

Myocardial Infarction

Introduction

Definition

- Myocardial infarction (MI) (ie, heart attack) is the irreversible necrosis of heart muscle secondary to prolonged ischemia.
- This usually results from an imbalance in oxygen supply and demand, which is most often caused by plaque rupture with thrombus formation in a coronary vessel, resulting in an acute reduction of blood supply to a portion of the myocardium.

Introduction

- Myocardial infarction (MI) is a multifactorial disease that is influenced by environmental and genetic factors.
- Indians are more prone to cardiovascular diseases, including MI, at a younger age compared to other populations.
- Nearly 25% of all MIs are silent and do not display symptoms such as chest pain.

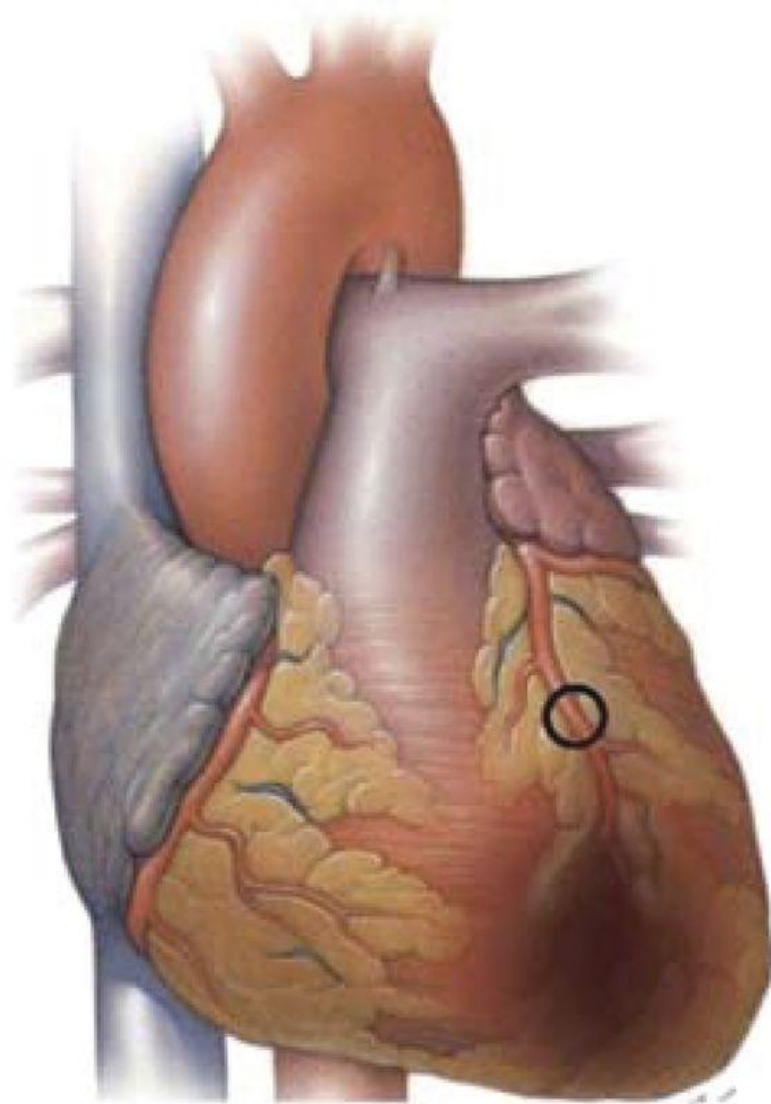
Introduction

- The classical risk factors for developing MI are smoking, alcohol consumption, hypertension, dyslipidaemia, male gender and diabetes mellitus.
- In addition, a family history of cardiovascular disease (CVD) has been found to be a major risk factor for MI, thus indicating the involvement of a genetic component

Etiology and Pathophysiology

Causes of reduced blood flow:

- Narrowing of a coronary artery owing to atherosclerosis
- A complete occlusion of an artery owing to embolus or a thrombus
- Myocardial necrosis caused by acute occlusion of a coronary artery due to plaque rupture or erosion with imposed thrombosis)



Plaque rupture with thrombus



MI Type 1

Vasospasm or endothelial dysfunction



MI Type 2

Fixed atherosclerosis and supply-demand imbalance



MI Type 2

Supply-demand imbalance alone



MI Type 2

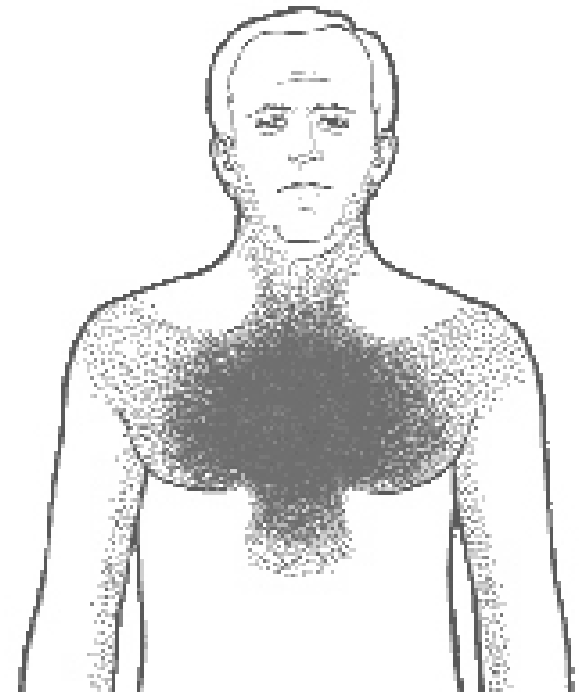
Natural History of CHD

- CHD is a progressive disease with an untreated annual mortality rate of 4% per year in patients with chronic stable angina before the advent of widespread use of aspirin, betablockers, and risk factor modification.
- However, data from recent clinical trials suggest that mortality can be reduced to <1% per year if rates of aspirin, beta-blocker, and lipid-lowering therapies were optimized.

Clinical manifestations

Symptoms

- Pain is the cardinal symptom of an MI
- Anxiety and fear of impending death
- Nausea and vomiting
- Breathlessness
- Collapse/syncope



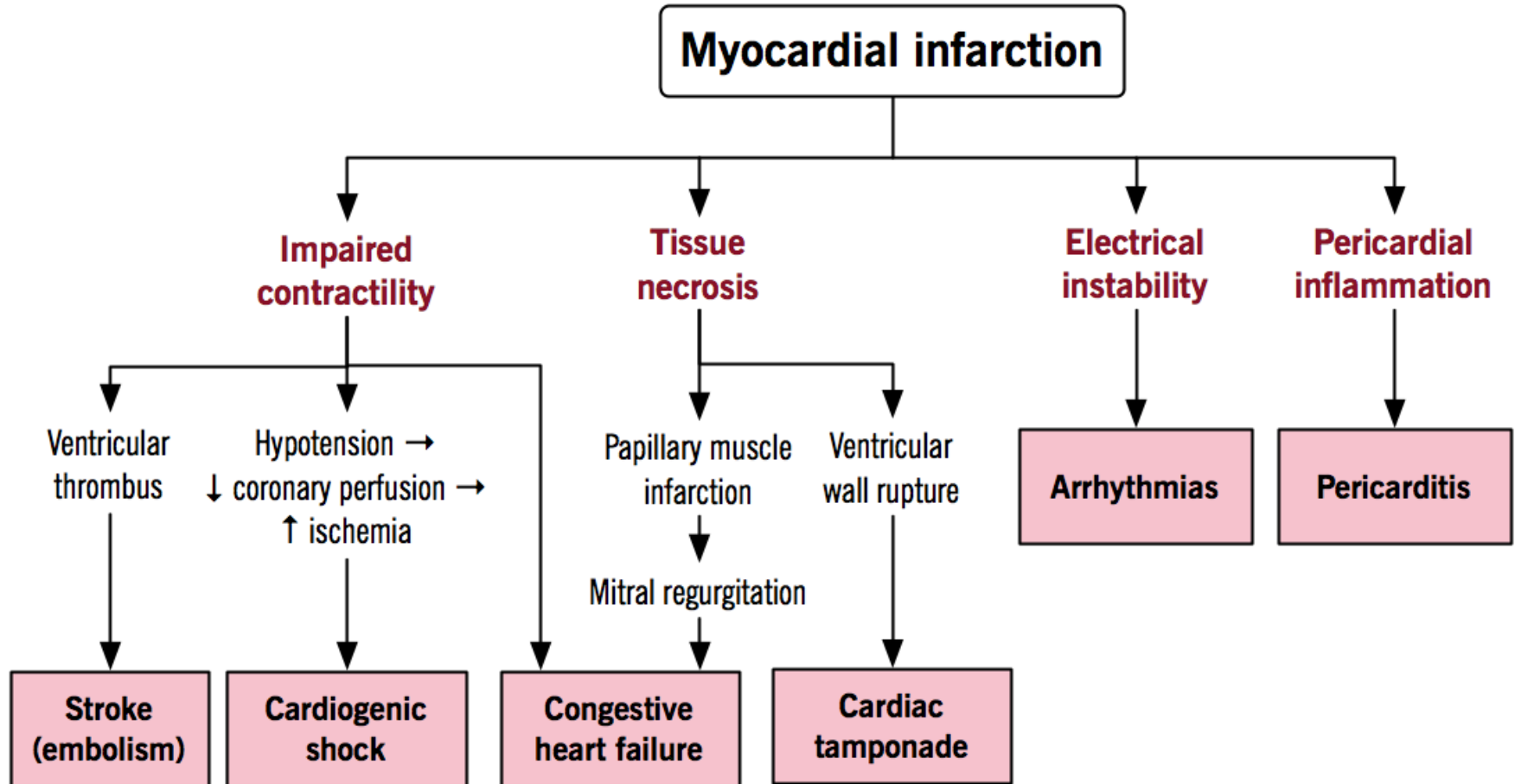
Clinical manifestations

Physical signs

- **Signs of sympathetic activation:** pallor, sweating, tachycardia
- **Signs of vagal activation:** nausea, vomiting, bradycardia
- **Signs of impaired myocardial function:** hypotension, oliguria, cold peripheries
- **Signs of complications:** e.g. mitral regurgitation, pericarditis

Complications of myocardial infarction

Dominique Yelle



Epidemiology

Epidemiology

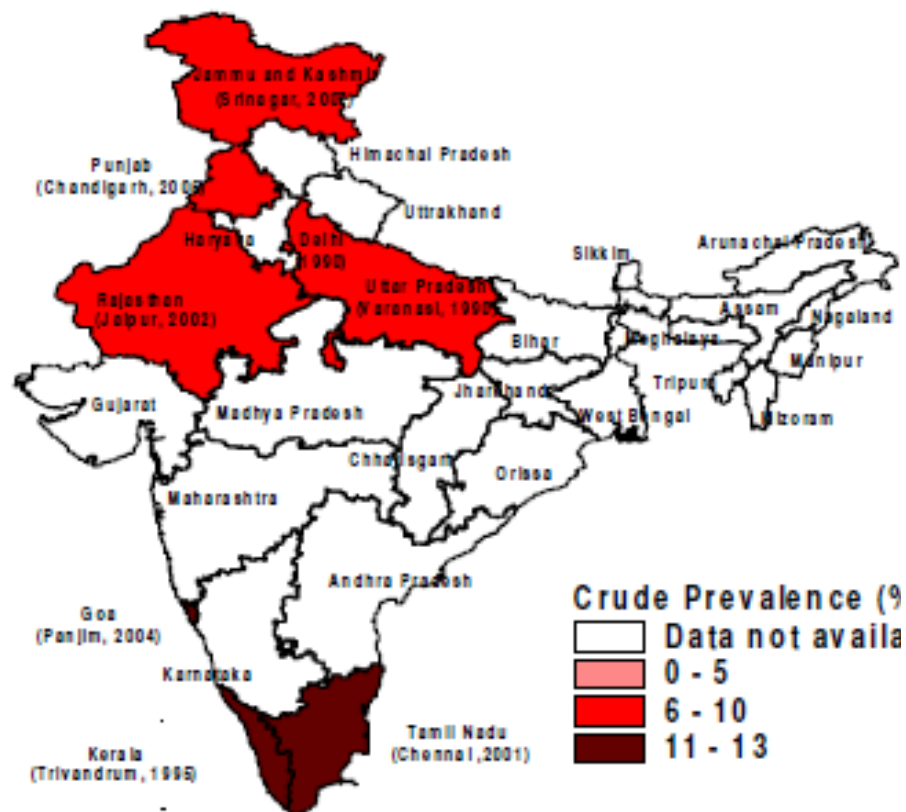
- India is undergoing a rapid health transition with rising burden of coronary heart disease (CHD).
- Among adults over 20 yr of age, the estimated prevalence of CHD:
 - 3–4 per cent in rural areas and
 - 8–10 per cent in urban areas,
- Representing a *two-fold* rise in rural areas and a *six-fold* rise in urban areas

Epidemiology

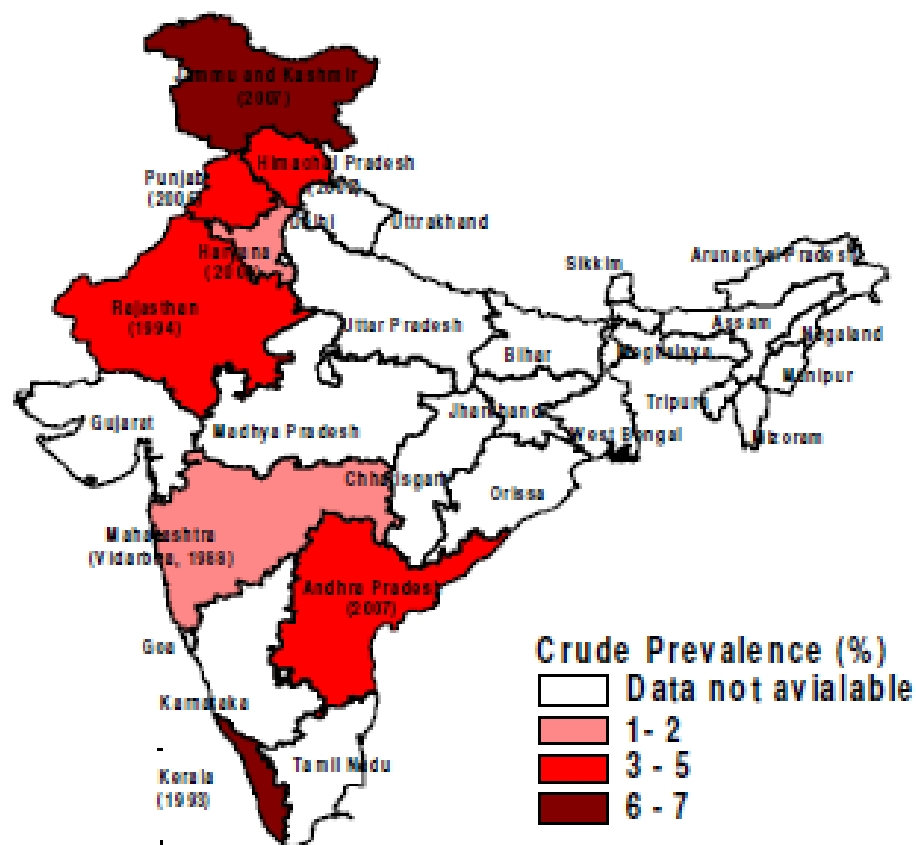
- Epidemiological studies (largely cross-sectional surveys) from various parts of India have reported the rising trends and a high burden in the levels of conventional risk factors such as
 - diabetes,
 - hypertension and
 - metabolic syndrome

which are largely determined by urbanization as evident from the urban-rural difference in the risk factors observed in India

Crude Prevalence of CHD in Urban and Rural India



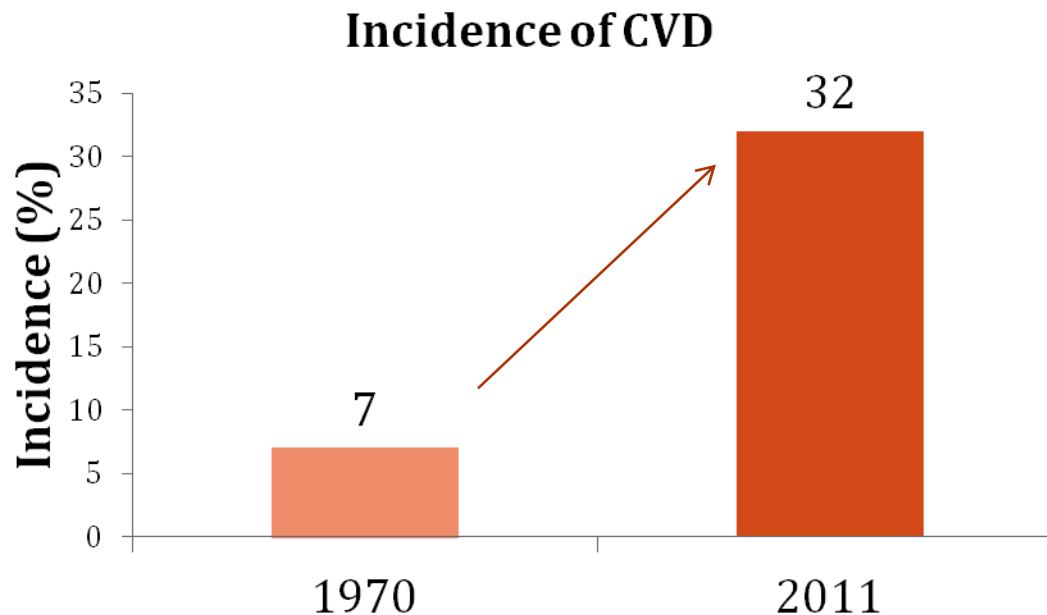
(A) Urban CHD Prevalence



(B) Rural CHD Prevalence

Epidemiology

- In India, **31.7%** of deaths occur due to MI.
- Incidence of cardiovascular diseases was about 7% in 1970 and increased up to 32% in 2011 in India.



Epidemiology

- A total of nearly **6.4 crore** cases of coronary vascular disease are likely in the year 2015,
- Nearly **96%** would be coronary heart disease cases.
- Deaths from this group of diseases are likely to amount to be a staggering **34 lakh.**

Epidemiology

- An estimated 1.3 million Indians died from this in 2000.
- The projected death from coronary artery disease by 2015 is **2.95 million.**
- Of which
 - 14% will be <30 years,
 - 31% will be <40 years.

Risk Factors

Risk Factors of Coronary Artery Diseases

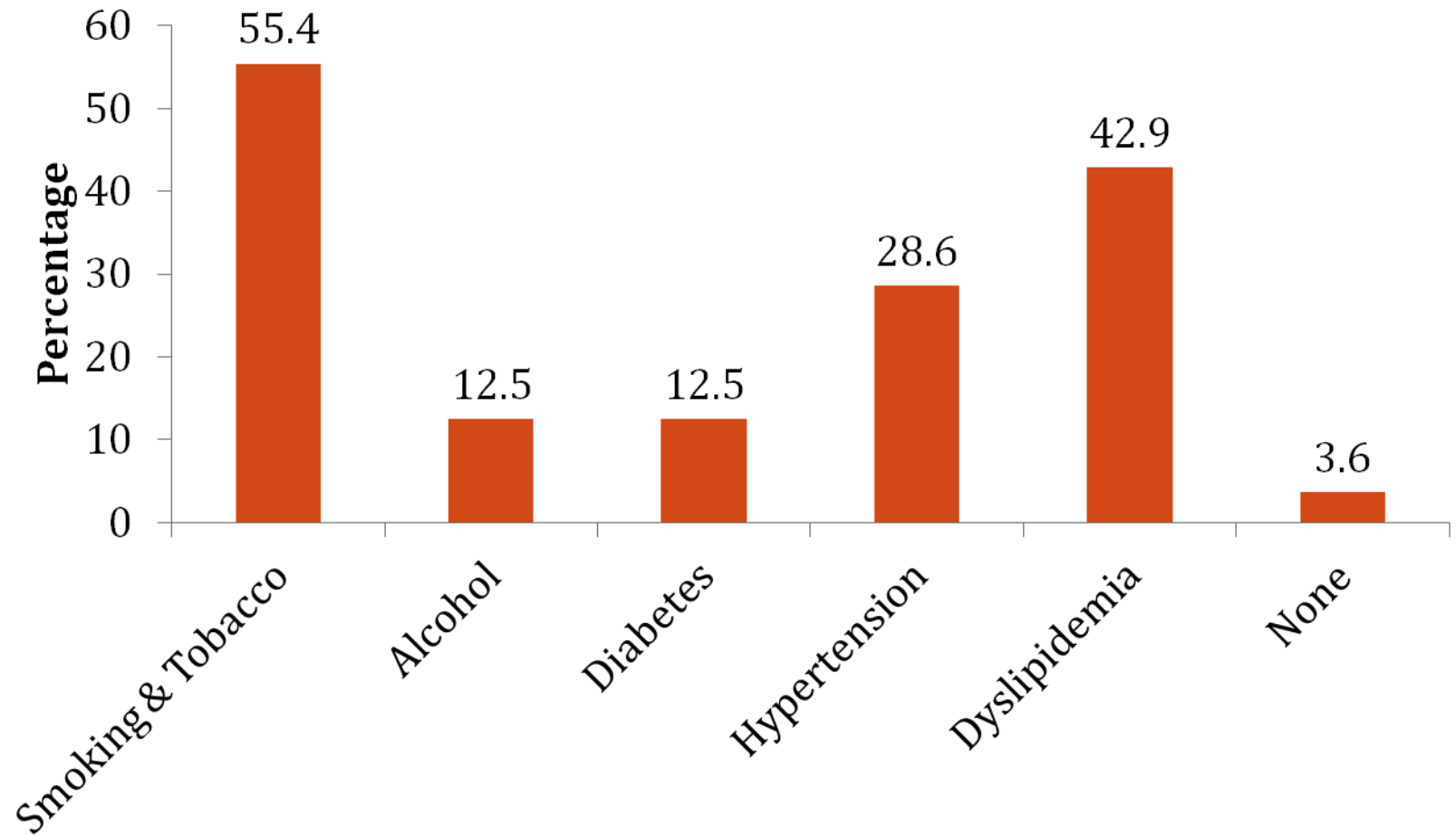
Major

- Diabetes
- High Blood Pressure
- Abnormal Cholesterol
- Family History
- Smoking
- STRESS

Minor

- Obesity
- Inactivity
- Diet
- Gout
- Hormonal Disorders

Common Risk Factors for MI



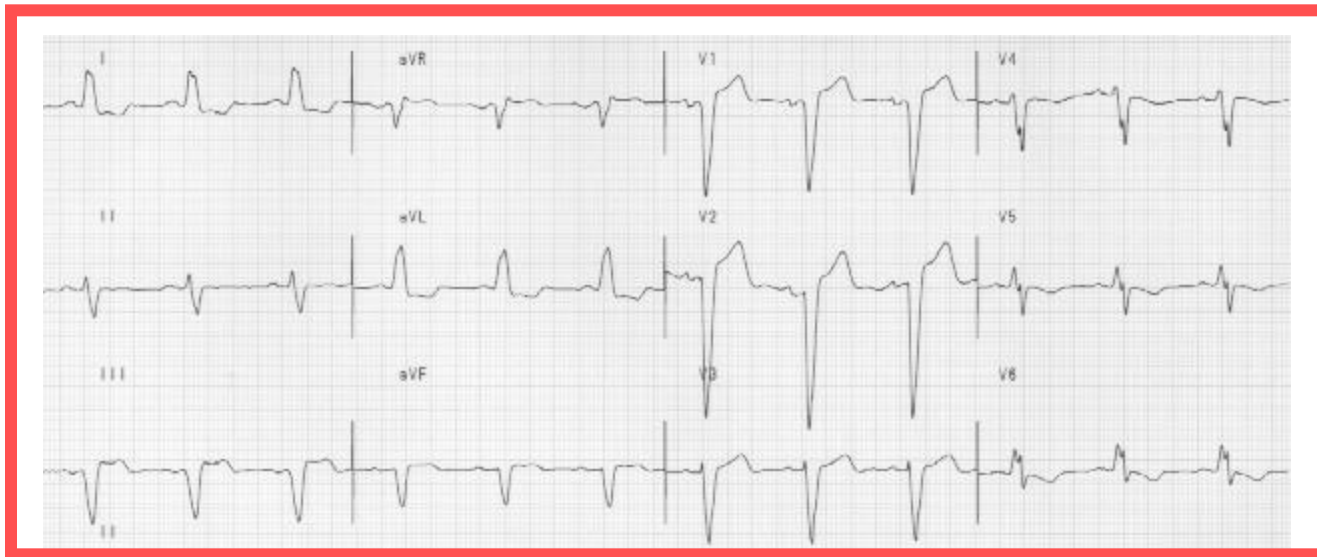
A Note on ECG

ECG

- Normal ECG does not mean a normal heart
- ECG indicates the condition of the heart at the time of recording.
- ECG does not have any prognostic value

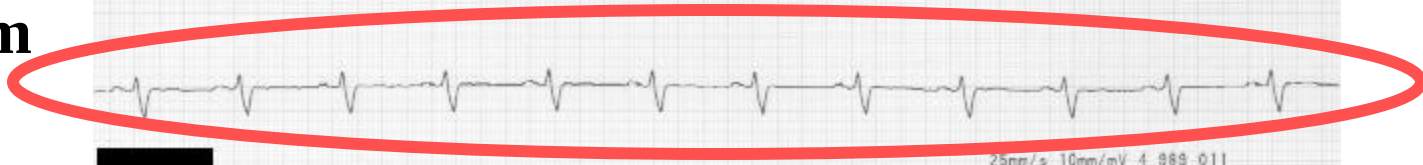
Diagnosing a MI

To diagnose a myocardial infarction you need to go beyond looking at a rhythm strip and obtain a 12-Lead ECG.



**12-
Lead
ECG**

**Rhythm
Strip**



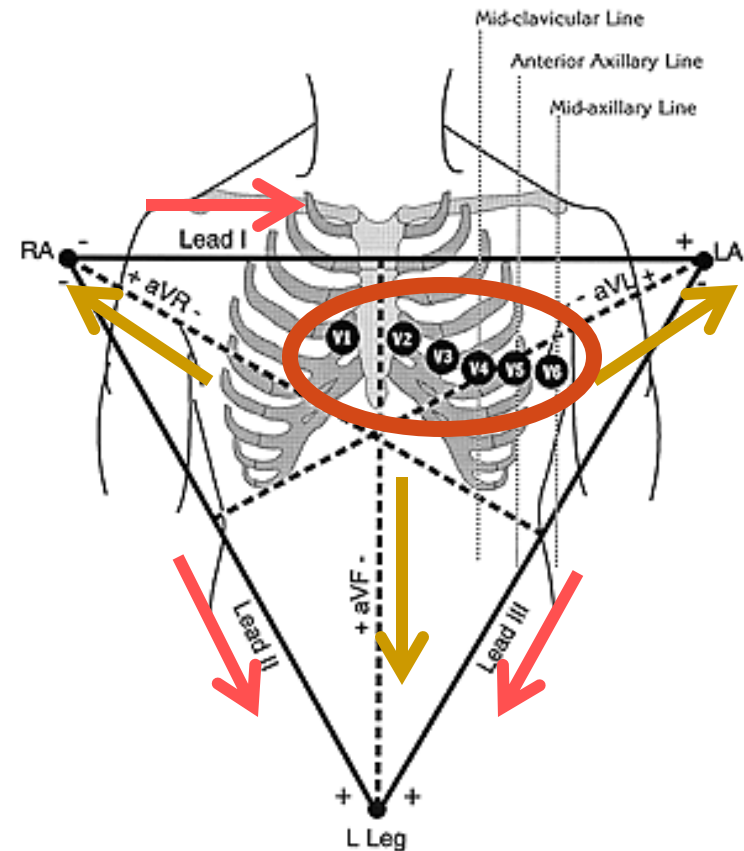
The 12-Lead ECG

- The 12-Lead ECG sees the heart from 12 different views.
- Therefore, the 12-Lead ECG helps you see what is happening in different portions of the heart.
- The rhythm strip is only 1 of these 12 views.

The 12-Leads

The 12-leads include:

- **3 Limb leads**
(I, II, III)
- **3 Augmented leads**
(aVR, aVL, aVF)
- **6 Precordial leads**
(V₁- V₆)



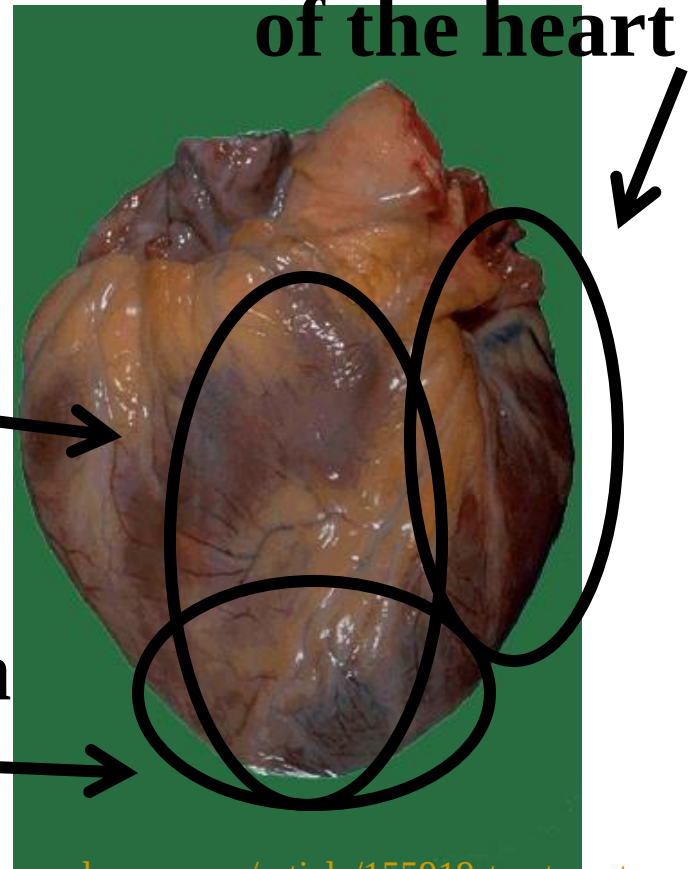
Views of the Heart

Some leads get a good view of the:

**Anterior
portion of the
heart**

**Inferior portion
of the heart**

**Lateral portion
of the heart**



Prevention

Risk Factor Concepts in Primary Prevention

- **Nonmodifiable risk factors** include age, sex, race, and family history of CVD, which can identify high-risk populations
- **Behavioral risk factors** include sedentary lifestyle, unhealthful diet, heavy alcohol or cigarette consumption.
- **Physiological risk factors** include hypertension, obesity, lipid problems, and diabetes, which may be a consequence of behavioral risk factors.

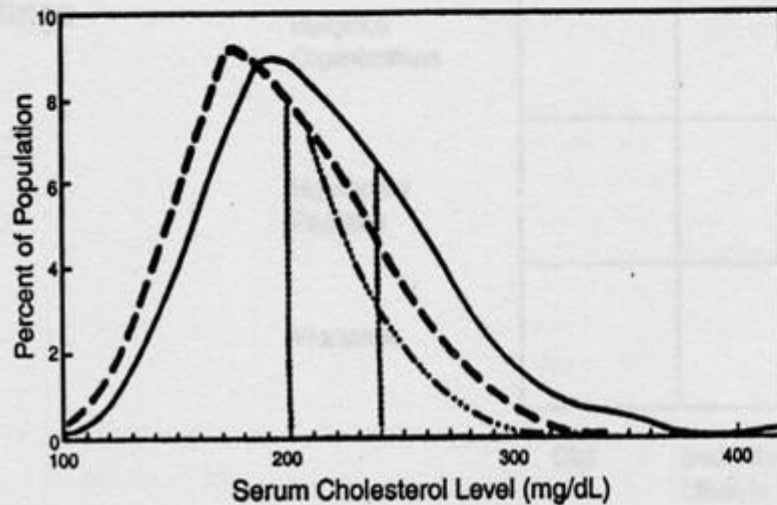
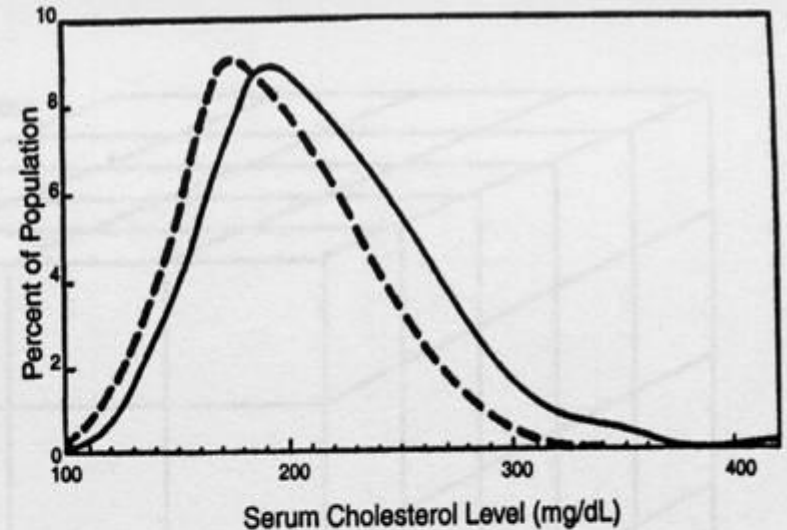
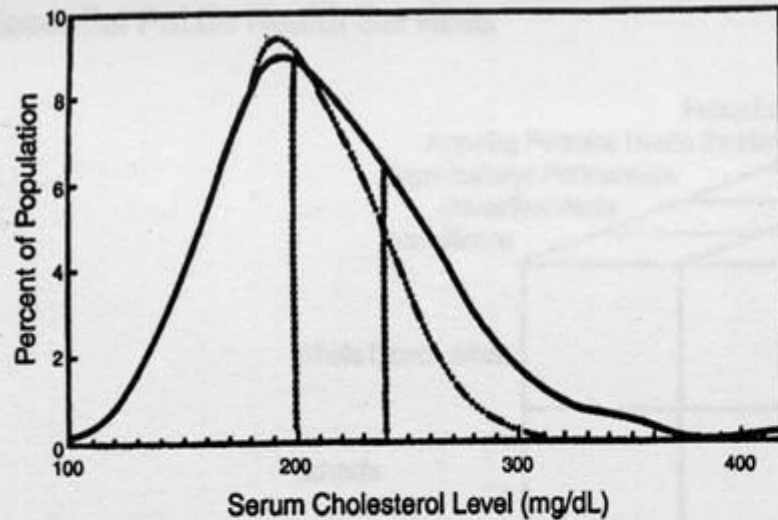
Population vs High-Risk Approach

- Risk factors, such as cholesterol or blood pressure, have a wide bell-shaped distribution, often with a “tail” of high values.
- The “high-risk approach” involves identification and intensive treatment of those at the high end of the “tail”, often at greatest risk of CVD, reducing levels to “normal”.

Population vs High-Risk Approach

- But most cases of CVD do not occur among the highest levels of a given risk factor, and in fact, occur among those in the “average” risk group.
- Significant reduction in the population burden of CVD can occur only from a “population approach” shifting the entire population distribution to lower levels.

Expected Shifts in Cholesterol Distribution from High-Risk, Population, and Combined Approaches



Population and Community-Wide CVD Risk Reduction Approaches

- Populations with high rates of CVD are those with Western lifestyles of high-fat diets, physical inactivity, and tobacco use.
- Targets of a population-wide approach must be these behaviors causative of the physiologic risk factors /directly causative of CVD.
- Activities in a variety of community settings: schools, worksites, healthcare facilities, entire communities

Individual Risk Assessment

- Careful assessment of medical history, physical examination, laboratory examinations
- Tobacco, diet, and physical activity history
- Blood pressure, height/weight, waist/hip or waist circumference, lipid profile
- Determination of global risk score (for assessing 10-year CHD risk probability)

Framingham Risk Algorithms

- Provides 10-year estimated risk of CHD (some focus only on hard endpoints, others include angina pectoris), Stroke, CHF, or Intermittent Claudication.
- Applicable to specific ages and persons w/o CHD

Considerations for Secondary Prevention

- CVD event rates in those with pre-existing disease are 5-7 times greater than healthy individuals.
- Diabetics run a similar event rate as those with a previous myocardial infarction.
- Risk factor modification is the cornerstone of secondary prevention efforts

Considerations for Secondary Prevention

- Categories of patients for secondary prevention efforts:
 - 1) stable CHD,
 - 2) unstable angina,
 - 3) prior MI,
 - 4) prior CABG, and
 - 5) prior PTCA
- Framingham algorithms can be used for prediction of recurrent CHD events over next 2 years.
- SBP, total cholesterol, and diabetes remain important predictors of reinfarction or CHD death over 10-years post-MI.

Secondary Prevention Strategies of Proven Benefit

- AHA Secondary Prevention Statement outlines recommended assessment, management, and risk factor goal levels.
- Proven strategies include:
 - Cholesterol-lowering (Trials: 4S, CARE, LIPID, HIT)
 - Blood pressure reduction (Trials: HDFP, HOT)
 - Antiplatelet treatment (Trials: Antiplatelet Trialists Collab)
 - Smoking (Trials: CASS)
 - Dietary therapy and exercise (Trials: Lifestyle Heart Trial, Hhidelberg)

Approach to the management of patients

Coronary and Other Atherosclerotic Vascular Disease

Smoking

	Intervention Recommendation
Goal <i>Complete cessation.</i> <i>No exposure to environmental tobacco smoke.</i>	•Ask about tobacco use status at every visit. •Advise every tobacco user to quit. •Assess the tobacco user's willingness to quit. •Assist by counseling and developing a plan for quitting. •Arrange follow-up, referral to special programs, or pharmacotherapy (including nicotine replacement and bupropion). •Urge avoidance of exposure to environmental tobacco smoke at work and home.

Blood Pressure Control

Goal <i><140/90 mm Hg</i> <i>Or</i> <i><130/80 mm Hg if patient has diabetes or chronic kidney disease</i>	<u>For all patients</u> Initiate or maintain lifestyle modification—weight control; increased physical activity; alcohol moderation; sodium reduction; and emphasis on increased consumption of fresh fruits, vegetables, and low-fat dairy products For patients with blood pressure $\geq 140/90$ mm Hg (or $\geq 130/80$ mm Hg for individuals with chronic kidney disease or diabetes): As tolerated, add blood pressure medication, treating initially with β-blockers and/or ACE inhibitors, with addition of other drugs such as thiazides as needed to achieve goal blood pressure.
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Lipid Management

Goal

*LDL-C <100 mg/dL
If triglycerides are
≥200 mg/dL,
non-HDL-C should be
<130 mg/dL*

For all patients:

- Start dietary therapy. Reduce intake of saturated fats (to <7% of total calories), *trans*-fatty acids, and cholesterol (to <200 mg/d)
- Adding plant stanol/sterols (2 g/d) and viscous fiber (>10 g/d) will further lower LDL-C.
- Promote daily physical activity and weight management.
- Encourage increased consumption of omega-3 fatty acids in the form of fish[‡] or in capsule form (1 g/d) for risk reduction. For treatment of elevated triglycerides, higher doses are usually necessary for risk reduction.

Lipid Management

Assess fasting lipid profile in all patients, and within 24 hours of hospitalization for those with an acute cardiovascular or coronary event. For hospitalized patients, initiate lipid-lowering medication as recommended below before discharge according to the following schedule:

- LDL-C should be <100 mg/dL
- Further reduction of LDL-C to <70 mg/dL is reasonable.
- If baseline LDL-C is ≥ 100 mg/dL, initiate LDL-lowering drug therapy.
- If on-treatment LDL-C is ≥ 100 mg/dL, intensify LDL-lowering drug therapy.
- If baseline LDL-C is 70 to 100 mg/dL, it is reasonable to treat to LDL-C <70 mg/dL.

Lipid Management

- If triglycerides are 200 to 499 mg/dL, non-HDL-C should be <130 mg/dL.
- Further reduction of non-HDL-C to <100 mg/dL is reasonable.
- Therapeutic options to reduce non-HDL-C are:
 - ⇒ More intense LDL-C-lowering therapy or
 - ⇒ Niacin (after LDL-C-lowering therapy) or
 - ⇒ Fibrate therapy (after LDL-C-lowering therapy)
- If triglycerides are ≥ 500 mg/dL, therapeutic options to prevent pancreatitis are fibrate or niacin before LDL-lowering therapy; and treat LDL-C to goal after triglyceride-lowering therapy.
- Achieve non-HDL-C <130 mg/dL if possible.

Physical Activity

Goal

*30 minutes,
7 days per week
(minimum 5 days
per week)*

For all patients, assess risk with a physical activity history and/or an exercise test, to guide prescription.

- For all patients, encourage 30 to 60 minutes of moderate-intensity aerobic activity, such as brisk walking, on most, preferably all, days of the week, supplemented by an increase in daily lifestyle activities (eg, walking breaks at work, gardening, household work).
- Encourage resistance training 2 days per week.
- Advise medically supervised programs for high-risk patients (eg, recent acute coronary syndrome or revascularization, heart failure).

Conclusion

Conclusion

- Coronary heart diseases (CHD) have reached epidemic proportions among Indians.
- According to the World Health Organization (WHO), comprehensive and integrated action is the means to prevent and control CHD.

Conclusion

- Comprehensive action requires combining approaches that seek to reduce the risks throughout the entire population with strategies that target individuals at high risk or with established disease.