



# Acute Coronary Syndromes

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Coronary syndromes incorporate a spectrum of diseases ranging from unstable angina (UA), non-ST-elevation myocardial infarction (NSTEMI) to acute ST-elevation myocardial infarction (STEMI).

Thinking of this constellation of diseases together reminds you to consider more than just acute MI's when contemplating cardiac disease. You don't want to look at a normal EKG and normal initial set of cardiac enzymes and assume that the patient is not having or will not have a cardiac event.

## Classic Presentation

The classic description of cardiac chest pain is an intermittent, substernal chest pressure, usually on the left which radiates to the arm and neck, exacerbated with exertion and associated with shortness of breath, diaphoresis, nausea and palpitations.

These classic symptoms are more often the exception than the rule. The pain can occur anywhere from the umbilicus to the neck and to the back. It can be sharp, burning (simulating gastric reflux). Diabetics and the elderly may have no chest pain at all. Women often present simply with fatigue, shortness of breath and generalized weakness.

Distinguish stable angina (unchanged exertional pain lasting 5-15 minutes and relieved by rest or nitroglycerin) from unstable angina (increasing in frequency, at lower exertional levels or occurs at rest). Unstable Angina (UA) is a dynamic process which may lead to MI or death.

The physical exam can also be highly variable. Patients may appear normal in appearance or in full cardiac arrest. They may be diaphoretic, hypotensive or hypertensive, tachycardic or bradycardic, or dyspneic. They may have normal heart sounds, or a murmur from the rupture of a papillary muscle or valve. There may be signs of heart failure (third heart sound, JVD, pedal edema, pulmonary edema).

This high variability in presentation makes ruling out an ACS by secondary survey alone very difficult. Classic findings may lead you to increase your pretest probability of ACS, but unless your evaluation leads you to another high probability diagnosis, be wary removing ACS from your differential just because it doesn't fit the classic description .

## Diagnostic Testing

An acute MI is diagnosed by satisfying two of the following three criteria:

- A consistent clinical history
- EKG changes
- Changes in cardiac enzymes (CK-MB)

### EKG

EKG's are an essential screening tool in anyone with chest pain. It can be diagnostic of AMI if ST-elevations are present. ST elevations are present in nearly 40% of the cases, however non-specific findings are quite frequent. These should be interpreted in the context of old EKGs. Nearly 50% of patients with ACS initially have normal or non-diagnostic ECG. Serial ECGs tend to be more useful and majority of patients will show signs of ischemia.

An MI can be localized by noting the leads affected with ST-elevations. Posterior and right sided MI are not measured by the traditional 12-lead EKG. You'll should look for reciprocal changes (ST-depressions in leads on the opposite side of the heart) and then order the appropriate extra leads (V7, V8, V9 for posterior; V4R for right sided).

Localizing MI				
Location	ST Elevations	Reciprocal	Affected	Example

		<b>ST-depressions</b>	<b>Artery</b>	<b>ECG</b>
Anterior MI	V1-V6	none	Left Anterior Descending	need
Septal MI	V1-V3	none	Left Anterior Descending	need
Inferior MI	II, III, aVF	I, aVL	Right coronary artery (80%) or Left Circumflex (20%)	need
Lateral MI	I, aVL, V5, V6	II, II, aVF	Left Circumflex	need
Posterior MI	V7, V8, V9	V1-V3	Right Coronary Artery or Left Circumflex	need
Right Ventricular MI	V1, V4R	I, aVL	Right Coronary Artery	need

### Cardiac Enzymes

Serial enzyme testing is another staple of ACS diagnosis. Usually only the first set of enzymes is usually available in the emergency department, and these initial values may be negative. Obtaining several types of cardiac markers (CK-MB, Troponin and myoglobin), especially initially, is useful for determination of the time line of the ACS. All three enzymes have different times for initial elevation, peak and resolution.

<b>Cardiac markers</b>			
<b>Marker</b>	<b>Initial Elevation</b>	<b>Peak Elevation</b>	<b>Return to Baseline</b>
Myoglobin	1-4 h	6-7 h	18-24 h
CK-MB	4-12 h	10-24 h	48-72 h
Cardiac Trop I	3-12 h	10-24 h	3-10 d

Cardiac Trop T	3-12 h	12-48 h	5-14 d
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The troponin I is the most sensitive cardiac marker, detectable in serum 3-6 hours after an MI, and its level remains elevated for 14 days.

Also consider...

- CBC (anemia may be a cause),
- CXR (may show pulmonary edema or other causes of chest pain),
- electrolytes, BUN and creatinine (may effect treatment regimens),
- echocardiogram (usually after admission to look for regional wall motion abnormality),
- stress testing (either exercise or chemically-induced exertion to look for EKG changes and/or decreased radionuclide uptake in the ischemic region).

So how do you make the diagnosis?

The diagnosis of ACS is ultimately made using cardiac catheterization. In the emergency department, the diagnosis of an MI is strongly suggested by ST-elevation on EKG or a positive troponin. However if these tests are negative, you cannot rule-out the disease. While your secondary survey frequently is unremarkable, your history (descriptors and risk factors) may increase or decrease your suspicion.

Listen to the History

Classic features are strongly suggestive of ACS. Exertional pain or pressure, exertional shortness of breath, history of vascular disease, strong cardiac family history, and prior MI's can all lead toward a diagnosis of ACS.

Look at the EKG

For a ST-elevation MI (STEMI) look for ST-elevations of 1 mm or more in two contiguous limb leads (high lateral: I, aVL; inferior: II, III, aVF) or 2 mm elevations in the precordial leads (anterior: V1, V2, V3; lateral: V4, V5, V6).

Look at the enzymes

Previously cardiac enzymes were not specific to heart tissue. An elevated CPK or myoglobin could come from other causes (such as muscle breakdown). However, troponin I is fairly cardiac specific, so an elevated troponin usually represents an AMI.

What if it's all negative?

Diagnosing an MI with a positive EKG or positive troponin is easy. What is more challenging is the patient who has a non-diagnostic EKG, or normal initial set of cardiac enzymes. How do you make the diagnosis here?

A simple clinical scoring system, the TIMI Risk Score for Unstable Angina and Non-ST-Elevation MI's (UA/NSTEMI) has been developed to aide in this decision.

TIMI Risk Score for UA/NSTEMI

- 65 or older?
- 3+ CAD risk factors?
- Known CAD?
- Aspirin use in past week?
- Severe angina?
- ST segment changes?
- Positive cardiac markers?

These numbers represent probabilities, and therefore are not perfect predictors. Patients with zero risk factors do not have 0% probability of a cardiac event. Use these numbers only as a guide.

## Treatment

Remember the following mantras:

IV O2 monitor!"

MONA greets all patients at the door.

All potentially critical patients should get IV access, oxygen, and be placed on a cardiac monitor. MONA stands for morphine, oxygen, nitroglycerin and aspirin. Beta-blockers should be used to control the heart rate and blood pressure.

Antithrombin therapy (a heparin) and antiplatelet therapy (aspirin or a IIb/IIIa inhibitor) should be given to all patients with an ACS.

- Those with persistent ST-elevations will need some sort of revascularization procedure – either pharmacological (thrombolytic) or an angioplasty in the cardiac catheterization lab.
- Those without ST-elevations should get an angiogram when appropriately as determined by the interventional cardiologist.

## Disposition

Determining the patient's risks for these events can help you decide how and when to pursue further testing. Those at lower risk may benefit from outpatient testing, or a 23-hour admission. It may be more prudent for you to admit those with higher probabilities to the cardiac care unit.

## Pearls and Pitfalls

- Get an EKG within 10 minutes of presentation to the ED. Remember to look at it.
- One set of negative enzymes and a normal EKG does not rule-out an MI.
- Cardiac enzyme testing will be negative in patients with angina, functional testing is needed to discover any partially occluded coronary arteries.

## References

- McSweeney, Jean C et al. "Women's Early Warning Symptoms of Acute Myocardial Infarction." *Circulation* 2003; 108: 2619-2623.
- Antman et al. "The TIMI Risk Score for Unstable Angina/Non-ST Elevation MI." *JAMA* 2000;284:835-842