Ischaemic Heart Disease Assessment and Management

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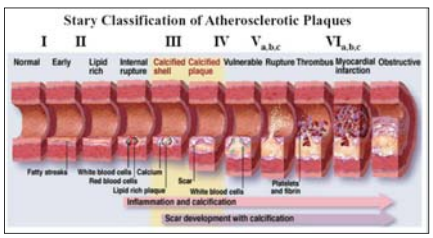
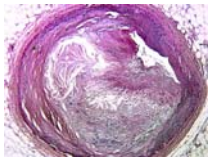
Learning outcomes

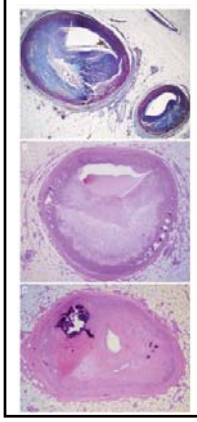
1. Understand the importance of the clinical history and physical examination in the initial assessment of patients with suspected ischaemic heart disease
2. Understand the importance of risk stratification in the management of patients with suspected or known CAD.
3. State the clinical indications for exercise ECG, non-invasive cardiac imaging and invasive coronary angiography
4. Describe the methods available for the detection of myocardial ischaemia
5. Appreciate the value of non-invasive imaging in the diagnosis of CAD
6. Understand the role of risk factor modification and pharmacological therapy in the management of patients with stable angina

Coronary artery disease: The atherosclerotic plaque



The atherosclerotic plaque



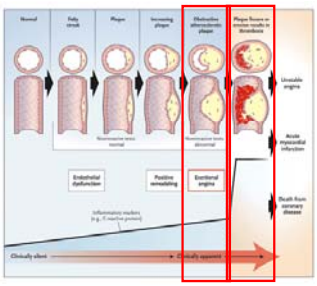


Fibroatheroma with Ca++ and cholesterol clefts
80% stenosis
(Trichrome stain)
37 y.o.

Fibroatheroma 80% stenosis (H-E stain)
28 y. o

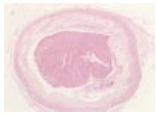
Calcified fibroatheroma 95% stenosis
42 y.o.

Spectrum of Coronary Artery Disease

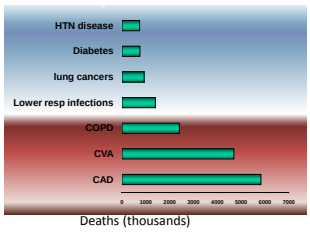


Stable but Progressive

Unstable

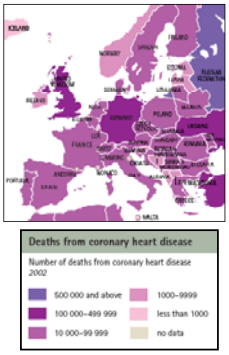


Deaths from Coronary Heart Disease



Deaths (thousands)

WHO, 2002



Assessment

Diagnosis of ischaemic heart disease

- Clinical history and physical examination

- Cardiovascular risk factors
  - Diabetes
  - Hypertension
  - High cholesterol
  - Smoking
  - Family history... Others...obesity, sedentary life

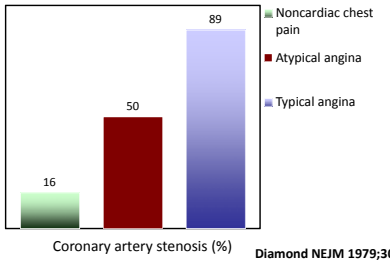
Diagnosis

- Clinical History and Physical Examination

"Pain in his arm, in his breast and in one side of his cardia... it is death that threatens him."

Ebers Papyrus, 1600 B.C

History and diagnosis...



Diamond NEJM 1979;300:1350

Physical examination

Extent of atherosclerosis

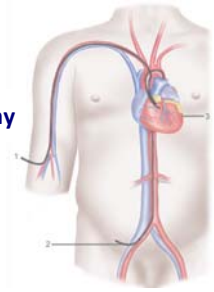
Differential Diagnosis:

Obstructive airways disease

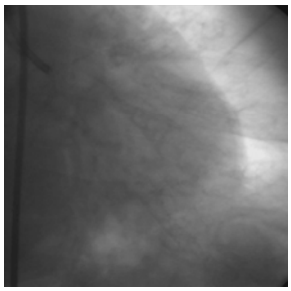
GI diseases

Musculoskeletal aetiology

X-ray coronary angiography

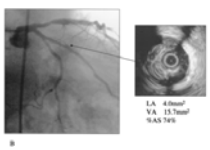


X-ray Coronary Angiography



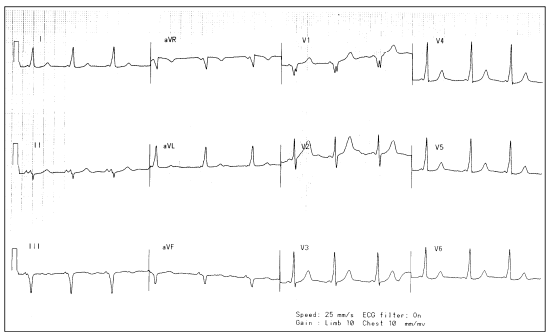
Additional diagnostic tools

- Non-invasive
  - 12-lead resting ECG
  - Exercise ECG
  - Stress cardiac imaging
  - Coronary calcium and CT Angiography (anatomical rather than functional imaging)
- Invasive
  - X-ray coronary angiography
    - IVUS
    - Fractional flow reserve measurements
    - Optical coherence tomography



ECG

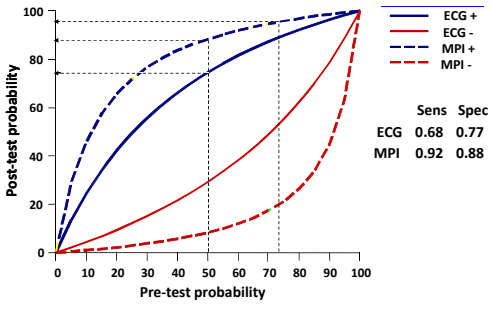
WPW Syndrome



Risk Stratification:

Importance

Bayes Theorem



	Sens	Spec
ECG	0.68	0.77
MPI	0.92	0.88

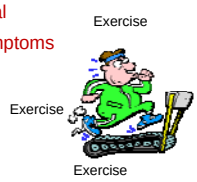
Risk Stratification: Pre-test Probability of CAD

Diamond and Forrester Criteria

Age (years)	Gender	Angina	Atypical CP	Non cardiac	Asympt
30-39	Men	Interm	Interm	Low	Very low
	Women	Interm	Very low	Very low	Very low
40-49	Men	High	Interm	Interm	Low
	Women	Interm	Low	Very low	Very low
50-59	Men	High	Interm	Interm	Low
	Women	Interm	Interm	Low	Very low
60-69	Men	High	Interm	Interm	Low
	Women	High	Interm	Interm	Low

Exercise ECG

- Physiological
- Reproduce symptoms
- Diagnostic & prognostic information
- Demanding
- Cooperation
- LBBB
- True cardiac limitation or deconditioning?



Exercise ECG:

Sensitivity 68%

Specificity 77%

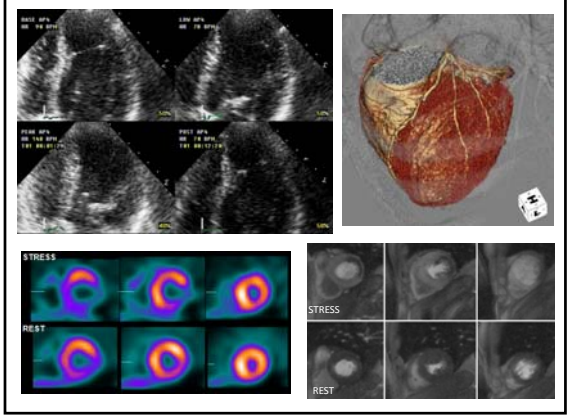
Southampton experience

- 1522 patients with chest pain referred Dec 97 to Apr 2000
- Clinical management decisions by SpR with consultant supervision

	Male %	Female %
Ex ECG	100	100
MPS	8	5
Angiogram	31	23
Normal angiogram	16	56

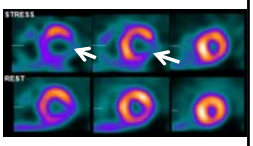
Wong. Heart 2001;85:149

Non-invasive Cardiac Imaging



Non-invasive Cardiac Imaging: Surrogates for Ischaemia

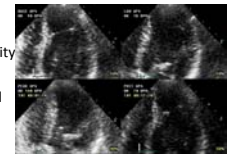
- Assessment of myocardial perfusion:
  - Heterogeneous distribution of blood flow
  - Techniques:
    - ✔ Myocardial perfusion scintigraphy
    - ✔ Myocardial contrast echocardiography
    - ✔ Magnetic resonance imaging (MRI)



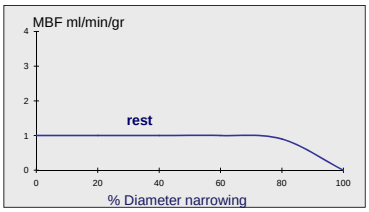
- Assessment of contractile reserve and stress-induced regional wall motion abnormality

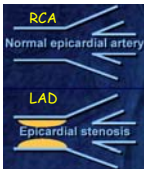
  Techniques:

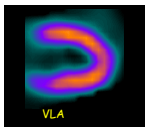
  Stress echocardiography, MRI and ECG-gated SPECT



Resting Perfusion

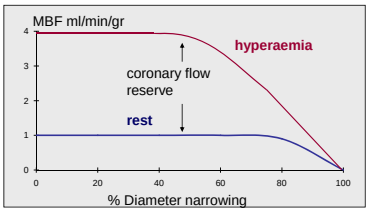


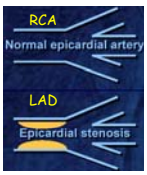


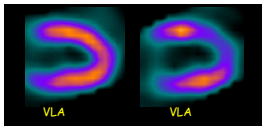


Myocardial distribution of tracer at rest

Hyperaemia







Myocardial distribution of tracer following stress

How to induce hyperaemia and ischaemia?

Physiological:

Exercise

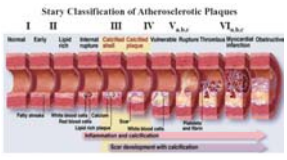
Pharmacological:

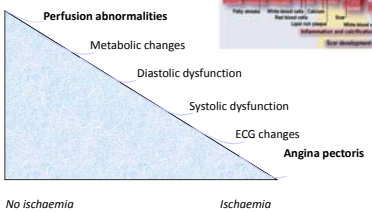
Inotroppic agents

Primary vasodilator agents

Imaging procedure	Sensitivity (%)	Specificity (%)
Exercise MPS	85-90	70-75
Pharmacological MPS	83-94	64-90
Exercise echocardiography	74-97	64-86
Dobutamine echocardiography	61-95	51-95
Perfusion CMR	84-87	58-83
Dobutamine CMR	83-89	86-96
Coronary calcium CT imaging	82-87	64-79
CT angiography	85-99	64-98

The Ischaemic Cascade



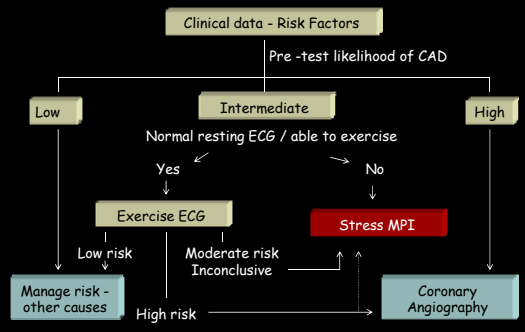


Patients unable to exercise

Pharmacological Stress Agents:

- Adenosine
- Dipyridamole
- Dobutamine
- A_{2A} Receptor Agonists

Assessment of Chronic Chest Pain - Algorithm



Modified from de Bono, Heart 1999, 81:546

Heart ONLINE

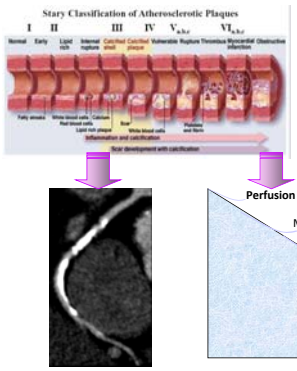
Procedure guidelines for radionuclide myocardial perfusion imaging

C Anagnostopoulos, M Harbinson, A Kelion, K Kundley, C Y Loong, A Notghi, E Reyes, W Tindale and S R Underwood

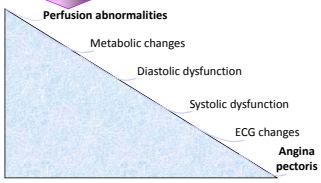
Indications

- To assess the presence and severity of coronary obstruction
- To aid the management of patients with CAD:
  - Risk stratification and prognosis (e.g. after MI or before non-cardiac surgery)
  - To guide strategies of revascularisation
  - To assess adequacy of revascularisation
- To assess viability and hibernation
- Special indications:
  - Anomalous coronary arteries
  - Muscle bridging
  - Kawasaki's disease

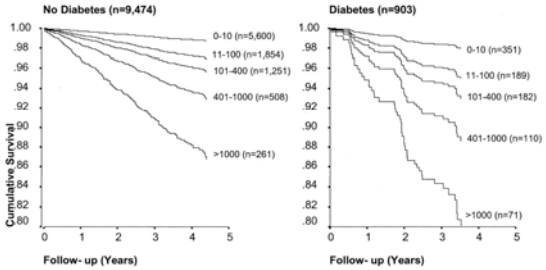
Normal Perfusion Tetrofosmin MPI



The Ischaemic Cascade

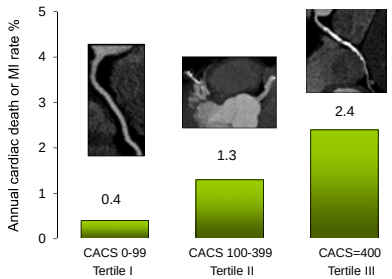


Coronary calcium and prognosis



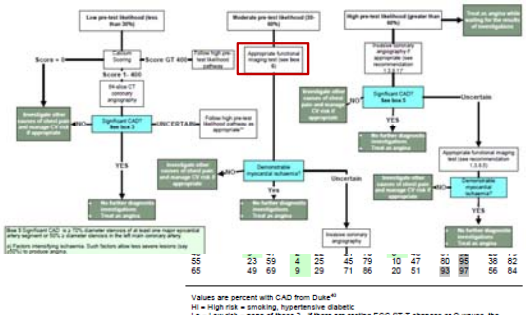
Raggi *JACC* 2004;43:1663

Risk stratification



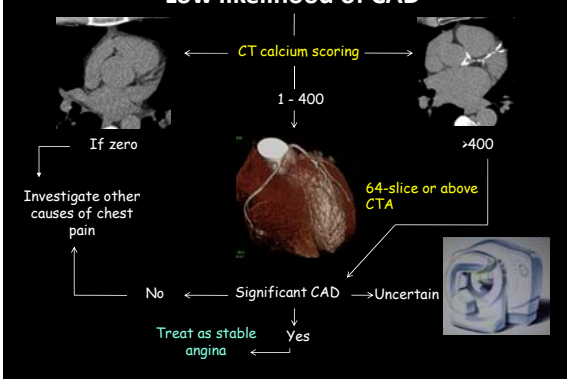
Greenland et al. Circulation 2007

New NICE Guidelines for Stable Chest Pain

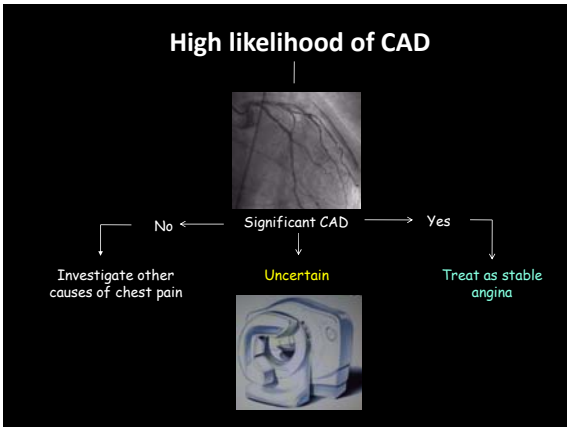


NICE guidelines 2010.In print

Low likelihood of CAD



High likelihood of CAD



Intermediate likelihood of CAD

Functional Imaging

No ← Reversible myocardial ischaemia → Yes

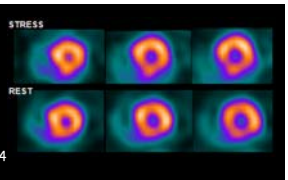
Investigate other causes of chest pain

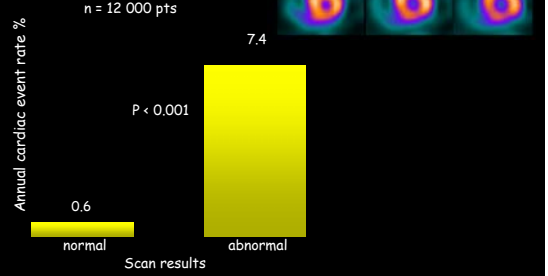
Uncertain

Treat as stable angina

Risk Stratification Post-assessment

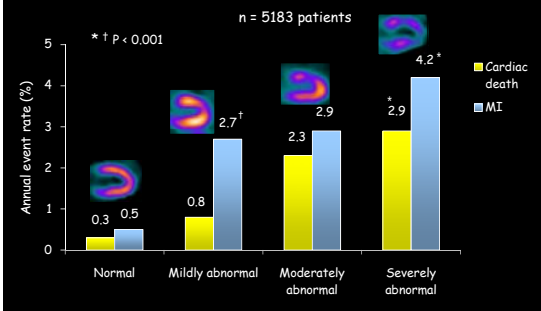
Risk stratification





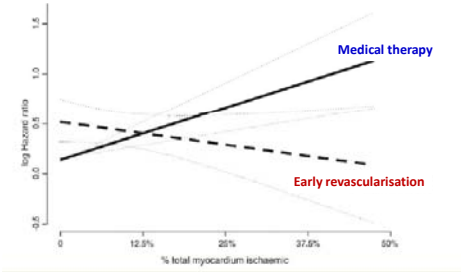
Iskander S et al. JACC 1998;32:57

Prognostic value of MPS



Hachamovitch R et al. Circulation 1998;97:535

MPS-guided therapy and prognosis



Hachamovitch. European Heart Journal 2011

Management

Management

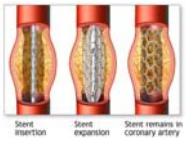
- **Risk factor modification**
  - Lifestyle changes:
    - Smoking cessation
    - Healthy eating
    - Weight loss
    - Exercise
    - Reduction in alcohol consumption

Management

- **Risk factor modification**
  - Management of other risk factors:
    - Blood pressure and hypertension control
    - Cholesterol - Statins
    - Blood glucose and diabetes
    - Antithrombotic therapy:
      - Aspirin 75 mg per day
      - Clopidogrel

Management

- Medical therapy
  - **Antianginal drugs**
    - Beta-blockers
    - Calcium antagonists
    - Nitrates
    - Nicorandil
  - Risk factor reduction drugs (statins, aspirin)



- Mechanical revascularisation
  - Percutaneous coronary procedures
  - Coronary artery bypass grafting surgery