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Growth of Necrotic Cores in Vulnerable Plaque PAK-WING FOK, Mathematical Sciences — Plaques are fatty deposits that grow mainly in arteries and develop as a result of a chronic inflammatory response. Plaques are called *vulnerable* when they are prone to mechanical rupture. Vulnerable Plaques (VPs) are characterized by lipid-rich, necrotic cores that are heavily infiltrated with macrophages. The rupture of VPs releases thrombogenic agents into the bloodstream, usually resulting in myocardial infarctions. We propose a quantitative model to predict the development of a plaque's necrotic core. By solving coupled reaction-diffusion equations for macrophages and dead cells, we explore the joint effects of hypoxic cell death and chemo-attraction to Ox-LDL, a molecule that is strongly linked to atherosclerosis. Our model predicts cores that have approximately the right size and shape. Normal mode analysis and subsequent calculation of the smallest eigenvalues allow us to compute the times required for the system to reach its steady state. This study allows us to make quantitative predictions for how quickly vulnerable plaques develop and how their growth depends on system parameters such as chemotactic coefficients and cell death rates.

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