

Scenes from a CFAE: Complex Fractionated Atrial Electrogram Map in a Woman with Longstanding Persistent Atrial Fibrillation Following Mechanical Mitral Valve Replacement

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Abstract

Case: A 62-year-old woman was referred for atrial fibrillation (AF) ablation. She had longstanding persistent AF for 8 years since mechanical mitral valve replacement for rheumatic heart disease.

EPS: A strategy of substrate-based ablation targeting areas of complex fractionated atrial electrograms (CFAE) was pursued. These sites were identified by inspection of electrograms and verified with software-based electrogram analysis, with the left atrial roof demonstrating the highest density of CFAE sites. Successful catheter ablation was performed. The patient has remained free of recurrence over 4 months of follow-up.

Discussion: This case presents a successful ablation procedure using the emerging strategy of CFAE-targeted ablative lesions. Given the patient's longstanding persistent AF and mechanical mitral valve, the high density of CFAE sites on the left atrial roof was an unexpected finding. Analysis for CFAE sites guided the procedure in a direction that might otherwise not have been undertaken, leading to a successful ablation.

Introduction

Recent studies have shown improved efficacy of atrial fibrillation (AF) ablation using a strategy that isolates pulmonary vein triggers and modifies AF substrate at sites of complex fractionated atrial electrograms (CFAE).¹⁻³ We present a case of longstanding persistent AF that was successfully ablated with this strategy. The novel features of this case include the use of this emerging ablation technique

and the ablation of longstanding persistent AF in the setting of a mechanical mitral valve.

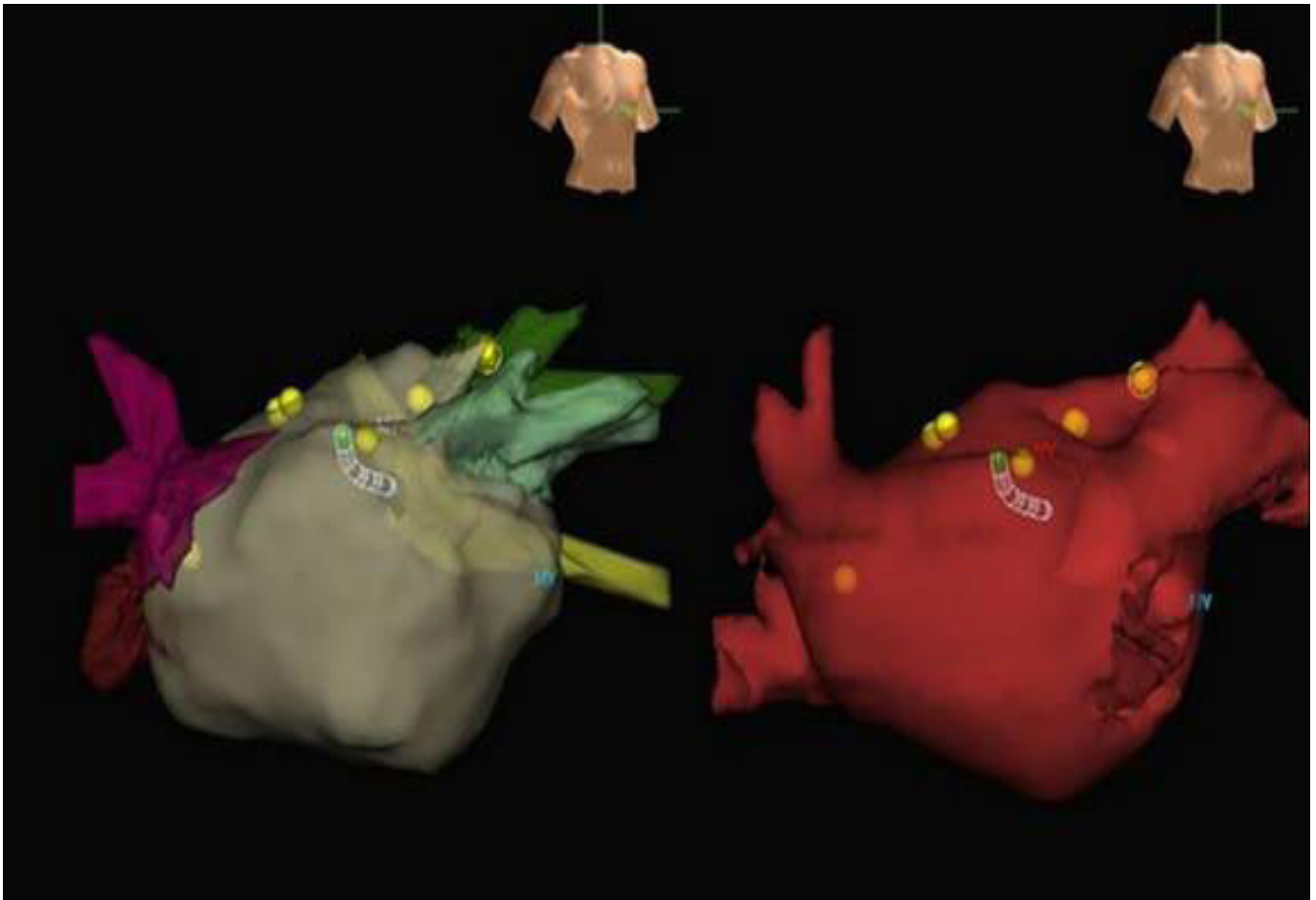
Case

A 62-year-old woman presented with 8 years of palpitations. She had longstanding persistent atrial fibrillation (AF) since mechanical mitral valve replacement for rheumatic heart disease. The patient failed antiarrhythmic therapy and was referred for catheter ablation of her AF.

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Figure 1: Noncontact Mapping Geometry and CT Angiography.

RAO projection of left atrium in NavX system. Left: Catheter-based noncontact mapping geometry. Pulmonary veins are separated by color. Right: CT Angiography-based anatomy. In both panels, yellow dots indicate sites of highly fractionated activity by conventional atrial electrograms. Ablation catheter is visible. MV: Mitral Valve prosthesis



EPS

At electrophysiology study, noncontact catheter mapping was performed to obtain an atrial geometry, which was then fused with CT-based data to produce a merged image (Figure 1). Transseptal left atrial access was obtained under intracardiac echocardiographic guidance. An ablation strategy targeting CFAE sites and pulmonary vein isolation was then undertaken. Esophageal temperature monitoring was used throughout the procedure.

CFAE sites were first localized by inspection of conventional intracardiac electrograms and marked on the CT-geometry image (Video). Using the St. Jude Medical NavX system, a CFAE map was then constructed using the CFAE-Mean software. Briefly, fibrillatory deflections meeting appropriate frequency and amplitude criteria are gathered at each point over an 8-second collection period. The mean time between these deflections

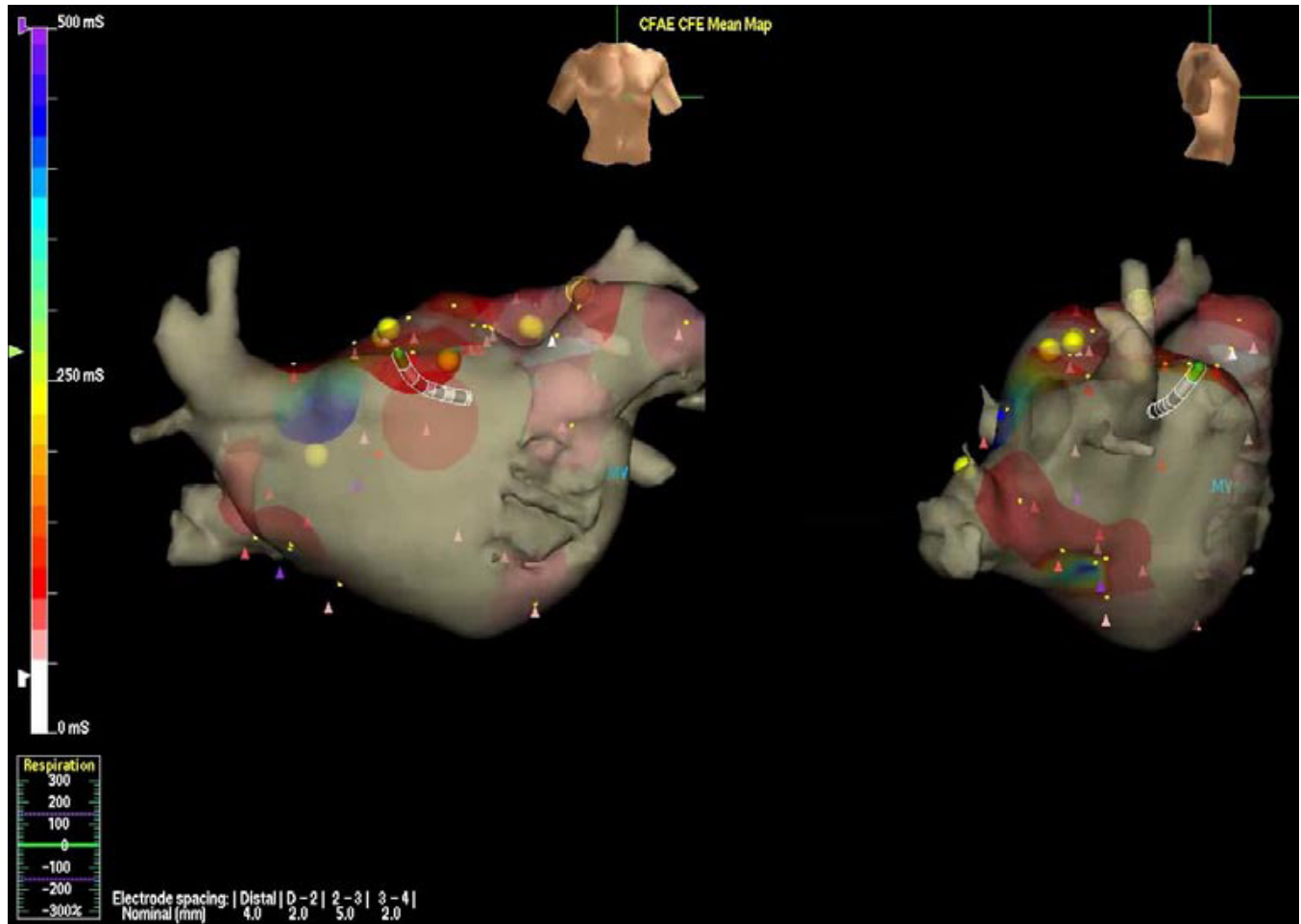
over the period is then calculated and displayed by a color-coded scale, thus generating points and regions of varying degrees of fractionation (Video).

Radiofrequency lesions were placed with a 4mm-tip catheter at areas of highly fractionated electrical activity, as indicated on the CFAE map (Figure 2). Pulmonary vein isolation was also performed, with a final lesion set resembling wide area circumferential ablation (WACA) with a left atrial roof line and a mitral isthmus line. The patient's AF organized to an atypical flutter, treated with IV ibutilide. Cardioversion then restored sinus rhythm. She has not had any AF recurrences by symptoms or routine EKG monitoring in over 4 months of follow-up.

Discussion

This case presents a successful ablation procedure

Video Legend: Merged CT angiogram and catheter-based mapping geometry with CFAE map using the St. Jude Medical NavX system are displayed. Left panel starts in LAO view and right panel in RAO projection. Yellow dots indicate areas of highly fractionated activity by conventional electrograms. Ablation catheter and mechanical mitral valve prosthesis (MV) are demonstrated. Scale to the left indicates average time interval between deflections, in milliseconds (mS). Inter-electrode spacing is indicated at the bottom of the display. Radiofrequency AF ablation was performed successfully



using the emerging strategy of CFAE-targeted ablative lesions. The highest density of CFAE sites was found to be at the left atrial roof, which was an unexpected finding. This may reflect fractionation as a result of the past atriotomy. It is also possible that the previous rheumatic mitral valve disease had led to atrial scarring in the region of the mitral valve, leaving the atrial roof as the only remaining active area, which was debulked by the ablation procedure. In either case, analysis for CFAE sites guided the procedure in a direction that led to a successful ablation. Although strict CFAE-guided ablation has met with limited success, the addition of pulmonary vein isolation to the procedure has increased efficacy.² Recent evidence suggests that with longstanding persistent AF, a strategy that targets CFAE sites in addition to pulmonary vein isolation leads to higher success rates both at the

time of procedure and in long-term maintenance of sinus rhythm.³

Conclusion

Ablation of AF employing a strategy targeting CFAE sites in addition to pulmonary vein isolation can be a curative therapy in patients for whom a substrate modification ablation strategy is appropriate, such as in our example of longstanding persistent AF following mechanical MVR.

References

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Figure 2: Representative Example of Radiofrequency Ablation Lesion Targeting Complex Fractionated Atrial Electrograms. Left panel shows ablation catheter tip (ABL-d, bottom) at a region of complex fractionated activity, characterized by continuous electrical activity of multiple variable frequencies, with periods of very short cycle lengths. Fractionation is also seen in the coronary sinus, in contrast to the regular, organized right atrial activity. The right panel demonstrates the same region following 30 seconds of radiofrequency ablation. Nearly all electrical potential has been ablated from the site of the distal tip.



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