EKG Conferences – 2013 - 2014

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POSTERIOR WALL INFARCTION

• Review of inferior MI
• Posterior Myocardial Infarction
  – Classic ECG patterns
  – Coronary anatomy
  – Posterior leads
Key Points

• Posterior MI may occur:
  – Concurrent with inferior or lateral STEMI
  – In isolation (*True Posterior*)

• Often missed

• Present with anterior ST-depressions

• ABSENCE of ST-elevations on 12-lead

• Do not meet classic definition (>1 mm ST-elevation in 2 adjacent leads)
Isolated Posterior STEMIs

• Frequently missed
• TRITON-TIMI 38 study (1,198 acute posterior MIs):
  – Median “balloon time:” 29 hours
  – In ¾, anterior ST-segment depressions were *misclassified as NSTEMI or unstable angina*
  – Delayed reperfusion associated with worse outcomes
“True” Posterior Wall Infarction

• 3-8 % of all acute MIs (+ troponin) are:
  – Posterior MIs presenting without ST elevation on the 12-lead ECG

• Patients with extensive posterior STEMI, **presenting only with anterior ST-segment depressions**, benefit from immediate reperfusion

• **Culprit lesion**: RCA or Left Circumflex
  – If isolated Posterior MI, usually is LCA occlusion (or one of its branches)
UCH Cath Lab Activation

UCH STEMI Alert Pathway

**ED Patient with:**
- New ST elevation ≥2mm at J point in 2 contiguous leads, **AND**
- Symptoms or presentation consistent with AMI, **AND**
- Symptom onset < 12 hours?

**Pre-Hospital EMS “Cardiac Alert”**

Activate Cath Lab
Defining a STEMI

STEMI is a clinical syndrome defined by characteristic symptoms of myocardial ischemia in association with persistent electrocardiographic (ECG) ST elevation and subsequent release of biomarkers of myocardial necrosis. Diagnostic ST elevation in the absence of left ventricular (LV) hypertrophy or left bundle-branch block (LBBB) is defined by the European Society of Cardiology/ACCF/AHA/World Heart Federation Task Force for the Universal Definition of Myocardial Infarction as new ST elevation at the J point in at least 2 contiguous leads of $\geq 2$ mm (0.2 mV) in men or $\geq 1.5$ mm (0.15 mV) in women in leads V₂–V₃ and/or of $\geq 1$ mm (0.1 mV) in other contiguous chest leads or the limb leads. The majority of patients will evolve ECG evidence of Q-wave infarction. New or presumably new LBBB has been considered a STEMI equivalent. Most cases of LBBB at time of
STEMI *Equivalents*

- ECG patterns regularly associated with acute coronary occlusion .. And needing reperfusion … But lacking “classic ST-elevation”
- “Minor” ST-elevations w/ reciprocal ST-segment depressions
- Left main coronary artery occlusion
- LBBB + Sgarbossa changes
- Anterior precordial hyper-acute T-waves
- DeWinter ST/T complex
- ROSC after sudden cardiac death
- TRUE POSTERIO MYOCARDIAL INFARCTION
54 y.o. man with hypertension, diabetes, hypercholesterolemia. Had intermittent SSCP for two months, then acute, severe pain for past 4 hours.
Right coronary artery: right anterior oblique view

- Sinuatrial (SA) nodal branch
- Conus (arteriosus) branch
- Right coronary artery
- Right (acute) marginal branch
- Atrioventricular (AV) nodal branch
- Right posterolateral branches (to back of left ventricle)
- Posterior interventricular branch (posterior descending artery)
True POSTERIOR WALL MI

Causes ST elevations over back of heart

• **ECG Diagnosis**
  – “Reciprocal Sign”
    • ST-depressions V1 – V4)
    • Concomitant lateral ST-elevations
  – Posterior leads
Culprit Artery Occlusion in *True Posterior STEMI*
J.M.: 56 year old man with chest pain (S/P CABG)
J.M.: 1 day later

- Old inferior infarction
- Old lateral infarction – voltage “drop-off”
- Old posterior infarction (V1-V2)
  - Tall, broad R-waves
  - R:S ratio > 1.0
The “Reciprocal Sign”

**Identifying Isolated Posterior MI**

Leads V1-V2

- ST-segment depressions – **OFTEN SUBTLE**
- Upright T-waves - **CRITICAL**
- Prominent R-waves
  - Tall or broad ($\geq 0.04$ sec or slurred upstroke)
  - R:S ratio $> 1$ in lead V2
Reciprocal Sign
Posterior MI: Summary of ECG changes

- ST-segment depression in V1-V2-V3
  - * With upright T-waves
- Prominent R-waves in V1-V2
- Coexisting inferior or lateral wall injury
  - ST-elevations inferior leads or V5-V6
  - Voltage “drop off”
# Differential Diagnosis

## Tall R V1-V2
- COPD
  - RAD, RAE, low voltage, poor R-progression
- Acute RV strain (PE)
- RBBB
- WPW, HCM (IHSS)
- Dextroversion

## ST-depressions V1-V3
- Posterior STEMI
- Anterior ischemia
- Anterior non-STEMI
- Acute or chronic pulmonary hypertension (RV strain)
  - Pulmonary embolism
FIGURE 16-2. ST depression in posterior AMI versus UA/NSTEMI. Persistent ST depression, maximal in V1–V4, is usually due to posterior injury. This is especially true with an upright T wave. (a) If the T wave is inverted and asymmetric (b), it could also be due to anterior UA/NSTEMI. If, as in (c), the QRS returns to baseline before the ST segment downslopes, anterior UA/NSTEMI is likely, especially with a symmetrically inverted T wave.
1. A 57 year-old male presents with a 6-hour history of left-sided chest pain radiating to his back with associated nausea, shortness of breath, and diaphoresis. His vital signs are normal. His initial ECG is below. Initial diagnosis: Probable ACS, rule-out anterior ischemia. Correct?
80 year old female, presented with confusion, diaphoresis and DKA; CK was 3,000; died 24 hours later.

Angiography → 100% CIRC occlusion + RCA and LAD disease
31 year old man with SOB, chest pain

- Broad, tall R w/ slurred upstroke in V1-V2
- ST-depression in V1
- Likely lateral injury current
64 yo female: COPD, no hx CAD. Had 5 days stuttering, 8/10 chest pain, radiated to both arms

- Atrial fibrillation
- Anterior ischemia??
- Would posterior leads have helped?
- EKG Dx: Posterior STEMI

- In ED received metoprolol, heparin, NTG
- Developed pulmonary edema
- Peak Trop = 107
- Cath: Subtotal left circumflex clot
71 yo man with history of CAD. Presented with 1 week of stuttering chest pain, nausea & vomiting and SOB

- Treated in ED as ACS; later received streptokinase
- CK peaked at 1,537
- Cath: 100% proximal circ occlusion
- Echo: Basal, posterior, lateral hypokinesis
Posterior Leads

- **V-7**
  - Same level as V6 (in posterior axillary line)

- **V-8**
  - Tip of scapula

- **V-9**
  - Half way from V8 to paraspinal mm

- **Positive:** > 0.5 (or 1.0) mm ST elevation
15-lead EKGs (Body Surface Mapping)

- Detect injury in silent or near-silent areas
  - Posterior wall
  - Far-lateral and far-inferior walls
  - Right ventricle
- Expand use of urgent reperfusion therapies

The Earth is flat! The electrocardiogram has 12 leads! The electrocardiogram in the 15-lead electrocardiogram...
Posterior Leads – Recent studies

• Some studies (but not all) indicate:
  – Using posterior leads significantly increase the sensitivity of ECG in diagnosis of left circumflex occlusion
Posterior Leads – When

• Patient with acute IMI or lateral MI *(maybe)*
  – Check for posterior wall involvement (prognosis)
  – Especially if ST-segment changes *subtle or borderline* in inferior or lateral leads

• Patient with ST-depressions in V1-V3
  – Diagnose true posterior STEMI
    • *Versus.* anterior ischemia (*unstable angina*) or non-STEMI (or PE)

• Patient with normal or near-normal EKG (?)
• Don’t forget echocardiography
Final point

• True posterior MI should be treated as a STEMI equivalent … not a NSTEMI
  – Isolated **ST-segment depressions** V1 – V3, along with **upright t-waves**, are the dominant findings on standard 12-lead ECG.
  – Positive posterior leads (V7 – V9) may be helpful
  – Emergency reperfusion is indicated
We need an approach

- To patients presenting with chest pain (ACS) who have isolated anterior ST-segment depressions
  - Posterior STEMI (should trigger emergent reperfusion protocol)
  - Anterior wall ischemia or Non-STEMI
  - Pulmonary embolism (or chronic pulmonary hypertension)
REVIEW TRACINGS

2012-2013
54 YEAR OLD MAN WITH ACUTE ONSET OF SUB-STERNAL CHEST PAIN AT REST, NAUSEA, DIAPHORESIS.
• Trop peak at 12.4
• Cath: Distal RCA occlusion

Acute Inferior and Posterior STEMI

1st degree AV block
18-Oct-1956
Male
Room: STARB
Loc: 106
Opt:

Technician: 969
Test ind: POSTERIOR

Vent. rate 78 bpm
PR interval 236 ms
QRS duration 122 ms
QT/QTc 366/417 ms
P-R-T axes 47 62 73

Sinus rhythm with 1st degree AV block
Nonspecific intraventricular conduction delay
ST elevation, consider inferolateral injury or acute infarct
*** ACUTE MI ***
Consider right ventricular involvement in acute inferior infarct
Abnormal ECG

Secondary ID: 13126560
Referred by: HATTEN, 3
Unconfirmed

[ECG Tracing]

[Notes]

INFERIOR + POSTERIOR MI

100% RCA - [Handwritten]
CASE

- 63 year old man with sudden onset of central chest pressure and severe SOB.
- BP = 100/78, Heart rate = 123
- Examination consistent with pulmonary edema
- Loud holosystolic murmur
Approximately 1 hour later:

- Acute Posterior STEMI
- 100% PDA occlusion
- Papillary muscle rupture
  - *Postero-medial papillary muscle has single blood supply from PDA*
CASE

• 72 year old man, with no history of CAD, had severe chest pain while running at the airport. History of pulmonary fibrosis, on home oxygen.
• Initial troponin = .01
• Recognized immediately as acute STEMI
• Cath lab activated
• Dx: Acute 100% occlusion of proximal left circumflex artery, prior to takeoff of the first OM
• Peak troponin: 25.8.
• Recovered completely after placement of DES in Left Cx