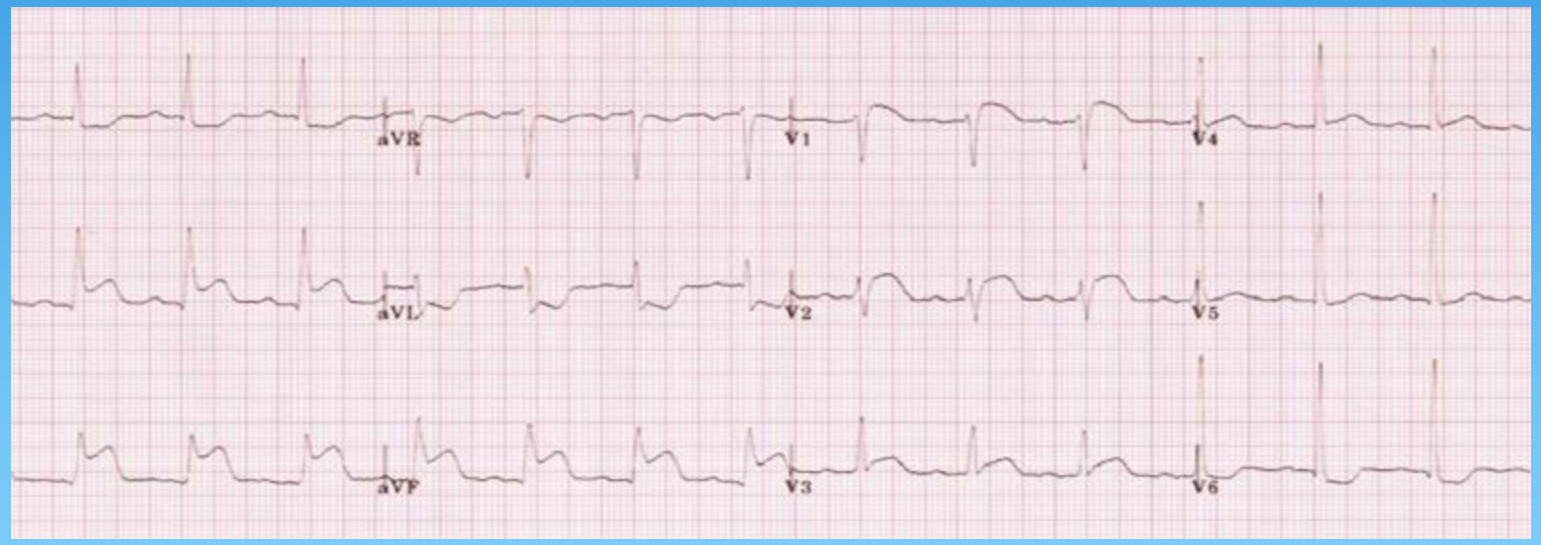
The Patient With Chest Pain



GP Webinar, Mater Hospital, North Sydney

Wednesday, 23 March, 2022

Dr Samuel Birch

Introduction

- Assessment of the patient with chest pain, including risk and differential diagnoses
- Indications for hospital and/or cardiology referral
- Current hospital pathways for patients with chest pain
- Investigation and management of patients with high risk chest pain
- Antiplatelet and anticoagulant use in patients with cardiac chest pain
- Investigation and management of patients with low to intermediate risk chest pain
- Current imaging modalities used in patients with low to intermediate risk chest pain

Learning Objectives

- To determine the risk level of a patient presenting with chest pain
- To appreciate how to exclude important non-ischaemic causes of chest pain
- To recognise indications for hospital and/or cardiology referral in patients with chest pain
- To develop an appreciation for the latest hospital pathways for management of patients with chest pain
- To implement appropriate investigations and management for the patient with low to intermediate risk chest pain
- To develop an understanding on investigations and management for the patient with high-risk chest pain
- To understand current usage of antiplatelets/anticoagulants in patients with cardiac chest pain
- To appreciate the advantages and disadvantages of stress echocardiography, CT coronary angiography, and myocardial perfusion scanning so as to manage appropriately the patient with low to intermediate risk chest pain

Case Study

- 83-year-old lady with gradually worsening breathlessness and mild chest pains
- Has had a recent hospital admission with breathlessness, shingles over the left side of her chest, a dislocated shoulder, and unilateral lower limb swelling on a background of osteoarthritis
- Background
  - Ex-smoker and overweight
  - RCA stent 2018
  - Hypertension
  - Moderate renal impairment (eGFR 31)
  - Mild asthma
  - Insulin resistance

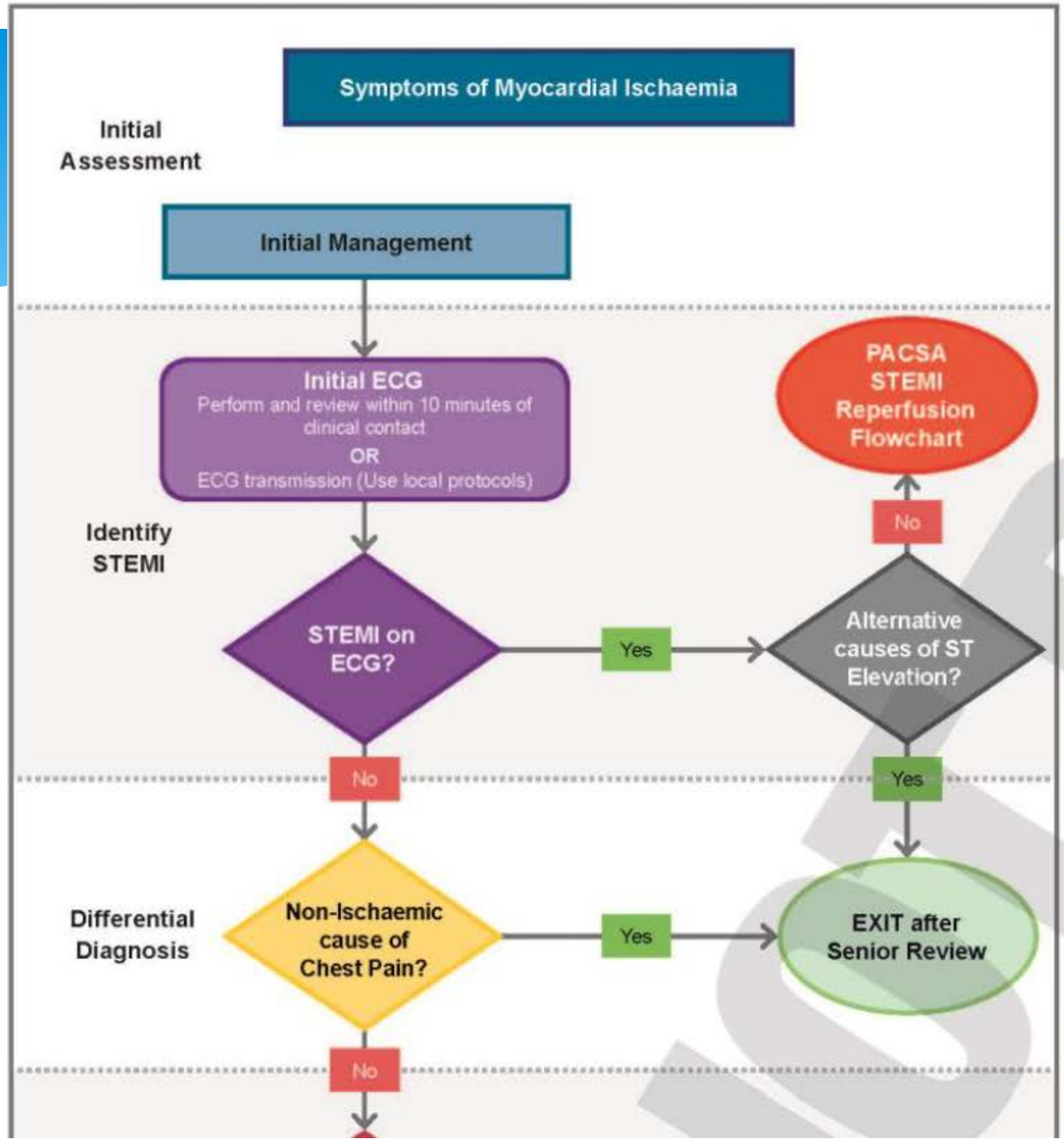
Case Study

- Stress echocardiogram normal 6 months ago
- HRCT not suggestive of interstitial lung disease and pulmonary function tests indicative of stable asthma control
- TTE demonstrated mild degenerative valvular heart disease but normal left ventricular size and systolic function

- Best next step in management?
  - Referral to dietitian
  - Send back to respiratory physician for sleep study
  - Coronary angiogram
  - VQ scan

Initial Approach to the Patient With Chest Pain

- Restricted rule-out (Murtagh's process), which involves considering the most likely causes as well as serious diagnoses that are less likely but still require exclusion, can be a helpful framework (Morgan et al., 2014, Australian Family Physician: Starting off in general practice – consultation skill tips for new GP registrars).
- Excluding life-threatening differential diagnoses initially is important. These include acute myocardial ischaemia, pulmonary embolus, aortic dissection, and pericarditis with large pericardial effusion
- Other important differential diagnoses in general practice include aortic stenosis, lung cancer, and upper gastrointestinal illnesses
- Initial ECG



Symptoms of Myocardial Ischaemia

Pain or tightness in chest, jaw, neck, left arm, right arm or epigastrium associated with symptoms of dyspnoea, diaphoresis or fatigue

Groups associated with atypical presentation

Female | People with diabetes | Elderly

High Risk Conditions

Central obesity, autoimmune or chronic renal disease, diabetes and HIV

Initial Management

Triage (Australasian Triage Scale): Vital signs and resuscitate
Aspirin 300mg (soluble) unless already given or contraindicated
ECGs at 0 and two hours, when repeating troponin and every 30 minutes if ongoing symptoms
GTN: caution if SBP<100mmHg and in right-sided and inferior infarcts
O_2 not required in stable patients if SpO_2 is greater than or equal to 93%
Bloods (including troponin), CXR, cardiac monitoring and analgesia

ECG STEMI Criteria

Ongoing Chest Pain

AND ST elevation of 1mm or more in 2 or more adjacent leads except V_2 and V_3 which require ST elevation of:
- 2.5mm or more in men under 40 years
- 2.0mm or more in men aged 40 years or over
- 1.5mm or more in women

OR Left bundle branch block and haemodynamically unstable
OR Left bundle branch block and haemodynamically stable with positive modified Sgarbossa criteria
OR Posterior infarct (ST depression V_1-V_3): needs posterior ECG
OR de Winter T waves V_2-V_6

Alternative causes of ST Elevation

Intracranial bleed	Ventricular paced rhythm	Early repolarisation
Previous AMI	Left bundle branch block	Cardiomyopathy
Pericarditis	Coronary vasospasm	Brugada syndrome
Myocarditis	Left ventricular hypertrophy	Wellens syndrome
Ventricular aneurysm	Takotsubo cardiomyopathy	Hyperkalaemia

Non-Ischaemic causes of Chest Pain

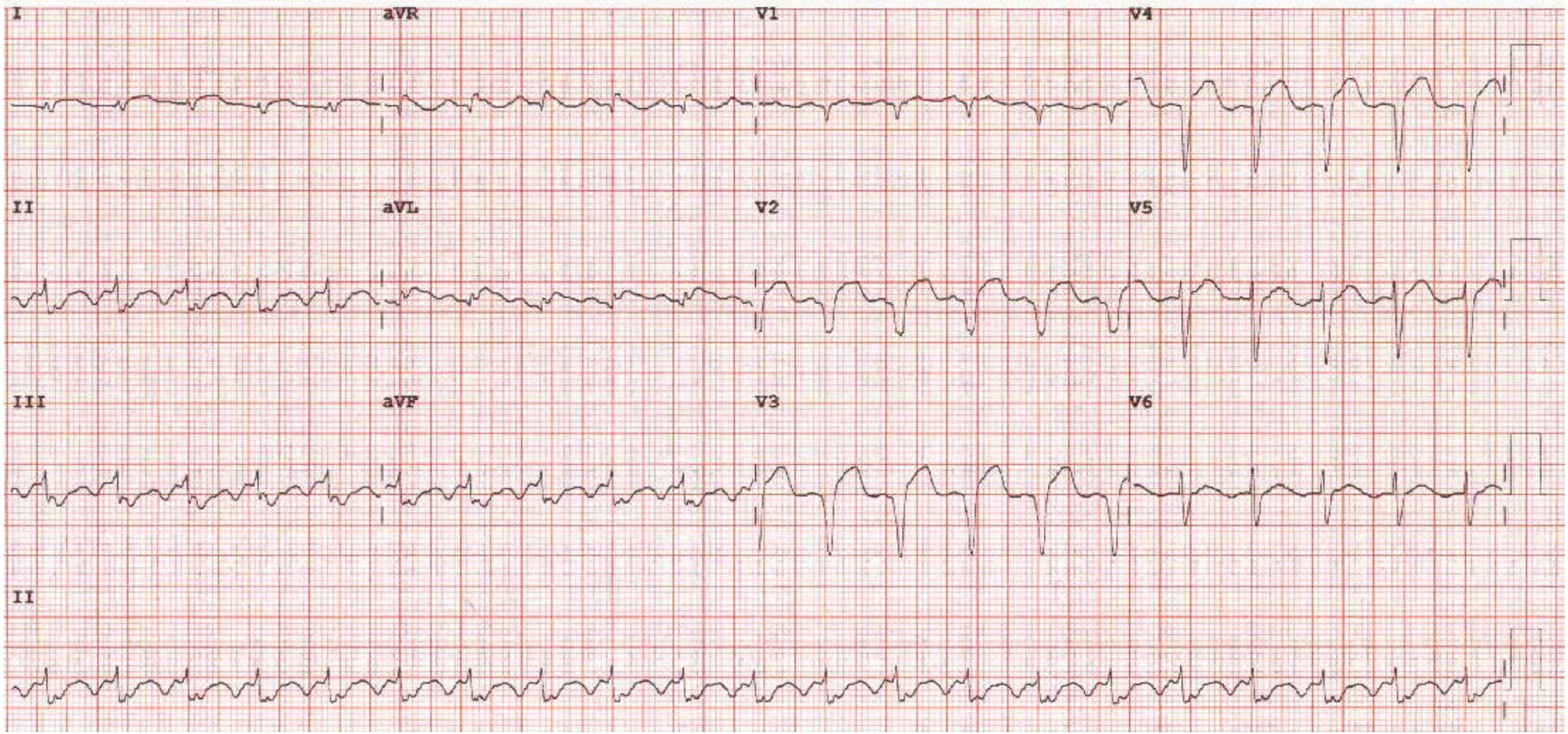
Aortic dissection	Pulmonary embolus	Gastrointestinal
Pericarditis	Trauma	Musculoskeletal

Case Study: Mr ED

- 63-year-old gentleman presenting to Secondary Hospital ED
  - Bilateral wrist pain with neck pain for about 2 weeks
- Background
  - Episode of supraventricular tachycardia in 2017
- Social
  - Lives with wife (ex-nurse)
  - Independent, works as ambulance cleaner
  - Heavy smoker (100 cigarettes/day)
  - Obese

Case Study: Mr ED

- Best next step in management?
  - Admit for exclusion of coronary artery disease (e.g. CTCA or coronary angiogram)
  - Panadol and referral for MRI cervical spine
  - Outpatient stress echocardiogram within the next month
  - Counsel patient to give up smoking, commence regular exercise regime, and dietary changes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V2
V5
III
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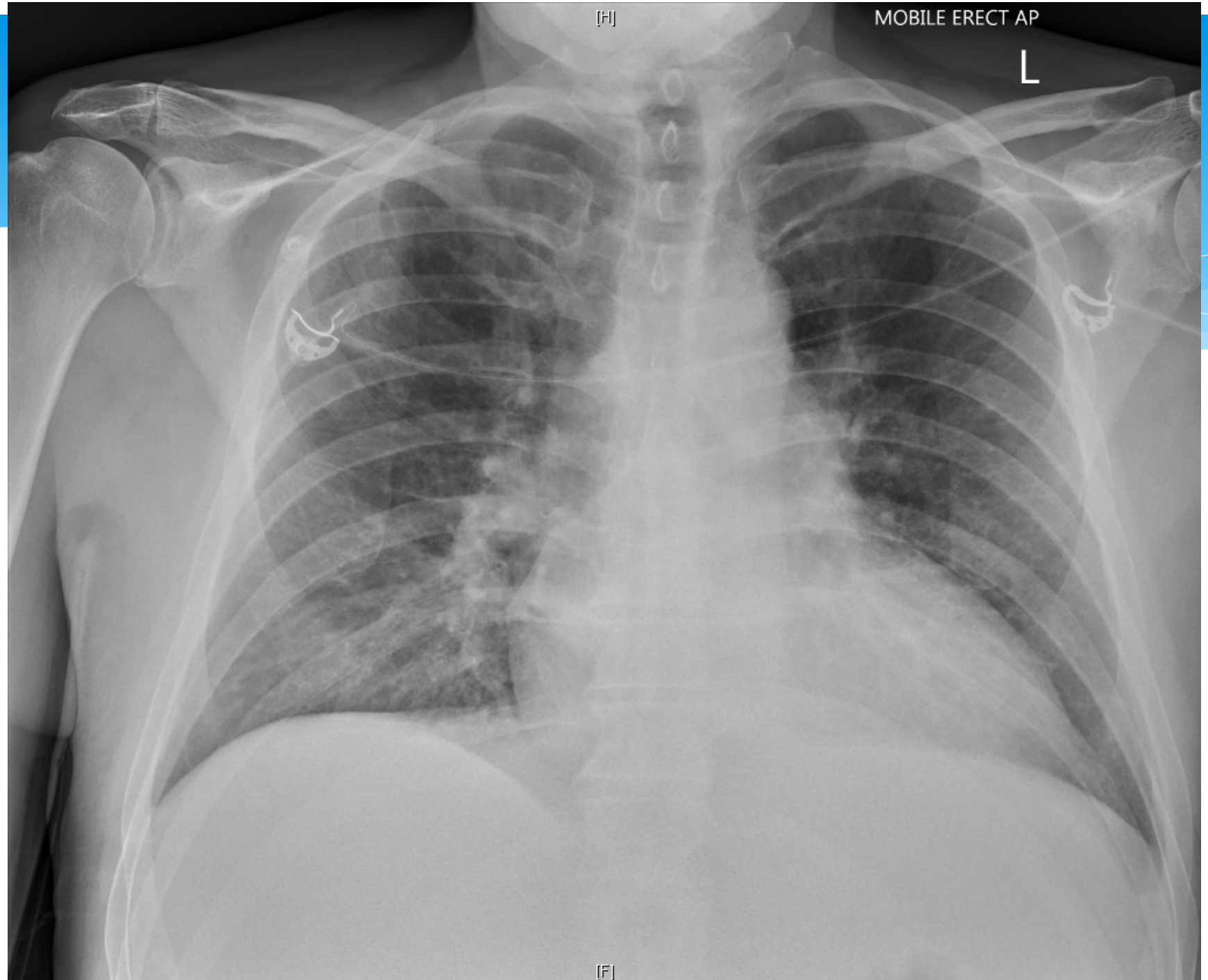
V3
V6
II

Case Study: Mr ED

- What does this ECG show and, therefore, what should be the best next step in management?
  - LBBB. Determine whether this is new or old before deciding on next step in management.
  - This is the most common ECG pattern in aortic dissection. Urgent CT chest.
  - Likely STEMI. Urgent cath lab activation.
  - Likely NSTEMI. Admit and perform serial troponins.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Case Study: Mr ED

- SOB and chest heaviness for about 3 days
- Patient loaded with aspirin and ticagrelor and sent urgently to Tertiary Hospital
  - Unable to lie flat, due to dyspnoea (did not appear significantly fluid overloaded)
  - Hypotensive
- Na 125, K 4.9, Bicarb 20, urea 9.6, Cr 121, eGFR 54, Mg 0.96
- Bilirubin 31, ALP 138, GGT 156, ALT 2974, AST 3703
- Troponin 19605
- WCC 11.6, Hb 131, Plt 172

Case Study: Mr ED

- Patient transferred to ICU → intubated, arterial line inserted
- Noradrenaline and adrenaline infusions started
- Episode of rapid atrial fibrillation → IV amiodarone commenced → reverted to sinus rhythm
- Angiogram performed

Case Study: Mr ED

- Worsening acidosis (pH 7.04 a few hours post angio), renal failure (Cr 186), and ischaemic hepatic injury (AST 7068, ALT 4360) in the setting of worsening inotrope requirements
- Discussion with RNS about ?CABGs → too unwell currently
- Discussion with St Vincent's Hospital → transfer to ICU for consideration of advanced heart failure therapies
- Despite worsening hypoperfusion, did not require ECMO for transfer

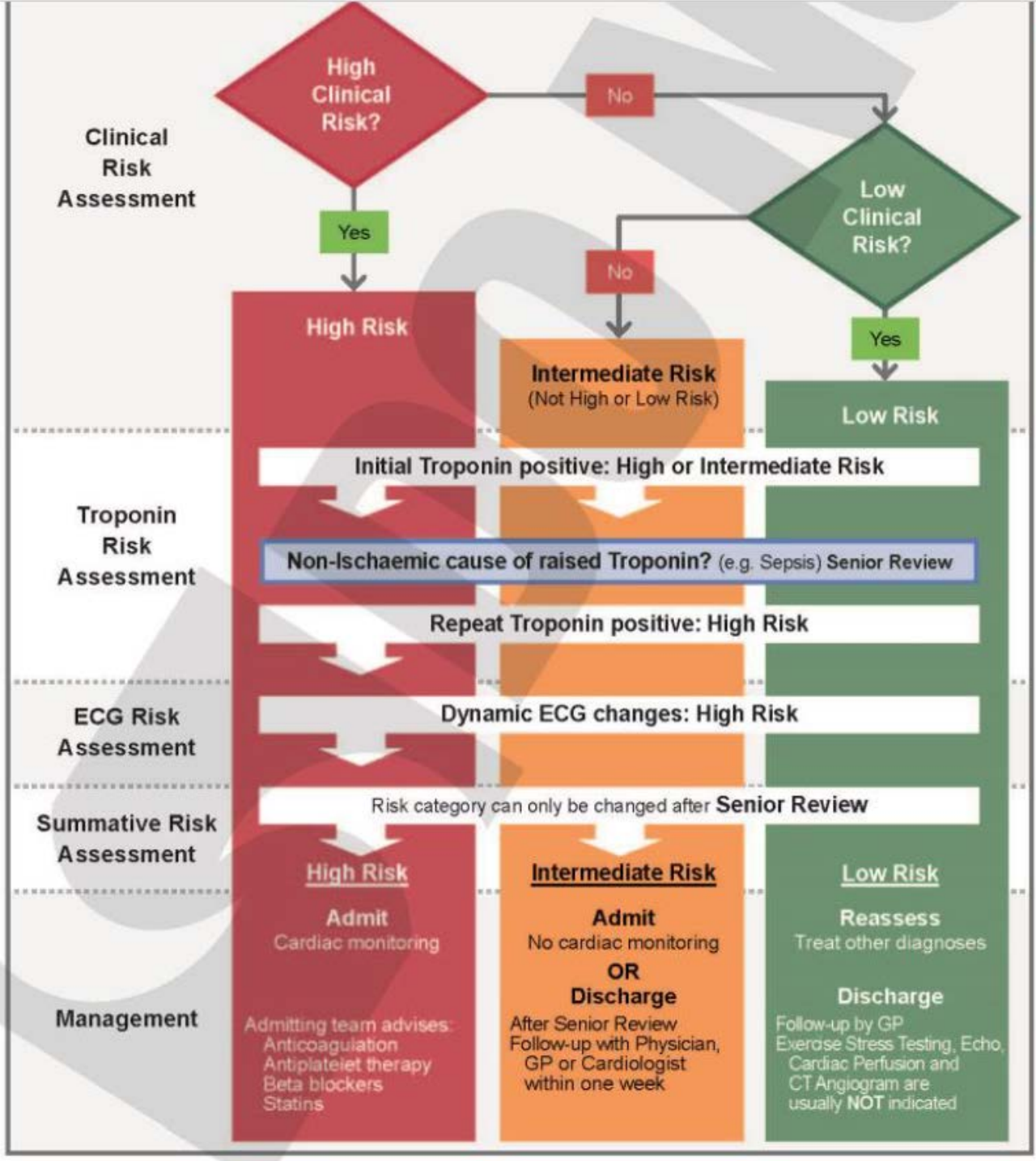
Stratifying Risk in Chest Pain

- High risk features
  - Dynamic ECG changes/VT
  - Elevated troponin
  - Syncope
  - Haemodynamic compromise
  - Ongoing symptoms despite treatment
  - Left ventricular failure
  - AMI, PCI, or CABG within the last 6 months
  - (Diabetes or chronic renal failure)

Stratifying Risk in Chest Pain

- Low risk features
  - Symptom-free with non-ischaemic ECGs AND
    - Age <45 years
    - Atypical symptoms
    - No known cardiac history
  - Low risk according to a validated risk score (e.g. EDACS of <16)
- A cardiac history >6 months ago, two or more risk factors, and age >65 is consistent with at least intermediate risk chest pain

Stratifying Risk in Chest Pain



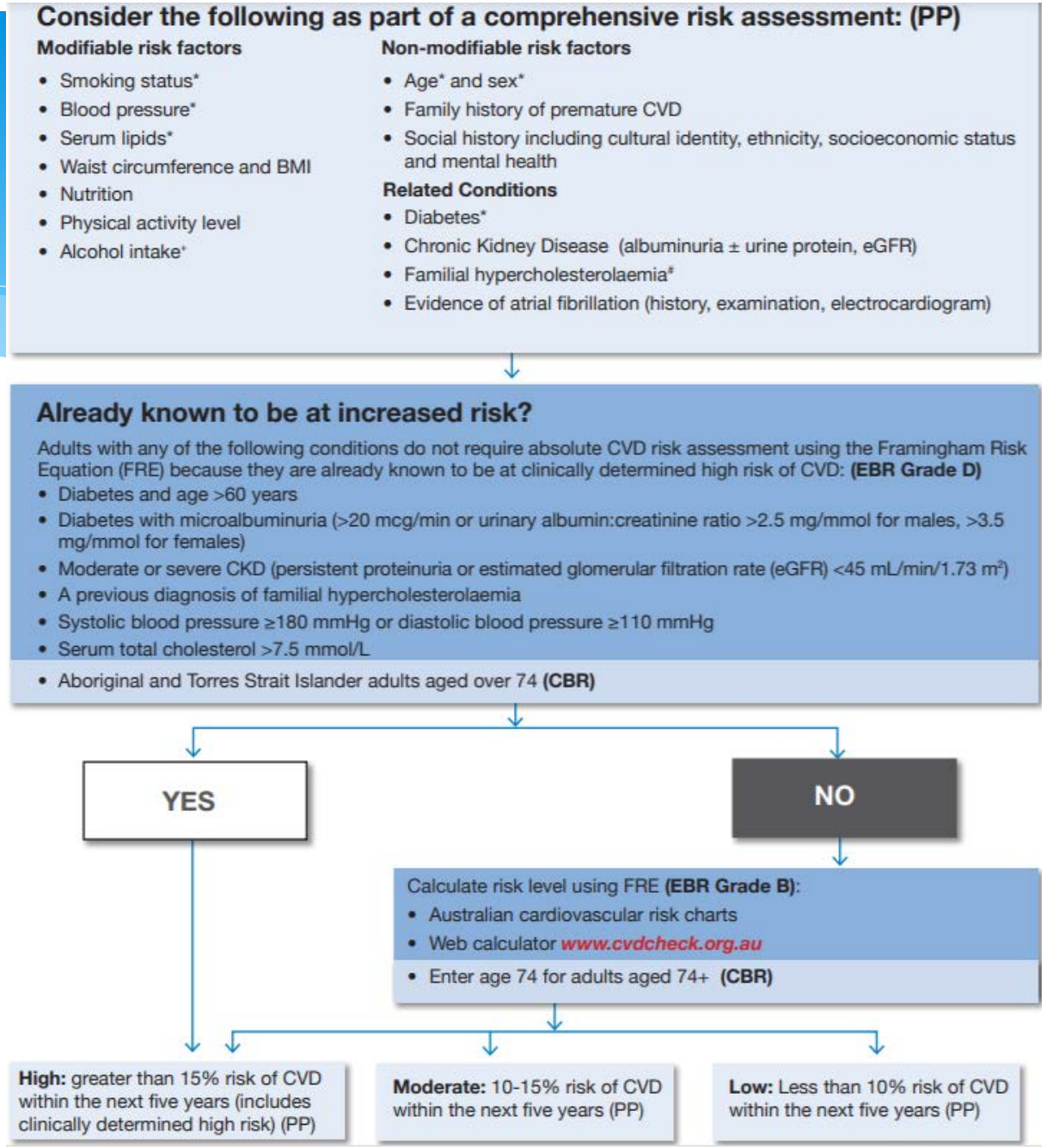
Assessment of Cardiovascular Risk

- Case study
  - 41-year-old gentleman with occasional chest pains
    - At rest, pinching in nature over different areas of his chest, and usually at rest
    - Total cholesterol 6.7 but normalized after commencement of atorvastatin. Pains also resolved after commencement of atorvastatin. States that he is under significant work stress (works from home as an IT consultant).
    - Mildly overweight
    - Subcontinental background but no known family history of ischaemic heart disease
    - Smoked for a few years when in his 20s. No other known cardiovascular risk factors. CVD risk of 2% in next 5 years.
    - Best next step in management?
      - Repeat lipid studies in 6 months' time
      - Outpatient CT calcium score
      - Refer to hospital
      - Outpatient cardiology referral

Assessment of Cardiovascular Risk

- Patients over the age of 40 or in high-risk groups require assessment of cardiovascular risk
- This includes the risk of ischaemic heart disease, cerebrovascular disease, peripheral arterial disease, and aortic disease
- In asymptomatic patients, assessment of risk includes assessment of risk factors and consideration of high-risk or special groups
- Several risk calculators for cardiovascular risk exist
  - Framingham risk score (5 year risk): e.g. https://www.cvdcheck.org.au/
  - ASCVD risk score (10 year risk)
  - QRISK lifetime cardiovascular (long term)

Assessment of Cardiovascular Risk



CT Calcium Score in Assessing Cardiovascular Risk

- MESA risk score and coronary artery calcium score
- A negative or very low calcium score (<10) can be used as a negative risk factor, particular in older patients with relative few risk factors apart from age
- When to use coronary artery calcium score?
  - Moderate risk patients
  - Less useful in many elderly patients
  - Assists in making decisions about statin therapy
- What does the score mean?

Table 1. Interpretation of coronary calcium score[3]

Calcium score	Interpretation	Risk of myocardial infarction/stroke at 10 years
0	Very low risk	<1%
1–100	Low risk	<10%
101–400	Moderate risk	10–20%
101–400 and >75th percentile	Moderately high risk	15–20%
>400	High risk	>20%

Stratifying Risk in Chest Pain

- Patients may have stable symptoms or may present with acute chest pain
- Patients with chest pain, particular those presents with acute chest pain, need to have their symptoms taken seriously
- Patients, particularly those in certain groups, can have atypical presentations for ischaemic heart disease
- Any factors that indicate high-risk chest pain necessitate hospital admission and consideration of coronary angiography (and many patients with acute intermediate risk chest pain require hospital admission and further investigation)
- CT coronary angiography is changing how patients with chest pain are assessed and managed in the outpatient and the inpatient setting
- Patients with ECG changes, troponin elevation, or past history of coronary artery disease are automatically high-risk and non-invasive testing should not be considered first-line for them

Stratifying Risk in Chest Pain

- High-risk chest pain or patient presents in chest pain → referral to hospital
- If coronary artery disease cannot be excluded as a cause of the chest pain, cardiology referral is required
- Low CVD risk score is not already reliable, particularly in the presence of symptoms

Investigations in Low to Intermediate Risk Chest Pain

- Investigation with troponin in the outpatient setting is generally not helpful. If it is being ordered, it may indicate that the patient is high-risk and waiting for troponin result may delay appropriate management in the meanwhile. GP-initiated troponin testing has been associated with poorer outcomes and should generally be avoided in the outpatient setting (although it may be helpful if vaccine-related myopericarditis is suspected)
- Patient setting (e.g. hospital, after review in cardiology practice) and ease of arranging investigation may affect which investigation is chosen as a means of determining whether the patient has significant coronary artery disease

Investigations in Low to Intermediate Risk Chest Pain

- Functional testing versus anatomical testing
- Exclusion of ischaemia (diagnostic) versus risk prediction (prognostic)
- Consider patient-specific factors and potential contraindications to certain tests
- Further management of these patients depends on results of investigations. If there is any doubt on functional non-invasive investigations, further investigation with CTCA or invasive coronary angiogram is warranted.
- Non-obstructive coronary plaque on CTCA or invasive coronary angiography is usually an indication for aggressive risk factor modification and treatment with lipid-lowering agents and aspirin.
- Obstructive disease on CTCA generally requires further investigation on invasive coronary angiography with an outcome of percutaneous coronary intervention, medical therapy, or coronary artery bypass grafting depending on the findings obtained.

Case Study

- History
  - 53 yo woman with palpitations, mild breathlessness on exertion, and occasional “niggles” in her chest for the last few weeks
  - She experiences the “niggles” over the centre of her anterior chest generally at rest
  - Also having headaches, nausea, and dizziness

Case Study

- Background
  - Only mildly overweight
  - Admits her diet is excessively high in carbohydrates and cheese
  - Exercises regularly by playing tennis, which she is still able to do
  - Non-smoker
  - Father had an AMI at the age of 83, but otherwise denies any family history of ischaemic heart disease
  - Recent blood tests: total cholesterol 7.4mmol/L, LDL 5.0mmol/L, fasting glucose 4.8mmol/L, HbA1c 5.4%
  - CVD risk assessment based on Framingham risk score = 4% (low-risk)
  - Medications: nil regular

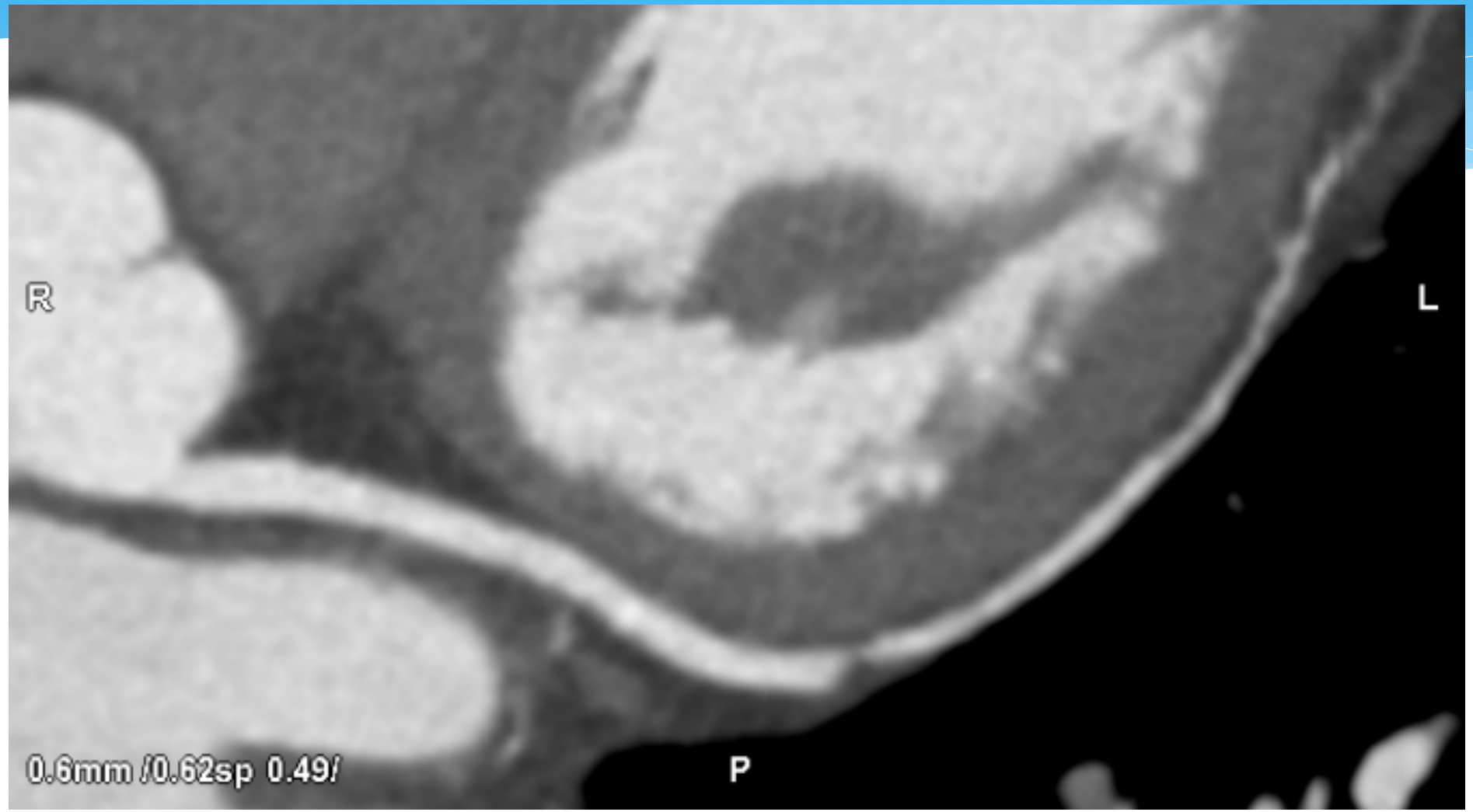
Case Study

- Investigations
  - 12 lead ECG: normal sinus rhythm at 70bpm
  - Stress echocardiogram:
    - ECG: horizontal ST depression in the inferior leads (1-2mm deep)
    - Echo: normal

Case Study

- Investigations
  - CTCA (patient had ongoing symptoms at this stage):
    - Calcium score: 5 (70th percentile) due to LAD disease
    - LMCA: normal
    - LAD: <25% stenosis in proximal and mid vessel
    - LCX: non-dominant vessel; main vessel is normal but OM1 has 50-60% ostial stenosis
    - RCA: dominant vessel; normal

Case Study



Case Study

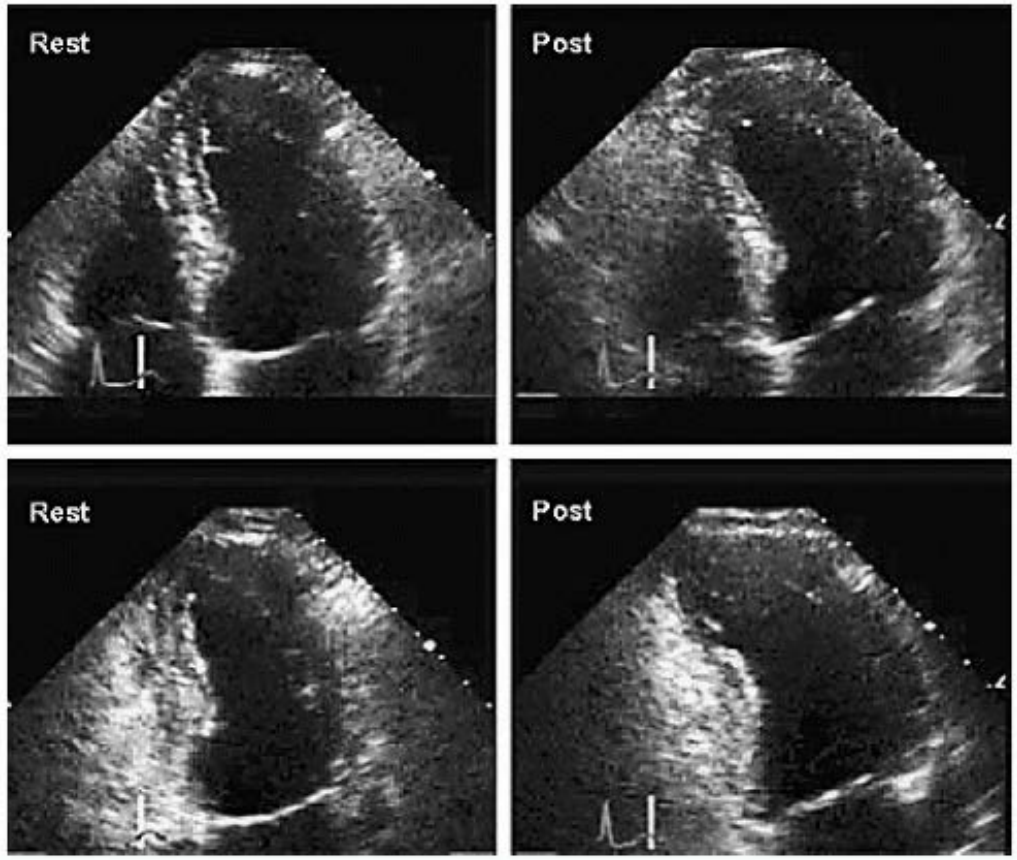
- Coronary angiogram
  - Minor disease in LAD
  - 80% ostial/proximal stenosis of OM1
  - Otherwise, normal coronary arteries
  - OM1 stented with 2 drug-eluting stents

Case Study

- Progress
  - Commenced on aspirin and rosuvastatin after abnormal CTCA finding

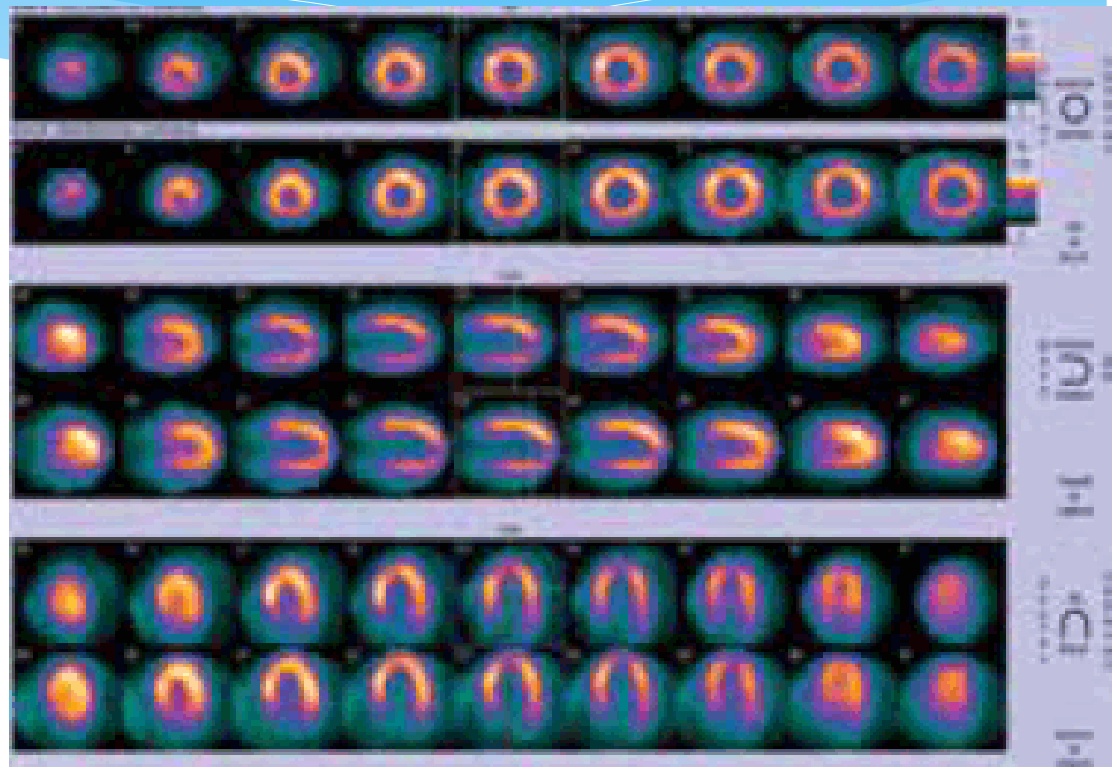
Stress Echocardiography

- What the test involves
  - Treadmill or bicycle exercise, ECGs, pre and post exercise echocardiography
  - Superior in sensitivity and specificity to stress ECG, which is rarely used in cardiology practices now
- Advantages
  - Good sensitivity and specificity
  - Information on patient symptoms and exercise capacity
  - 7 or more METs is indicative of a good surgical outcome
  - Functional information not provided by CTCA
  - Cost-effective and convenient
  - Higher specificity than myocardial perfusion imaging
- Disadvantages
  - Exercise component (although dobutamine stress echocardiography may be used)
  - Operator and heart rate dependent
  - Does not detect non-haemodynamically significant coronary artery disease



Myocardial Perfusion Imaging

- What the test involves
- Advantages
  - Can be performed without exercise
  - Information on left ventricular function
  - Many scanners do allow detection of coronary calcification
- Disadvantages
  - Impacted by body habitus
  - Balanced ischaemia
  - Diaphragmatic artefact
  - Does not detect non-haemodynamically significant coronary artery disease
  - Time-consuming and labour intensive



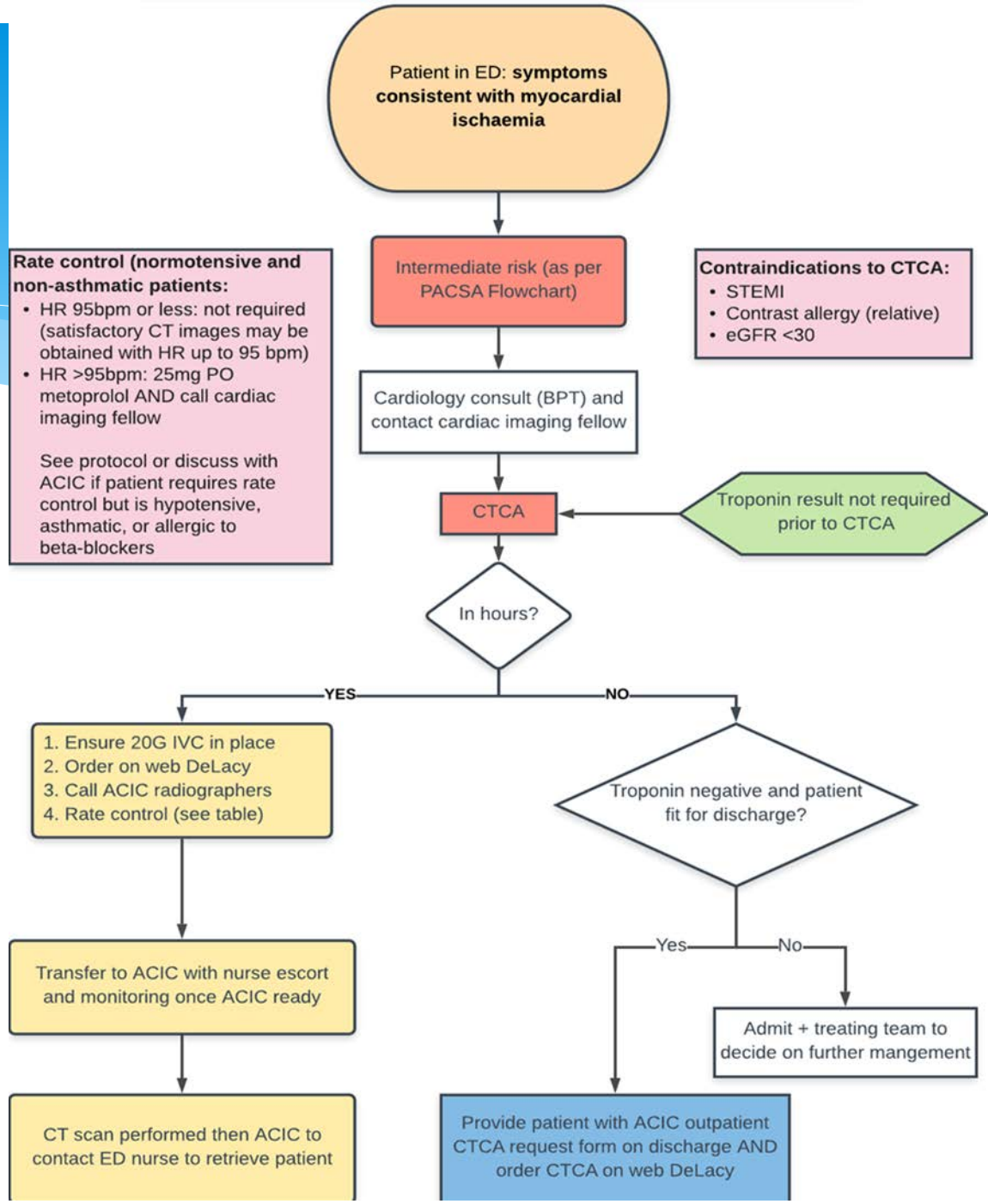
CT Coronary Angiography

- MBS indications include:
  - Patient has stable or acute symptoms consistent with coronary ischaemia, is at low to intermediate risk, and has no significant biomarker elevation or ECG changes indicating acute ischaemia
  - Patient requires exclusion of coronary artery anomaly or fistula
  - Patient will undergo non-coronary cardiac surgery
  - Patient has stable symptoms and newly recognised left ventricular systolic dysfunction of unknown aetiology
- What the test involves
  - CT scan with IV contrast
  - Appropriate CT scanner, gating, and interpretation (software and reporter) are required (i.e. a radiology facility having a CT scanner is not synonymous with a radiology facility being able to perform a CTCA on a patient)

CT Coronary Angiography

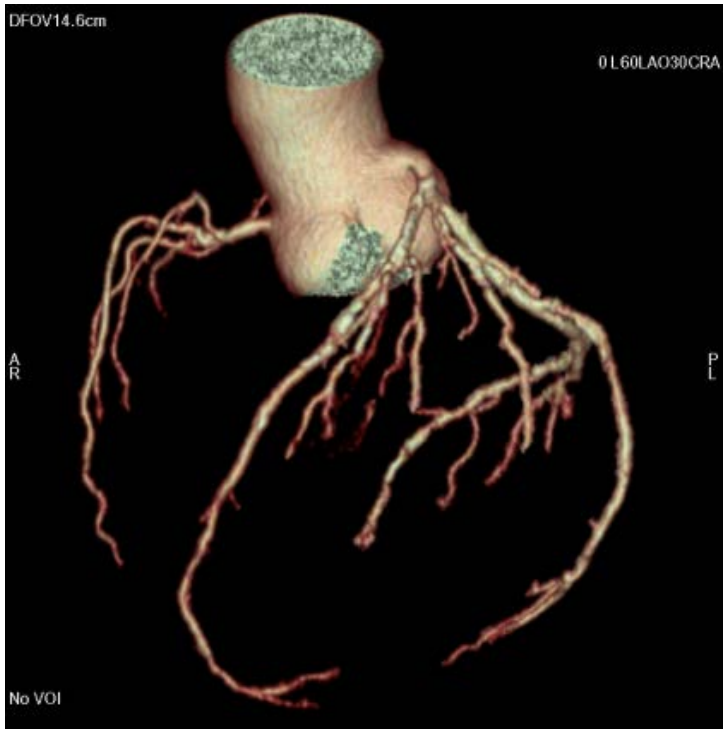
- Advantages:
  - Diagnostic and prognostic data
  - Quick and useful for facilitating quick discharge of patients from hospital (increasing use in emergency departments)
  - Does not require exercise
  - High negative predictive value
  - Very good sensitivity with good specificity
- Disadvantages
  - Difficult in patients with a high burden of calcium
  - As it is not a functional test, assessment of haemodynamic significance of coronary lesions can sometimes be difficult
  - Contrast use in patients with renal impairment or iodine allergy
  - Heart rate dependent and requires good radiographers who are well-trained in this

CT Coronary Angiography



Results of CT Coronary Angiography

- No coronary artery disease detected
- <50% stenosis
- 50-75% stenosis
- >75% stenosis



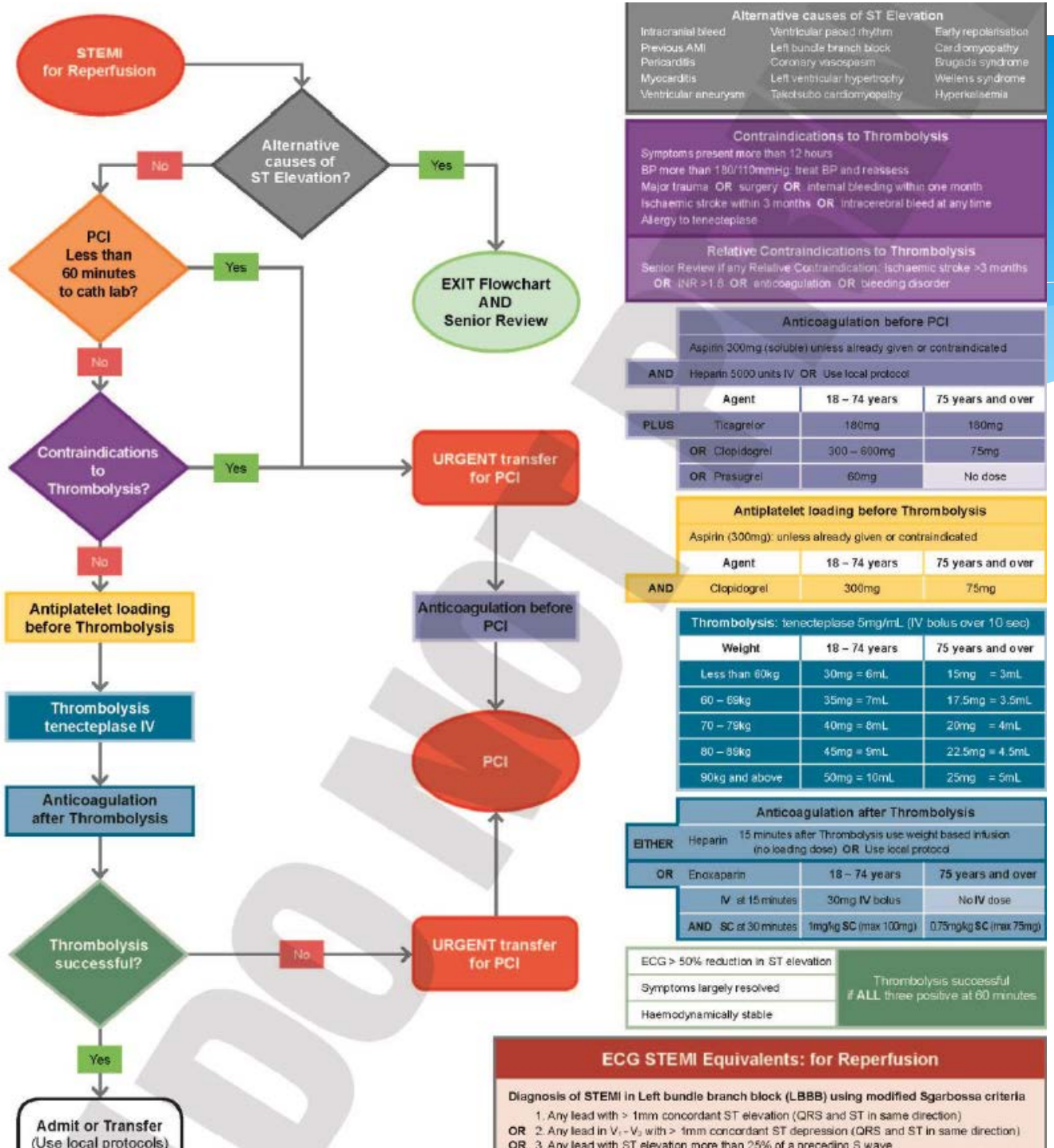
Other Uses for Cardiac CT Scanning

- Long term risk prediction
- Assessment of coronary arteries in patients undergoing non-coronary cardiac surgery
- Exclusion of coronary anomalies
- Assessment of patients with arrhythmias, heart failure, or cardiomyopathy
- Transplant patients
- Assessment prior to ablation
- Assessment for non-surgical valve procedures

Investigation/Management of High Risk Chest Pain

- Aspirin loading, GTN, supplemental oxygen (if SaO_2 92% or less), and further analgesia if required while awaiting transfer to hospital (GP setting)
- Cardiology admission to monitored bed, serial troponin measurements (2 hours apart, according to latest guidelines), and serial ECGs
- STEMI pathway with cath lab activation and/or thrombolysis is protocol driven, although it does depend on the patient setting
- NSTEACS pathway is more individualized to patient and hospital

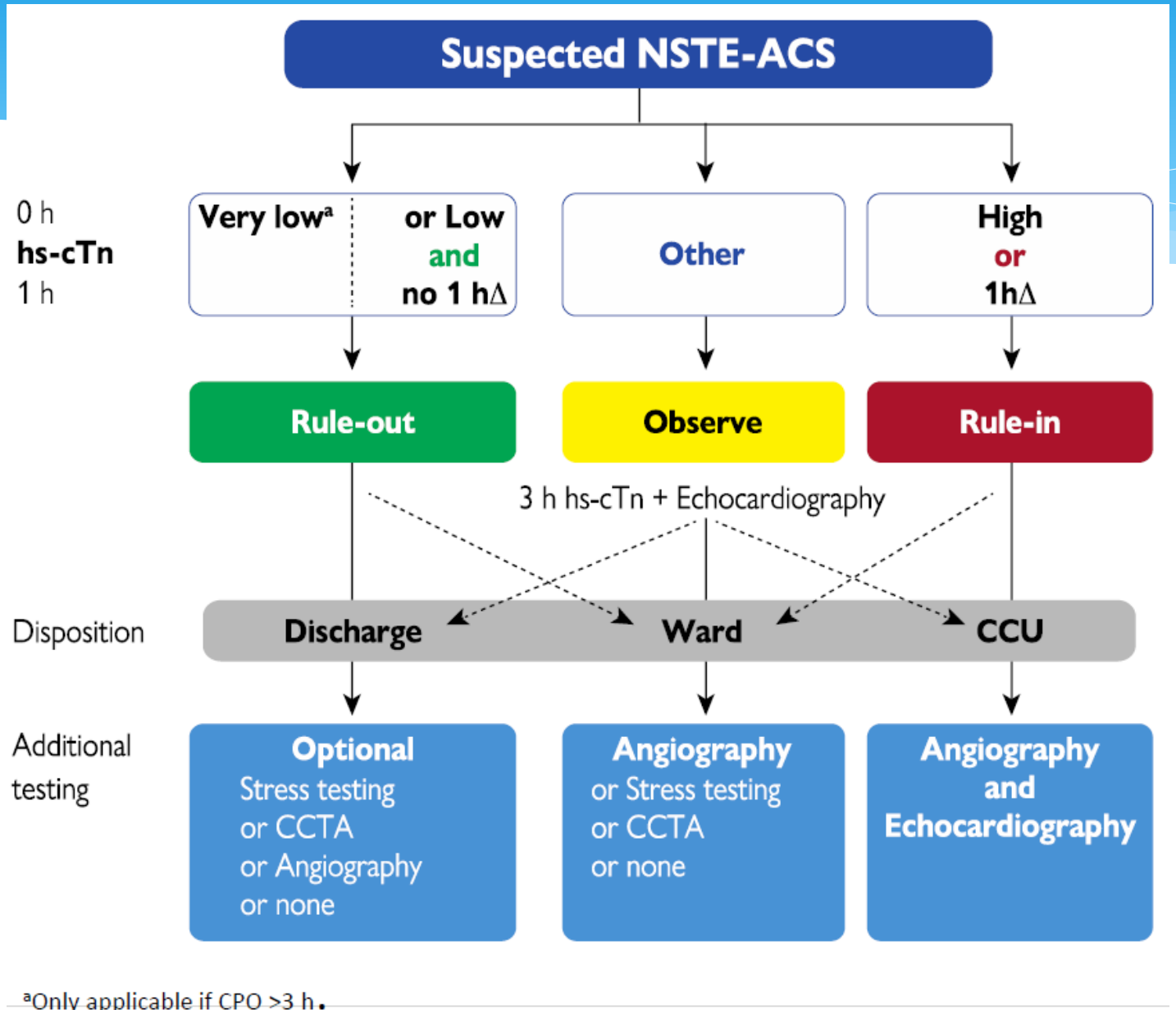
STEMI Pathway



Investigation/Management of High Risk Chest Pain

- Although invasive coronary angiography was the almost solely the investigation used in these patients, CTCA is now sometimes used in practice in certain cases because of its accuracy, speed of use, and high negative predictive value
- Management with antiplatelet therapy, anticoagulation, beta-blockers, and statin depending may be considered while waiting for definitive diagnosis

Investigation/Management of High Risk Chest Pain



[a]Only applicable if CPO >3 h.

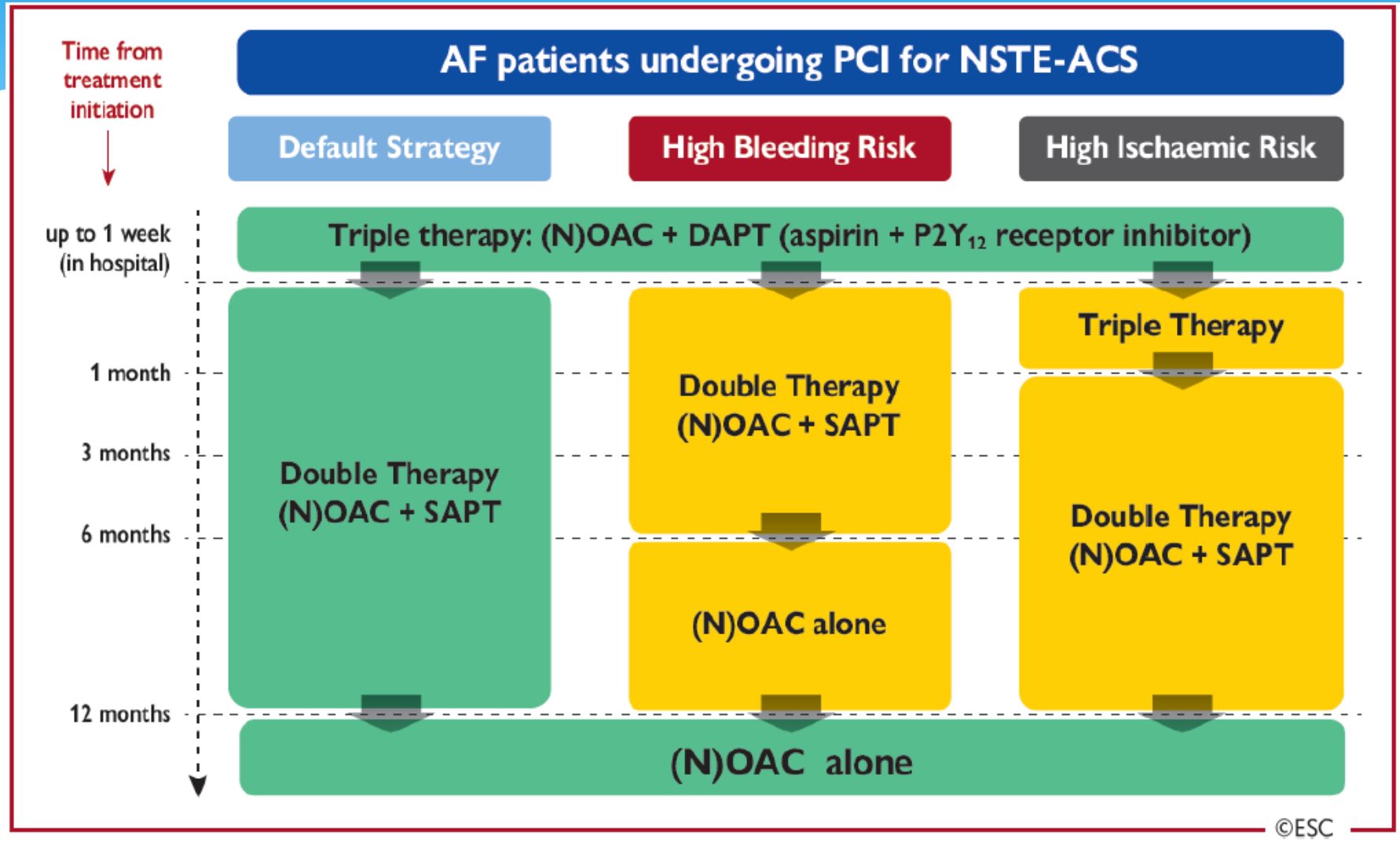
Antiplatelet/Anticoagulation Therapy in High Risk Chest Pain

- Aspirin + P2Y12 inhibitor (ticagrelor, prasugrel, or clopidogrel) in NSTEMI or STEMI. Clopidogrel may be preferable in the elderly due to the lower risk of bleeding complications.
- DAPT for 6 months followed by aspirin monotherapy is permissible and newer trials are indicating ticagrelor monotherapy or even aspirin monotherapy at 1 month may considered in some low-risk patients if required (but only after cardiology advice)
- Ongoing refinement of guidelines for patients who have undergone stenting who have AF. After 12 months, NOAC monotherapy is now preferred in many guidelines unless ischaemia risk is high.

Antiplatelet/Anticoagulation Therapy in High Risk Chest Pain

- Recent changes to international guidelines:
  - First troponin then second troponin at 1 or 2-hours post
  - Patients with high-risk NSTEACS, including NSTEMI, should have angiogram within 24 hours of presentation
  - DAPT duration in NSTEMI depends on bleeding risk (very high = 1 month, high = 3 months, low 6 or 12 months)
  - Antithrombotic therapy in AF with NSTEMI depends on bleeding risk and ischaemia risk (routine = DAPT in hospital, SAPT 12 months, then NOAC alone; high bleeding risk = DAPT in hospital, SAPT 6 months, then NOAC alone; high ischaemia risk = triple therapy 1 month, NOAC and SAPT until 12 months, then NOAC alone)

Anticoagulant/Antiplatelet Therapy in High Risk Chest Pain



Green (Class I)
yellow (Class IIa)

Summary

- Referral to hospital in patients with high-risk features or ongoing chest pain or else referral for cardiology review in other patients with chest pain is important in the outpatient setting
- Management pearls:
  - Consider dangerous differential diagnosis
  - Do not delay management of patients who have high-risk features or multiple risk factors
  - Stress echocardiography may be less sensitive in practice than trials suggest; a low threshold for CTCA is important
- Imaging options in low to intermediate risk chest pain include stress echocardiography (and not simply stress ECG), myocardial perfusion imaging, and CTCA and these have different advantages and disadvantages, although guidelines tend to moving away from stress echocardiography somewhat and more to CTCA
- There may be a greater opportunity for reducing antiplatelet duration in certain settings, but only after cardiology consultation and only if patient is not high-risk for further ischaemia

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References

- Up to Date: Cardiac imaging with computed tomography and magnetic resonance in the adult
- Up to Date: Clinical use of coronary computed tomographic angiography
- Up to Date: Evaluation of emergency department patients with chest pain at low or intermediate risk for acute coronary syndrome
- Up to Date: Noninvasive testing and imaging for diagnosis in patients at low to intermediate risk for acute coronary syndrome
- Up to Date: Selecting the optimal cardiac stress test
- https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.racgp.org.au%2Fafp%2F2013%2Faugust%2Fmyocardial-perfusion-scans%2F&psig=AOvVaw3gTe11O1tKUddMAJzFIw0v&ust=1634790643508000&source=images&cd=vfe&ved=0CAwQjhxqFwoTCODjvfGT2PMCFQAAAAAdAAAAABAI
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