

# Acute Coronary Syndromes: Unchain My Heart

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## David Schneider, MD, FAAFP

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Dr. Schneider cares for the underserved in Santa Rosa, CA, serving Latino, Southeast Asian, and Eritrean populations. His professional interests include the doctor-patient relationship, clinical skills, and teaching the breadth and depth of family medicine for over 20 years. Cardiovascular system conditions are one of his specialty topics, and he points to "the growing body of evidence suggesting that lifestyle is as effective as, or more effective than, pharmacologic interventions in primary prevention." He also focuses on conditions of the endocrine system (especially thyroid), skin and dermatology, primary prevention focusing on lifestyle, and procedures. Dr. Schneider is board certified not only in Family Medicine, but also in Integrative Holistic Medicine. He produces Dr. Dave's To Your Health segments for Wine Country Radio and BlogTalkRadio.com.



## Learning Objectives

1. Use TIMI or GRACE risk models to stratify ACS patients according to individual risk.
2. Implement evidence-based secondary prevention recommendations in post-ACS patients.
3. Use evidence-based criteria in determining safe and effective medications to prescribe at discharge post-ACS.
4. Counsel patient to address concerns in the period immediately following discharge for ACS, with an emphasis on assessing and monitoring for psychosocial issues that may impact post-ACS outcomes.



## Audience Engagement System



## What is Acute Coronary Syndrome?

- AHA: "...an **umbrella term** used to cover any group of clinical **symptoms compatible with acute myocardial ischemia.**"
  - "Acute myocardial ischemia is chest pain due to **insufficient blood supply to the heart** muscle that results from coronary artery disease."
- Practically speaking: **ACS means acute MI or unstable angina.**

<http://www.americanheart.org/resenter.jhtml?identifier=101000>  
<http://www.nlm.nih.gov/medlineplus/ency/article/000099a01-27.html>

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## AES Question

Which of the following does NOT qualify as unstable angina?

- Angina of longer duration.
- Angina with more pain (0-10 scale).
- Angina occurring at lower activity level.
- Angina of very recent onset.
- None of the above (all are unstable angina).

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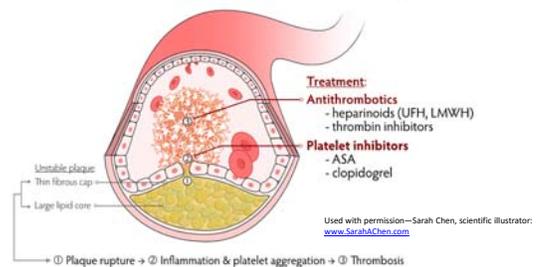
## Unstable Angina

- Unstable angina:
  - Angina at **rest** (esp > 20 min)
  - **New** onset angina limiting physical activity
  - **Increasing** angina
    - More frequent
    - Longer duration
    - Occurs with lower exertion
- Angina that occurs early after infarction or revascularization is also considered by many to be unstable angina.

[http://www.medicinenet.com/contents/definition\\_of\\_unstable\\_angina\\_and\\_myocardial\\_infarction.htm](http://www.medicinenet.com/contents/definition_of_unstable_angina_and_myocardial_infarction.htm)  
<http://www.ncbi.nlm.nih.gov/pubmed/11429113> <http://www.ncbi.nlm.nih.gov/pubmed/11333333>

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## ACS: Mechanism → Management



## Symptoms of ACS/MI

- Chest pain/angina
- N +/- V
- Indigestion
- **Dyspnea**
- Sweating
- Dizziness, lightheadedness
- **Fatigue**
- Pain in:
  - Either arm
  - Jaw
  - Neck
  - Back
  - Abdomen

AFP 2005;72(1):119-26 [http://www.uptodate.com/contents/management-of-suspected-acute-coronary-syndrome-in-the-emergency-department#anchor=tab\\_10](http://www.uptodate.com/contents/management-of-suspected-acute-coronary-syndrome-in-the-emergency-department#anchor=tab_10) result@directlink?2-150

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## Atypical MI Symptoms

- 1/3 had no CP.
- Atypical sx:
  - Dyspnea alone
  - Weakness
  - Nausea and/or vomiting
  - Palpitations
  - Syncope
  - Cardiac arrest
- **More likely to be older, diabetic, women.**

JAMA. 2000;283:3223-9. JACC 2007;50:e1-e157

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## Silent MI

- Hot off the press: Circulation, 5/16 ePub:
  - 9498 Caucasian & African-American pts in ARIC study.
  - Mean F/U 13.2 yrs.
  - 703 incident MI's:
    - **45% silent MI.**
    - Silent MI → ↑ mortality, though sl lower than clinical MI.

<http://circ.ahajournals.org/content/early/2016/04/28/CIRCULATIONAHA.115.021177>

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## Angina & MI in Women

- Women **more likely than men** to c/o **atypical** sx (burning/sharp; neck/jaw).
- Women still get **typical angina**, too!
- MI more likely to go undetected in women, esp young (40% unrecognized 35-39 yo vs **27% @ 75-79**).
- Study of 515 women w/MI:
  - Only 30% had prodromal CP; CP during MI in only 57%.
  - **Dyspnea** in 58%.
- **High index of suspicion for CAD in women.**

AmJHJ 2006;151(4):813-9; EurHJ 2008;29(6):707-17; JAMAIntMed 2014;174:241-9; AmCardiol 1994;74(3):326-31; Circulation 2013;127:1254-63; EurHJ 1998;19:1011-8; AnnIntMed 2001;134:1043-7; AmHJ 1998;138:188-95; Circulation 2003;108:2619-23

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## DDx of Chest Pain

- **Cardiovascular**
  - Ischemic (<20-30%, but **2-4% of MI's are missed**)
  - Non-ischemic
    - Aortic dissection\*
    - Myocarditis
    - Pericarditis

NEJM 2000;342:1163-70

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## Other Causes of CP

- **Pulmonary**
  - PE\*
  - Tension pneumothorax\*
  - PNA
  - Pleurisy/pleuritis
- **Psych**
  - Depression
  - Anxiety d/o's
  - Somatoform d/o's
  - Delusional d/o's
- **Musculoskeletal**
  - Cervical disc dz
  - Costochondritis
  - Fibromyalgia
  - Herpes zoster (before the rash)
  - Neuropathic pain
  - Rib fracture
  - Sternoclavicular arthritis

<http://www.upstate.com/content/differential-diagnosis-of-chest-pain>

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## GI Causes of CP

- **Biliary**
  - Cholangitis
  - Cholecystitis
  - Choledocholithiasis
  - Biliary colic
- **Peptic ulcer disease**
  - Nonperforating
  - Perforating\*
- **Esophageal**
  - Esophagitis
  - Spasm
  - Reflux
  - Rupture\*
- **Pancreatitis**

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## Life-Threatening Causes of Chest Pain

- **D**issection (aneurysm)\*
- **E**mbolism (pulmonary)\*
- **A**cute coronary syndrome\*
- **T**ension Pneumothorax\*
- **H**ole in GI tract
  - Esophageal rupture
  - Perforated ulcer
- (And Taxes....)

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| Cause of CP             | History  | Exam   | Lab/X-Ray                                   | EKG  |
|-------------------------|--|--|---|--|
| Dissecting Aneurysm     | • Sudden onset, tearing pain<br>• Chest, back    | • ↓ pulse UE/carotid (15%)<br>• SBP L/R Δ<br>• AR murm (32%) | • 90% abnl; 75% widened mediastinum         | • NSSTT chg—30%<br>• Ischemia 15%            |
| Pulmonary Embolism      | • SOB<br>• Pleuritic/no CP<br>• Unilat LE edema  | • Tachypnea<br>• Tachycardia                                 | • Usu WNL<br>• Hampton's hump (infarct)     | • Sinus Tach<br>• RV strain<br>• S1Q3T3 ~10% |
| Acute Coronary Syndrome | • Ischemic CP<br>• SOB, palp, sweat, N/V (infer) | • Often WNL<br>• Signs of HF, hemo instability               | • Troponins ↑<br>• CXR usu WNL, may show HF | • ST ↑, new Q, new LBBB, etc                 |
| Tension PTX             | • Sudden onset SOB<br>• Pleuritic CP             | • ↓ Breath sounds<br>• SQ emphy (rare)                       | • PTX                                       | • WNL  |
| Esophageal rupture      | • S/P N/V, EGD<br>• SOB                          | • Hamman's crunch  | • Mediastinal air, pleural effusion         | • WNL  |

http://www.ncbi.nlm.nih.gov/pubmed/17421451  
JAMA. 2003;289(18):2177-83

### Features Suggesting MI

| Clinical feature                                 | Likelihood ratio |
|--|------------------|
| Pain in chest or left arm                        | 2.7              |
| Chest pain radiation                             |                  |
| Right shoulder                                   | 2.9-4.7          |
| Left arm   | 2.3              |
| Both left and right arm                          | 4.1-7.1          |
| Chest pain most important symptom                | 2.0              |
| Hx of myocardial infarction or other vascular dz | 1.5-3.0          |
| Nausea or vomiting                               | 1.9              |
| Diaphoresis                                      | 2.0              |
| Third heart sound (S3) on auscultation           | 3.2              |
| Hypotension (systolic BP ≤80 mmHg)               | 3.1              |
| Pulmonary crackles on auscultation               | 2.1              |

JAMA. 1998;280:1256-63; Circulation. 2002;106:3143-3421; AmJMed. 2004;117:334-43; AcadEmergMed. 2002;9:203-8

### Sx Suggesting Non-Ischemic CP

- **Duration:**
  - Days
  - Few seconds or less
- **Radiates** above mandible or to legs
- **Pleuritic** (sharp, non-exertional, positional)
- Located only in mid- or low-**Abdomen**
- Can be **Localized** w/1 finger
- **Reproducible** by **Movement** or palpation

JAMA. 1998;280:1256-63; JAMA. 2005;294:2623-9; AmJMed. 2004;117:334-43; Clinical Practice Guideline Number 13; AHA/ACC Publication No. 04-0002. <http://www.clinicalcardiology.com/book/040002/>

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### CP in ED: HEART Score

- **H**istory
- **E**KG
- **A**ge
- **R**isk factors
- **T**roponin

Risk factors: "HOT CAD"

- HTN
- Obesity
- Tobacco/Smoking w/in 1 mo
- Cholesterol (Hyperlipidemia)
- Ancestry (FH)
- DM

- **0-3:** 0.9-2.5% risk of CV event → **D/C**.
  - 2013 validation study: 0-3 → **1.7% had MACE** → 98.3% sens.
- **≥ 7** → high risk.
  - Major Adverse Cardiovascular Event

NethHeartJ. 2008;16:191-6; IntJCardiol. 2013;168:2153-58; CurrCardiolRev. 2011;7:2-8

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|                      |   |   |
|----------------------|---|---|
| <b>H</b> istory      | Highly suspicious                         | 2 |
|                      | Moderately suspicious                     | 1 |
|                      | Slightly suspicious                       | 0 |
| <b>E</b> CG          | Significant ST depression                 | 2 |
|                      | NS repolarization disturbance             | 1 |
|                      | Normal                                    | 0 |
| <b>A</b> ge          | ≤65 year                                  | 2 |
|                      | 45-65 year                                | 1 |
|                      | <45 year                                  | 0 |
| <b>R</b> isk factors | ≥3 risk factors or h/o atherosclerotic dz | 2 |
|                      | 1 or 2 risk factors                       | 1 |
|                      | No risk factors known                     | 0 |
| <b>T</b> roponin     | >2x normal limit                          | 2 |
|                      | 1-2x normal limit                         | 1 |
|                      | ≤normal limit                             | 0 |

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### HEART Score + 2<sup>nd</sup> Troponin

- If 1<sup>st</sup> or 2<sup>nd</sup> troponin ↑ → manage as ACS.
- HEART ≤3 + neg 2<sup>nd</sup> troponin:
  - Neg 2<sup>nd</sup> troponin @ 3 hr → **100% sensitivity** & NPV (2015, N=282).
  - Neg 2<sup>nd</sup> trop @ 4 hr → **100% sens** & NPV (2011, N = 1070).
  - Neg 2<sup>nd</sup> trop @ 3 hr → **99-99.6% sens** (2013, N=1005).
  - Earlier D/C, less testing, lower costs.

Crit Pathw Cardiol. 2011;10:128-33; CircCardiovasQualOutcomes. 2015;8:195-203; Int J Cardiol. 2013;168:795-802; JAMA Int Med. 2014;174:51-8 [2-hr trop]

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## Other CP Risk Scores

- **TIMI risk score:**
  - Predicts 14 & 30-day mortality.
  - Has been used in ED to stratify risk, MI.
- **GRACE model (harder to calculate):**
  - In-hospital (did not perform as well as TIMI).
  - 6-month & 1 yr: = or sl better than TIMI.
- Risk increases w/score—both.
- Also used to stratify risk & guide management.

Circulation 2013;127:529-55; Curr Cardiol Rev 2011;7:2-8; Circulation 2000;102:2031-7; JAMA 2000;284:835-42; JAMA 2001;286:1356-9; Am J Cardiol 2008;102:6-11; AJCC 2004;44:783-9; Arch IM 2003;163:2545-53; JAMA 2004;291:2727-33; Acad Emerg Med 2006 Jan;13(1):13-8; QJM 2007;100:11-8

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## ACS: UA vs MI

- Unstable angina:
  - NO elevation in cardiac enzymes.
  - +/- ischemic ECG changes—transient.
- MI:
  - Elevated cardiac enzymes – rise & fall.
  - Evolving ECG changes.
- **Cardiac enzymes may not ↑ for hours, so UA may be indistinguishable from non-ST elevation MI at presentation** (see HEART score).

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## Diagnosis of Acute MI

- Rise & fall of cardiac biomarkers AND at least one of:
  - Ischemic sx
  - ECG changes
  - Imaging evidence of new myocardial loss or wall motion abnormality

Eur Heart J 2012;33:2551-67; EurHeartJ 2007;28:2525

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## Cardiac Enzymes

- **Troponins** most sensitive & specific
  - Tnl & TnT are equivalent.
  - Tn now preferred to dx reinfarction— ≥20% ↑ 3-6 hrs after prior value suggests reinfarction.
  - [Low sensitivity until ≥4 – 6 hrs after sx onset
  - Enzymes may not rise for 12 hrs (see HEART).]

|           | Onset     | Peak       | Duration    |
|-----------|-----------|------------|-------------|
| CK-MB     | 3 – 12 hr | 18 – 24 hr | 36 – 48 hr  |
| Troponins | 3 – 12 hr | 18 – 24 hr | 7 – 10 days |

JACC 2003;36:959-69; EurHeartJ 2012; 33:2551-67; Circulation 2004;110:482-299; JACC 2007;50:143-57; <http://www.ajccardio.com/contents/criteria-for-the-diagnosis-of-acute-myocardial-infarction>

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## Nonischemic Causes of Elevated Cardiac Enzymes

- Cardiac ischemia/injury without infarction
- HF (heart failure)
- Myocarditis
- Rapid atrial fib
- PE
- Proximal aortic dissection
- Chronic (or acute) renal insufficiency
- Sepsis, critical illness
- Look for rise & fall – not just elevation.

Heart 2006;92:987-992; EurHJ 2007;28:1598-1600

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## ACS: 123, ABC (Squared)

1. Emergency management.
  - a) Monitor.
  - b) MONA.
2. EKG.
  - a) STEMI → reperfuse.
  - b) NSTEMI → might not reperfuse.
3. (ABC)<sup>2</sup> meds.

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## Initial Meds

- **Immediate ASA** 162 – **325** mg chewed.
  - CURRENT-OASIS 7 Trial (2010):
    - No difference in outcomes w/**low dose (75-100 mg)** or higher dose (300-325); ↓ GI bleeding w/low dose.
    - ACC 2013 STEMI guideline: **162-325** mg pre-PCI.
    - There may be a change in the air...
  - Need **rapid absorption**—do NOT use EC.
  - Do not use if anaphylactic reaction.

Chest 2008; 133:6705; NEJM 2010; 363:930-43; www.acc.org/qualityandscience/clinical/statements.htm; J Am Coll Cardiol. 2008; 51: 210-2147; Circulation 2013; 127:529-55

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## Diagnosis of Acute MI

- Rise & fall of cardiac biomarkers AND at least one of:
  - Ischemic sx
  - **ECG changes**
  - Imaging evidence of new myocardial loss or wall motion abnormality

Eur Heart J 2012;33:2551-67; Eur Heart J 2007;28:2525

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## Step 2: Look at the ECG

- ST elevation
  - ST-elevation MI (**STEMI**).
  - Prinzmetal's angina (**transient** ST ↑).
- No ST elevation
  - ST depression – angina or **NSTEMI**.
  - T wave inversions – NSTEMI or increased risk for acute MI.

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## Initial ECG in ACS

- Initial ECG may be non-diagnostic in 45%, **normal** in 20%.
- Non-diagnostic initial ECG + pt w/high suspicion of MI (including continued sx) → **repeat ECG** every 5-10 minutes (ACC).
- **SERIAL ECG's**—remember to order f/u ECG.

JThrombThrombolysis 1998;6:63-74; AnnEmergMed 1998;31:3-11; JACC 1998;32(1):17-27

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## EKG Changes in MI

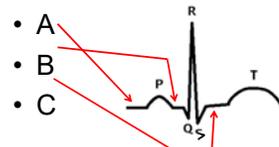
- ST segments:
  - ST **depression** → myocardial **ischemia**.
  - **Elevation** (immediately post plaque-rupture) → myocardial **injury**.
    - Resolution of ST elevation suggests reperfusion.
    - Persistent ST elevation: consider **ventricular aneurysm**.
- T wave inversions → ischemia/injury.
- Q waves:
  - Develop ~12 hrs post plaque-rupture → **infarction**.
  - Typically permanent.



CC 2.5, Patrick J. Lynch, medical illustrator; C. Carl Jaffe, MD, cardiologist, via [http://commons.wikimedia.org/wiki/File:Heart\\_ventricular\\_aneurysm\\_vjapan18](http://commons.wikimedia.org/wiki/File:Heart_ventricular_aneurysm_vjapan18)

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## AES Question



Which is baseline for comparing ST segments?

permission granted: [http://commons.wikimedia.org/wiki/File:ECG\\_Complex.png](http://commons.wikimedia.org/wiki/File:ECG_Complex.png), QRS complex diagram, drawn by Matt Otto, 2005-10-16 (first version); 2007-06-06 (last version)

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## What's Elevation & Depression?

- **Baseline is the TP segment** – electrical neutrality.
  - T wave is ventricular repolarization.
  - P wave is atrial depolarization.
  - Between T & P is the only point in ECG when heart is not “doing” anything, electrically speaking.



Public domain via [https://commons.wikimedia.org/wiki/File:ECG\\_LeadII\\_LeadIII\\_Lead\\_aVF.png](https://commons.wikimedia.org/wiki/File:ECG_LeadII_LeadIII_Lead_aVF.png)

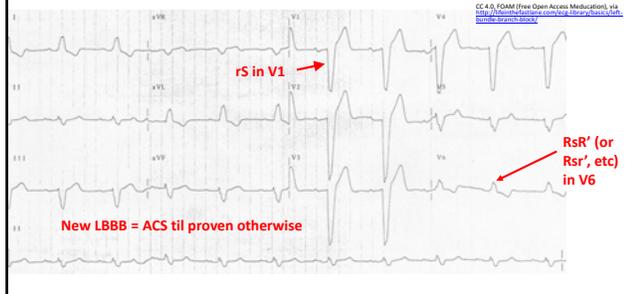
## Review: Summary of EKG Criteria

- **Everything is 1 mm, except V2 & V3 are weird.**
  - **ST elevation:** 1 mm (except V2-V3; age/gender criteria).
  - **ST depression:** 1 mm (except V2-V3).
    - [Measure 2 small boxes after J point.]
  - Q waves: 1 mm wide + 1 mm deep (except V2-V3).
- Everything should be in 2 contiguous leads.
  - Not d/t pericarditis or LV aneurysm.

Circulation 2012;126:2020-2035

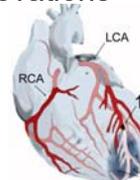
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## New Onset LBBB → Assume MI



## ECG Localization of MI: ST Elevations

- V1 – V2: septal, anteroseptal
- V3 – V4: anterior, anteroseptal
- V4 – V6: lateral
- I, aVL, V5, V6: lateral
- II, III, aVF: inferior
  - Check V4R – V6R – RVMI (ACC/AHA)
- **ST depressions in V1-V2:** consider posterior MI (check V7-V9)



Licensed for reuse, CC 3.0, J Heuser via [https://commons.wikimedia.org/wiki/File:AMI\\_scheme.png](https://commons.wikimedia.org/wiki/File:AMI_scheme.png)

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## Reciprocal ECG Changes

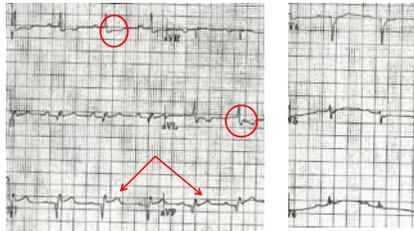
- **ST depressions**
- Anterior MI: II, III, aVF (inferior leads).
- Lateral MI: II, III, aVF (inferior) + V1-V2 (anterior).
- Inferior MI: V1-V3, I, aVL (anterior, +/- lateral).
- “Inferior partners with everything.”

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## ST Changes

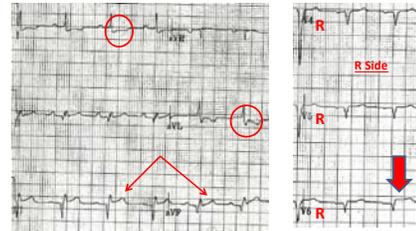


## Inferior MI, Reciprocal Depressions



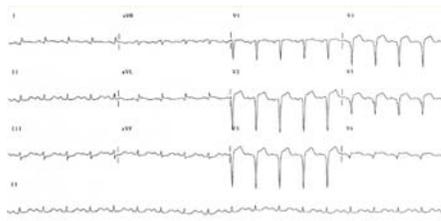
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## Inferior MI → R-Sided EKG



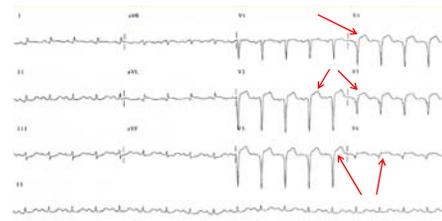
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## Where's the MI?



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## Extensive Anterior + Lateral



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## Summary: STEMI Reperfusion Guidelines

- Pt w/onset of ischemic sx w/in **12 hrs**:
  - PCI-capable (1<sup>st</sup> medical contact **FMCI-balloon time ≤90 min**) → **PCI (IA)**.
  - Non-PCI-capable:
    - If **door-in-door-out (DIDO) ≤30 min AND FMC-balloon time at referral hospital ≤120 min** → **transfer (IB)**.
    - **FMC-balloon >120** → **thrombolysis**, no transfer (IB).
- See supplemental info.

Circulation 2013;127:529-55

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## Sicker STEMI Pts Get More Leeway

- PCI at any time if cardiogenic shock, acute/severe HF—incl transfer for PCI (IB).
- Consider PCI 12-24 hrs if ongoing ischemia (IIa/B).
- Consider TL 12-24 hrs if lg area of myocardium at risk, hemodynamic instability (IIa/C).

Circulation 2013;127:529-55

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## PCI: Stents

- Bare metal:
  - Metal = foreign body → ↑ risk of in-stent thrombosis – clopidogrel + ASA decreases risk.
  - Epithelialization may progress to in-stent stenosis.
- Drug-eluting:
  - Delay epithelialization, maintaining bare metal longer → ↓ stenosis but ↑ thrombosis.

J Am Coll Cardiol 2011;58:2550-63

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## Stents

- **Stent** (bare-metal or drug-eluting) is useful in primary PCI for pts w/**STEMI**. (LOE A)
- **Bare-metal** stents (LOE C):
  - Pts w/high **bleeding risk**.
  - **Inability to comply** with 1 year of dual antiplatelet therapy (DAPT).
  - **Anticipated invasive** or surgical procedure in next year.
- Selected pts may get PTCA w/o stent.

Circulation 2011;127:529-55

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## AES Question

Dual antiplatelet therapy after MI should be given for:

- 1-12 months
- 90 days
- Indefinitely
- At least 12 months
- The heck of it

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## Dual Antiplatelet Therapy: Stents

- Aspirin: continue indefinitely for all stents.
- Post ACS: all stents **minimum 12 months** (I/B).
  - Clopidogrel 75 mg daily (preferred—2016); OR
  - Prasugrel 10 mg daily (not if h/o CVA); OR
  - Ticagrelor 90 mg bid (less convenient dosing).
  - NNT = 33-53.
- [Not ACS:
  - Bare metal: 1-12 months.
  - Drug-eluting: ≥ 12 mo if not high risk for bleeding.]

JACC 2016, doi: 10.1016/j.jacc.2016.03.513; JAMA 2013;310:189-196; JACC 2011;58:2550-63; JAMA 2007;298:2411-20; Circ 2011;124:2574-609

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## DAPT Trial—2014

- 9961 pts – 26% p-MI, 17% unstable angina.
  - Drug-eluting stents only (1/2 = 1<sup>st</sup> gen, 1/2 = 2<sup>nd</sup> gen).
  - 18 extra mo DAPT (=30 mo).
  - ↓ stent thrombosis (HR 0.29, NNT=100).
  - ↓ MI (HR 0.47, NNT=50).
  - ↓ MACE + cerebrovascular (HR 0.71, NNT=63).
  - 56% more mod/severe bleeding (NNH=57).
  - ↑ all-cause mortality (HR=1.36, NNH=200).

NEJM 2014;371:1255-66; JACC 2016, doi: 10.1016/j.jacc.2016.03.513

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## DAPT Score—Hot Off the Press!

|                          |    |
|--------------------------|----|
| Age ≥75                  | -2 |
| Age 65 to <75 y          | -1 |
| Age <65 y                | 0  |
| Current smoker           | 1  |
| DM                       | 1  |
| MI @ presentation        | 1  |
| Prior PCI or MI          | 1  |
| Stent diameter <3 mm     | 1  |
| Pacitaxel-eluting stent  | 1  |
| CHF or LVEF <30%         | 2  |
| Saphenous vein graft PCI | 2  |

- DAPT score ≥2 → favorable benefit/risk ratio for prolonged DAPT (53% ↓ ischemic events; no sig ↑bleeding).
- DAPT score <2 → unfavorable benefit/risk ratio (no sig diff ischemic events; 114% ↑ bleeding!!).

JACC 2016, doi: 10.1016/j.jacc.2016.03.513; JAMA 2016;315:1735-49

## ABC's of MI Drugs

- **A**SA + **A**nticoagulant
  - **B**-Blockers
  - **C**lot inhibitor (non-ASA antithrombotic) + **C**holesterol (statin)
- 
- ↓ morbidity, mortality, 2<sup>nd</sup> MI.
  - Guideline- & evidence-based.

FMX

## Nitrate Precautions in ACS

- Contraindicated if **PDE-5 inhibitors** within 24 hrs (hypotension):
  - Sildenafil (Viagra™ and Revatio™)
  - Vardenafil (Levitra™)
  - Tadalafil (Cialis™, Adcirca™) – may need to wait 48 hrs.
- [Extreme caution if **inferior MI & possible R ventricular involvement**.
  - RVMI → dependent on preload to maintain cardiac output (RV not working well).
    - Consider FLUIDS – ↑ neck veins may NOT be due to fluid overload in this situation!]

FMX

## How & When to Give β-Blockers

- Early β-blockade is preferred (rec I/LOE B).
  - **IV** β-blockers only for MI pts w/o contraindications and **with HTN** @ presentation; or if ongoing ischemia.
  - Otherwise, **oral** β-blockers w/in 24 hrs of presentation.
- Pt w/early contraindications to β-blockers should be **reassessed** after 24 hrs for β-blocker appropriateness (I/C).
- β-blockers save lives → D/C NTG, not β-B, for low BP.

Circulation 2013;127:529-55; JACC 2007;50(7):652-726; Lancet 2005;366:1622-32

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## Meds in STEMI

- Already received **A**SA, **β-b**lockers.
- **C**lot inhibitors (added to ASA):
  - Benefits (↓ death, MI) in pts undergoing thrombolysis.

Lancet 2010;376:1233-45; <http://www.upToDate.com/contents/antiplatelet-agents-in-acute-st-elevation-myocardial-infarction>

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## Antithrombotics in STEMI

- In addition to ASA.
- Loading dose.
- If PCI:
  - Clopidogrel (Plavix) 600 mg.
  - Prasugrel (Effient) 60 mg (**NOT** if H/O CVA or TIA).
  - Ticagrelor (Brilinta) 180 mg—usu preferred now.
- If thrombolysis:
  - Clopidogrel 300 mg if age ≤ 75; 75 mg if > 75.

Circulation 2013;127:529-55

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## Anticoagulants in STEMI: Principles

- If pt will have a procedure (e.g., CABG) which might require **reversing** the anticoagulant (heparin or related med), use **unfractionated** heparin, as it is completely **reversible** w/protamine.
- If reperfusion, continue anticoagulation for at least **48 hours** (or until revascularized if TL and no initial PCI).

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## AES Question

High intensity statin should be given before PCI if possible.

- A. True.
- B. False.

FMX

## Statins in STEMI

- **High-intensity statin** therapy should be initiated or continued in all patients with STEMI and no contraindications to its use.
  - Start as early as possible.
  - Atorvastatin 80 mg daily.
    - ARMYDA-ACS (industry-sponsored): early atorvastatin (12 hr before PCI) → ↑ 30-day outcomes.
  - Caution: high-dose statins associated w/new DM— but **benefit > risk**.

Circulation 2013;127:529-55; NEJM 2004;350:1495-504; JAMA 2001;285:1711-8; JACC 2007;49:1272-8; JAMA 2011;305:2556-2564

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## Meds After STEMI (D/C + Office)

- **ACEI** (Rec I/LOE A):
  - HF.
  - LVEF <40%.
  - Anterior STEMI.
  - ARB may be used if ACEI not tolerated (rec I/LOE B).
  - May be given to all p-MI pts (IIa/A = “reasonable”).
- **Statin** (IA).
- Long-term **β-blocker** (IB).
- **Aldosterone antagonist** if LVEF <40 & on ACEI + β-blocker (IB).

JAMA 2001;285:1711-8; Circulation 2013;127:529-55

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## Summary of Chronic Meds @ D/C p-ACS

- Dual antiplatelet therapy ≥12 mo.
  - ASA 81 mg indefinitely (I/A).
  - P2Y<sub>12</sub> “-grel” drug 12 mo or more (I/B).
- **Statin** (I/A).
- **β-blocker** (I/A).
- Low EF & other:
  - ACEI.
  - Aldosterone antagonist.

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## Mnemonic: Post-MI Meds

- **A**SA
- **β**-blocker
- **C**holesterol (statin)
- **D**AAPT.
- **E**xtra A's (ACEI/ARB, Aldo antagonist)

FMX

## Testing After STEMI (Late Risk Stratification)

- LVEF: ↓ EF → ↑ mortality.
  - **Echo**—wait for recovery after reperfusion (stunned myocardium) → 14 days.
- **Stress test** (guide CV rehab, eval for residual ischemia):
  - If revascularization: few wks after D/C.
  - No revascularization: pre-D/C, if no recurrent angina or CHF.

Circulation 2013;127:529-55

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52 yo M, Squeezing SSCP, Rad LUE, EKG WNL 6 Mo Prior → NSTEMI



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## Reperfusion in NSTEMI

- TIMI risk score early stratification:
  - TIMI risk score  $\geq 5$  (maybe  $\geq 3$ ) may benefit from early PCI.
  - Sicker pts + DM + renal dysfunc benefit.
- **Thrombolysis is NOT useful in NSTEMI, and may be harmful.**
- O/w similar management to STEMI.

EurHeartJ 2007;28:2125; Circ 1994;89(4):1545-56; JACC 1995;26(7):1643-50; JACC 2007;50(4):157; JACC 2013;61:1179-347

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## Summary of ACS Management

- **Everybody** (unless contra):
  - Morphine } Emergency
  - O<sub>2</sub> } Mgmt
  - NTG } Mgmt
  - ASA }
  - $\beta$ -blocker
  - Clopidogrel/other
  - Statin (cholesterol)
  - Stress test:
    - Pre-D/C if no reper
    - Few weeks later if PCI
- Low EF: ACEI
- Heparinoid:
  - Poss CABG: UFH
  - STEMI + PCI: UFH, bivali
  - STEMI + TL: enoxaparin
  - STEMI w/o reper: UFH or enoxaparin
  - NSTEMI:
    - Invasive: UFH, enoxaparin
    - Non-invasive: enoxaparin, UFH
    - Fondaparinux if higher bleed risk

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## Post-ACS Management: 2° Prevention

- **Healthy diet** –  $\geq 5$  servings of vegetables & fruits/day, low sat fat, olive oil as main fat, low starch, high fiber.
- Appropriate **exercise**.
- **Control of risk factors.**
  - ASA—indefinite.
  - Statin – no more treat to target!
  - $\beta$ -blocker—indefinite.
  - Smoking cessation.
  - Control BP & glc.

AnnMed 2007;130:598-603; NEJM 2003;348:2599-2608; NEJM 2000;343:16-22; JAMA 2004;292:1433-1439; Circulation 2011;124:2458-2473

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## AES Question

Which of the following is NOT a strong recommendation for post-MI prevention/mgmt?

- Screen for depression after MI.
- Cardiac rehab may be optional for pts who are already seeing a cardiovascular care specialist.
- Influenza shot should be given to all post-MI pts.
- Healthy lifestyle including diet, exercise.
- None of the above.

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## Specific 2° Prevention of MI

- **Influenza vaccine**, if available
  - $\downarrow$  CV death, CV events, effect may last 1 yr.
  - Give during hosp for MI, or up to 8 wks later.
- **Fish oil?** (Fish or supplements.)
  - Conflicting evidence—but heterogeneous trials.
  - Some trials may be underpowered to detect effects in pts on maximal p-MI tx.
  - Very low risk – why not?
  - Avg dose in + trials  $\sim 1.8$  g **omega-3 (NOT oil)**,

EurHeartJ 2004;25:25-31; Circulation 2000;102:2029-40; EurHeartJ 2011;32:1370-5; Clin 2002;105:1897-903; CardiovascMed (Hagerstown) 2007;8 Suppl 1:534-7; JAMA 2006;296:1885-9; BMJ 2008;337:a2551; ClinCardiol 2009;32:365-72; Arch Int 2009;169:659-68; NEJM 2010;363:2015-16; Circ 2010;122:2552-6; BMJ 2010;341:c2273; Arch Int 2012;172:686-94

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## Depression After MI

- **Depression is common after MI:**
  - 3X > general population.
  - 16-20% meet depression criteria in hospital p-MI.
  - 33% have sx of depression.
  - Evidence review: prevalence 7-47%.
  - 35-60% of those depressed p-MI stay depressed > 1 month.
  - ½ w/major depression & 42% w/"minor" sx remained depressed at 1 year.

JGIM 2006;21:30-8; JAMA 2001;286:1621-7; AmHeart 2005;150:871-81; AnnFM 2009;7:71-79; GenHospPsychiatry 1996;18:81-5

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## Consequences of Post-MI Depression

- Reduced adherence.
- ↑ p-MI mortality.
- Possible ↑ hosp readmission & nonfatal CV events.
- ↑ suicide risk p-MI:
  - ARR 3.25 if no prior psych condition.
  - ARR 64 if prior psych condition.

AnnFM 2009;7:71-79; Circulation 2010;122:2188-93

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## Does Tx of P-MI Depression Help?

- Treatments used:
  - SSRI's.
  - Psychosocial—psychotherapy, CBT, self-help.
- Depression improved.
- Cardiac endpoints & mortality may ↓, but poor quality &/or underpowered studies.

AnnFM 2009;7:71-79

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## Recommendations: Depression

- Use a standardized depression checklist to screen periodically p-MI (SOR A).
  - No specific tool recommended.
  - PHQ-2 OK, if + → PHQ-9.
- Treat depression if present (SOR A).
  - SSRI's preferred > TCA's, but actually poor evidence.
  - Psychotherapy may help, no specific type recommended.

AnnFM 2009;7:71-79; Circulation 2008;118:1768-1775

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## Cardiac Rehabilitation

- **All eligible pts with ACS or p-CABG or p-PCI should be referred to a comprehensive outpatient CV rehabilitation program prior to D/C or during 1<sup>st</sup> F/U office visit.** (I/A)
- All eligible outpts with the dx of ACS, CABG or PCI (I/A), chronic angina (I/B), and/or PAD (I/A) **within the past year** should be referred.
- Home-based CV rehab program OK for low-risk pts. (I/A)

Circulation 2011;124:2458-2473

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## Impact of Cardiac Rehab

- ↓ mortality.
- ↓ recurrent MI.
- ↑ aerobic capacity.
- Mild improvement in LVEF if EF<40.

Am Heart J 2011;162:571-584; AnnFM 2005;143:659-72; Circulation 1997;96:1790-7

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## Have We Forgotten?

- Cardiac rehabilitation is underutilized.
  - 14-20% of eligible pts are referred.
  - Pts w/depression are less likely to complete cardiac rehab (OR = 5.6).
  - Women less likely to complete (OR = 2.5).
  - Convenience factors.
  - Language & cultural barriers.
  - Strength of physician recommendation.

Circulation 2007;116:1653-62; Mayo Clin Proc 2009; 84: 373-383; Prev Cardiol 2007;10:15-21; Am Heart J 2006;151:249-56

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## Does Lifestyle Work in 2° Prevention?

- YES!
  - Ornish: ↓ angina, ↓ CV events, ↑ QOL.
  - Lyon Heart Study: Medit diet → ↓ CV events, ↓ mortality, ↓ CA.
  - Meditation ↓ CAD adverse outcomes.
  - See Supplemental Materials for many fun details.

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## Long-Term Adherence to Meds

- Less expensive medications.
- Enroll pt in a diet and exercise program.
- Enroll pt in a post-D/C comprehensive cardiac rehabilitation program.
- Help pt find programs that help pay for meds.
- Minimize # of meds given at D/C.
- Schedule F/U w/cardiologist.
- System of med tracking (pillbox, calendar, alarm).

J Cardiol 2009;104:175-81

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## Practice Recommendations

- Unless contraindicated, pts should remain on ASA, β-blockers, and high-intensity statin after an ACS/MI for 2° prevention (SOR A).
- Post-MI pts w/LVEF <40% should be placed on ACEI (ARB 2<sup>nd</sup> choice) + aldosterone antagonist indefinitely (SOR A).
- After ACS or revascularization (CABG, PCI), all eligible pts should be referred to a comprehensive outpt CV rehabilitation program prior to D/C or during 1<sup>st</sup> F/U office visit. (SOR A)

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Questions?

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## Contact Info

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- Work email: [schneid2@sutterhealth.org](mailto:schneid2@sutterhealth.org)

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## ICD-10 Codes

- ACS: I24.9.
- Unstable angina: I20.0.
- STEMI: I21.xx
  - Ant wall STEMI = I21.0.
    - AAMI involving LAD = I21.02.
- NSTEMI: I21.4.

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## Billing & Coding

**When services performed in conjunction with:**

Office Visit + EKG 992xx - 25 + 93000

**Additional tests to confirm or monitor:**

Echocardiography (see CPT for additional options)

93306 Echo (TTE), 2D, M-mode, complete (including doppler and color flow)

93015 Stress test

**Other studies available typically available in an outpatient facility:**

Nuclear studies

CT

MRI

Vascular imaging

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## Associated Session

- Acute Coronary Syndromes: PBL

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Interested in More CME on this topic?

[aafp.org/fmx-cardio](http://aafp.org/fmx-cardio)

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## Supplemental Material



Purchased and used with permission: iqconcept, from <http://www.healthunics.com/online/Smart-Choices-2900735.asp>

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## CAD is Common

- 15.5 million adults  $\geq 20$  (6.2%).
- 750,000 MI's/yr (550K new + 200K recurrent).
- Additional 160,000 silent MI's/yr (est).
- 1 MI per 42 seconds.
- Avg age 1<sup>st</sup> MI: M = 65.1 years; F = 72.0 yrs.
- 117,000 deaths d/t MI + 250K additional CAD.

AHA 2016 statistics: <http://circ.ahajournals.org/content/133/4/e384sec-368>

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## Silent MI—2

- Prior studies showed silent MI 22-44% of MI's.
- ARIC odds ratios :
  - Silent MI: men → OR 1.7 vs women (?!?)
  - Clinical MI: men → OR 3.5 vs women.
  - CAD death: silent MI → 3.06; clinical → 4.74.

AmJCardiol 2013;111:914-8; AnnIntMed 2001;135:801-11; JACC 2000;35:119-26; AmJCardiol 1990;66:533-7; EurHeartJ 1998;19:1011-8

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## Common Noncardiac Causes of CP

- MSK (chest wall, costochondritis): palpation reproduces tenderness.
  - NB: R/I costochondritis does **NOT** R/O ACS.
- GERD: burning retrosternal pain, acid brash.
- Panic/anxiety: validated questionnaire.
- Pericarditis:
  - Pleuritic CP, ↑ supine & inspiration, ↓ leaning fwd.
  - Diffuse ST changes on EKG.
  - +/- pericardial friction rub.

Lancet 2004;363:717-27; [http://www.uptodate.com/contents/differential-diagnosis-of-chest-pain-in-adults?source=search\\_result&source\\_rank=1&source\\_start=1&source\\_end=1](http://www.uptodate.com/contents/differential-diagnosis-of-chest-pain-in-adults?source=search_result&source_rank=1&source_start=1&source_end=1)

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## CP Characteristics: Low MI Risk

| Pain descriptor          | Positive LR |
|--------------------------|-------------|
| Pleuritic                | 0.2         |
| Positional               | 0.3         |
| Sharp                    | 0.3         |
| Reproducible w/palpation | 0.3         |

AnnIntMed 2004;137:334-43; JAMA 2005;294:2623-9

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## Ruling In Dx Does NOT R/O MI

- Common sense.
- 2007 ED study:
  - 1995 pts; 77 (4%) had MI.
  - 30% (599) given clear-cut non-cardiac dx.
    - MACE: in-hosp RR = 0.32; 30-day RR = 0.45.
    - Still a 4% event rate @ 30 days (too hi for ED D/C).

Acad Emerg Med 2007;14:210-15

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## Angina in Women

- Women **more likely than men** to c/o **atypical** sx:
  - Pain: more intense, sharp, burning
  - Location: more often in neck, throat than men
  - Inciting factors: more likely assoc'd w/sleep, rest, mental stress
  - 2014 study: minor differences, many not clinically important.
- NB: Women still get **typical angina**, too!
- **High suspicion for CAD in women w/risk factors or sx.**
- Women underestimate CAD risk & mortality (& less aware of atypical sx), though improving.

AmJHU 2006;151(4):813-9; EurHU 2008;29(6):707-17; JAMAIntMed 2014;174:241-9; AmJCardiol 1994;74(3):226-31; Circulation 2013;127:1254-63

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## Unrecognized MI in Women

- MI is more likely to go undetected in women, esp young women (40% unrecognized 35 – 39 yo vs **27% @ 75-79**).
- Women **more likely than men** to have pain in neck, jaw, back, & to have nausea w/CP.
- Study of 515 women w/MI:
  - Only 30% had prodromal CP.
  - CP during MI in only 57%.
  - **Dyspnea** in 58%.

EurHU 1998;19:1011-8; AnnIntMed 2001;134:1043-7; AmJHU 1998;136:189-95; Circulation 2003;108:2619-23; JAMAIntMed 2014;174:241-9

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## Chest Pain in the ED

- 8-10 million ED visits annually for chest pain.
- \$5-10 billion/yr for chest pain ED visits.
- ~10% of ED visits for CP have MI.

Crit Pathw Cardiol 2011;10:128-33; NEJM 2000;342:1163-70; AmJEmergMed 2010;28:771-9; Circulation 2011;123:e18-e209

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## Type 1 vs Type 2 MI

- Type 1:
  - Spont MI d/t plaque rupture/ulceration/fissuring etc → intraluminal thrombus → ↓ myocardial blood flow or distal plt emboli w/consequent myocyte necrosis.
  - Good evidence for mgmt.
- Type 2 (controversial):
  - Supply/demand mismatch, w/o plaque rupture, w/ myocardial necrosis.
  - ?Less CP/more SOB?
  - Older, more comorbidities.
  - May have higher mortality & complications.
  - Less evidence.
  - Treat underlying condition.

PLoS ONE 2014; 9(11): e84285. doi:10.1371/journal.pone.0084285; Circulation 2012; 126:2020-5; Heart 2015; 151:1667-73; JACC 2014; 63:2079-87; <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4071813/>; <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3511120/>

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## Initial Meds—Not ASA

- Sublingual **NTG** 0.4 mg q 5 min X3.
  - IV **NTG** if persistent pain, CHF, HTN
  - D/C NTG if BP too **low**—**more important to give β-blockers.**
- **Morphine** 2 – 4 mg IV. Repeat prn.
  - Relieves pain, anxiety.
  - Reduces sympathetic stimulation caused by
- Replete **K** if below 4 (2X ↑ in VF if < 3.6).

Chest 2008; 133:6705; www.acc.org/qualityandscience/clinical/statements.htm; J Am Coll Cardiol. 2008; 51: 210-2147; JACC 2007; 50:633-756; Circulation 2013;127:229-55

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## Detail: Criteria for ST Changes

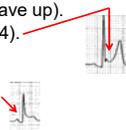
- ST Elevation:
  - Men:
    - ≥ 40: 2 mm in **V2-V3**; 1 mm in other leads.
    - < 40: 2.5 mm in **V2-V3**; 1 mm in others.
  - Women:
    - 1.5 mm in **V2-V3**; 1 mm in other leads.
- ST depression (men & women):
  - 0.5 mm in **V2-V3**, 1 mm in other leads.
  - Horizontal or downsloping ST depression of 0.5 mm in 2 contiguous leads.

JACC 2009;53:1003-11

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## ST Elevation DDX

- Healthy young men—esp V2 (concave up).
- Early repolarization (notched J in V4).
- LVH.
- LBBB.
- Pericarditis (diffuse ST ↑, w/PR↓).
- PE.
- Prinzmetal's angina (transient).
- ↑K<sup>+</sup> (tall/tented T's, wide QRS, downsloping ST).
- Brugada syndrome.
- Persistent ST elevation may be seen with **ventricular aneurysm.**



NEJM 2003;349:2128-35

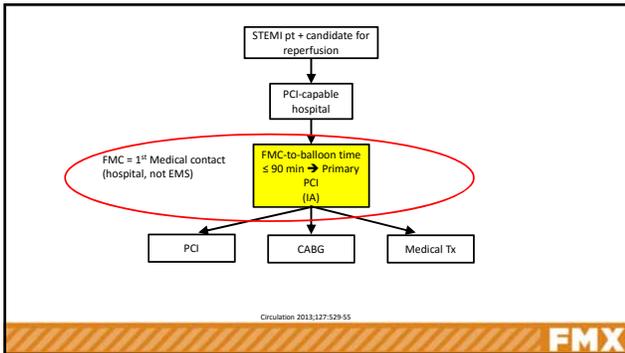
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## New(er) STEMI Reperfusion Guidelines

- PCI-capable hospital, do PCI (cardiologist):
  - **STEMI w/< 12 hrs** of sx—incl contraindication to **TL**, regardless of time to first medical contact. (IB)
  - Consider in STEMI **w/ongoing ischemia** (clinical, EKG) between **12 and 24 hours** after sx onset. (IIa, B)
  - STEMI **w/cardiogenic shock** or acute severe HF, **irrespective of time** delay from MI onset. (IB)

Circulation 2013;127:529-55

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## New STEMI Reperfusion Guidelines—2

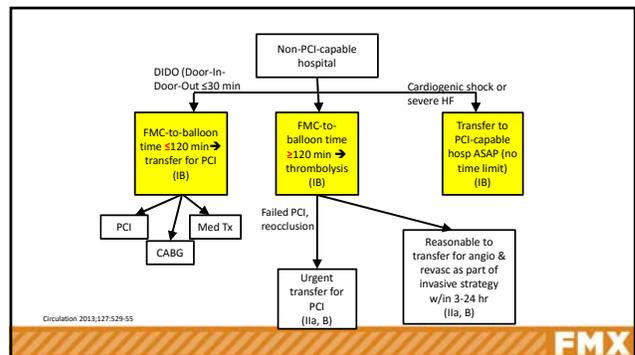
- Non-PCI-capable hospital:
  - If PCI can't be done w/in **120 min** of 1<sup>st</sup> medical contact → thrombolysis (if no contraindication). (IA)
  - Consider TL in STEMI if ongoing ischemia w/in 12-24 hr of sx onset, and either:
    - Lg area of myocardium @ risk, OR
    - Hemodynamic instability.
    - IIa,C.

Circulation 2013;127:529-55

### Transfer to PCI-Capable Hospital

- **For 1° PCI w/in 30 min (door-in-door-out) + first contact-to-balloon time ≤ 120 min—preferred.**
- After TL:
  - “Suitable” STEMI pts w/cardiogenic shock or acute severe HF. (IB)
  - “Reasonable” if failed reperfusion. (IIa,B)
- If no reperfusion:
  - Cardiogenic shock or acute, severe CHF.
  - High risk finding on pre-D/C noninvasive test.

Circulation 2013;127:529-55



### STEMI W/O Reperfusion

- Pts may benefit from clopidogrel even if not reperfused.
  - COMMIT-CCS2: ~1/2 of pts on clopidogrel were not reperfused, still mortality benefit.
  - Uncertain dose: COMMIT-CCS2 used 600 mg; NSTEMI study used 300.

Lancet 2009;366:1607-21

### New Antiplatelet Agents – 3

- Neither prasugrel nor ticagrelor has been studied in thrombolysis, and should not be used.

## β-blocker Contraindications

- Active **b**ronchospasm
- Severe **b**radycardia
- Heart **b**lock > 1° (if no pacemaker)
- Pulmonary edema
- Hypotension with or without shock
- Overt heart failure should be brought under medical control 1<sup>st</sup>
- Most pts w/MI d/t cocaine should not be treated with beta blockers (risk of coronary artery spasm, severe HTN)

[http://www.uptodate.com/contents/beta-blockers-in-the-management-of-acute-coronary-syndrome?source=see\\_link](http://www.uptodate.com/contents/beta-blockers-in-the-management-of-acute-coronary-syndrome?source=see_link) Circulation 2013;127:529-55

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## NSTEMI Management: Differences vs STEMI

- **Enoxaparin** (if no renal failure, and no CABG within 24 hr) or heparin.
- No reperfusion → pre-D/C stress test (as in STEMI).
- Measure LVEF – echo (same).
- **Statin** (same).
- **?ACEI** if EF <40%, DM, HTN (same, less evidence).
- GP2b/3a inhib depends on troponin, anticoagulant, other emerging factors.

[http://www.uptodate.com/contents/initial-treatment-agents-in-acute-non-ST-elevation-acute-coronary-syndrome?source=see\\_link](http://www.uptodate.com/contents/initial-treatment-agents-in-acute-non-ST-elevation-acute-coronary-syndrome?source=see_link)

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## Time Out: Early Risk Stratification

- All ACS pts should have **early risk stratification** w/in 4-6 hrs.
  - **TIMI risk score**—predicts 14 & 30-day mortality.
    - Has been used in ED to stratify risk.
  - **GRACE** model (<http://www.outcomes-umassmed.org/grace/>, smartphone apps):
    - In-hospital (did not perform as well as TIMI score).
    - 6-month & 1 yr: = or sl better than TIMI.

Circulation 2013;127:529-55; Circulation 2005;112:2033-7; JAMA 2000;284:835-42; JAMA 2002;286:3356-9; Am J Cardiol 2008;102:6-11; JACC 2004;44:783-9; Arch IM 2003;163:2345-53; JAMA 2004;291:2727-33; Acad Emerg Med 2006;Jan;13(1):13-8

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## TIMI Risk Score

- Age ≥65 years
- ≥3 risk factors for CHD (HTN, DM, dyslipidemia, smoking, + FH of early MI)
- Prior coronary stenosis of ≥ 50%
- ST segment deviation on admission ECG
- ≥ 2 anginal episodes in prior 24 hours
- Elevated serum cardiac biomarkers
- Use of ASA in prior seven days

JAMA 2000;284:835-42

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## A TIMI Score Mnemonic

- **A**ge
- **A**SA use
- **R**isk factors
- **P**rior stenosis
- **E**nzymes
- **A**ngina recently
- **ST** elevation
- TIMI score & composite event rate (death/MI/ revasc):
  - 0-1 = low risk (4.7%)
  - 2-3 = intermediate risk (8-13%)
  - ≥ 4 = high risk (20-41%)

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## 2012 Guideline—Summary of NSTEMI Pts Who Benefit From Early Invasive Strategy

- Hemodynamic **instability** or cardiogenic **shock**.
- Severe LV **dysfunction** or heart failure.
- Recurrent or **persistent** rest angina despite intensive medical therapy.
- New or worsening mitral **regurgitation** or new ventricular septal defect.
- Sustained ventricular **arrhythmias**.
- Recent **PCI** (6 mo) or prior **CABG**.
- **DM** or **renal dysfunction** (new guideline).

EurHeartJ 2007;28:2523; Circ 1994;88(4):1545-56; JACC 1995;26(7):1643-50; JACC 2013;61:e179-347

FMX

## Preventing Premature Platelet Pill D/C

- ACC recs include:
  - If pt unlikely/unable to comply w/1 yr DAPT (\$ or other) → avoid DES.
  - Plan to delay elective surg >1yr; if unable to delay, consider BMS.
  - If unexpected surgery, cont ASA & restart anti-plt med ASAP.
  - Pt education.
- Risk: MI, stent thrombosis.

Circulation 2007;115(6):813-8

FMX

## Stress Testing in Stable Angina

- 2012 ACC/AHA guidelines still recommend stress testing for most pts w/stable angina in order to:
  - Confirm dx.
  - Evaluate efficacy of therapy
  - Obtain prognostic info
  - Identify “high risk” pts who might need PCI
- Hold anti-ischemic drugs for 4-5 half-lives (~48 hrs).

Circulation 2011;126:3097-117

FMX

## Which Stress Test?

- **Exercise is preferred** over pharmacologic.
- Pharmacologic stress (pt can't exercise to goal):
  - Vasodilators—↑ coronary blood flow.
    - Adenosine.
    - Regadenoson (Lexiscan™).
    - Dipyridamole.
  - Inotrope—↑ HR & contractility.
    - Dobutamine – preferred for stress echo.

FMX

## Key Questions—Stress Testing

- **Can pt exercise?** Exercise preferred, if able.
- **Is EKG interpretable?**
  - LBBB, ST changes.
  - Ventricular pacer.
  - Pre-excitation.
- What is the **indication** for stress test?
- Cardiac **comorbidities**.
  - Prior revascularization.
  - Digoxin.

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## Which Stress Test?

- Exercise EKG test (treadmill—ETT).
  - 1<sup>st</sup> test for most pts, including women.
    - ETT may be less specific in women.
    - Insufficient evidence to recommend imaging in all women.
  - Useful if normal resting EKG.
  - Difficult to interpret if:
    - Unable to exercise to goal.
    - Baseline EKG abnormalities.

Circulation 2012;126:3097-117

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## Contraindications to Stress Test

- | Absolute Contraindications   | Relative Contraindications  |
|--|---|
| <ul style="list-style-type: none"><li>• <u>Acute MI (w/in 2days)</u></li><li>• Unstable angina</li><li>• Arrhythmias w/sx or hemo ↓</li><li>• Symptomatic severe AS</li><li>• Uncontrolled sx heart failure</li><li>• Acute PE or pulmonary infarction</li><li>• Acute myocarditis or pericarditis</li><li>• Active endocarditis</li><li>• Acute aortic dissection</li><li>• Acute noncardiac disorder that may affect or be aggravated by exercise (eg, infection, renal failure, thyrotox)</li><li>• Inability to obtain consent</li></ul> | <ul style="list-style-type: none"><li>• Left main CAD or equivalent</li><li>• Mod stenotic valvular heart dz</li><li>• Electrolyte abnormalities</li><li>• Severe HTN (SBP ≥200 &amp;/or DBP ≥110)</li><li>• Tachy- or bradyarrhythmias, incl AFib w/RVR</li><li>• Hypertrophic cardiomyopathy &amp; other outflow tract obstruction</li><li>• Mental or physical impairment leading to inability to cooperate</li><li>• High-degree AV block</li></ul> |

Circulation 2002;106:1883-92

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## Contraindications to Stress Agents

- Vasodilators:
  - RAD/asthma.
  - Hypotension.
  - Sinus node dysfunction.
  - High degree AV block.
  - Oral dipyridamole—may use dipyridamole for stress, not adenosine or regadenoson.
- Dobutamine:
  - Ventricular arrhythmias.
  - Recent MI (w/in 3 days).
  - Unstable angina.
  - Significant LV outflow obstruction.
  - Aortic dissection.
  - Severe HTN.

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## Rule: When To Image

- **Baseline EKG abnormalities:**
  - LBBB.
  - LVH
  - Prior revascularization.
  - Pacemaker.
  - Pre-excitation.
  - Resting nonspecific ST-T abnormalities.
  - Digoxin.
- Pt **can't exercise to a sufficient degree** to obtain an adequate routine exercise test.

Circulation 2012;126:3097-137

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## Selecting the Right Test

- Pt can exercise:
  - No prior revasc:
    - Interpretable EKG: **Exercise treadmill test.**
      - Note: high risk pts benefit from exercise MPI or echo—prognostic info.
    - Uninterpretable EKG: exercise MPI or echo.
  - Prior revasc: exercise MPI or echo.

Circulation 2012;126:3097-137

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## Selecting the Right Test

- Pt can NOT exercise:
  - Pharm stress MPI or echo (MPI if Afib or wall motion abnormality).
  - Low likelihood → can use pharm stress echo.
- Known CAD (testing for prognosis):
  - Stress MPI or echo.
  - If pt can exercise, do exercise not pharm.
  - If interpretable EKG, & pt can exercise, **EIT** is an option.

Circulation 2012;126:3097-137

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## Just Do It!

- You don't have to be a cardiologist to refer to a cardiac rehab program.
- Part of comprehensive care of the p-MI pt.
- One of Dr Dave's rules: "Never **blindly** entrust the care of your pts to specialists."
  - Get the info from other docs.
  - Continue to participate in pt's care—incl meds, rehab, etc.

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## Statins vs Lifestyle—1° Prevention

| Condition             | Statins | Lifestyle        |
|-----------------------|---------|------------------|
| CV Dz                 | ↓ 25%   | ↓ 70-87%         |
| DM                    | ↑ 18%   | ↓ 91-93%         |
| HTN                   |         | ↓ 78%            |
| All-cause mortality   | ↓ 14%   | ↓ 65-69%         |
| CA                    |         | ↓ 36-70%         |
| MI                    |         | ↓ 81%            |
| Stroke—total/ischemic | ↓ 22%   | ↓ 50-55%/71-80+% |
| CAD                   | ↓ 27%   | ↓ 59-70%         |
| HF                    |         | ↓ 52-57%         |
| SCD                   |         | ↓ 92%            |
| Revascularization     | ↓ 38%   |                  |

**Yes, your pts should still take statins when appropriate! Statins save lives—AND so does healthy lifestyle!**

CochraneDatabaseSystRev 2013, DOI: 10.1002/14651858.CD004816.pub5

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## Primary Prevention Rules!

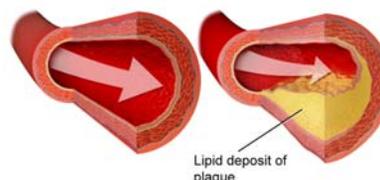
- Primary prevention is best, when possible – prevent dz before it is evident.
- 1° prevention reduced death by 4-fold vs 2° prevention in study that synthesized data & used mathematical modeling.

BMJ 2005;331:614-7

**FMX**

## Secondary Prevention

Normal Artery      Narrowing of Artery



Lipid deposit of plaque

With permission, from Wikimedia Commons via Bruce Blausen, Blausen Medical Communications, Inc-[http://en.wikipedia.org/wiki/File:Blausen\\_0239\\_CoronaryArteryDisease\\_02.png](http://en.wikipedia.org/wiki/File:Blausen_0239_CoronaryArteryDisease_02.png)

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## Mediterranean Diet – 2013

- Purported 1° prevention study in Spain.
  - 48.5% w/DM2.      }
  - 82.7% w/HTN.     } ?? 2° +/- 1°
  - 72.3% w/dyslipidemia. } prevention?
  - Mean BMI = 29.9.   }
- 1° endpoint (MI/CVA/CV death):
  - Med diet w/nuts: 28% ↓.
  - Med diet w/EVOO: 30% ↓.
- 39% ↓ stroke (2° endpoint).
- **No adverse effects of diet.**

NEJM 2013;368(14):1279-90

**FMX**

## The Ornish Program

- Intensive lifestyle program in CAD pts:
  - Low fat, low carb, vegetarian diet (difficult to adhere).
  - Aerobic exercise (30 min/session, 3 hr/week).
  - Stress management training.
  - Smoking cessation.
  - Group psychosocial support.
- Regression of atherosclerosis & ↓ CV events, 5 yr F/U.

JAMA 1998;280:2001-7; Lancet 1990;336:129-33

**FMX**

## More-nish

- Intensive lifestyle program assoc'd w/less hostility & psychological distress, esp in those w/best adherence.
- Ornish program → ↓ angina in CAD pts.
  - 74% angina-free at 1 year.
  - 9% more moved from limiting angina to mild.
  - Improved exercise capacity & QOL.
  - 757 men/395 women, only 12 week study.

HealthPsychology 2008;27:584-92; AmJCardiol 2008;101:911-8

**FMX**

## Lifestyle in 2° Prevention

- Mediterranean diet
  - Lyon Heart Study: 27 mo f/u → 73% ↓ in nonfatal MI, 70% ↓ overall mortality.
  - Lyon Heart Study f/u: 46 mo f/u → 72% ↓ cardiac death + nonfatal MI (combo), 56% ↓ overall mortality, 47% ↓ all endpoints combined; 61% ↓ CA!!
  - Indo-Mediterranean Diet Heart Study: ~50% ↓ total cardiac endpoints, SCD, nonfatal MI vs NCEP diet.

Lancet 1994;343:1454-9; Circulation 1999;99(6):779-85; Lancet 2002;360:1455-61; ArchIM 1998;158:1181-7

**FMX**

## Mediterranean Diet – 2

- Italian study: 2.8 kg more **wt loss** than “prudent diet”, lower CRP, less insulin resistance, almost 50% ↓ metabolic syndrome @ 2 yrs.
- Esposito et al: obese women, 2 yrs Med diet + exercise vs general info on diet/exer → **BMI** ↓ by 4.2 more, lower CRP in Med diet group

JAMA 2004;292:1440-6; JAMA 2003;289:1799-1804

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## Mediterranean Diet – 3

- Heart Institute of Spokane Diet Intervention & Evaluation Trial: small study, Med diet = low fat, both ~70% ↓ events vs usual care.
- Greek Study of ACS (GREECS): validated diet score – closer to Med diet → **less severe MI** (troponin), 19% ↓ **recurrence**

AmiCardio 2008;101:1523-30; Nutrition 2006;22(7-8):722-30; EurCardiovascPrevRehab 2006;13(6):901-8

**FMX**

## Mediterranean Diet – 4

- GISSI-Prevenzione Study: advice to increase their consumption of fish, fruit, raw and cooked vegetables and olive oil, 42 mo:
  - Those most adherent to Med diet had 49% ↓ **mortality** vs worst quartile.
  - Ω-3 ↓ **SCD** 58% in pts w/systolic HF.
  - Ω-3 save more lives than pravastatin
  - 30% ↓ **CAD death**/45% ↓ SCD.

EurJClinNutr 2003;57:604-11; EurJHFall 2005;7:904-9; Lipids 2001;36 Suppl:5119-26; JCardiovascMed 2007;8 Suppl 1:538-41

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## Mediterranean Diet – 5

- EPIC-Elderly Study: 2700 pts >60 yo, 6.7 yrs – 20% better adherence to Med diet (standardized scale) → 18% ↓ **mortality**
- Trichopoulou et al: 20% better adherence to Med diet → 27% lower **mortality** in pts w/preexisting CAD.

EurEpidemiol 2007;22:871-81; ArchIM 2005;165:929-35

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## Mediterranean Diet – 6

- Systematic review:
  - “...benefits from the Mediterranean diet were significant in all studies.... reduction in the risk of coronary heart disease varied from 8% to 45%...”
  - “The systematically reviewed studies reveal a **cardio-protective effect** of the Mediterranean diet and point to this dietary pattern as highly **appropriate for public health objectives.**”

MedSciMonit 2004;10:RA193-8

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## Med Diet & Atrial Fib??

- ↓ adherence to Mediterranean diet → ↑ Afib risk.
- Better Med diet adherence → ↑ chance of spontaneous conversion of AF to SR.

NutrMetabCardiovascDis 2013;23:115-21; EurHeartJ 2013;34 (suppl 1):doi: 10.1093/eurheartj/ehs309.P4270

**FMX**

## More Lifestyle in 2° Prevention

- GOSPEL Study: 3200 p-MI pts (Italy), 3-yr intensive intervention (exercise, diet, psychosocial stress, less deterioration of body weight control) → ↓ in 2° endpoints:
  - 48% ↓ nonfatal MI.
  - 33% ↓ CV mortality + nonfatal MI and stroke.
  - 36% ↓ cardiac death + nonfatal MI.

ArchM 2008;168:2194-204

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## Meditation

- 201 African-American pts w/>50% stenosis on cath.
  - 20 min TM daily (after full training) vs 20 min "heart-healthy behaviors"/day (exercise, relax, healthy meal, etc).
  - 5.4 yrs f/u → 48% ↓ in combined endpoint (total mortality + MI + CVA).
  - 24% ↓ 2° endpt (CV mortality + revasc + CV hospitalization).
  - SBP ↓ by 5.

CircVOutcomes 2012;5:750-8

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## Meditation – 2

- Mindfulness meditation reduces CAD adverse outcomes.
- TM mostly 1° prevention studies in high risk elderly pts w/HTN or pre-HTN, 36 mo survival:
  - TM = 100%
  - Mindfulness meditation = 87.5%
  - "Relaxation" = 65%
  - F/U 7.6 yrs (max 18.8 yrs) → 23% ↓ total mortality, 30% ↓ CV mortality.

JPsychosomaticResearch 2004;57:35-43; CardioRev 2004;12:262-266; JPersSocialPsychology 1989;57:950-964; Circulation 1996;93:9629 [Abstract]; AmJCardiol 2005;95:1090-1094

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## Meditation – 3

- TM vs usual care, pilot study in CAD pts:
  - Less exercise-induced ischemia.
  - Better exercise tolerance.

AmJCardiol 1996;78:77-80

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## Because I'm From Wine Country...

- Alcohol consumption and mortality in patients with cardiovascular disease: a meta-analysis.
  - J-shaped curve for CV mortality.
  - 22% ↓ in CV mortality – max protection at 26 g/day.
  - 18% ↓ in all-cause mortality – max protection at 5-10 g/day.
  - Conclusion: mod alcohol consumption of 5-25 g/day in pts with CV dz = assoc w/ ↓ CV & total mortality.

JACC 2010;55:1339-47

FMX

## Buzz Kill: Not Too Much Wine

- Stroke, e-Pub online 1/25/15.
- Swedish Twin Registry.
- > 2 servings/day of ETOH → 34% ↑ stroke risk.
- Stroke risk of >2 ETOH/day during midlife predominated over typical risk factors (HTN, DM) til ~ 75 yo.

Stroke 2015;46:627-33

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