Oklahoma Heart Institute

VOLUME 6 | NUMBER 1 | WINTER 2011

Taking Care of Your Heart

Lower Extremity Peripheral Arterial Disease
By Raj H. Chandwaney, MD, FACC, FSCAI

I Know I Should Exercise, But ...
By Wayne N. Leimbach, Jr., MD, FACC, FSCAI, FCCP, FAHA

Why Cholesterol Matters
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Sucessfully Treating Heart Failure
By Alan M. Kaneshige, MD, FACC, FASE

The Ups and Downs of Arrhythmias
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Longevity With Vitality
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Why Blood Pressure Matters
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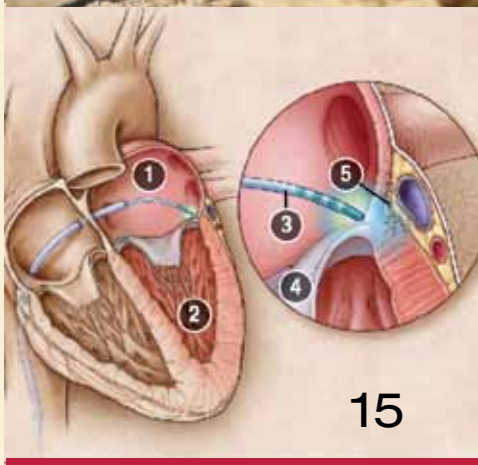


ON THE COVER

Oklahoma Heart Institute - Hospital treats any kind of heart problem you might have. Our team of 26 cardiologists and endocrinologists is highly trained in all of the areas of cardiology to provide you the whole heart care package.

Lower Extremity Peripheral Arterial Disease

By Raj H. Chandwaney, MD, FACC, FSCAI

Figure 1

Blood vessels that provide blood supply to the feet

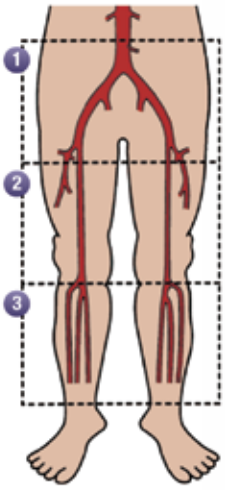


Figure 2

Calculation of the Ankle-Brachial Index (ABI)

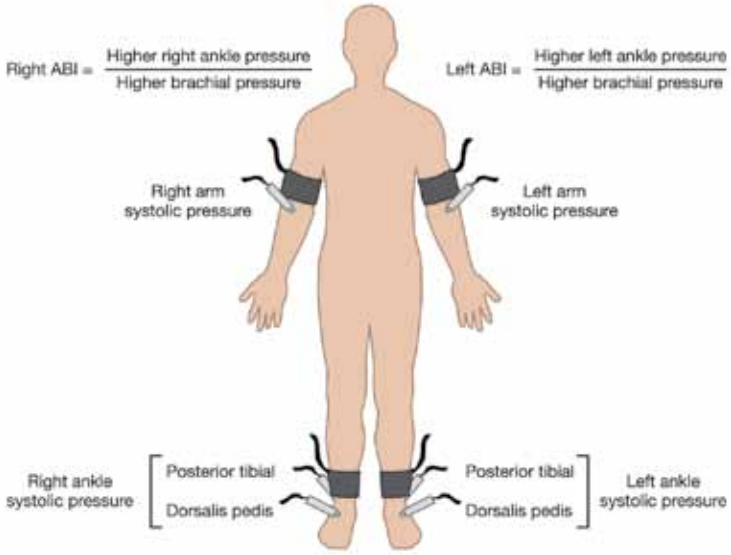


Figure 3

Interpretation of the Ankle-Brachial Index

>1.3	Noncompressible vessels (abnormal)
0.91–1.3	Normal
0.41–0.9	Mild to moderate PAD
<0.4	Severe PAD

Figure 4

Magnetic resonance angiogram of the superficial femoral arteries

Figure 5

CT angiogram of the abdominal aorta and lower extremity arteries

Lower extremity peripheral arterial disease (PAD) refers to the presence of plaque accumulation in the blood vessels that deliver blood to the feet. The plaque accumulation in these blood vessels is due to a disease called atherosclerosis. Atherosclerosis causes heart attacks when plaque accumulates in the blood vessels that feed the heart. Atherosclerosis causes strokes if the plaque accumulates in the blood vessels that feed the brain.

Prevalence Lower extremity peripheral arterial disease is very common. The disease is present in 25-30% of people over age 70 and in 25-30% of high-risk individuals over age 50. Individuals who have a history of diabetes or tobacco use are at high risk for developing lower extremity peripheral arterial disease.

The Classic Symptoms of lower extremity peripheral artery disease is called claudication. Claudication is tightness or aching that occurs in the thighs or calves while walking. Interestingly, claudication only occurs in 10% of patients who have lower extremity peripheral arterial disease. Atypical leg symptoms refer to any other type of leg discomfort that may occur in patients with lower extremity peripheral arterial disease. Atypical leg symptoms occur in 30% of patients with lower extremity peripheral arterial disease. Sixty percent of patients with lower extremity peripheral arterial disease are asymptomatic. Despite the fact that the majority of patients with lower extremity peripheral arterial disease are asymptomatic, it is very important to diagnose the disease in these asymptomatic individuals.

Mortality rates are four times greater amongst individuals with lower extremity peripheral arterial disease compared to individuals without the disease. The increased risk of death is equally present in lower extremity peripheral arterial disease patients with or without symptoms. The five-year mortality rate for patients with lower extremity peripheral arterial disease is 25% (one of four patients with the disease are dead in 5 years if not treated). Seventy-five percent of the deaths that occur in patients with lower extremity peripheral arterial disease are cardiovascular deaths (predominantly heart attack and stroke). Patients with lower extremity peripheral arterial disease are at high risk for heart attack and stroke, because individuals with plaque accumulation in the lower extremity arteries are very likely to have plaque accumulation in the arteries that feed the heart and brain. Atherosclerosis is a systemic disease. This means it is usually present throughout the body rather than in just one area of the body.

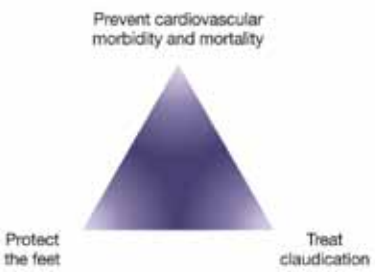
The Risk Factors for lower extremity peripheral arterial disease are similar to the risk factors for heart attack and stroke. These risk factors include: tobacco use, diabetes, high blood pressure, high cholesterol, family history of atherosclerosis, and advanced age. For unclear reasons, tobacco use and diabetes carry a much higher risk for lower extremity peripheral arterial disease than the other risk factors. The risk of developing lower extremity peripheral arterial disease is equal amongst men and women. Certain races are at higher risk for developing lower extremity peripheral arterial disease, such as African-Americans.

Figure 6

Invasive angiogram of the abdominal aorta and iliac arteries

Figure 7

Lower Extremity PAD Treatment Triangle



The Diagnosis of lower extremity peripheral arterial disease is easily established with the use of the Ankle-Brachial Index (ABI). The ABI is the perfect screening test because it is safe, cheap, accurate, and readily available. The ABI can be measured with the use of a simple hand-held Doppler by obtaining the systolic blood pressure in the ankle and brachial (arm) arteries. The calculation and interpretation of the ABI are demonstrated in Figures 2 and 3. In my opinion, the ABI is the ideal test to establish the diagnosis of atherosclerosis in asymptomatic individuals. Experts suggest performing a screening ABI on all individuals over age 70, and high-risk individuals over age 50. Screening ABIs facilitate the early diagnosis of systemic atherosclerosis in asymptomatic individuals.

When patients have symptoms that are concerning for lower extremity peripheral arterial disease, more sophisticated diagnostic tests may be required to diagnose and treat the patient's symptoms. These diagnostic tests include duplex ultrasound, magnetic resonance angiography, CT angiography, and invasive angiography. Examples of these more sophisticated diagnostic tests are demonstrated in Figures 4, 5, and 6.

The Treatment of patients with lower extremity peripheral arterial disease is best summarized with the Lower Extremity PAD Treatment Triangle, which is demonstrated in Figure 7. The most important priority involves addressing the high risk of cardiovascular mortality. This priority is emphasized on the Lower Extremity PAD Treatment Triangle by its placement at the top of the triangle. Strategies used to address this high risk of cardiovascular mortality in patients with lower extremity peripheral arterial disease include:

- Smoking cessation
- Antiplatelet therapy (aspirin or clopidogrel)
- Cholesterol control
- Hypertension control
- Diabetes control
- Therapeutic Lifestyle Changes (heart healthy diet, routine exercise, weight loss)
- Flu shot annually

The next priority to be addressed in patients with lower extremity peripheral arterial disease is protecting the feet from amputation. This priority is demonstrated on the Lower Extremity PAD Treatment Triangle located at the left lower corner of the triangle. This priority is addressed by referring patients with lower extremity peripheral arterial disease to a podiatrist for annual foot exams and patient education for diligent foot care. Additionally, physicians caring for patients with lower extremity peripheral arterial disease need to diagnose critical limb ischemia and acute limb ischemia to protect their patients' feet from amputation.

Critical limb ischemia is defined as limb pain occurring at rest or impending limb loss that is caused by severe compromise of blood flow to the affected extremity. Patients with critical limb ischemia have objectively proven arterial occlusive disease, as well as chronic ischemic rest pain, ulcers, or gangrene. Patients suffering with critical limb ischemia require elective, but prompt, referral to a vascular specialist. They will require more sophisticated diagnostic testing to establish a treatment strategy.

Acute limb ischemia refers to a rapid or sudden decrease in limb perfusion that threatens limb viability. Acute limb ischemia is associated with the six Ps:

- Pain
- Paresthesia
- Pallor
- Paralysis
- Pulselessness
- Polar

Patients with acute limb ischemia need to be admitted to the hospital and will require urgent consultation with a vascular specialist to promptly determine whether they are a candidate for urgent revascularization (restoration of blood flow). Invasive angiography is likely to be required to guide treatment options.

The final priority to be addressed in patients with lower extremity peripheral arterial disease is the treatment of leg pain that may be due to claudication. This priority is demonstrated on the Lower Extremity PAD Treatment Triangle located at the right lower corner of the triangle. Claudication symptoms can be treated with exercise rehabilitation, pharmacologic therapy, and/or revascularization.

Formalized exercise rehabilitation programs lasting 3 to 6 months have been proven to increase patient walking distances 100-150%. Rehabilitation sessions typically last 35 to 60 minutes. Patients are instructed to walk at an intensity that causes pain in 3 to 5 minutes, followed by rest until pain resolution, followed by walking again.

Pharmacologic therapy for claudication involves the prescription of cilostazol at a dose of 100 mg twice daily. Cilostazol has been proven to increase patient walking distances by 50%. Cilostazol has limited use with many lower extremity peripheral arterial disease patients because of common side effects that include headache, diarrhea, dizziness, and palpitations. Also noteworthy is that cilostazol has a black box warning contraindicating its use in patients with a history of congestive heart failure.

Finally, revascularization (restoration of blood flow) may be required in patients who do not achieve adequate symptom relief with exercise rehabilitation or pharmacologic therapy. Revascularization strategies include endovascular techniques (balloon angioplasty, stents, atherectomy, or laser) and surgical techniques (bypass surgery).

Conclusions Lower extremity peripheral arterial disease is a disease with a high prevalence. Most patients with lower extremity peripheral arterial disease are asymptomatic or have atypical symptoms. Patients with lower extremity peripheral arterial disease have significantly higher mortality rates (25% five year mortality) compared to the general population. Patients with lower extremity peripheral arterial disease die of cardiovascular diseases such as heart attack and stroke. Lower extremity peripheral arterial disease can easily be diagnosed in most patients with a cheap, safe, and simple screening test in the office (ABI). Treatment of all patients with lower extremity peripheral arterial disease should primarily focus on lowering their risk of cardiovascular death. Patients with lower extremity peripheral arterial disease require routine foot exams and diligent foot care. Some patients with lower extremity peripheral arterial disease will require treatment to improve claudication symptoms (exercise, pharmacologic, and/or revascularization). A smaller minority of patients will require revascularization to treat critical limb ischemia or acute limb ischemia.

Raj. H. Chandwaney is an interventional cardiologist with expertise in cardiac catheterization, coronary angioplasty and related interventional procedures such as coronary stents, atherectomy, intravascular ultrasound and peripheral vascular interventional procedures. In addition to board certifications in cardiovascualr disease and interventional cardiology, Dr. Chandwaney is also board certified in endovascular medicine by the American Board of Vascular Medicine.

I Know I Should Exercise, But . . .

By Wayne N. Leimbach, Jr., MD, FACC, FSCAI, FCCP, FAHA

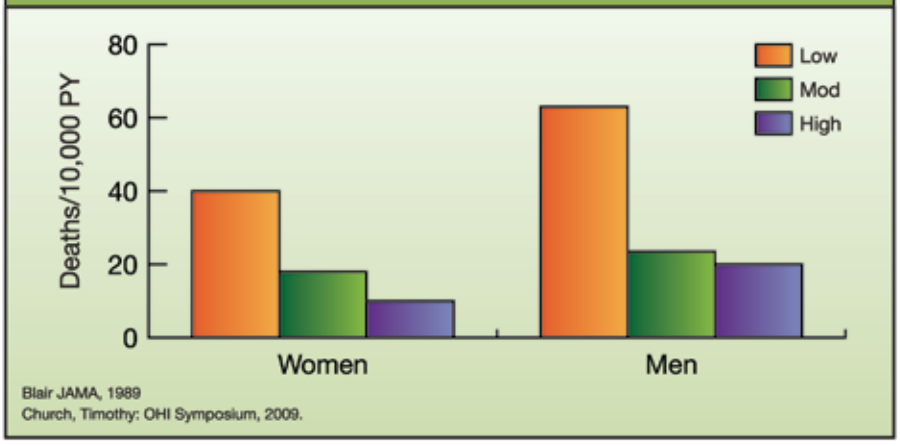
Everybody knows they should exercise, but most of us feel we don't have the time, or think we can't do the exercise activity level needed to get any benefit. To further confuse us, recommendations in the media vary greatly and often reflect a particular sales pitch for exercise equipment, a workout program, or a health club membership.

So what does the scientific data say regarding how much someone should exercise to lead a healthier life?

First, you might question how much benefit is actually gained from routine exercise. Wouldn't living longer be a good incentive to exercise?

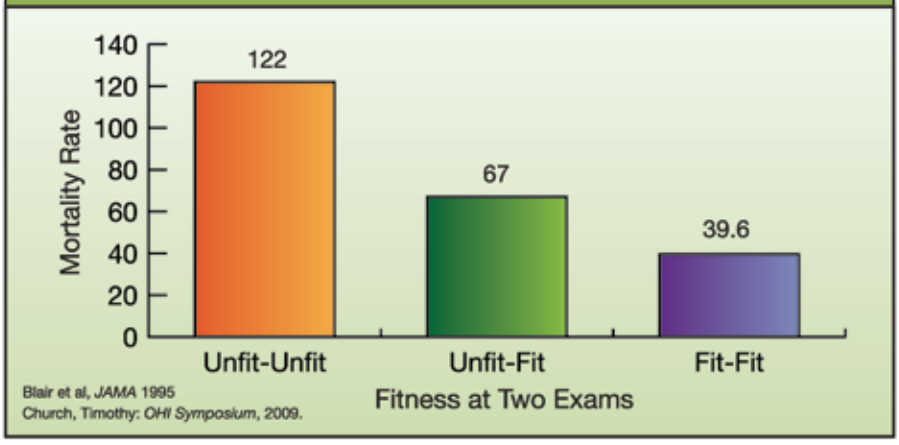
Dr. Steven Blair at the Cooper Clinic in Dallas, Texas, has evaluated more than 70,000 individuals with maximal exercise treadmill testing. Maximum exercise treadmill tests were performed at baseline on all patients, and the majority had follow up exercise treadmill tests

Figure 1
Mortality Rates by Fitness



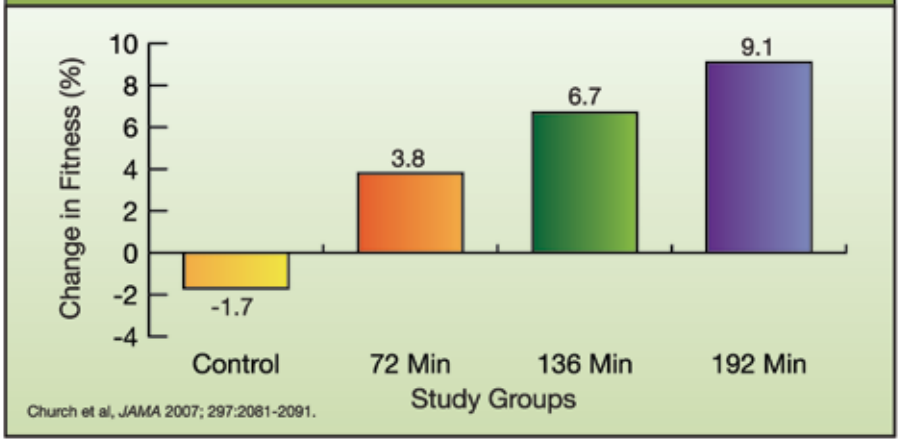
Blair JAMA, 1989
Church, Timothy: OHI Symposium, 2009.

Figure 2
Changes in Physical Fitness and All-Cause Mortality



Blair et al, *JAMA* 1995
Church, Timothy: *OHI Symposium*, 2009.

Figure 3
Change in Fitness Based on Weekly Walking Times



Church et al, *JAMA* 2007; 297:2081-2091.

over the subsequent years. Dr. Blair divided the subjects into three categories: the "unfit" (lower 20 percent based on time on the treadmill adjusted for gender and age), the "moderately fit" (the next 40 percent of patients based on time on the treadmill), and the "high fitness" group (which included the top 40 percent based on time on the treadmill). He collected the mortality rates during 18 years of follow up for both men and women, based on whether they were initially found to have a low, moderate, or high level of fitness on the initial treadmill testing.

He found a greater than 50 percent reduction in mortality for women by just being in the moderately fit group as compared to the low fit group, and moderately fit men had an even greater reduction as compared to the low fit group (Figure 1).

In addition, people who initially tested as "unfit" on the first exam and remained in the "unfit" category at follow up exams had a two-fold higher mortality rate than those who initially tested as unfit on the first exam, but then tested moderately fit on the follow up exams (Figure 2).

For those subjects who tested fit on both the initial and follow up treadmill tests, there was a 60 percent lower mortality rate as compared to the unfit group, so exercising even to a moderate level of fitness can substantially decrease all cause mortality.

Many people think you have to jog or run a marathon to make a difference. The real question for them is, "How little can I do to make a difference in my health and my life?"

Dr. Timothy Church, Director of the Pennington Biomedical Research Center at Louisiana State University, measured the effects of different doses of physical activity in cardiopulmonary fitness among sedentary, overweight, or obese postmenopausal women. Women were randomly assigned to one of four groups. The first group was a non-exercising group, which served as a control. The second group was a low exercise group that walked 72 minutes a week. The third group was a moderate level exercising group that walked 136 minutes per week, and the fourth group was a high level exercise group that walked 192 minutes per week. After six months, the control, non-exercising group experienced a 1.7 percent decrease in physical fitness as compared to a 3.8 percent, 6.7 percent, and 9.1 percent improvement in fitness for the low, moderate, and high level groups respectively (Figure 3).

These findings showed that just a 10 minute walk seven days a week not only prevented deterioration in fitness that was seen in the non-exercising group, but a 10 minute a day walk produced a measurable increase in fitness in just six months.

So the smallest amount of exercise time to produce a measurable benefit in health is a 10-minute walk seven days a week.

The United States Government has produced a Physical Activity Guideline similar to what the government has done in regards to nutritional recommendations. The guideline recommends that adults accumulate two hours and 30 minutes a week of moderate intensity exercising, which includes walking. So, 30 minutes of walking five days a week produces a significant improvement in health (Table 1).

There have been several studies, which show that a person doesn't have to be a marathon runner to gain benefits from exercise. Studies have shown that simple strategies to increase one's daily activity produce long term benefits (Figure 4). Such strategies include walking more than 10,000 steps a day or simply doubling the number of steps a person walks each day. People who consistently use the stairway in their work place instead of the elevator also showed benefit over time.

Most everyone knows they should exercise, but most don't realize that even a 10-minute walk once a day produces a substantial benefit. So, there is no need to buy any special exercise equipment or join a health club unless you want to do more.

It is important to remember that it is far better and easier to maintain good health than try to regain it once it is lost.

A 10-minute walk seven days a week produces a measurable benefit in your health.

Table 1

Physical Activity Has Many Health Benefits

Adults and Older Adults

Strong evidence

- Lower risk of early death
- Lower risk of coronary heart disease
- Lower risk of stroke
- Lower risk of high blood pressure
- Lower risk of adverse blood lipid profile
- Lower risk of type 2 diabetes
- Lower risk of metabolic syndrome
- Lower risk of colon cancer
- Lower risk of breast cancer
- Prevention of weight gain
- Weight loss, particularly when combined with reduced calorie intake
- Improved cardiorespiratory and muscular fitness
- Prevention of falls
- Reduced depression
- Better cognitive function (for older adults)

Moderate to strong evidence

- Better functional health (for older adults)
- Reduced abdominal obesity

Moderate evidence

- Lower risk of hip fracture
- Lower risk of lung cancer
- Lower risk of endometrial cancer
- Weight maintenance after weight loss
- Increased bone density
- Improved sleep quality

http://www.health.gov/paguidelines

Figure 4

An Active Lifestyle

Options

1. Increase number of steps per day from 5000 to 12,000
2. Use the stairs instead of elevators
3. Park away from the door
4. Take a 10-minute brisk walk twice a day
5. Additional activity produces additional benefits

Wayne N. Leimbach, Jr. is an Oklahoma Heart interventional cardiologist specializing in cardiac catheterization, coronary angioplasty, percutaneous closure of PFOs & ASDs and related interventional procedures such as stents, atherectomy, laser, intravascular ultrasound imaging and direct PTCA for acute myocardial infarction.

Why Cholesterol Matters

By Eric G. Auerbach, MD, FACC

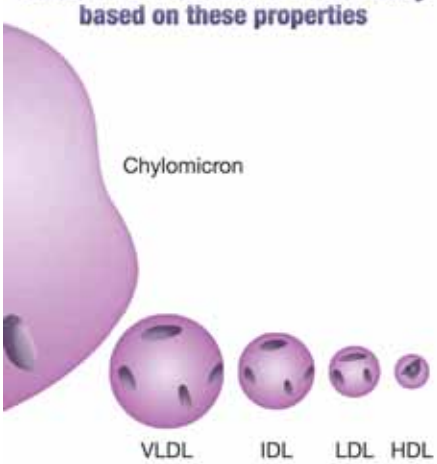
Oil and water don't mix. Still, both are essential for life. In medical terminology, the oils of the human body are referred to as lipids. They include triglycerides and sterols (such as cholesterol), and they serve several important functions. In addition to their role as the body's major energy storage depot, lipids form the basis of hormones for intracellular communication and are the primary component of the membranes that enclose every one of the trillions of cells in the human body.

Since lipids are not water soluble, they are packaged into containers called lipoproteins for distribution through the aqueous solution that is blood plasma. These lipoproteins are assigned specific tasks. Some shuttle newly digested fat from the gut to the liver. Others emanate from the liver, bringing a supply of lipids to cells throughout the body. Still others act as scavengers, picking up stranded lipids in the periphery and returning them to the liver for productive use. These various lipoproteins have chemical labels identifying their primary cargo and destination. In a laboratory, they can be segregated based on their physical properties (Figure 1). For example, "low density lipoproteins" or LDL (the "bad cholesterol" particles) carry fat and cholesterol out from the liver to the cells of the body, while "high density lipoproteins" or HDL (the "good cholesterol" particles) collect unused lipids for return to the liver.

Much as problems can potentially arise from the oil transportation and distribution needs of a modern economy, our contemporary diet and lifestyle can contribute to health problems stemming from our internal lipid transport system. Like tankers unable to dock at a busy port, overnutrition can lead to an abundance of circulating lipoproteins that are denied access to the liver and are unable to unload their cargo. With too many lipoproteins in the blood, these particles will move out of the flow of the blood stream and into the wall of the artery surrounding it. There, in the arterial wall, the lipoprotein can be identified by cells of the immune system as something that does not belong. It is chemically "tagged" with a process called oxidation, leading to an aggressive immune response in which this foreigner is quarantined within a type of immune cell soldier called a macrophage. The result is a "foam cell," (Figure 2) a macrophage that is full of lipids, and which is the starting point for a fatty plaque (Figure 3) in the wall of the artery.

Figure 1

Lipoproteins vary in size and density and can be measured in a laboratory based on these properties



Cholesterol levels are consistently the single greatest predictor of heart disease risk.

Given the central role of lipids in the creation of the fatty plaque that is at the root of all atherosclerotic vascular disease, it should not be surprising that population studies have consistently demonstrated a strong and direct relationship between blood cholesterol levels and the risk of heart disease. In fact, a large number of studies conducted over many decades have consistently demonstrated that the risk of heart disease increases as cholesterol (and especially LDL cholesterol) increases, and that lower cholesterol confers a lower risk (Figure 4).

But how high is too high, and how low is low enough? These questions are difficult to answer, since the studies seem to indicate that the lower you get, the safer you are. No specific level of LDL cholesterol has been identified at which no further benefit is demonstrated from going lower still. Moreover, humans with a specific genetic mutation that results in a lifelong low level of LDL cholesterol appear to be protected from vascular disease without suffering any adverse effects in return. In fact, there is not even agreement on just what is a "normal" cholesterol. The median LDL cholesterol in the U.S. adult population is about 130 mg/dl. However, newborns have an LDL cholesterol of 35 to 70, as do adults in parts of rural China, and adults in hunter-gatherer societies, all of which are populations in which vascular disease is rare. Physiologically normal, then, may be quite lower than the norm in our society, and more in line with the "aggressive" targets that physicians will often recommend to their patients who have coronary artery disease.

Of course, there are many risk factors for vascular disease. Cigarette smoking, high blood pressure, diabetes, lack of exercise, obesity, and inflammatory diseases all prominently contribute to atherosclerosis. What they all have in common, however, is that they all somehow contribute to or exacerbate deposition of plaque in the arterial wall – a process that is cholesterol-dependent.

Elevated cholesterol alone is sufficient to result in plaque formation in the arteries. Animal models of vascular disease, for example, can be created by feeding a high calorie, high fat diet. And humans with a genetic abnormality that leads to very high cholesterol experience accelerated atherosclerosis even with excellent dietary and lifestyle habits, and without any other of the major risk factors. Even in the presence of those other risk factors, however, some abnormality of lipid metabolism is required for the manifestation of vascular disease. That may be why INTERHEART, a study of 29,000 people in 52 countries around the world, found that cholesterol levels are consistently the single greatest predictor of heart disease risk.

Cholesterol matters, because it is lipids in the blood that lead to plaque in the arteries, and because plaque in the arteries is the number one cause of death worldwide. And cholesterol matters because plaque in the arteries is both preventable and reversible. A comprehensive program of diet, lifestyle, and (when needed) medication can effectively lower cholesterol levels, preventing and even reversing arterial disease.

Figure 2

Foam cells are immune cells that have engulfed lipoproteins and lipids within the wall of the artery

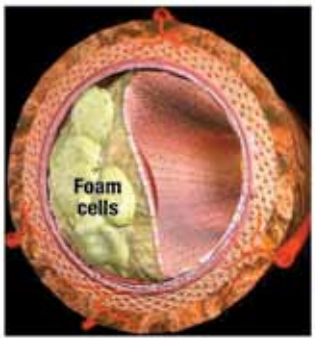


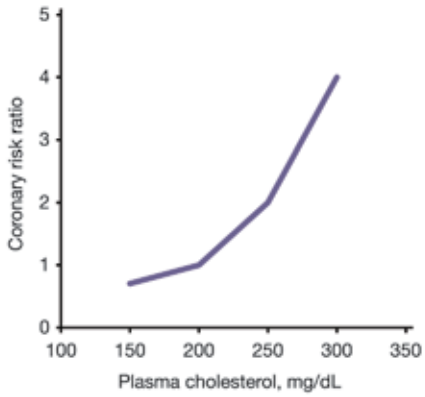
Figure 3

The fatty streak is an early manifestation of arterial disease

First lesion to appear as a result of atherogenesis, occuring possibly in early teen years. Consists primarily of foam cells in the subendothelial space.

Figure 4

Cholesterol level is directly related to risk of vascular disease



Eric G. Auerbach is a general cardiologist at Oklahoma Heart Institute. Dr. Auerbach is particularly interested in preventative cardiology and cardiovascular risk reduction.

Sucessfully Treating Heart Failure

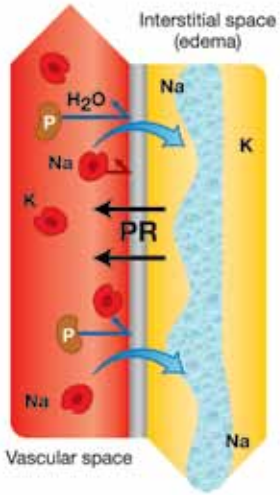
By Alan M. Kaneshige, MD, FACC, FASE

Heart failure (HF) is a major public health problem for the United States of America. Heart failure is the inability of the heart to keep up with the metabolic needs of the body, resulting in fluid retention and a decrease in functional capacity. Approximately five million people have the diagnosis of clinical HF. Each year, 550,000 new patients are diagnosed with HF. Heart failure accounts for a million hospital discharges each year and is the most common discharge diagnosis in the Medicare population. Approximately $30 billion is spent each year on patients with HF, the major portion being for costs of hospitalizations and readmissions.

There are two types of HF, systolic HF (abnormal pump with decreased pumping ability) and diastolic HF (normal pump but decreased ability to fill the heart). Patients with systolic HF are not able to pump enough blood through their circulatory system to keep up with the demands of their organs. These are patients who have damaged hearts from coronary artery disease, heart attacks, uncontrolled hypertension, or specific viral diseases that attack the heart muscle. Patients with diastolic HF have hearts with normal pumping function. Their hearts are able to squeeze out a normal amount of blood with each heartbeat. But, patients with diastolic heart failure have stiff hearts that take higher pressures to fill the pumping chambers (ventricles). These higher pressures are then reflected back to the lung circulation (pulmonary arteries) and cause congestion (shortness of breath). Patients with diastolic heart failure may have thick-walled hearts from hypertension and certain heart valve conditions.

For successful treatment of patients with both systolic and diastolic HF, the cause of HF must be identified. Heart failure is a syndrome, a collection of symptoms such as progressive shortness of breath, fatigue, and fluid retention. Heart failure is the product of a disease process, such as damage from heart attacks, valvular heart disease, high blood pressure, or even a viral illness. Finding the cause for a patient's HF can determine specific treatments.

Fluid Removal by Ultrafiltration



Ultrafiltration can remove fluid from the blood at the same rate that fluid can be naturally recruited from the tissue

The transient removal of blood illicits compensatory mechanisms, *termed plasma or intravascular refill (PR)*, aimed at minimizing this reduction[1,2]

1. Lauer et al. Arch Intern Med. 1983;99:455-460
2. Marenzi et al. J Am Coll Cardiol. 2001;38:4

Today, most HF is successfully treated with salt restriction, weight reduction, diet, and specific lifestyle changes such as avoiding alcohol and tobacco. In addition to lifestyle changes, physicians have key medicines to help relieve symptoms and to prevent further deterioration of the heart. Beta blockers, angiotensin converting enzyme inhibitor (ACE inhibitors), angiotensin receptor blockers (ARBs), and aldosterone inhibitors are key

Continued on page 10

Heart Failure continued from page 9

medicines that help improve heart function and prevent further deterioration. Diuretics (water pills) are used to balance fluids. With aggressive medical treatment and lifestyle changes, patients with damaged hearts have been known to normalize their heart functions and have a good quality of life.

Device therapy plays a large role in the successful treatment of heart failure. In patients with damaged hearts and clinical HF, the conduction system of the heart can be abnormal. When a patient's heartbeat is conducted down an abnormal conduction system, the cardiac chambers pumping blood become out of sync. This dyssynchronous pattern of pumping causes the heart to be inefficient and HF symptoms develop or get worse. Cardiologists with expertise in cardiac rhythms and conduction (electrophysiologists) can place special devices (biventricular pacemakers and defibrillators) that resynchronize a patient's heartbeat and, in most cases, restore cardiac efficiency. In addition to restoring cardiac efficiency, resynchronization therapy can normalize the pumping function of the heart more frequently than medicines alone.

Heart failure can be a progressive condition and may lead to advanced disease. Patients with advanced HF are usually elderly and have multiple medical problems. Many patients have chronic kidney disease. Most advanced HF patients retain too much salt and fluid (fluid overload) in spite of the best medical and device therapy. Approximately 90 percent of the one million annual hospitalizations for HF are due to symptoms of fluid overload. These symptoms include shortness of breath, lung congestion, abdominal distention, and lower extremity swelling (edema). Chronic fluid overload contributes to further HF progression and end-stage heart disease.

Conventional treatment for both acute decompensated and chronic advanced HF is aimed at reducing fluid overload. Physicians initially give diuretics to get rid of both salt (sodium) and water from the congested tissues (intersitial space). By making the kidneys able to excrete more salt and water, diuretics allow the extra fluid to leave the congested tissues, enter the bloodstream, and exit as urine. Diuretics, however, can also activate neurohormone systems in the body, which promote HF. Blood flow to the kidneys is reduced and, therefore, filtering and fluid removal are compromised. Prolonged usage of high dose diuretics can increase overall mortality of the HF patient. Patients requiring very high doses of diuretics to maintain their fluid balance and dry weight are said to be "diuretic-resistant". These patients require even more advanced HF therapy.

Patients with advanced HF represent difficult challenges. Even with aggressive HF therapy, a significant amount of advanced HF patients do not get adequate fluid removal (diuresis) during their hospitalizations. In one study, half of the patients treated for acutely decompensated HF were discharged from the hospital with less than a five-pound weight loss. Approximately 20 percent either remained at the same weight as admission or even gained pounds. This persistent fluid retention accompanied by congestion contributes to high readmission rates. Ideally, HF patients should strive to achieve and maintain their dry weight.

Ultrafiltration is a method by which salt and fluid can be removed from a fluid overloaded patient. Ultrafiltration allows plasma water to be separated from whole blood in the bloodstream (intravascular space). Blood is removed from the HF patient by way of a pump and ultrafiltrated by pushing the plasma water across a special semipermeable membrane (filter). The separated plasma water removed has the same salt concentration as whole blood. The ultrafiltrated blood is then returned to the patient. Ultrafiltration can remove much more salt than diuretic therapy in the same volume of fluid. Ultrafiltration does not significantly disturb the electrolyte balance in the bloodstream or reduce the filtering rate of the kidneys, unlike high dose diuretics. More tissue fluid can be removed at a predictable rate by ultrafiltration than diuretics. Ultrafiltration can carefully remove fluid from the bloodstream at a controlled rate so that fluid from the tissues (interstitial space) can enter the bloodstream at the same or higher rate as a compensatory reflex to fluid removal. The bloodstream is thus unlikely to become volume-depleted. This Plasma Refill Mechanism may be an explanation why ultrafiltration can avoid the problems of prolonged high dose diuretic usage.

Ultrafiltration is available for clinical use for the advanced heart failure patient who is diuretic-resistant, chronically volume overloaded, and has frequent hospital admissions. Aquapheresis is a term used to represent ultrafiltration in the advanced volume-overloaded HF patient using the Aquadex™ Flex Flow™ machine (a product of CHF Solutions). The Aquadex™ Flex Flow™ machine can precisely remove anywhere from 10 to 500 mL of plasma water per hour depending on patient needs and fluid status. The rate of fluid removal per hour is carefully maintained so as not to exceed the estimated rate of fluid entering the bloodstream from the tissues (plasma refill rate).

Multiple clinical studies have compared ultrafiltration to standard care in acutely decompensated HF patients requiring hospitalization. These studies had encouraging results and prompted the latest HF guidelines to include ultrafiltration as a recommended treatment for the advanced HF patient with congestion not responding to standard medical therapy.

Understanding what causes HF and instituting effective therapy, either medically or with HF devices, will aid in the successful treatment of the HF patient. Advanced treatment is now available for this progressive condition. If a person or family member continues to require frequent readmissions to a hospital for heart failure, consideration should be given to an evaluation at a center that provides advance heart failure therapy.

Alan M. Kaneshige is a noninvasive cardiologist with expertise in adult echocardiography, stress echocardiography and transesophageal echocardiography.

What is the Aquadex™ FlexFlow™?

Low blood flow	10-40 mL/min
Low blood volume	33 mL
Precise fluid removal rates	10-500 mL/h
Quick and easy setup	Less than 10 min
Highly automated operation	1 required setting

With aggressive medical treatment and lifestyle changes, patients with damaged hearts have been known to normalize their heart functions and have a good quality of life.

Oklahoma Heart Institute

Services of Oklahoma Heart Institute

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- Multivessel Angioplasty and Stenting
- Atherectomy
- Rotablator Atherectomy
- Thrombolytic Therapy
- Coronary Stents
- Carotid Stenting
- Fractional Flow Reserve
- Intravascular Ultrasound
- Myocardial Biopsy
- Pericardiocentesis
- Peripheral Angioplasty
- Peripheral Stents
- Percutaneuos ASD Closures
- Percutaneous PFO Closures
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Noninvasive Cardiology

- CT Angiography
- CT Heart Scan
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- Nuclear and Echocardiographic Exercise and Pharmacological Stress Testing
- Retinal Imaging
- Thyroid Ultrasound
- Transesophageal Echocardiography, Arterial Venous Peripheral Vascualr Imaging and Doppler Studies
- Peripheral Arterial Doppler and Duplex Imaging
- Cardiovascular Magnetic Resonance Imaging
- External Counterpulsation (ECP) Therapy
- Transcranial Doppler
- Aquapheresis Therapy

Electrophysiology

- Electrophysiology Studies
- Ablation Therapy
- Pacemaker Implantation
- Pacemaker and Lead Extraction
- Pacemaker Programming
- Pacemaker Monitoring and Clinic
- Implantable Cardioverter Defibrillator (ICD) Replacement
- ICD and Hardware Removal
- ICD Programming
- ICD Monitoring and Clinic
- Holter Monitoring and Interpretation
- 30 Day Cardiac Event Monitors
- Implantation and Interpretation of Long-Term Heart Monitors
- Signal Averaged EKGs and Interpretation
- Head Up Tilt Testing and Interpretation
- Direct Current Cardioversion
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Metabolic Disorders

- Diabetes
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- Hypertension
- Other Endocrine Problems

Specialty Clinics

- Advanced Center for Atrial Fibrillation
- Dysrhythmia and Pacer Clinic
- Hypertension Clinic
- Adolescent and Adult Congential Heart Clinic
- Lipid and Wellness Clinic
- Heart Failure Clinic
- Same Day Appointment Clinic
- Pre-Operative Clinic
- Center for the Treatment of Venous Disease

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Wayne N. Leimbach, Jr., MD, FACC, FSCAI, FCCP, FAHA

Dr. Leimbach is a specialist in interventional cardiology, including cardiac catheterization, coronary angioplasty, percutaneous closure of PFOs & ASDs and related interventional procedures such as stents, atherectomy, laser, intravascular ultrasound imaging and direct PTCA for acute myocardial infarction. He is Chief of Cardiology at Oklahoma Heart Institute Hospital, where he is also Director of the Cardiac and Interventional Laboratories. Dr. Leimbach is Co-Founder of the Lipid and Wellness Clinic at Oklahoma Heart Institute. He is Director of the James D. Harvey Center for Cardiovascular Research at Hillcrest Medical Center, as well as Director of the Oklahoma Heart Research and Education Foundation. He also serves as Clinical Associate Professor of Medicine at the University of Oklahoma College of Medicine – Tulsa. Dr. Leimbach completed a Clinical Cardiology Fellowship and a Research Fellowship at the University of Iowa Hospitals and Clinics. He also completed his Internal Medicine Internship and Residency programs at Iowa, where he was selected Chief Resident in Medicine. He received his medical degree from Northwestern University in Chicago and his Bachelor of Science degree from the University of Michigan.

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Robert C. Sonnenschein, MD, FACC, ASE, RVT

Dr. Sonnenschein specializes in echocardiography and noninvasive peripheral vascular imaging. He is past Director of Peripheral Vascular Ultrasound Imaging at Hillcrest Medical Center and Oklahoma Heart Institute and serves as Clinical Associate Professor of Medicine at the University of Oklahoma College of Medicine – Tulsa. He completed his Cardiology Fellowship at the State University of New York Upstate Medical Center in Syracuse, where he also completed his Internal Medicine Internship and Residency programs. Dr. Sonnenschein received his medical degree from Rush Medical College in Chicago and his Bachelor of Arts degree from the University of Pennsylvania.

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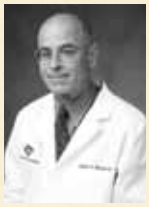
Dr. Lynch is a specialist trained in noninvasive and invasive cardiology with a special interest in the prevention of cardiovascular disease. He is former Chief of Cardiology at Hillcrest Medical Center, where he also has served as Chief of Medicine and President of the medical staff. Dr. Lynch is former Co-Director of the

Lipid and Wellness Clinic at Oklahoma Heart Institute and Director of the Executive Health Program. Dr. Lynch is also a Clinical Assistant Professor at the University of Oklahoma College of Medicine – Tulsa. He completed his Cardiology Fellowship, as well as his Internal Medicine Internship and Residency, at the University of Oklahoma Health Sciences Center. Dr. Lynch received his medical degree from the University of Oklahoma School of Medicine and his Bachelor of Science degree from the University of Tulsa. Before establishing his practice in Tulsa, he served as Chief of Medicine at the U.S. Army Hospital, Bangkok, Thailand.

Board certified in Internal Medicine and Cardiovascular Disease



James J. Nemec, MD, FACC

Dr. Nemec is a specialist in echocardiography, stress echocardiography and nuclear cardiology. He serves as Director of Nuclear Cardiology for Oklahoma Heart Institute. Dr. Nemec has served as Assistant Professor of Internal Medicine, Division of Cardiology, at Creighton University and as Assistant Professor, Department of Radiology, also at Creighton University. He completed his Clinical Cardiology Fellowship at the Cleveland Clinic Foundation and his Internal Medicine Internship and Residency at Creighton University. Dr. Nemec also completed a year of training in pathology at the University of Missouri, Columbia, MO. He received his medical degree from Creighton University, where he also received his Bachelor of Arts degree.

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Dr. Johnsen is an interventional cardiologist with expertise in cardiac catheterization, angioplasty and related interventional procedures, such as stents and atherectomy. He is Director of Cardiac Rehabilitation at Hillcrest Medical Center and Director of the Hillcrest Exercise and Lifestyle Programs. He completed his Clinical Cardiology Fellowship at the University of Oklahoma – Oklahoma City, where he then finished an extra year of dedicated training in interventional cardiology. He completed his Internal Medicine Internship and Residency training at the University of Oklahoma – Oklahoma City, where he also received his medical degree. Dr. Johnsen received his Bachelor of Science degree from Oklahoma State University.

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Alan M. Kaneshige, MD, FACC, FASE

Dr. Kaneshige is a noninvasive cardiologist with expertise in adult echocardiography, stress echocardiography and transesophageal echocardiography. He is past Chief of Cardiology at Hillcrest Medical Center. Dr. Kaneshige is also the Director of the Adolescent and Adult Congenital Heart Clinic at Oklahoma Heart Institute and Director of the Congestive Heart Failure C.A.R.E. Center at Oklahoma Heart Institute Hospital. Dr. Kaneshige completed his Internal Medicine Internship and Residency at Creighton University School of Medicine, where he also received his medical degree. He received a Bachelor of Science in chemistry at Creighton University. Dr. Kaneshige completed his Clinical Cardiology fellowship at Creighton, where he also served as Chief Cardiology Fellow for two years. He completed an additional Cardiac Ultrasound Fellowship at the Mayo Clinic in Rochester. Dr. Kaneshige served as Assistant Professor of Medicine at Creighton University School of Medicine, where he was Director of the Noninvasive Cardiovascular Imaging and Hemodynamic Laboratory.

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Edward T. Martin, MS, MD, FACC, FACP, FAHA

Dr. Martin is a noninvasive cardiologist with specialty expertise in non-invasive imaging. He is Director of Cardiovascular Magnetic Resonance Imaging at Oklahoma Heart Institute and Hillcrest Medical Center. In addition, he is a Clinical Associate Professor of Medicine at the University of Oklahoma College of Medicine – Tulsa. Dr. Martin has specialty training in Nuclear Medicine, as well as additional training dedicated to Cardiovascular Magnetic Resonance Imaging. He completed his Cardiology Fellowship at the University of Alabama. Dr. Martin's Internal Medicine Internship and Residency training were performed at Temple University Hospital in Philadelphia. He received his medical degree from the Medical College of Ohio. Dr. Martin completed his Master of Science degree in mechanical engineering at the University of Cincinnati and his Bachelor of Science degree in physics at Xavier University. Dr. Martin is a founding member of the Society of Cardiovascular Magnetic Resonance and is an editorial board member of the Journal of Cardiovascular Magnetic Resonance.

Board certified in Internal Medicine and Cardiovascular Disease

Roger D. Des Prez, MD, FACC

Dr. Des Prez is a noninvasive cardiologist with specialty expertise in echocardiography, nuclear cardiology and cardiac computed tomography. He is Director of Cardiac Computed Tomography at Oklahoma Heart Institute Hospital, at Hillcrest Medical Center and Bailey Medical Center. Dr. Des Prez received his medical degree and Bachelor of Arts degree from Vanderbilt University. He completed his Residency in Internal Medicine and Pediatrics at University Hospital of Cleveland. Dr. Des Prez practiced for six years as an internist with the Indian Health Services in Gallup, NM. He returned to Vanderbilt University as a member of the Internal Medicine Faculty, at which time he also completed his cardiology training.

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Christian S. Hanson, DO, FACE

Dr. Hanson is a specialist in Endocrinology, Metabolism and Hypertension at Oklahoma Heart Institute with expertise in diabetes, lipids and hypertension. He also serves as Clinical Associate Professor of Medicine in the College of Osteopathic Medicine – Oklahoma State University. He completed a Fellowship in Endocrinology, Metabolism and Hypertension at the University of Oklahoma in Oklahoma City. Dr. Hanson's Internal Medicine Residency and Rotating Internship were completed at Tulsa Regional Medical Center. He received his medical degree from Oklahoma State University and his Bachelor of Science degree from Northeastern Oklahoma State University in Tahlequah.

Board certified in Internal Medicine, Endocrinology and Metabolic Diseases

Rebecca L. Smith, MD, FACC, FASE

Dr. Smith is a noninvasive cardiologist with specialty expertise in transthoracic echocardiography, transesophageal echocardiography, intraoperative echocardiography, stress and pharmacological echocardiography and contrast echocardiography. Dr. Smith is Director of the Echocardiography and TEE Departments at Oklahoma Heart Institute Hospital. She completed an Advanced Cardiac Imaging Fellowship at the Cleveland Clinic Foundation and her Cardiology Fellowship at the University of New Mexico Health Sciences Center, Albuquerque, NM. Dr. Smith's Internal Medicine Internship and Residency training were performed at the University of Arizona Health Sciences Center in Tucson. She received her medical degree from the Medical College of Ohio. Dr. Smith completed her Bachelor of Science degree at Cleveland State University.

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David A. Sandler, MD, FACC, FHRS

Dr. Sandler is a cardiologist with subspecialty expertise in electrophysiology, complex ablation, and atrial fibrillation management. Dr. Sandler is Director of Electrophysiology at Oklahoma Heart Institute Hospital. He completed his Cardiac Electrophysiology Fellowship and his Cardiovascular Medicine Fellowship at New York University Medical Center, New York, NY. Dr. Sandler performed his Internal Medicine Internship and Residency at Mount Sinai Medical Center, New York, NY. He earned his medical degree from Georgetown University School of Medicine in Washington, DC. Dr. Sandler received his Bachelor of Arts degree at the University of Pennsylvania in Philadelphia.

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Dr. Chandwaney is an interventional cardiologist with expertise in cardiac catheterization, coronary angioplasty and related interventional procedures such as coronary stents, atherectomy, intravascular ultrasound and peripheral vascular interventional procedures. Dr. Chandwaney is Director of the Chest Pain Center and Cardiology Telemetry Unit at Oklahoma Heart Institute Hospital. He completed his Clinical Cardiology Fellowship at Northwestern University Medical School in Chicago, IL., where he also completed an Interventional Cardiology Fellowship. Dr. Chandwaney's Internal Medicine Internship and Residency were performed at Baylor College of Medicine in Houston, TX. He received his medical degree from the University of Illinois at Chicago. Dr. Chandwaney completed his Master of Science degree at the University of Illinois at Urbana-Champaign, where he also received his Bachelor of Science degree.

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D. Erik Aspenson, MD, FACE, FACP

Dr. Aspenson is a subspecialist in Endocrinology, Metabolism and Hypertension at Oklahoma Heart Institute, with expertise in diabetes, lipids, hypertension and thyroid diseases. He completed a fellowship in Endocrinology at Wilford Hall Medical Center, Lackland AFB, Texas. Dr. Aspenson's Internal Medicine Internship and Residency were completed at David Grant Medical Center, Travis AFB, California where he served as Chief Resident. He received his medical degree from the University of Oklahoma and his Bachelor of Science degree at Oklahoma State University.

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Frank J. Gaffney, MD, FACC

Dr. Gaffney is an interventional and noninvasive cardiologist with subspecialty expertise in transesophageal echocardiography, nuclear cardiology, and coronary angiography. He completed his Cardiovascular Medicine Fellowship at Scott & White Memorial Hospital in Temple, Texas. Dr. Gaffney completed his Internal Medicine Internship and Residency at Brooke Army Medical Center in San Antonio. He then remained on staff at Scott & White Memorial Hospital for several years, before entering his Fellowship in Cardiovascular Medicine. Dr. Gaffney earned his medical degree from New York Medical College, Valhalla, New York, and he received his Bachelor of Arts degree at Hofstra University in Hempstead, New York.

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Eric G. Auerbach, MD, FACC

Dr. Auerbach is a general cardiologist who is particularly interested in preventative cardiology and cardiovascular risk reduction. He completed his cardiology fellowship at the University of Miami/Jackson Memorial Hospital in Miami, FL, following which he obtained additional subspecialty training in cardiovascular MRI, nuclear cardiology, and cardiac CT imaging. His areas of expertise also include echocardiograpgy, transesophageal echocardiograpgy, stress testing, and management of lipid disorders. Dr. Auerbach's Internal Medicine Internship and Residency were performed at the University of Miami/Jackson Memorial Hospital. He earned his medical degree at the University of Miami, Miami, FL, and his Bachelor of Arts degree at Princeton University, Princeton, NJ.

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Kelly R. Flesner, MD

Dr. Flesner is a subspecialist in Endocrinology, Metabolism and Hypertension at Oklahoma Heart Institute, with expertise in diabetes, lipids, hypertension and thyroid diseases. Prior to joining Oklahoma Heart, she was at St. John Medical Center in Tulsa. She completed her fellowship in Endocrinology at the University of Texas at Galveston. Her Internal Medicine Internship and Residency were completed at the University of Texas in Houston, where she also received her medical degree. She earned her Bachelor of Science degree at Texas A&M University in College Station, TX.

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Dr. Smith specializes in interventional cardiology including cardiac catheterization, coronary angioplasty, and related interventional procedures such as coronary stents, atherectomy, intravascular ultrasound, and peripheral vascular interventional procedures. He completed an Interventional Cardiology Fellowship at the University of Florida College of Medicine in Jacksonville, FL. Dr. Smith performed his Clinical Cardiology Fellowship at Vanderbilt University School of Medicine in Nashville, TN and Tulane University School of Medicine in New Orleans. He received his medical degree from the University of Oklahoma College of Medicine in Oklahoma City and then completed his Internal Medicine Internship and Residency at Emory University School of Medicine in Atlanta, GA. Dr. Smith received his Bachelor of Arts, Bachelor of Science and Master of Science degrees at the University of Oklahoma in Norman, OK.

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Eugene J. Ichinose, MD, FACC

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Cristin M. Bruns, MD

Dr. Bruns is a specialist in Endocrinology, Diabetes and Metabolism at Oklahoma Heart Institute, with expertise in diabetes, thyroid disease (including thyroid cancer) and polycystic ovary syndrome. She completed her Internal Medicine Internship and Residency and Endocrinology Fellowship at the University of Wisconsin Hospital and Clinics in Madison, WI. Dr. Bruns earned her medical degree from Saint Louis University School of Medicine in St. Louis, MO and her Bachelor of Arts and Bachelor of Science degrees in biology from Truman State University in Kirksville, MO. Prior to joining Oklahoma Heart Institute, Dr. Bruns worked as a clinical endocrinologist at the Dean Clinic in Madison, Wisconsin.

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Gregory A. Cogert, MD, FACC

Dr. Cogert is a cardiologist who specializes in electrophysiology, including catheter ablation of arrhythmia, as well as the implantation and management of cardiac pacemakers, defibrillators, and cardiac resynchronization devices. He completed his Cardiac Electrophysiology Fellowship at Mayo Clinic in Rochester, MN and his Cardiovascular Fellowship at Cedars-Sinai Medical Center in Los Angeles, CA. Dr. Cogert's Internal Medicine Internship and Residency were completed at UCLA Medical Center in Los Angeles. He earned his medical degree from the University of California in Irvine and received his Bachelor of Science degree in microbiology and molecular genetics from the University of California in Los Angeles.

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John S. Tulloch, MD, FACC

Dr. Tulloch is a noninvasive cardiologist with expertise in adult echocardiography, peripheral vascular imaging, nuclear cardiology, cardiac computed tomography and MRI. He completed his Cardiovascular Fellowship at the University of Kansas Medical Center in Kansas City, KS. Dr. Tulloch's Internal Medicine Internship and Residency also were completed at the University of Kansas Medical Center. He earned his medical degree from Ross University School of Medicine in New Brunswick, NJ and received his Bachelor of Science degree in biology from Avila University in Kansas City, MO.

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Anthony W. Haney, MD

Dr. Haney is a noninvasive cardiologist with expertise in nuclear cardiology, echocardiography, peripheral vascular imaging and MRI. He also performs diagnostic cardiac catheterization. He completed his Cardiovascular Fellowship at the Medical College of Virginia in Richmond. Dr. Haney's Internal Medicine Internship and Residency were completed at the Mayo Clinic in Scottsdale, AZ. He earned is medical degree from the University of Oklahoma School of Medicine.

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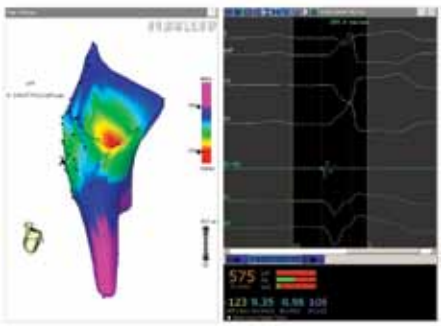
Dr. Duda is a specialist in Endocrinology, Diabetes and Metabolism at Oklahoma Heart Institute, with expertise in diabetes, lipids, hypertension and thyroid diseases. He completed his Fellowship in Endocrinology and Metabolism at the Mayo Graduate School of Medicine, where he also completed his Residency in Internal Medicine. Dr. Duda received his medical degree from Northwestern University School of Medicine in Chicago, IL. He earned his Bachelor of Science degree from Benedictine University in Lisle, IL.

Board certified in Internal Medicine, Endocrinology, Diabetes and Metabolism, Clinical Lipidology, Clinical Hypertension, Clinical Bone Densitometry and Thyroid Ultrasonography

The Ups and Downs of Arrhythmias

By David A. Sandler, MD, FACC, FHRS

Figure 1



Arrhythmia (literally, "without rhythm") is the medical term for irregular heart rhythms. Arrhythmias include everything from skipped beats to sudden cardiac arrest. There are several common reasons to seek a consultation with a rhythm specialist (electrophysiologist).

Skipped Beats

Ironically, the perception of a "skipped beat" is usually an extra, abnormal beat originating in the bottom chamber of the heart. These beats are called premature ventricular contractions or PVCs. While we all have a skipped beat every once in a while, some people are disabled by thousands of these beats every day. Initial treatment is aimed at lifestyle modification, including reducing caffeine intake. If symptoms continue, medications may offer relief.

When these simple noninvasive methods fail, patients may have to resort to catheter ablation. The Oklahoma Heart Institute arrhythmia specialists use state of the art 3-dimensional mapping systems to identify and eliminate the pesky trigger with success rates over 90%. Figure 1 is a 3-dimensional map of a patient's extra beat. The site of earliest activation (shown in red) identifies the origin of this beat. Catheter ablation at this target site resulted in complete elimination of palpitation.

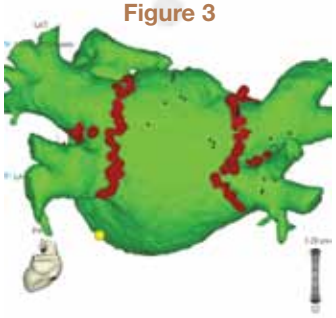
Inappropriate Sinus Tachycardia

This condition predominantly affects young, healthy women. The presenting complaint is usually a fast heartbeat while at rest or with minimal exertion. While bothersome, this condition is generally considered to be benign. Treatment includes hydration, salt loading and compression shorts. Medications aimed to block adrenaline (beta-blockers) can also be helpful. In very rare circumstances, catheter ablation may be required, although success rates are fairly poor for this condition. It is vital to distinguish this condition from supraventricular tachycardia.

Supraventricular Tachycardia (SVT)

Every year over 2 million Americans notice that their hearts begin to race rapidly without provocation. Heart rates vary from around 150 beats to 250 beats per minute. Sometimes they can make their hearts return to a normal rhythm by holding their breath or coughing. Other times, they will present to an emergency room and have a medication "stop the heart", returning the rhythm to normal. By far, the most common cause of this condition is a short circuit of the heart caused by an extra electrical pathway. While medications are often prescribed first, the only definitive treatment for this arrhythmia is a simple catheter ablation procedure aimed at destroying the extra pathway. Figure 2 shows catheter ablation of an abnormal electrical pathway in the left atrium. Electrophysiolgists can cure these rhythm problems with success rates over 98% and complication rates below 0.5%.

Figure 3



Atrial Fibrillation

Atrial fibrillation (AFib) is the most common sustained arrhythmia affecting millions of Americans. Symptoms can range from rapid, irregular palpitation to fatigue. Occasionally, patients can be completely symptom-free. It is vital to recognize AFib, because left untreated, pooling of blood in the top chambers of the heart can lead to a stroke. Once felt to be "incurable", rhythm specialists are now able to eradicate this arrhythmia with a minimally invasive catheter-based procedure (Figures 3 and 4). In fact, the OHI electrophysiologists have performed hundreds of AFib ablations, and we pride ourselves in providing state of the art AFib care.

Slow Heartbeats (Bradycardia)

Slow heartbeats may present in a number of different ways. Some patients develop severe fatigue when their heart rates are too slow. Others faint (syncope is the medical term) when the heart abruptly stops beating for a few seconds (Figure 5, see page 22). The procedure of implanting a pacemaker usually takes about 30 minutes and only requires a small 1-2 inch incision. Once reserved for only life-threatening conditions, pacemaker implantation may improve symptoms for many others who suffer from slow heart rhythms.

Continued on page 22

Figure 2

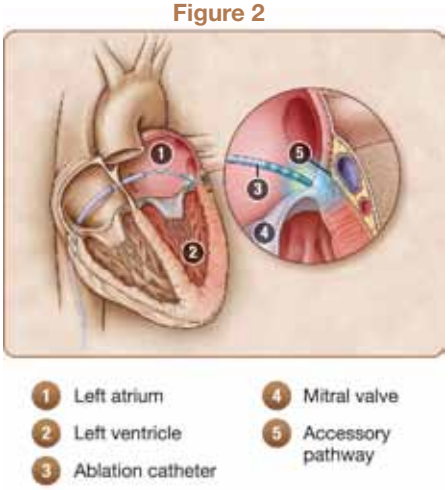
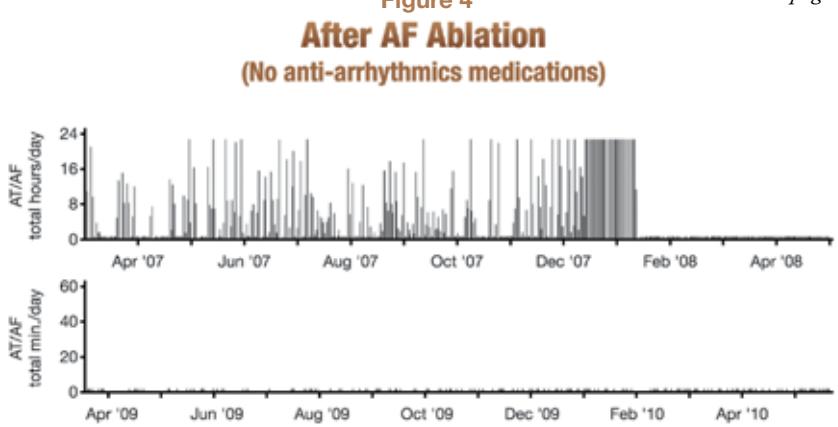


Figure 4



Vitamins and Cardiovascular Disease
Sorting it All Out

By Gregory D. Johnsen, MD, FACC, FSCAI

We know that vitamin deficiencies cause many types of illnesses. The value of high dose vitamin supplements is not completely understood.

In regards to heart disease and stroke, studies have shown that supplements of some vitamins do produce benefit, whereas no benefit has been seen with others.

So what vitamins should you consider taking for heart health?

Antioxidants
(Vitamins C, E, Beta Carotene)

Oxidation is thought to play an important role in the development of atherosclerosis (making blockages in the blood vessels in the body). In theory, taking an antioxidant vitamin such as vitamin E, vitamin C, or beta carotene could possibly reduce the progression or the development of atherosclerosis and reduce the risk of heart attacks and strokes. In the 1990s, several observational studies suggested that taking high doses of vitamin E was helpful for secondary prevention of coronary heart disease. However, prospective, secondary prevention trials were completed that showed vitamin E supplementation had no benefit in coronary heart disease risk. The Women's Antioxidant Cardiovascular study showed no benefit for women who took any of three antioxidants (vitamin E, vitamin C, or beta carotene) over 9 years in a secondary prevention trial. However, some researchers question whether the benefit of antioxidants is only in preventing the initiation of blockages and that they are not beneficial in regards to blockages already present. There have been some primary prevention trials that did not show protective benefit from taking vitamin antioxidants.

Atrial fibrillation is a very common arrthymia. which often occurs following cardiac surgery. Vitamin C (ascorbic acid) may be helpful in prevention of postoperative atrial fibrillation after cardiac surgery due to its antioxidant effects and reduction in inflammation and electrical remodeling. Two small studies have shown possible benefit. Overall, the benefit of taking antioxidants to prevent heart disease is not clear.

Folate and B-Vitamins

Elevated homocysteine levels in the blood have been shown to be associated with increased risk of heart attacks. It is known that homocysteine levels can be reduced with folate, vitamin B6, and vitamin B12 supplementation. Therefore, it would seem that, by taking folate and vitamin B6 and vitamin B12 for elevated homocysteine levels in the blood, heart attacks would be prevented. However, multiple studies have shown no reduction in heart events or stroke by using supplements with folate and B-vitamins. Some studies suggested possible harm from using high doses of folated and B-vitamin supplements. These studies suggested that folate supplementation may actually increase atherosclerotic disease progression by promotion of cellular proliferation of smooth muscle cells around the atherosclerotic plaque. High homocysteine levels may just be a marker for patients with advanced atherosclerosis. Thus, high doses of folate and B vitamin supplementation is not recommended for primary or secondary prevention for cardiovascular disease.

Figure 1

Low Vitamin D Levels are associated with increased risk of the following conditions:

- Coronary Artery Disease
- Heart Failure
- Atrial Fibrillation
- Peripheral Vascular Disease
- Stroke
- Ventricular Tachycardia
- High Blood Pressure

Vitamin D

Evidence is rapidly accumulating suggesting that vitamin D supplements are beneficial. An association between vitamin D deficiency and several cardiovascular diseases has been demonstrated. This includes: coronary artery disease, peripheral arterial disease, congestive heart failure, hypertension, diabetes mellitus, and metabolic syndrome. Cutaneous synthesis of vitamin D3 from sunlight exposure is the major source of vitamin D in humans (80% to 90%). Oily fish such as salmon, mackerel, herring and sardines, and fortified milk and juices are good sources of vitamin D in the diet. Serum 25 (OH) vitamin D is the major circulating metabolite of vitamin D resulting from both cutaneous synthesis from sun exposure and intake from the diet. A normal 25 (OH) vitamin D level is greater than or equal to 30ng/ml. Vitamin D insufficiency is present with 25 (OH) vitamin D levels of 21 to 29 ng/ml. Vitamin D deficiency is present with 25 (OH) vitamin D levels less than 20 ng/ml. Because of our lack of exposure to direct sunlight, vitamin D deficiency is very common, with 25-57% of U.S. adults having vitamin D deficiency. Risk factors for vitamin D deficiency include older age, dark skin color, institutionalized or homebound status, use of sunscreens, winter season, living further north, smoking, obesity, air pollution, and renal or liver disease. Malabsorbtion secondary to inflammatory bowel disease or celiac sprue can also lead to vitamin D deficiency.

A recent study analyzed medical records of 41,504 patients to determine the relation between vitamin D levels and cardiovascular disease, and cardiovascular disease risk factors. Vitamin D levels less than 30ng/ml were present in 63.6% of the patients. There was noted to be a strong inverse relationship between vitamin D levels and cardiovascular diseases including heart attacks, heart failure, stroke, high blood pressure, diabetes, and high cholesterol levels.

Vitamin D appears to be related to blood pressure control through several pathways. Several randomized studies have shown that vitamin D supplementation in patients with vitamin D levels less than 20 ng/ml resulted in statistically significant reductions in systolic blood pressure. Vitamin D deficiency is associated with the metabolic syndrome, a known risk factor for heart attacks and stroke. Vitamin D appears to be important in relation to diabetes mellitus. Vitamin D deficiency affects insulin secretion and peripheral tissue resistance to insulin. In patients with Type 2 Diabetes, replacing vitamin D improves insulin secretion and

Continued on page 22

How Not to Have a Heart Attack

By Wayne N. Leimbach, MD, FACC, FSCAI, FCCP, FAHA

Each year, more than a million Americans suffer a heart attack. The result is death in about one third of heart attacks. Heart attacks remain the number one cause of death not only for men, but also for women.

The amazing thing about these statistics is that most heart attacks are preventable. Having a heart attack is not a natural consequence of growing old. What causes most heart attacks is a build-up of blockage material (atherosclerotic plaque) in the walls of the blood vessels to the heart (Figure 1). This material narrows the lumen of blood vessels. This build-up can occur over months to years and in most people, it builds up slowly over years. What many people fail to realize is that the blockage material often starts to build up while they are young (during their 20s, 30s and 40s). The difference between a person who one day is feeling well and the next day having a heart attack, is that the covering of the blockage material ruptures and a blood clot forms on top of the ruptured area (Figures 1 and 2). If the blood vessel lumen is already too narrowed or the blood clot is too large for the lumen of the vessel, then the vessel becomes totally blocked and the heart muscle downstream from the occlusion becomes deprived of its blood supply and dies (Figures 1 and 4).

The reason heart attacks are preventable is as follows: If a person does not have the blockage material build up in the walls of their blood vessels to the heart, then the blockage material (plaque) can't rupture, the blood clot cannot form, the blood vessel can't become occluded, and the heart muscle will not die. So, if plaque is not made in the blood vessels to the heart, a heart attack would not occur.

So, how do you keep from making blockages (plaque) in the blood vessels to your heart?

There are six major factors that cause people to make blockages in the blood vessels to the heart. The good news is that all of these risk factors are treatable. These risk factors include: high blood pressure, high blood cholesterol and triglyceride levels (called lipids), diabetes (high blood sugar), smoking, lack of regular exercise, and increased inflammation in the body measured by a blood test called "hs-CRP". In today's world, these risk factors are all treatable by either lifestyle modification or by a combination of lifestyle modification with medications.

How powerful are the risk factors? A study called the INTERHEART Study evaluated the impact of these risk factors, plus three more. The three additional risk factors included lack of daily fruit and vegetable intake, depression, and alcohol consumption (a small amount of alcohol has a protective effect). The study followed 29,000 people for more than five years and found that 90% of heart attacks could be predicted just by these nine simple risk factors. The principal investigator, Dr. Salim Yusuf, emphasized that these are all modifiable risk factors. This study showed that high cholesterol levels were the strongest risk factor. In addition, smoking just 1-5 cigarettes a day increased the risk of heart attack by 38%.

Every adult should know their risk factors and treat them if they are abnormal. If your bad cholesterol (LDL-cholesterol) is greater than 130, you should consult with a doctor. If your resting blood pressures are frequently 140/90 or greater, you are carrying a higher risk for a heart attack and stroke. If your fasting blood sugar is greater than 100, you should be evaluated for diabetes. If your blood marker of inflammation (hs-CRP) is greater than 2, you are at increased risk of a heart attack. If you do not routinely exercise (as little as a 10 minute walk a day), you need to start. If you smoke, you need to stop. You also need to increase the amount of fruit and vegetables in your diet.

Amazingly, research shows that aggressively treating these few risk factors can decrease the risk of having a heart attack by almost 80%, so you do not have to die of a heart attack. For most people, the number one cause of death in the US is preventable. Just learn and treat your risk factors.

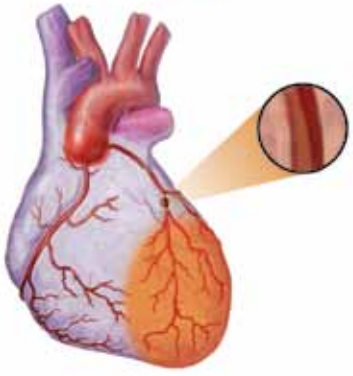
Wayne N. Leimbach, Jr. is an Oklahoma Heart interventional cardiologist specializing in cardiac catheterization, coronary angioplasty, percutaneous closure of PFOs & ASDs and related interventional procedures such as stents, atherectomy, laser, intravascular ultrasound imaging and direct PTCA for acute myocardial infarction.

Figure 1

Atherosclerosis: The Risk of High Cholesterol

1. Initially, as atherosclerotic plaque builds up in the artery, the vessel wall stretches to maintain the vessel lumen.
2. Eventually, as the plaque builds up, the vessel lumen narrows.
3. Plaque rupture exposes the blood to the plaque contents and promotes formation of a blood clot.
4. If the blood clot that forms on the ruptured plaque is large enough to occlude the vessel lumen, then a heart attack occurs.

Figure 2



A heart attack occurs when a blood vessel to the heart muscle becomes totally blocked causing the heart muscle downstream from the blockage to die.

Noninvasive Heart Imaging

Which Test is Best?

By Edward T. Martin, MD, FACC, FACP, FAHA

You present to your doctor's office with symptoms that sound heart related. Or your doctor hears a heart murmur. Suddenly you face the prospect of going through a heart imaging test. What does the test tell your doctor? What does the test entail? Is it the right test for you?

Technology continues to progress in medicine leading to improvement in the tests themselves as well as expanded indications. Therefore which test is best?

There are four major noninvasive heart imaging studies that you might undergo in the assessment of cardiovascular disease: Echocardiography, nuclear cardiac imaging, cardiovascular magnetic resonance imaging (CMR) and cardiac computed tomography (CT). The clinical indications, benefits and limitations of each are discussed below.

Echocardiography

An echocardiogram (echo) obtains images by utilizing sound waves. No radiation is used. A wand or transducer is placed on the chest and emits and receives sound waves that bounce off the intended anatomy and are processed to produce images. It is the same technique that is used on women during pregnancy. Echocardiography is relatively inexpensive, portable, and has good diagnostic imaging quality covering many different heart conditions (Table 1). In addition, because the technology is older, there is also a wealth of scientific studies that prove its usefulness in diagnosis, prognosis and outcomes that allow for risk stratification.

Echo is probably most useful in the assessment of heart valve disease, which can be detected as a heart murmur. It can provide information on stenosis and regurgitation of all 4 heart valves, valve morphology, prosthetic valve function, and valve infections.

Coronary artery disease patients can also be evaluated using stress echocardiography. It is accurate for identifying heart muscle at risk but can have limited sensitivity when compared with other stress tests such as nuclear imaging and cardiac MRI stress testing because of the way the test is acquired.

Table 1

Diagnostic Impact and Value of Non Invasive Heart Imaging Studies

	Echo-cardiography	Cardiac CT	Cardiac MRI	Nuclear Imaging
Heart Muscle Disorders (Structure & Function)	♥♥♥	♥♥	♥♥♥♥	♥♥
Heart Stress Testing (Blood Flow Assessment)	♥♥	♥	♥♥♥	♥♥♥♥
Heart Valve Diseases	♥♥♥♥	♥	♥♥♥	♥
Pericardial Disease (Sac Covering Heart)	♥♥♥	♥♥	♥♥♥	♡
Congenital Heart Disease	♥♥♥	♥♥	♥♥♥♥	♥
Heart Muscle Viability	♥♥	♡	♥♥♥♥	♥♥♥
Coronary Artery Imaging	♥	♥♥♥♥	♥♥	♡
Radiation	NO	YES	NO	YES
Cost	$	$$	$$$	$$$$

♡=Worst → ♥♥♥♥= Best
$=Less Expensive → $$$$= More Expensive

The technique is also very good at initially evaluating patients with congenital heart disease. Heart muscle disorders such as cardiomyopathies are easily evaluated by echo as well as pericardial disorders. The pericardium is the thin sac that covers the heart, which can fill with fluid causing a drop in blood pressure in its worst case. The thin sac can also become scarred and fibrotic, which can cause adherence to the heart muscle leading to severe and debilitating symptoms.

Despite its significant usefulness, echo can have significant limitations. Getting diagnostic images are dependent on a patient's body type and additional medical problems. Since image acquisition is based on sound waves getting to and from a transducer, larger people can pose imaging problems. Fat, muscle and bone can get between the transducer and the heart, thus limiting resolution. Also people with severe lung diseases can pose a resolution problem. Sometimes image resolution is so poor that additional imaging techniques or invasive testing is required.

Nuclear Cardiology Imaging

The predominant role for nuclear cardiology today is in the assessment of patients with known or suspected coronary artery disease. There is a wealth of scientific information detailing its diagnostic accuracy and prognostic ability. Nuclear cardiology studies use noninvasive techniques to assess myocardial blood flow, evaluate the pumping function of the heart as well as visualize the size and location of a heart attack (Table 1).

The decision about which test is best can depend on many factors.

The myocardial perfusion study is the predominant nuclear cardiology imaging technique, and it combines stress techniques (exercise or chemical) with the injection of a radioactive tracer agent in order to quantify blood flow in the heart muscle itself. A scanning device (gamma camera) is used to measure the uptake in the heart muscle and rotates around the patient while they lay on a table. If there is significant blockage of a coronary artery, the heart muscle in the supply territory of that artery will display limited uptake of the radiotracer during stress as compared to rest.

Another nuclear cardiology technique is radionuclide ventriculography. It is a noninvasive study, which provides information about the pumping function of the heart, the function of the valves of the heart, and the integrity of all the cardiac chambers. It can be used to monitor heart muscle function but gives no information on heart muscle morphology.

Nuclear cardiology tests do use radiation to obtain images and the test can be one of the most costly of all of the noninvasive imaging tests. In addition, the resolution can be limited in larger individuals as the radioactive signal may be attenuated.

Cardiovascular MRI

Cardiovascular MRI (CMR) is a noninvasive imaging test that obtains its images using a large magnet and not radiation. Images are acquired while a patient lies in the bore (tube) of the system. Its advantages over other imaging modalities are large fields of view, high resolution leading to high image quality and accurate images, and versatility. Its versatility is important in that CMR can be applied to many clinical scenarios (Table 1). Therefore, multiple clinical studies can be performed with only one imaging modality leading to improved patient convenience.

Cardiovascular MRI is extremely useful in the assessment of heart muscle function and disease states. Not only is CMR recognized as the gold standard in heart function but also it can often determine the etiology of dysfunction. Because of the high resolution, patients with heart failure and valvular heart disease can be followed longitudinally to monitor response to medical treatment and disease progression. Large fields of view and high resolution allow CMR to be an important diagnostic tool in patients with congenital heart disease and pericardial disease. These benefits may possibly eliminate the need for a riskier invasive procedure.

Cardiac MRI stress testing can be done using blood flow techniques (like nuclear cardiology) or wall motion techniques (like stress echo). CMR has proven more sensitive than either imaging modality in detecting ischemic heart muscle in scientific studies. However, because of the relative newness of CMR technology, outcomes studies are limited.

CMR is also regarded as the gold standard for determining viable or living heart muscle. This is important information that is needed prior to undergoing a percutaneous intervention procedure or heart bypass surgery because revascularizing these areas will lead to improvement in heart function.

Fortunately, all of these tests are available at Oklahoma Heart Institute.

Cardiovascular MRI is contraindicated in patients with certain implanted devices like pacemakers, insulin pumps and aneurysm clips and reduced image quality is seen in patients with certain heart rhythm abnormalities like atrial fibrillation. Patients who are claustrophobic may not be able to undergo CMR. Gadolinium contrast may also be needed for certain CMR imaging studies and this contrast agent needs to be used with caution in patients with severe kidney disease. Availability of CMR throughout the United States is also limited.

Cardiac CT

Cardiac computed tomography or cardiac CT is a noninvasive test that uses x-rays to look at the heart. During a cardiac CT scan, the patient lies in a doughnut-like structure while an x-ray machine moves around the body. Claustrophobia is usually not an issue. The machine will take a two-dimensional picture of each part of the heart and a computer puts the pictures together to make a three-dimensional image of the whole heart. The test usually involves the injection of an iodine-based contrast agent.

The cardiac CT is most commonly used to assess the coronary arteries noninvasively. It has limited use in other cardiac disease states (Table 1). Cardiac CT can be used initially to evaluate the risk for future coronary artery disease with a heart scan called a calcium score. This can be done with minimal radiation exposure. The most exciting and promising application for cardiac CT is the ability to noninvasively evaluate blockages in the coronary arteries. These are the arteries that can lead to a heart attack. This technique has a very high negative predictive value. This means that if, no blockages are seen, then none probably exist. On the other hand, cardiac CT has a low specificity, meaning that, if a blockage is seen, then it may or may not be as severe when reassessed with an invasive angiogram. This is especially true in areas of calcification. This makes it less useful in high-risk populations.

Additional limitations include limited prognostic data and the use of radiation to obtain images. The test requires close to normal kidney function and a low resting heart rate often achieved with pre-scan treatment with beta blocking medications

Which Test is Best?

As you can see, the decision about which test is best can depend on many factors such as appropriateness of the imaging modality for a given clinical indication, cost, and availability. You may have to choose among competing noninvasive imaging tests that can yield similar information, which, at times, can have comparable accuracy. In addition you must take into account local expertise in performance and interpretation of the test, insurance coverage and even patient preference. In the end, you and your doctor together can decide which test is best. Fortunately, all of the tests are available locally at Oklahoma Heart Institute.

Edward T. Martin is a noninvasive cardiologist at Oklahoma Heart Institute with specialty expertise in noninvasive imaging. Dr. Martin was a technical panel member for the American College of Cardiology (ACC) Appropriateness Criteria Panel for Cardiac Computed Tomography, Cardiac Magnetic Resonance Imaging and Echocardiography and is currently a member of the ACC Clinical Advisory Group on Strategies for Appropriate Use of Cardiovascular Imaging (SAUCI) as well as a member of the American College of Radiology (ACR) Expert Panel on Cardiac Imaging and the ACR Appropriateness Criteria Panel.

Longevity With Vitality
Benchmarks For Good Health

By Ralph J. Duda, Jr., MD

The US Department of Health and Human Services enacted the "Healthy People Initiative" in 1998 to define and begin documenting health habits of Americans by locale, ethnic origin, and age. While the Healthy People Initiative (HPI) represents an ongoing surveillance of 635 separate benchmarks, a recent analysis cites that only 18% of the benchmarks currently receive a favorable rating.

It is clear that well-established healthy living habits for our society are being unnoticed or ignored, leading many experts to predict unprecedented rates of diabetes, a reversal of the gains made in cardiovascular morbidity and mortality over the last few decades, and an increasing healthcare expenditure in decades to come. While state-of-the-art procedures and new pharmaceuticals can forestall death, they do not instill health. Health and vitality are contained within the context of disease prevention.

Six "primary" benchmarks will provide the greatest yields to "longevity and vitality." Those benchmarks involve salt restriction, smoking cessation, ideal body weight maintenance, copious fruit/vegetable consumption, daily exercise, and avoidance of diabetes.

Slow Down on Salt

Excessive salt consumption is directly linked to hypertension and life-threatening heart disease and stroke. In fact, it is estimated that reducing sodium consumption by a mere 1/2 teaspoon per day (1200 mg) could prevent stroke occurrence by 66,000 strokes annually.

Salt in the American diet largely originates from processed foods and snacks, the consumption of which has paralleled the rise in fast food and canned/microwaved meals. This year, the Institute of Medicine called on the US-FDA to begin an incremental imposition of salt restrictions for food and beverage manufacturers. While the FDA has yet to respond, some local city and state governments (i.e., New York City), reacting to failed voluntary programs, have now mandated restrictions of sodium on restaurant menu items. Inaction would result in fines and license probation. All in all, however, a significant elimination of processed foods, in favor of home-cooked meals replete with fruits and vegetables, would be sufficient in reducing salt consumption to less than the 2400 mg daily threshold and possibly allow achievement of what is considered by the Institute of Medicine as an adequate amount of salt, namely 1500 mg daily.

Put Down the Cigarettes

The rates of lung cancer, emphysema, heart disease and stroke are related to the percentage of Americans continuing to smoke cigarettes. Moreover, the failure to quit might not necessarily reflect a lack of willpower as much as it might indicate a genetic variance of the numbers of nicotine receptors contained in our individual brains. Chronic smokers need to embark upon multiple simultaneous actions and efforts to successfully discontinue tobacco habituation and improve their quality of life. Behavioral counseling, such as attendance to Smoke-Stoppers courses and online cites like, "BecomeAnEX.org", medications (Chantix and Zyban), nicotine tapering regimens (patches, lozenges) and displacement activities (gum chewing, Blue-tips) can all be employed in combination to achieve success. Today only 9% of Americans greater than 65 years of age continue to smoke. 23% of Americans ages 45-64 continue to smoke with HPI goals at 12%.

Shed Some Pounds

More than a third of Americans between ages 40 and 50 are obese (defined by a body mass index greater than 30). A healthy BMI is between 18.5-25.0 with an acceptable waist girth in men less than 36-38 inches and in women less than 31-33 inches. Paradoxically, worsening overweight/obesity rates are paralleling our attainment of knowledge about the hazards of obesity. Clearly, "knowing" what to do is not enough. A daily dedicated personal commitment to health and well-being, aligned with astute dietary awareness and exercise, are necessary to reverse the trend and maintain healthy weight. The display of nutritional information on all purchased foodstuffs and drinks, on menu items in restaurants, and on vending machine items is imperative in providing Americans informed choices. Today 27% of Americans are at ideal weight with goals of HPI at 60% or greater.

Consuming 5 portions of combined fruits and vegetables daily is thought to be beneficial in reversing cardiovascular disease. Presently, 38% of men and women achieve these food consumption guidelines. A plant-based paradigm of eating needs to supersede the "meat and

Continued on page 22

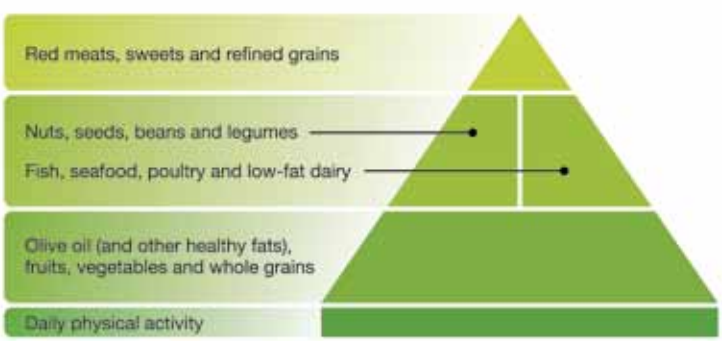
Figure 1

Characteristics of the Mediterranean Diet

- Generous amounts of fruits and vegetables, seasonally fresh and locally grown
- Higher in fat (within caloric limits), mostly from olive oil
- Rich in fiber from whole grain breads, cereals and beans
- Lower in sugar, fresh fruits are the typical daily dessert
- Low to moderate intake of dairy products with focus on cheese and yogurt
- Limited animal protein, especially from red meat
- Fatty fish on a regular basis, especially oily fishes high in omega-3 fatty acids
- Regular intake of small portions of nuts
- Lower dietary cholesterol intake with fewer than four eggs per week
- Regular consumption of low to moderate amounts of wine with meals (for those who drink alcohol)

Figure 2

Relative Consumption of Foods in the Mediterranean Diet



Wine may be consumed in moderation with meals.

Why Blood Pressure Matters

By Wayne N. Leimbach, MD, FACC, FSCAI, FCCP, FAHA

High blood pressure is the most common chronic disease in developed countries. High blood pressure (hypertension) affects one in three adult Americans. Just why does high blood pressure matter? Because of what it causes. The consequences of chronic high blood pressure include stroke, dementia, heart attacks, heart failure and kidney failure (Figure 1).

What is high blood pressure? Resting, sitting blood pressures of 140/90 mmHg or greater represents high blood pressure (See Figure 2 JNC 7 Guidelines), and they have been associated with 69% of first heart attacks, 74% of cases of heart failure and 77% of first strokes.

High blood pressure is such an important risk factor for heart attacks and strokes that even small reductions in blood pressure may result in large reductions in cardiovascular events, such as heart attacks and strokes. A large analysis of 61 large prospective studies involving over one million adults followed for 3 to 5 years or more showed that just a 2 mm decrease in the average systolic blood pressure (top blood pressure number) resulted in a 7% reduction in risk of death from heart attacks and a 10% reduction in risk of stroke death.

By analyzing the outcomes of over one million people based on their blood pressures, we have learned that each 20 mmHg rise in systolic blood pressure (top number) or 10 mm rise in the diastolic blood pressure (bottom number), starting from a blood pressure of 115/75, doubles the risk of death from heart attack or stroke.

The good news is that with lifestyle changes and, if needed, with medications, almost everyone's blood pressures can be normalized. The goal for most is to get the blood pressure less than 140/90 mmHg. For patients with diabetes, kidney disease, and coronary artery disease, the goal is a blood pressure of less than 130/80.

Therapy starts with reducing salt intake to less than 4000 mg a day of sodium (salt) a day and, ideally, less than 2000 mg a day. If decreasing salt intake and starting a simple exercise program does not normalize blood pressure, then a doctor should be seen about starting medications. Medications have improved so much over the past decades that most patients can have their blood pressures treated with medications that do not cause them to have any side effects.

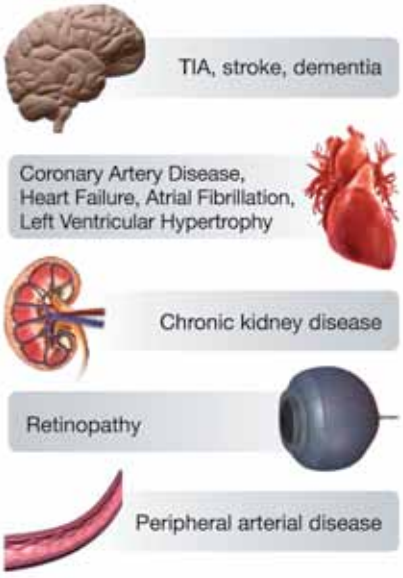
Treating high blood pressure substantially decreases the risk of heart attacks and strokes, which are the number 1 and number 3 causes of death in United States. This is why knowing your numbers matters.

Wayne N. Leimbach, Jr. is an Oklahoma Heart interventional cardiologist specializing in cardiac catheterization, coronary angioplasty, percutaneous closure of PFOs & ASDs and related interventional procedures such as stents, atherectomy, laser, intravascular ultrasound imaging and direct PTCA for acute myocardial infarction.

The good news is that with lifestyle changes and, if needed, with medications, almost everyone's blood pressures can be normalized.

Figure 1

Consequences of Hypertesion: Organ Damage



Chobanian AV et al, *JAMA* 2003; 289:2560-2572

Figure 2

Hypertesion JNC-7

BP Classification	Systolic BP	Diastolic BP
Normal	<120	<80
Pre-hypertension	120–139	80–89
Stage 1	140–159	90–99
Stage 2	>160	>100

Arrhythmias continued from page 15

Figure 5

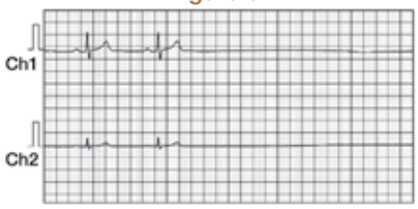
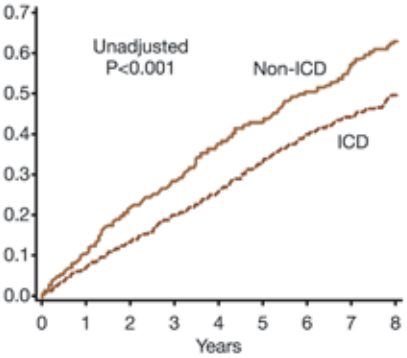


Figure 6

MADIT II: 8-Year Data

Patients at Risk – Cumulative Probability of Mortality



Goldenberg I, *Circulation, 2010; 122:1265*

Sudden Cardiac Arrest

Sudden Cardiac Arrest (SCA) remains the #1 cause of death in the United States. Often confused with a heart attack, SCA is a rhythm disorder in the bottom chambers of the heart (ventricles). When the ventricles beat too fast, blood cannot be effectively pumped to the vital organs (including the brain) resulting in death.

The last two decades have significantly changed the management of SCA and identification of those at risk. The implantable cardioverter-defibrillator (ICD) has been shown to dramatically reduce the risk of death in survivors of heart attack. In fact, long-term follow-up of the landmark MADIT II trial was published earlier this year. In the trial, ICDs provided a 34% reduction in mortality in patients with impaired heart function following a heart attack (Figure 6). For this reason, patients who have been told they have a weak heart muscle should be evaluated by a rhythm specialist for an ICD.

As you can see, arrhythmias can come in a variety of forms. Electrophysiologists are usually able to quickly identify and treat an assortment of rhythm disorders. This could involve ablation to treat an abnormal rhythm, pacemaker implantation for a slow heart rhythm or the life-saving benefits of an ICD.

David A. Sandler is a cardiologist with subspecialty expertise in electrophysiology, complex ablation, and atrial fibrillation management.

Vitamins continued from page 16

peripheral insulin sensitivity.

The present recommended daily dose of vitamin D is 400 IU. Because of lack of sun exposure, the recommended daily dose is probably not sufficient to achieve adequate serum concentration of vitamin D. Many experts now recommend a daily vitamin D dose of 1,000 to 2,000 units for most people, with higher doses of vitamin D (up to several doses of 50,000IU) initially for treatment of patients with vitamin D deficiency or insufficiency.

In conclusion, supplementation with antioxidant vitamins (vitamin C and vitamin E and beta carotene) have not shown benefit for either primary prevention or secondary prevention for cardiovascular disease. Vitamin C may have some benefit in prevention of postoperative atrial fibrillation after cardiac surgery. B vitamins and folate supplementation have not shown to be beneficial for either primary or secondary prevention of cardiovascular disease.

Low levels of vitamin D have been shown to be associated with several coronary risk factors and with coronary artery disease, peripheral arterial disease and congestive heart failure. Vitamin D supplementation has been shown to reduce blood pressures in many patients with difficult to control high blood pressure. Large, prospective, placebo controlled, randomized trials with adequate doses of vitamin D supplementation are needed to clarify the true role of vitamin D supplementation. A recently announced, prospective randomized trial plans to enroll 20,000 elderly patients to examine the benefits of vitamin D and omega-3 supplementation. In the meantime, it makes sense to check serum vitamin D levels and supplement with vitamin D as needed for vitamin D deficiency or vitamin D insufficiency.

Gregory D. Johnsen is an interventional cardiologist with expertise in cardiac catheterization, angioplasty and related interventional procedures, such as stents and atherectomy.

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Longevity continued from page 20

potatoes" mentality of old. The importance of eating breakfast is under-stressed in today's busy world. A "fruit and veggie" packet on the run needs to replace the "sausage and eggs burrito with hash browns" at the drive-thru.

How About a Little Exercise

The Centers for Disease Control recommends that middle-aged adults engage in moderately intense exercise 150 minutes per week, in addition to muscle-strengthening exercises (isometrics or weight lifting). More than a third of Americans do not exercise even 10 minutes a day. Besides the mental benefits of this commitment, exercise staves off diabetes, maintains muscle mass while eliminating visceral (waist) fat, improves self-esteem, libido, and energy, and enhances cardiovascular health and fitness.

Diabetics: Take Control

Finally, until the statistics on exercise and obesity improve, it is unlikely that the prevalence of diabetes and prediabetes will improve either. Diabetic patients need to take a steadfast control over their blood glucose levels; this involves weight loss and management, astute dietary restrictions of carbohydrate grams and calories, regular exercise, and compliance with prescribed medications and physician's visits. The data are clear and stark: early and aggressive management of diabetes saves eyesight, limbs, kidneys, and preserves longevity. If obesity trends continue, it is estimated that diabetes will double in the next 3-4 decades. Currently 24 million Americans have diabetes and another 57 million citizens have prediabetes, a constellation of clinical findings epidemiologically linked to insulin resistance and type 2 diabetes mellitus. These clinical markers include waist girth measurements in women greater than 35 inches and in men greater than 40 inches, a history of hypertension, fasting glucose greater than 100 mg/dL, fasting triglycerides greater than 150 mg/dL, and low HDL cholesterol less than 50 mg/dL in women and 40 mg/dL in men. Highest prevalence rates of diabetes reside among African-American, Native American and Hispanic groups. Diabetes self-management skills (glucose monitoring, Hgb A1c awareness, diet, exercise) are essential components of care in maintenance of health.

Bottom line? If you want to live longer and with greater vitality, aggressively addressing the 6 "primary" benchmarks will provide you the greatest yields.

Ralph J. Duda is a specialist in Endocrinology, Diabetes and Metabolism at Oklahoma Heart Institute, with expertise in diabetes, lipids, hypertension and thyroid diseases.

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1 Carotid Artery Evaluation

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2 Cardiac Function Evaluation

To analyze cardiac function and calculate your Ejection Fraction (the amount of blood your heart is able to pump), an ultrasound probe will be positioned at various locations on your chest. **15 minutes, $40**

3 Abdominal Aorta Evaluation

Most abdominal aneurysms are asymptomatic. They're the 10th leading cause of death in males over 55. To screen for aneurysm, an ultrasound probe is used to analyze your abdominal aorta. **15 minutes, $40**

4 Ankle/Brachial Index

Blood pressures are obtained from your legs and arms to screen for peripheral artery disease. It not only assesses circulation to the legs, but also is a marker of heart attack risk. **15 minutes, $40**

5 Cardiac Calcium Score

Coronary plaque can build up silently for years, and if untreated can cause blockages and heart attacks. This test measures the calcified plaque in the coronaries and is an indirect measure of the total amount of plaque in the coronaries. A multi-slice CT scanner takes a series of pictures of your heart in just a few seconds. **15 minutes, $99**

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