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Analysis of Cardiac Health Using Chaotic Theory

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Abstract : The prevalent knowledge of the biological systems is based on the standard scientific perception of natural equilibrium, determination and predictability. Recently, a rethinking of concepts was presented and a new scientific perspective emerged that involves complexity theory with deterministic chaos theory, nonlinear dynamics and theory of fractals. The unpredictability of the chaotic processes probably would change our understanding of diseases and their management. The mathematical definition of chaos is defined by deterministic behavior with irregular patterns that obey mathematical equations which are critically dependent on initial conditions. The chaos theory is the branch of sciences with an interest in nonlinear dynamics, fractals, bifurcations, periodic oscillations and complexity. Recently, the biomedical interest for this scientific field made these mathematical concepts available to medical researchers and practitioners. Any biological network system is considered to have a nominal state, which is recognized as a homeostatic state. In reality, the different physiological systems are not under normal conditions in a stable state of homeostatic balance, but they are in a dynamically stable state with a chaotic behavior and complexity. Biological systems like heart rhythm and brain electrical activity are dynamical systems that can be classified as chaotic systems with sensitive dependence on initial conditions. In biological systems, the state of a disease is characterized by a loss of the complexity and chaotic behavior, and by the presence of pathological periodicity and regulatory behavior. The failure or the collapse of nonlinear dynamics is an indication of disease rather than a characteristic of health.

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