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Novel Radiofrequency Ablation Catheter with Contact Force Sensor Predicts Lesion Size and Incidence of Steam Pop in Canine Model

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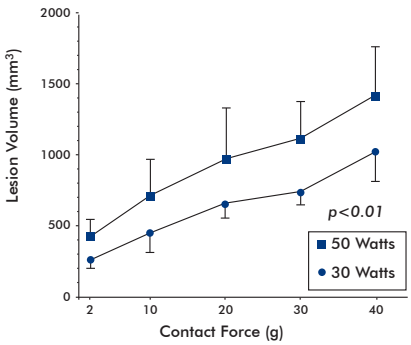
Introduction: Radiofrequency ablation catheter has been developed to measure real-time contact force. Three optical fibers measure micro- deformation of the catheter tip. Contact force is calculated every 100 ms from the strain on the 3 fibers (sensitivity <1 g). The purpose of this study was to determine the relationship between contact force, lesion size and incidence of steam pop using a canine thigh muscle preparation.

Methods: In 6 anesthetized dogs, the skin over the thigh muscle was incised and raised to form a cradle which was superfused with heparinized blood at 37°C. A 7F catheter with 3.5mm saline irrigated electrode and contact sensor (Endosense) was held perpendicular to the muscle. Catheter-tissue contact force was applied at 2, 10, 20, 30 and 40 grams (g) as measured by the catheter force sensor. RF was delivered (n=60) for 60 sec at 30W or 50 W (irrigation 17 or 30ml/min). Tissue temperature at 3mm and 7mm depths, initial impedance (IMP) and IMP decrease during ablation (D IMP) were measured.

Results: Table and figure. Lesion volume, depth and tissue temperature at 7mm depth increased significantly with increasing contact force at each RF power. Steam pop occurred only with 40g contact force at 30 W. At 50W, steam pop occurred in 0/6 (2g),1/6 (10g), 2/6 (20g), 4/6 (30g) and 3/6 (40g) applications.

Conclusions: At same RF power, lesion size and incidence of steam pop increase strikingly with increasing contact force. The novel ablation catheter with real-time contact sensor may prove effective in predicting RF lesion size and risk of steam pop in clinical application.



RF Power (W)	Contact Force (g)	n	Tissue Temp (Π) 3mm Depth	Tissue Temp (Π) 7mm Depth	Impedance (Ω) Initial	Impedance (Ω) ΔIMP	Incidence of Pop	Lesion Depth (mm)	Lesion Volume (mm3)
30	2	6	76±7	51±3	111±15	10±6	0/6	6.2±0.5	264±55
	10	6	73±11	50±6	112±14	10±4	0/6	7.5±0.5	453±136
	20	6	83±12	62±14	113±13	13±4	0/6	8.2±0.5	658±98
	30	6	80±13	59±11	115±14	13±4	0/6	8.9±0.7	739±85
	40	6	90±10	70±12	115±15	16±7	2/6	9.9±0.9	1028±211
	p-value		NS	p<0.05	NS	NS		p<0.01	p<0.01
50	2	6	85±10	64±11	100±11	7±4	0/6	7.0±0.1	431±117
	10	6	102±8	78±15	104±11	10±3	1/6	8.4±0.8	714±250
	20	6	96±9	88±9	104±15	9±6	2/6	9.2±1.2	975±352
	30	6	93±15	88±14	110±12	14±6	4/6	10.4±1.0	1115±258
	40	6	98±9	92±16	112±12	15±6	3/6	11.1±1.1	1419±341
	p-value		NS	p<0.05	NS	NS		p<0.01	p<0.01