Peak frequency analysis and differentiation of near-field from far-field electrograms of the ventricular tachycardia circuit leads to successful ablation of the arrhythmia

Authors: Jakub Malinowski, Jan Ciszewski, Mariusz Pytkowski, Aleksander Maciąg
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Peak frequency analysis and differentiation of near-field from far-field electrograms of the ventricular tachycardia circuit leads to successful ablation of the arrhythmia

Short title: Peak frequency analysis of electrograms in ventricular tachycardia ablation

Jakub Malinowski\textsuperscript{1,2}, Jan Ciszewski\textsuperscript{3}, Mariusz Pytkowski\textsuperscript{3}, Aleksander Maciąg\textsuperscript{3}

\textsuperscript{1}Faculty of Medicine, Medical University of Warsaw, Warszawa, Poland
\textsuperscript{2}Students’ Scientific Society affiliated at National Institute of Cardiology, Warszawa, Poland
\textsuperscript{3}\textsuperscript{2}nd Department of Arrhythmia, National Institute of Cardiology, Warszawa, Poland

Correspondence to: Jakub Malinowski,
Cardinal Stefan Wyszyński National Institute of Cardiology,
Alpejska 42, 04–628 Warszawa, Poland,
phone: +48 882 622 478,
e-mail: jmalinowski@ikard.pl

Achieving the subepicardial substrate of ventricular tachycardia (VT) during endocardial mapping can be challenging, particularly in the low-amplitude area [1, 2]. Multipolar electrodes and omnipolar technology allow the mapping of even small areas of electrically active tissue, particularly in the area of post-infarction scar, and provide a wealth of information useful for visualising the arrhythmia substrate [3]. Complementing this technology is the EnSite OT Near Field (Abbott Chicago, IL, US) technology which provides a distinction between near-field and far-field potentials of intracardiac electrograms in electroanatomic mapping. It facilitates differentiation of the arrhythmia substrate component from irrelevant signal components [4].

The authors present the case of a 64-year-old man with a history of electrical storm, left ventricular (LV) inferior wall myocardial infarction, heart failure with reduced ejection fraction of \( \sim 30\% \), stable coronary artery disease, and an implantable cardioverter-defibrillator implanted for secondary prevention, who was admitted to the cardiac arrhythmia unit for recurrent ventricular tachyarrhythmias with a rate below implantable cardioverter-defibrillator detection. Patient qualified for catheter ablation of underlying VT.

The patient was connected to an intracardiac recording system (Bard US) and an Ensite X electroanatomic system (Abbott). Decapolar and quadripolar diagnostic catheters were
placed in the coronary sinus and His bundle area, respectively, via the right femoral approach. The Advisor HD Grid Mapping Catheter and subsequent Tacti Cath ablation catheter (both Abbott) were introduced into the LV via transseptal puncture. Clinical VT with a cycle of approximately 530 ms was easily induced during the electrophysiological study. Endocardial mapping of the LV was performed during the hemodynamically well tolerated VT. A large post-infarction scar was visualised in the inferior-posterior part of the left ventricle. Despite the multipolar catheter and the omnipolar technology, only the entry and exit tachycardia areas could be visualised on the propagation map, while the critical tachycardia isthmus was not visible.

During the entrainment it was possible to locate areas close to the VT exit with up to 79% pace mapping and a PPI of around 44 ms. The EnSite OT near-field technology was then used, with peak frequency (PF) recorded signals set at 250–1000 Hz, to distinguish the near-field from the far-field components and to analyze the low-field region, allowing areas associated with VT conduction to be identified.

PF analysis of the fragmented potentials allowed selection of the site for further RF energy application. Possible modification of part of the tachycardia circuit led to VT termination during RF application, probably with transmural application near the exit site. Clinical ventricular tachycardia was no longer induced during electrophysiological study after ablation.

The case presented here illustrates the potential benefits of using the PF tool as an adjunct to multipole mapping and entrainment [5]. Although this method does not replace existing methods, it may reduce the risk of unnecessary applications at sites where far-field signals are present and may distinguish the correct fragmented potential as part of the arrhythmogenic substrate.

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**REFERENCES**


Sites of tachycardia interruption: 

A: IEGM recordings. Entrainment in application site near tachycardia exit. Pace mapping of tachycardia morphology. 75% PPI TCL = 64 ms. 

B: Moment of final VT interruption. 

C: Propagation map showing VT circle on left ventricular inferior wall with arrhythmia interruption site marked (red arrow) note that only half of circle was visible. 

D: Potential map with peak frequency analysis filter overlay highlighting area of interest in the scar.