Time to Failure: A Stochastic Model of the Formation and Development of Abdominal Aortic Aneurysms

Jeremy Brooks

28 July 2009

Abstract

Abdominal aortic aneurysms are occuring more frequently in today's older population. This paper presents a mathematical model that describes the progression of abdominal aortic aneurysms. The model examines the interaction between four key species - collagen, elastin, smooth muscle cells, and inflammatory markers - involved in the disease. The stochastic model simulates the disease moving through a section of the arterial wall until the aorta reaches a critical point at which it can no longer withstand the hemodynamic pressures placed on it by the heart and consequently ruptures. The results give the mean and standard deviation of the time it takes for the aorta to reach the critical point of rupture. More importantly, the results show that a model of this type could be used to give cardiologists a better time frame for when varying types of intervention should be taken.