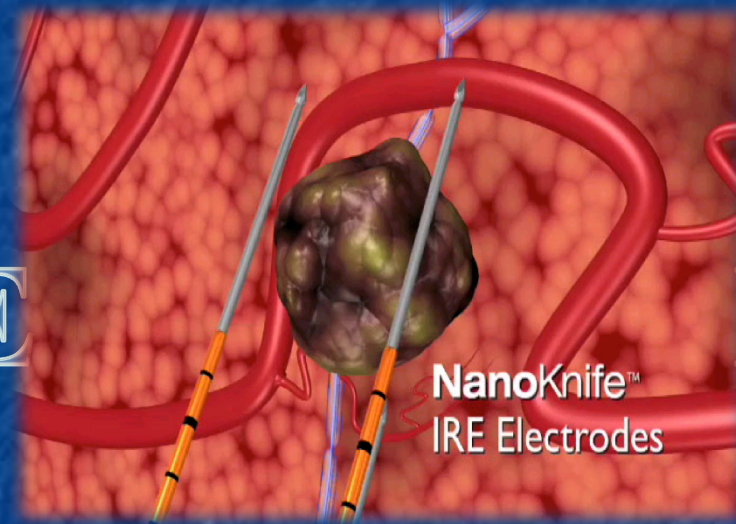


IRREVERSIBLE ELECTROPORATION

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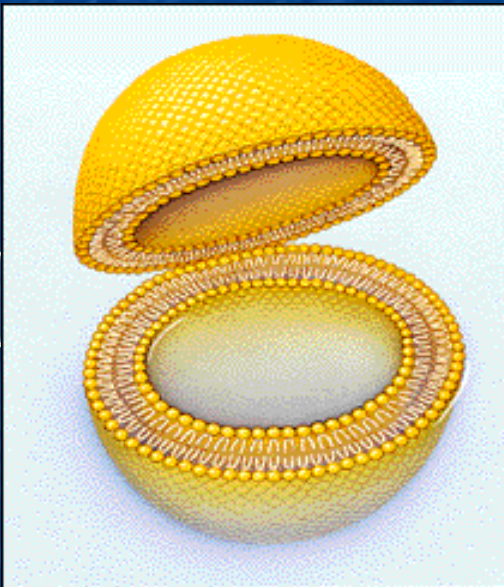
RAJ NARAYANAN.M.D.

CHIEF- VASCULAR INTERVENTIONAL
RADIOLOGY

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OF MEDICINE



IRE: *What is It?*



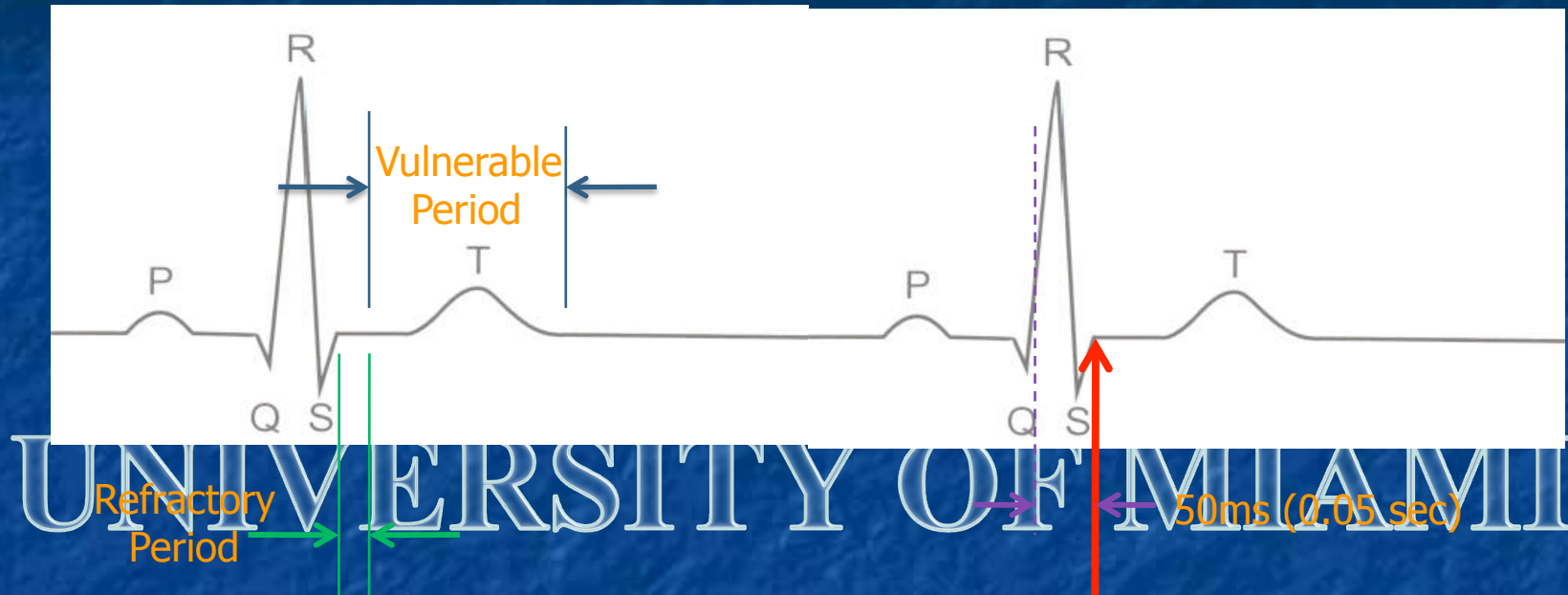
- A FOCAL “NON THERMAL” ABLATION THERAPY THAT USES HIGH VOLTAGE LOW ENERGY DC ELECTRICAL PULSES TO PERMANENTLY OPEN PORES IN THE CELL MEMBRANES CAUSING CELLS TO DIE.



IRREVERSIBLE ELECTROPORATION



ECG SYNCHRONIZED



Energy Pulse

Sync device (e.g. AccuSync 72) senses the rising slope of the R-wave, and sends a signal to the NanoKnife. The NanoKnife waits 50 milliseconds (.05 sec) and delivers 1 energy pulse. The energy pulse is delivered during (or just before) the ventricular refractory period.



510 k

- RFA IN ORGANS OTHER THAN LIVER

- MICROWAVE

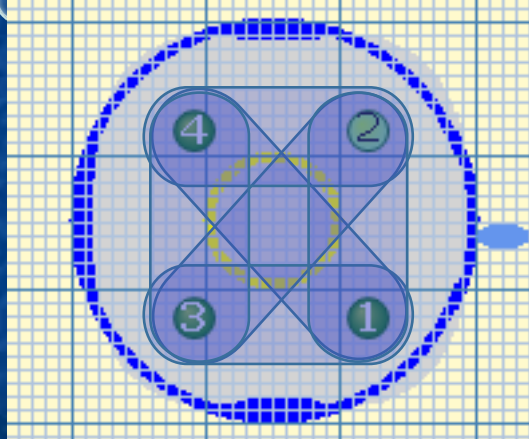
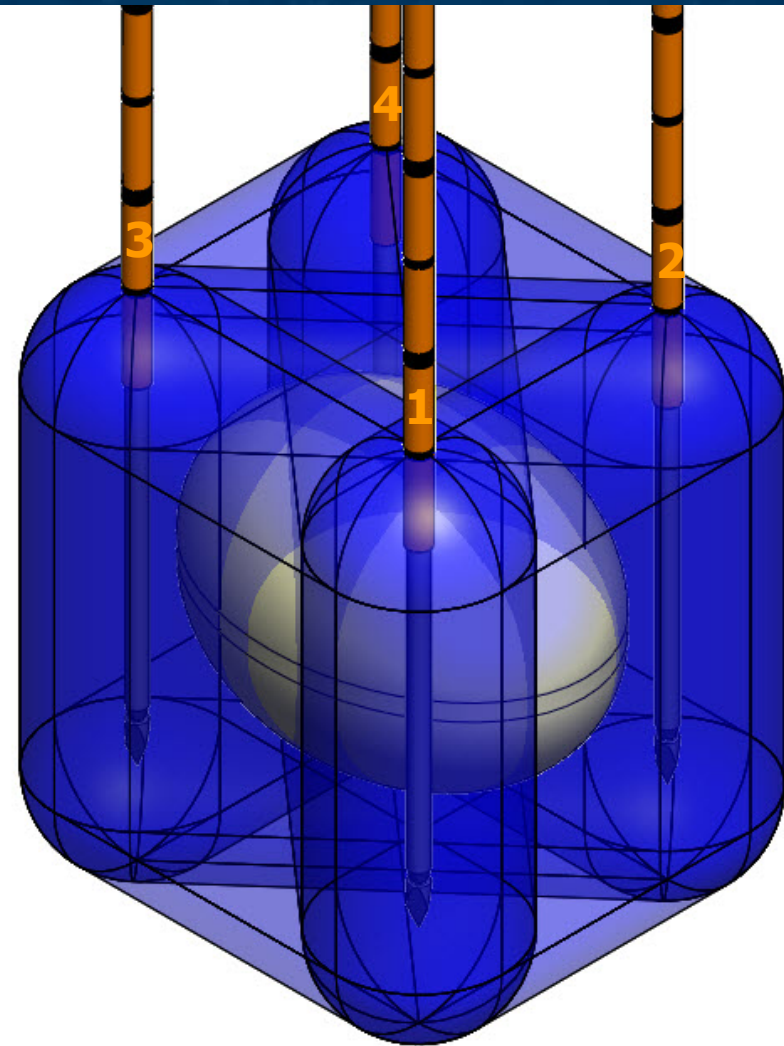
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- CRYOABLATION



FOUR PROBE ABLATION SEQUENCE

Probe (+)	Probe (-)	Voltage	Pulse Length h	N. Pulses	V/cm	Distance
1	4	3000	100	90	1500	2.2
2	3	3000	100	90	1500	2.2
2	4	2550	100	90	1500	1.7
3	1	2550	100	90	1500	1.7
3	4	2250	100	90	1500	1.5
1	2	2250	100	90	1500	1.5



PRE IRE WORK UP

- PATIENTS ARE SEEN IN A PRE PROCEDURE CONSULT WITH IR AND ANESTHESIA.

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- PROCEDURES PERFORMED UNDER GENERAL ANESTHESIA
- CT AND ULTRASOUND GUIDANCE



PROCEDURAL OVERVIEW

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PATIENT SET UP

- **Discuss with anesthesiologist**

- Nanoknife requires muscle blockade during energy delivery

■ 0/4 to 1/4 twitches on the train of four test

- High energy pulses will interfere with EKG

monitor—use a fast pulse oximeter or arterial line



- **Defib pads recommended**



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OUR EXPERIENCE

- “SAFETY & EFFICACY OF IRE USING NANOKNIFE- INITIAL AMERICAN EXPERIENCE –POSTER AT CIO
- “SAFETY & EFFICACY OF IRE IN THE TREATMENT OF PRIMARY HCC” – SIR 2011
- “IRE USING THE NANOKNIFE IN THE TREATMENT OF COLORECTAL HEPATIC METASTASES- INITIAL OBSERVATION” – WCIO 2011
- “INITIAL EXPERIENCE USING PERCUTANEOUS IRREVERSIBLE ELECTROPORATION (IRE) IN THE TREATMENT OF LOCALLY ADVANCED PANCREATIC ADENOCARCINOMA (LAPC) WITH VASCULAR ENCASEMENT” – POSTER ASCO GI 2012
- “PERCUTANEOUS IRREVERSIBLE ELECTROPORATION (IRE) IN THE TREATMENT OF HEPATOCELLULAR CARCINOMA (HCC) AND METASTATIC COLORECTAL CANCER (MCRC) TO THE LIVER “ PRESENTED AT SIR 2012
- “DOWNSTAGING LOCALLY ADVANCED PANCREATIC CANCER WITH VASCULAR ENCASEMENT USING IRE” DISTINGUISHED ABSTRACT AT SIR 2012
- “VESSEL PATENCY POST IRE AB;LATION – A 15 MONTH FOLLOW UP” PRESENTED AT SIR 2012



POST TREATMENT IMAGING FINDINGS

- Lack of enhancement
- Exaggerated zone of hypodensity with peripheral hypermia in post procedure imaging
- Decrease in size of this zone in the 1 month follow up imaging
- Preservation of vasculature in treatment zone



“PERCUTANEOUS IRREVERSIBLE
ELECTROPORATION (IRE) IN THE TREATMENT
OF HCC AND METASTATIC COLORECTAL
CANCER (MCRC) TO THE LIVER”

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SIR 2012

Narayanan, Govindarajan ; Hosein, Peter; Arora,
Geetika; Barbery, Katuska J.; Yrizarry, Jose



MATERIALS AND METHODS

- Retrospective review of patient records treated with IRE for HCC and mCRC, between 1/2010 and 8/2011

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- Procedures were all done percutaneously under general anesthesia using a standard protocol
- Primary endpoint: Progression-free survival (PFS)
- Responses were assessed using the modified RECIST criteria.

RESULTS

1/2010 - 8/2011

TOTAL PATIENTS	49	
Unresectable HCC	33	
mCRC	16	
LESIONS		
Lesions	76	Treated in 62 sessions
Median # of lesions per/pt	1	Range (1-4)
Tumor Size	2.1cm	Range (0.8-6)

RESULTS CONT..

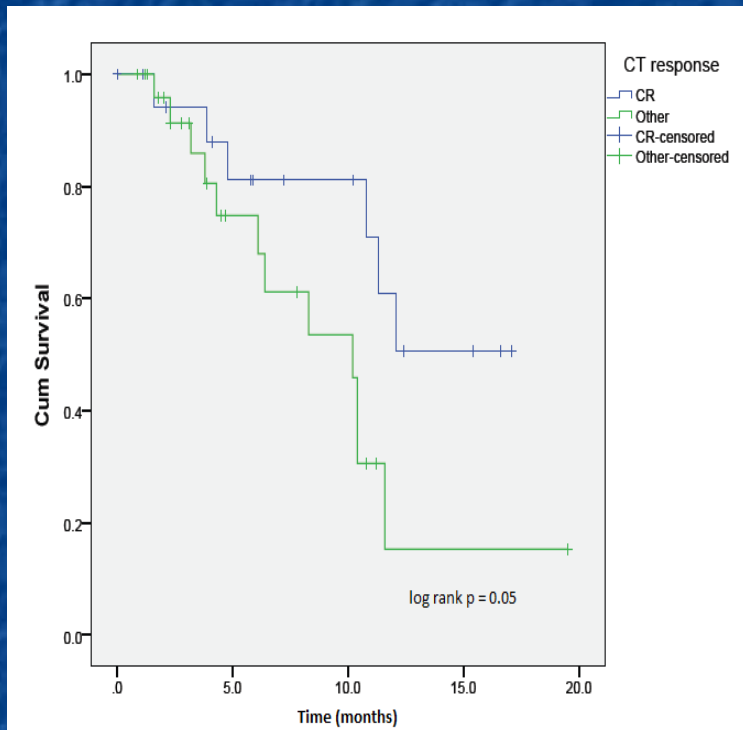
POST-IRE TUMOR RESPONSE

M RECIST	PATIENTS	%
CR	20	41
PR	19	39
SD	10	20

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SURVIVAL DATA ANALYSIS



KAPLAN-MEIER	MONTHS	CI	PATIENTS
Median PFS	11.3	95% CI 9.6-12.9	All
Median PFS	11.6	95% CI 10.2-12.9	HCC
Median PFS	10.4	95% CI 5.4-15.4	mCRC



RESULTS

- Transplant: 2 HCC patients
- One-year PFS was significantly higher for pts achieving a CR compared to those who did not achieve a CR (75% versus 59%, log rank $p = 0.05$).
- Number of liver lesions at baseline and size of treated lesions were not associated with any differences in survival.

COMPLICATIONS

- Pneumothorax (2)

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- Pleural effusion (2)

- Atrial Flutter/Fibrillation (2)

- 1 patient died in hospice within 1 month

RESULTS

- Complete response was achieved in 36 lesions (76 %)

- Partial response was achieved in 11 lesions (23%)

- Patient 31% recurrence rate

- 1 had resection

- 2 patients underwent liver transplant

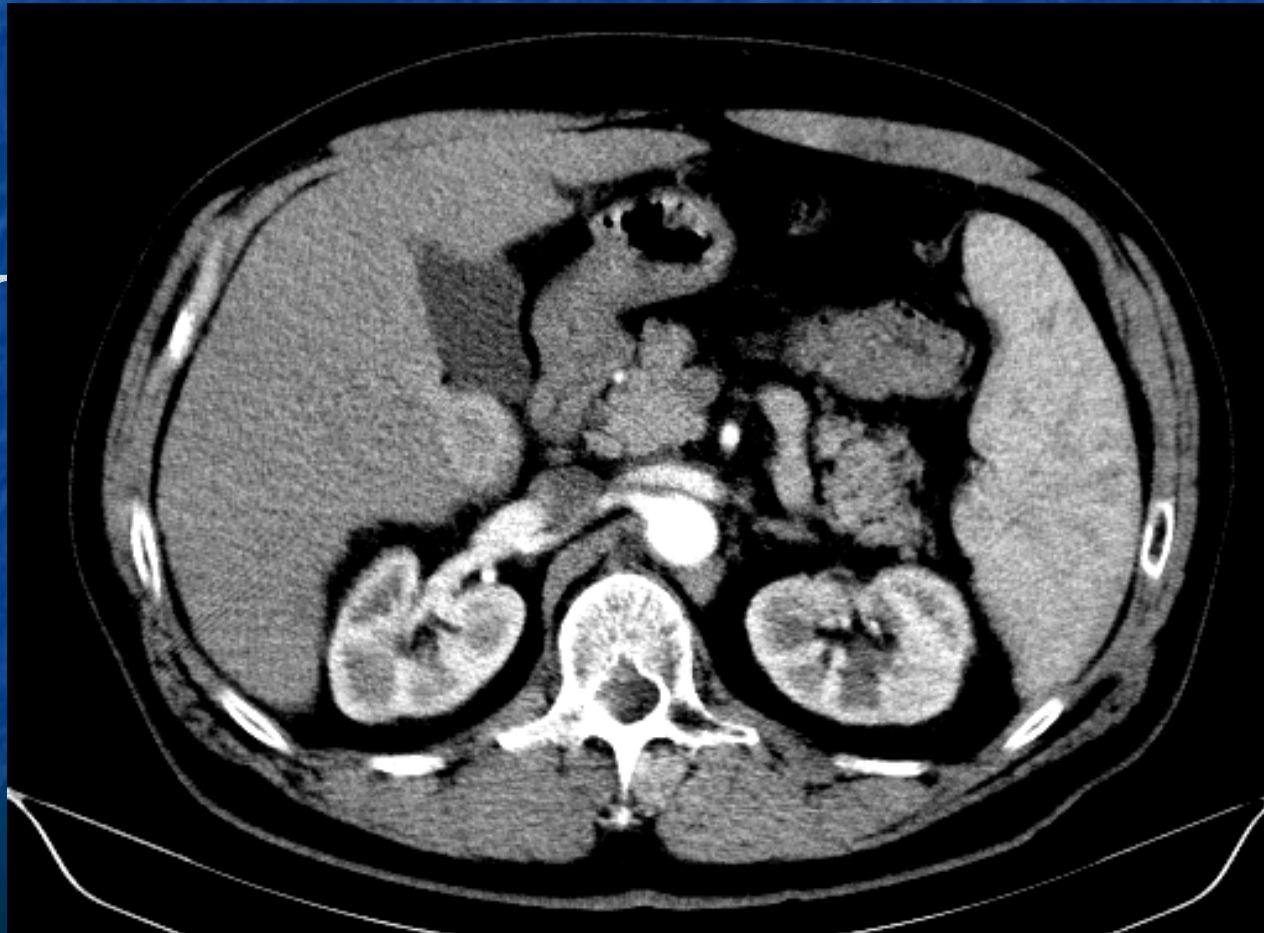


COMPLICATIONS

- SVT (n=1)
- Atrial fibrillation (n=1)
- Pneumothorax (n=2)
- Pleural effusion (n=2)
- Fever (n=1)
 - 1 patient died in hospice



CASE # 1
BIOPSY PROVEN HCC 1/5/11



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Y

3D 1 On Projection Distance: 1.30 cm
3D 1 On Projection Min/Max: ?? Spin: -103
Tilt: 2

3D 6 On Projection Distance: 1.88 cm
3D 6 On Projection Min/Max: ??

3D 5 On Projection Distance: 1.39 cm
3D 5 On Projection Min/Max: ??

3D 2 On Projection Distance: 2.20 cm
3D 2 On Projection Min/Max: ??

On Projection Distance: 2.21 cm
On Projection Min/Max: ??

3D 3 On Projection Distance: 1.62 cm
3D 3 On Projection Min/Max: ??

3D 4 On Projection Distance: 1.79 cm
3D 4 On Projection Min/Max: ??



1 MONTH FOLLOWUP

