

A radiofrequency hot balloon catheter for the treatment of atrial fibrillation

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Background

Atrial fibrillation (AF) is the most common serious abnormal heart rhythm with an increased risk of heart failure, cerebral infarction and dementia. For the treatment of drug-resistant AF, radiofrequency (RF) ablation using a large tip electrode catheter is used for isolation of pulmonary vein (PV) and superior vena cava (SVC) which are main origins of AF. However, it was sometimes complicated by thromboembolism and perforation. Therefore, we developed a noble RF hot balloon catheter (RBC) with an agitation system for uniformly heating target tissues without complication

Methods and Results

An elastic and compliant balloon (inflated diameter: 20-33mm) was set up at the distal end of a catheter shaft. Inside the balloon, a coil electrode for delivery of RF energy (1.8 MHz) and a thermal sensor for monitoring the coil electrode temperature were installed. The balloon and the shaft were filled of contrast medium mixed with saline, and vibratory waves were supplied through the transmission lumen of the catheter shaft into the balloon to agitate the balloon fluid, using a vibration generator. We studied the temperature disparity around the balloon during RF delivery for keeping the balloon center temperature from 70 degrees Celsius, in the bath with constant temperature of 37 degrees Celsius. Without an agitation system, there was a marked disparity of the temperature between the upper and the lower of the balloon, but under functioning of an agitation system, there was no significant disparity of the temperature around the balloon. Then, in 8 porcine hearts under general anesthesia and artificial ventilation, we tried to isolate the superior vena cava (SVC) and pulmonary vein (PV) using RBC keeping the temperature of the balloon center, at 70 degrees C for 3-5 minutes respectively. Isolation of SVC and PVs could be performed by one application of RF energy in all of 8 pigs. The histological study by Azan

staining after ablation procedure showed circumferential transmural necrosis around SVC and PVs without complications such as thrombus formation or collateral damage.

Conclusion

RBC with an agitation system can safely perform isolation of SVC and PV and be a useful device for the treatment of Af.

Key words

Radiofrequency ablation, balloon catheter, agitation device, temperature disparity