Stable Angina Pectoris

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Prevalence

	45-64 yrs	65-84 yrs
Women	5-7%	10-12%
Men	4-7%	12-14%

Prognosis

	Per year
Total mortality	1.2-2.4%
Cardiac mortality	0.6-1.4%
Non-fatal myocardial infarction	0.6-2.7%

Table 3 Main features of stable coronary artery disease

Pathogenesis
Stable anatomical atherosclerotic and/or functional alterations of epicardial vessels and/or microcirculation

Natural history
Stable symptomatic or asymptomatic phases which may be interrupted by ACS

Eur Heart J 2013;34:2949

Clinical presentations

Effort induced angina caused by:

- epicardial stenoses;
- microvascular dysfunction;
- vasoconstriction at the site of dynamic stenosis;
- combination of the above.

Rest angina caused by:

- Vasospasm (focal or diffuse)
  - epicardial focal;
  - epicardial diffuse;
  - microvascular;
  - combination of the above.

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Asymptomatic:

- because of lack of ischaemia and/or of LV dysfunction;
- despite ischaemia and/or LV dysfunction.

Ischaemic cardiomyopathy

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Stable angina:
three major steps for decision-making

1) Assess the probability of stable angina
2) Non-invasive testing to confirm diagnosis in pats. w. an intermediate probability (15 – 85%) of the disease
3) Risk assessment for decision to proceed to coronary angiography


It's the
history
Stupid!

Traditional clinical classification of chest pain

Typical angina (definite)	Meets all three of the following characteristics: • substernal chest discomfort of characteristic quality and duration; • provoked by exertion or emotional stress; • relieved by rest and/or nitrates within minutes.
Atypical angina (probable)	Meets two of these characteristics.
Non-anginal chest pain	Lacks or meets only one or none of the characteristics.

This slide corresponds to Table 4 in the full text.

Eur Heart J 2013;34:2949–3003. doi:10.1093/eurheartj/eht296

Stable angina: history

- Symptoms induced by physical and/or emotional stress
  - Pain, pressure in the chest often with radiation to arms, back, throat or jaws
  - dyspnoe, fatigue, ”nedsatt ork”, ”tar emot” = anginaekvivalenter
  - asymptomatic = silent ischemia
  - relief of symptoms after sublingual nitroglycerin
- Functional class(CCS)

Non-anginal chest pain

- Musculoskeletal
  - Neck, back, shoulders, thorax, Tietze's syndrome
- Gastroesofageala sjukdomar
  - GERD, oesophagitis, oesophageal dysfunction
- Neurological disorders
  - Cervical disk prolapse, thoracic root impingement (rizopati), intercostal neuralgia
- Pulmonary disease
  - Astma/KOL, other
- Functional or psychiatric disorders

Classification of angina severity according to the Canadian Cardiovascular Society

Class I	**Ordinary activity does not cause angina such as walking and climbing stairs.** Angina with strenuous or rapid or prolonged exertion at work or recreation.
Class II	**Slight limitation of ordinary activity.** Angina on walking or climbing stairs rapidly, walking or stair climbing after meals, or in cold, wind or under emotional stress, or only during the first few hours after awakening. Walking more than two blocks on the level and climbing more than one flight of ordinary stairs at a normal pace and in normal conditions.
Class III	**Marked limitation of ordinary physical activity.** Angina on walking one to two blocks[a] on the level or one flight of stairs in normal conditions and at a normal pace.
Class IV	**Inability to carry on any physical activity without discomfort,** angina syndrome may be present at rest.

[a]Equivalent to 100–200 m.

This slide corresponds to Table 5 in the full text.

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CCS classification

Proceed directly to angiography if:

- Severe angina at low levels of exercise (CCS class III)
- Clinical constellation indicating high risk

Revascularization based on the result of fractional flow reserve.

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Anamnes - stabil angina

- Limitations in daily living
  - Leasure, work
  - Angina vs other limitations
- Cardiovascular riskfactors
  - Detailed assessment is crucial for management of the patient!
- Other disease
  - Contributory or causal
  - Important to take into account during assessment and management

Stable angina, initial assessment

- EKG
- Blood tests
- Echocardiography

Stable angina, initial assessment

EKG:

- Most often no abnormalities
- Previous MI
- LBBB, RBBB
- LVH
- AV-block
- Arrhythmias (atrial fibrillation)

Blood tests in assessment of patients with known or suspected SCAD in order to optimize medical therapy

Recommendations	Class	Level
If evaluation suggests clinical instability or ACS, repeated measurements of troponin preferably using high sensitivity or ultrasensitive assays are recommended to rule out myocardial necrosis associated with ACS.	I	A
Full blood count including haemoglobin and white cell count is recommended in all patients.	I	B
It is recommended that screening for potential T2DM in patients with suspected and established SCAD is initiated with HbA_{1c} and fasting plasma glucose and that an OGTT is added if HbA_{1c} and fasting plasma glucose are inconclusive.	I	B
Creatinine measurement and estimation of renal function (creatinine clearance) are recommended in all patients.	I	B
A fasting lipid profile (including LDL) is recommended in all patients.	I	C
If indicated by clinical suspicion of thyroid disorder assessment of thyroid function is recommended.	I	C
Liver function tests are recommended in patients early after beginning statin therapy.	I	C
Creatine kinase measurements are recommended in patients taking statins and complaining of symptoms suggestive of myopathy.	I	C
BNP/NT-proBNP measurements should be considered in patients with suspected heart failure.	IIa	C

ACS = acute coronary syndrome; BNP = B-type natriuretic peptide; HbA_{1c} = glycated haemoglobin; LDL = low-density lipoprotein; NT-proBNP = N-terminal pro B-type natriuretic peptide; SCAD = stable coronary artery disease; T2DM = type 2 diabetes mellitus.
This slide corresponds to Table 6 in the full text.

Eur Heart J 2013;34:2949–3003. doi:10.1093/eurheartj/eht296

Echocardiography

Recommendations	Class	Level
A resting transthoracic echocardiogram is recommended in all patients for: a) exclusion of alternative causes of angina; b) identification of regional wall motion abnormalities suggestive of CAD; c) measurement of LVEF for risk stratification purpose; d) evaluation of diastolic function.	I	B
Ultrasound of the carotid arteries should be considered to be performed by adaequately trained clinicians to detect increased IMT and/or plaque in patients with suspected SCAD without known atherosclerotic disease.	IIa	C

CAD = coronary artery disease; IMT = intima-media thickness; LVEF = left ventricular ejection fraction; SCAD = stable coronary artery disease.

This slide corresponds to Table 9 in the full text.

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Stable angina

Diagnostic testing, i.e. confirmation of inducable myocardial ischemia

Decisions are based on:

Pre Test Probability (PTP)

Sensitivity and specificities of tests

Clinical pre-test probabilities[a] in patients with stable chest pain symptoms

	Typical angina		Atypical angina		Non-anginal pain	
Age	Men	Women	Men	Women	Men	Women
30-39	59	28	29	10	18	5
40-49	69	37	38	14	25	8
50-59	77	47	49	20	34	12
60-69	84	58	59	28	44	17
70-79	89	68	69	37	54	24
>80	93	76	78	47	65	32

[a] Probabilities of obstructive coronary disease shown reflect the estimates for patients aged 35, 45, 55, 65, 75, and 85 years. This slide corresponds to Table 13 in the full text.

From: Genders TS, et al. Eur Heart J 2011;32:1316–1330.

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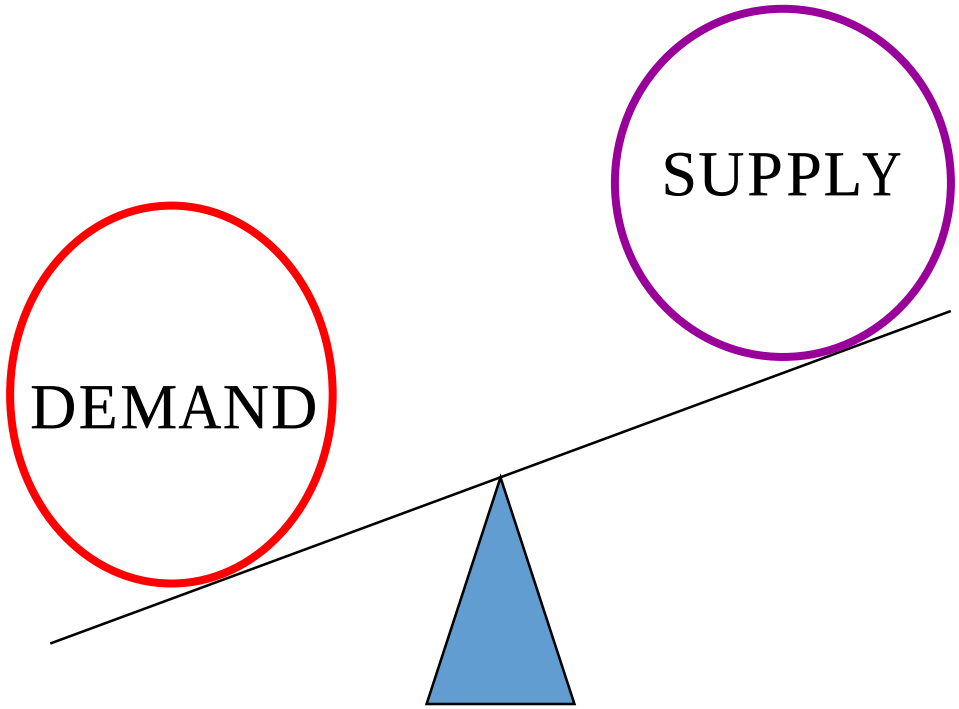
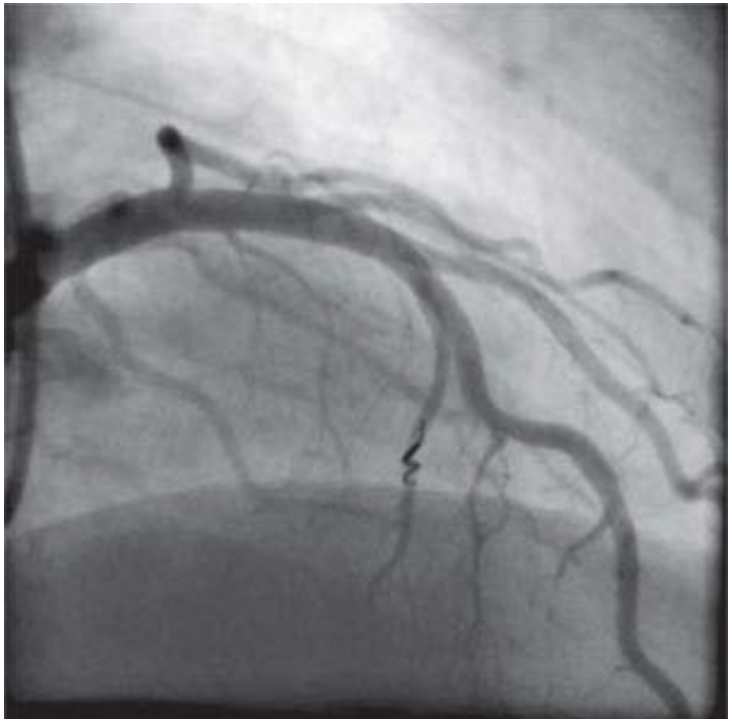
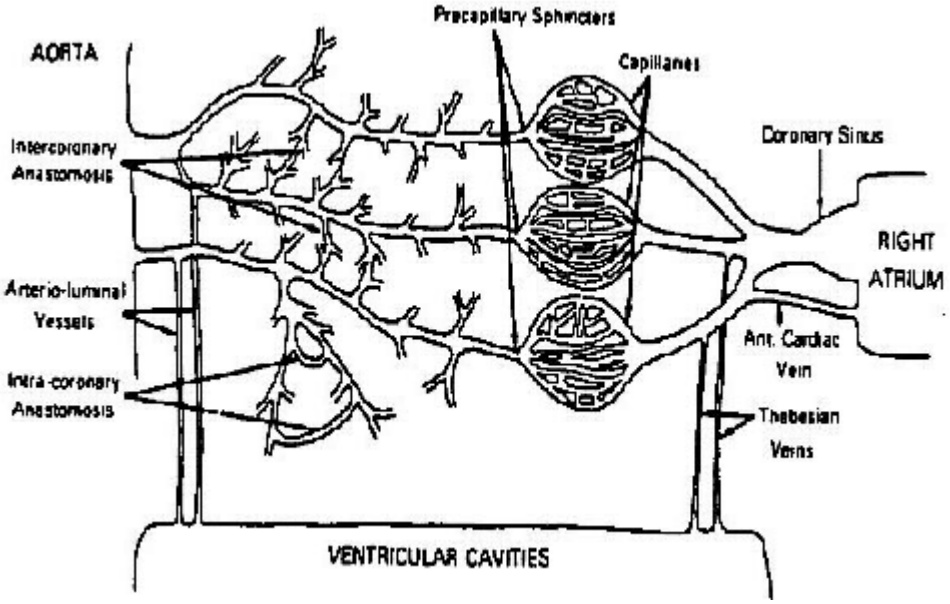
PATHOPHYSIOLOGY



MYOCARDIAL ISCHEMIA!!




Precapillary Sphincters
AORTA
Capillaries
Coronary Sinus
Intercoronary Anastomosis
RIGHT ATRIUM
Arterio-luminal Vessels
Ant. Cardiac Vein
Intra-coronary Anastomosis
Thebesian Veins
VENTRICULAR CAVITIES

Characteristics of tests commonly used to diagnose the presence of CAD

	Diagnosis of CAD	
	Sensitivity (%)	Specificity (%)
Exercise ECG[a]	45-50	85-90
Exercise stress echocardiography	80-85	80-88
Exercise stress SPECT	73-92	63-87
Dobutamine stress echocardiography	79-83	82-86
Dobutamine stress MRI[b]	79-88	81-91
Vasodilator stress echocardiography	72-79	92-95
Vasodilator stress SPECT	90-91	75-84
Vasodilator stress MRI[b]	67-94	61-85
Coronary CTA[c]	95-99	64-83
Vasodilator stress PET	81-97	74-91

CAD = coronary artery disease; CTA = computed tomography angiography; ECG = electrocardiogram; MRI = magnetic resonance imaging; PET = positron emission tomography; SPECT = single photon emission computed tomography.
[a]Results without/with minimal referral bias; [b]Results obtained in populations with medium-to-high prevalence of disease without compensation for referral bias; [c]Results obtained in populations with low-to-medium prevalence of disease.
This slide corresponds to Table 12 in the full text.

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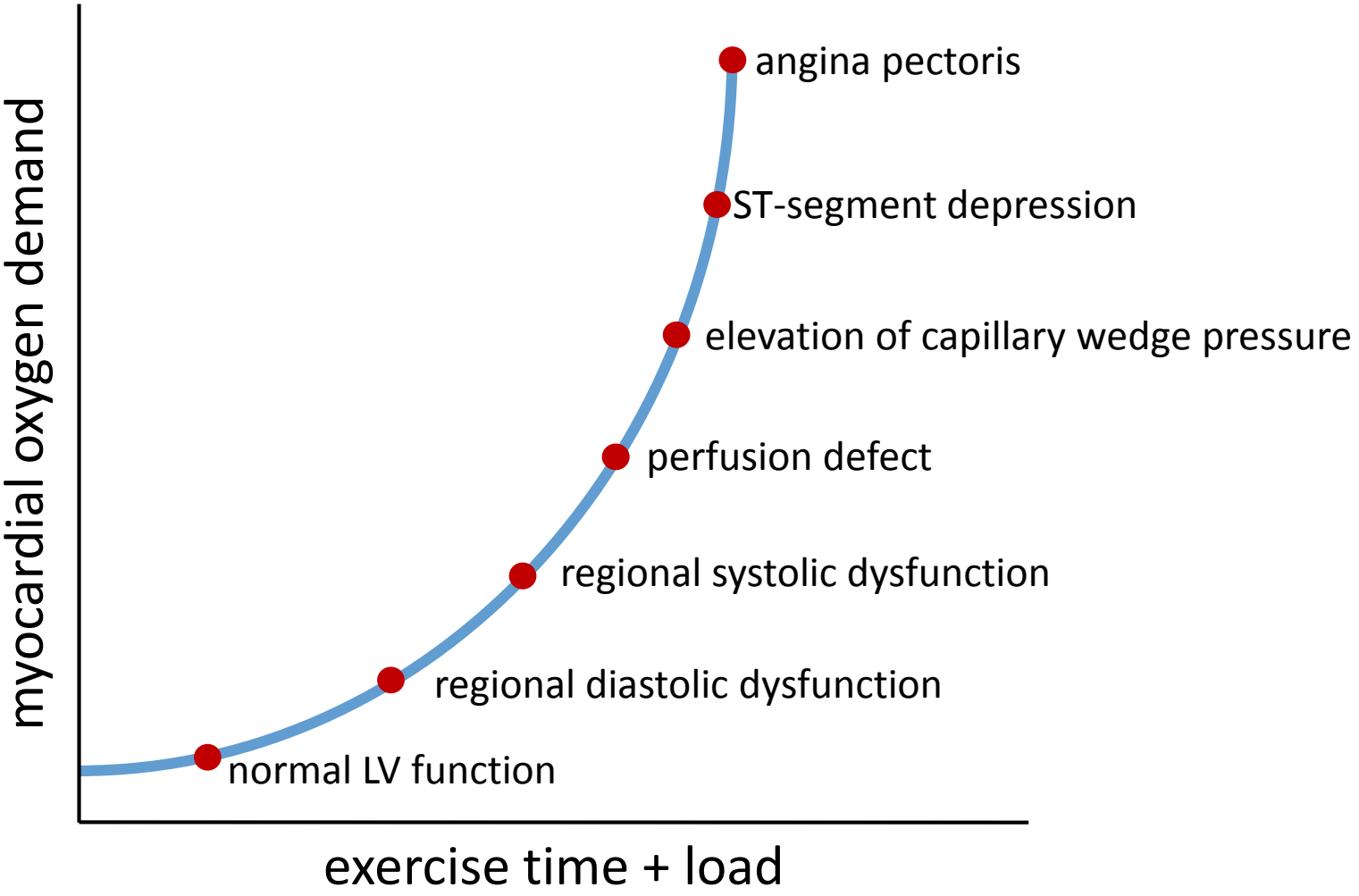
myocardial oxygen demand
angina pectoris
ST-segment depression
elevation of capillary wedge pressure
perfusion defect
regional systolic dysfunction
regional diastolic dysfunction
normal LV function
exercise time + load

Stable angina

Pre Test Probability (PTP) in relation to sensitivity and specificity of tests:

Typical sensity + specificity of a non-invasive imaging based test ≈ 85%

Hence 15% of results will be false

Not performing a test will provide fewer incorrect diagnoses in pats. w. a PTP < 15% or > 85%

Traditional clinical classification of chest pain

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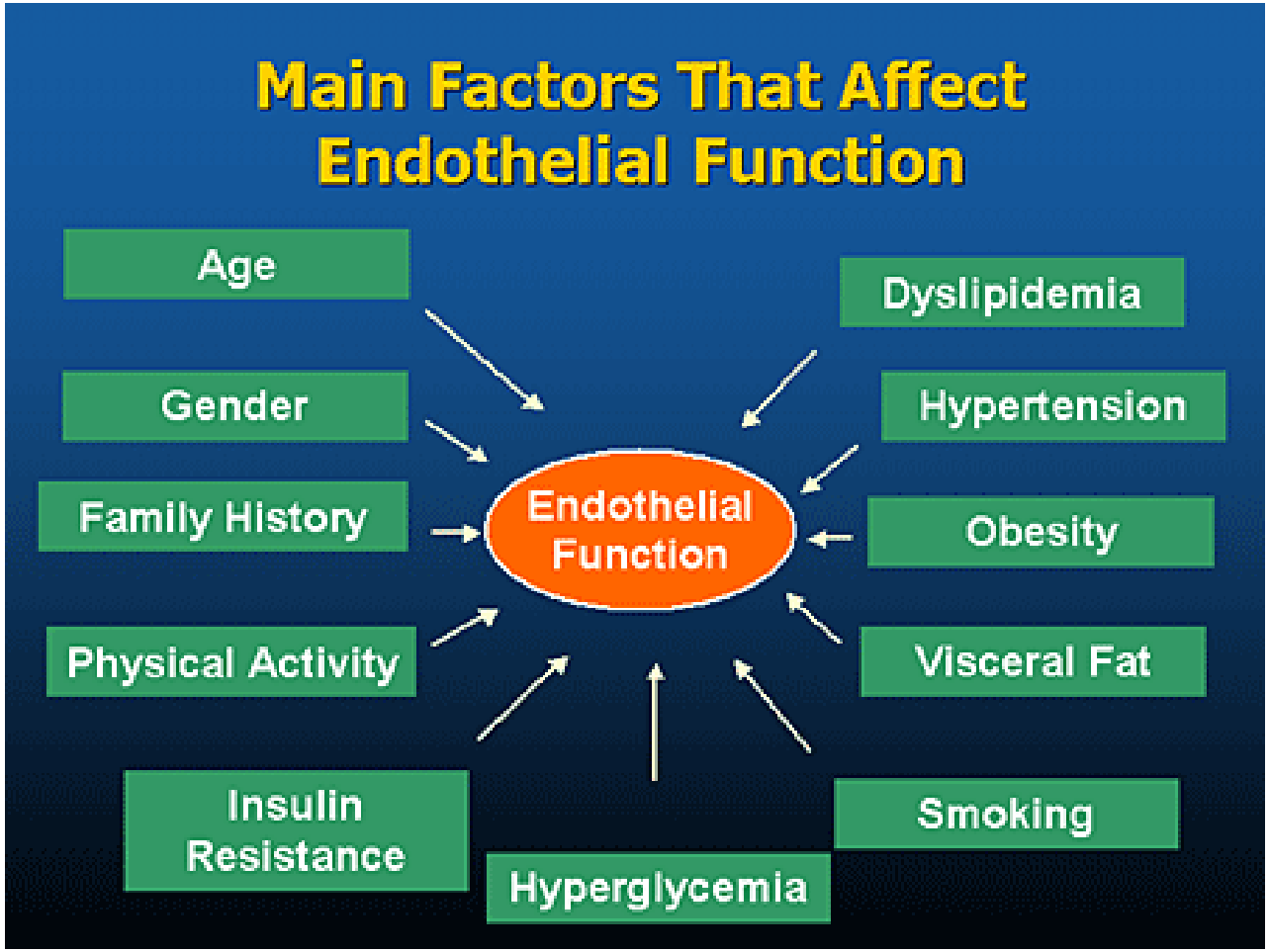
ATHEROSCLEROSIS



http://www.medscape.org/viewarticle/527850

Performing an exercise ECG for initial diagnostic assessment of angina or evaluation of symptoms

Recommendations	Class	Level
Exercise ECG is recommended as the initial test for establishing a diagnosis of SCAD in patients with symptoms of angina and intermediate PTP of CAD, free of anti-ischaemic drugs, unless they cannot exercise or display ECG changes which make the ECG non-evaluable.	I	B
Stress imaging is recommended as the initial test option if local expertise and availability permit.	I	B
Exercise ECG should be considered in patients on treatment to evaluate control of symptoms and ischaemia.	IIa	C
Exercise ECG in patients with ≥0.1 mV ST-depression on resting ECG or taking digitalis is not recommended for diagnostic purposes.	III	C

CAD = coronary artery disease; ECG = electrocardiogram; PTP = pre-test probability; SCAD = stable coronary artery disease.
This slide corresponds to Table 14 in the full text.

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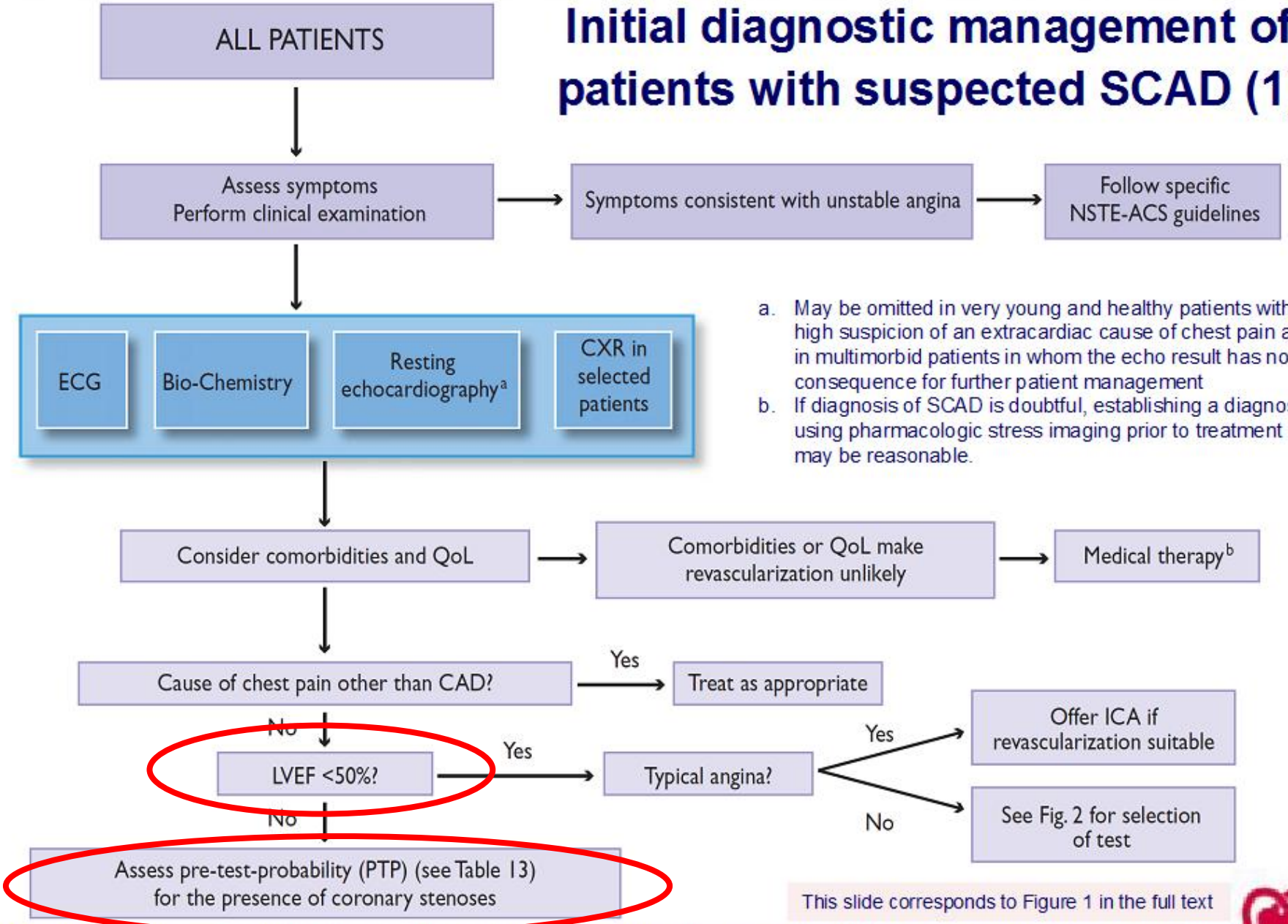
Initial diagnostic management of patients with suspected SCAD (1)

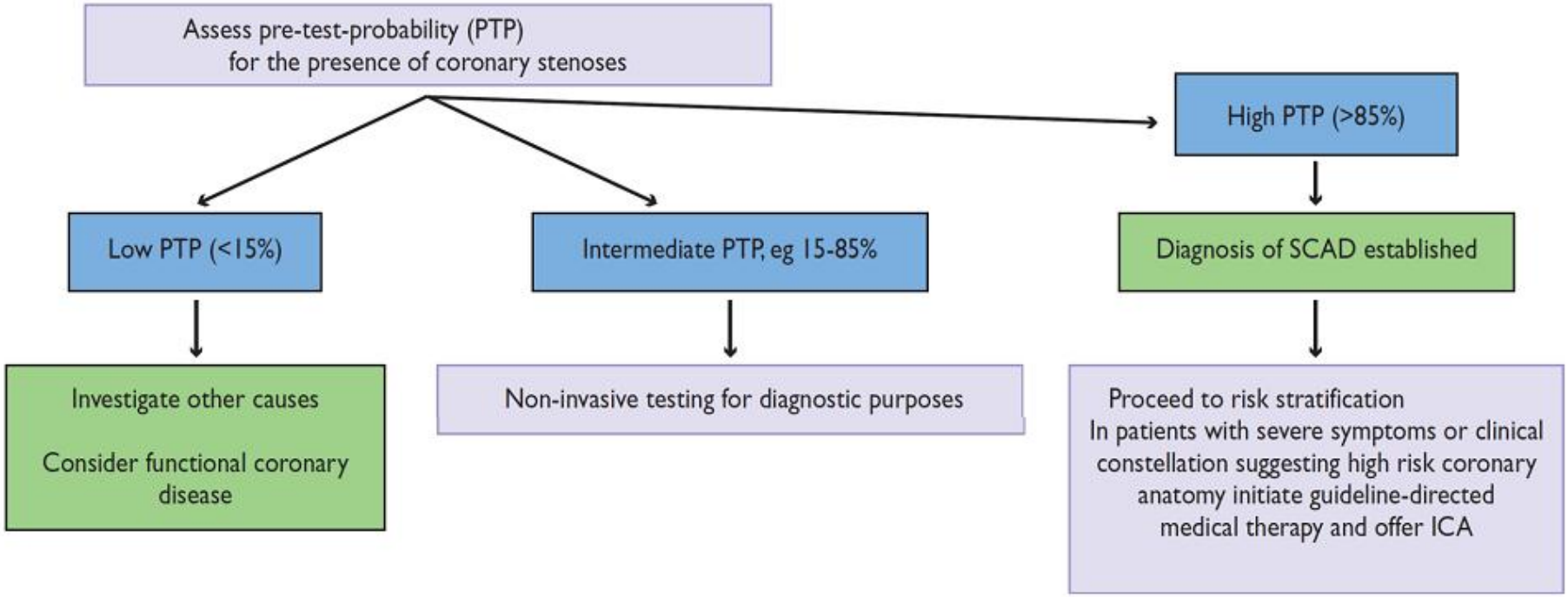


a. May be omitted in very young and healthy patients with a high suspicion of an extracardiac cause of chest pain and in multimorbid patients in whom the echo result has no consequence for further patient management
b. If diagnosis of SCAD is doubtful, establishing a diagnosis using pharmacologic stress imaging prior to treatment may be reasonable.

This slide corresponds to Figure 1 in the full text

[a]May be omitted in very young and healthy patients with a high suspicion of an extracardiac cause of chest pain and in multimorbid patients in whom the echo result has no consequence for further patient management. [b]If diagnosis of SCAD is doubtful, establishing a diagnosis using pharmacological stress imaging prior to treatment may be reasonable.

Initial diagnostic management of patients with suspected SCAD (2)



This slide corresponds to Figure 1 in the full text
ICA = invasive coronary angiography.

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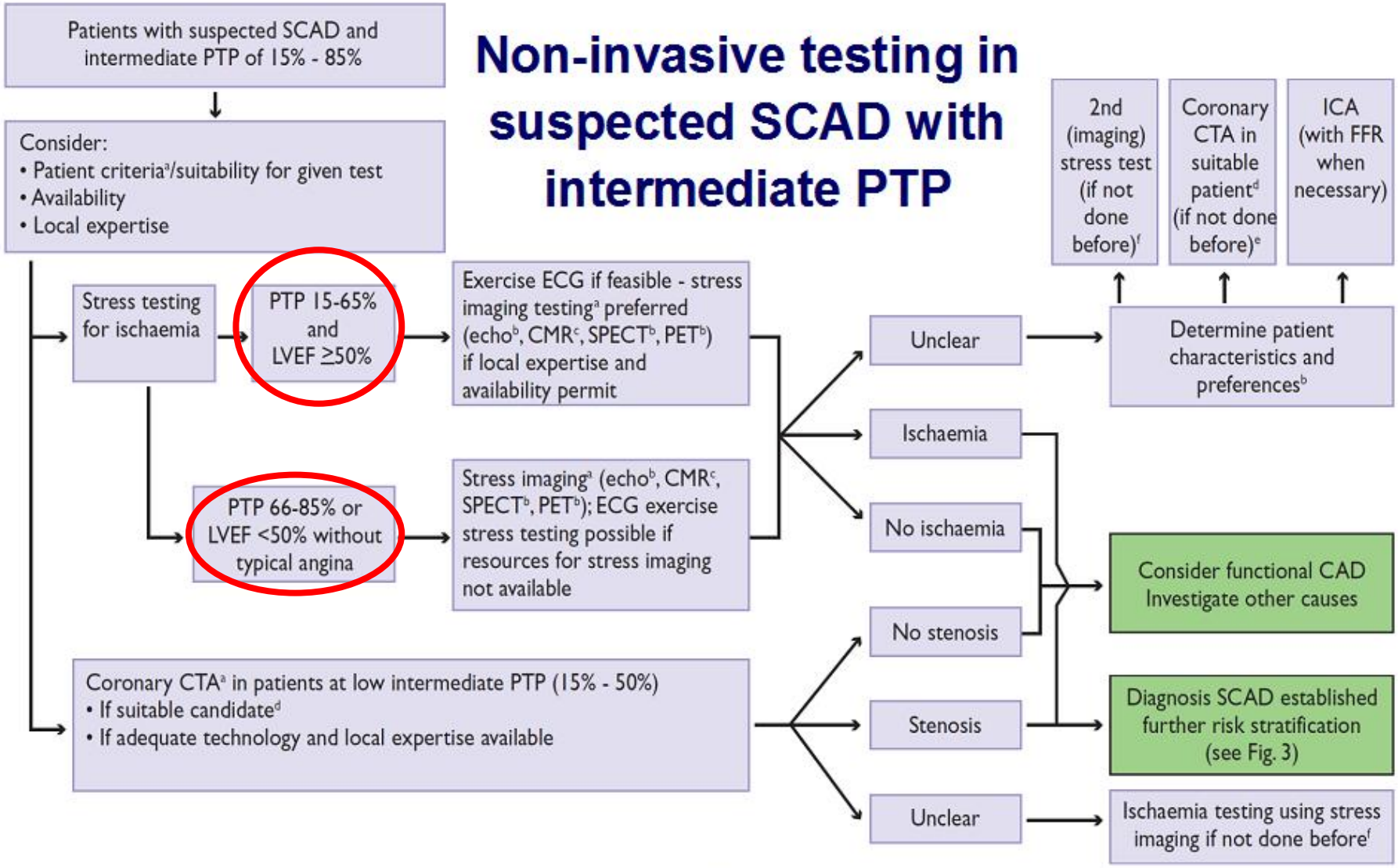
Non-invasive testing in suspected SCAD with intermediate PTP



a. Consider age of patient versus radiation exposure.
b. In patients unable to exercise use echo or SPECT/PET with pharmacologic stress instead.
c. CMR is only performed using pharmacologic stress.
d. Patient characteristics should make a fully diagnostic coronary CTA scan highly probable (see section 6.2.5.1.2) consider result to be unclear in patients with severe diffuse or focal calcification.
e. Proceed as in lower left coronary CTA box.
f. Proceed as in stress testing for ischaemia box.

This slide corresponds to Figure 2 in the full text.

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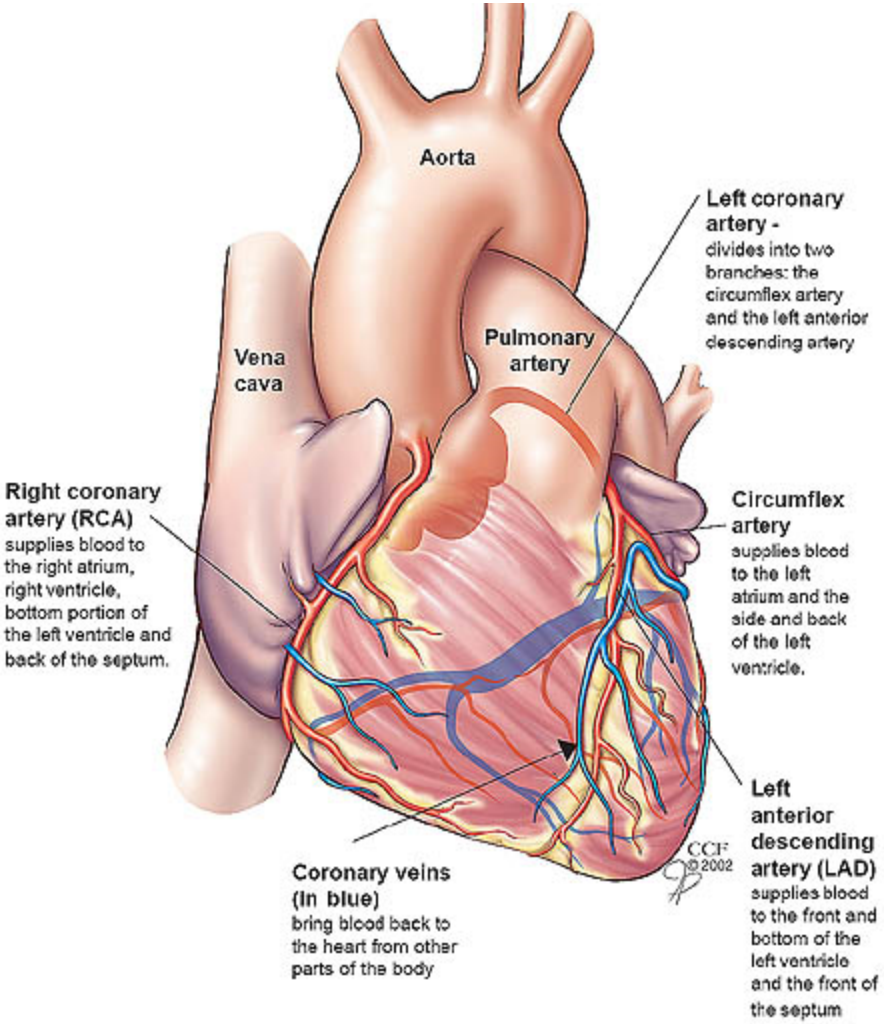
Stable angina

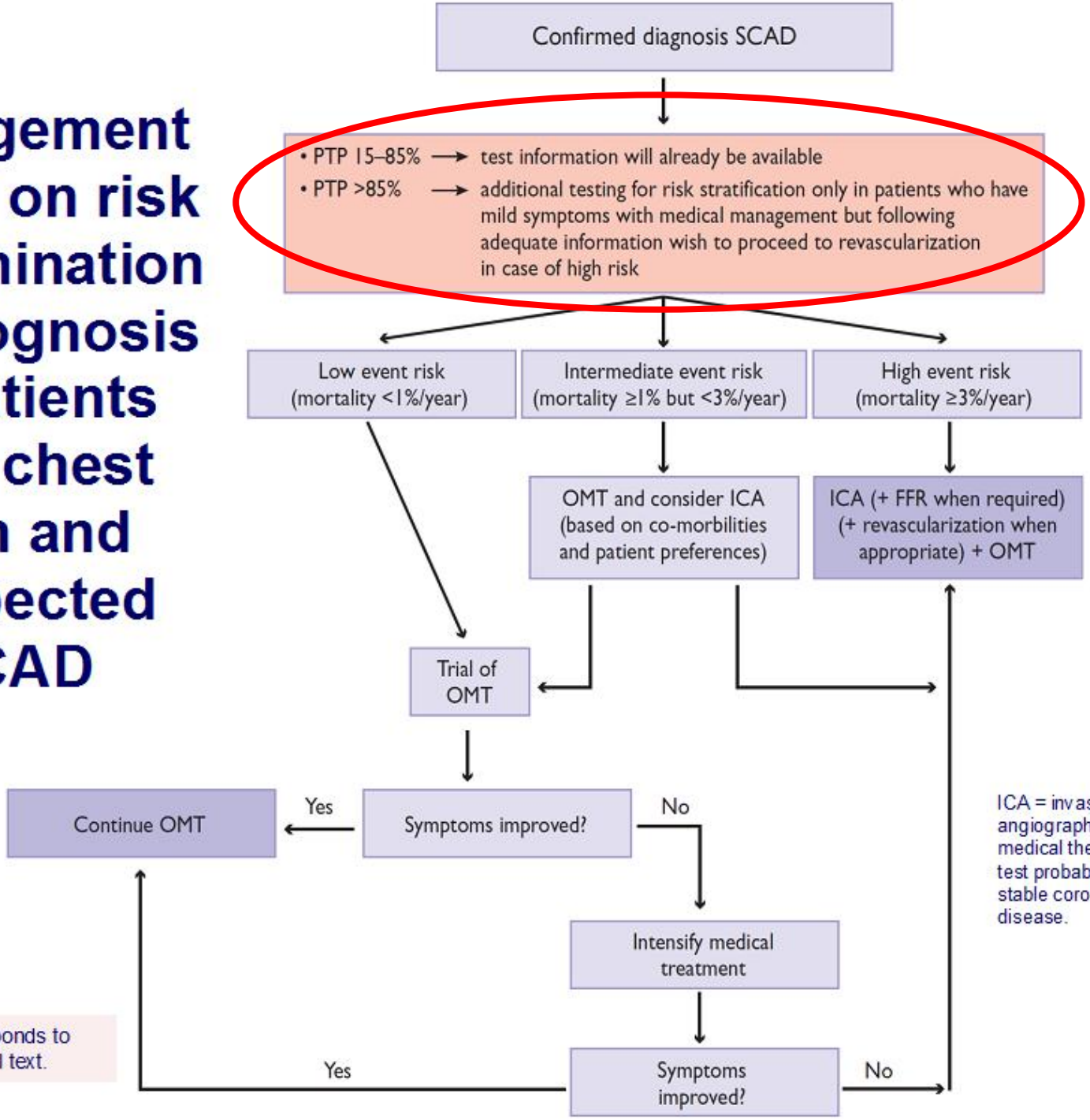
Once the diagnosis of stable angina has been established proceed to risk stratification based on:

- Clinical assessment
- Resting EKG
- Echocardiography
- Stress testing

CORONARY ANATOMY



Management based on risk determination for prognosis in patients with chest pain and suspected SCAD



ICA = invasive coronary angiography; OMT = optimal medical therapy; PTP = pre-test probability; SCAD = stable coronary artery disease.

This slide corresponds to Figure 3 in the full text.

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Low event risk
(mortality <1%/year)

Intermediate event risk
(mortality ≥1% but <3%/year)

High event risk
(mortality ≥3%/year)

Definitions of risk for various test modalities[a]

Exercise stress ECG[b]	High risk Intermediate risk Low risk	CV mortality >3%/year. CV mortality between 1 and 3%/year. CV mortality <1%/year.
Ischaemia imaging	High risk Intermediate risk Low risk	Area of ischaemia >10% (>10% for SPECT; limited quantitative data for CMR – probably ≥2/16 segments with new perfusion defects or ≥3 dobutamine-induced dysfunctional segments; ≥ 3 segments of LV by stress echo). Area of ischaemia between 1 to 10% or any ischaemia less than high risk by CMR or stress echo. No ischaemia.
Coronary CTA[c]	High risk Intermediate rick Low risk	Significant lesions of high risk category (three-vessel disease with proximal stenoses, LM, and proximal anterior descending CAD). Significant lesion(s) in large and proximal coronary artery(ies) but not high risk category. Normal coronary artery or plaques only.

CAD = coronary artery disease; CMR = cardiac magnetic resonance; CTA = computed tomography angiography; CV = cardiovascular; ECG = electrocardiogram; LM = left main; SPECT = single photon emission computed tomography.

a. For detailed explanation on rationale for risk stratification scheme see web addenda.
b. From nomogram (see web addenda, Figure W1) or http://www.cardiology.org/tools/medcalc/duke/
c. Consider possible overestimation of presence of significant multivessel disease by coronary CTA in patients with high intermediate PTP (≥50%) and/or severe diffuse or focal coronary calcifications and consider performing additional stress testing in patients without severe symptoms before ICA.

This slide corresponds to Table 17 in the full text.

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Stable angina: risk stratification

Clinical assessment:

- Diabetes
- Hypertension
- Current smoking
- Elevated triglycerides

Have been shown to be predictive of adverse outcomes

Stable angina: risk stratification

Resting EKG:

- Previous MI
- ST changes suggestive of ischemia
- New onset LBBB (only if diagnosis of stable angina has been established!)

Stable angina: risk stratification

Echocardiography:

- LV ejection fraction
- Wall motion abnormality

For example, 12-year survival:

- EF ≥ 50%: 73%
- EF 35 – 49%: 54%
- EF < 35%: 21%

Circulation 1994;90:2645

Stable angina: risk stratification

Stress testing:

1) EKG stress testing:
    - exercise capacity
    - blood pressure response
    - severity of EKG changes

The Duke treadmill score is well validated, combining exercise time, ST-deviation and angina during exercise to calculate the patient's event risk (for more information and a web based tool see web addenda)

Stable angina: risk stratification

Stress testing:

2) Stress echocardiography

- extent of indicible walll motion abnormality

Stable angina: risk stratification

Stress testing:

3) Stress perfusion scintigraphy

- perfusion defects > 10% of total LV myocardium = high risk

Stable angina: treatment

Betablockers
Nitrates
Calcium antagonists

Statins
Acetylsalicilicacid

Anti-hypertensives
Anti-diabetics

Risk factor goals and target levels

Smoking	No exposure to tobacco in any form.
Diet	Low in saturated fat with a focus on wholegrain products, vegetables, fruit and fish.
Physical activity	At least 150 minutes a week of moderate aerobic PA (30 minutes for 5 days/week) or 75 minutes a week of vigorous aerobic PA (15 minutes for 5 days/week) or a combination thereof.
Body weight	BMI 20–25 kg/m^2. Waist circumference <94 cm (men) and or <80 cm (women).
Blood pressure	<140/90 mmHg.[a]
Lipid	
LDL [b] is the primary target	**Very high-risk: <1.8 mmol/L (<70 mg/dL)**, or a reduction of at least 50% if the baseline is between 1.8 and 3.5 mmol/L (70 and 135 mg/dL).[d] **High-risk: <2.6 mmol/L (<100 mg/dL)** or a reduction of at least 50% if the baseline is between 2.6 and 5.2 mmol/L (100 and 200 mg/dL). **Low to moderate risk: <3.0 mmol/L (115 mg/dL).**
Non-HDL-C [b]	<2.6, <3.3 and <3.8 mmol/L (<100, <130 and <145 mg/dL) are recommended for very high, high and low to moderate risk subjects, respectively
HDL-C	No target but >1.0 mmol/L (>40 mg/dL) in men and >1.2 mmol/L (>45 mg/dL) in women indicate lower risk.
Triglycerides	No target but <1.7 mmol/L (<150 mg/dL) indicates lower risk and higher levels indicate a need to look for other risk factors.
Diabetes	HbA1c: <7% (<53 mmol/L).

a. The target can be higher in frail elderly patients, or lower in most patients with DM and in some (very) high risk patients without DM who can tolerate multiple blood pressure lowering drugs
b. A view was expressed that primary care physicians might prefer a single general LDL-C goal of 2.6 mmol/L.
c. Non-HDL-C is a reasonable and practical alternative target because it does not require fasting.
d. This is the general recommendation for those at very high risk. It should be noted that the evidence for patients with chronic kidney disease is less strong

Thank You!