AHA/ACCF/HRS Recommendations for the Standardization and Interpretation of the Electrocardiogram:

Ischemia and Infarction

103.10.07

Presented by:

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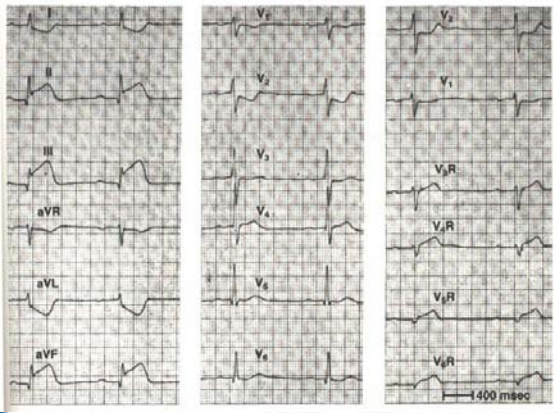
Citation

This slide set was adapted from the AHA/ACCF/HRS Recommendations for the Standardization and Interpretation of the Electrocardiogram (*Journal of the American College of Cardiology).* Available at: http://content.onlinejacc.org/cgi/content/full/j.jacc.2008.12.016

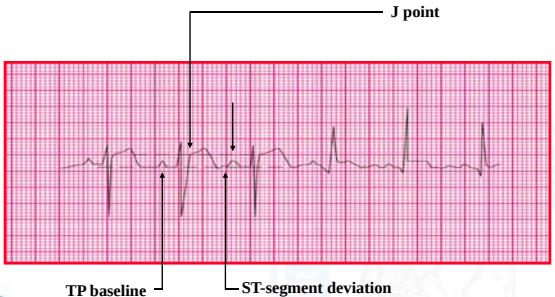
The full-text guidelines are also available on the following Web sites:
ACC (www.cardiosource.org) and,
AHA (www.americanheart.org)



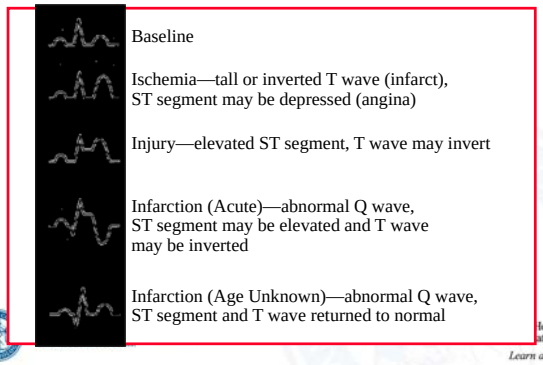
Preface: Wang's Viewpoints

- Baseline and ST reference point
- Dynamic changes
- Few reciprocal changes
- Wide QRS as BBB
- ECG and History

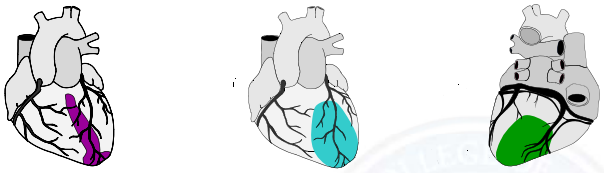
How to Measure ST-Segment Deviation



12-Lead ECG Variations in AMI and Angina



AMI Localization



I High lateral	aVR	V_1 septal	V_4 anterior
II inferior	aVL high lateral	V_2 septal	V_5 lateral
III inferior	aVF inferior	V_3 anterior	V_6 lateral

Basic Concepts

- Ischemia/Infarction
  - Hyperacute T-wave changes
  - ST-segment elevation and/or depression
  - Changes in the QRS complex
  - Inverted T waves

Basic Concepts

- Injury Currents
  - ST-segment changes generated by the voltage gradients across the boundary between the ischemic and nonischemic myocardium during the resting and plateau phases of the ventricular action potential, which correspond to the TQ and ST segments

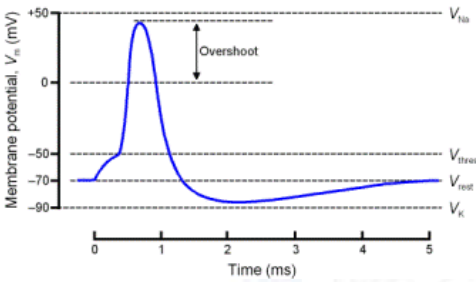
Basic Concepts

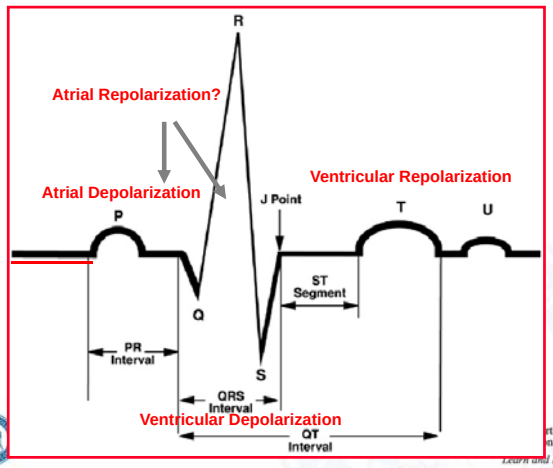
- Current Guidelines
  - ST-segment shifts reach predetermined threshold values in 2 or more anatomically contiguous body surface ECG leads

Evolutional Changes

- Hyperacute T → VF Risk
- ST elevation
- Q wave formation → New or Recent
- ST elevation decline
- T inversion
- (ST depression)

Pitfall:
Hyperacute T is NOT Himalaya high!





Basic Concepts

- STEMI vs. NSTEMI
  - NSTEMI (NSTEACS)
    - Those with lesser amounts of ST-segment elevation
    - Abnormal ST-segment elevation in fewer than 2 contiguous leads
    - ST-segment depression
    - T-wave inversion
    - No abnormalities at all

Basic Concepts

- Rationale

  The coronary artery involved, the site of occlusion within the artery, and the presence or absence of collateral circulation

  →The size and location of the affected region (+the relationship of this region to the spatial orientation of the particular ECG lead)

  →Changes in electrical activation within the severely ischemic or infarcted region

  →The magnitude and extent of the ECG changes

Meaning and Importance of ST-Segment Elevation and Depression

- Bioelectric Principles
  - All leads are bipolar
    - Only 3 leads (I, II, III) use 2 dedicated electrodes
    - Precordial leads
    - Augmented limb leads

Meaning and Importance of ST-Segment Elevation and Depression

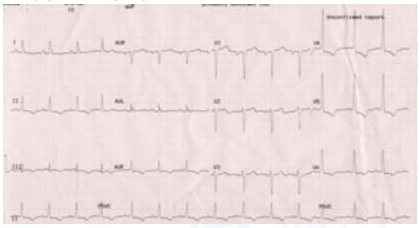
- Reciprocal Changes
  - In leads whose positive pole is directed opposite to the leads showing ST changes
  - Reciprocal change may be absent if the voltage transmitted to he body surface is inadequate to meet diagnostic criteria
    - LVH, IVCD, pericarditis
  - Comments:
    - *Don't abuse reciprocal changes*

Meaning and Importance of ST-Segment Elevation and Depression

- ST-Segment Depression Other Than Ischemia/Infarction
  - Hypertrophy
  - Cardioactive drugs
  - Hypokalemia

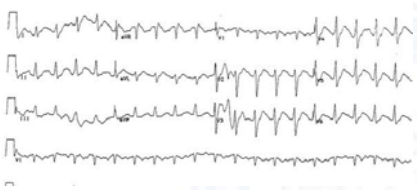
Meaning and Importance of ST-Segment Elevation and Depression

- ST-Segment Depression Other Than Ischemia/Infarction
  - Hypertrophy



Meaning and Importance of ST-Segment Elevation and Depression

- ST-Segment Depression Other Than Ischemia/Infarction
  - TCA overdose



Meaning and Importance of ST-Segment Elevation and Depression

- ST-Segment Depression Other Than Ischemia/Infarction
  - Hypokalemia

Meaning and Importance of ST-Segment Elevation and Depression

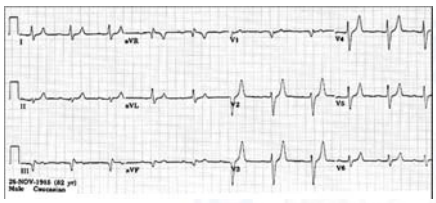
- ST-Segment Elevation Other Than Ischemia/Infarction
  - Pericarditis
  - Hyperkalemia
  - Osborne waves
  - Acute myocarditis
  - Certain cardiac tumors
  - Early repolarization
- Comments
  - *Dynamic changes*

Meaning and Importance of ST-Segment Elevation and Depression

- ST-Segment Elevation Other Than Ischemia/Infarction
  - Pericarditis

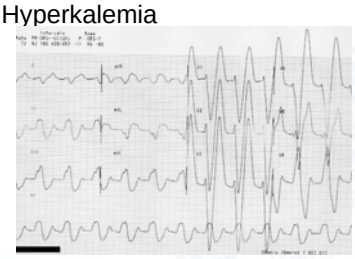
Meaning and Importance of ST-Segment Elevation and Depression

- ST-Segment Elevation Other Than Ischemia/Infarction
  - Hyperkalemia



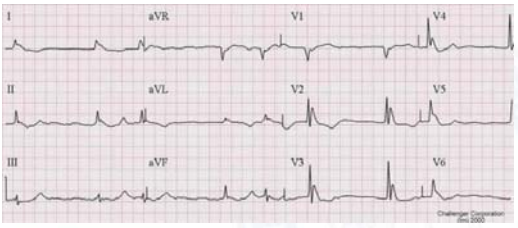
Meaning and Importance of ST-Segment Elevation and Depression

- ST-Segment Elevation Other Than Ischemia/Infarction
  - Hyperkalemia



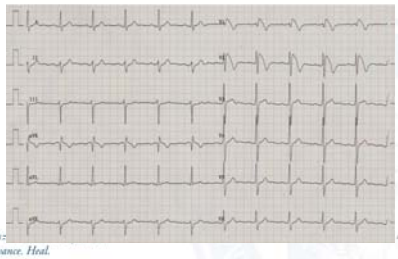
Meaning and Importance of ST-Segment Elevation and Depression

- ST-Segment Elevation Other Than Ischemia/Infarction
  - Osborne waves



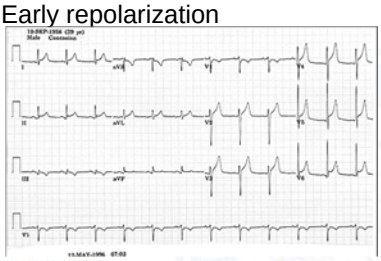
Meaning and Importance of ST-Segment Elevation and Depression

- ST-Segment Elevation Other Than Ischemia/Infarction
  - Acute myocarditis



Meaning and Importance of ST-Segment Elevation and Depression

- ST-Segment Elevation Other Than Ischemia/Infarction
  - Early repolarization



Meaning and Importance of ST-Segment Elevation and Depression

- Recommendation
  - Labeling specific leads as anterior, inferior, and lateral should be avoided.
  - Leads should be identified according to their original nomenclature, that is, leads I, II, III, aVR, aVL, aVF, and V1 through V6.
  - Reference to the anatomic location of the ischemic/infarcted region, such as anterior or inferior, is still recommended and is based on the leads that show the ST-segment alterations.

Concept of Anatomically Contiguous Leads

- Current Criteria
  - ST-segment elevation be present in 2 or more contiguous leads and that the elevation of the ST segment at the J point be greater than 0.2 mV (2 mm with standard calibration) in leads V1, V2, and V3 OR
  - greater than 0.1 mV in all other leads

Concept of Anatomically Contiguous Leads

- Recommendation
  - ECG machines should be equipped with switching systems that will allow the limb leads to be displayed and labeled appropriately in their anatomically contiguous sequence.

Threshold Values for ST-Segment Changes

- The threshold values are dependent on gender, age, and ECG lead
- In healthy individuals, the amplitude of the ST junction is generally highest in leads V2 and V3 and is greater in men than in women.

Threshold Values for ST-Segment Changes

- Recommendation
  - For men 40 years of age and older, the threshold value for abnormal J-point elevation should be 0.2 mV (2 mm) in leads V2 and V3 and 0.1 mV (1 mm) in all other leads.

Threshold Values for ST-Segment Changes

- Recommendation
  - For men less than 40 years of age, the threshold values for abnormal J-point elevation in leads V2 and V3 should be 0.25 mV (2.5 mm).

Threshold Values for ST-Segment Changes

- Recommendation
  - For women, the threshold value for abnormal J-point elevation should be 0.15 mV (1.5 mm) in leads V2 and V3 and greater than 0.1 mV (1 mm) in all other leads.

Threshold Values for ST-Segment Changes

- Recommendation
  - For men and women, the threshold for abnormal J-point elevation in V3R and V4R should be 0.05 mV (0.5 mm), except for males less than 30 years of age, for whom 0.1mV (1 mm) is more appropriate.

Threshold Values for ST-Segment Changes

- Recommendation
  - For men and women, the threshold value for abnormal J-point elevation in V7 through V9 should be 0.05 mV (0.5 mm).

Threshold Values for ST-Segment Changes

- Recommendation
  - For men and women of all ages, the threshold value for abnormal J-point depression should be -0.05 mV (-0.5 mm) in leads V2 and V3 and -0.1 mV (-1 mm) in all other leads.

Correlation of ST Changes to the Region Involved and to the Occluded Vessel

- Anterior Wall Ischemia/Infarct: LAD
- Occlusion of the proximal LAD above the first septal and first diagonal branches → the basal portion of the LV, as well as the anterior and lateral walls and the interventricular septum. → the ST-segment spatial vector being directed superiorly and to the left →
  - ST-segment elevation in leads V1 through V4, I, aVL, and often aVR.
  - reciprocal ST-segment depression in the leads whose positive poles are positioned inferiorly, that is, leads II, III, aVF, and often V5
  - Typically, there will be more ST elevation in aVL than in aVR
  - more ST-segment depression in lead III than in lead II, because the ST-segment spatial vector will be directed more to the left than to the right.

Correlation of ST Changes to the Region Involved and to the Occluded Vessel

- Anterior Wall Ischemia/Infarct: LAD
- Occlusion of the proximal LAD between the first septal and first diagonal branches →
  - the basal interventricular septum will be spared, and the ST segment in lead V1 will not be elevated.
  - In that situation, the ST-segment vector will be directed toward aVL, which will be elevated, and away from the positive pole of lead III, which will show depression of the ST segment

Correlation of ST Changes to the Region Involved and to the Occluded Vessel

- Anterior Wall Ischemia/Infarct: LAD
- Occlusion of the proximal LAD below both the first septal and first diagonal branches →
  - the basal portion of the left ventricle will not be involved, and the ST-segment vector will be oriented more inferiorly. Thus, the ST segment will not be elevated in leads V1, aVR, or aVL, and the ST segment will not be depressed in leads II, III, or aVF.
  - Indeed, because of the inferior orientation of the ST-segment vector, elevation of the ST segment in leads II, III, and aVF may occur.
  - In addition, ST-segment elevation may be more prominent in leads V3 through V6 and less prominent in V2 than in the more proximal occlusions

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Correlation of ST Changes to the Region Involved and to the Occluded Vessel

- Recommendation
  - ECG manufacturers are encouraged to develop software capable of displaying the spatial orientation of the ST-segment vector in both the frontal and transverse planes.

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ul user, 2011/2/8

Correlation of ST Changes to the Region Involved and to the Occluded Vessel

- Recommendation
  - Wherever possible, the ECG diagnosis provided by automated algorithms should refer to the occluded vessel and to the site of the occlusion within that vessel, as well as to the region involved.

Correlation of ST Changes to the Region Involved and to the Occluded Vessel

- Recommendation
  - When ST-segment elevation is present in I and aVL, as well as in leads V1 through V4 and sometimes in V6, and ST-segment depression is present in leads II, III, and aVF, the automated interpretation should suggest an extensive anterior wall or anterobasal ischemia/infarction due to occlusion of the proximal portion of the left anterior descending coronary artery.

Correlation of ST Changes to the Region Involved and to the Occluded Vessel

- Recommendation
  - When ST-segment elevation is present in leads V3 through V6, and ST-segment depression is not present in leads II, III, and aVF, the automated interpretation should suggest anterior wall ischemia/infarction due to occlusion of the mid or distal portion of the left anterior descending coronary artery.

Correlation of ST Changes to the Region Involved and to the Occluded Vessel

- Inferior Wall Ischemia/Infarct: RCA or LCx, depending on which provides the posterior descending branch
- Occlusion of RCA
  - the spatial vector of the ST segment will usually be directed more to the right than when the LCx is occluded
  - greater ST-segment elevation in lead III than in lead II
  - often ST-segment depression in leads I and aVL leads
  - Proximal RCA occlusion → RV infarct (ST-segment elevation in V3R and V4R, and often in V1
  - Lead V4R is the most commonly used right-sided chest lead. It is of great value in diagnosing right ventricular involvement in the setting of an inferior wall infarction and in making the distinction between RCA and LCx occlusion and between proximal and distal RCA occlusion.

Correlation of ST Changes to the Region Involved and to the Occluded Vessel

- Inferior Wall Ischemia/Infarct: RCA or LCx, depending on which provides the posterior descending branch
- Occlusion of RCA vs. LCx
  - ST-segment depression in leads V1, V2, and V3 that occurs in association with an inferior wall infarction may be caused by occlusion of either the RCA or the LCx. This ECG pattern has been termed *posterior* or *posterolateral* ischemia before.
  - Recent studies suggested that the terms *posterior ischemia* and *posterior infarction* be replaced by the terms *lateral*, *inferolateral*, or *basal-lateral* depending on the associated changes in II, III, aVF, V1, V5, and V6.

Correlation of ST Changes to the Region Involved and to the Occluded Vessel

- Recommendation
  - ECG machines should be programmed to suggest the recording of the right-sided chest leads V3R and V4R when ST elevation greater than 0.1 mV occurs in leads II, III, and aVF.

Correlation of ST Changes to the Region Involved and to the Occluded Vessel

- Recommendation
  - ECG machines should be equipped with a mechanism to label leads V3R and V4R.

Correlation of ST Changes to the Region Involved and to the Occluded Vessel

- Recommendation
  - Descriptive and interpretative statements should be developed to describe and interpret abnormalities that might occur in leads V3R and V4R.

Correlation of ST Changes to the Region Involved and to the Occluded Vessel

- Recommendation
  - The current ECG terminology of posterior is retained to describe ST depression in leads V1 and V2 and the subsequent development of broad R waves in these leads, as described in the previously published section concerning terminology.
  - Further collaborative studies involving larger groups of patients having a variety of ages and body builds and having acute ischemia as well as established infarctions are recommended to provide further data on this topic. This recommendation, as well as the others in this report, will be reviewed periodically to determine whether changes should be recommended.

Correlation of ST Changes to the Region Involved and to the Occluded Vessel

- Occlusion of RCA vs. LCx
  - It is not possible to determine whether the RCA or LCx vessel is occluded when changes of inferior wall ischemia/infarction are accompanied by depression of the ST segment in leads V1, V2, and V3; however, the absence of such changes is more suggestive of RCA than LCx occlusion.
  - LCx occlusion → directed to the left than RCA occlusion → the ST segment may be elevated to a greater extent in lead II than in lead III and may be isoelectric or elevated in leads 1 and aVL

Correlation of ST Changes to the Region Involved and to the Occluded Vessel

- Recommendation
  - When the resting ECG reveals ST-segment depression greater than 0.1 mV (1 mm) in 8 or more body surface leads coupled with ST-segment elevation in aVR and/or V1 but is otherwise unremarkable, the automated interpretation should suggest ischemia due to multivessel or left main coronary artery obstruction.

Postischemic T-Wave Changes

- Recommendation
  - The specific pattern of deeply inverted T waves with QT prolongation in leads V2 through V4 should be interpreted as consistent with severe stenosis of the proximal left anterior descending coronary artery or with a recent intracranial hemorrhage (CVA [cerebrovascular accident] pattern).

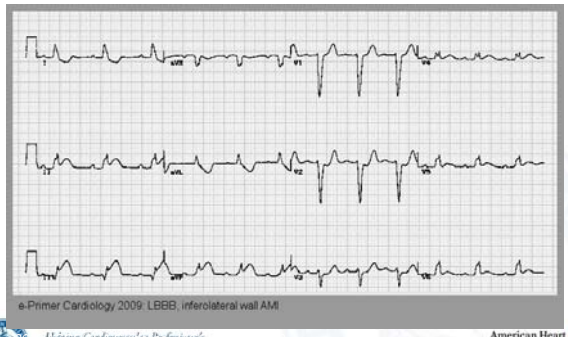
Diagnosis of Ischemia/Infarction in the Setting of Intraventricular Conduction Disturbances

- Not affected by the presence of fascicular blocks or by right bundle-branch block
- Affected by the presence of left bundle-branch block because of the more pronounced secondary ST- and T-wave changes

Diagnosis of Ischemia/Infarction in the Setting of Intraventricular Conduction Disturbances

- GUSTO I:
  - Concordant ST-segment changes
    - ST-segment elevation greater than or equal to 0.1 mV (1 mm) in leads with a positive QRS complex
    - ST depression greater than or equal to 0.1 mV (1 mm) in leads V1 through V3, that is, leads with a dominant S wave
  - Discordant ST-segment changes
    - ST-segment elevation greater than or equal to 0.5 mV (5 mm) in leads with a negative QRS complex

Diagnosis of Ischemia/Infarction in the Setting of Intraventricular Conduction Disturbances


e-Primer Cardiology 2009: LBBB, inferolateral wall AMI

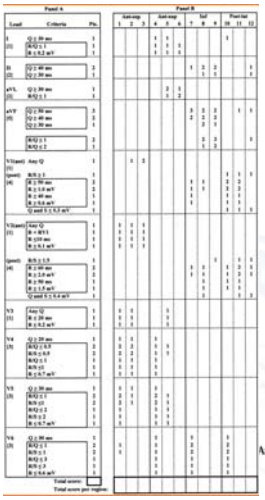
Diagnosis of Ischemia/Infarction in the Setting of Intraventricular Conduction Disturbances

- Recommendation
  - Automated ECG algorithms should suggest the possibility of acute ischemia/infarction in patients with left bundle-branch block who have ST-segment changes that meet the above criteria.

Quantitative QRS Changes for Estimation of Infarct Size

- The Minnesota Code
- The Selvester QRS scoring system
  - 54 weighted criteria from the QRS complexes in 10 of the standard leads (leads I, II, aVL, aVF, and V1 through V6), which totaled 32 QRS points, each equivalent to approximately 3% of the left ventricular wall

Selvester QRS Scoring System



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Quantitative QRS Changes for Estimation of Infarct Size

- Recommendation
  - Algorithms capable of determining the Selvester score in tracings that meet the criteria for prior infarctions should be developed and available for use by the reader if so desired.

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Case Scenarios

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Acute Coronary Syndrome

- ST-elevated Myocardial Infarction (STEMI)
- Non-ST-elevated Myocardial Infarction (NSTEMI)
- Unstable Angina (UA)

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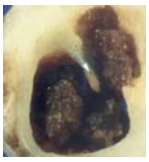
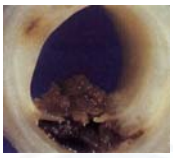
STEMI



Adapted from Michael Davies

CK- MB or Troponin ↑

NSTE-ACS



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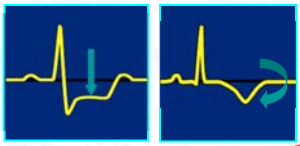

Troponin elevated or not

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Diagnosis of Myocardial Infarction

- Symptom and Sign
  - Typical Chest Pain
  - Atypical Chest Pain
    - Angina Equivalent
- ECG findings
- Cardiac Enzymes
- DILEMMA

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Diagnosis of Myocardial Infarction

- Symptom and Sign
  - Typical Chest Pain
  - Atypical Chest Pain
    - Diabetes Mellitus
    - Women
    - Elderly
    - Stroke? Impaired Sensation? Autonomic Dysfunction?
- ECG findings
- Cardiac Enzymes
- DILEMMA

Diagnosis of Myocardial Infarction

- Symptom and Sign
  - Typical Chest Pain
  - Atypical Chest Pain
    - Angina Equivalent
    - Not Characteristics of MI:
      - Associated with Respiratory Movement
      - Associated with Position
      - Associated with Tender Point
- ECG findings
- Cardiac Enzymes

Diagnosis of Myocardial Infarction

- Symptom and Sign
  - Typical Chest Pain
  - Atypical Chest Pain
    - Angina Equivalent
- ECG findings
  - Evolutional Changes (Dynamic ST Changes)
  - BBB pattern
    - LBBB/RBBB, Pacemaker Rhythm, WPW, LV Aneurysm
- Cardiac Enzymes

ECG Classification

- The ECG in AMI may manifest as Types 1 to 4.
- The ECG in UA/NSTEMI may manifest as Types 1c, 1d, and 2 through 4.

Type 1

- Meets recommended “criteria” for reperfusion therapy
- ST elevation (or hyperacute T waves or ST depression of posterior AMI in V1-V4)
- If due to AMI: indications for thrombolytics as well as angiography ± PCI
- Type 1a, 1b, 1c, 1d

Type 1a

- Clearly diagnostic of AMI due to acute, thrombotic occlusion
- Indication for reperfusion therapy
- 45% of initial ECGs
- Specificity: 94%

Type 1a

- ST elevation >2mm in two consecutive precordial leads or > 1 mm in two consecutive limb leads
- No confounding factors, such as left ventricular hypertrophy (LVH), bundle branch block (BBB), early repolarization, pericarditis, and ventricular aneurysm
- Typical morphology

Type 1b

- Diagnostic of AMI, but subtle and difficult
- Indications for reperfusion therapy
- Specificity: 90%

Type 1b

- These ECGs may be due to lateral AMI, AMI with borderline ST elevation, ST elevation in one lead only, posterior AMI, hyperacute T waves, or AMI in the absence of confounding factors such as LVH, LBBB or RBBB, early repolarization, pericarditis, or ventricular aneurysm.
- ST elevation is borderline because the ECG was recorded early in the course of AMI or AMI is in an silent area, or there is good collateral or intermittent occlusion.

Type 1c

- Equivocal
- ST elevation that meets “criteria” for thrombolytics, but uncertain if it is due to AMI
- Additional information is needed
- Angiography $\pm$ PCI is preferable

Type 1c

- The ST elevation may be due to AMI or another abnormality, such as LVH, LBBB, early repolarization, ventricular aneurysm, or pericarditis.
- Additional information may include comparison with a previous ECG, serial ECGs, echocardiography, angiography, and/or biomarker levels.

Type 1d

- ST elevation $\pm$ QS waves
- ST elevation diagnostic of AMI but with
  - T-wave inversion indicative of spontaneous reperfusion OR
  - QS waves and T-wave inversion indicative of subacute MI

Type 1d

- Reperfusion therapy is indicated if
  - An especially careful history clearly establishes symptom onset within less than 12 hours; be certain that this Type 1 ECG is due to acute infarction.
  - Symptoms are unequivocally ongoing; be certain that this infarction has not already spontaneously reperfused.
  - Angiography ± PCI may be preferred.

Type 2

- Diagnostic of UA/NSTEMI
- "Primary"ST depression or T-wave inversion that is nondiagnostic of AMI is diagnostic if myocardial ischemia.
- Angiography ± PCI may be indicated, but thrombolytic therapy is not indicated

Type 2

- New or evolving ST depression, especially 1 mm or more, that is not posterior AMI
- New or evolving T-wave inversion of 1 mm or more
- 25% to 35% of AMI (mostly NQWMI, some UA)

Type 3

- Nonspecific ECG that is abnormal but nondiagnostic of any kind of ACS
- Angiography ± PCI (but not thrombolytics), esp. in hemodynamically unstable cases
- 22.5% of AMI; 8.6% of ischemic symptoms

Type 3

- One or more:
  - Q waves; LVH; minor, nondynamic ST or T-wave abnormalities not suggestive of ischemia or infarction
- May change to other types

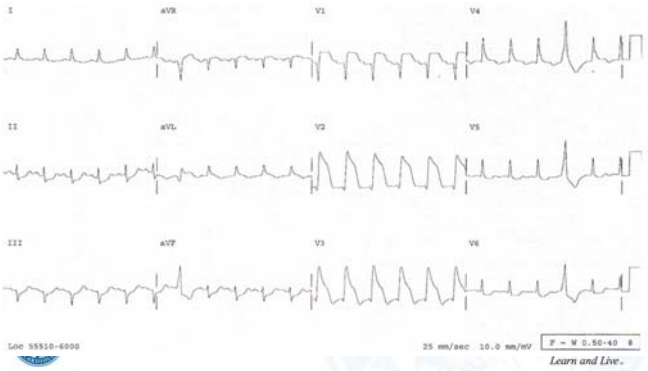
Type 4

- Normal ECG
- 6.4% of all AMIs
- 3.4% of ischemic sysmptoms
- Many of UA

Case 3-1

- This 73-year-old man presented at 00:45 complaining of abdominal pain, nausea, vomiting, and bloating （atypical symptoms）that began at midnight, with no CP or dyspnea.

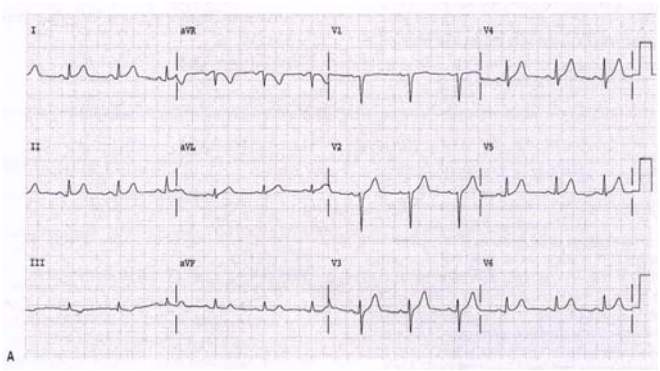
Case 3-1



Case 3-2

- This 62-year-old man complained of burning pain from epigastrium to throat, which he had never before experienced. He was otherwise healthy. His physical examination was normal.

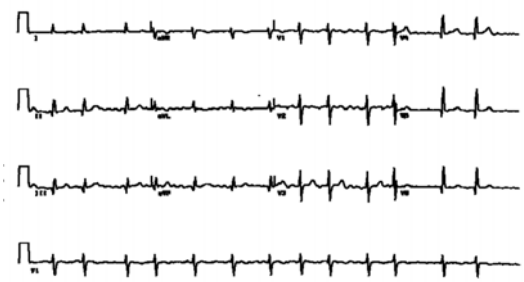
Case 3-2



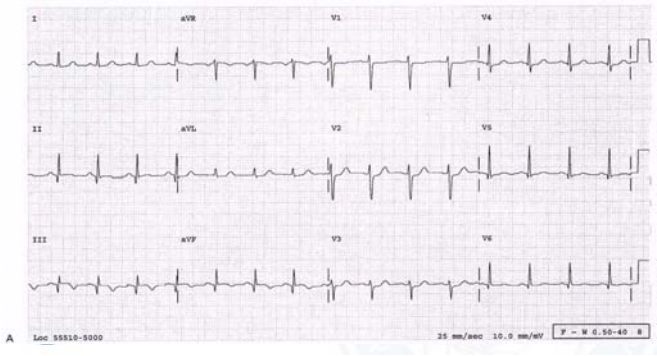
Case 3-3

- This 48-year-old woman presented with CP one week after successful thrombolytic therapy for an inferior AMI. She had discontinued her medications and continued smoking.

Case 3-3



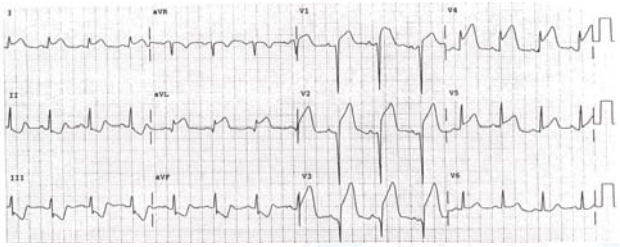
Case 3-3



Case 11-1

- This 55-year-old man presented with 2 hours of CP.

Case 11-1



Case 11-1

- ECG 11-1 (Type 1a)
  - Well-developed, acutely formed Q waves: aVL, V2-V3; terminal QRS distortion: V2-V4; and reciprocal ST depression: II, III, aVF are clearly diagnostic of a large anterolateral AMI.

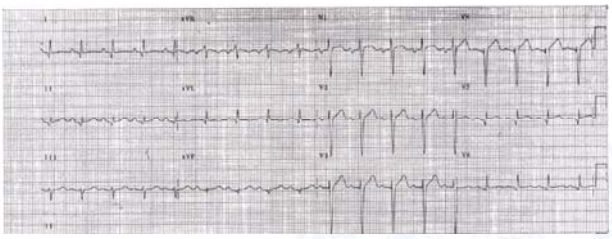
Case 11-1

- Thrombolytics/PCI offer much benefit in this case. The presence of Q waves does not imply less benefit to thrombolytics/PCI. In fact, this ECG manifests very high acuteness, and reperfusion is indicated regardless of symptom duration.

Case 11-2

- This 47-year-old aboriginal man complained of 7 hours of constant typical CP, partly relieved with NTG. He reported a history of “two strokes” that he said were only treated in the ED and had not caused headache, and he stated that he had no remaining weakness or numbness. No previous records or ECG were available. BP=120/80 mm Hg and P=110 beats per minute (bpm).

Case 11-2



Case 11-2

- ECG 11-2 (Type 1b)
  - ST elevation: <2 mm, V1-V5, possibly due to early repolarization, although V5 morphology is more typical of AMI; and Q waves: tiny, V2-V4, larger in V5 and V6. These Q waves are not part of early repolarization but, rather, support the diagnosis of anterolateral AMI, although they could be due to previous MI.

Case 11-2

- Subsequent ECGs never developed high ST elevation. Clinicians administered thrombolytics immediately, solely on the basis of the initial ECG. The patient continued to have pain and the ECG did not show significant ST recovery. Within 1 hour, the patient became hypotensive. Immediate angiography revealed an EF of 25%, anterior and apical akinesia, severe multivessel disease with high-grade LAD stenosis necessitating an intra-aortic balloon pump and CABG.

Case 11-2

- The patient's CK and cTnI at the specified time intervals were, respectively, 335 IU/L and 4.1 ng/mL and 4.1 ng/mL at 17:41 on Day 0 (time of presentation), 3,070 IU/L and 402 ng/mL at 21:45 on Day 0, 4,229 IU/L and 526 ng/mL at 01:30 on Day 1, 4,4374 IU/L and 369 ng/mL at 05:46 on Day 1, 829 IU/L and 84 ng/mL at 15:46 on Day 2.

Case 11-2

- Q waves, including reverse R-wave progression, may appear very early in AMI and may help distinguish early AMI from look-alikes. The increased cTnI concentration (4.1 ng/mL) at admission confirmed the diagnosis of AMI; this should bolster the confidence of a physician who is uncertain of the ECG interpretation (especially if the result can be obtained within 5 minutes), although this ECG is diagnostic (Type 1b) to the trained interpreter.

Case 11-2

- This also demonstrates that the patient's onset of myocardial ischemia was at least 4 hours before the time of presentation. Furthermore, the rapid increase of cTnI to 402 ng/mL over the initial period following thrombolytic therapy suggests that there was successful reperfusion.

Case 11-3

- This 60-year-old man presented with 2 hours of constant CP.

Case 11-3

Case 11-3

- ECG 11-3 (Type 1a)
  - At 16:16.
  - ST elevation: aVL, V2-V5; reciprocal depression: II, III, aVF; and hyperacute T waves: V2-V5 are diagnostic of anterolateral AMI.
  - Q waves (QS pattern): V2-V3
  - The differential diagnosis when viewing precordial leads includes old anterior MI with acute reinfarction, and anterior AMI with acutely formed Q waves. Ventricular aneurysm (old anterior MI with persistent ST elevation) would not have such hyperacute T waves.

Case 11-3

- Because of hypotension resulting from use of IV NTG, clinicians spent 80 minutes managing the hypotension resulting from use of IV NTG, clinicians spent 80 minutes managing the hypotension before giving thrombolytics. Angiography immediately following thrombolytics showed severe LAD stenosis with reperfusion and an EF of 54%. ST segments normalized with ensuing T-wave inversion and persistent Q waves 48 hours later. One year later, R waves had replaced all Q waves and the ECG was normal.

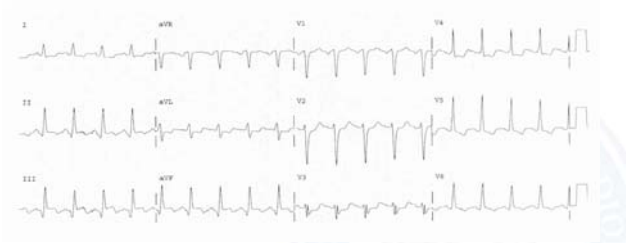
Case 11-3

- ST elevation in a VL, absence of Q wave in V4, and hyperacute T waves all help to make this ECG diagnostic of acute MI. Treatment was unnecessarily delayed by inappropriate administration of IV NTG before thrombolytics.

Case 11-4

- This 66-year-old man with no history of MI but history of aortic aneurysm repair and HTN, presented with dyspnea and diahoresis. His initial BP=220/152 and a chest x-ray revealed pulmonary congestion.

Case 11-4



Case 11-4

- ECG 11-4 (Type 1c)
  - IVCD
  - ST elevation: II, III, aVF; and ST depression: V2-V5, are highly suspicious of inferoposterior AMI.
  - qR waves with well-formed Q waves, but also well-formed R waves: II, III, aVF.
  - Possible ventricular aneurysm, but probable AMI.

Case 11-4

- Records showed that the Q waves were old but the ST elevation was new. Serial ECGs revealed increasing ST elevation and depression. Angioplasty opened a 100% acute RCA occlusion.

Case 11-4

- Inferior QR waves with ST elevation can be difficult to interpret, but unless there is good historical information to the contrary or an immediate ultrasound that confirms ventricular aneurysm, they should be assumed to be a manifestation of AMI. This is especially true in the presence of simultaneous precordial ST depression.