Exercise treadmill & Stress Echocardiography

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Classification

Classic anginal features:

- Is triggered by physical or emotional stress
- Is relieved by rest or SL NTG
- Sub-sternal location

3 out of 3: typical angina

2 out of 3: atypical angina

1 out of 3: non-anginal chest pain

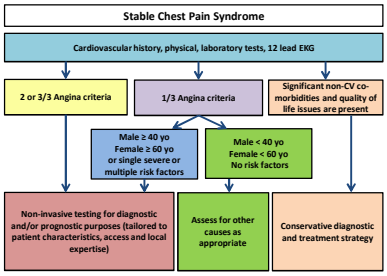
Pretest likelihood of CAD as detected by invasive angiography in symptomatic patients according to age and sex (Combined Diamond Forrester and CASS Data).

A low pretest risk of CAD is considered < 10% (green) and a high pretest risk is considered > 90% (red). All others are at intermediate risk (yellow).

	Chest Pain Classification					
	Non-anginal Pain 1 of 3 Criteria		Atypical Angina 2 of 3 Criteria		Typical Angina 3 of 3 Criteria	
Age	Male	Female	Male	Female	Male	Female
30 – 39	4%	2%	34%	12%	76%	26%
40 - 49	13%	3%	51%	22%	87%	55%
50 - 59	20%	7%	65%	33%	93%	73%
60 – 69	27%	14%	72%	51%	94%	86%

Adapted from Diamond et al *NEJM* 1979;300:1350-58 and Weiner et al *NEJM* 1979;301:230-5

Use of non-invasive testing for diagnostic and prognostic purposes in patients with classical anginal chest pain symptoms suggestive of SIHD.

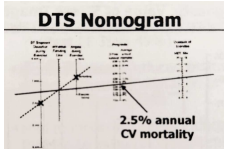


Non-invasive Stress Test

- Two components:
  - Stress:
    Exercise, dobutamine, or adenosine
  - Test:
    ECG, Echo, CT,
    Myocardial perfusion imaging (MPI) e.g. Radionuclide/ MR

Duke Treadmill Score

- DTS =
  Treadmill time (Bruce)
  – 5 x ST deviation (no. mm)
  – 4 x Angina index (0, 1, 2)



	score
• Low risk	>/= 5
• Intermediate risk	-10 to 4
• High risk	</= -11

Dobutamine stress Echo (DSE)

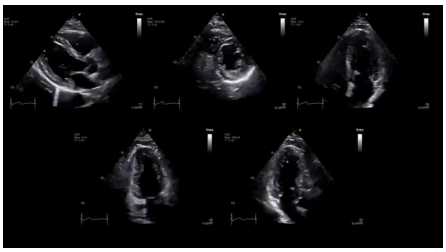
Advantages:

- Feasible in renal failure/ COPD
- Assess viability, esp. in poor EF
- Not affected by stents (vs CT) or balanced ischemia (vs perfusion imaging)

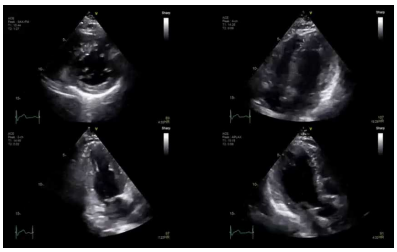
Limitations:

- Acoustic window/ operator dependent
- Less accurate in fast AF
- C/I if Significant LV outflow obstruction

60y/F, TTE at rest



DSE (intermediate stress)



Question

False-negative results for stress echocardiography are attributable to all of the following EXCEPT:

A) Fail to reach target HR
B) Fast AF reaching target HR for termination of protocol
C) Poor image quality
D) Mild disease
E) Antianginal therapy

Answer

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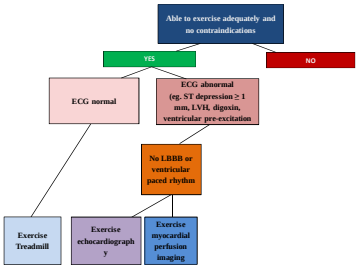
Canadian Cardiovascular Society

2014 Guidelines for the Diagnosis and Management of Stable Ischemic Heart Disease

Canadian Journal of Cardiology 30 (2014) 837–849

Guidance for selection of an initial non-invasive test for diagnosing suspected CAD in routine practice settings.



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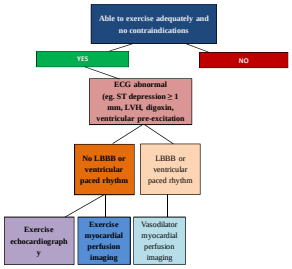

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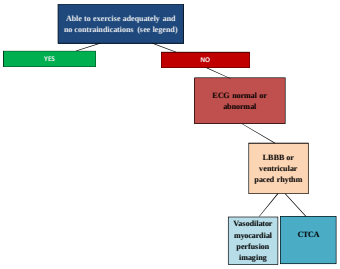

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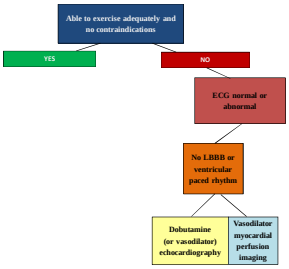

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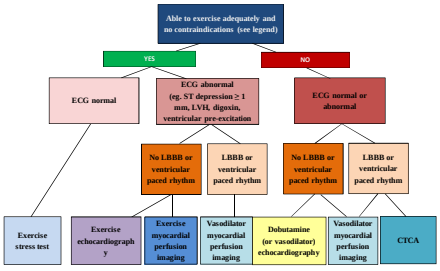
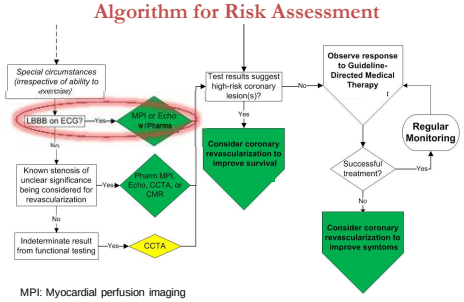


Canadian Journal of Cardiology 30 (2014) 837–849

2014 ACC/AHA/AATS/PCNA/SCAI/STS Focused Update Incorporated Into the 2012 ACCF/AHA/ACP/AATS/PCNA/SCAI/STS Guideline for the Diagnosis and Management of Patients With Stable Ischemic Heart Disease

Algorithm for Risk Assessment



MPI: Myocardial perfusion imaging

*Colors correspond to the ACCF/AHA Classification of Recommendations and Levels of Evidence Table.

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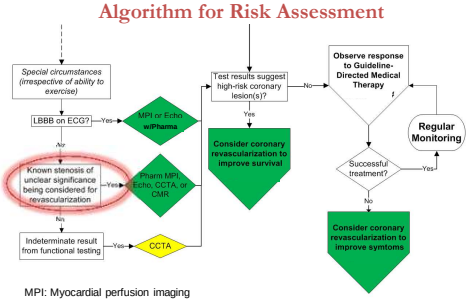

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Last but not least… cost

TEST	COST (USD)
Ex. Treadmill	$ 140
Ex. Treadmill + IMAGING	$ 906 (Nucl-
	$ 5200

Well-obtained History & experience: Priceless

Marine et al. COST-EFFECTIVENESS OF STRESS-ECHOCARDIOGRAPHY. Cardiology Clinics, Volume 17, 2003.

Thank you

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High Risk Features of Noninvasive Test Results Associated with > 3% Annual Rate of Death or MI

Exercise Treadmill

- ≥ 2mm of ST-segment depression at low (< 5 metabolic equivalents, METS) workload or persisting into recovery
- Exercise-induced ST-segment elevation
- Exercise-induced VT/VF
- Failure to increase systolic blood pressure to > 120 mm/ BP drop

Stress Echocardiography

- Inducible wall motion abnormality involving >4 segments or 2 coronary beds
- Wall motion abnormality developing at low dose of dobutamine (≤ 10 micrograms/kg/min) or at a low heart rate (<120 beats/min)

Adapted from Fihn et al Circ 2012;126:e354-e471

Summary Estimates of Pooled Sensitivity and Specificity (with 95% confidence intervals) for Non-Invasive Cardiac Tests for the Diagnosis of Coronary Artery Disease

Technology	Sensitivity	Specificity
Exercise Treadmill	0.68 (0.23-1.0)	0.77 (0.17-1.0)
Attenuation Corrected SPECT	0.86 (0.81-0.91)	0.82 (0.75-0.89)
Gated SPECT	0.84 (0.79-0.88)	0.78 (0.71-0.85)
Traditional SPECT	0.86 (0.84-0.88)	0.71 (0.67-0.76)
Contrast Stress Echocardiography (wall motion)	0.84 (0.79-0.90)	0.80 (0.73-0.87)
Exercise or Pharmacologic Stress Echocardiography	0.79 (0.77-0.82)	0.84 (0-.82-0.86)
Cardiac Computed Tomographic Angiography	0.96 (0.94-0.98)	0.82 (0.73-0.90)
Positron Emission Tomography	0.90 (0.88-0.92)	0.88 (0.85-0.91)
Cardiac MRI (perfusion)	0.91 (0.88-0.94)	0.81 (0.75-0.87)

Adapted from Gianrossi et al Circulation 1989; 80:87-98, *Medical Advisory Secretariat* 2010; 10:1-40, and McArdle et al *J Am Coll Cardiol* 2012;60:1828-37