RESULTS *for* LIFE

LAB TESTING: BETTER HEALTH, IMPROVED OUTCOMES

LAB TESTS FOR HEART ATTACK:

ENABLING ACCURATE DIAGNOSIS AND TARGETED TREATMENT

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.

She was turning a flower pot for her granddaughter—on a pottery wheel in her sunporch— when terrible pressing in her chest overwhelmed her.

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.

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

CONTINUED FROM PAGE 1

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.

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

GETTING BACK CONTINUED FROM PAGE 1

attack, they may experience shortness of breath, weakness, cold sweating, and dizziness. Although women may have traditional symptoms too, men more frequently feel pain or discomfort in the chest, discomfort in the arms, and shortness of breath.

Following the troponin test, the ER physicians sent her to the hospital's cardiac unit where they performed an angiography to identify blockages, then angioplasty to open blockages in two arteries. Two days later, she was home—finishing the flower pot for her granddaughter.

Carol is not a real person, but the facts and information presented here accurately depict the role of lab tests in heart attack and the circumstances faced by many patients.

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.

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

Sources:
Bianco, C, "How Heart Disease Works," at www.health.howstuffworks.com/heart-attack2.htm;
Schreiber, D, "Use of Cardiac Markers in the Emergency Department," June 26, 2006, E-Medicine from Web, MD, at www.emedicine.com/emerg/topic932.htm

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.
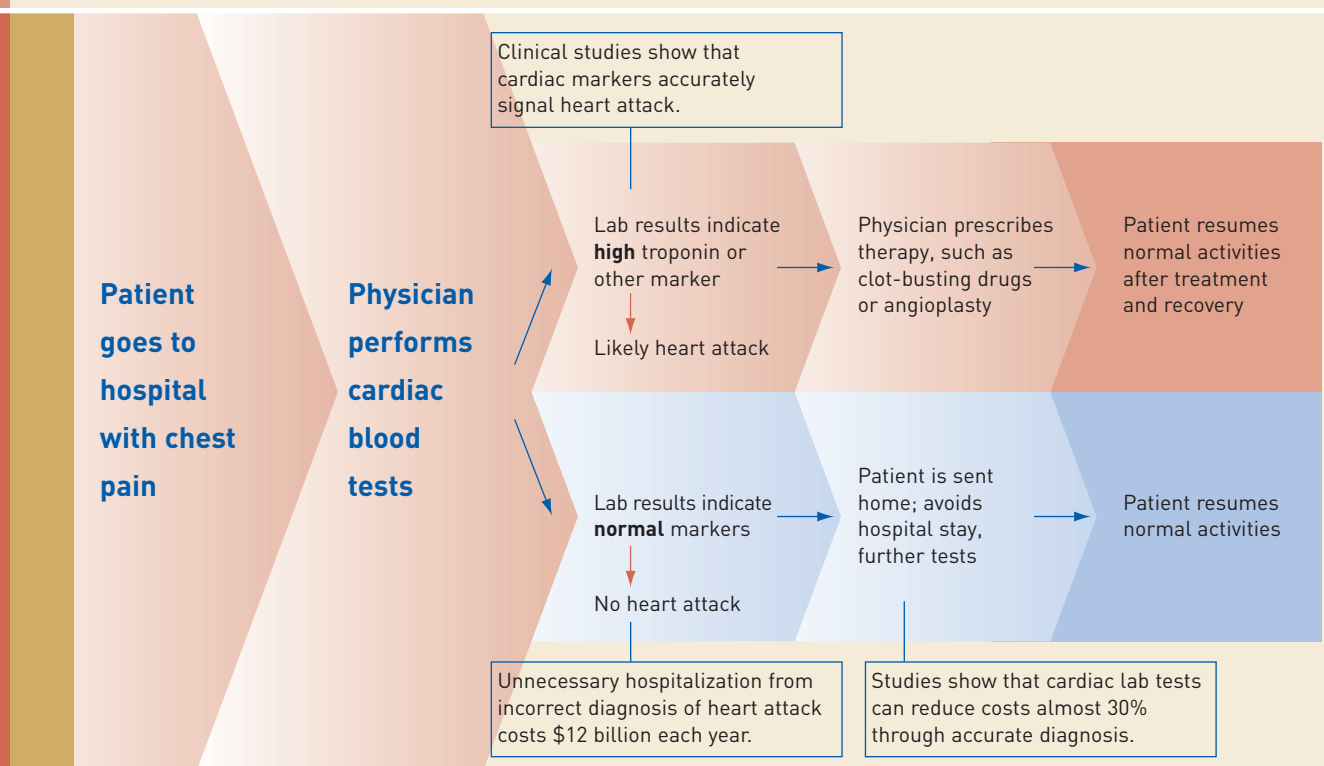
Source: *Academic Emergency Medicine*, September 2006

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.

How Lab Tests are Used in Diagnosing Heart Attack

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.

Clinical studies show that cardiac markers accurately signal heart attack.

Patient goes to hospital with chest pain

Physician performs cardiac blood tests

Lab results indicate **high** troponin or other marker

Likely heart attack

Physician prescribes therapy, such as clot-busting drugs or angioplasty

Patient resumes normal activities after treatment and recovery

Lab results indicate **normal** markers

No heart attack

Patient is sent home; avoids hospital stay, further tests

Patient resumes normal activities

Unnecessary hospitalization from incorrect diagnosis of heart attack costs $12 billion each year.

Studies show that cardiac lab tests can reduce costs almost 30% through accurate diagnosis.

Source: Jaffe, Up To Date, 2006; Caragher, *Arch Path Lab Medicine*, 2000; diagram adapted from Lewin Group, *The Value of Diagnostics*, 2005

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.

Tests used in study	Results for patient	Cost Savings	
		Length of stay reduced...	Total costs reduced...
More frequent use of **CK, CK-MB, myoglobin,** and **troponin** tests[1]	Better accuracy, faster diagnosis	33%	29%
CK-MB tests[2]	More accurate diagnosis	44%	
More frequent **CK-MB tests** for complicated cases[3]	Earlier discharge from hospital	8.3%	"The potential impact is tremendous when the difference [in LOS] is multiplied by the millions of cardiac patients seen in the US each year."
Troponin[4]	More accurate diagnosis	2 days	
Troponin[5]	Earlier discharge	✓ 8.5% increase in number of patients who did not have a heart attack discharged the day after admission ✓ 50% increase in number of patients diagnosed with confirmed heart attack	Earlier discharge for patients=107 saved hospital bed days
Troponin[6]	Diagnoses concluded no heart attack or low-risk		Lower drug, lab, hospitalization costs

Sources:
1. Caragher, TE, et.al., "Long-Term Experience With an Accelerated Protocol for Diagnosis of Chest Pain," *Archives of Pathology and Laboratory Medicine*, Vol. 124, October, 2000, 1434–1439.
2. Bholasingh, R, et.al., "Safe Discharge from the Cardiac Emergency Room with a Rapid Rule-out Myocardial Infarction Protocol Using Serial CK-MB Mass," *Heart*, Vol 85, 143–148, 2001.
3. Wu, AH, et.al., "Impact of CK-MB Testing Policies on Hospital Length of Stay and Laboratory Costs for Patients with Myocardial Infarction or Chest Pain," *Clinical Chemistry*, Vol 43, No. 2, 326–332, 1997.
4. Cavanagh, N, "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*, Vol. 95, No. 1, 16–17, 2002.
5. Jishi, F, et.al., "Troponin I, Laboratory Issues, and Clinical Outcomes in a District General Hospital: Crossover study with 'Traditional' Markers of Myocardial Infarction in a Total of 1990 Patients," *Journal of Clinical Pathology*, Vol. 57, 1027–1032, 2004.
6. Scullin, C, et.al., "Cost Implications of the Use of Troponin I (cTnI) Measurement to Diagnose Heart Conditions," *The International Journal of Pharmacy Practice*, R–68, September, 2001.

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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