

Advancing Atrial Fibrillation Management: Roles and Outcomes of Radiofrequency Ablation

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Abstract: Atrial fibrillation (AF) is a common heart rhythm disorder that increases the risk of stroke and heart failure, requiring effective management to improve patient outcomes. This article highlights the case of a 67-year-old male with persistent AF, who, after failing medical and electrical cardioversion, underwent radiofrequency ablation (RFA) for symptom control. RFA, performed with 3D electro-anatomic mapping, successfully isolated the pulmonary veins, restoring normal sinus rhythm and eliminating arrhythmic episodes over a year of follow-up. The procedure demonstrated the transformative potential of RFA in managing AF, especially for patients unresponsive to medication, by targeting the root cause, reducing symptom burden, and improving long-term cardiovascular health. This case underscores RFA's role as a definitive treatment option for improving quality of life and reducing hospitalizations in AF patients.

Keywords: Sinus rhythm, Cardiac arrhythmias, Atrial fibrillation, Pulmonary vein isolation, Radiofrequency ablation

1. Introduction

Atrial Fibrillation (AF)

Atrial fibrillation (AF) is a common arrhythmia characterized by irregular, rapid heartbeats originating in the atria. It affects approximately 2 - 3% of the global population, with prevalence increasing with age. AF significantly raises the risk of stroke, as the disorganized atrial contractions can lead to blood clot formation, which may embolize to the brain. It also contributes to heart failure due to impaired atrial contraction and inefficient ventricular filling. Effective rhythm control—through medications, electrical cardioversion, or ablation—can help restore normal heart rhythm, reduce symptoms, and lower the risk of complications like stroke and heart failure progression. Early intervention in managing AF is essential to improving long-term outcomes and reducing the burden of these associated risks.²

Radiofrequency Ablation (RFA)

Radiofrequency ablation is the targeted cautery of cardiac tissue by local application of radiofrequency energy. Target zones are identified during an electrophysiological study, in which a series of catheters are placed in the heart.³ In case of atrial fibrillation (AF), the pulmonary veins, are the primary source of abnormal electrical impulses triggering AF. The procedure involves creating controlled lesions around the pulmonary veins using radiofrequency energy to disrupt these electrical signals. By isolating these veins, RFA prevents the erratic electrical activity from spreading to the rest of the atria. RFA is particularly beneficial for patients who do not respond to antiarrhythmic drugs or those with persistent AF who continue to experience symptoms despite pharmacologic treatment. It can significantly reduce the frequency of AF episodes, improve symptoms, and enhance quality of life.

RFA is often considered when medical therapy fails or when patients are intolerant to drugs.

2. Case Presentation

67 y/o male retired gentleman, came to OPD with complains of SOB class III since last 2 months and also complains of palpitations since last 10 days and has exertional fatigue, ECG showed AF with FVR >140, He was started on betablocker for rate control, Amiodarone for rhythm control, was anticoagulated, ECHO revealed EF 30%, LA size 4.2cm - rate was controlled, rhythm was AF. Electrical Cardioversion was done with 200J - converted to sinus rhythm, as he was having severe LV dysfunction, he underwent CAG or r/o Obstructive CAD which revealed normal coronaries, Troponins were in normal limits

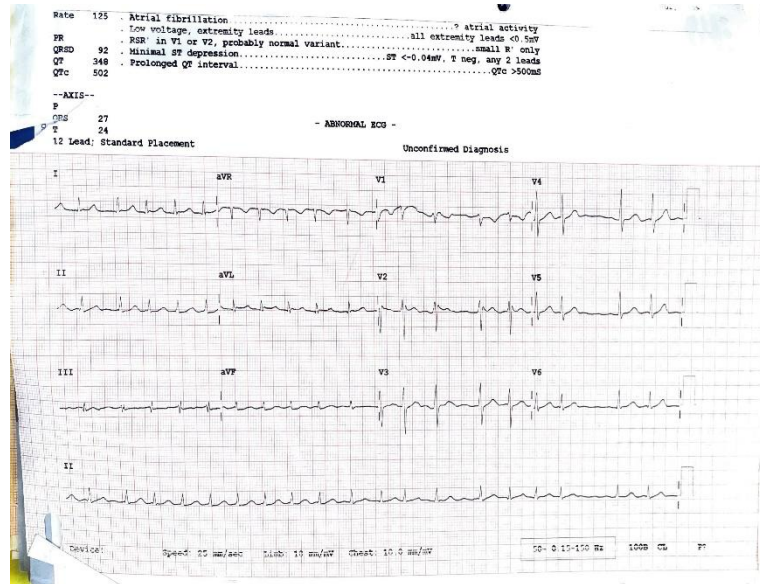
He was under close follow up for next 3 years, asymptomatic status, one fine day he came with atrial fibrillation with fast ventricular rate, refractory to medical cardioversion also response to electrical cardioversion was negative, echo revealed EF of 60%, LA size remained 4.2cm, he was then offered EPS+ RFA

RF Ablation was planned, 3D mapping was performed Under aseptic precautions, successful all four pulmonary vein isolation (WACA) was done under 3D Electro - anatomic mapping system. Post procedure, no tachycardia was induced at baseline or on isoprenaline. Procedure was uneventful. There were no major peri/post procedural complications.

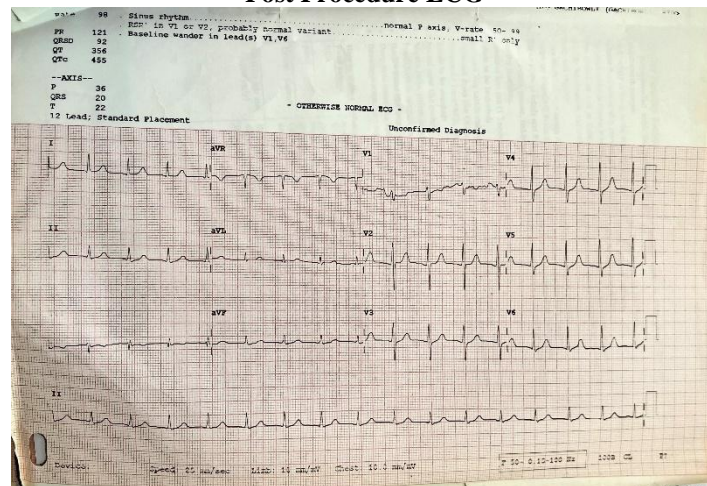
Post procedural ECG showed Sinus rhythm[at]68/min

He was discharged with a beta blocker and is under follow up for last 1 year and has no relapses/hospitalization till now

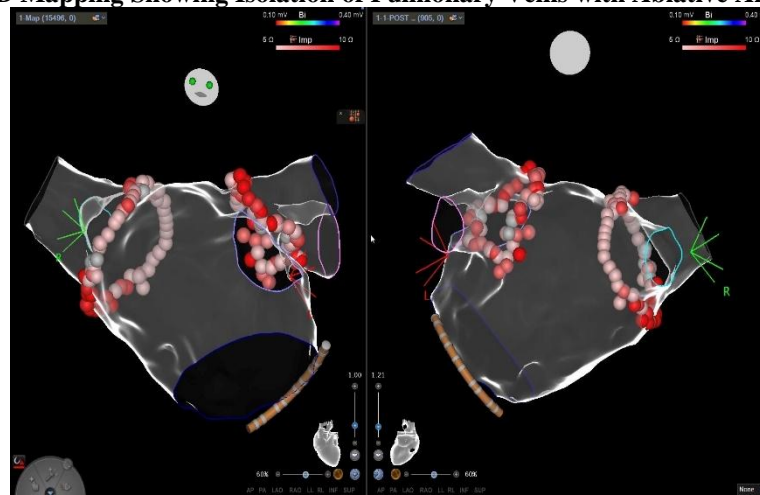
Pre - Procedural ECG



Post Procedure ECG



3D Mapping Showing Isolation of Pulmonary Veins with Ablative Areas



3. Discussion

Radiofrequency ablation (RFA) has become an effective treatment for atrial fibrillation (AF), particularly in patients who do not respond to antiarrhythmic drugs or have persistent symptoms¹. In patients with paroxysmal AF, RFA has higher

success rates, with 50% achieving long-term freedom from AF after a single procedure⁵. Success rates tend to be lower in those with persistent AF, typically ranging from, as the arrhythmia becomes more complex with structural and electrical remodeling. However, repeat ablation procedures can improve outcomes in persistent AF patients.⁵

Long - term outcomes demonstrate a reduction in AF recurrence and the need for long - term anticoagulation therapy, improving overall cardiovascular health and reducing stroke risk.

Comparison to Medical Management

Radiofrequency ablation (RFA) offers several advantages over antiarrhythmic drug therapy and other management strategies for atrial fibrillation (AF). Unlike drugs, which may require lifelong use and can have significant side effects or limited efficacy, RFA targets the root cause of AF by isolating the pulmonary veins, potentially offering a long - term solution with a single procedure. While antiarrhythmic drugs may control AF episodes, they do not prevent recurrence and may not alleviate symptoms for all patients. RFA has been shown to reduce AF burden, improve quality of life, and reduce hospitalizations. It is particularly beneficial for patients with symptomatic paroxysmal or persistent AF, and it lowers the need for ongoing anticoagulation therapy, reducing stroke risk. Compared to other strategies like rate control, which manage symptoms without addressing the underlying arrhythmia, RFA offers a more definitive approach with higher success rates in maintaining normal sinus rhythm.⁴

Complications

Common complications of radiofrequency ablation (RFA) for AF include stroke, cardiac tamponade, and pulmonary vein stenosis. Rare but serious complications include phrenic nerve injury, which can affect diaphragmatic function, and esophageal injury, potentially leading to atrio - esophageal fistula.

4. Conclusion

Radiofrequency ablation (RFA) is transforming atrial fibrillation (AF) management by offering a definitive, rhythm - controlling approach. It reduces AF recurrence, enhances symptom relief, and improves long - term outcomes, especially in patients unresponsive to medications. By restoring normal sinus rhythm, RFA decreases hospitalizations, lowers stroke risk, and enhances quality of life.

5. Summary

Radiofrequency Ablation has revolutionised the management of atrial fibrillation, particularly recurrent non - valvular atrial fibrillation, offering a more definitive and effective approach compared to traditional pharmacological therapies¹ By targeting the source of abnormal electrical impulses, RFA achieves higher success rate in restoring and maintaining sinus rhythm⁵ reducing AF recurrence, and alleviating symptoms. The case discussed underscores the importance of personalized intervention highlighting how RFA can enhance long term outcomes, improve quality of life and reduce hospitalisations for patients unresponsive to medical therapy.

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