

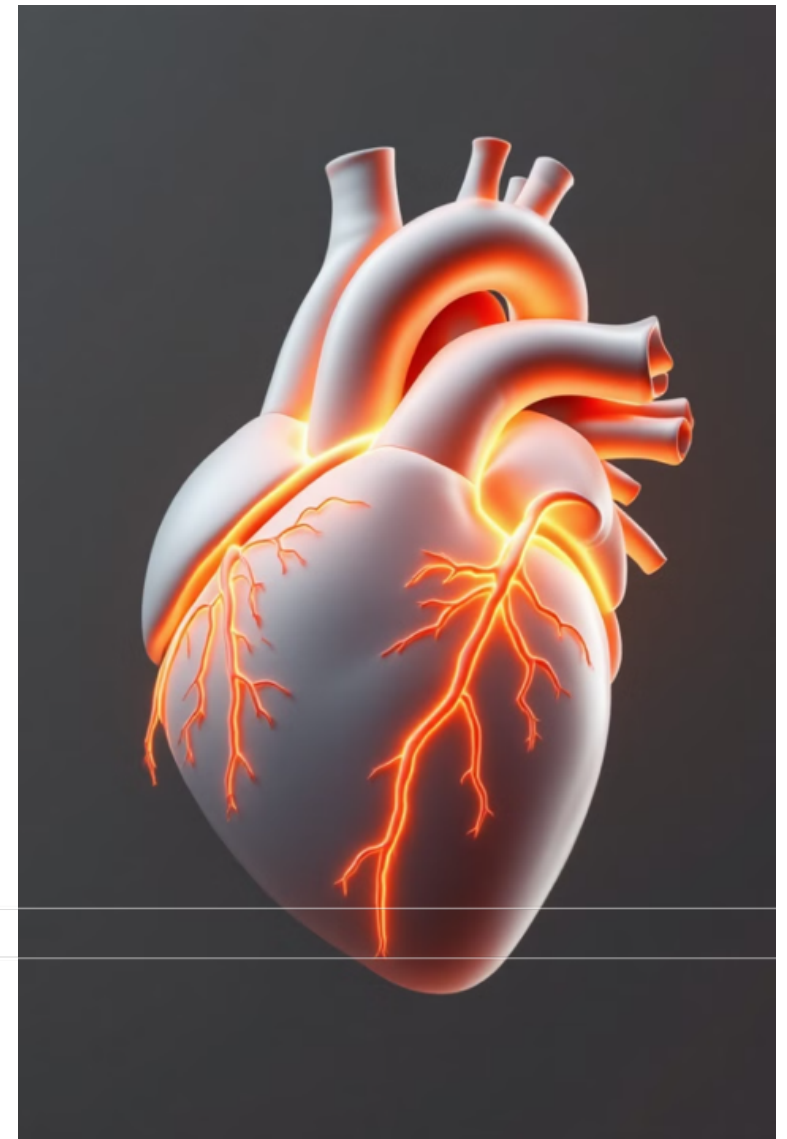
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Acute Coronary Syndromes

Acute coronary syndromes (ACS) encompass a spectrum of conditions from unstable angina to acute myocardial infarction. As the leading cause of death among adults in the United States, ischemic heart disease results in over 400,000 deaths annually.



by Esmat
Shabani





Epidemiology of Acute Coronary Syndromes

1 Prevalence

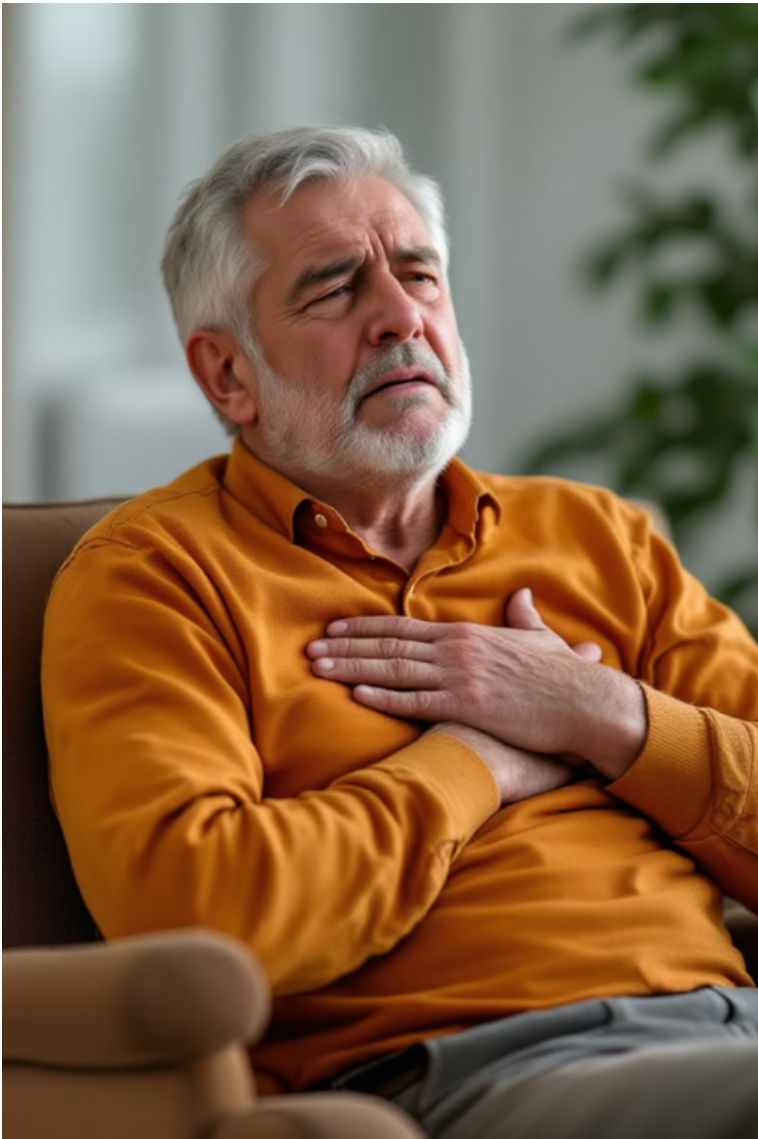
Over 8 million ED visits annually for chest pain in the U.S.

2 ACS Incidence

Approximately 15% of chest pain patients have ACS

3 AMI vs Unstable Angina

About 1/3 of ACS patients have AMI, 2/3 have unstable angina



Presentations of Unstable Angina

Rest angina

Angina occurring at rest, usually >20

New-onset angina

New angina that markedly limits ordinary physical activity

Increasing angina

Previously diagnosed angina that has become more frequent, longer in duration, or lower in threshold

Risk Stratification in Unstable Angina

High Risk

Prolonged ongoing rest pain, pulmonary edema, hypotension, new mitral regurgitation murmur, ST-segment changes $>0.5\text{mm}$, elevated cardiac troponins

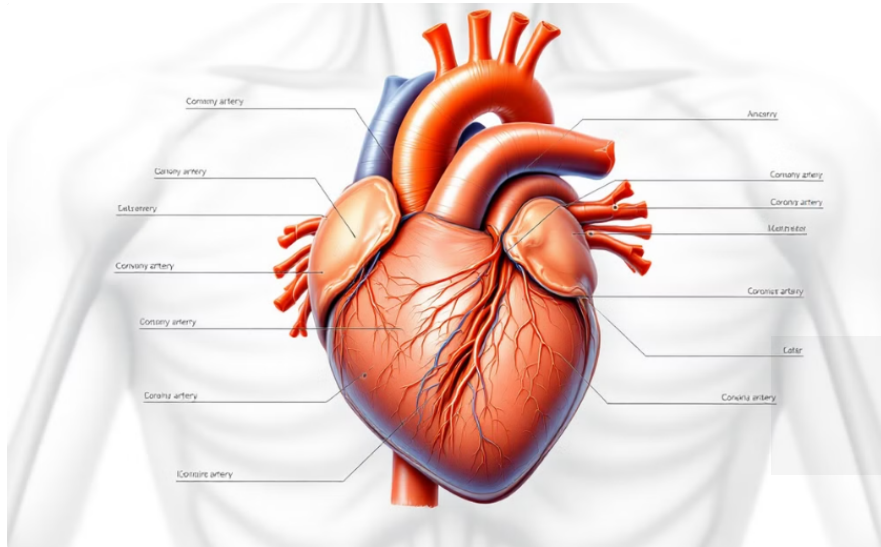
Intermediate Risk

Prolonged rest angina now resolved, nocturnal angina, new onset angina in past 2 weeks, age >70 years, T-wave changes, slightly elevated troponins

Low Risk

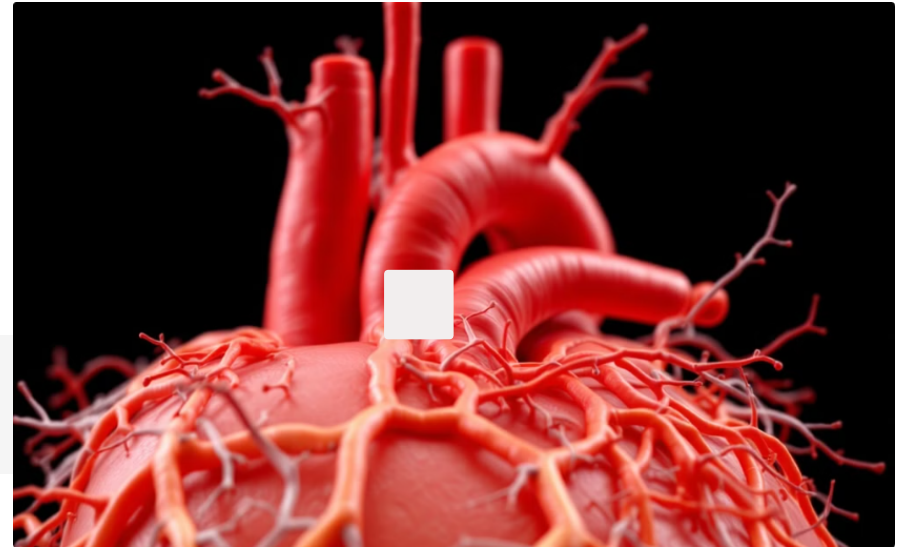
Increased angina frequency/severity, angina provoked at lower threshold, normal ECG, normal cardiac markers

Coronary Artery Anatomy



Coronary Artery Distribution

The left coronary artery divides into the left circumflex and left anterior descending branches. The right coronary artery supplies the right ventricle and part of the left ventricle's inferior aspect.



Blood Supply to Conduction System

The atrioventricular conduction system receives blood from the atrioventricular branch of the right coronary artery and septal perforating branch of the left anterior descending artery.

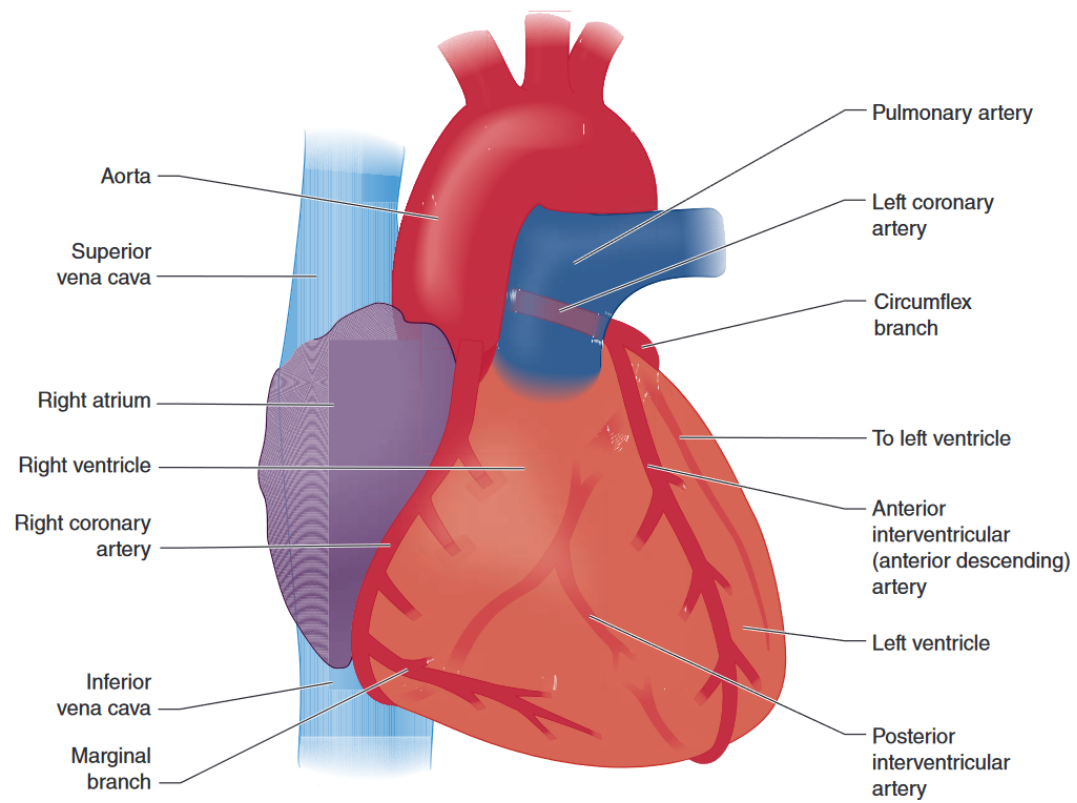


FIGURE 49-1. Schematic diagram of the coronary arteries.

Pathophysiology of Myocardial Ischemia

1

Oxygen Demand-Supply Imbalance

Ischemia occurs when there is an imbalance between oxygen demand and supply in the myocardium.

2

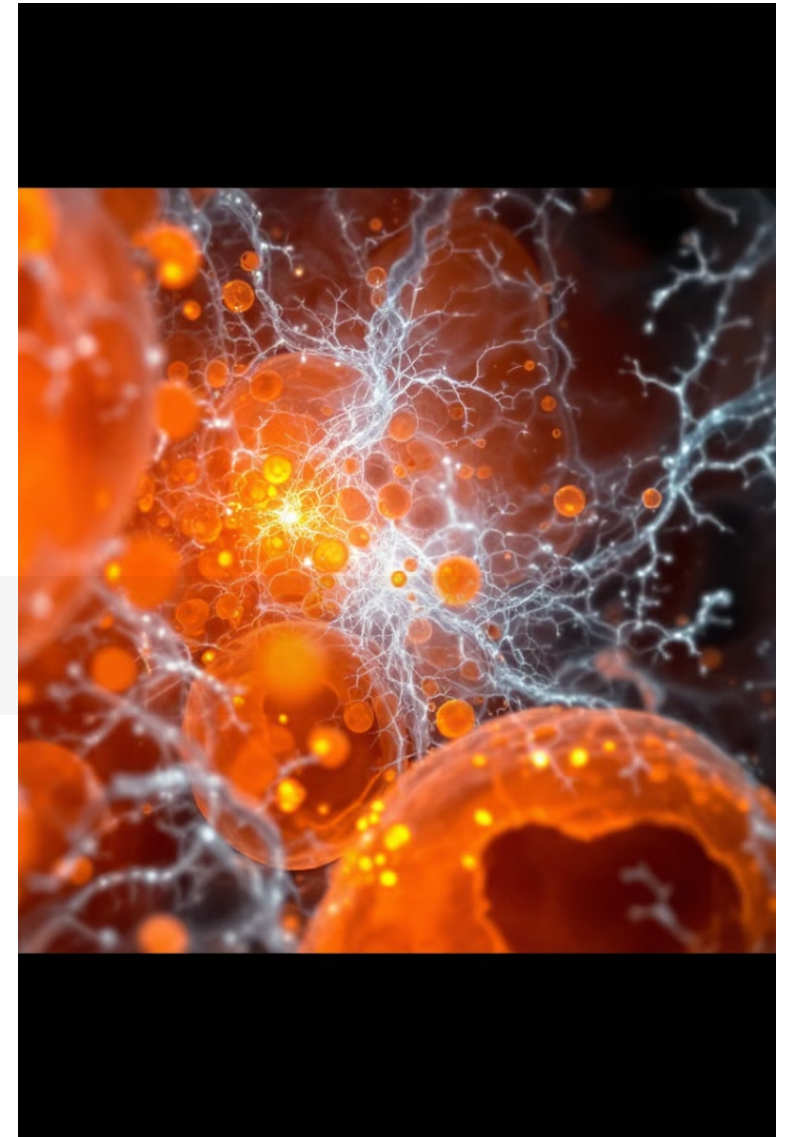
Factors Affecting Oxygen Supply

Oxygen supply is influenced by the oxygen-carrying capacity of the blood and coronary blood flow.

3

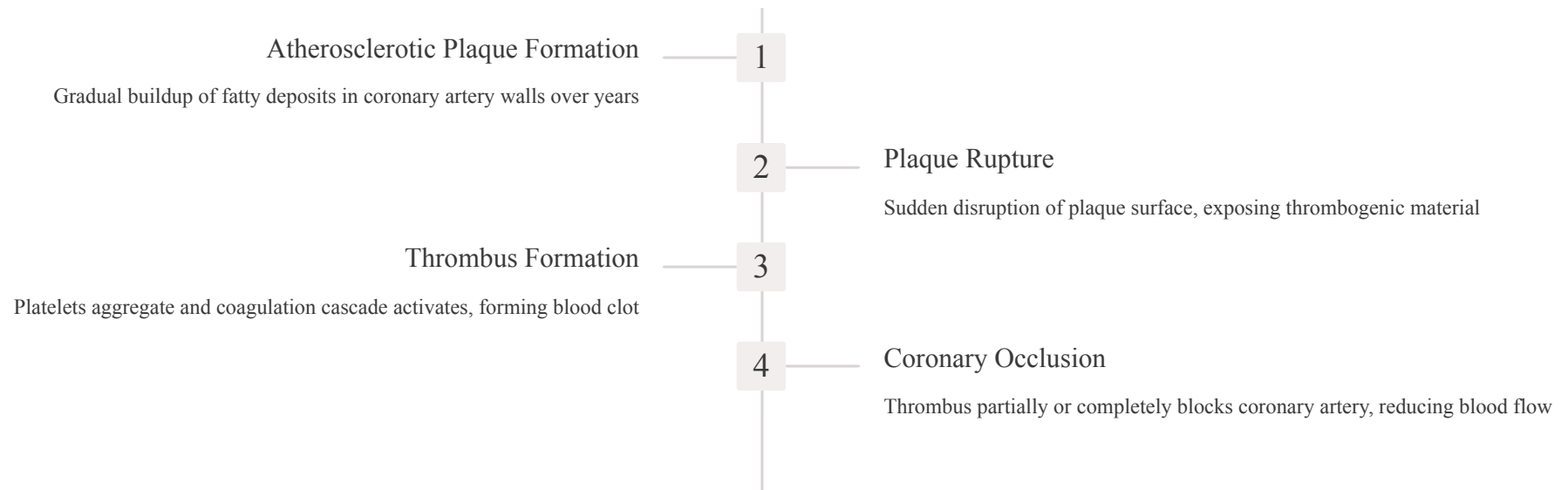
Factors Affecting Oxygen Demand

Oxygen demand is influenced by heart rate, myocardial contractility, and wall stress.





Mechanisms of Acute Coronary Syndromes





Clinical Manifestations of ACS

Chest Pain

Typically described as pressure, squeezing, or heaviness in the chest, often radiating to arms, neck, or jaw

Dyspnea

Shortness of breath, often accompanying chest discomfort or occurring as the primary symptom

Associated Symptoms

May include nausea, vomiting, diaphoresis, lightheadedness, or fatigue

Atypical Presentations

More common in women, elderly, and diabetics; may present with vague symptoms or even be pain-free

کیس شماره 1

سن و جنس: 65 ساله، مرد

سوابق پزشکی: فشار خون بالا و دیابت نوع 1

علائم: بیمار به دلیل درد شدید قفسه سینه به اورژانس مراجعه می‌کند. درد به صورت ناگهانی شروع شده و به کمر و شکم انتشار یافته است.

bpm. ضربان قلب 120، mmHg، فشار خون 90/50

دهنده عدم تقارن در نبض‌های دست و پاها است

کیس شماره 2

سن و جنس: 54 ساله، زن

سوابق پزشکی: چاقی و سابقه دیابت

علائم: بیمار ناگهان دچار تنگی نفس شدید و درد قفسه سینه

می‌شود. همچنین سابقه سفر طولانی در هواپیما وجود دارد

و افزایش ضربان قلب به 115 mmHg **معاینه:** فشار خون 100/60

معاینه ریوی نشان‌دهنده کورس کراکل خفیف در قفسه سینه. bpm.

است.

تشخیص: ؟

کیس شماره 3

سن و جنس: 75 ساله، مرد

و سابقه سیگار COPD سوابق پزشکی: بیماری مزمن انسدادی ریه
کشیدن.

علائم: بیمار با تب بالا، سرفه مداوم و تنگی نفس به اورژانس مراجعه
می‌کند.

معاینه: تب 39 درجه سانتی‌گراد، نبض 102 و تنفس 24.
معاینه صدای تنفسی خفیف و کاهش صدای ریه راست است.

تشخیص: ؟

کیس شماره 4

سن و جنس: 45 ساله، زن

سوابق پزشکی: هیچ بیماری قبلی

علائم: بیمار پس از استفراغ شدید به دلیل مصرف غذا، ناگهان دچار درد قفسه سینه و تنگی نفس می شود

معاینه: درد شدید و حساسیت در قسمتی از قفسه سینه. همچنین، صداهای ریوی نرمال در معاینه تنفسی وجود دارد

تشخیص؟

کیس شماره 5:

سن و جنس: 28 ساله، مرد

سوابق پزشکی: ورزشکار و هیچ مشکل قبلی

علائم: بیمار ناگهان پس از ورزش دچار درد قفسه سینه و تنگی نفس می شود.

bpm. معاینه: فشار خون نرمال و ضربان قلب 110

معاینه ریوی نشان دهنده کاهش صدای تنفسی در سمت چپ است

تشخیص: ؟

کیس شماره 6:

سن و جنس: 50 ساله، زن -

سوابق پزشکی: سابقه عفونت ویروسی اخیر -

علائم: بیمار از درد قفسه سینه تیز و خنجرگونه شکایت دارد که -
با تنفس عمیق و دراز کشیدن بدتر می شود

معاینه: صدای تنفسی ضعیف و وجود صدای پریکاردیال در -
معاینه قلب

تشخیص؟ -

کیس بالینی شماره 7

- سن و جنس: 60 ساله، مرد
- NSAIDs سوابق پزشکی: سابقه مصرف غیرمجاز -
و زخم معده

- علائم: بیمار ناگهان دچار درد شدید و ناگهانی در ناحیه شکم می‌شود و همچنین به حالت شوک پیشرفت می‌کند.

- معاینه: تب 38 درجه سانتی‌گراد و شکم سخت و حساس

کیس شماره 8

سن و جنس: 68 ساله، زن

سوابق پزشکی: فشار خون بالا و کلسترول بالا

علائم: بیمار از درد قفسه سینه به همراه تعریق و تهوع به اورژانس مراجعه می‌کند. درد در ناحیه چپ قفسه سینه و فک احساس می‌شود

نوار قلب نشان‌دهنده bpm. ضربان قلب 95، mmHg، **معاینه:** فشار خون 150/90
است ST leads V4-V6 در تغییرات

تشخیص؟



Diagnostic Tools for ACS



Diagnostic Approach to ACS



History and Physical Exam

Detailed assessment of symptoms, risk factors, and physical findings



12-Lead ECG

Rapid acquisition and interpretation to identify ST-segment changes or other ischemic patterns



Cardiac Biomarkers

Serial troponin measurements to detect myocardial injury



Imaging Studies

Chest X-ray, echocardiography, or coronary CT angiography as indicated

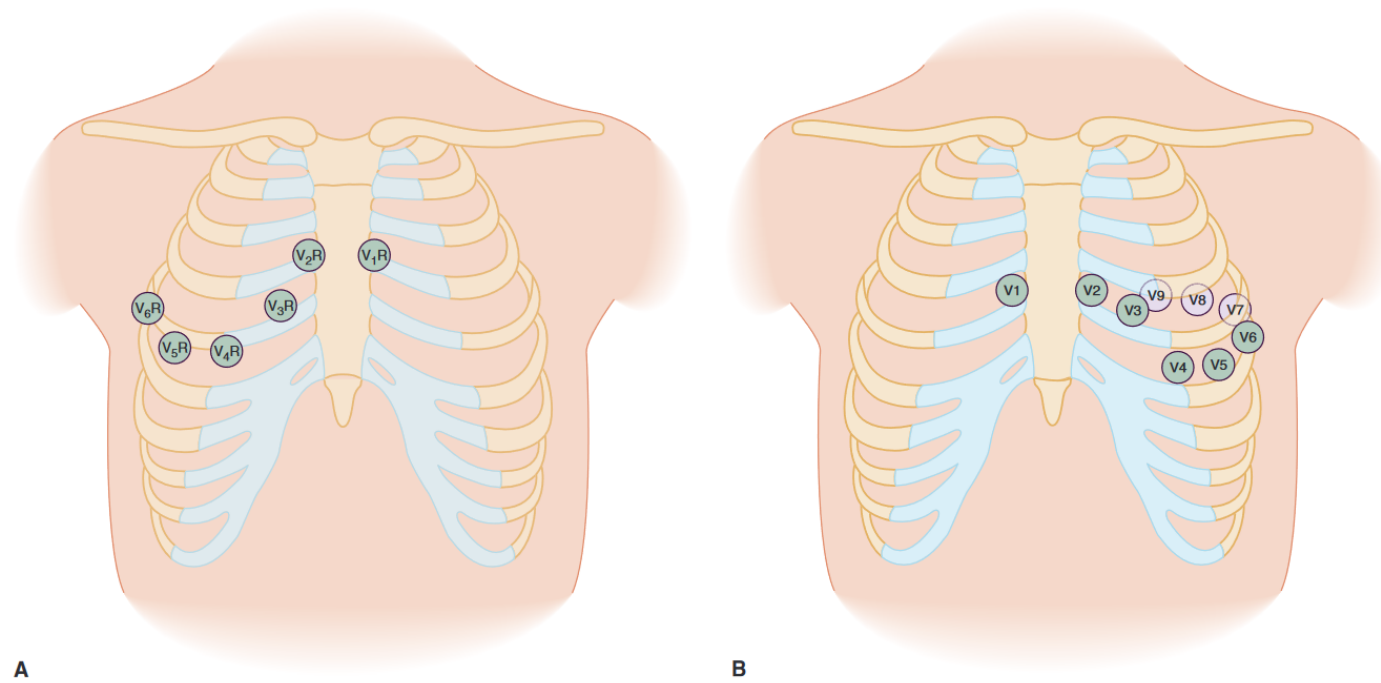


FIGURE 49-2. A. Right-sided lead placement. B. Posterior lead placement. Leads V₄ to V₆ are removed from the anterior chest wall and replaced as V₇ to V₉ on the back. Lead V₉ is placed paraspinal.

ST Elevation (STEMI):

- Indicates complete coronary artery occlusion.
- Characterized by elevated ST segments in two or more contiguous leads.
 - ≥ 2.5 mm in men <40 years, ≥ 2 mm in men ≥ 40 years, or ≥ 1.5 mm in women regardless of age in leads V2–V3
 - and/or ≥ 1 mm in the other leads (in the absence of left ventricular [LV] hypertrophy or left bundle branch block [LBBB])

ST Depression:

- Suggests subendocardial ischemia.
- Can indicate unstable angina or NSTEMI (Non-ST Elevation Myocardial Infarction).

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T-Wave Changes

- **Inverted T Waves:**

May indicate myocardial ischemia or recent infarction.

- **Peaked T Waves:**

Often seen in early stages of myocardial injury.

Other Changes

- **Prolonged QT Interval:** Can occur due to ischemia or electrolyte imbalances

- **Bradycardia/ Tachycardia:** Arrhythmias may occur secondary to ischemia

TABLE 49-4 ECG ST-Segment–Based Criteria for Acute Myocardial Infarction

Location	ECG Findings
Anteroseptal	ST-segment elevations in V_1 , V_2 , and possibly V_3
Anterior	ST-segment elevations in V_1 , V_2 , V_3 , and V_4
Anterolateral	ST-segment elevations in V_1 – V_6 , I, and aVL
Lateral	ST-segment elevations in I and aVL
Inferior	ST-segment elevations in II, III, and aVF
Inferolateral	ST-segment elevations in II, III, aVF, and V_5 and V_6
True posterior*	Initial R waves in V_1 and V_2 >0.04 s and R/S ratio ≥ 1 ; right-sided ECG shows 0.5-mm ST elevation in V_7 – V_9
Right ventricular (RV)	ST-segment elevations in II, III, and aVF and ST-segment depression in lateral leads; ST-segment elevation in RV leads V_3R – V_6R

*Posterior wall infarction does not produce Q-wave abnormalities in conventional leads and is diagnosed in the presence of tall R waves in V_1 and V_2 .

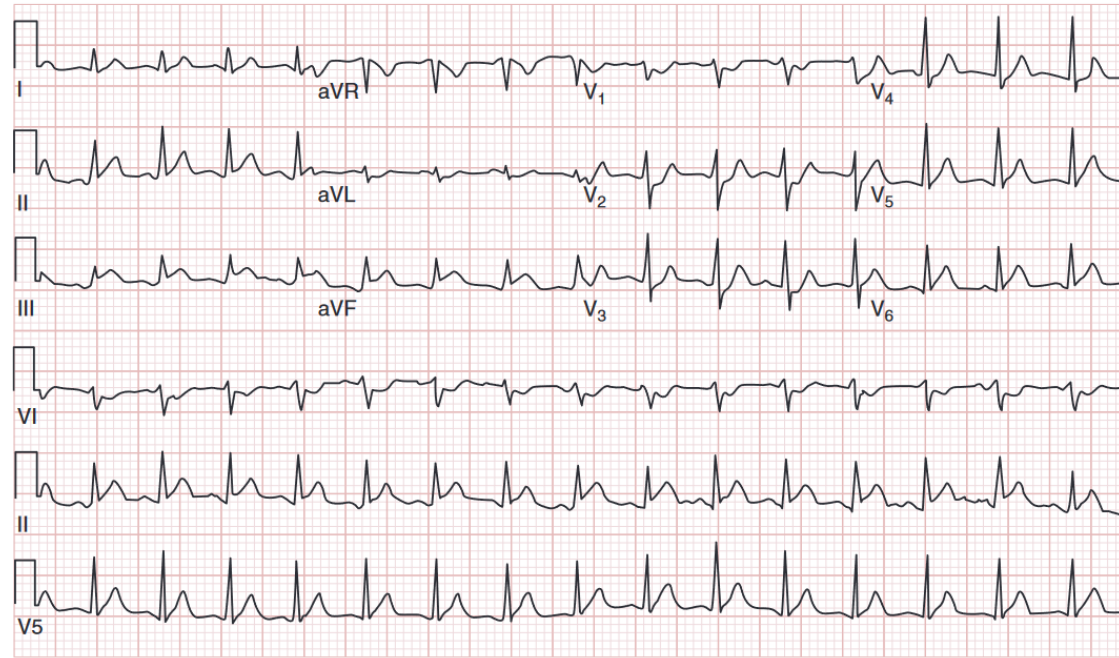


FIGURE 49-3. ECG showing inferior-lateral myocardial infarction from left circumflex coronary artery occlusion. ECG from a 42-year-old man presenting with chest pain. ECG shows ST-segment elevation in limb leads II, III (inferior), and aVF, as well as lead V₆ (lateral). ST-segment depression is evident in leads V₁, V₂, and V₃, reflecting reciprocal changes in the anterior leads. The patient was found to have 100% occlusion of the left circumflex coronary artery at cardiac catheterization. [Used with permission of David M. Cline, MD, Wake Forest University.]

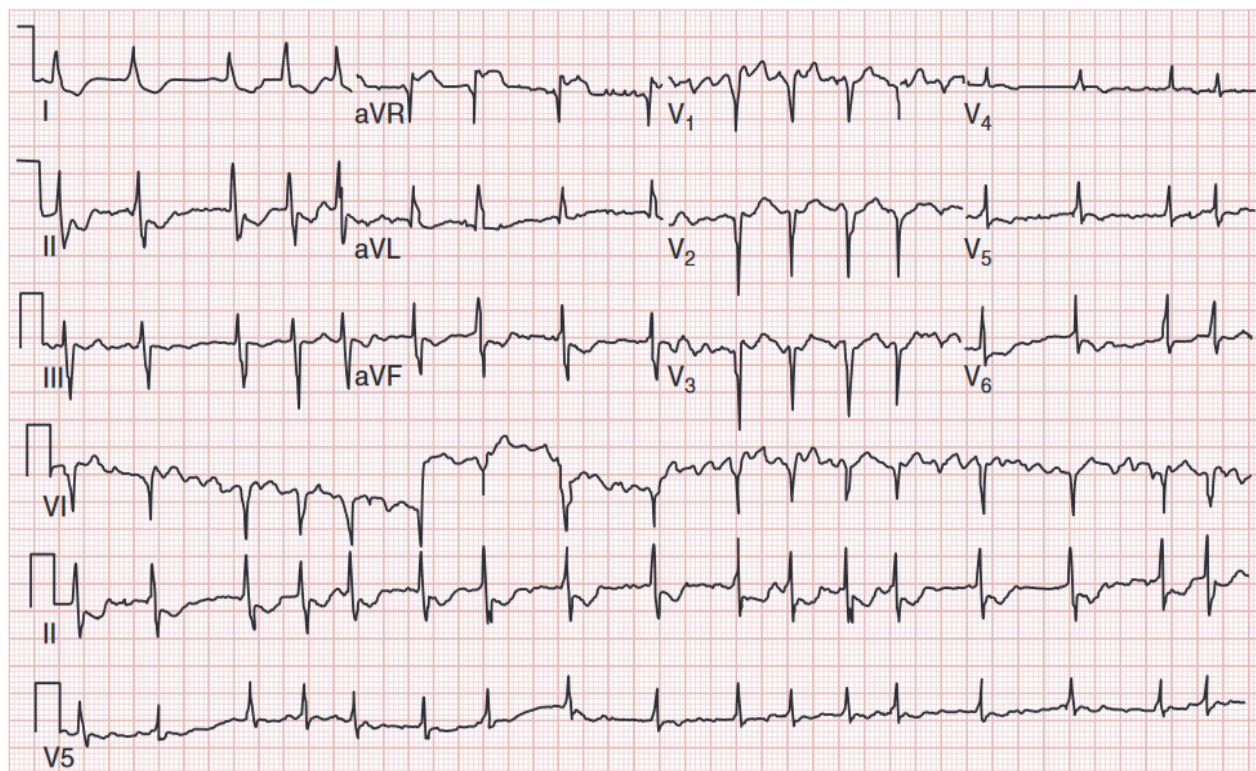


FIGURE 49-4. ST-segment elevation in lead aVR. First ED ECG taken in a patient with acute chest pain. Note elevation in aVR greater than that of V₁, suggesting left anterior descending artery occlusion. Initial troponin was normal; second troponin was abnormal. Emergency cardiac catheterization demonstrated 90% occlusion of left main coronary artery. [ECG used with permission of Department of Emergency Medicine, University of North Carolina Hospitals.]

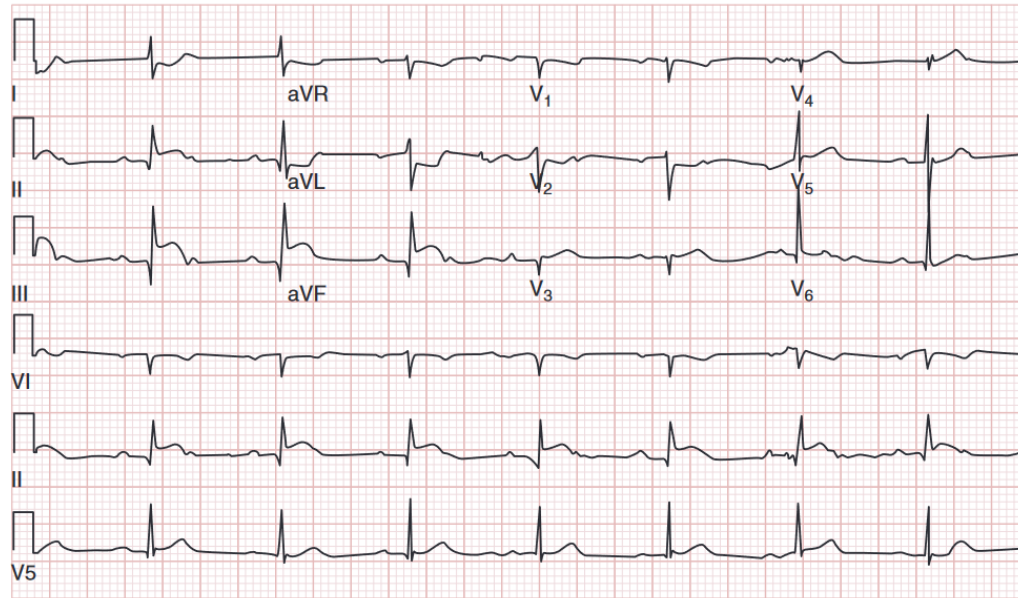
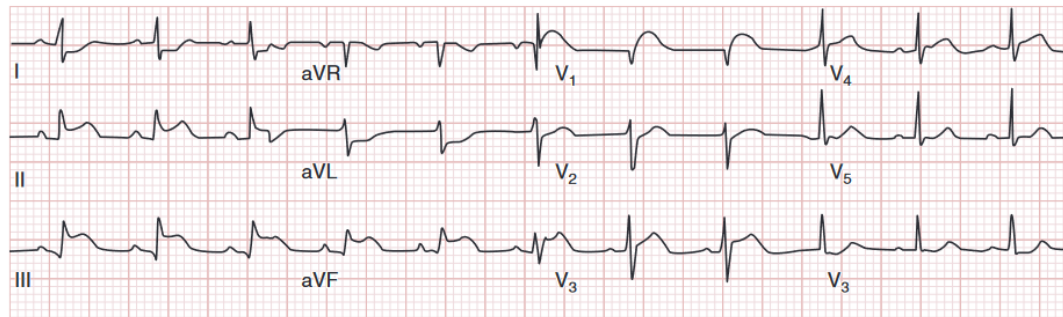
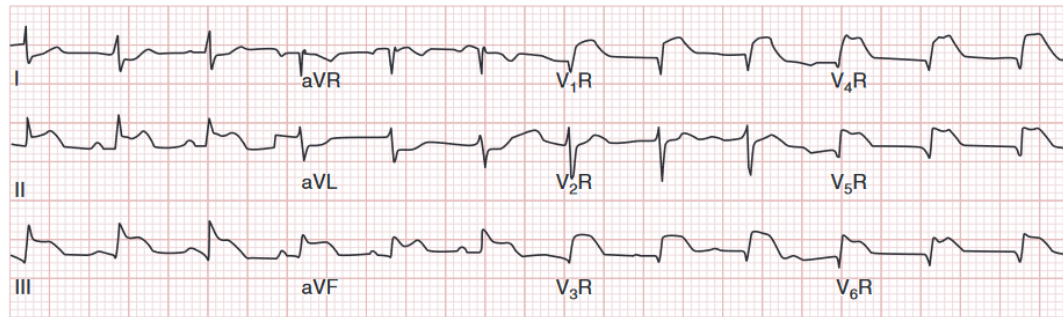


FIGURE 49-5. ECG showing inferior myocardial infarction from right coronary artery occlusion. ECG from an 80-year-old man presenting with acute chest pain. The ECG shows ST-segment elevation in lead III greater than in lead II plus ST-segment depression of >1 mm in lead I and lead aVL. The patient was found to have 100% occlusion of the right coronary artery at cardiac catheterization. [Used with permission of David M. Cline, MD, Wake Forest University.]



A



B

FIGURE 49-6. Right ventricular infarction. A. ECG showing inferior ST-segment elevation myocardial infarction and ST-segment elevation in lead V₁, suggestive of right ventricular infarction. B. Same patient with placement of right ventricular leads, see Fig. 49-2A, showing ST-segment elevation in V_{3R}, V_{4R}, V_{5R}, and V_{6R} compatible with right ventricular infarction. [Used with permission of J. Stephan Stapczynski, Maricopa Medical Center.]

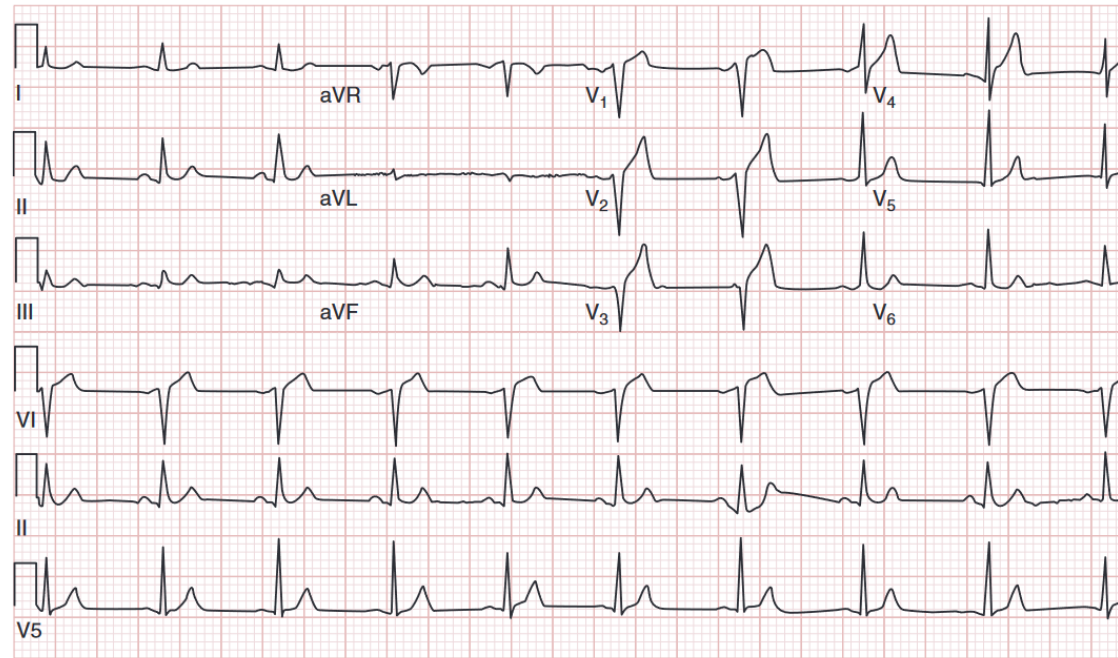


FIGURE 49-7. ECG showing anterior myocardial infarction from distal left anterior descending coronary artery occlusion. ECG from a 52-year-old man presenting with chest pain. ECG shows ST-segment elevation in V₁, V₂, and V₃, with the absence of ST-segment depression in leads II, III, and aVF. The patient was found to have 100% occlusion of the distal left anterior descending coronary artery at cardiac catheterization. [Used with permission of David M. Cline, MD, Wake Forest University.]

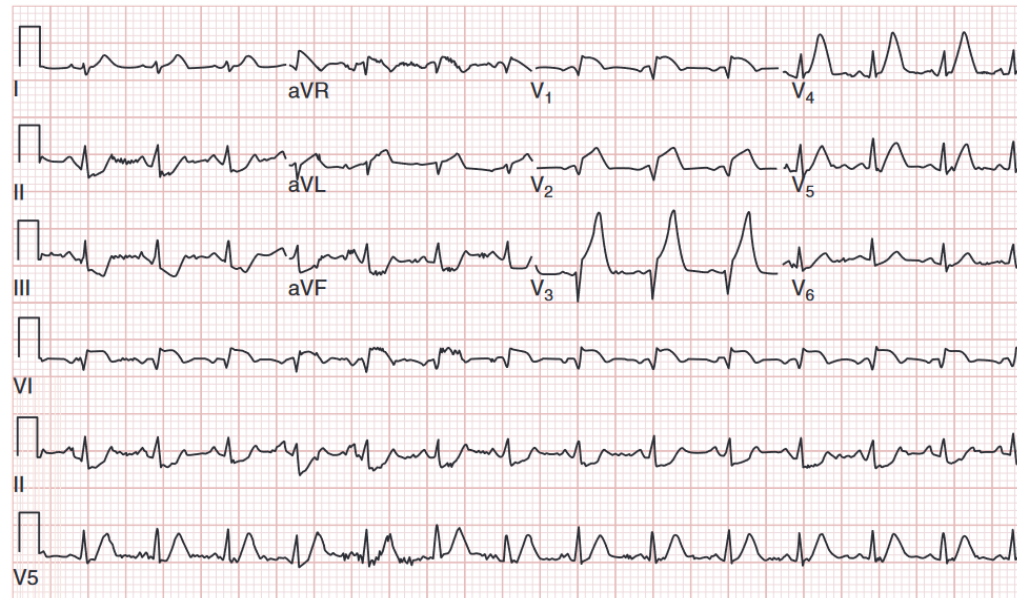


FIGURE 49-8. ECG showing anterior myocardial infarction from proximal left anterior descending coronary artery occlusion. ECG from a 65-year-old man presenting with chest pain. ECG shows ST-segment elevation in V_1 , V_2 , and V_3 , and >1 mm of ST-segment depression in leads II, III, and aVF. The patient was found to have 100% occlusion of the proximal left anterior descending coronary artery at cardiac catheterization. [Used with permission of David M. Cline, MD, Wake Forest University.]

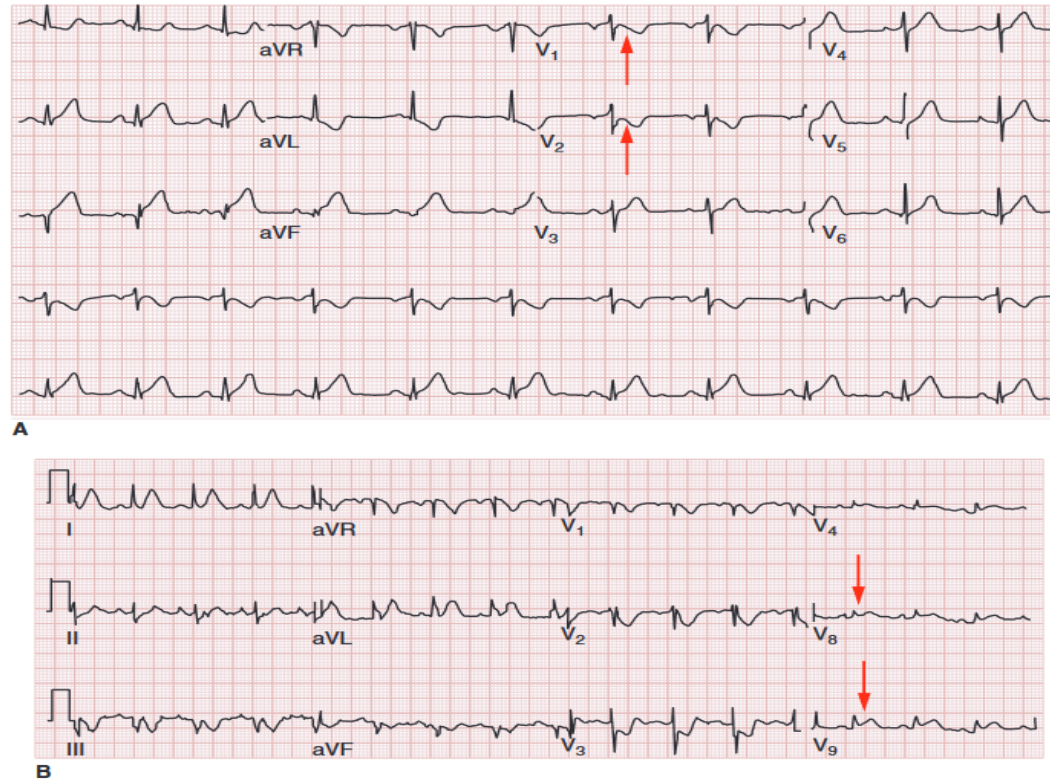


FIGURE 49-9. A. ECG with acute inferior wall myocardial infarction (MI) but ST-segment depression in V_1 and V_2 , suggesting accompanying posterior wall MI. B. Posterior lead placement with ST-segment elevation in V_8 and V_9 confirming posterior wall MI.

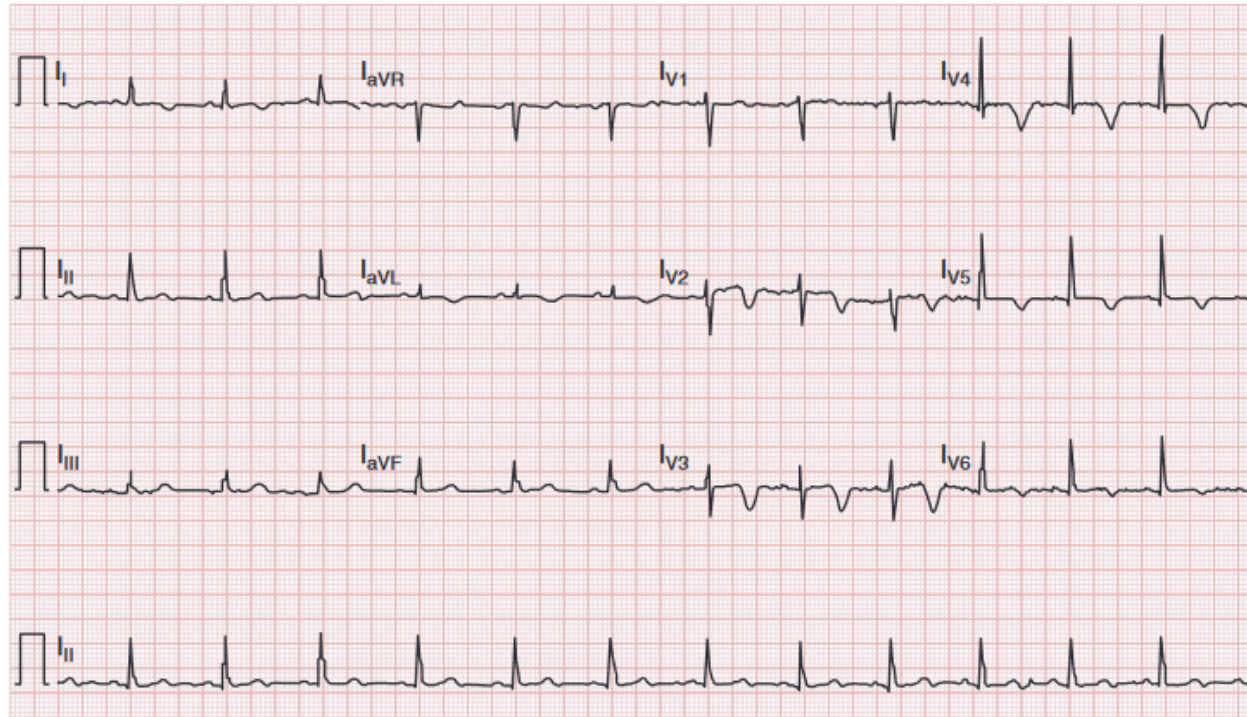


FIGURE 49-11. Wellens' sign with ECG showing deep symmetric T-wave inversions in leads V_2 to V_5 . [Reproduced with permission from Lefebvre C, O'Neill J, Cline D (eds): *Atlas of Cardiovascular Emergencies*. New York, NY: McGraw-Hill Education, Inc. © 2015. Fig 2.32.]

Serum Markers

Troponins (cTnI, cTnT) - Most sensitive and specific markers for myocardial injury. - Elevate within 3-6 hours after onset of MI; can remain elevated for up to 14 days. - Used to differentiate between MI and unstable angina.

Creatine Kinase (CK-MB) - Specific to cardiac tissue; rises within 4-6 hours post-MI. - Peaks at 24 hours and returns to baseline over 48-72 hours. - Useful for detecting reinfarction.

Myoglobin

Early marker; elevates within 2-4 hours of myocardial injury. -
Lacks specificity as it can also rise in skeletal muscle injury.

B-type Natriuretic Peptide (BNP) - Primarily used in heart failure assessment but can be elevated in ACS. - Helps in risk stratification and management decisions.

Other Markers

D-dimer: May be elevated due to thrombus formation but is not specific to ACS. -

High-sensitivity C-reactive protein (hs-CRP): Indicates systemic inflammation but not specific for ACS.

Risk Stratification Based on History, ECG, and Biomarkers

High Risk

Rest pain >20 min,
elevated troponins,
ECG changes

Intermediate Risk

History of CAD,
mild ECG changes

Low Risk

Atypical symptoms,
normal troponins