


## CASE REPORT

# A cavotricuspid isthmus pouch revealed to be a breakout site for gap conduction of recurrent common atrial flutter

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**Abstract**

A cavotricuspid isthmus pouch can be a breakout site for gap conduction of cavotricuspid isthmus block line. If the previous block line is electrically silent, high-density 3-D mapping and pouchography are useful to find the pouch and ablate within it.

**KEYWORDS**

cavotricuspid isthmus block line, cavotricuspid isthmus pouch, common atrial flutter

## 1 | INTRODUCTION

A cavotricuspid isthmus (CTI) pouch, a common anatomical anomaly, complicates the creation of a CTI block line for common atrial flutter (cAFL) because ablation within the pouch is difficult. The clinical significance of the pouch for a cAFL circuit has not fully been explained. This case demonstrates that the CTI pouch can act as a component of the cAFL circuit and can be a target site for ablation.

## 2 | CASE REPORT

Our patient was a 90-year-old man with cAFL. He had no structural heart diseases. Despite the extensive ablation of the CTI, we were unable to create a complete block line during the first ablation session. Five months after the first session, the patient's AFL recurred with slight

cycle length prolongation and showed 1:1 atrioventricular conduction of the AFL. Therefore, a second ablation session was performed. Because clinical AFL was sustained at the beginning of the session, high-density activation mapping of the CTI to detect the site of gap conduction was performed initially. The whole right atrial mapping was consistent with the recurrence of counterclockwise cAFL (Video S1). Despite the high-density mapping by CARTO@3 CONFIDENSE (Biosense Webster, Diamond Bar, CA, USA) of the CTI, the previous ablation line was almost electrically silent, and the site of gap conduction was unrecognizable on the map. Once the activation wave disappeared after it entered into the low voltage area of the previous block line, it then reappeared from the medial side of the previous block line (Figure 1 and Video S2). To diagnose whether this was a focal atrial tachycardia from the CTI or the recurrence of counterclockwise cAFL, we performed entrainment pacing from the coronary sinus ostium and the lateral wall of the right atrium. Because this

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AFL was entrained and postpacing interval minus tachycardia cycle length was < 30 milliseconds from both sites, we diagnosed the recurrence of common macroreentrant AFL. As the gap conduction site was unrecognizable in the previous block line, we decided to target the earliest activation site medial to the previous block line; it was revealed to be within the CTI pouch by right atriography (Figure 2 and Videos S3, S4). During radiofrequency (RF) delivery (30-35 W and the average contact force of 7-16 g with an open-irrigated contact force sensing catheter in a knuckle-curve position supported by a deflectable sheath), the AFL repeatedly terminated (Supplementary Figure S1) and re-initiated. After adequate ablation within the pouch (Figure 3), we performed activation mapping during pacing from the proximal coronary sinus and differential pacing, which confirmed a bidirectional CTI block. The impedance within the pouch was approximately 100  $\Omega$  which was not remarkably higher compared to the other locations, probably because the pouch was wide enough to prevent the decrease in the blood flow and catheter trapping. No additional ablation was needed on the previous block line.

### 3 | DISCUSSION

A CTI pouch is mainly seen in the medial side of the CTI<sup>1</sup> and is known to complicate the creation of a CTI block line. Shimizu et al reported that the depth of the pouch was related to the RF duration and energy required to create a CTI block line, and the usefulness of knuckle-curve ablation inside the pouch.<sup>2</sup> The use of intracardiac

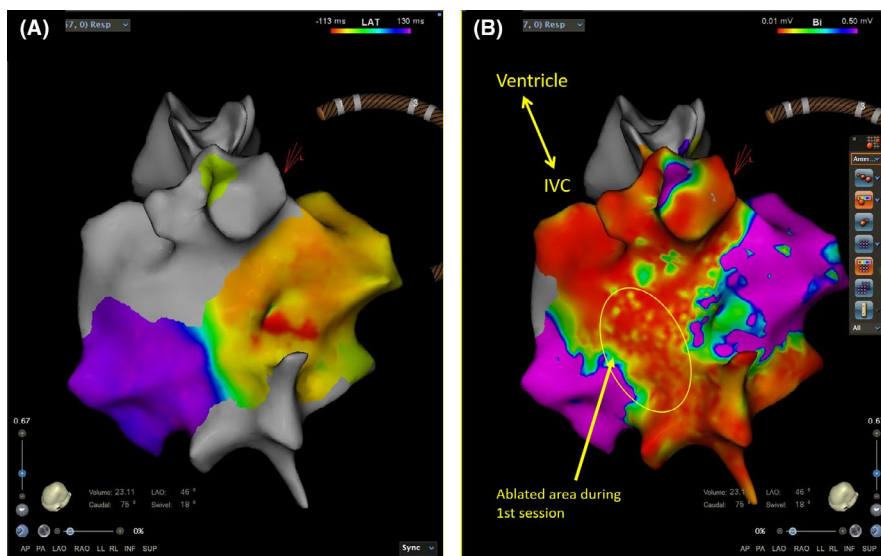
echocardiography is reported to be useful to detect CTI pouch in difficult cases.<sup>3</sup> In our case, we could not notice the existence of the prominent CTI pouch and failed to create a complete CTI block line during the first session. Meticulous electroanatomical mapping and pouchography by contrast injection from the deflectable sheath revealed the existence of the gap within the pouch during the second session. The high-density activation and voltage maps acquired during the second session revealed that the area of the previous block line was almost electrically silent endocardially, and the determination of the appropriate ablation site to eliminate the gap conduction was impossible. These findings were indicative of sub-endocardial gap conduction between lateral CTI and the CTI pouch. In fact, we successfully created a complete CTI block line by RF delivery only within the pouch without additional ablation on the previous block line. High-density mapping of the CTI area accompanied by pouchography helped to determine the location of the pouch and the appropriate site of ablation. If we encounter recurrences or difficult cases of cAFL despite extensive ablation of lateral CTI, instead of performing gap ablation on the initial block line, exploring the existence of the CTI pouch and the ablation within them should be considered.

### ACKNOWLEDGMENTS

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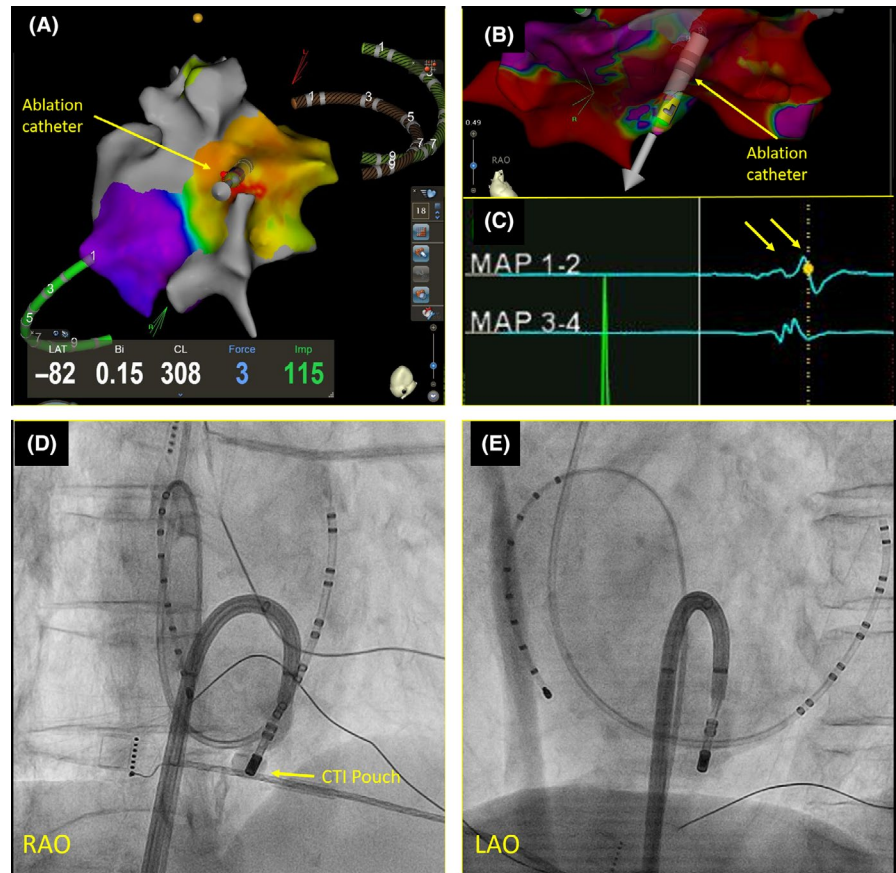
### CONFLICT OF INTEREST

None declared.

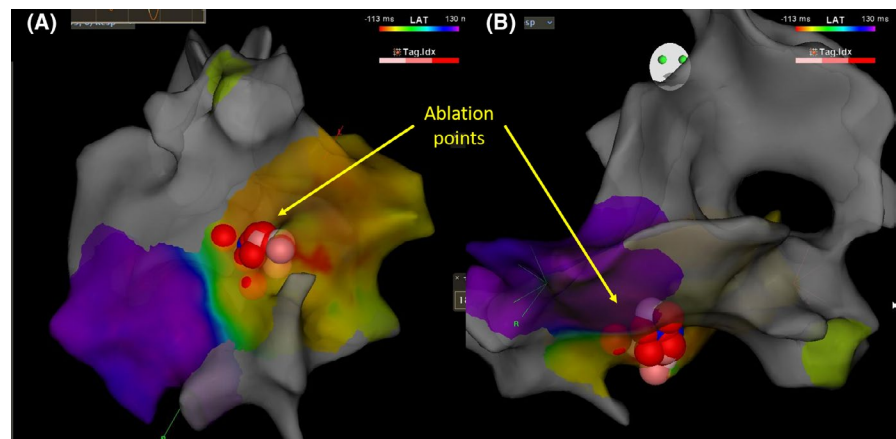


**FIGURE 1** A, Activation map and B, voltage map of the CTI during clinical AFL. A ripple map is also available (Video S2). Scar threshold of the voltage map (red area) is 0.01 mV. AFL, atrial flutter; CTI, cavotricuspid isthmus; IVC, inferior vena cava

**FIGURE 2** Electroanatomical features of the CTI pouch. Ablation catheter was placed within the pouch. A, B, The position of ablation catheter placed within the pouch superimposed on the activation map (LAO-caudal view) and voltage map (RAO view) of the clinical AFL (identical to Figure 1). C, Local electrogram within the CTI pouch. (D, E) RAO and LAO view of right atriotriography by contrast injection from the deflectable sheath. All data were acquired almost simultaneously. The movies of right atriotriography (Video S3: RAO and Video S4: LAO) are also available. AFL, atrial flutter; CTI, cavotricuspid isthmus; LAO, left anterior oblique; RAO, right anterior oblique



**FIGURE 3** A, B, LAO caudal view and RAO view of ablation points within the CTI pouch superimposed on the activation map of the AFL. AFL, atrial flutter; CTI, cavotricuspid isthmus; LAO, left anterior oblique; RAO, right anterior oblique



## AUTHOR CONTRIBUTIONS

Takayuki Sekihara: acquired the images and drafted the manuscript; Takuryu Sonoura, YN, IS, YM, MI, MY, TY, and YY: revised the manuscript critically.

## ETHICAL APPROVAL

We obtained written consent form for this case report.

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## REFERENCES

1. Gami AS, Edwards WD, Lachman N, et al. Electrophysiological anatomy of typical atrial flutter: the posterior boundary and causes for difficulty with ablation. *J Cardiovasc Electrophysiol.* 2010;21(2):144-149.
2. Shimizu Y, Yoshitani K, Murotani K, et al. The deeper the pouch is, the longer the radiofrequency duration and higher the radiofrequency energy needed-Cavotricuspid isthmus ablation using intracardiac echocardiography. *J Arrhythm.* 2018;34(4):410-417.
3. Bencsik G, Pap R, Makai A, et al. Randomized trial of intracardiac echocardiography during cavotricuspid isthmus ablation. *J Cardiovasc Electrophysiol.* 2012;23(9):996-1000.

**SUPPORTING INFORMATION**

Additional supporting information may be found online in the Supporting Information section.

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