Diagnosing heart attack can be very difficult. Many patients have symptoms—such as dizziness or nausea—that may mimic other conditions. Many have normal EKG readings, and a quarter of heart attack patients have no chest pain.

Lab tests give physicians vital information that helps identify heart attack quickly—even when a patient’s symptoms are unclear. They do so by measuring substances that signal cardiac stress or damage, which are released into the bloodstream. Examples of such cardiac markers include:

- **Troponin**, which helps the heart muscle pump and remains at elevated levels for days—thus helping diagnose heart attack for patients who delayed seeking care.
- **Myoglobin**, which helps oxygen fuel the heart’s pumping action and is one of the first proteins to be released after a heart attack.
- **Creatine kinase**, which gives an indication of possible damage to the heart muscle.

Lab tests tell whether chest pains signal a heart attack—or something totally unrelated. This allows physicians to provide rapid treatment for heart attack victims and rapid reassurance for patients who had nothing to worry about.

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**A Virtual Case Study**

**Getting Back to the Pottery Wheel**

Carol, 70, was normally chipper, but had been feeling—as she told friends—a bit “unusual” for a week. Sometimes dizzy, sometimes so tired she had trouble getting out of bed. She was turning a flower pot for her granddaughter—on a pottery wheel in her sunporch—when terrible pressing in her chest overwhelmed her.

She had delayed going to the doctor all week, but this time the pain was too great. So she called 911. By the time she got to the emergency room, the pressing was gone. Now, she felt nausea and dizziness. The ER physicians took an EKG—perfectly normal.

The initial ER assessment was “no heart attack.” Maybe stomach flu? The ER physicians decided to then run a troponin test. Troponin is a cardiac marker that enters the bloodstream quickly after heart tissue is damaged and remains in the blood for as long as a week.

The troponin result closed the case: Based on the patient’s history, the heart attack had occurred several days before, since elevated troponins were still present. Although the EKG was negative, the symptoms were typical of women who have heart attacks. Before a heart attack, many women experience unusual fatigue, sleep disturbances, and anxiety. During a heart attack...
More accurate diagnosis of heart attack by lab tests can result in faster, better care.

- Patients with a confirmed diagnosis can be treated promptly, thus reducing the likelihood of death and disability from heart attack.

- Patients in whom heart attack is ruled out can be sent home sooner, thus avoiding unnecessary treatments.

A range of medical groups, such as the American College of Cardiology and the American Heart Association, have incorporated cardiac lab tests into their treatment guidelines and have made such tests a centerpiece of heart care.

HEART ATTACKS ARE HARDER TO SPOT THAN YOU THINK...

“Movie heart attacks”—the kind where an actor grips his chest with sudden pain—aren’t all that common. The American Heart Association says that most heart attacks start only with mild pain or discomfort. That means people often wait too long to seek help—another reason why lab tests for heart attacks are so critical. Heart attacks can be especially tricky to diagnose in older people, particularly women. According to the journal, Circulation, women tend to seek medical care later than men and often suffer from such symptoms as abnormal pain locations, nausea, vomiting, and fatigue. Thus, the lab tests are especially important because they can:

- Distinguish between heart damage and other problems, such as muscle pain, even if the symptoms are mild or other tests find no problem.

- Diagnose heart attack many hours after it has occurred because some cardiac markers released by the heart can remain in the bloodstream for as long as a week following a heart attack.

- The number of Medicare patients is increasing and older patients often have symptoms that are atypical and harder to diagnose, but may be identified by cardiac lab tests.

- The Medicare population includes many female patients who are also more likely to experience symptoms that differ from heart attack symptoms in men.
LAB TESTS THAT DETECT HEART ATTACK START EARLY AND STAY LATE

The cardiac markers that are detected by lab tests appear at different time intervals during and after a heart attack. Some rise quickly, within an hour or so, and peak anywhere from 4-6 hours later. Others do not appear for a full 8 hours. Lab tests target each of these enzymes, offering unique information for physicians and more opportunities to target treatment.

For example, a Troponin test is often the first test that emergency rooms use because the protein appears early, giving physicians a clue to whether a heart attack is occurring. Troponin stays in the blood for as long as a week, allowing physicians to identify heart attack and take action to prevent further damage even if the patient was slow to seek medical care. Other cardiac markers such as the CK-MB test are useful in determining whether a patient may have had a heart attack within the previous two days.

<table>
<thead>
<tr>
<th>Test</th>
<th>Cardiac Marker Starts to Increase</th>
<th>Reaches Peak Level</th>
<th>Total Duration</th>
<th>Enzyme from...</th>
</tr>
</thead>
<tbody>
<tr>
<td>CK</td>
<td>4–8 hours</td>
<td>—</td>
<td>48–72 hours</td>
<td>Heart, Brain, Skeletal Muscle</td>
</tr>
<tr>
<td>CK-MB</td>
<td>3–4 hours</td>
<td>12–24 hours</td>
<td>48 hours</td>
<td>Heart</td>
</tr>
<tr>
<td>Myoglobin</td>
<td>1–2 hours</td>
<td>4–6 hours</td>
<td>24 hours</td>
<td>Heart, Skeletal Muscle</td>
</tr>
<tr>
<td>Troponin</td>
<td>3–6 hours</td>
<td>12–24 hours</td>
<td>1 week</td>
<td>Heart</td>
</tr>
</tbody>
</table>

Sources:

WHY ARE CARDIAC LAB TESTS SO CRITICAL?

The chances of dying from a heart attack are doubled for a person who is sent home from the hospital because his or her symptoms are atypical or do not register on an EKG.

Source: Academic Emergency Medicine, September 2006

LIFE-SAVING RESULTS FROM EASY TESTS

Commonly used blood tests for identifying heart attack can be done with a quick blood sample taken from a vein in an arm or sometimes just a finger prick. The test itself takes less than a minute and results arrive often within about 15 to 30 minutes. The tests involve minimal pain and require no special preparation.

Using lab tests to accurately rule-in or rule-out heart attack in patients with chest pain leads to dramatically different treatment pathways—with clear impact on patients.

**Troponin Test**

- Measures the level of cardiac muscle proteins which contract or squeeze the heart muscle.
- Normal levels of troponin are very low and increase substantially with heart muscle damage.
- Troponin levels rise three to six hours after heart attack symptoms begin and stay high for up to one to two weeks after a heart attack.
- Considered the most accurate blood test for diagnosing a heart attack because the enzyme is only found in heart muscle.
LAB TESTS IMPROVE DIAGNOSIS OF HEART ATTACK

Patients go to the emergency room more than 6 million times each year because of chest pain. But because heart attack can be difficult to diagnose—

- roughly 2-10% of patients who are actually experiencing a heart attack are sent home.
- some $12 billion is spent every year on inappropriately hospitalizing patients who are not actually experiencing a heart attack.
- the costs of cardiac lab tests are miniscule compared to the total costs of misdiagnosis.

Studies show that cardiac lab tests help physicians diagnose heart attack accurately and promptly. Accurate diagnosis means more appropriate care, earlier discharge for patients who are at no risk, and cost-savings. The following table summarizes several studies.

<table>
<thead>
<tr>
<th>Tests used in study</th>
<th>Results for patient</th>
<th>Cost Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>More frequent use of CK, CK-MB, myoglobin, and troponin tests</td>
<td>Better accuracy, faster diagnosis</td>
<td>Length of stay reduced... 33%</td>
</tr>
<tr>
<td>CK-MB tests</td>
<td>More accurate diagnosis</td>
<td>Total costs reduced... 29%</td>
</tr>
<tr>
<td>More frequent CK-MB tests for complicated cases</td>
<td>Earlier discharge from hospital</td>
<td>8.3%</td>
</tr>
<tr>
<td>Troponin</td>
<td>More accurate diagnosis</td>
<td>2 days</td>
</tr>
<tr>
<td>Troponin</td>
<td>Earlier discharge</td>
<td>8.5% increase in number of patients who did not have a heart attack discharged the day after admission and 50% increase in number of patients diagnosed with confirmed heart attack</td>
</tr>
<tr>
<td>Troponin</td>
<td>Diagnoses concluded no heart attack or low-risk</td>
<td>Earlier discharge for patients=107 saved hospital bed days</td>
</tr>
</tbody>
</table>

Sources:
CREATINE KINASE (CK)

- CK is an enzyme released by dying cells in the heart, brain, or skeletal muscle.
- Increased CK often indicates the severity of damage to the heart.
- CK levels begin to rise within the first 4 to 6 hours after heart attack symptoms begin and reach their highest level after about 18 to 24 hours.
- Test results may distinguish a heart attack from unstable angina and other chest pain inducers.
- CK levels can also be used to tell whether heart attack treatments such as clot-busting drugs are working.

MYOGLOBIN

- Myoglobin is a protein in heart and skeletal muscles that is released into the bloodstream when the muscle is damaged.
- A high level of myoglobin, or an increase in the level between the first and subsequent tests, indicates injury.
- Myoglobin levels are generally checked every two to three hours.
- May be used in addition to Troponin test to help rule out a heart attack.

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Cavanagh, N, et.al., “The Effect of a Change from Conventional Cardiac Enzymes to Troponin I on Overall Hospital Costs in Patients with Suspected Myocardial Infarction,” Irish Medical Journal Volume 95, Number 1, 2002.


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Lab Tests Online at www.labtestsonline.org


