بسم الله الرحمن الرحيم

Chronic Stable Angina

By

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Overview

- **Definitions & Historical perspectives**
- **Pathophysiology**
- **Clinical presentations**
- **Silent ischemia**
- **Classifications & grading**
- **Investigations**
- **Risk stratification**
- **Management**

Definition

Angina pectoris (literally "strangling" in the chest) is a recurrent symptom complex of discomfort in the chest or related areas associated with myocardial ischemia or dysfunctions but without myocardial necrosis, characteristically, the discomfort is produced by exertion and promptly relieved by rest or nitroglcerine

"But there is a disorder of the breast marked with strong and peculiar symptoms, considerable for the kind of danger belonging to it, and not extremely rare, which deserves to be mentioned more at length. The seat of it, and the sense of strangling and anxiety with which it is attended, may make it not improperly be called angina pectoris.

Those who are afflicted with it are seized while they are walking (more especially if it be uphill, and soon after eating), with a painful and most disagreeable sensation in the breast, which seems as if it would extinguish life, if it were to increase or to continue; but the moment they stand still, all this uneasiness vanishes."

William Heberden first published 225 years ago.

Angina pectoris: a glossary

- **Stable angina** A predictable pattern regarding frequency and precipitating factors (sustained over 3 months).

- **New-onset angina** Recently developed angina (within the previous 1 to 3 months).

- **Primary angina** Angina at rest with obvious precipitating cause. If primary angina develops with exercise, the level at which it occurs is inconsistent. A synonym for this type of angina is "variable threshold"angina.

- **Secondary angina** Typical exertional angina associated with specific and usually predictable forms and levels of physical activity.

- **Mixed angina** Composite pattern of primary and secondary angina.

Angina pectoris: a glossary

- **Emotional angina** — Angina with specific psychological factors that precipitate symptoms.

- **Nocturnal angina** — Angina that awakens and is sometimes associated with dreaming or sleep apnea.

- **Angina decubitus** — Angina that occurs shortly after adopting the recumbent posture.

- **Status anginosus** — Frequent, recurrent, sustained angina refractory to usual treatment.

- **Walk-through angina** — Angina with effort that disappears gradually during activity that is sustained (although usually at reduced intensity) and after which improved exercise tolerance results.

- **Second-wind angina** — A brief rest after an initial attack results in a markedly improved threshold free from angina. A synonym is "warm-up" angina.
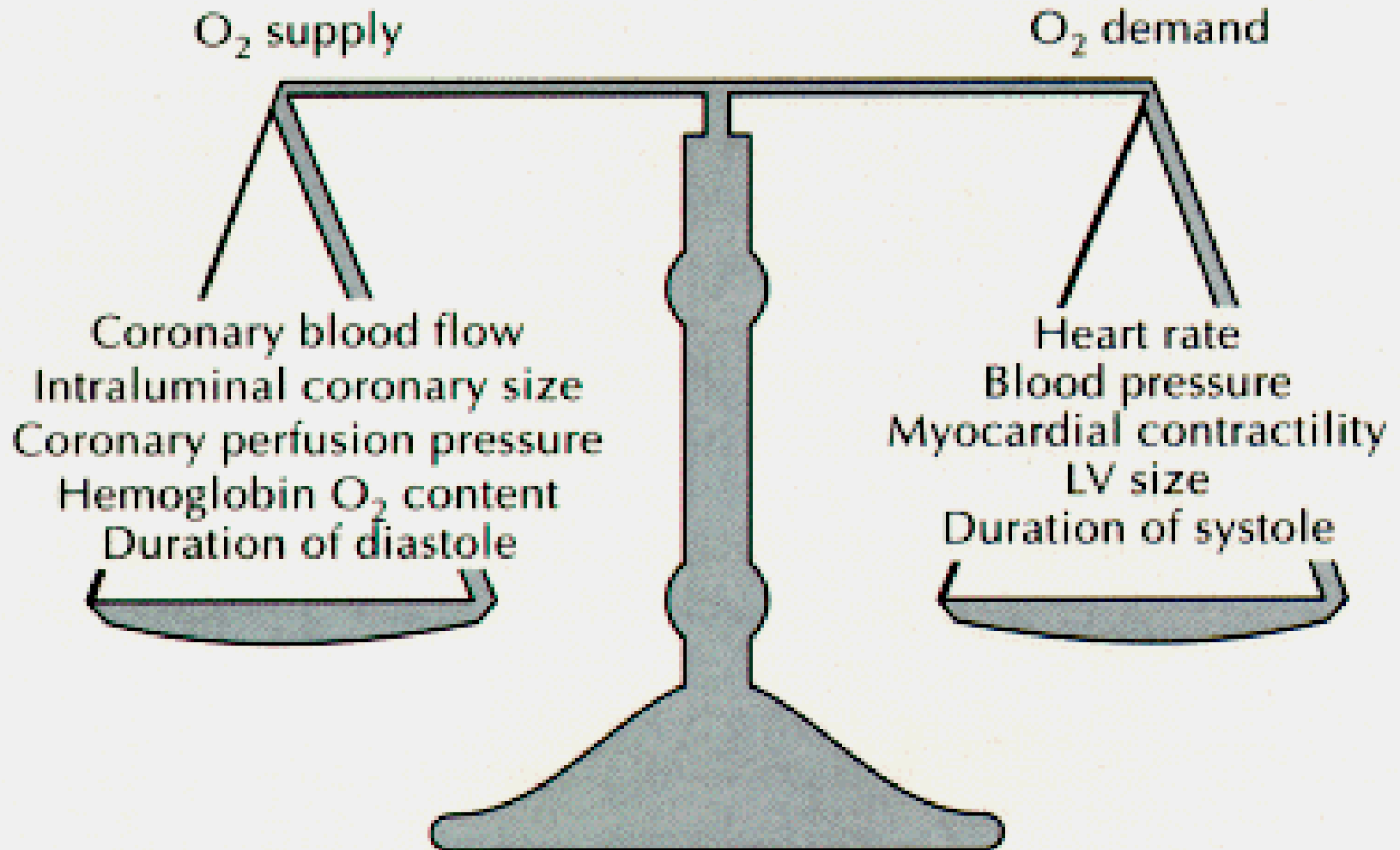
Angina pectoris: a glossary

- **Caudal angina** — Angina symptoms occurring in the scalp or head via referred pain.

- **Angina equivalents** — Symptoms other than pain or discomfort that are ischemic related and serve as angina surrogates, e.g., dyspnea, diaphoresis, fatigue, or light-headedness.

- **Silent angina** — Objective manifestations of ischemia without symptoms.

- **Crescendo angina** — Synonym is "accelerated" angina. Change in the pattern of angina such that it comes on more easily, lasts longer, or is more frequent.

- **Acute coronary insufficiency** — Sustained anginal pain, i.e., 20 to 30 minutesusually at rest, that may or may not be preceded by crescendo angina and obvious precipitating factors.

- **Unstable angina** — A collection of symptoms of angina usually incorporating crescendo angina and/or acute coronary insufficiency. By definition, unstable angina includes rest pain.
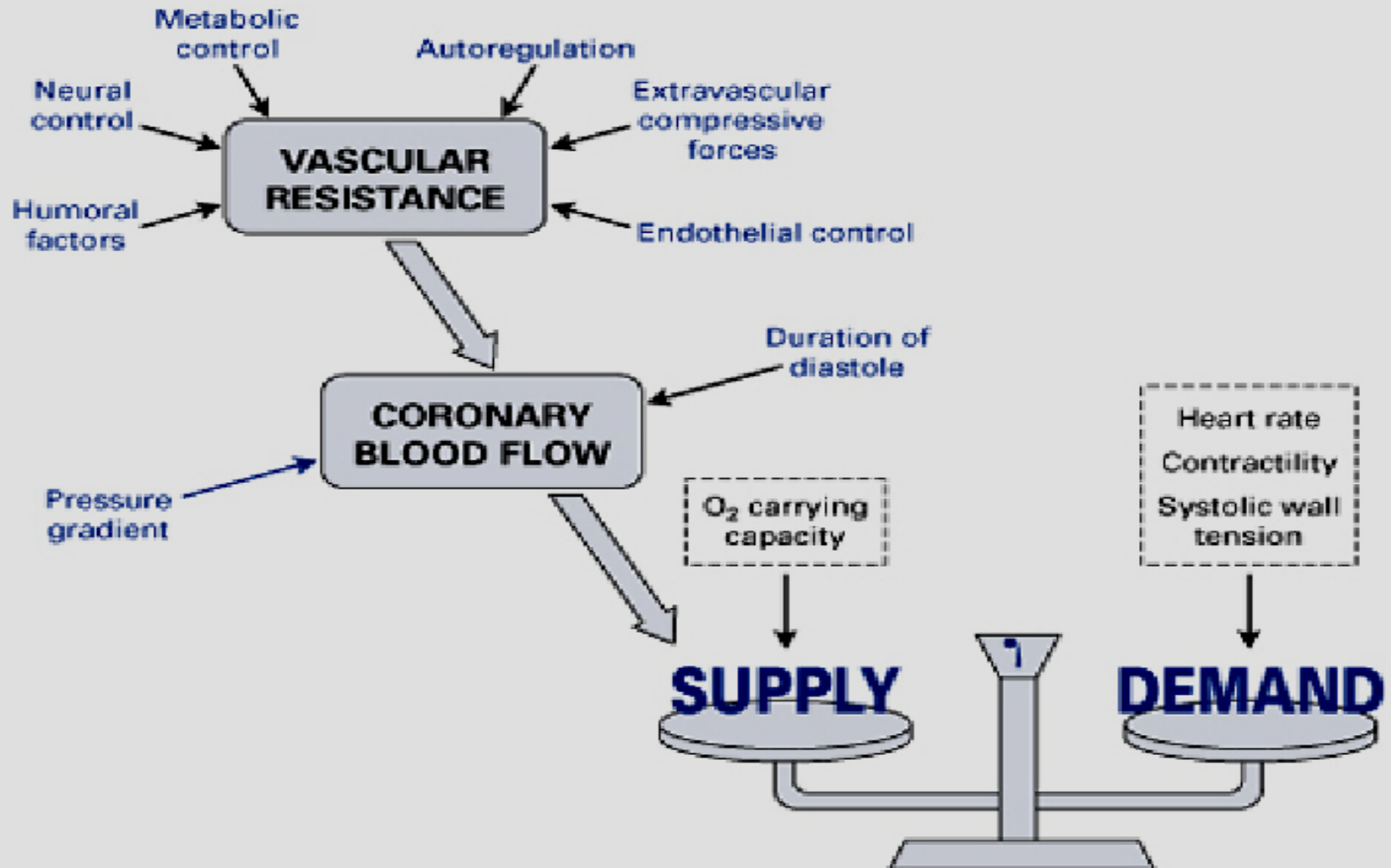
Angina pectoris: a glossary

- **Postinfarction angina** Symptoms that follow within 24 hours to 30 days of acute myocardial infarction.

- **Angina with normal CA** Syndrome X or microvascular angina.

- **Variant angina** Prinzmetal's or vasospastic angina related to epicardial coronary spasm. Pain often at rest that is sustained and may have circadian variation. Exercise tolerance often is normal.

- **Right ventricular angina** Anginal symptoms developing in association with pulmonary hypertension thought to be secondary to right ventricular ischemia.

Myocardial Ischemia Balance

O₂ supply

O₂ demand

Coronary blood flow
Intraluminal coronary size
Coronary perfusion pressure
Hemoglobin O₂ content
Duration of diastole

Heart rate
Blood pressure
Myocardial contractility
LV size
Duration of systole

Pathogenesis of Angina

Conditions Provoking or Excerpting Ischemia

| Increased Oxygen Demand	Decreased Oxygen Supply
Noncardiac	*Noncardiac*
Hyperthermia	Anemia
Hyperthyroidism	Hypoxemia
Sympathomimetic toxicity	Pneumonia
(e.g., cocaine use)	Asthma
Hypertension	Chronic obstructive
Anxiety	pulmonary disease
Arteriovenous fistulae	Pulmonary hypertension
	Interstitial pulmonary
	fibrosis
	Obstructive sleep apnea
Cardiac	Sickle cell disease
Hypertrophic cardiomyopathy	Sympathomimetic toxicity
Aortic stenosis	(e.g., cocaine use)
Dilated cardiomyopathy	Hyperviscosity
Tachycardia	Polycythemia
Ventricular	Leukemia
Supraventricular	Thrombocytosis
	Hypergammaglobulinemia
	Cardiac
	Aortic stenosis
	Hypertrophic cardiomyopathy

Circadian Variation in Angina
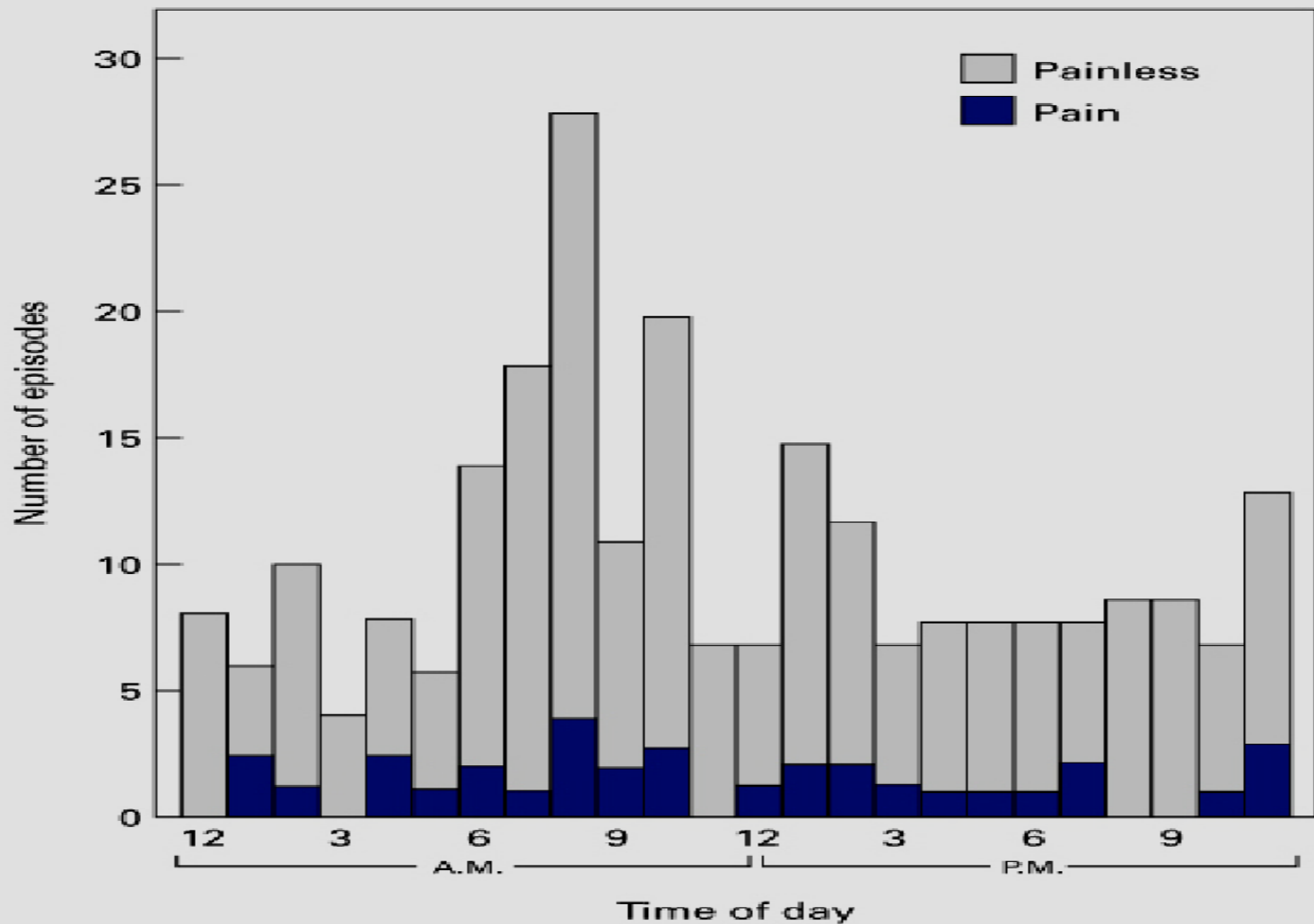
The hourly frequency of episodes of ischemic ST-segment depression in

MECHANISMS THAT DECREASE CORONARY BLOOD FLOW

- Coronary stenosis constriction

- Endothelial dysfunction

- Coronary collateral or distal coronary vessel vasoconstriction downstream from coronary occlusion

- Epicardial coronary artery spasm
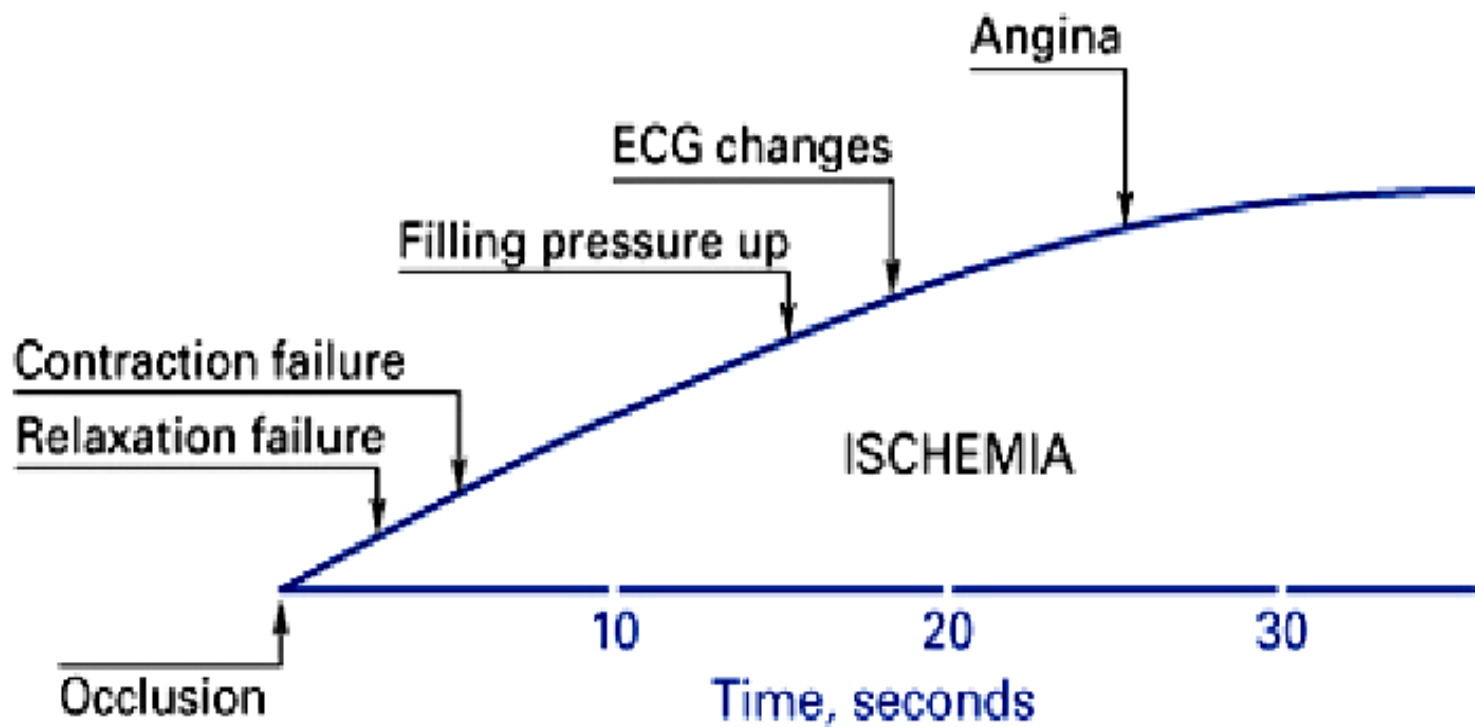
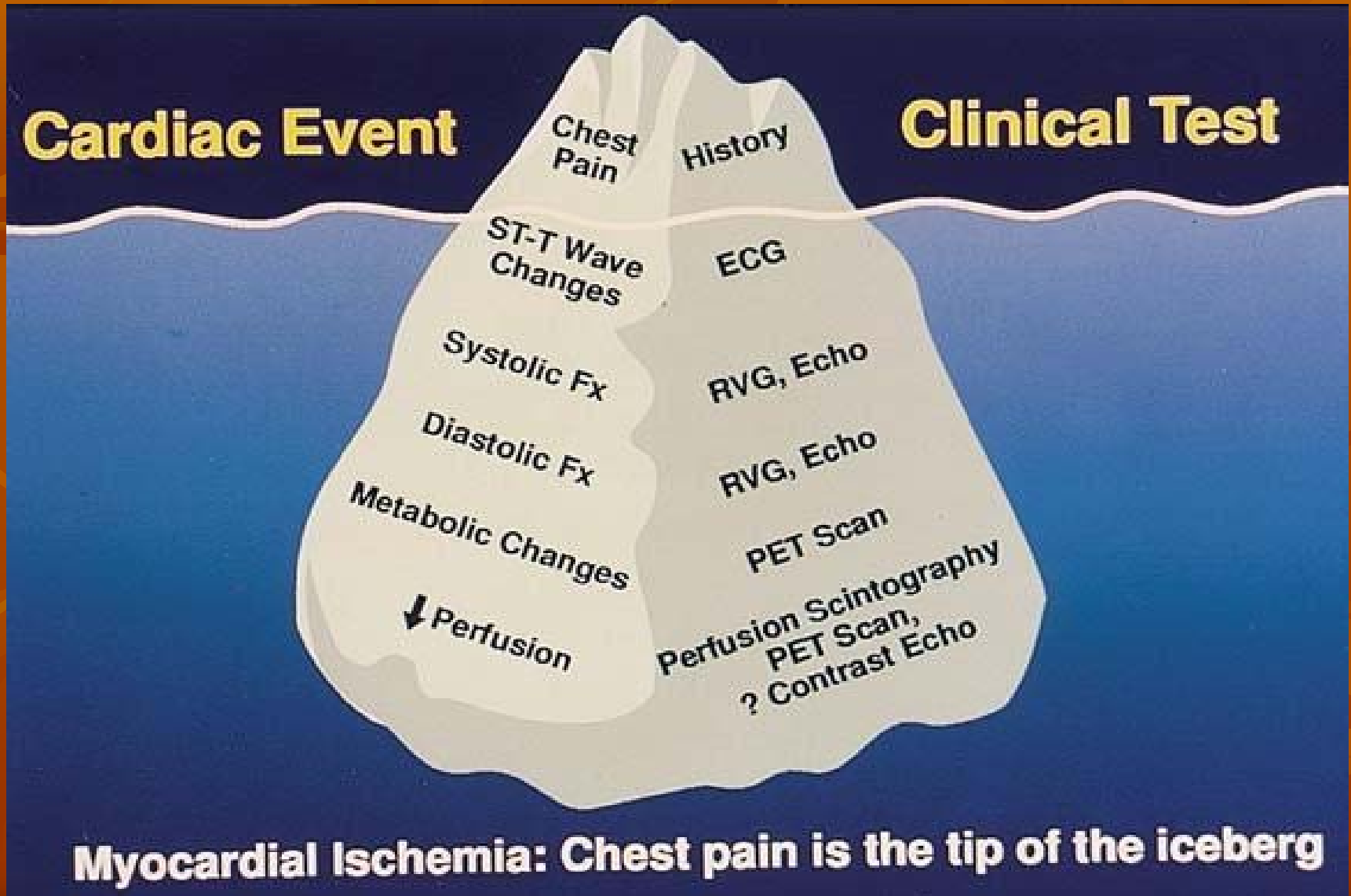Appearance of events during transient coronary occlusion.

(From Sigwart et al.124 Reproduced with permission from the publisher and authors.)

Ischemic Iceberg

Myocardial Ischemia: Chest pain is the tip of the iceberg

Clinical Presentation:

- **Typical anginal pain**
- **Anginal Equivalent:**
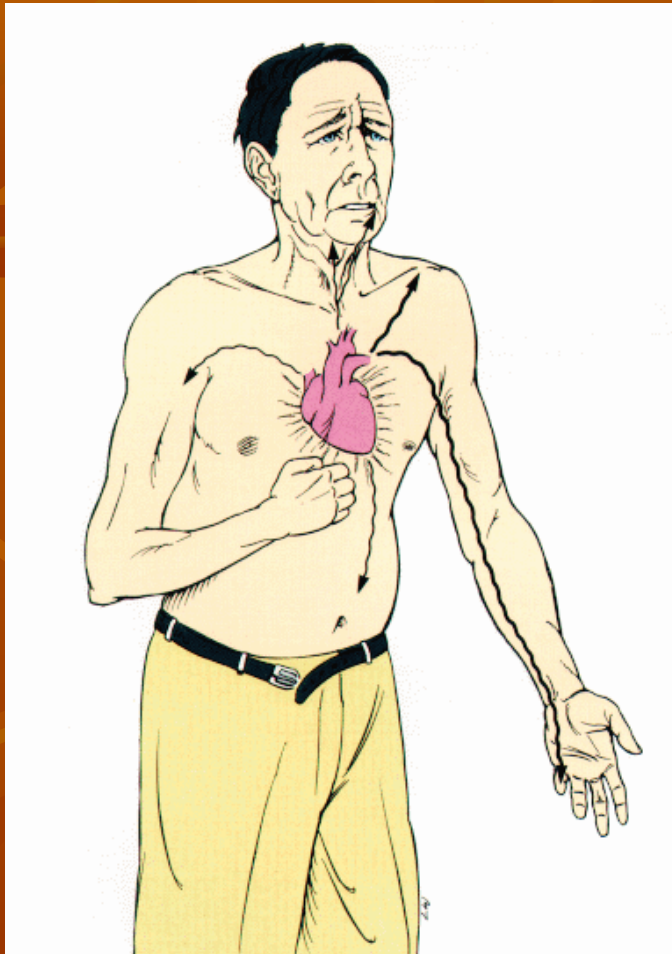 - **Exertional Dyspnea**
  - **Exertional Fatigue**

    (associated with exertion and relieved by nitroglcerine)
- **Risk Factors**

Anginal Pain

ATYPICAL FEATURES OF ANGINA PAIN

- **Location: Radiation to right shoulder or arm, jaw, tongue, teeth**
- **Duration: Ranges from seconds* to hours***
- **Descriptors: Sharp*, sticking*, stabbing, knifelike*, pricking*, gas***
- **Triggers: None, meals, body position***

- **Localization: Small area of chest (< 3 cm)*, entire right or left side,***
- **leg pain***
- **Associated skin or chest wall tenderness***

***Usually indicates a noncardiac cause.**

Clinical Examination:

- **Pale quiet sweating patient**
- **Levine sign**
- **Pulse mild tachycardia or arrhythmias**
- **BP slight elevation**
- **Abnormal apex beat**
- **New gallop S4 or S3**
- **Apical SM (MR)**
- **Response to CS massage**
- **Signs of risk factors**

Grading of Angina

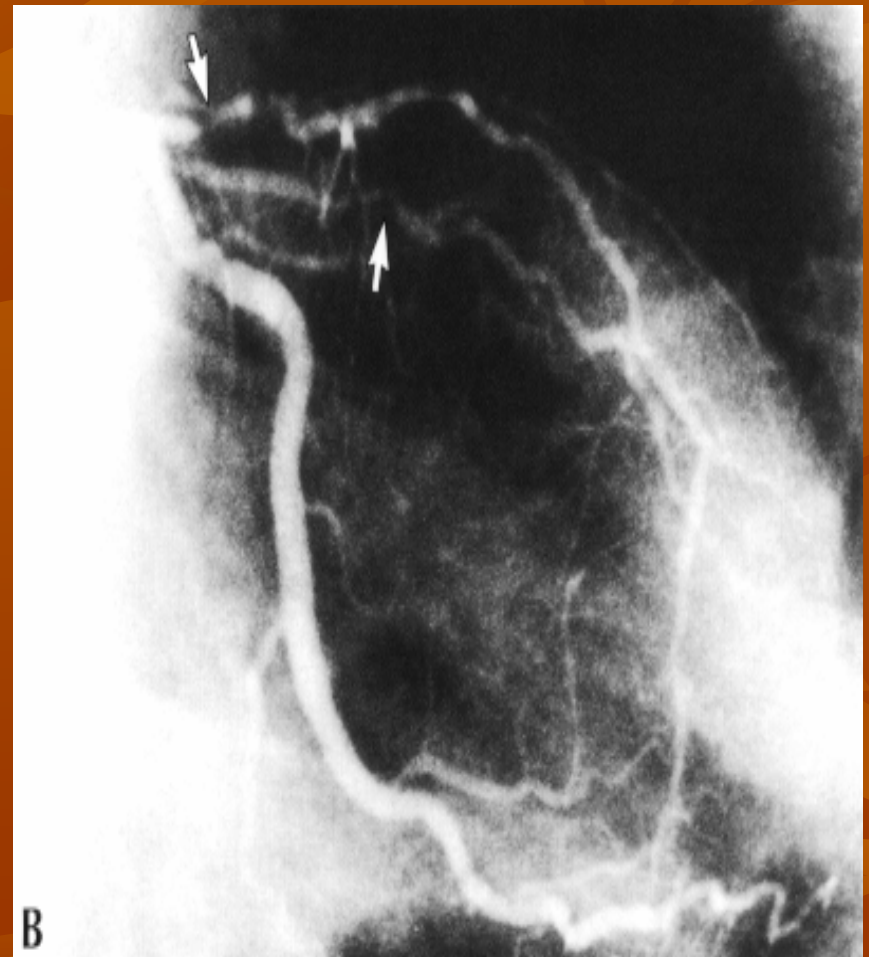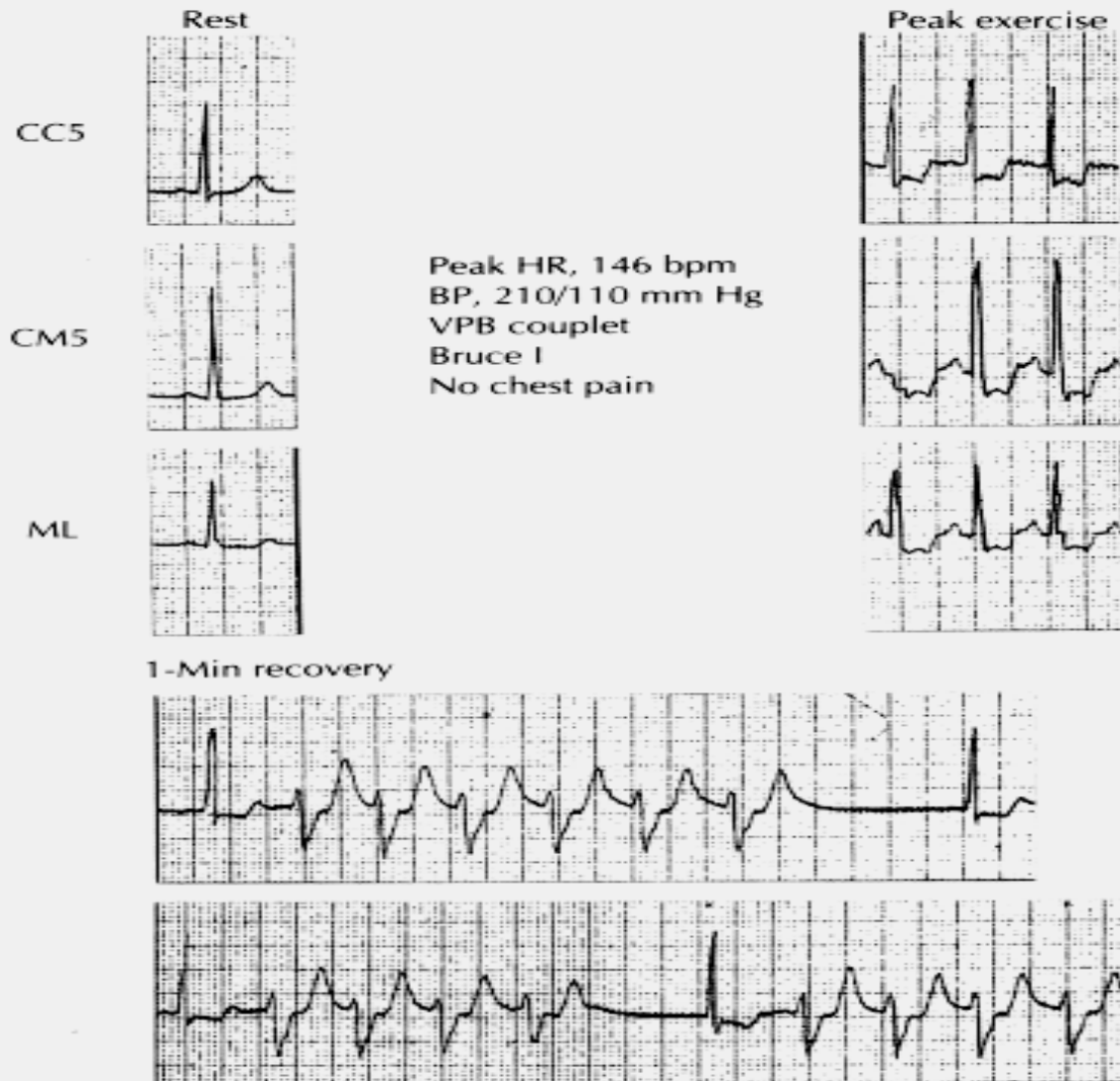| Class	Description
I	Ordinary physical activity does not cause angina, it occurs with strenuous, rapid or prolonged exertion
II	Slight limitation of ordinary activity. Angina occurs on rapid walking or climbing stairs, emotional stress, walking uphill or after meals.
III	Marked limitations of ordinary physical activity. Angina occurs on walking one to two blocks on the level and climbing one flight of stairs
IV	Inability to carry on any physical activity without Discomfort, anginal symptoms may be present at rest.
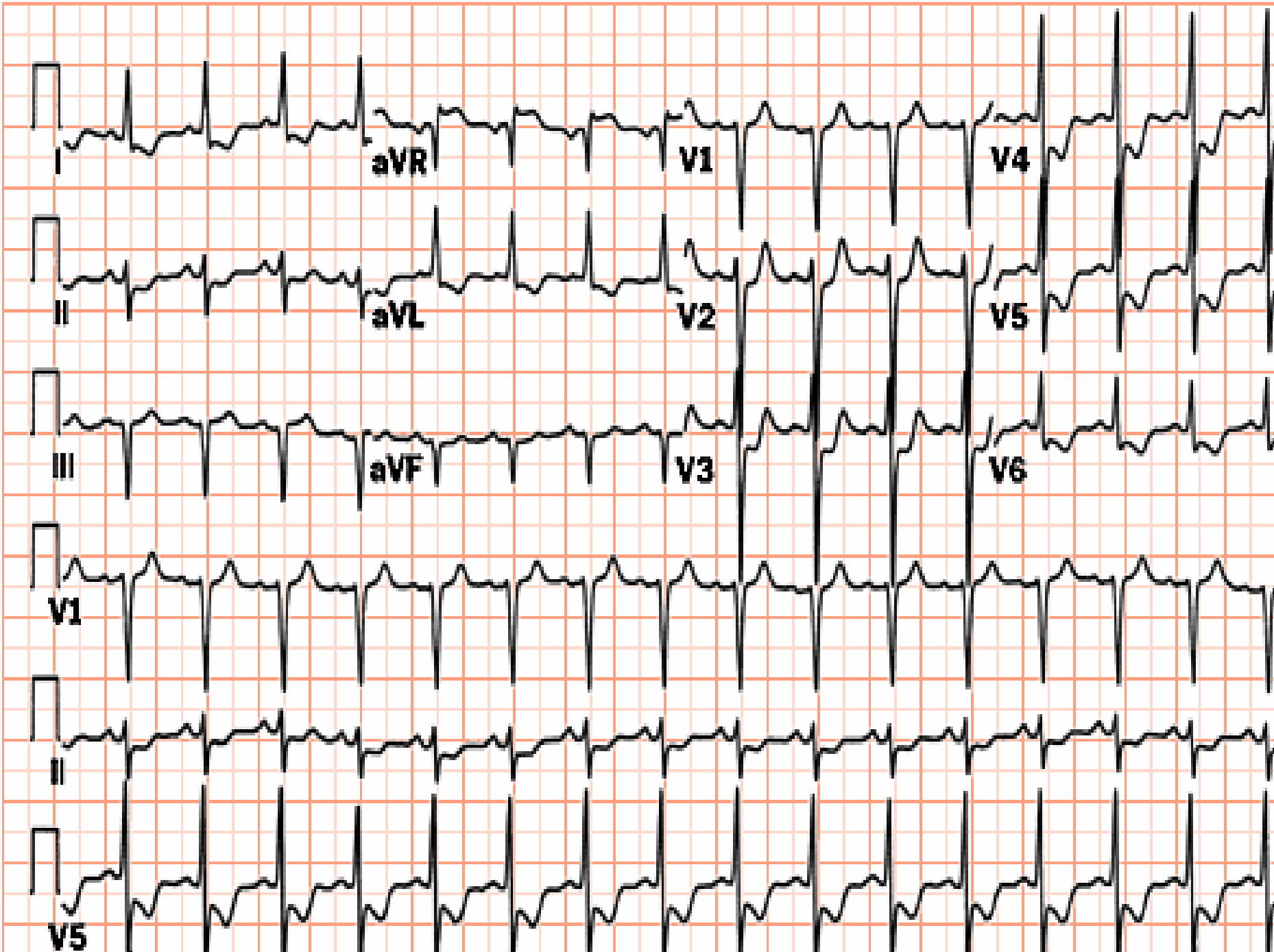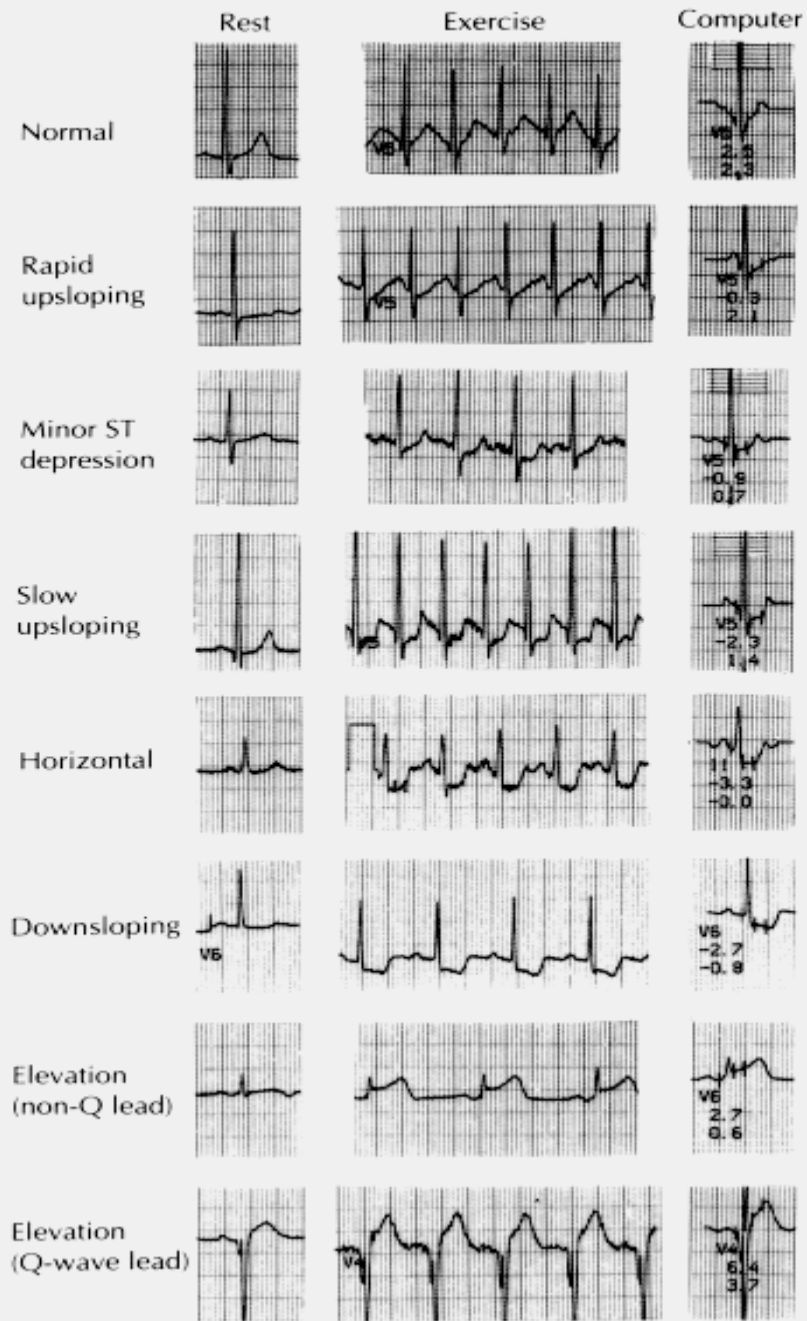
S-T elevation with Exercise

Rest   Exercise

II

V₁

V₂

V₃

V₄
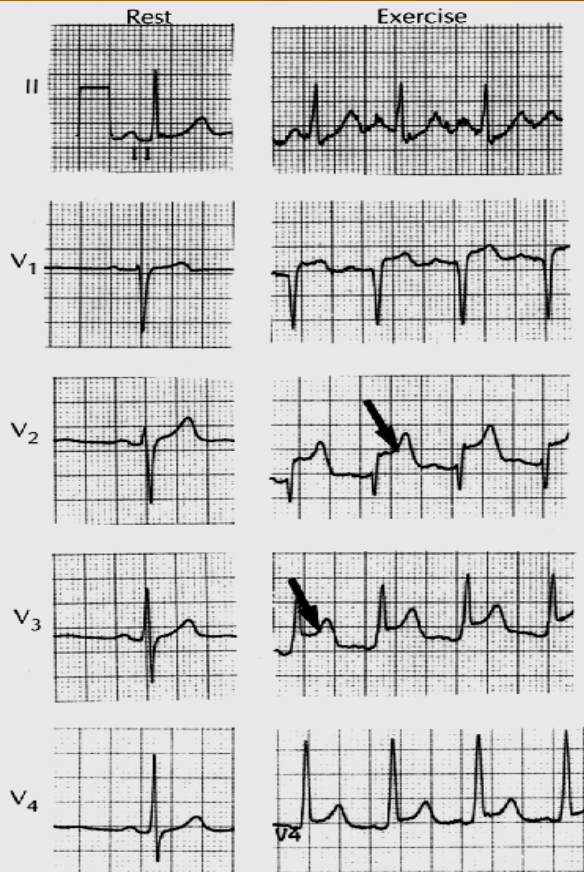
HR, *bpm*	59	110
SBP, *mm Hg*	110	148
Workload: 4 METs		
Termination: angina		

A

B

Severe EET Response

Rest — Peak exercise

CC5

CM5

ML

Peak HR, 146 bpm
BP, 210/110 mm Hg
VPB couplet
Bruce I
No chest pain

1-Min recovery

Pseudo-normalization of T-wave
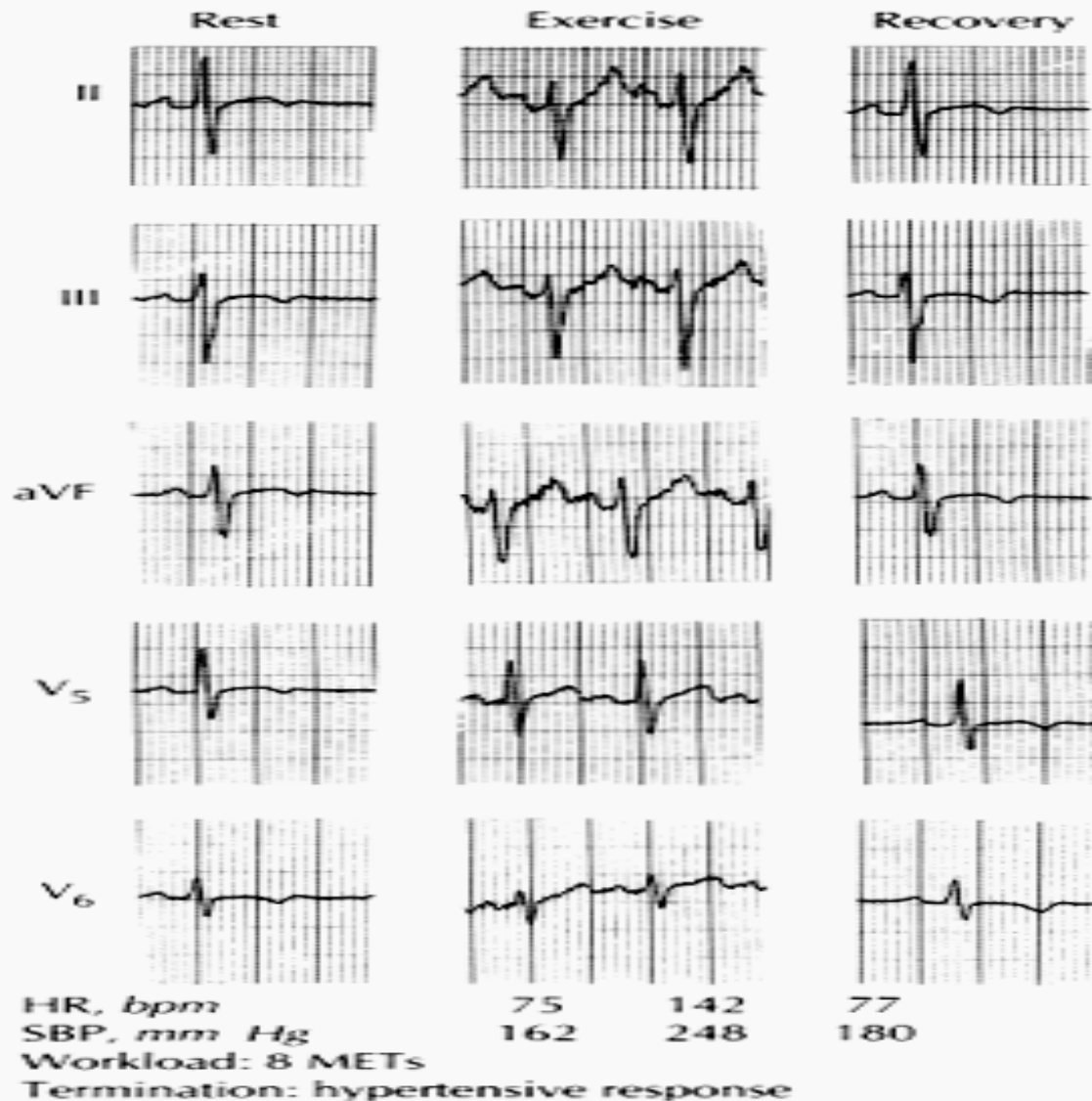
Some non-specific Responses
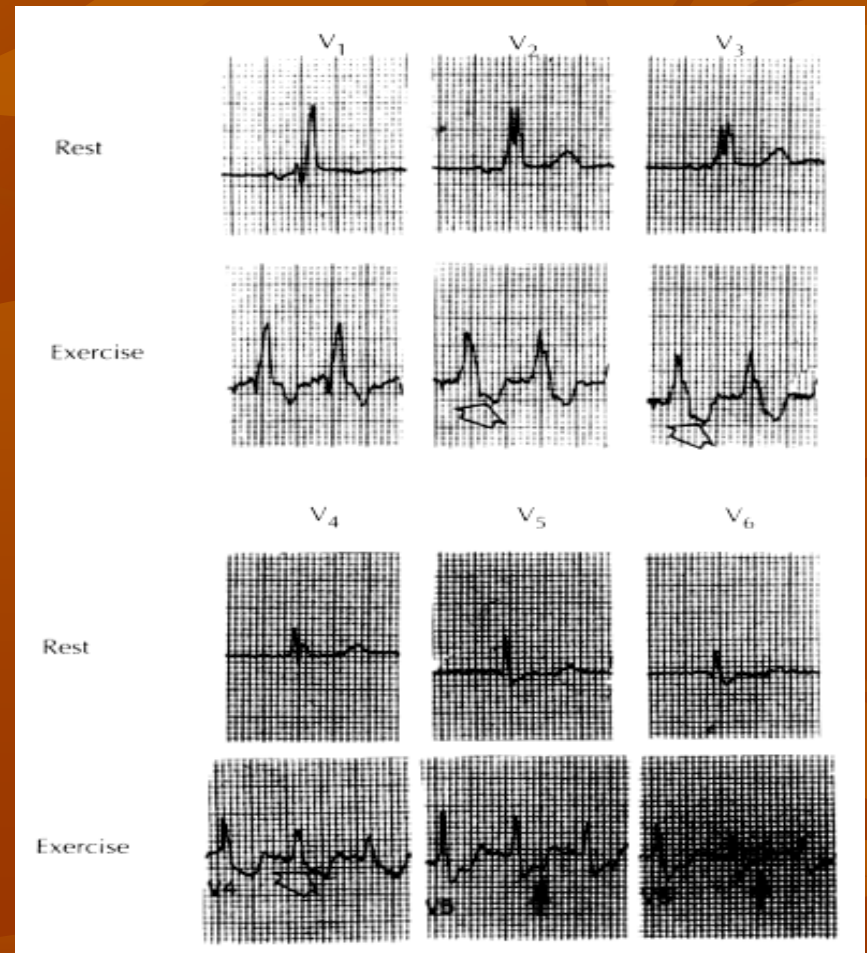
Patient with abnormal hemodynamic response decrease BP
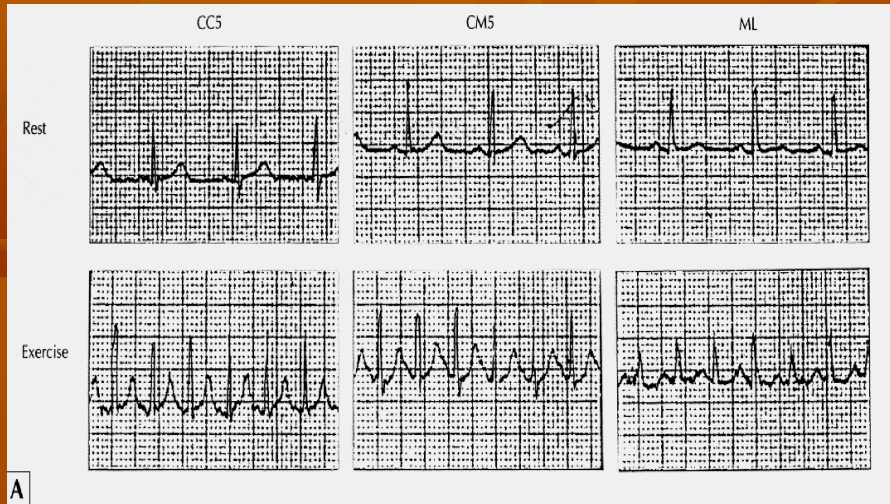
Contraindications of Exercise Test

Absolute:

- Acute myocardial infarction (within 2 d)
- High-risk Uunstable angina
- Uncontrolled cardiac arrhythmias causing symptoms or hemodynamic compromise
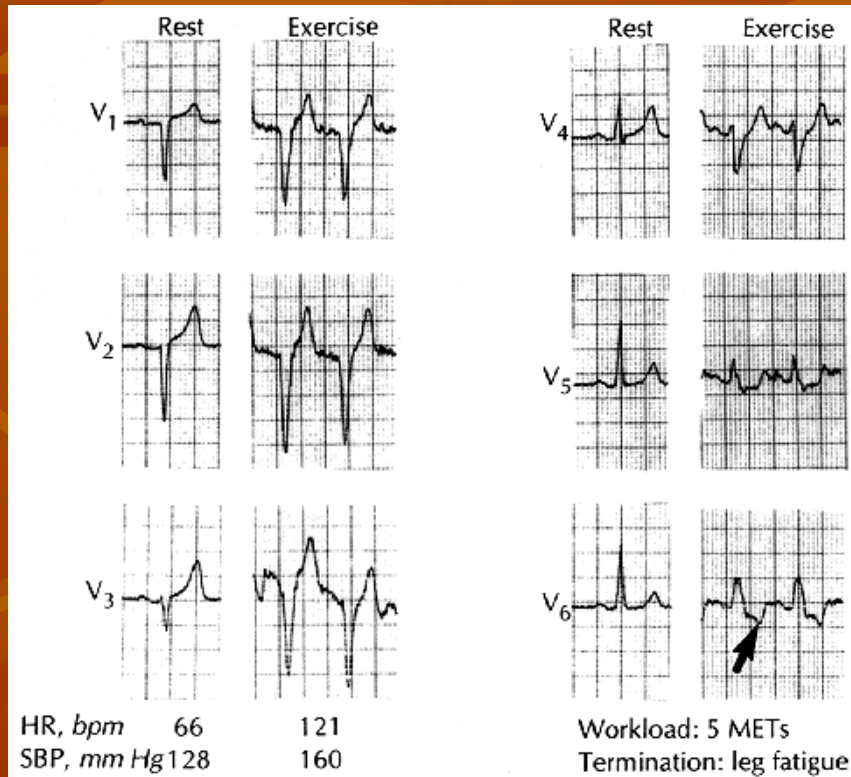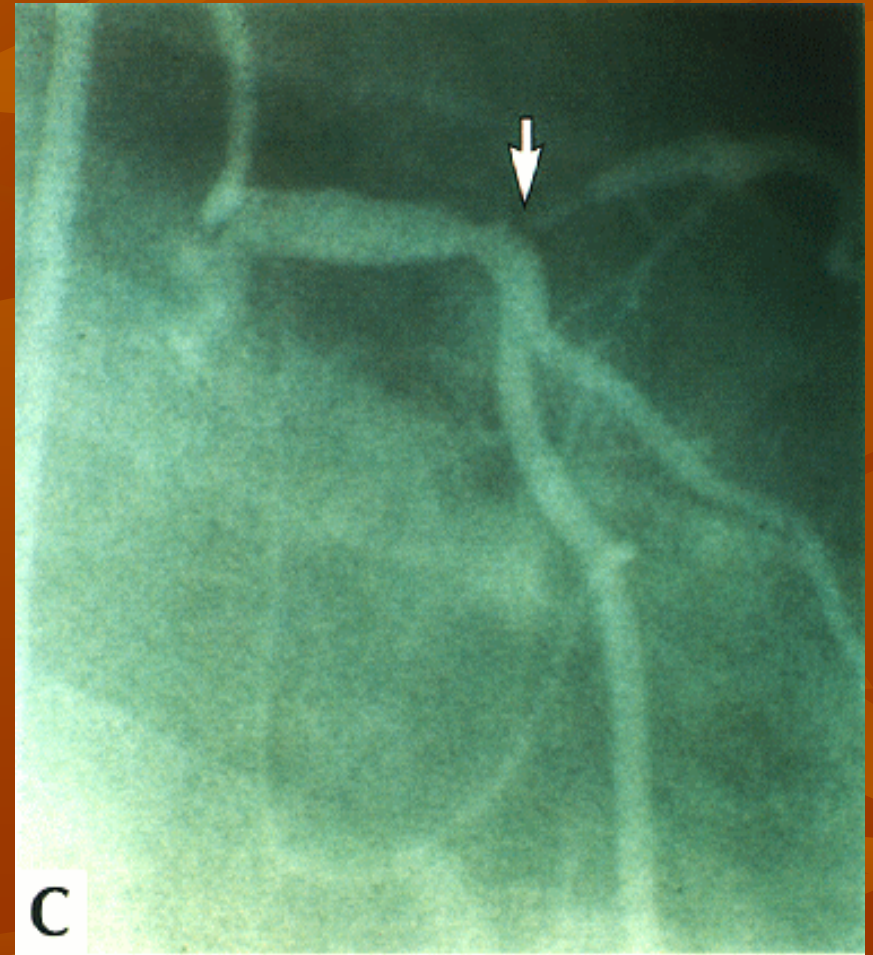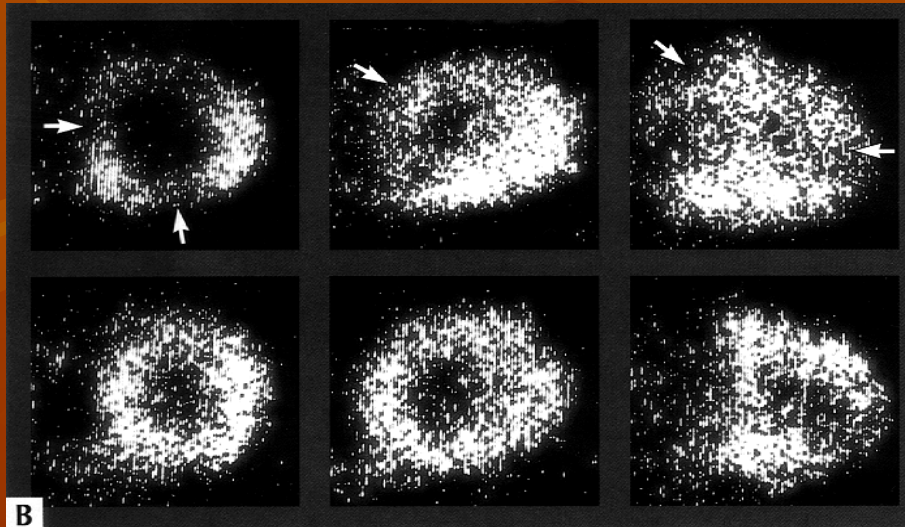- Symptomatic severe aortic stenosis
- Uncontrolled symptomatic heart failure
- Acute pulmonary embolus or pulmonary infarction
- Acute myocarditis or pericarditis
- Acute aortic dissection

Relative:

- Left main coronary stenosis
- Moderate stenotic valvular heart disease
- Electrolyte abnormalities
- Severe arterial hypertension‡
- Tachyarrhythmias or bradyarrhythmias
- Hypertrophic cardiomyopathy and other forms of outflow tract obstruction
- Mental or physical impairment leading to inability to exercise adequately
- High-degree atrioventricular block

CONDITIONS THAT CAN PRODUCE ST-SEGMENT SHIFTS DURING EXERCISE TESTING

- **Coronary artery disease**
- **Valvular heart disease**
- **Congenital heart disease**
- **Cardiomyopathies**
- **Pericardial disorders**
- **Left bundle branch block**
- **LVH**
- **Pre-excitation conduction variants**
- **MVP**
- **Vasoregulatory abnormalities**
- **Hyperventilation**
- **Hypertension**

- **Drugs**
  - Digitalis
  - Tricyclic antidepressant drugs
  - Some antiarrhythmic agents
- **Electrolyte abnormalities**
  - Hyperkalemia
  - Hypokalemia
  - Hypomagnesemia
  - Hypercalcemia
  - Hypocalcemia
- **Anemia**
- **Nonfasting state**
- **Postural changes**

Indications for Terminating Exercise Testing ACC Guidelines 2002

Absolute indications

- Drop in systolic BP of >10 mm Hg from baseline BP despite an increase in workload, when accompanied by other evidence of ischemia
- Moderate to severe angina
- Increasing nervous system symptoms (eg, ataxia, dizziness, or near-syncope)
- Signs of poor perfusion (cyanosis or pallor)
- Technical difficulties in monitoring ECG or systolic BP
- Subject's desire to stop
- Sustained ventricular tachycardia
- ST elevation (> 1.0 mm) in leads without diagnostic Q-waves (other than V1 or aVR)

Relative indications

- Drop in systolic BP of >10 mm Hg from baseline BP despite an increase in workload, in the absence of other evidence of ischemia
- ST or QRS changes such as excessive ST depression (>2 mm of horizontal or downsloping ST-segment depression) or marked axis shift
- Arrhythmias other than sustained ventricular tachycardia, including multifocal PVCs, triplets of PVCs, supraventricular tachycardia, heart block, or bradyarrhythmias
- Fatigue, shortness of breath, wheezing, leg cramps, or claudication
- Development of BBB or IVCD that cannot be distinguished from VT
- Increasing chest pain
- Hypertensive response

High-risk Exercise Test

- **Inability to complete 6 minutes (Bruce protocol)**
- **Early positive test, i.e., 3 minutes**
- **Strongly positive test i.e., 2 minutes ST depression**
- **Sustained ST depression 3 minutes after cessation of exercise**
- **Downsloping ST depression**
- **Ischemia developed at a low heart rate(120 bpm)**
- **Flat or lowered blood pressure response**
- **Serious ventricular arrhythmia**

Silent Ischemia

- **At least 75% of the ischemia occurring in patients with stable angina is clinically silent**

- **silent ischemia, may be categorized into 3types:Cohn 1987**

  - **type 1 patients are totally asymptomatic**

  - **type 2 are those who are symptomatic after a prior documented myocardial infarction**

  - **type 3 patients manifest silent ischemia but also have symptomatic ischemia**

METHODS TO DETECT SILENT MYOCARDIAL ISCHEMIA

- **Exercise stress testing with ECG monitoring**
- **Ambulatory ECG monitoring**
- **Exercise stress echocardiography**
- **Dobutamine stress echocardiography**
- **Stress radionuclide angiography**
- **Ambulatory left ventricular function monitoring (VEST)**
- **Positron emission tomography**
- **Exercise stress thallium-201 scanning**
- **Adenosine thallium-201 scanning**
- **Dipyridamole thallium-201 scanning**

PERSONS FOR WHOM SCREENING FOR SMI MAY BE USEFUL

ASYMPTOMATIC PERSONS

- **Men older than 40 years with at least two other traditional cardiac risk factors**

- **Postmenopausal women older than 55 years with at least two other traditional cardiac risk factors**

- **Those at high risk for premature atherosclerosis (*eg*, familial heperlipidemia, evidence of severe hypercholesterolemia, family history of coronary artery disease at an early age)**

- **Those with ECG evidence of prior unrecognized myocardial infarction**

- **Those > 5 years after coronary artery bypass**

PERSONS FOR WHOM SCREENING FOR SMI MAY BE USEFUL

SYMPTOMATIC PERSONS

- **Those with stable angina well controlled by medication**

- **Those with unstable angina after rest and pain well controlled by medication**

- **Those who have experienced myocardial infarction**

- **Those who have survived nearly fatal cardiac events**

- **Those with peripheral vascular disease or cerebrovascular disease to undergo noncardiac surgery**

Risk Stratification
ACC Guidelines 2002

High-Risk (greater than 3% annual mortality rate)

- **Severe resting left ventricular dysfunction (LVEF < 35%)**

- **High-risk treadmill score (score < –11)**

- **Severe exercise left ventricular dysfunction (exercise LVEF < 35%)**

- **Stress-induced large perfusion defect (particularly if anterior)**

- **Stress-induced multiple perfusion defects of moderate size**

Risk Stratification
ACC Guidelines 2002

Intermediate-Risk (1%-3% annual mortality rate)

1) **Mild/moderate resting left ventricular dysfunction (LVEF = 35% to 49%)**

2) **Intermediate-risk treadmill score (–11 < score < 5)**

3) **Stress-induced moderate perfusion defect without LV dilation or increased lung intake (thallium-201)**

4) **Limited stress echocardiographic ischemia with a wall motion abnormality only at higher doses of dobutamine involving less than or equal to two segments**

Risk Stratification
ACC Guidelines 2002

6. **Large, fixed perfusion defect with LV dilation or increased lung uptake (thallium-201)**

7. **Stress-induced moderate perfusion defect with LV dilation or increased lung uptake (thallium-201)**

8. **Echocardiographic wall motion abnormality (involving greater than two segments) developing at low dose of dobutamine (>10 mg/kg/min) or at a low heart rate (<120 beats/min)**

9. **Stress echocardiographic evidence of extensive ischemia**

Risk Stratification
ACC Guidelines 2002

Low-Risk (less than 1% annual mortality rate)

1. Low-risk treadmill score (score >5)

2. Normal or small myocardial perfusion defect at rest or with stress*

3. Normal stress echocardiographic wall motion or no change of limited resting wall motion abnormalities during stress*

FACTORS INFLUENCING CLINICAL OUTCOME IN ANGINA

- Number of coronary arteries diseased, (*eg,* one-, two-, or three-vessel disease)

- Presence or absence of left main coronary artery disease

- Extent of ischemia or amount of jeopardized myocardium

- Status of left ventricular function

ACC Guidelines 2002 for Stable Angina

A = **A**spirin and **A**ntianginal therapy

B = **B**eta-blocker and **B**lood pressure

C = **C**igarette smoking and **C**holesterol

D = **D**iet and **D**iabetes

E = **E**ducation and **E**xercise

CANDIDATES FOR USE OF NITRATES FOR ANGINA

IDEAL CANDIDATES

- Consistent response to sublingual nitroglycerin
- Patients suspected of having episodes of vasoconstriction (mixed angina), eg, variable effort threshold, rest, or mental stress angina
- Left ventricular dysfunction: congestive heart failure, reduced ejection fraction, cardiomegaly
- Postinfarction angina

POOR CANDIDATES

- Persistent or intolerable headache, nausea, or dizziness
- Nitrate hypersensitivity
- Limited clinical response to long-acting nitrates

CANDIDATES FOR USE OF B-BLOCKERS FOR ANGINA

IDEAL CANDIDATES

- Prominent relationship of physical activity to attacks of angina
- Coexistent hypertension
- History of supraventricular or ventricular arrhythmia
- Postmyocardial infarction angina
- Prominent anxiety state

POOR CANDIDATES

- Asthma or reversible airway component in chronic lung patients
- Diabetes
- Severe left ventricular dysfunction
- Congestive heart failure resulting from systolic impairment
- History of depression
- Raynaud's phenomenon
- Peripheral vascular disease
- Bradyarrhythmia

CANDIDATES FOR USE OF CALCIUM ANTAGONISTS FOR ANGINA

IDEAL CANDIDATES

- With coexistent hypertension
- Believed to have episodes of vasoconstriction (mixed angina) or vasospasm
- With supraventricular arrhythmia (verapamil or diltiazem

POOR CANDIDATES

- Severe left ventricular dysfunction or congestive heart failure
- Bradyarrhythmias (sinus bradycardia, slow atrial fibrillation, atrioventricular node block); such individuals should not be given verapamil or diltiazem

EVALUATION OF CORONARY REVASCULARIZATION FOR PROLONGING SURVIVAL

1. Age
2. Severity of symptoms
3. Stress testing and severity of ischemia
4. Ventricular function
5. Coronary anatomy
6. Extent and site of disease
7. Potential for revascularization
8. Coexisting medical conditions

FACTORS IN SELECTING MYOCARDIAL REVASCULARIZATION OVER MEDICAL THERAPY IN PATIENTS WITH ANGINA

CLINICAL

- Poor or partial response to intensive medical therapy
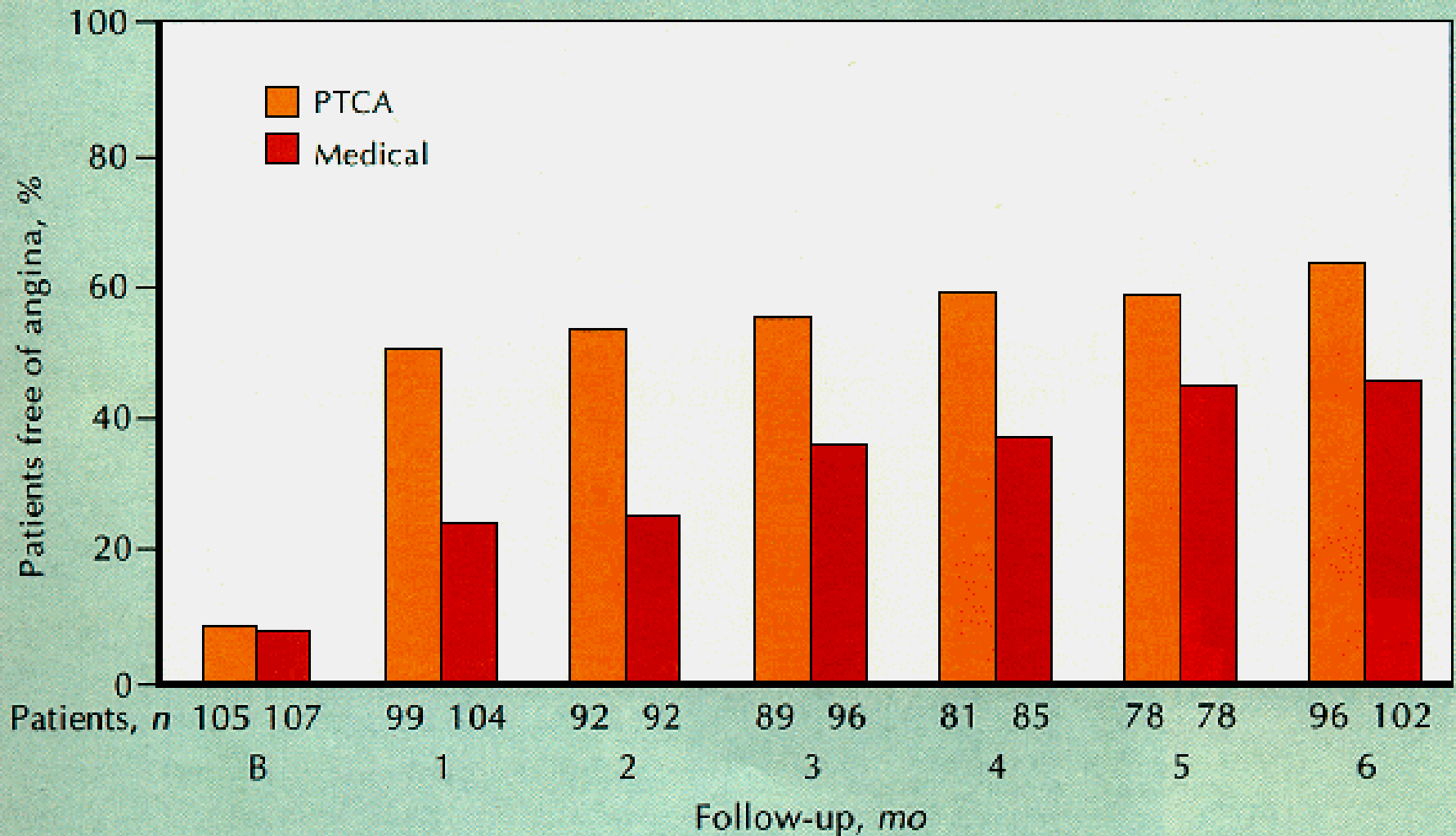- Lifestyle (occupation, recreation) limited stable angina on medical therapy

NONINVASIVE

- Objective evidence for major ischemia
- Strongly positive stress test (low workload, ST-segment depression ³ 2 mm, failure of systolic blood pressure to rise, early onset of ischemia)
- Large, reversible thallium defect; two or more reversible thallium defects; increased lung thallium uptake
- Extensive or multiple wall motion abnormalities on stress echocardiography or stress radionuclide angiography
- Strongly positive ambulatory recording: > four episodes of ST depression per day, >30 min of ST depression per day

FACTORS IN SELECTING MYOCARDIAL REVASCULARIZATION OVER MEDICAL THERAPY IN PATIENTS WITH ANGINA

INVASIVE

- **Main left coronary artery stenosis or three-vessel disease, especially if LV function is decreased (CABG)**

- **Two-vessel disease with decreased LV function and/or proximal LAD involvement**

- **Two-vessel disease with frequent symptoms or ischemia on noninvasive testing while on medical therapy**

- **One-vessel disease with easily induced ischemia on medical therapy (PTCA)**

PTCA Vs Medical Therapy

Thank You