The effect of geometric shape of heart on cardiac electric propagation

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The intrinsic properties of myocardial tissues change the cardiac electric propagation such as the duration and the speed of the cardiac excitation. Ion channel reactions at cellular level determine how fast the cardiac wave travels and how long is the interval between depolarization and repolarisation. Whether cardiac waves, for example, pass through periodic arrays of ablation marks mainly depends on these properties of myocardial tissues such as the excitability and conductivity.

However, are there any exterior factors other than the state of myocardial tissue that change cardiac excitation propagation? For example, what is the influence of the geometric shape of atrium and ventricle at the organ level? Or does the unique geometric structure have any influence on the propagation of the spread of cardiac waves?

Recent mathematical and computational models reveal the relationship between the geometry and cardiac electrical propagation in the hope of providing biological and clinical insight. Not only the mathematical analysis of geometric effects, but also several illustrative examples such as the cardiac wave propagation around pulmonary vein (Fig) will be presented to demonstrate the validation of mathematical theories and to increase the understanding through visualization.