# Mental Stress as a Predictor of Atrial Fibrillation

Natasha Hu

*Atrial fibrillation (AF), a heart rhythm disorder characterized by irregular, fluttering contractions of the atria, causes about 15 percent of the strokes every year in the United States. Therefore, aggressively treating atrial fibrillation and its underlying causes is a crucial step towards preventing strokes. In recent years, anger and hostility have been suspected to have a direct correlation to the development of atrial fibrillation. One study found that these personality traits to be significant predictors of AF. Animal studies on stress and arrhythmias also agree with these findings.*

SINCE 1900, HEART DISEASE HAS REMAINED the number-one cause of death in the United States.[1] The success of heart disease prevention requires that it be put into effect at an early stage, an improbable feat due to the undetectable nature of early heart disease. Therefore, it is important to find the triggers of heart disease to prevent large numbers of deaths.

In the field of psychosomatic medicine, personality characteristics that cause social stress have been long suspected, tested, and finally widely acknowledged to have a definite association with heart complications such as coronary heart disease (CHD), which causes the heart's arteries narrow drastically. Only in the past few years, personality traits such as anger and hostility have been suspected to have a direct correlation with a heart problem called atrial fibrillation.

Atrial fibrillation (AF) is a heart condition characterized by irregular, fluttering contractions of the atria, the upper chambers of the heart. During AF, the atria, which normally contract about sixty to eighty times per minute, contract a whopping 400 to 600 beats per minute. This condition causes the heart to work harder, pumps blood inefficiently, and increases the risk of heart disease and stroke. A stroke can occur when fluttering contractions cause blood to remain in the heart and form clots that travel to the brain. The National Center for Chronic Disease Prevention reports that over the last two decades, AF mortality has more than doubled in the United States; discovering its possible causes has become imperative. Although most cases of AF are a benign arrhythmia or abnormal rhythm of the heart, AF still causes about 70,000 strokes every year.[1] This paper explores the biological consequences of psychological stress and the possibility that it is a predictor of AF.

The possibility that anger and hostility, a form of stress, cause AF is based on the fact that psychological factors can influence health. How exactly can the mind override matter? This has been proven on many accounts, specifically with CHD. Hostility, anger, impatience, and a competitive drive are common components of what is labeled Type A personality; people with Type B personality have an opposite easy-going attitude. A project called the Western Col-laborative Group Study interviewed 3,154 men ranging from 39 to 59 years old and labeled them either as having type A or type B personalities.[2] Those with Type A behavior were twice as likely to develop CHD. Type A men between the ages of 39 to 49 developed heart disease six times more frequently than men with Type B personality. The results of this study are positively striking without any knowledge about the effects of mental stress on the body.

When a person feels stress—or a disagreeable state of arousal—the body's sympathetic nervous system, which is composed of involuntary nerves that prepare glands and muscles for defense, activates. Specifically, the adrenal gland secretes epinephrine (a.k.a. adrenaline) and norepinephrine, which cause the heartbeat to accel-

erate, muscle tension to increase, blood pressure to rise, and blood sugar to rise, as well as a number of other defensive responses. At the same time, the hypothalamus and pituitary gland are both working to secrete another hormone that releases free fatty acids into the bloodstream. Through this process, the body is preparing itself to use more energy to either fight or run away. However, the price to pay for these stressful moments is costly: Frequent occurrences of high blood pressure risk damaging arteries, and fatty acids floating through the bloodstream cause a plaque lining to build up slowly but surely. As one can see, excessive stress can increase the risk of heart diseases such as hypertension (high blood pressure) and CHD.

The first human study on the correlation between anger, hostility, and Type A behavior and the development of AF was undertaken in 2004 to explore AF's risk of causing stroke. Scientists thoroughly analyzed 3,873 male and female subjects with a mean age of 48.5, who were monitored for CHD, AF, and total mortality for ten years. Increased trait-anger—the tendency to perceive situations as anger-provoking and respond with expressions of anger—hostility, and symptoms of anger were found to be significant predictors to the development of AF in men, as was trait-anger in women. The probability of developing AF was 30 percent higher in men who had scored high on the standard test for hostility and anger given to them at the start of the study.[3] Overall, this study also supports the idea that there is a greater risk of AF in men than women.[4]

Although the 2004 study is so far the only one done on humans, its results agree with animal studies. One 1998 experiment studied stress-induced rats and their vulnerability to any type of heart arrhythmias.[5] The researchers advanced the hypothesis that there are direct correlations between the concentration of norepinephrine, heart rate, and arrhythmia responses. This is because the increase of norepinephrine and heart rate are symptoms of stress response. The rats that experienced short intervals of social stress caused by being in another rat's territory showed high norepinephrine levels and occurrences of rhythm disturbances. Of the two types of rats used, wild-type and Wistar rats, the latter strain seemed to have a greater parasympathetic counteractivity to sympathetic nervous system responses.[5] The parasympathetic nervous system is responsible for calming the body in an attempt to conserve energy.

The difference in vulnerability to social stress between the two strains of rats is an important observation. Monitoring those differences in a future experiment could help discover how stress causes AF on a molecular level. Another significant detail that can be learned from the 2004 human anger and hostility study can also be considered for further study: While the connection between mental stress and AF is evident, it is not yet clearly understood. Continued research can lead to treatments for intermediate complications of stress that may cause AF.

### Sources


1 National Center for Chronic Disease Prevention and Health Promotion. "Atrial Fibrillation Fact Sheet." January 11, 2005. <http://www.cdc.gov /cvh/library/fs_atrial_fibrillation.htm> (March 3, 2005).

2 Barlow, David H. and V. Mark Durand. "Physical Disorders and Health Psychology." In: *Abnormal Psychology An Integrated Approach*. Belmont: Thomson Wadsworth, 2005. Pages 303-335.

3 Eaker, D.E., L.M. Sullivan, M. Kelly-Hayes, R.B. D'Agostino, and E.J. Benjamin. "Anger and hostility predict the development of atrial fibrillation in men in the Framingham Offspring Study." *Circulation* 109 (2004): 1267-1271.

4 Electrophysiology Division of Cardiology Department of Medicine. "What Are the Risk Factors for Atrial Fibrillation?" 2004. <http://cardiology.ucsf.edu/ep/afibnyou/risk.html> (March 3, 2005).

5 Sgoifo, A., S.F. De Boer, B. Buwalda, G. Korte-Bouws, J. Tuma, B. Bohus, J. Zaagsma, J.M. Koolhaas. "Vulnerability to arrhythmias during social stress in rates with different sympathovagal balance." *American Journal of Physiology* 275 (2 part 2, August 1998): H460-H466.