Radiofrequency Ablation of Atrial Fibrillation: Modern Tools and Techniques for a Safe, Effective, and Efficient Procedure

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INTRODUCTION
The cornerstone of therapy for atrial fibrillation ablation is pulmonary vein isolation.1,2 Point-by-point radiofrequency (RF) ablation allows for tailored, titratable, and targeted therapy over single-shot balloon approaches. RF ablation also allows the ability for additional ablation of atrial flutter, atrial tachycardia, or other SVT mechanisms such as AVNRT in a single procedure with a single ablation catheter.3-5

Standard RF ablation protocols traditionally included fixed curve sheaths with poor torque control and stability, or deflectable sheaths with pull wires. In addition, traditional ablation protocols included fluoroscopy use as well as low electrode density circular mapping catheters, 3D mapping systems without robust automated electrogram and lesion annotation, double transseptal punctures with transseptal needles, 20- to 30-second RF ablation lesions at low power, intermittent positive pressure ventilation, and 10-minute RF applications.

Key Metrics from a High-Power Short-Duration Ablation Case:

<table>
<thead>
<tr>
<th>Metric</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td>Time to Isolation</td>
<td>34 minutes</td>
</tr>
<tr>
<td>Average Contact Force</td>
<td>14 grams</td>
</tr>
<tr>
<td>Average Impedance Reduction</td>
<td>11.7 ohms</td>
</tr>
<tr>
<td>RF Application Duration</td>
<td>8.5 minutes</td>
</tr>
<tr>
<td>Fluoroscopy Time</td>
<td>0 minutes</td>
</tr>
</tbody>
</table>

Figure 2: The resultant time to isolation of all four pulmonary veins from left atrial access was 34 minutes. The average contact force per lesion was 14 grams with an average impedance reduction of 11.7 ohms. Total radiofrequency application time was 8.5 minutes. No fluoroscopy was used during the procedure.
Delivering a higher power for a longer duration will improve the durability of RF lesions. However, there is also concern for increased complication related to this method of power delivery. In recent years, the concept of high-power short-duration (HPSD) RF ablation has emerged after promising results were shown in several animal as well as human studies. In comparison to the standard RF ablation protocol, HPSD protocol utilizes the application of 45-50W of power for 5-15 seconds per lesion. This method of power delivery was associated with lower complication rates, more localized and durable RF ablation lesions, and reduced procedural and fluoroscopy time. Using this protocol, we were able to significantly reduce the overall case time and improve durable RF lesions for our patients. (Figures 4 and 5)

A key tool utilized to accomplish these goals was the Nagare Steerable Sheath. Since tissue contact and catheter stability are vital to delivering effective RF ablation lesions, we have chosen to use Nagare in more than 200 cases because of its superior performance compared to other mechanical sheaths.

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and rapid deployment of this ablation strategy.

**RF Ablation**

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sensing algorithm. Contiguous transmural RF lesions can be accomplished using this detailed geometry combined with automated lesion tagging (lesion size index, ablation lesion location variability, and impedance drop during ablation).

Procedures that do not use fluoroscopy are accomplished using ultrasound-guided venous access, ICE-guided, and 3D electroanatomic map-guided advancement of catheters, sheaths, transseptal needles, and wires. This has led to decreased radiation exposure to patients and staff, as well as a reduced risk of orthopedic injuries from wearing heavy lead aprons.

**SUMMARY**

A multitude of newer technologies can be readily implemented in the modern electrophysiology laboratory to accomplish safe, effective, and efficient radiofrequency ablation of atrial fibrillation. One of the more important advancements in RF pulmonary vein isolation ablation has been the use of high-power, short-duration lesions. The Nagare sheath enables facile, precise, and rapid deployment of this ablation strategy.

**Disclosures:** Dr. Daniel Friedman reports he is a consultant to Terumo. He also reports personal fees from Abbott outside the submitted work.

**References**


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