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Computational simulation of guidewire motion in a blood vessel[1]

WANHO LEE, National Institute for Mathematical Sciences — The guidewire is made of a thin stainless-steel wire, inserted into the human body and moved through the blood vessel, and is an essential tool for the treatment and diagnosis of vascular diseases. In this study, Kirchhoff rod theory is applied to develop a guidewire model as an elastic rod, and to simulate moving within a given blood vessel. Particularly, the inherent characteristics (shape, strength, torque, and elasticity) of the guidewire are applied to the model, and the reaction of the guidewire to the axial movement and rotation of the operation portion is simulated. The blood vessel is presented with single branch, and the movement of guidewire along the shape of the vessel is examined. It will be also discussed the tip shape of the guidewire that must be selected to navigate to the desired path. The development of guidewire simulations can provide a safe environment for practitioners to practice as often as necessary while avoiding bioethics issues. In addition, it is possible to find an optimal pathways and controls for moving the guidewire to the clinical target with minimal stress on the environments within the vessel.

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