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Original Article

Novel Contact Force Sensor Incorporated in Irrigated Radiofrequency Ablation Catheter Predicts Lesion Size and Incidence of Steam Pop and Thrombus

Katsuaki Yokoyama¹; Hiroshi Nakagawa^{1,5};
Dipen C. Shah²; Hendrik Lambert³; Giovanni Leo³;
Nicolas Aeby³; Atsushi Ikeda¹; Jan V. Pitha⁴;
Tushar Sharma¹; Ralph Lazzara¹ and
Warren M. Jackman¹

¹ University of Oklahoma and Veterans Administration Medical Center, Oklahoma City, OK;

² Hospital Cantonal De Geneve, Geneva, Switzerland;

³ Endosense, Geneva, Switzerland;

⁴ Heart Rhythm Institute, Department of Medicine and Pathology, Oklahoma City, OK

⁵ E-mail: hiroshi-nakagawa@ouhsc.edu

Background—An open-irrigated radiofrequency (RF) ablation catheter was developed to measure contact

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force (CF). Three optical fibers measure micro-deformation of the catheter tip. The purpose of this study was to: 1) validate the accuracy of CF sensor (bench test); and 2) determine the relationship between CF and tissue temperatures, lesion size, steam pop and thrombus during RF ablation using a canine thigh muscle preparation.

Methods and Results—CF sensor (CFS) measurements (total 1409) from two catheters in 3 angles (perpendicular, parallel and 45degrees) were compared to a certified balance (range 0-50grams). CFS measurements correlated highly ($R^2 \geq 0.988$, mean error ≤ 1.0 gram). In 10 anesthetized dogs, a skin cradle over the thigh muscle was superfused with heparinized blood at 37°C. A 7F catheter with 3.5mm saline irrigated electrode and CFS(Endosense) was held perpendicular to the muscle at CF of 2, 10, 20, 30 and 40grams. RF was delivered (n=100) for 60sec at 30W or 50W (irrigation 17 or 30ml/min). Tissue temperature (3mm and 7mm depths), lesion size, thrombus and steam pop increased significantly with increasing CF at each RF power. Lesion size was greater with applications of lower power(30W) and greater CF (30-40grams) than at high power (50W) with lower CF (2-10grams).

Conclusions—This novel ablation catheter, which accurately measures CF, confirmed CF is a major determinant of RF lesion size. Steam pop and thrombus incidence also increases with CF. CFS in an open-irrigated ablation catheter may optimize the selection of RF power and application time to maximize lesion formation and reduce the risk of steam pop and thrombus.

Key Words: catheter ablation • fibrillation • tachyarrhythmias • radiofrequency • ventricular tachycardia

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