An anatomically detailed arterial network (ADAN) model for computational hemodynamics

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Hemodynamics is strongly associated with the first two leading causes of death in the world. Provided that the onset and progress of cardiovascular diseases are difficult to understand and predict, computational blood flow models allow us to gain insight on the causal chain while pursuing a rational mechanistic approach. The model presented here introduces an ultimate description of the arterial network on top of which anatomical data, physiological knowledge, physical principles and scientific computing are assembled to deliver a genuine and complete assessment of arterial blood flow in the human body. The model features 1598 named arterial vessels, taking into account most of the standard collateral pathways, and 544 perforator arteries which supply blood to 28 organs and 116 distributed vascular territories. Here we present extremely detailed blood flow simulations to evaluate the model in a healthy state as well as under pathological conditions of medical interest. Model predictions in different cardiovascular scenarios are discussed on the light of the domain knowledge. Finally, potential areas of research in the field and future directions are summarized.