Can chaos theory help predict heart attacks?

July 21 2010

Chaos models may someday help model cardiac arrhythmias -- abnormal electrical rhythms of the heart, say researchers in the journal *CHAOS,* which is published by the American Institute of Physics.

In recent years, medical research has drawn more attention to chaos in cardiac dynamics. Although chaos marks the disorder of a dynamical system, locating the origin of chaos and watching it develop might allow researchers to predict, and maybe even counteract, certain outcomes.

An important example is the chaotic behavior of ventricular fibrillation, a severely abnormal heart rhythm that is often life-threatening. One study found chaos in two and three dimensions in the breakup of spiral and scroll waves, thought to be precursors of cardiac fibrillation. Another study found that one type of heartbeat irregularity, a sudden response of the heart to rapid beating called "spatially discordant alternans," leads to chaotic behavior and thus is a possible predictor of a fatal heart attack.

Mathematicians Shu Dai at Ohio State University and David Schaeffer at Duke University have built on this work to find another chaotic solution to an equation for alternans along a one-dimensional fiber of cardiac tissue with stimuli applied at one end. Assigning extreme parameter values to the model, the team was able to find chaotic behavior in space over time. The resulting chaos may have a unique origin, which has not yet been identified.

More information: The article, "Chaos for cardiac arrhythmias