

Novel Three-Dimensional Mapping Integrating Electrocardiogram Morphology for Difficult-to-Map Premature Ventricular Contractions

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Background

- Catheter ablation for premature ventricular contraction (PVCs) management is an option when highly symptomatic or with high burden but may be unsuccessful in certain patients due to challenges with identifying PVC origin during the procedure
- These difficult-to-map (DTM) PVCs may occur due to anatomical locations, low intra-procedural burden, or other factors that may require advanced techniques
- VIVO™ (Catheter Precision, Fort Mill, SC) is a pre-procedural tool to better identify PVCs by overlaying vector cardiograms – derived from multiple QRS vectors on 12-lead electrocardiograms – on computed tomography imaging; this activation map is then superimposed on electroanatomic maps created by standard software (**Figure 1**).
- Use of VIVO has been demonstrated to localize PVCs accurately in up to 75% of cases but has not been evaluate for these DTM PVCs¹

Objective

We evaluate the efficacy of the VIVO system for DTM PVCs

Methods

- This was a multicenter (Overland Park Regional Medical Center, Overland Park, KS; Lovelace Medical Center, Albuquerque, NM), observational study of patients undergoing catheter ablation for PVCs utilizing VIVO from July 2021 onwards
- Procedures were labeled as DTM if they met one of the following criteria: 1) Failed a prior attempt at PVC ablation, 2) Low pre- and intra-procedural PVC burden - especially with use of adrenergic agents, 3) Challenging anatomical locations, including septal, parahisian, papillary, and other locations proximal to the conduction system.
- Endpoints included acute and long-term success. Acute success was defined as complete – elimination of all PVCs immediately post-procedure – or partial success; long-term success was defined as >75% reduction in PVC burden at three months.

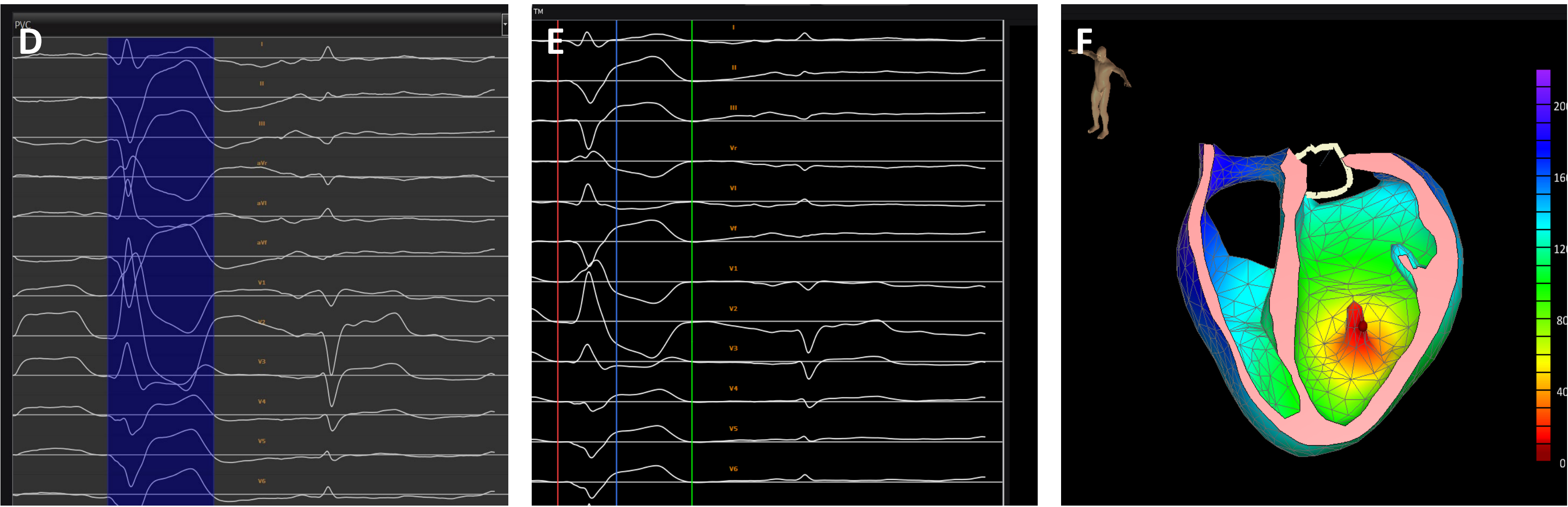
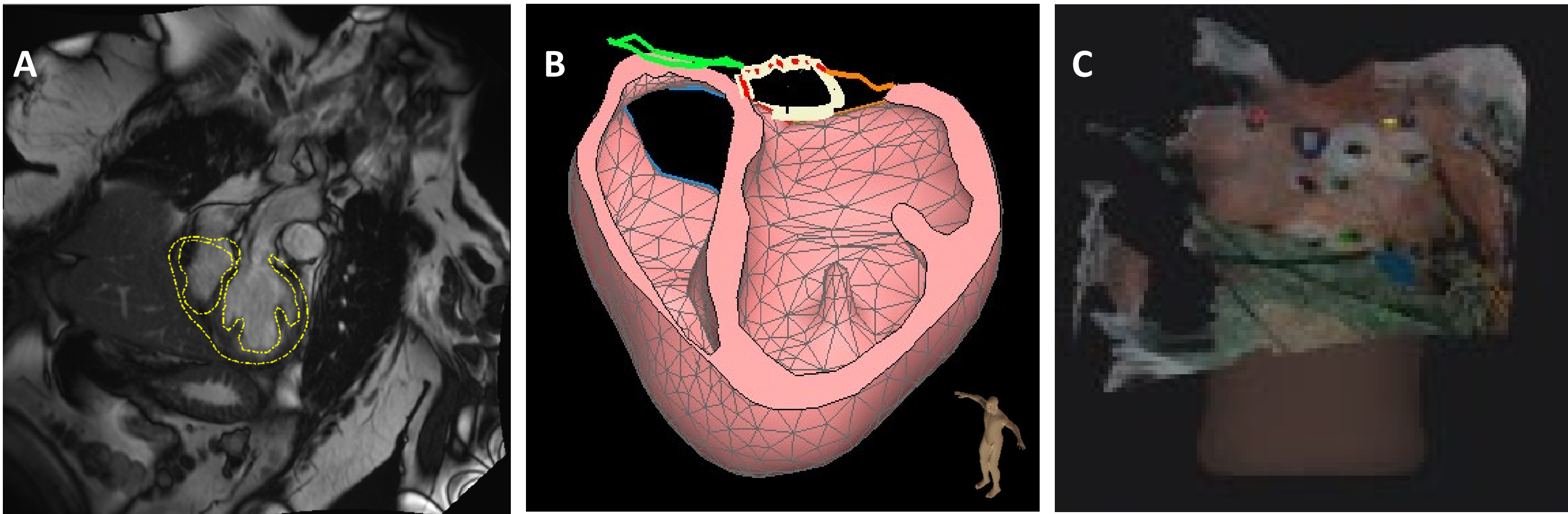


Figure 1. VIVO Model. (A) VIVO model constructed from MRI. (B) Segmented VIVO model with a long-axis cross-sectional view of the patients' ventricles, partially reflected on the side. (C) ECG leads merged to the patients' torso. (D) Pulling in PVC morphology. (E) VIVO analysis of the PVC origin. (F) VIVO map of PVC localization.

Results

Table 1. Baseline Characteristics. 117 patients were identified with DTM PVCs.

Age	65.8±12.5
Male Gender	68.1% (81)
Coronary Artery Disease	22.7% (27)
Left Ventricular Ejection Fraction	49.5±13.2
Baseline PVC Burden	16.4±10.9
Prior AAD Use	24.4% (29)
Prior Ablation	32.8% (39)

Figure 2. Reasons for DTM PVCs. Many PVCs ablated with the VIVO systems were labeled DTM for multiple reasons.

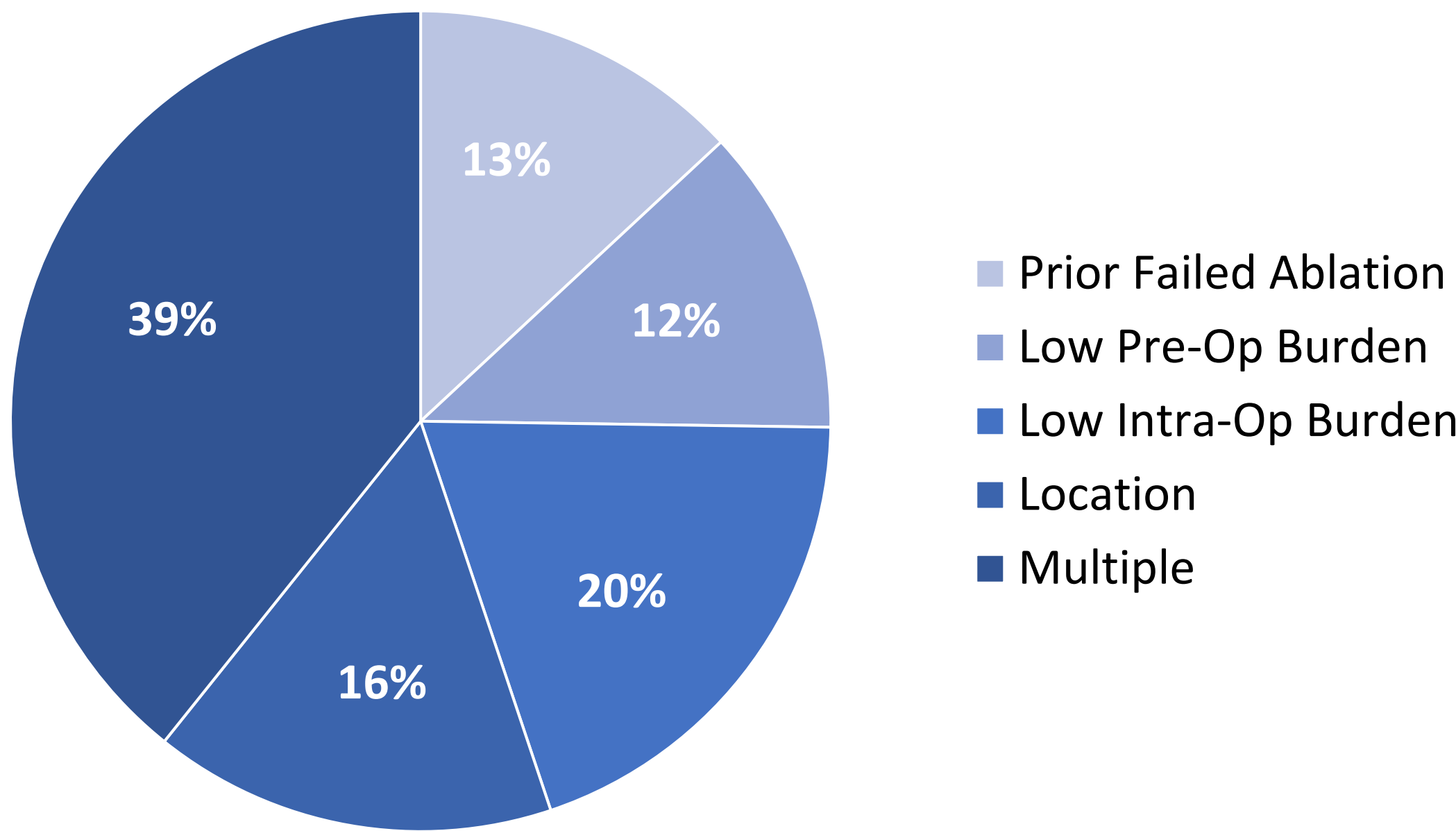


Figure 3. (A) Acute and (B) Long-term Success. Using VIVO resulted in high acute complete and partial success that marginally decreased over time.

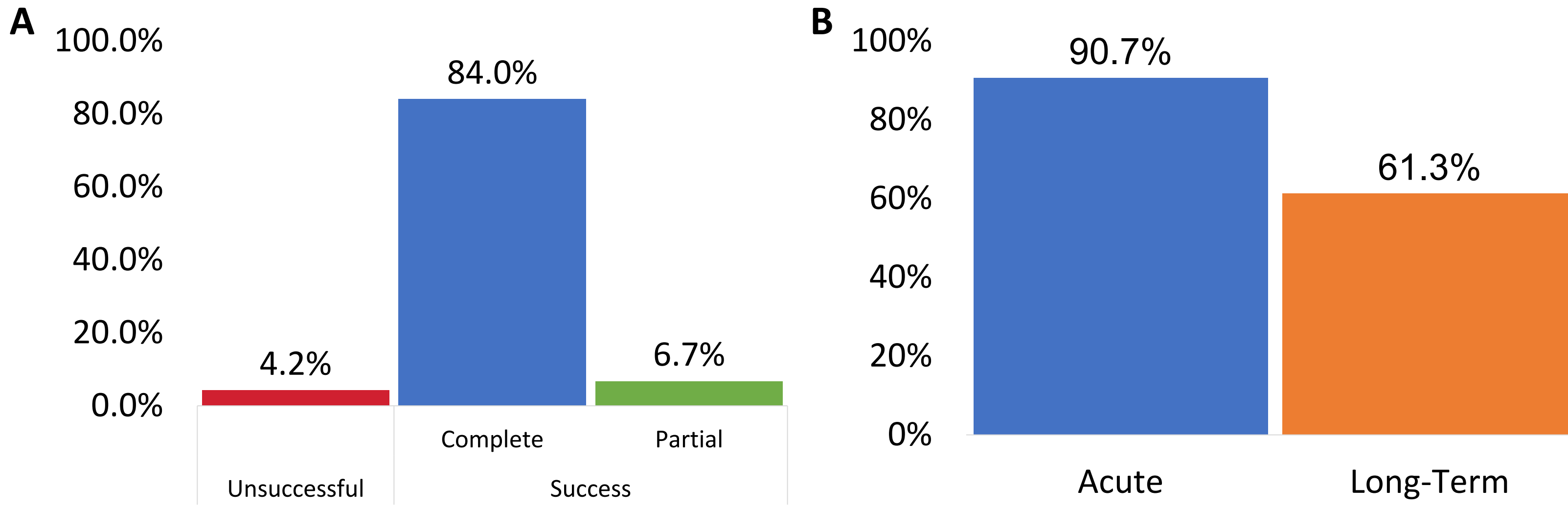
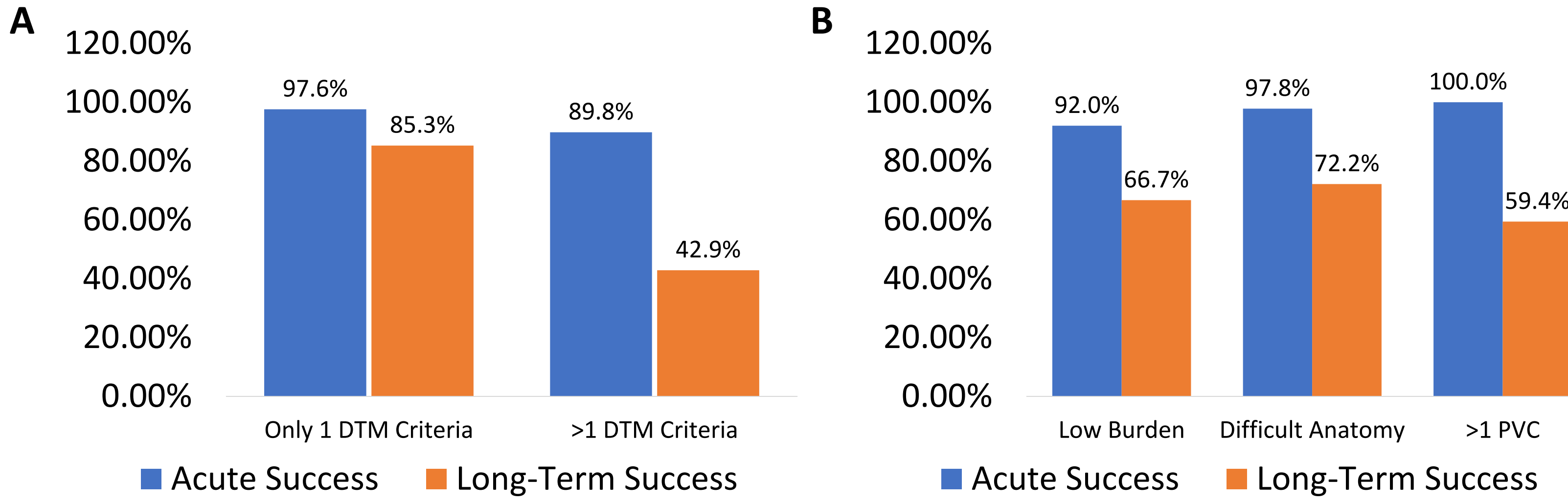


Figure 4. Success With (A) Only 1 DTM Criteria and (B) Individual Components of DTM Criteria. Using VIVO has much higher success in patients that had only one DTM criteria. PVCs meeting individual components for DTM criteria also had high acute success using the VIVO system.



Conclusions

- Certain PVCs are challenging to treat due to difficulty with mapping, identification, and access to the origin.
- Specific locations, such as the left ventricular summit, close to the conduction system, and intramural myocardium have a high failure rate and may benefit from enhanced pre-procedural planning.
- In these patients with DTM PVCs, utilizing VIVO provides a non-invasive tool for localization and enhance ablation, leading to to high acute and long-term success.
- Further studies of VIVO are still needed

References

1. Lesina K, Szili-Torok T, Peters E et al. Performance and Robustness Testing of a Non-Invasive Mapping System for Ventricular Arrhythmias. *Front Physiol* 2022;13:870435.