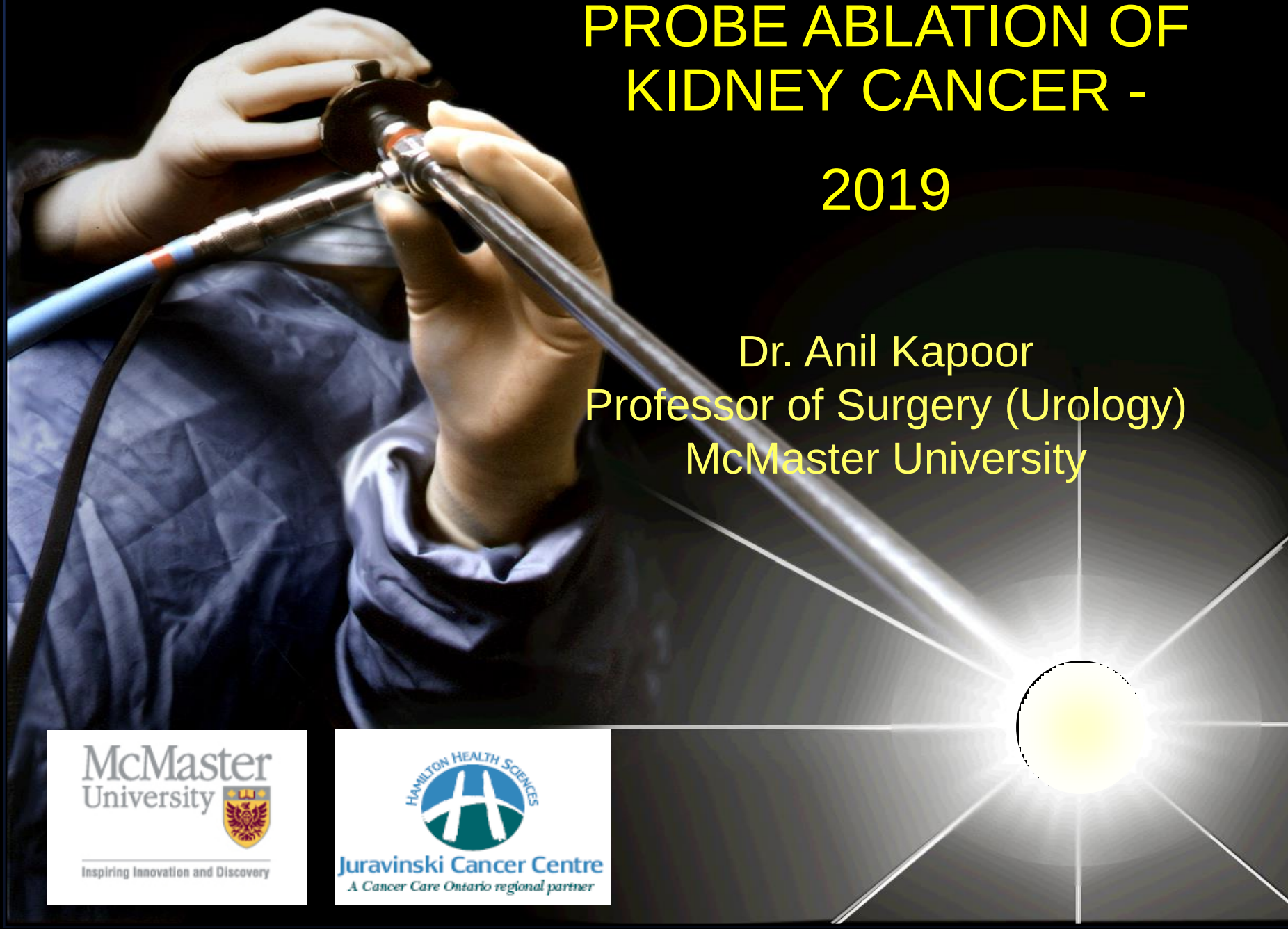


PROBE ABLATION OF KIDNEY CANCER - 2019

Dr. Anil Kapoor
Professor of Surgery (Urology)
McMaster University

McMaster University
Inspiring Innovation and Discovery

Hamilton Health Sciences
Juravinski Cancer Centre
A Cancer Care Ontario regional partner

Disclosure information

- Research Funding and Speaker's Bureau for Pfizer Oncology, Novartis Oncology, BMS, Roche Oncology, Ipsen, Bayer Oncology, Amgen, Janssen, Baxter

Progress in Kidney Cancer Management

- Medical Management
- Surgical Innovation

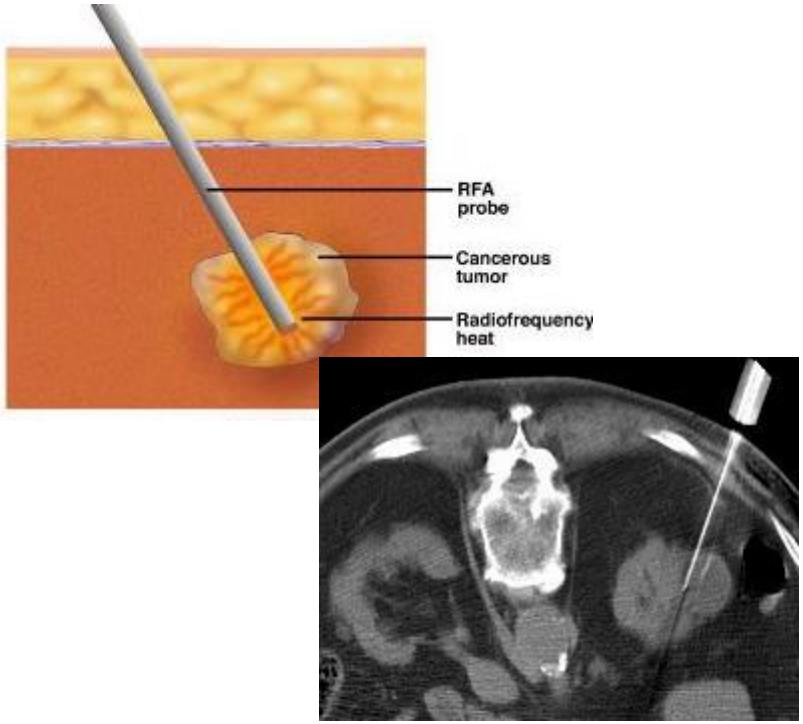
Surgical Innovation in Kidney Cancer Management

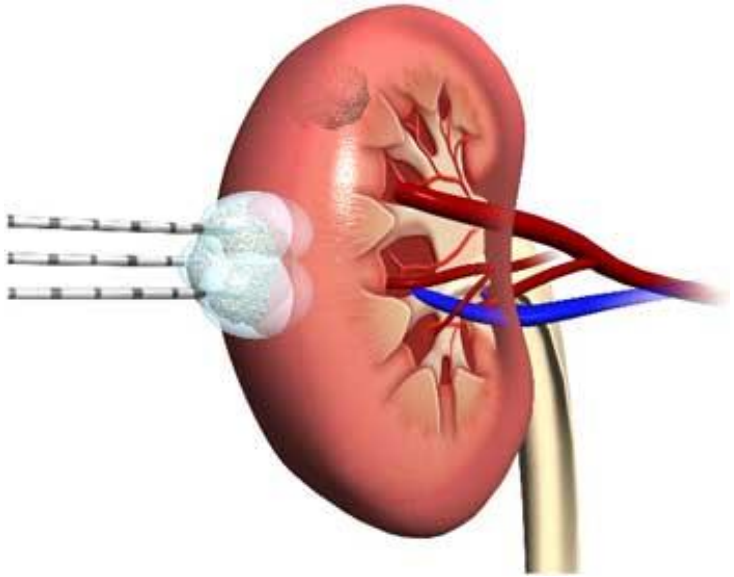
- **Laparoscopic Surgery**
- **Partial Nephrectomy**
- **Robotic Surgery**
- **Single Port Surgery**
- **Cryo-Ablation**
- **Radio Frequency Ablation**
- **SBRT**

Surgical Innovation in Kidney Cancer Management

- **Laparoscopic Surgery**
- **Partial Nephrectomy**
- **Robotic Surgery**
- **Single Port Surgery**
- **Cryo-Ablation**
- **Radio Frequency Ablation**
- **SBRT**

Probe Ablation





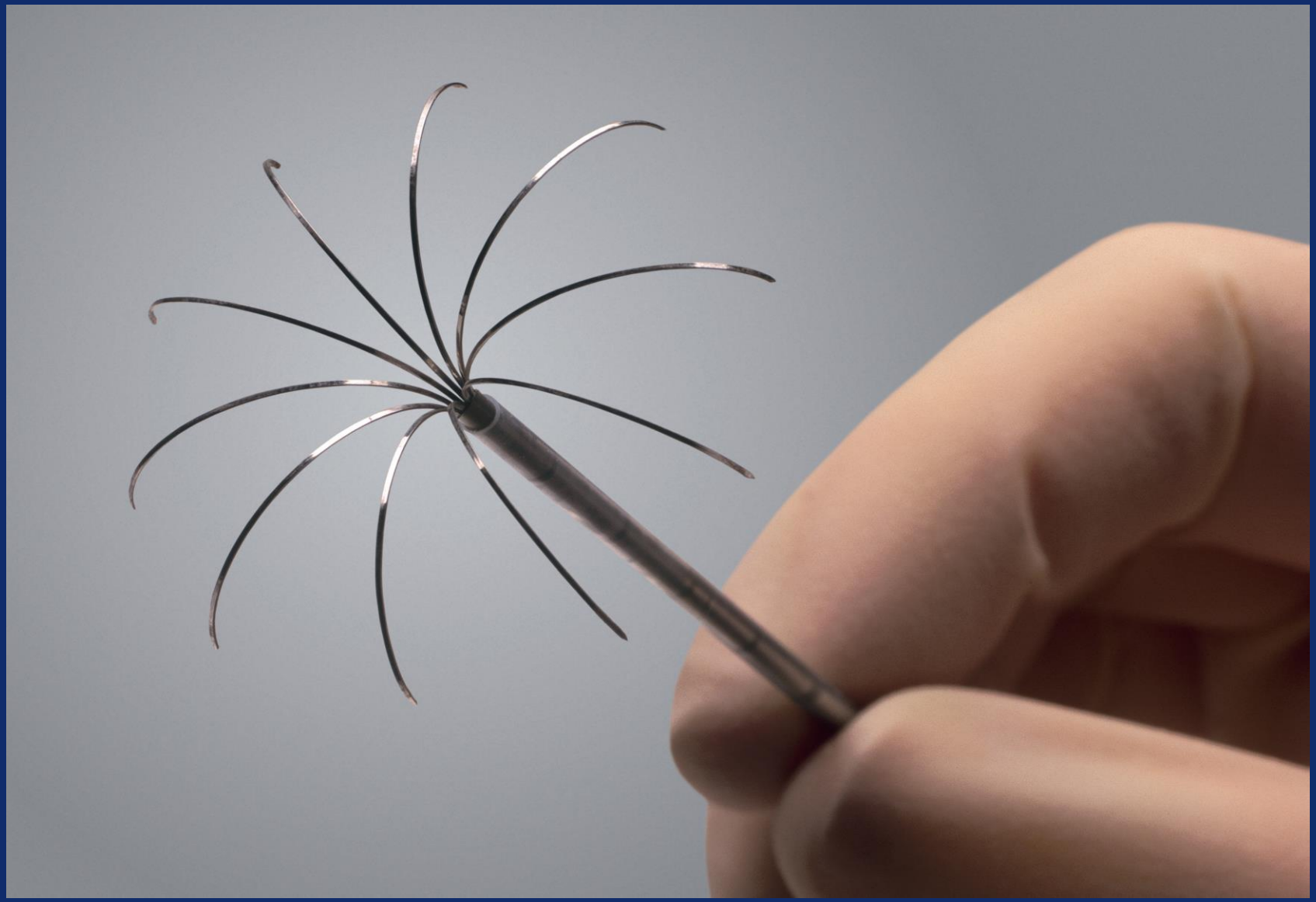
Zagoria R J Radiographics 2004;24:S59-S71

RFA

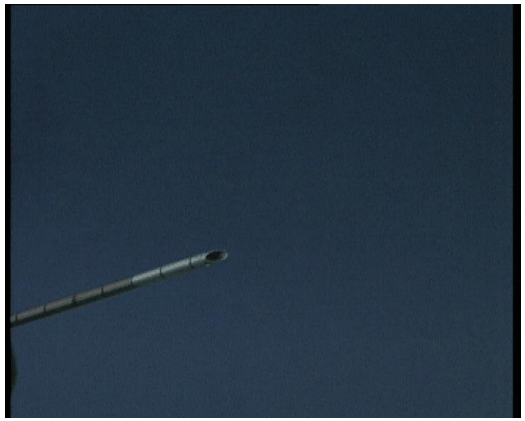
- lots of clinical experience
- ~90% control in tumours ≤3cm
- ~1 in 5 chance of complications

Cryotherapy

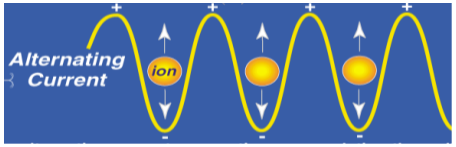
- specialized expertise
- ~90% control in tumours ≤3cm
- ~1 in 5 chance of complications



What is radiofrequency ablation?

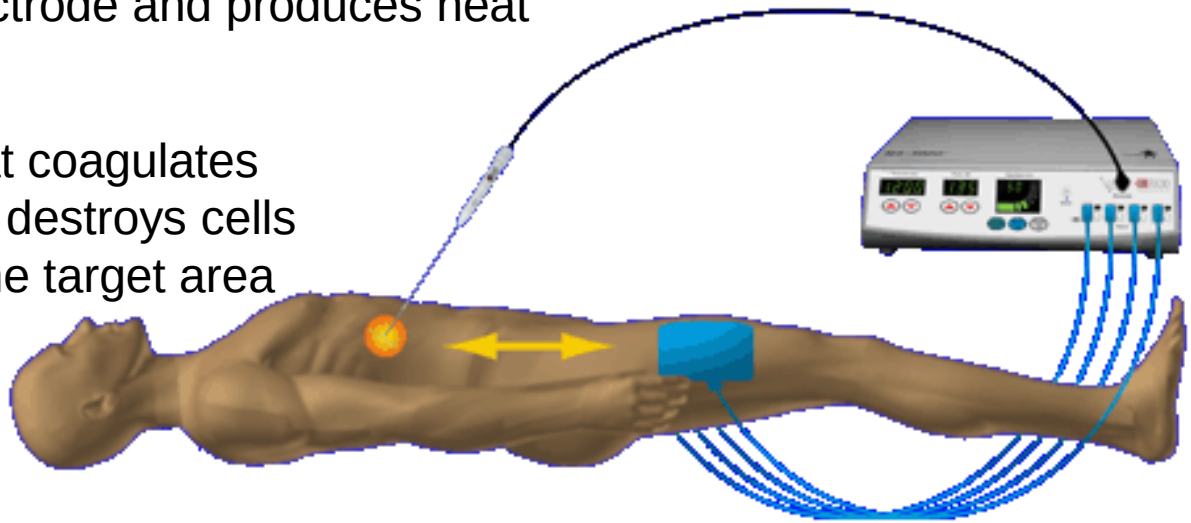


420 – 500 kHz sinusoidal current



RF energy passes through an electrode and produces heat

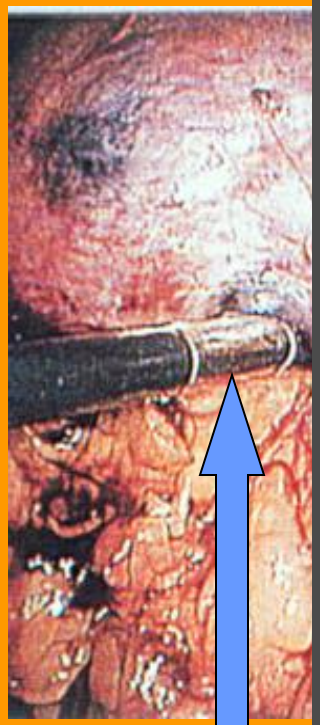
Heat coagulates and destroys cells in the target area



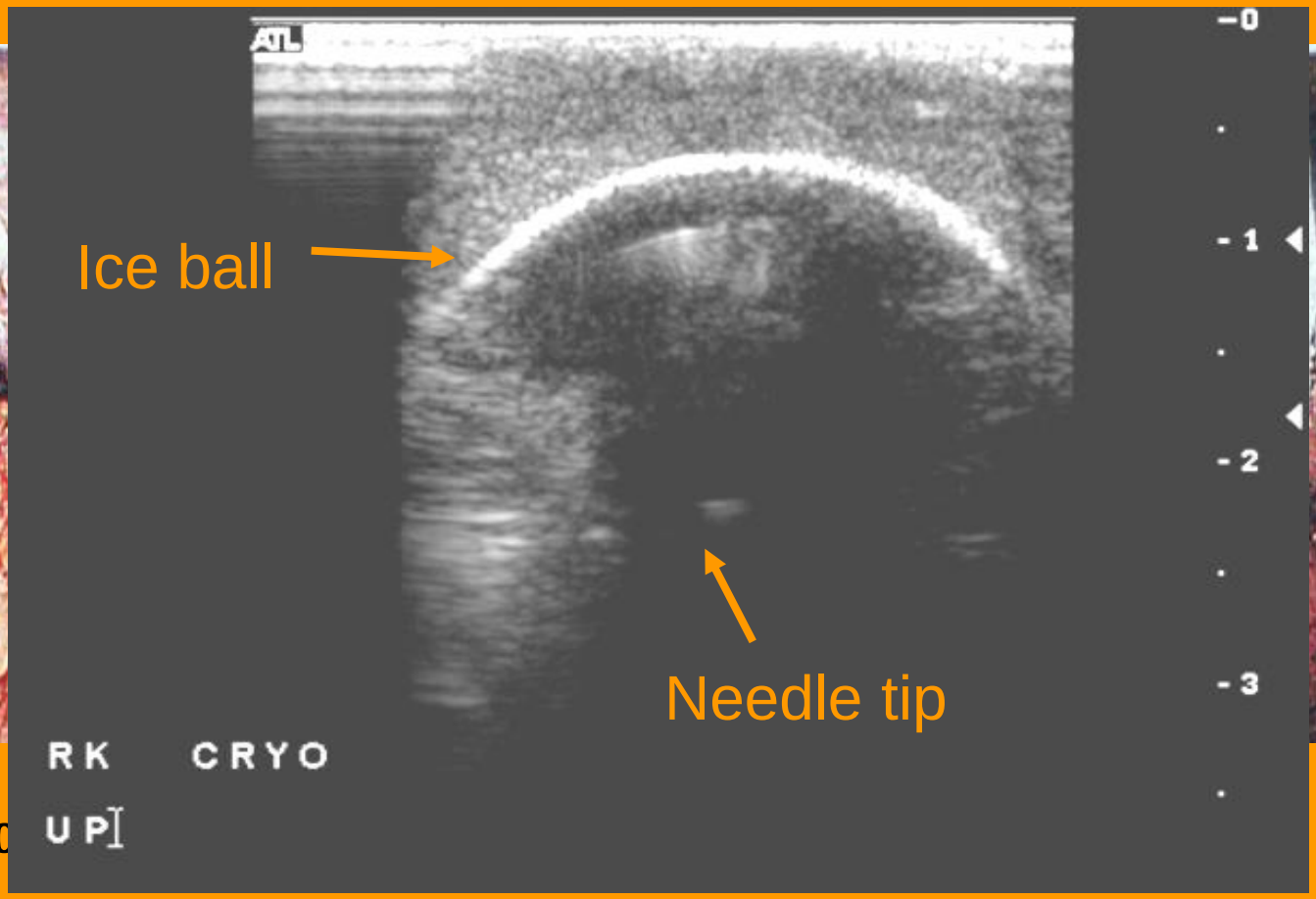
Temperature > 60˚ C : immediate cellular death

To FREEZE – Cryo-Ablation

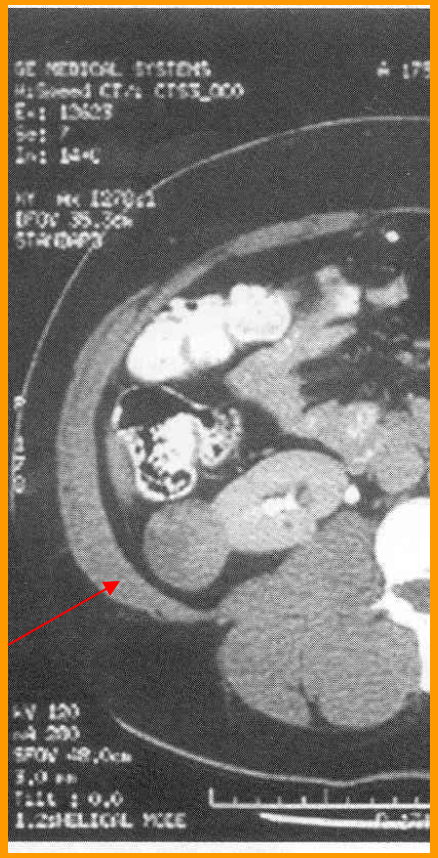
LAPAROSCOPIC RENAL CRYOABLATION



Cryopro

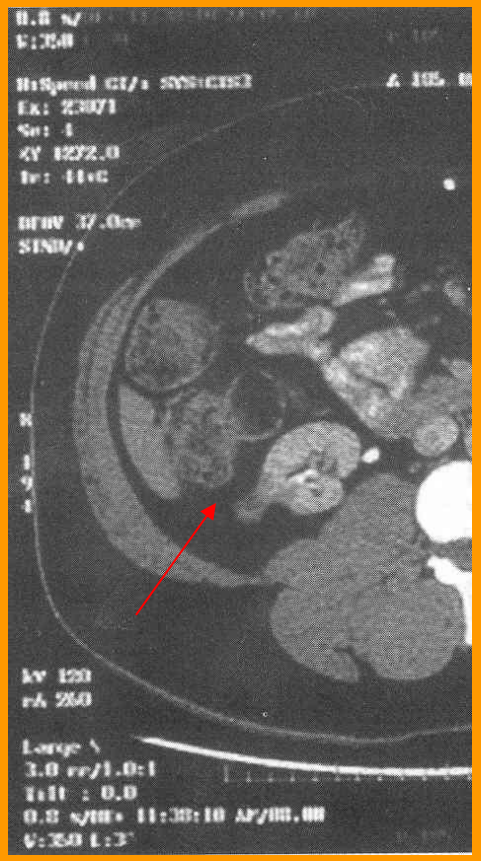


PERCUTANEOUS CRYOABLATION



Preoperative

Intraoperative



Postoperative: 1 yr.

A.U.A. Recommendations - 2017

Thermal Ablation (TA)

1. Consider TA an alternate approach for management of cT1a renal masses <3 cm in size. A percutaneous approach is preferred.
2. Both radiofrequency ablation and cryoablation are options.
3. A RMB should be performed prior to TA.
4. Counseling about TA should include information regarding increased likelihood of tumor persistence/recurrence after primary TA, which may be addressed with repeat TA if further intervention is elected.

Ontario

Cancer Care Ontario

Action Cancer Ontario

Evidence Summary FA3

A Quality Initiative of the Program in Evidence-Based Care (PEBC), Cancer Care Ontario (CCO)

Focal Ablation 3: Focal Tumour Ablation for Renal Cell Carcinoma

J. Kachura, F. Baldassarre, A. Kielar, M. Baerlocher, and the Interventional Oncology Steering Committee

Report Date: August 8, 2016

. For kidney tumour patients, the Advisory Committee recommends thermal ablation of the kidney according to the following criteria:

A. RFA is recommended for renal cell carcinoma (RCC) in the following cases:

a. Biopsy proven stage T1a N0 M0 RCC, in whom surgery or active surveillance is not recommended, and

b. The size of the tumour is up to and including four centimetres, and

c. The maximum number of tumours is three per presentation.

EUROPEAN UROLOGY 63 (2013) 486–492

available at www.sciencedirect.com
journal homepage: www.europeanurology.com

European Association of Urology

Platinum Priority – Kidney Cancer

Editorial by Maciej Salagierski, Bülent Akdogan, Sabine Brookman-May, et al. on pp. 493–495 of this issue

Long-Term Oncologic Outcomes After Radiofrequency Ablation for T1 Renal Cell Carcinoma

Sarah P. Psutka[a,†], *Adam S. Feldman*[a,†], *W. Scott McDougal*[a,*], *Francis J. McGovern*[a], *Peter Mueller*[b], *Debra A. Gervais*[b]

[a] *Department of Urology, Massachusetts General Hospital, Boston, MA, USA;* [b] *Department of Radiology, Massachusetts General Hospital, Boston, MA, USA*

Article info

Abstract

EUROPEAN UROLOGY 63 (2013) 486–492

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Platinum Priority – Kidney Cancer

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Long-Term Oncologic Outcomes After Radiofrequency Ablation for T1 Renal Cell Carcinoma

Conclusions: In poor surgical candidates, RFA results in durable local control and low risk of recurrence in T1a RCC. Higher stage correlates with a decreased disease-free survival. Long-term surveillance is necessary following RFA. Patient selection based on tumor characteristics, comorbid disease, and life expectancy is of paramount importance.

Article info

Abstract

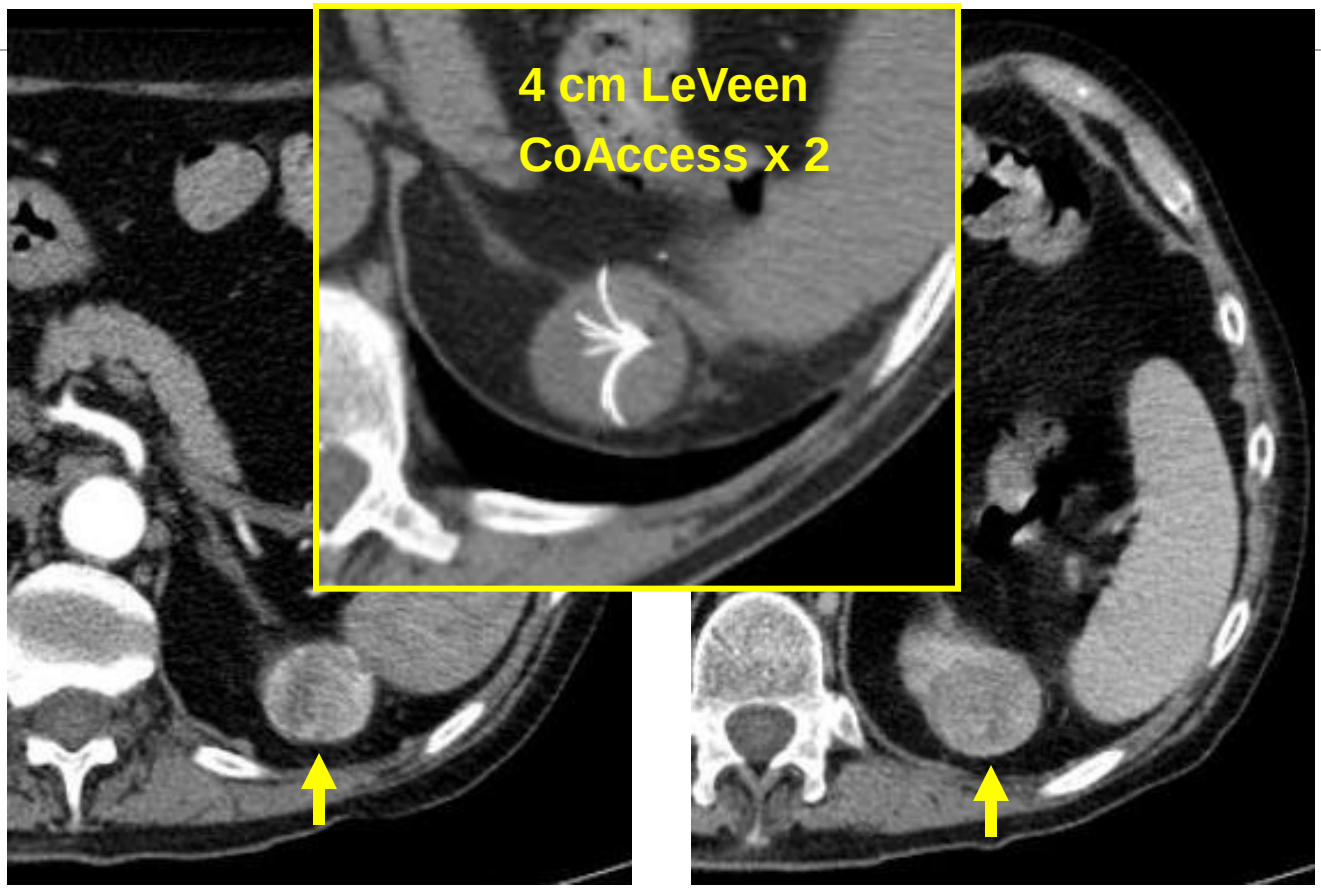
Small Renal Masses: Ablation

The Issues

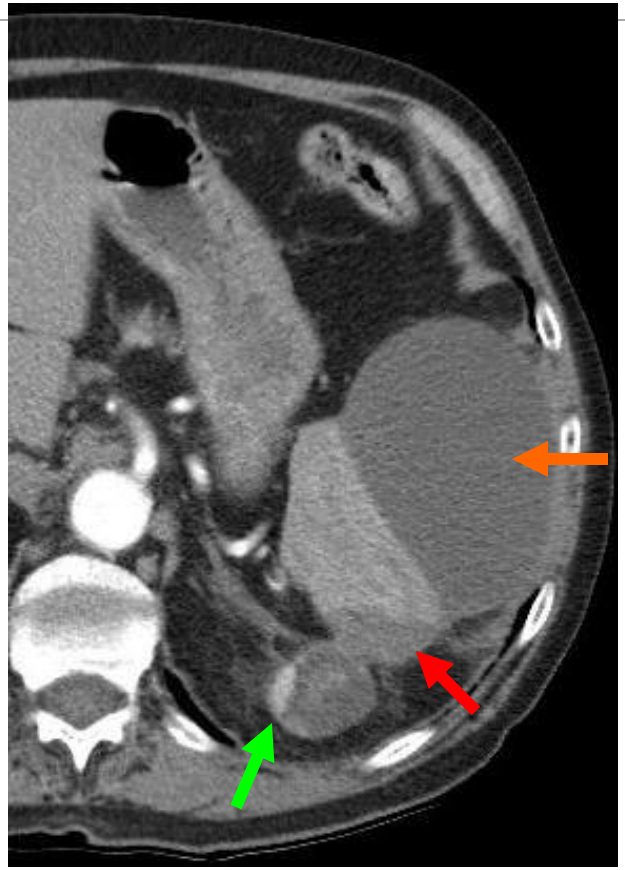
- Size
- Heat sink effect
- Collateral thermal injury
- Follow-up

Pre-RFA arterial phase

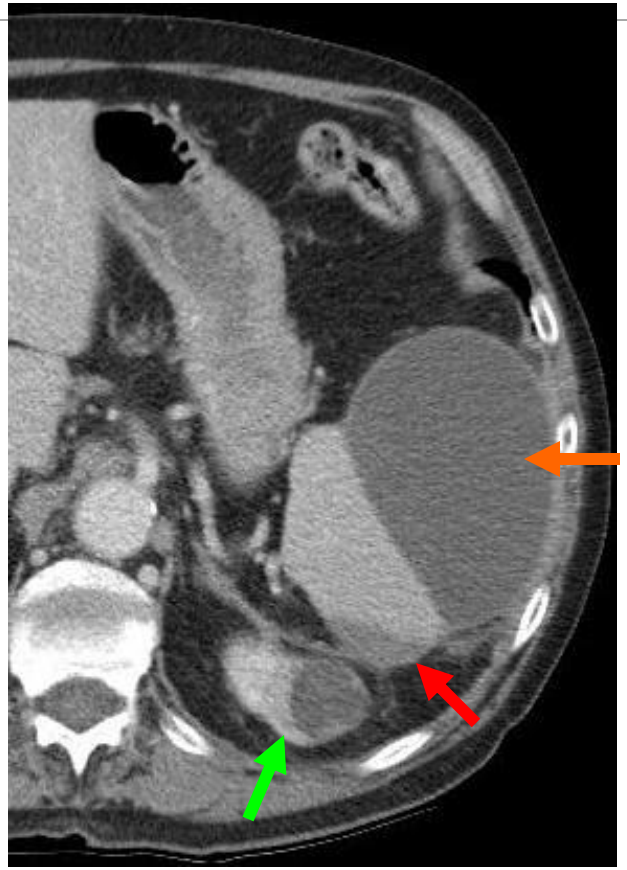
Pre-RFA venous phase



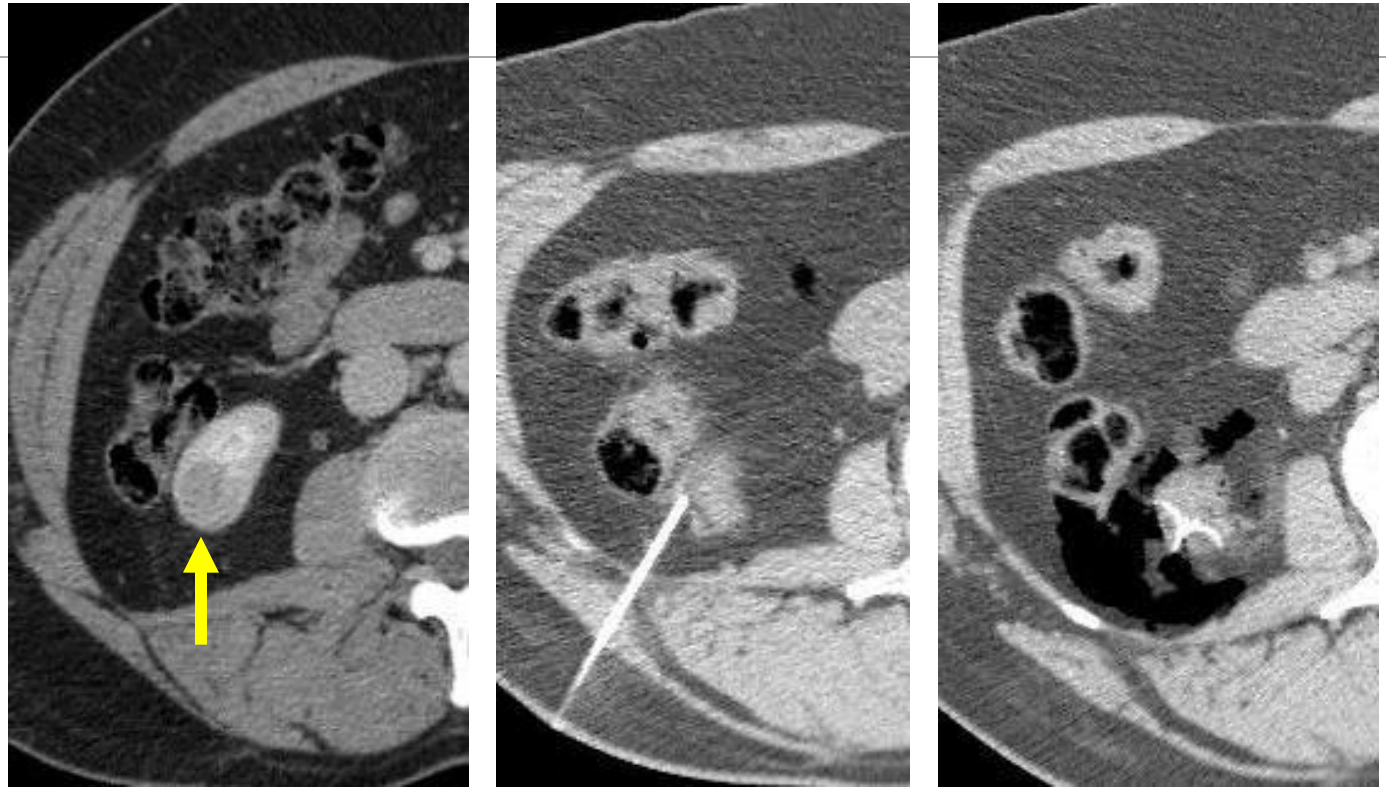
1 month post-RFA
arterial phase



1 month post-RFA
venous phase



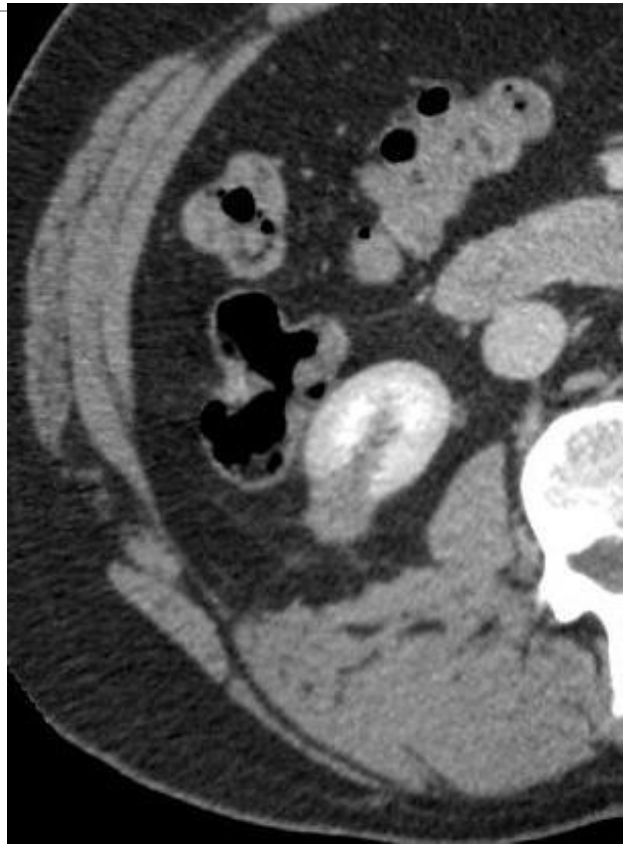
- 2.8 cm RCC lower pole right kidney
- Adjacent to ascending colon



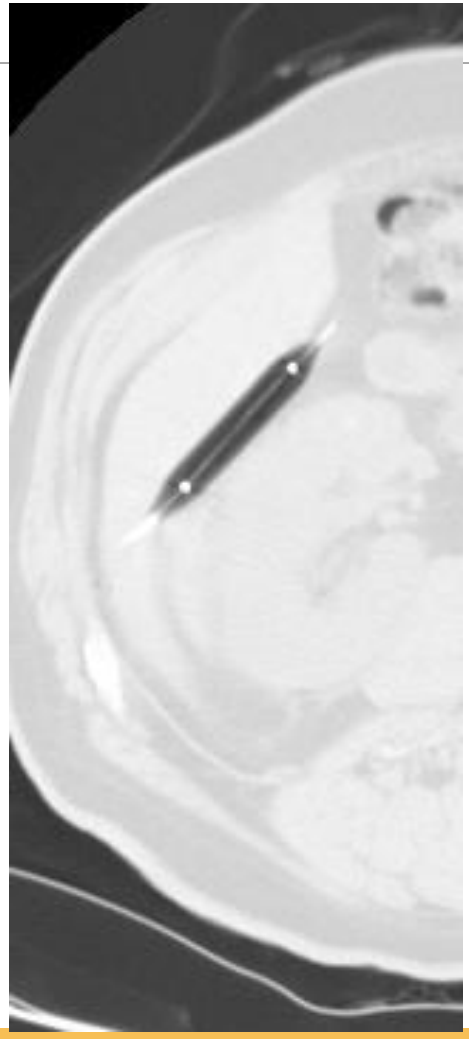
Pre-RFA
venous phase CT

1 month post-RFA
venous phase CT

3.5 years post-RFA
venous phase CT



Balloon Interposition



Imaging F/U

- Requires Contrast Imaging follow-up (CT/MRI)
- First 5 years - low risk patients
  - q6 months for 1 year then annually for 5 years
- High risk patients
  - every 6 months for 3 years then annually for 5 years
  - Multidisciplinary decision
- After 5 years
  - Low risk patients : Every 2 years ? Beyond 10 years ?
    High risk patients : multidisciplinary decision

UROLOGY

Contrast-enhanced Ultrasonography for Surveillance of Radiofrequency-ablated Renal Tumors: A Prospective, Radiologist-blinded Pilot Study

Christopher B. Allard, Alexander Coret, Shawn Dason, Camilla Tajzler, Bobby Shayegan, Edward D. Matsumoto, Anil Kapoor

DOI: https://doi.org/10.1016/j.urology.2015.04.062 |

UROLOGY

Contrast-enhanced Ultrasonography for Surveillance of Radiofrequency-ablated Renal Tumors: A Prospective, Radiologist-blinded Pilot Study

Conclusion

This is the first prospective study incorporating radiologist blinding to evaluate CEUS for RFA surveillance. Our findings suggest CEUS may ultimately be incorporated into RFA surveillance protocols. The operator dependency of CEUS is a possible barrier to its widespread adoption. These findings justify larger studies with longer follow-up.

2018 CUA follow-up guidelines after treatment of nonmetastatic RCC

Months Post-op	3	6	12	18	24	30	36	48	60
Low Risk (pT1)									
Hx & PE			x		x		x	x	x
Blood test			x		x		x	x	x
CXR			x		x		x	x	x
Abdominal CT/MRI/US					x				x
Intermediate Risk (pT2)									
Hx & PE		x	x	x	x	x	x	x	x
Blood test		x	x	x	x	x	x	x	x
CXR or Chest CT		x	x	x	x	x	x	x	x
Abdominal CT/MRI/US			x		x		x		x
High Risk (pT3-4)									
Hx & PE		x	x	x	x	x	x	x	x
Blood test		x	x	x	x	x	x	x	x
CXR or Chest CT		x	x	x	x	x	x	x	x
Abdominal CT/MRI		x	x	x	x		x		x
Very High Risk (pTxN+)									
Hx & PE	x	x	x	x	x	x	x	x	x
Blood test	x	x	x	x	x	x	x	x	x
CXR or Chest CT	x	x	x	x	x	x	x	x	x
Abdominal CT/MRI	x	x	x	x	x	x	x	x	x

Follow-up post ablation for T1a

	Months after surgery								
	3	6	12	18	24	30	36	48	60
cT1a									
H&P			x		x		x	x	x
Blds			x		x		x	x	x
CXR			x		x		x	x	x
CT/MR	x	x	x		x		x	x	x

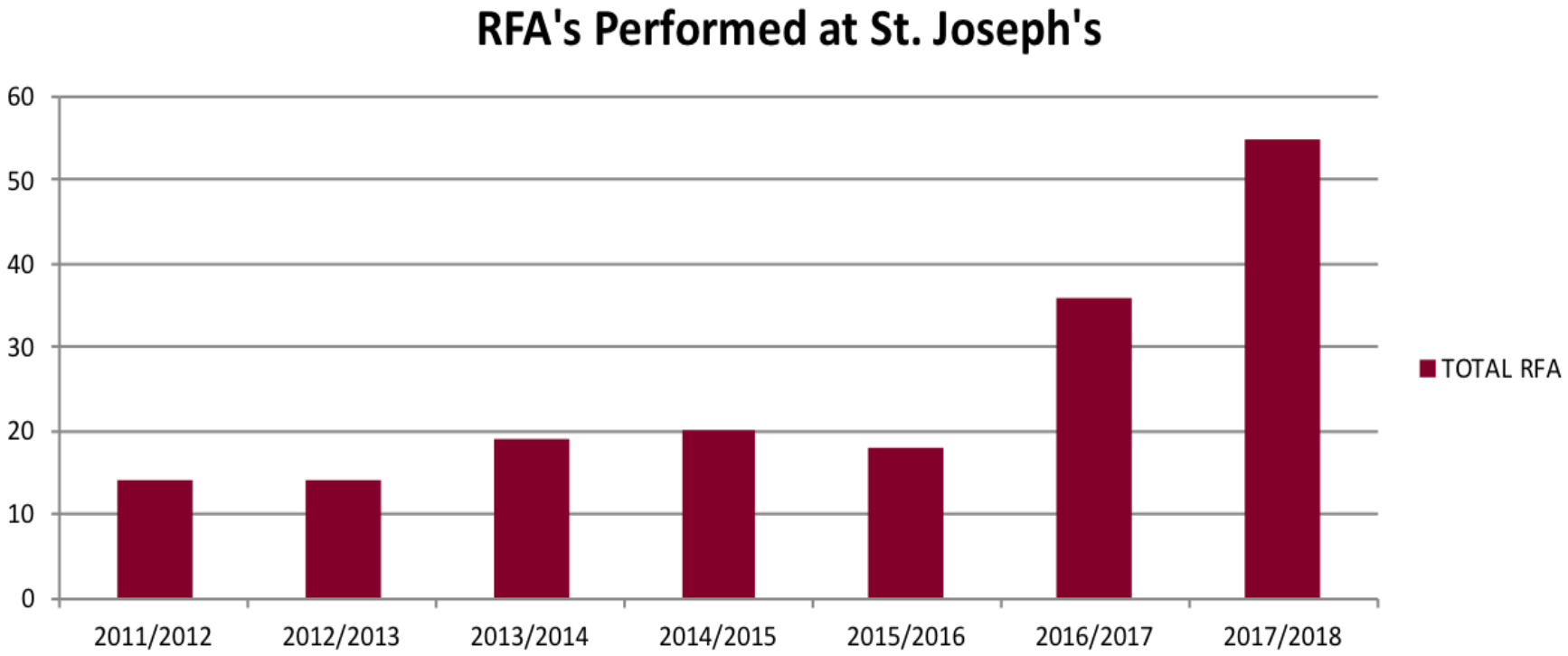
2018 McMaster Experience with Percutaneous Ablation of Renal Tumors

A. Kapoor, M. Voss, H. Athreya

Cost of RFA Procedure

ITEM	COST
Medical Supplies (sterile gloves, contrast media, medications, sodium chloride, needles, etc.))	$2,500
Salaries Broken Down:	
Prep Nurse 1 hour x 65	$65
Recovery nurse 4 hours x 65	$260
Procedure nurse 2 hours x 65	$130
Tech 65 x 2.5 hours	$162.50
Infrastructure Cost (service agreement, depreciation, housekeeping, utilities, etc.	$120
Total per procedure	**$3,238**

Total RFA's (2011-2018)



Study Design and Scope

- Retrospective review (October 2011 – April 2017)
  -84 RFA's reviewed

1) Primary Objective – to evaluate the recurrence rate and time to recurrence for RFA patients.
2) Secondary Objective - to identify prognostic factors for recurrence such as age, gender, lesion size, pathology (if available), and existing radiographic scoring systems (RENAL nephrometry score), and PADUA score).

Exclusion: 1) Patients with distant metastases
2) Repeat RFA for recurrence (only initial RFA used)
3) Patients with a biopsy proven to be benign

Results

Parameters	Variables
Cases (N)	84
Age	68.6 ± 10.6 years
Sex	59 male, 25 female
Tumour size	2.42 ± 0.81 cm
Pathology	40 clear cell, 16 papillary RCC, 3 chromophobe, 25 not completed
RENAL nephrometry score	6.81 ± 1.58
PADUA score	8.13 ± 1.39

Results - Recurrence

Parameters	Variables
Cases (N)	84
Number of true recurrences	4 (4.8%)
Median time to recurrence	17 months
Longest time to recurrence	30 months
Number of incomplete ablations	5 (6%)
Median time to identification	3 months
Longest time to identification	8 months

Results - Recurrence

- Out of the four patients with recurrence;
  - -Two had repeat RFA and are currently cancer free.
  - - One chose palliation following metastatic development.
  - - One did not have follow-up clinical data available.
- Five incomplete ablations;
  - -Defined as residual tumor present at first imaging study post-RFA.
  - -More data is needed to determine a definitive guideline.

Predictors of Recurrence

- No predictors of recurrence in univariate or multivariate analysis

Univariate Analysis

Parameters	HR	95% CI	*p*-value
Age	1.01	0.92-1.10	0.900
Sex	0.03	0-354.34	0.464
Tumour size	1.27	0.41-3.93	0.684
RENAL score	1.21	0.21-6.95	0.830
PADUA score	1.56	0.38-6.43	0.541

Predictors of Incomplete Ablation

	Univariate Analysis			Multivariate Analysis		
Parameters	HR	95% CI	*p*-value	HR	95% CI	*p*-value
Age	1.03	0.94-1.13	0.582			
Sex	1.61	0.27-9.60	0.604			
Tumour size	**2.40**	**1.01-5.71**	**0.047**	2.13	0.81-5.63	0.127
RENAL score	2.95	0.53-16.41	0.217	1.05	0.08-13.45	0.973
PADUA score	2.62	0.64-10.78	0.183	1.98	0.26-15.33	0.512

McMaster University HEALTH SCIENCES

Summary

- Tumour size, heat sink, and collateral thermal injury are important issues for thermal ablation of RCC.
- Consider RFA for non-surgical (and surgical?) candidates with T1a RCC
- LHIN 4 RFA Outcomes are excellent and likely comparable to Partial Nephrectomy

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European Association of Urology

Platinum Priority – Kidney Cancer

Editorial by Alexander Kutikov, Marc C. Smaldone and Robert G. Uzzo on pp. 260–261 of this issue

Comparison of Partial Nephrectomy and Percutaneous Ablation for cT1 Renal Masses

R. Houston Thompson [a,], Tom Atwell [b], Grant Schmit [b], Christine M. Lohse [c], A. Nicholas Kurup [b], Adam Weisbrod [b], Sarah P. Psutka [a], Suzanne B. Stewart [a], Matthew R. Callstrom [b], John C. Cheville [d], Stephen A. Boorjian [a], Bradley C. Leibovich [a]*

[a] *Department of Urology, Mayo Clinic and Mayo Medical School, Rochester, MN, USA;* [b] *Department of Radiology, Mayo Clinic and Mayo Medical School, Rochester, MN, USA;* [c] *Department of Health Sciences Research, Mayo Clinic and Mayo Medical School, Rochester, MN, USA;* [d] *Department of Pathology, Mayo Clinic and Mayo Medical School, Rochester, MN, USA*

Thermal Ablation vs Surgery for Localized Kidney Cancer: a Surveillance, Epidemiology, and End Results (SEER) Database Analysis

T Choueiri, F Schutz, N Hevelone, P Nguyen, S Lipsitz, S Williams, S Silverman, J Hu
Urology 2011; 78: 93–98

- 578 patients underwent TA, 4402 PN, and 10165 RN
- *** RCC ≤7 cm
- TA more likely older, more recent, smaller RCC
- No statistical difference in cancer-specific or overall survival between TA vs PN or RN
- *** data 2004-2007, and average follow-up 20 months

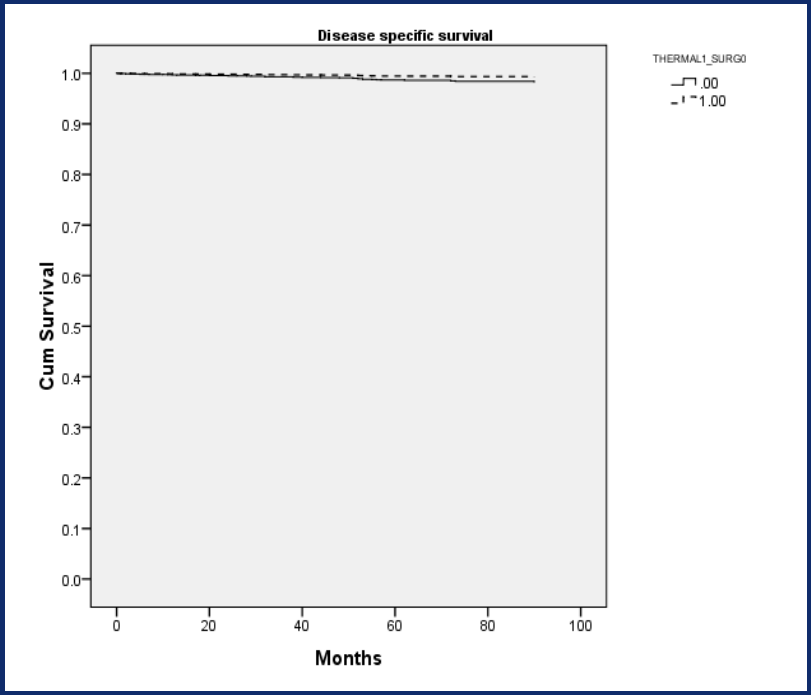
Comparison of TA and PN for the treatment of RCC in the SEER database population

O Mironov, A Jaberi, JR Kachura

- 383 patients underwent TA and 4057 had PN
- TA patients were significantly older (69.9 vs. 58.7 years, $p<0.001$)
- *** RCC $\leq$4 cm; mean tumor size 2.5 cm for both groups
- Univariate analysis showed a significant difference in observed ($p<0.001$) and disease specific survival in favor of PN compared to TA (105.9 vs 103.4 months, $p=0.001$)
- *** data 2004-2012, and average follow-up 55 months

Results

- After adjusting for age, there was no significant difference in observed survival (TA hazard ratio 5.047; 95%CI: 0.821-31.032; p=0.089)
- After adjusting for age, there was also no significant difference in disease specific survival (TA hazard ratio 0.405; 95%CI: 0.001-117.592; p=0.755)

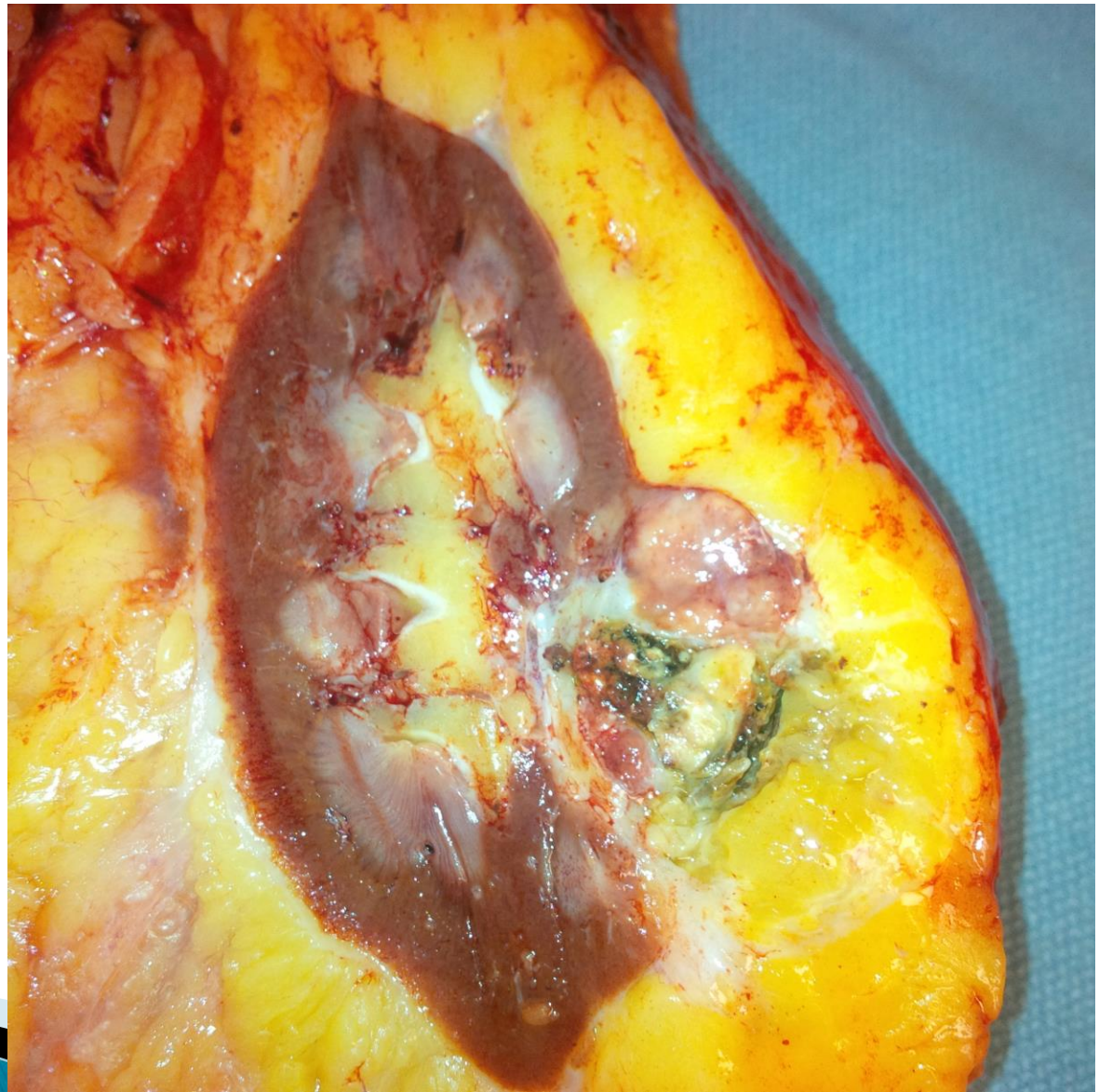


Conclusions

- Older patients are more likely to undergo TA than PN
- There is no significant difference in overall or disease specific survival between PN and TA for ≤4 cm RCCs in the SEER population after accounting for differences in age
- The difference in unadjusted disease specific survival is 2 months.

Surgery post RFA Failure

Surgery post RFA Failure



Summary

- Tumour size, heat sink, and collateral thermal injury are important issues for thermal probe ablation of RCC.

- Consider Probe Ablation for non-surgical (and surgical?) candidates with T1a RCC

- Still to be resolved – When to stop follow-up ? Need long term Contrast Imaging; Probably can stop after 5 years

A PROSPECTIVE RANDOMIZED PILOT TRIAL OF STEREOTACTIC BODY RADIATION THERAPY VERSUS RADIOFREQUENCY ABLATION FOR THE MANAGEMENT OF SMALL RENAL MASSES

Thank you

Anil Kapoor, MD, FRCS(C)

akapoor@mcmaster.ca

McMaster University