What have he learnt about RF and the Atrium?
How to use RF in the atrium?

Jacob S. Koruth, MD
Director, Experimental Laboratory
Helmsley Electrophysiology Center,
Mount Sinai Medical Center,
New York, NY

Jacob.koruth@mountsinai.org
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This talk discusses investigational non-FDA approved devices
RF (Point-by-Point) ablation in the Atria

• Types of ablation
  – **Focal ablation** – Challenge is to find the “*best spot*” – e.g.-AVRT, AT, etc. *Creating a lesion* is not often the challenge – *its Where*?

  – Atrial fibrillation/Atypical flutter ablation- **Unique challenges**
  – Requires-
    • Multiple ablation lesions
    • Creating lines of block (forces user to ablate more)
    • Acute success is not the same as chronic success
RF ablation in the Atrium: Why do we still struggle?

- Ablation efficacy suboptimal
  - Insufficient lesion width and depth
  - Lack of circumferentiality and contiguity

- Ablation safety
  - Risk of thromboembolism, steam pop
  - Risk of AE fistula
Nice lesions on the map = Nice lesions in the tissue?
What is the story line/history of this catheter?

How did we learn about non-irrigated RF? - models/preclinical - thick tissue: Ventricle/Thigh

- Initial challenge and focus in RF ablation – Eliminate pathways, AV node-His bundle and VT circuits

- Need
- To create deeper and safer lesions - Birth of Irrigated RF ablation
Point-by-point ablation: *the 3.5mm irrigated RF tip*

How did we learn about irrigated RF? - models/preclinical-thick tissue: Ventricle/Thigh

But how thick is the atrium? - 1-2.5mm and in some areas as thick as 5mm

What about *Shallow, wide and safe lesions* ???

*Irrigated 3.5mm tip and power controlled RF* quickly adopted for LA ablation
Variable Point by Point RF Ablation lesions

Medium Power/ Medium Duration

- **Determinants of lesion**
  - Stability: Contact force/Coupling
  - Power
  - Duration

![Toroidal](image1)
![Circular](image2)
![Rectangular](image3)

- Sparing
- Irregular
- Sparing
How does the atrium respond to irrigated RF over time?
Thin tissue with heat sinks on both sides
Medium Power/ Medium Duration

Atrium 2.75 ratio

Right Ventricle

Left Ventricle 2.0 ratio

Koruth/Reddy 2017 JACCEP
How does the atrium respond to irrigated RF over time?
Thick tissue with heat sinks on both sides

Medium Power/ Medium Duration

- 25 ± 11 (12-60) seconds
- 14 ± 5 (5-25) gms
- 37.0 ± 8.6 (20-50) Watts

- Half of lesions (27/54) - non-transmural

- Marked variability in Atrial lesions

- Based on this study, in the atrium, 80% of dimensions were within 1.75mm (diameter) of the observed lesion
- You can't treat thicker atria the same as thin atria
Challenges in Atrial 3.5mm tip RF Ablation Today

Medium power and Medium duration

- Achieving Stability - cardiac motion / respiration
- Contact force or is it coupling - interdependent
- Duration dependent creation of width
- Tailored RF needed in the atrium – thick and thin atria
- Endocardial sparing that comes with irrigation
- Power control RF

- Despite this we are doing well - with AI, LSI targets with tight spacing Durable PVI rates -90%+
  - Posterior wall thickness changes
    Fat layer changes
    Esophagus is not thick
  - No one wants to see a fistula
  - No one wants to have a reconnection
Aim

1) Wide & Shallow – 1-3mm tissue (Posterior wall LA)

What works against irrigated RF

“Medium Power Medium Duration”?

- Too much surface cooling (irrigation)
- Lesions acquire unwanted depth as we aim for reasonable width (FTI/AI/LSI)
The Problem with Irrigated RF: “Medium Power Medium Duration”

Solution 1) Lower Flow

Low-flow, compared with high-flow, 20 W- 10-15 seconds- <20gm CF 2ml/min vs 17ml/min

Low-flow -max diameter -endocardial surface
High-flow lesions- max diameter 1.5 mm below endo

Higher impedance fall ≥10 Ω, loss of pace capture, electrograms characteristic of transmural lesions, visible lesions on anatomic inspection

Kumar, Michaud et al JACCEP Oct 2017
How to use Solution 1=Low-Flow - Post wall LA

• **20-25 Watts- 2ml/min** (Thermocool- ST)
  • Unfortunately you need time -10-20s
  • Watch for impedance drop, Force -20gm, Avoid temps>43°C
  • Respond to Esophageal temperature!! (you need to know where it is)

• **Avoid heat stacking**
  • If you stop very early- will be shallow and small!!

• What are ‘low flow’ settings for other catheter tips? (SF/FA)?
  • Incidence of asymptomatic cerebral lesions?
The Concept of High Power Short Duration

- 50 W for 2-5 seconds – repeat till egm elimination “minimize heat transfer to prevent deep heating” – safe / effective?

- Winkle et al: 50W – 7-11 seconds
The Problem with Irrigated RF: “Medium Power Medium Duration”

**Solution 2)** Use High Power for Short duration

Overlay view of schematic lesion geometries
(30W 30s red, 50W 13s purple, 60W 10s light blue, 70W 7s blue)
How to use HPSD? : Post wall LA

• Current catheters - 50W/ 5-7-11 sec
• Temperature sensing catheter (Q Dot): 90W/4 seconds – ongoing

• 50W-5 seconds- depth ~2.5mm- too much for inferior venous ostium ?
• No reason not to tailor approach
• Post wall only and use what works….. elsewhere?
• If 50 W- flexible strategy based on CF- yes -7-11 seconds

• Esophageal injury appears comparable based on MRI data
  • Will this reduce Fistulas? Will this eliminate Fistula?
  • Combine low flow, high power, short duration ?
Esophageal Deviation

Mechanical esophageal displacement during ablation for atrial fibrillation.
Koruth JS, Reddy VY
JCE 2015

The Extent of Mechanical Esophageal Deviation to Avoid Esophageal Heating During Catheter Ablation of Atrial Fibrillation - Palinswamy/ Koruth/Reddy
JACCEP -2017
The Problem with Irrigated RF: “Medium Power Medium Duration”
Solutions for the rest of the atrium

• Different modes of RF delivery: ‘Tissue’ temp controlled-
  Power control is not enough

• Fast ablation- Make up for what contact assessment cant fix
  Prolonged contact/ stability is our weakness

• Delivery tools- Change from 3.5mm tip to larger foot print

“Bigger, Faster & Safer lesions” ?
Rest of the atrium

Temperature Controlled-Irrigated RF Diamond tip ablation

- Diamond-tip radiofrequency (RF) irrigated catheter
- Six thermocouples - separated by two diamonds
- Allow heat shunting - high thermal diffusivity
- Split-tip configuration - high resolution egms- rapid lesion assessment

Temperature-Controlled Radiofrequency Ablation for Pulmonary Vein Isolation in Patients With AF

Iwasawa J, Koruth JS, Reddy VY. J Am Coll Cardiol 2017 Aug
Fast ablation 90Wx4 seconds - Temp Limited

Traditional ablation RF time 40-50 min

Fast ablation RF time 4-5 min
Novel RF tips

Expandable irrigated tip catheter with surface thermocouples: 9mm irrigated-tip that also contains thermocouples:
Temperature-controlled mode

Uniform RF delivery over the entire electrode-tip, providing a much larger effective surface area (250 -275mm²)

Wider lesions compared to traditional RF tips (that are typically 3.5-4mm in length)

By abbreviating the duration of lesion and using higher powers, creates shallow lesions
Multi-Electrode Balloon Ablation Catheter
Helios: Directionally-Titratable RF Energy

Courtesy V Reddy
Thank you