



**THE LEVEL OF AWARENESS** about cardiovascular disease (CVD) among women is still very low. Therefore, the American Heart Association (AHA) and several other organizations urge women to have their personal risk assessed.

# The Role of Ultrasound in Women's Heart Health

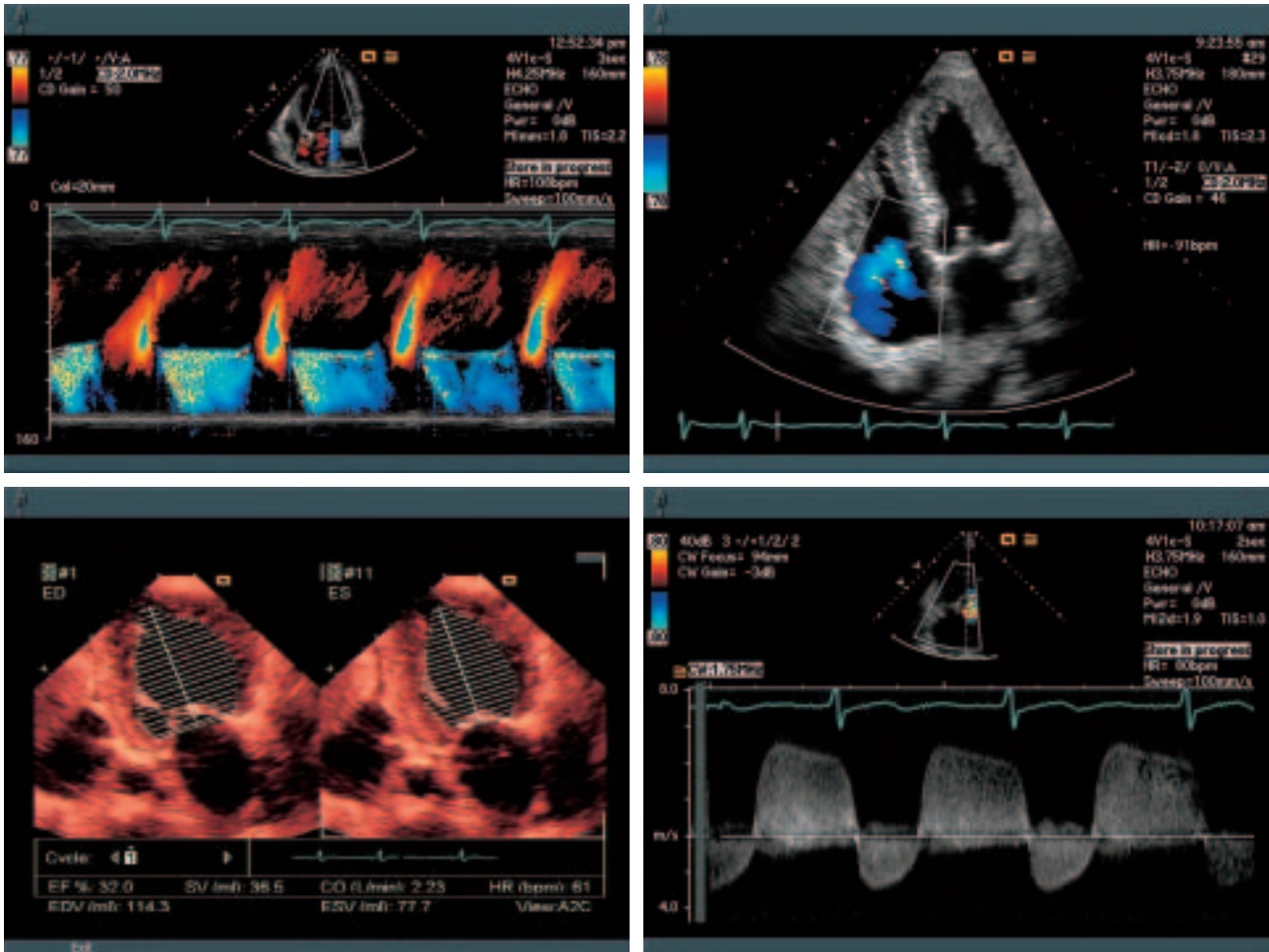
Symptoms for cardiovascular disease in women are usually different from those of men. This is why women are more likely to be treated only when they have had their second heart attack. Ultrasound imaging is an important diagnostic tool to improve cardiovascular risk prediction in women.

*By Amy Cook*

For women, heart disease is the number one killer, yet there persists a widespread misconception about heart disease. It is often thought to be primarily a disease of middle-aged men, and many women believe they are more at risk of breast cancer than of having a heart attack. According to the American Heart Association (AHA) and the Centers for Disease Control and Prevention, of the American women who die each year, 1 in 2.5 dies of heart disease, stroke, and other cardiovascular diseases (CVD), and 1 in 30 dies of breast cancer. In other words, more than 500 000 women die of CVD each year, which exceeds the number of CVD deaths in men and seven of the top 10 causes of death in women combined. Why then is a regular breast exam one of the mainstays of preventative health for women, while a

heart checkup is often little more than an afterthought?

Globally, heart disease and stroke kill approximately 17 million people annually, which is almost one-third of all deaths. By 2020, it is estimated that heart disease and stroke will become the leading causes of both death and disability worldwide. This, according to the World Health Organization (WHO), puts into perspective the severity of CVD. Additionally, the WHO reports that heart disease is under-detected in women worldwide, particularly in younger women. In developed countries, women are less likely to be referred to a heart specialist, hospitalized, or prescribed medicine and treatment. And women are less likely to be referred for stress exercise testing or echocardiography exams. As a result, a woman is more likely to enter the



IMAGES FROM THE ACUSON Sequoia system showing a color M-mode of left ventricular inflow tract, a color Doppler tricuspid regurgitation, an axis ejection fraction, and an aortic insufficiency and an aortic stenosis using CW Doppler (clockwise from upper left).

medical system with the diagnosis of a second heart attack, if she survives her first one. The primary prevention of cardiovascular heart disease, which includes coronary atherosclerotic disease, coronary artery disease, myocardial infarction, acute coronary syndromes and angina, has become a health-care priority. To redress this serious problem in the U.S., the AHA issued new guidelines in 2004 to help women prevent heart attacks and strokes. They urge women as young as age 20 to see their doctors to assess their risk of CVD, and to come up with prevention

strategies tailored to their personal level of risk. The WHO advises adherence to published guidelines for the prevention and control of heart disease and stroke, and calls for action to address the global epidemic of cardiovascular disease that is not only increasing, but also shifting from developed to developing nations. Research in the second half of the 20th century shows that cardiovascular disease can often be prevented, yet since 1990, more people have died from coronary heart disease, specifically coronary artery disease (CAD),

than from any other cause. And, unlike stroke, coronary artery disease is a comparative newcomer to the world stage of heart disease. While genetic factors play a part, 80 to 90 percent of people dying from CAD have one or more major risk factors that are influenced by lifestyle. In women, this is even more apparent. CAD occurs when the arteries that supply blood to the heart muscle (coronary arteries) become hardened and narrowed, which is the result of plaque buildup on the inner walls or lining of the arteries (atherosclerosis).

## Risk Factors in Women

Risk factors for cardiovascular disease are similar for men and women, but for women, tobacco use is more dangerous. For example, women who smoke only three to five cigarettes a day double their risk of heart attack, while men must smoke six to nine cigarettes a day to double their risk.

In addition, high blood triglycerides are an important cause of atherosclerosis in young women, but not in young men. Menopause has no direct effect, but hormone replacement therapy (HRT) increases the risk of cardiovascular disease.

According to Pamela S. Douglas, M.D., FASE, chief of Cardiology at Duke University Medical Center, Durham, NC, ultrasound and other imaging techniques that measure both anatomy and function provide well-validated surrogate markers for atherosclerosis, and may be useful in designing primary prevention strategies for this disease. Atherosclerosis is a systemic disease that involves most of the arteries in the body, so not only is it fatal, it is often silent and can cause death at its first manifestation. "Thus there is a compelling need to detect disease in individuals who are asymptomatic, with a goal of decreasing their long-term risk," says Dr. Douglas.

Primary risk reduction for atherosclerosis is effective; however, cost-effective risk modification has to rely on accurate and individualized risk-factors. "Traditional risk-factor-based assessment fails to account for the individual's progression," says Dr. Douglas. "Ultrasound, because it can measure both

anatomy and heart function, provides well-validated markers for atherosclerosis, offering additional information to the Framingham heart study score, for example," continues Dr. Douglas, noting that further research will document whether using ultrasound imaging for cardiovascular risk prediction is clinically effective and has a positive cost-benefit ratio.

Recently, AdvaMed, the world's largest association representing manufacturers of medical devices, diagnostic products, and medical information systems, reported that health-care providers must be aware of women's cardiovascular health and how it could greatly benefit from innovative medical technologies that are more routinely applied to men. Despite greater incidence of heart disease among women, the beneficiaries of many life-saving cardiac technologies are overwhelmingly men. The National Coalition for Women with Heart Disease reveals that women receive only 33 percent of angioplasties and stent placements, and only 28 percent of implantable cardioverter defibrillators.

This imbalance may be due in part to the fact that women have different symptoms from men when suffering a heart attack. In fact, the problem may even start with the women themselves, who often aren't aware of their risk from heart disease, and with their primary care physicians, who may not recognize it in their female patients.

## Symptoms Can Be Atypical

For women, most symptoms of heart disease are atypical. Women don't experience classic crushing chest pressure below the breastbone with a tingling down the left arm, accompanied by profuse sweating, shortness of breath, and lightheadedness. Instead, they may feel new episodes of fatigue, shortness of breath, insomnia, indigestion, and an anxious feeling. And, even if a doctor suspects that a woman's symptoms may be due to heart disease, making a definitive diagnosis can be more challenging than with a male patient.

According to Aasha Gopal, M.D., director, clinical echocardiography, associate professor



**AASHA GOPAL, M.D.**, often combines a stress test with an ultrasound exam to measure the thickness of the arterial walls and the pulsatility of vessels surrounding the heart.

of medicine at St. Francis Hospital in Roslyn, NY, “Women usually show signs of CAD about 10 years later than men do due to the age of menopause, but it does not mean that the severity of their CAD is any less than that of men. Additionally, for women the lipid profiles – the cholesterol level and how it is broken down in LDL, HDL, and triglycerides, all components of coronary risk factors – are different in men and women, which is something not everyone is aware of yet.”

The level of awareness among women and their primary care doctors can be low, therefore, not as many patients are referred to cardiologists when they should be. Additionally, women having heart problems are more likely than men to experience exhaustion or nausea, and frequently this leads to misdiagnosis. “For some women, a heart attack may feel more like indigestion

or the flu, and because women experience stress differently from men, they are often misdiagnosed due to their atypical symptoms,” says Dr. Gopal. “Women also tend to be at higher risk for and have poorer results from interventions such as percutaneous transluminal coronary angioplasty (PTCA) because women have smaller, technically more challenging coronary arteries and are older when they first seek medical attention.”

### Combining Stress Test with Ultrasound

In some cases, symptoms of heart disease, such as tightness in the chest, only occur during exercise. Doctors will often perform stress tests on men, putting them on the treadmill to help gauge how much the arteries have narrowed, but a woman’s breast tissue can often interfere with the results. Dr. Gopal says doctors need to



**I** **ULTRASOUND MEASURES** both anatomy and heart function, providing well validated markers for arteriosclerosis.

go beyond routine treadmill testing when examining women patients. She often combines a stress test with an ultrasound exam using the ACUSON Sequoia™ echocardiography system with patient-specific imaging technology to measure precisely the thickness of the arterial walls, as well as the pulsatility of the vessels surrounding the heart. For example, imaging the wall thickness of the carotid artery can be used as a surrogate marker for the thickness and the disease process that is taking place in other arteries of the body leading to the heart.

"I think echocardiography is much better suited for women, because of breast attenuation artifacts resulting from the presence of subcutaneous fat and breast tissue that overlie the heart," says Dr. Gopal. "Especially with the latest improvements in image resolution and the ability to penetrate

through large body mass, ultrasound really is an excellent choice for evaluating women. Additionally, it is non-invasive, safe, and highly accessible to the population at large," continues Dr. Gopal.

Along with the AHA and the American College of Cardiology (ACC), both Drs. Douglas and Gopal urge all women to follow the new AHA guidelines beginning in early adulthood to get risk assessments.

### Prevention

The AHA and other organizations urge primary care physicians as well as ob/gyns to make heart disease risk assessment part of routine checkups for women, and suggest that routine echocardiography ultrasound would help identify risk factors earlier and more accurately. "If you are a woman of middle age, and you have one or more coronary risk factors, you need to

visit your internist," says Dr. Gopal. "Women need to be aggressive and follow up with their physicians on routine findings like ECG abnormalities, findings of a murmur during a physical examination, irregular rhythms of the heart, or even skipped beats. All of these could be symptoms that something is wrong." Gopal adds that, in terms of prevention, it is also very important to maintain the proper body mass index (BMI). Additionally, she says that "having a family history of early heart disease increases a person's risk, and lack of exercise, smoking, high blood pressure, diabetes, obesity, and having an apple-shaped body (thick through the middle), rather than a pear shape (thick around the hips), also increases risk."

The new guidelines from the AHA recommend that women get an evaluation of their heart health using the Framingham Risk Score, a composite score derived from the person's age, total cholesterol, HDL, smoking vs. non-smoking, and systolic blood pressure. These results formulate the chances for an individual to have a heart attack or stroke over the next 10 years. Results indicate that a score of 20 percent is considered high risk, 10 to 20 percent is considered an intermediate risk, and below 10 percent is viewed as low risk of heart disease.

## Heart Risk and Menopause

The AHA guidelines also call for a reevaluation of the science behind heart disease prevention in the aftermath of two recent major studies that found a widely used hormone replacement therapy not only failed to protect women's hearts, but also may have harmful consequences.

"Until those results, many doctors believed that taking HRT to relieve symptoms of menopause essentially took care of the heart risk at the same time," says Dr. Gopal. "Numerous epidemiological studies and the fact that heart disease doesn't routinely develop in women until after menopause led to the belief that estrogen protects against heart disease. While the protective effects of estrogen are widely believed to be true, the specific forms in which artificial

estrogens are administered in HRT have not been shown to be beneficial, and indeed may be harmful in some cases. Therefore, HRT is not recommended for women solely for the prevention of cardiovascular disease," continues Gopal. Smoking promotes CVD through several mechanisms. It damages the endothelium lining of the blood vessels, increases cholesterol plaques (fatty deposits in the arteries), increases clotting, raises LDL cholesterol levels and lowers HDL, and promotes coronary artery spasm. Nicotine accelerates the heart rate and raises blood pressure. Second hand smoke also plays a serious role in impairing normal blood flow to the heart.

## Research

A Japanese study, which appeared in the *Journal of the American Medical Association* (JAMA, July 25, 2001 – Vol. 286, No. 4), examined the effects of spending 30 minutes in a hospital's smoking room on 15 non-smokers and 15 smokers. The smokers, whose arteries already showed damage, were not affected, but in nonsmokers, the result was a reduced ability of heart arteries to dilate, which previous research has suggested may be a precursor to hardening of the arteries. This change may be one reason why passive smoking is a risk factor for CVD. In the study, physicians from Osaka City University Medical School and colleagues used blood pressure tests and the ACUSON Sequoia echocardiography system to examine the effect on heart arteries' ability to dilate.

In the 2004 issue of the *Journal of the American Society of Echocardiography* (doi: 10.1016/j.echo.2004.03), seven studies were published on the newer applications of cardiovascular ultrasound directly related to atherosclerosis, and the authors' attempt to take the lead in early disease detection using non-invasive imaging for assessing brachial reactivity, carotid intima-media thickness measurement, arterial age, and coronary flow reserve. The studies were performed using ACUSON Sequoia echocardiography systems. Most recently, the February issue of *Circulation* (February 2005 – 111: 682–696)

includes a scientific consensus statement from the AHA focusing on the underrecognition and underdiagnosis of CAD as contributory to high mortality rates in women. The statement notes that timely and accurate diagnosis can significantly reduce CAD mortality for women, once the diagnosis is made. The statement provides a synopsis of available evidence on the role of exercise ECG and cardiac imaging modalities, including echocardiography, that may add clinical value to the diagnosis and risk assessment of the symptomatic and asymptomatic woman with suspected CAD. A summary of the results regarding the role of stress echocardiography with exercise or dobutamine proves it is an effective and highly accurate non-invasive means of detecting ischemic heart disease and risk-stratifying symptomatic women with an intermediate to high pretest likelihood of CAD.

To date, research data suggests that women do benefit from commonly used non-invasive cardiac tests such as ultrasound. This, coupled with the efforts worldwide to raise awareness of heart disease, means women can take steps to better understand their own health risks and experts can take advantage of innovative, non-invasive medical technologies to help increase the recognition and diagnoses of this deadly disease in women.

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## Biography of Dr. Aasha Gopal

Dr. Aasha Gopal is the director of clinical echocardiography at St. Francis Hospital's Heart Center in Roslyn, New York, and associate professor of medicine at the Stony Brook University of New York.

She has been involved in echocardiography research for close to 15 years, has published more than 100 journal articles, and has written several book chapters.

Dr. Gopal has been principal investigator in over 25 clinical trials and has been the recipient of grants from the American Heart Association, the Empire Clinical Investigator Research Program, as well as from corporate sources.

She has lectured widely and has been recognized with several academic and professional honors, including the honor of investigator of the American Heart Association, New York City affiliate. She is a fellow of the American College of Cardiology, the American Heart Association, and the American Society of Echocardiography, and is a member of the Society of Cardiovascular Magnetic Resonance, as well as the American College of Physicians.

Dr. Gopal was born in Trivandrum, India.