Pseudo micro-reentrant activation pattern created by coherent mapping of the right atrial free wall: A case report

Masao Takahashi, MD*, Rintaro Hojo, MD, PhD*, Tomoyuki Arai, MD*, Takashi Kimura, MD*, Seiji Fukamizu, MD, PhD*

*Tokyo Metropolitan Hiroo Hospital, Cardiology

Address for Correspondence:

Masao Takahashi, MD, Department of Cardiology, Tokyo Metropolitan Hiroo Hospital

2-34-10 Ebisu Shibuya-ku, Tokyo, 150-0013, Japan

Email: seikouudokuforever0419@yahoo.co.jp

Disclosures: All authors declared no conflict of interest associated with this report.

Abstract

Coherent mapping with CARTO3 is useful to identify the critical isthmus of scar-related AT. However, it has also a pitfall. We present atrial tachycardia (AT) with pseudo micro-reentrant activation pattern created by coherent mapping on the right atrial free wall. It is possible that a pseudo tachycardia circuit was created due to the algorithm for the reconstruction of coherent mapping. Finally, entrainment mapping led to the

identification of correct tachycardia circuit and termination of tachycardia by catheter ablation. When using coherent mapping with CARTO3, it is necessary to understand the pitfall well.

Keywords: atrial tachycardia, dual-loop circuits, coherent mapping

Introduction

Three-dimensional electroanatomic mapping is a useful tool to identify tachycardia circuits. A report demonstrated that coherent mapping was better than conventional activation mapping in identify critical isthmus sites where ablation terminated the tachycardia.[1] However, treatment can become difficult without understanding the characteristics of the coherent mapping

Case report

A 71-year-old man underwent an electrophysiological study and catheter ablation for recurrent atrial tachycardia (AT) after pulmonary vein isolation and cavo-tricuspid isthmus (CTI) ablation. Since AT with a cycle length of 290 ms was sustained and the activation sequence of the coronary sinus proceeded distally, right atrial activation mapping was initially performed with a multi-electrode catheter (Pentaray, Biosense-Webster, Inc., Diamond Bar, CA, USA) and the CARTO 3 system with the CONFIDENSE module. The activation pattern showed a counter clockwise rotation pattern around the tricuspid annulus (Figure 1. A) and coherent mapping showed

another activation pattern that rotated clockwise around a small slow or nonconducting region on the right atrial free wall (Figure 1. B). Furthermore, a conduction gap was observed on the inferior vena cava (IVC) side of CTI. We performed entrainment mapping from the selected sites as follows. It was confirmed that the tachycardia cycle length and the post-pacing interval were equal upon pacing from the lateral side of the IVC, on the CTI (Figure 2, site 1), and from the septum (site 2). Futhermore, entrainment pacing was performed on three locations to analyze whether the activation pattern shown by coherent mapping was correct. At two of the three sites, the difference between the post-pacing interval and the tachycardia cycle length was 0 ms (site 4) and -5 ms (site 5), respectively. However, the difference found through entrainment pacing at the remaining site (site 6) was +55 ms. Through careful analysis of the above, it was found that the circuit of the right atrial free wall was not the main circuit, and a diagnosis of an isthmus-dependent typical common type atrial flutter through conduction gap of IVC side in CTI was made. Using an irrigated tip catheter (ThermoCool SmartTouch SF, Biosense-Webster, Inc.), radiofrequency energy was applied to the IVC side of the CTI, and the tachycardia was terminated within 1.3 s. After performing three additional radiofrequency applications, we succeeded in creating a bidirectional conduction block. The procedure was completed without complications.

Discussion

This case presented that coherent mapping has a pitfall causes hindrance of the correct identification of the tachycardia circuit. The pitfall was the interpretation of the electric propagation on coherent mapping. As shown in Figure 1B, the conduction velocity vectors turned clockwise around the slow or nonconducting region recognized on the right atrial free wall and counterclockwise in the tricuspid annulus, giving rise to the misconception of dual-loop circuits. In this case, a long low-voltage region had spread on the free wall, and there was a basis for considering dual-loop circuits from previous study. [2] This initial misleading was due to the prevailing algorithms for the reconstruction of coherent mapping. This algorithm uses the local activation time (LAT) values of all points in the map to perform iterative calculations, revealing the optimal solution for the entire chamber of the target arrhythmia and automatically orients the coloring and conduction velocity vectors to create a tachycardia circuit. Several reports have shown the efficacy of coherent mapping in identifying the critical isthmus of scar-related AT.[1] However, this automatic analysis had a pitfall in this case. It was found that the micro-reentrant activation pattern was reconstructed by automatically calculating the optimum solution of the LAT value. The most effective solution for this pitfall was entrainment mapping, as described above. Further evolution of the mapping system is expected in the future, but the power of entrainment mapping, which is a conventional approach, will be required to identify complicated tachycardia circuits.

References

1. Vicera JJB, Lin YJ, Lee PT, Chang SL, Huang SH, Chou CY, Lugtu I, Liu CH, Chen SA. Identification of critical isthmus using coherent mapping in patients with scar-related atrial tachycardia. Journals of Cardiovascular Electrophysiology 2020;31:1436-1447.
2. Yang JD, Sun Q, Guo XG, Zhou GB, Liu X, Luo B, Wei HQ, Santangeli P, Liang JJ, Ma J. Right atrial dual-loop reentrant tachycardia after cardiac surgery: Prevalence, electrophysiological characteristics, and ablation outcomes. Heart Rhythm 2018;15:1148-1157.

Figure legends

Figure 1. A: Activation map of the right atrium during AT. The lower threshold of the early meets late was set to 23%. Thick white arrows indicate the direction of the activation. B: Coherent map under the same conditions as A. Threshold of conduction velocity vectors was set to 10. In addition to A, excitement propagation was observed clockwise around the slow or nonconduction region of the free wall.

AT = atrial tachycardia, IVC = inferior vena cava, CTI = cavo-tricuspid isthmus

Figure 2. Entrainment map of right atrium. Left side is a view looking up from IVC side. Right side is a front view of free wall. Site 1-6 are each pacing site for entrainment and red circles show ablation tag. TA = tricuspid annulus.

Figure 1.

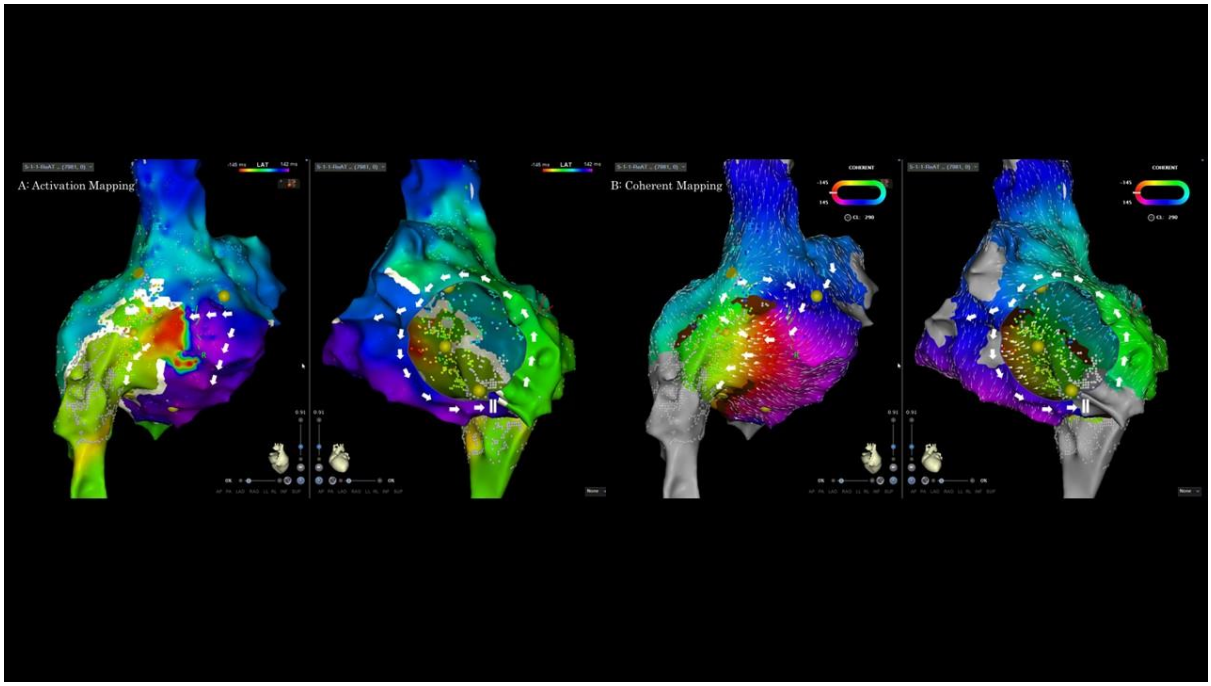

Figure 2.