Numerical modeling of electrode with saline irrigation for radiofrequency cardiac ablation Jin-Woo Ahn,Kang-Moo Lee, Seung-A Lee, Ha-Chul Jung, Young-Jin Kim.
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ABSTRACT

We numerically investigated the heat transfer of the temperature-controlled ablation electrode to eliminate cardiac tissue caused by arrhythmias. The purpose of study is set up the numerical modeling of the temperature-controlled ablation electrode including the flow problem about the blood circulation and the saline irrigation flow.

The problem we wish to solve is the temperature distribution of cardiac tissue, electrode and blood when the saline is injected through the electrode including 6 irrigation holes. The model is based on coupled electric-thermal-flow problems. In the properties of the materials, the electrical and thermal conductivity of cardiac tissue are temperature-dependent function. We consider a temperature-control ablation on the electrode tip. To control the temperature of the electrode tip, the model is implemented standard proportional-integral(PI) control system by setting the probe of temperature at the electrode tip. In the flow problem, the inlet velocity boundary condition is applied on the left surface to impose a blood flow 0.1 m/s. In the thermal boundary conditions, the temperature of the outer surface is constant 37℃. And the temperature of the saline injected through the electrode and catheter body is constant 20℃ at the entrance of catheter body.

The results of the numerical models show that the thermal lesion of parallel position, respect to the cardiac tissue surface, is larger than the thermal lesion of perpendicular position. The temperature of electrode tip with the saline irrigation is reduced for several seconds due to convective heat transfer between electrode and saline irrigation.

*Please provide 5 key words in alphabetical order separated with semicolons, not included in the title.

Keywords: arrhythmias; multiphysics; radiofrequency ablation; saline irrigation; finite element analysis;