

# Feasibility of 12-Lead ECG Computational Analysis in Patients After COVID-19 Infection

David E. Krummen MD<sup>1,2</sup>, Kevin Sung, MD<sup>1</sup>, Andrea Sandri, BS<sup>1</sup>, Sandhya Sihra, BS<sup>3</sup>, Jamie Marsal<sup>1</sup>, Christopher T. Villongco, PhD<sup>4</sup>, Robert J. Krummen, JD<sup>4</sup>, Jonathan C. Hsu, MD, MAS<sup>1</sup>, Kurt S. Hoffmayer, MD<sup>1,2</sup>, Frederick T. Han, MD<sup>1,2</sup>, Gordon Ho, MD<sup>1,2</sup>

1. Department of Medicine, University of California San Diego, 2. VA San Diego Healthcare System, 3. Department of Bioengineering, University of California San Diego, 4. Vektor Medical, Inc.



## INTRODUCTION

- Myocardial inflammation is common following COVID-19 infection and may cause or exacerbate arrhythmias in patients with comorbid conditions (1).
- Potential mechanisms for cardiac arrhythmias include hypoxia, myocarditis, abnormal immune response, myocardial ischemia, myocardial strain, electrolyte abnormalities, intravascular volume derangements, and side effects from medications (2).
- Rapid assessment may facilitate patient-specific care for patients with cardiac arrhythmias.
- We hypothesized that 12-lead electrocardiographic (ECG) computational analysis is feasible and may provide insights beyond the standard ECG in patients following COVID-19 infection.

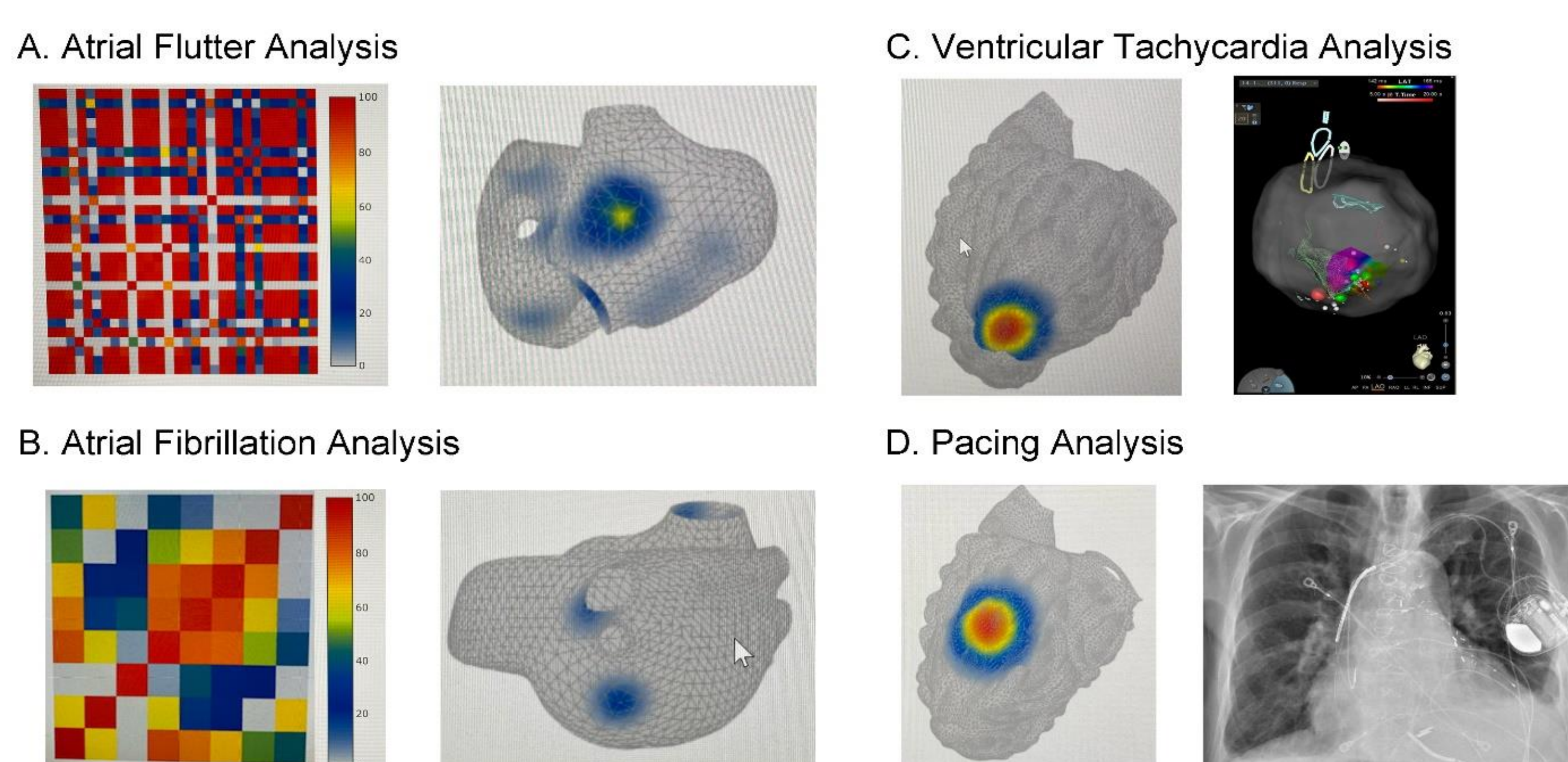
## METHODS

- Under an IRB-approved protocol, 12-lead ECG data from patients who had recently recovered from COVID-19 infection and who required arrhythmia management was analyzed using a computational ECG algorithm.
- The algorithm included analysis regarding the organization of atrial (3) and ventricular arrhythmias (4), potential activation site information, and likely sites of pacing.
- We compared analysis results with results from invasive electrophysiology mapping and/or clinical imaging.
- We assessed feasibility and utility within the clinical spectrum of arrhythmia issues in patients following COVID-19 infection.

**Table:** Patient Characteristics

Patient Number	Age	LV EF	Time After COVID-19 Dx (Months)	Arrhythmia Type	CIED Type	Advanced Heart Failure Support, Type
1	76	20	2.6	Typical Atrial Flutter	BiV ICD	No
2	68	20	0.5	Ventricular Tachycardia	BiV ICD	Yes, HeartWare LVAD
3	85	17	3.0	Atrial Fibrillation, AV Block	BiV ICD	No
4	68	35	1.8	Atrial Fibrillation	Dual Chamber ICD	No
5	77	50	0.9	Atrial Fibrillation, Ventricular Tachycardia	Pacemaker	No

**Figure:** (A, left) Mosaic analysis shows characteristic features of typical atrial flutter (right). (B, left) Mosaic analysis during atrial fibrillation is shown, with potential AF sites of interest (right). (C, left) Ventricular tachycardia heatmap analysis with potential hotspot at the apex of the left ventricle compared with invasive VT mapping results (right). (D, left) ventricular pacing heatmap analysis of LV lead pacing compared with location of BiV ICD LV lead (right) by radiography.



## RESULTS

- 5 patients were evaluated (age  $75 \pm 7$  y, LVEF  $28 \pm 14\%$ , NYHA Class  $3.0 \pm 0.7$ ) at  $1.8 \pm 1.1$  months after COVID-19 diagnosis.
- A total of 7 clinical arrhythmias were observed (1.4 per patient), including typical atrial flutter (n=1, fig A), atrial fibrillation (n=3, fig. B), ventricular tachycardia (n=2, fig. C), and high-grade AV block with ventricular pacing (n=1, fig. D).
- Analysis was performed successfully in 6 of 7 arrhythmias (86%).
- The exception was due to excessive ECG noise precluding detailed analysis of atrial fibrillation.

## DISCUSSION

- Additional studies are required to assess the mapping accuracy of 12-lead ECG computational analysis compared with invasive electrophysiology study results.
- Care must be taken to ensure acceptable noise during clinical ECG recording to optimally facilitate this analysis.
- Additional work is required to better understand the relationship between myocardial inflammation and arrhythmias related to COVID-19.

## CONCLUSIONS

- In this sample population, atrial arrhythmias (AF and AFL) were the most common after COVID-19 infection, followed by ventricular tachycardia and AV block.
- Computational 12-lead ECG analysis was feasible in most cases and provided insights beyond those available from the standard 12-lead ECG

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## FINANCIAL DISCLOSURES

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