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症 例

Sick Sinus Syndrome Disclosed by the Successful Radiofrequency Catheter Ablation of Persistent Common Atrial Flutter

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Abstract Sick sinus syndrome was disclosed in a 77 year-old man after a radiofrequency (RF) linear catheter ablation of cavotricuspid isthmus for persistent common atrial flutter. Prolongation of corrected sinus node recovery time, sinoatrial conduction time and AH interval, as observed after RF ablation, suggested binodal (sinus as well as atrioventricular node) dysfunction. Adams-Stokes syndrome due to sinus arrest was encountered on the day of RF ablation and a permanent DDD pacemaker was implanted consequently. Our experience indicates that careful observation is very important after the RF ablation when atrial flutter is associated with sick sinus syndrome. The present case suggests that binodal dysfunction underlies persistent atrial flutter and vice versa.

Introduction

Recently radiofrequency (RF) catheter ablation is an established therapy of the persistent atrial flutter, which is frequently resistant to the pharmacologic therapy¹⁾. On the other hand, sick sinus syndrome is diagnosed by routine clinical electrophysiologic study (EPS), but contains diagnostic problems in the concomitant presence of atrial flutter as well as fibrillation. A domestic study demonstrated that the incidence of atrial flutter observed during the follow-up period of physiologic permanent pacemaker implantation for sick sinus syndrome was 8.1%⁶⁾. However, the manifestation of sick sinus syndrome after the ter-

mination of persistent atrial flutter is extremely rare. Here, we describe a case of sick sinus syndrome which was disclosed after the successful RF linear ablation for treatment of persistent common atrial flutter.

Case Report

A 77 year-old male without structural heart disease was referred to us for treatment of persistent atrial flutter in January, 2002. The 12-lead ECG on admission showed atrial flutter presenting 2:1 to 4:1 atrioventricular conduction (Fig. 1). This patient complained of exertional dyspnea due to persistence of atrial flutter which had been documented by Holter monitoring in

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October, 2001. No antiarrhythmic drugs had been attempted at least after the onset of the persistence of atrial flutter.

After written informed consent was obtained, the patient received EPS and RF ablation under a mildly sedated and fasting state in January, 2002. Intracardiac electrograms were recorded in the high right atrium (RA), His bundle region and coronary sinus. RA endocardial mapping was performed using a deflectable 7-French catheter with 20 electrodes spaced at 2-7-2 mm intervals (Halo catheter, Cordis-Webster, USA) to investigate the propagation sequence within RA during atrial flutter¹⁰. As in Fig. 2, counterclockwise sequence with a spontaneous cycle length of 293 msec within the RA was observed, and hence the diagnosis of common atrial flutter was obtained. An ablation catheter was introduced from the right femoral vein, advanced to RA and positioned at the anatomical cavotricuspid isthmus¹¹⁰. Atrial flutter was synchronized with pacing at the isthmus with a cycle length of 210 msec.

Moreover, the postpacing interval at this pacing site was identical to the spontaneous flutter cycle length, indicating that atrial flutter in this case was critically dependent on the cavotricuspid isthmus. RF energy was applied to this site under the temperature-controlled mode, and linear conduction blockline formation was attempted by repetitive applications of RF energy. After the 5th application of the RF energy, atrial flutter was converted to sinus rhythm. After the additional 4 applications of RF current, the formation of bidirectional blockline between the low lateral RA and coronary sinus ostium was confirmed by rapid pacing at each of these two sites. Moreover, it was confirmed that atrial flutter could not be induced by rapid pacing at each of two sites under the continuous administration of isoproterenol causing an increase in the basic sinus rhythm approximately to 120 bpm. This ablation session was considered to be successful according to the blockline criteria as well as no induction criteria.

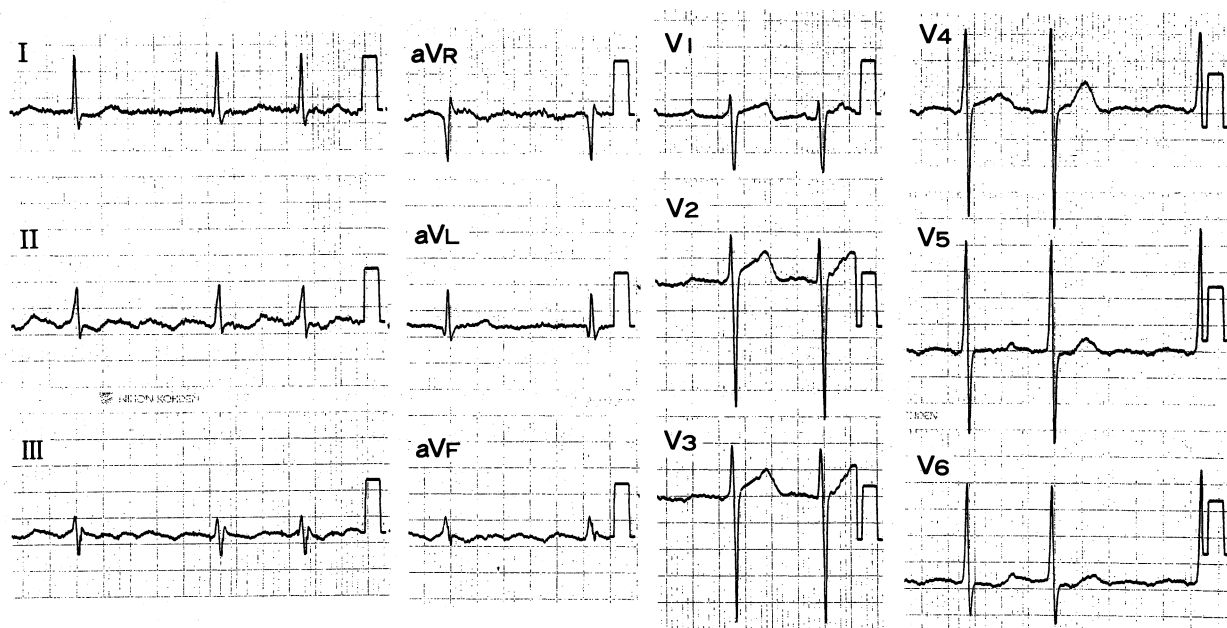


Fig. 1 Standard surface ECG on admission showed atrial flutter presenting 2:1 to 4:1 atrioventricular conduction.

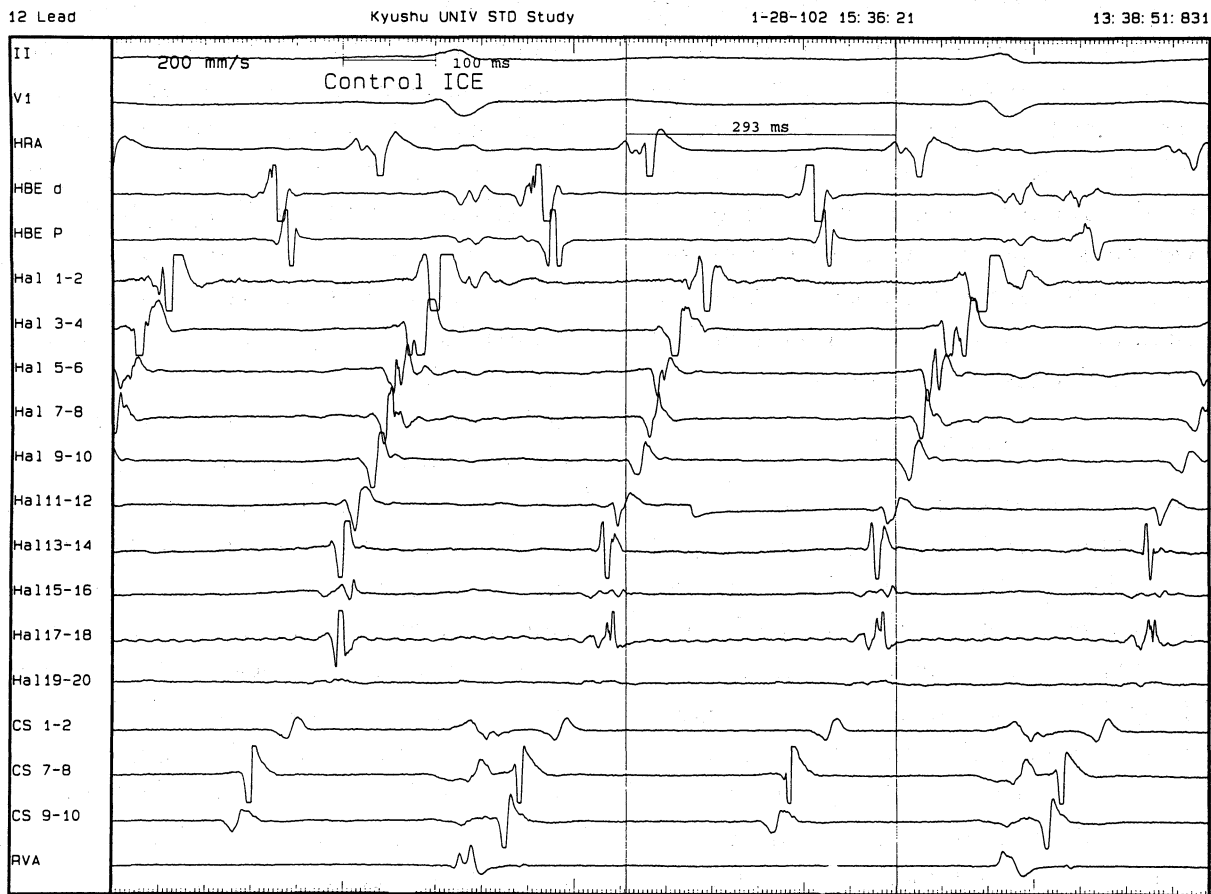


Fig. 2 Clinical electrophysiologic study demonstrated intraatrial counterclockwise activation sequence with 2:1 atrioventricular conduction which is compatible with common type atrial flutter. Endocardial mapping was conducted as indicated in the left side of electrograms. ICE, intracardiac electrogram; II, limb lead II of surface ECG; V₁, precordial lead V₁ of surface ECG; HRA, high right atrium; HBE, His bundle electrogram; Hal, endocardial mapping within right atrium using deflectable 20 electrodes catheter (Halo catheter, Cordis-Webster, USA); CS, coronary sinus; RVA, right ventricular apex.

Postablation EPS was performed without any treatment with atropine. Repeated evaluations of the sinoatrial conduction time clarified evident prolongation showing 237 and 243 msec, which are usually less than 150 msec in normal subjects. The sinus node recovery time showed a normal value of 1351 msec whereas corrected sinus node recovery time was prolonged to 554 msec (less than 525 msec in normal subjects). High RA pacing study did not induce atrial flutter and the Wenckebach type atrioventricular block was induced at a pacing rate of 160 bpm, which was within

the normal range of more than 150 bpm. Postablation His bundle electrogram showed an increase in the AH interval of 238 msec (normal range is less than 150 msec).

The surface ECG recording after leaving the EPS laboratory showed first-degree atrioventricular block (Fig. 3). Approximately four hours after ablation, the patient complained of fainting, and ECG monitoring showed instantaneous sinus arrest with a duration of 7 sec (Fig. 4, upper). Subsequently, the patient developed a typical Adams-Stokes syndrome, when the ECG

monitoring detected a sinus arrest of 10 sec followed by junctional escaped beats (Fig. 4, lower). A temporary pacing lead was inserted immediately under the fluoroscopic guidance. Because ECG monitoring showed right ventricular full pacing for eleven days, a permanent DDD pacemaker was implanted in February, 2002. After the implantation, episodes of Adams-Stokes syndrome disappeared completely.

Discussion

The present case indicates that binodal dysfunction, indicated by prolonged sinoatrial conduction time and AH interval, was disclosed after the successful RF catheter ablation of common atrial flutter. Although the Japanese Circulation Society guideline defined the drug-resistant common atrial flutter as an indication of class IIa⁷⁾, RF ablation was conducted because the patient complained of exertional dyspnea due to persistent atrial flutter. A recent study has demonstrated that a small

percentage of patients with atrial flutter are complicated with sinus node dysfunction such as prolonged sinus node recovery time²⁾ and the corrected sinus node recovery time partially recovered by about 25% three months after the RF ablation. In the present case, we implanted permanent pacemaker because repetitive sinus arrest accompanied by fainting did not alleviate for more than a week. Sinus and atrioventricular node dysfunction have been reported to be interrelated with atrial flutter. Gomes et al⁵⁾ reported coexistence of sick sinus syndrome and atrial flutter in an old hypertensive patient. In their case, sinus node activity was protected from flutter wavefront by an entrance block. On the other hand, entrance block in sinus node was not confirmed in the present case. Since high RA activity is synchronized with flutter cycle length (Fig. 2), sinus node function is suspected to be overdrive-suppressed by the persistent rapid firings of atrial flutter. Experimentally induced atrial fibrilla-

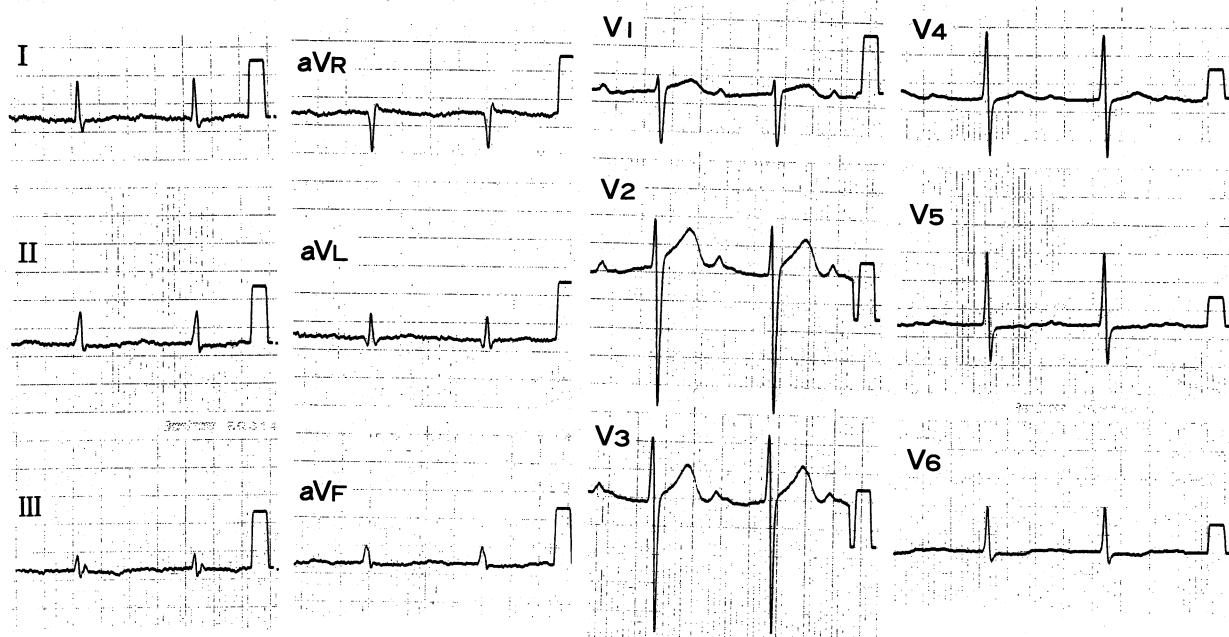


Fig. 3 Standard surface ECG recorded after the successful catheter ablation showing first-degree atrioventricular block.

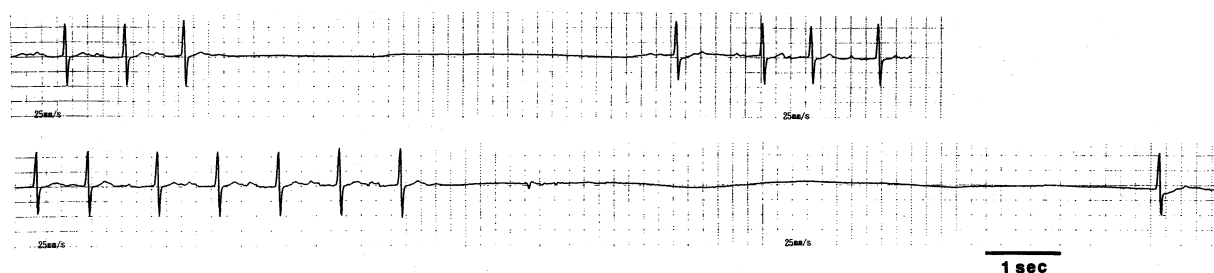


Fig. 4 ECG monitoring detected a sinus arrest with a duration of 7 sec (upper). Patient exerted Adams-Stokes syndrome at the moment of ECG monitor demonstrating a sinus arrest with a duration of 10 sec, which was followed by junctional escaped beats (lower).

tion exerts sinus node dysfunction³⁾ and this effect is augmented by the maintenance of atrial fibrillation⁴⁾. These effects are explained in part by the “electrical remodeling” evoked by atrial fibrillation¹²⁾. The present case shows the problem whether the sinus node dysfunction caused by the persistence of atrial fibrillation and flutter is long-term overdrive suppression or so-called “electrical remodeling”. Conversely, binodal dysfunction possibly underlies the occurrence and maintenance of atrial flutter. Intraatrial conduction time from the high RA to the atrioventricular junction is reported to be prolonged in patients with atrial flutter⁸⁾. This finding suggests that local conduction delay in response to supraventricular premature beats is involved in the initiation and maintenance of atrial flutter. Furthermore, functional conduction barrier along the crista terminalis is a causal substrate of the common atrial flutter¹¹⁾. This substrate is easily established in diseased atria in the senile and hypertensive patients. In this sense, binodal dysfunction is one of the causal mechanisms of atrial flutter.

Since subjective symptoms due to sinus node dysfunction are prone to be relieved during atrial flutter⁹⁾, the present case sug-

gests the necessity of careful observation and intensive ECG monitoring after the successful RF linear ablation of persistent common atrial flutter associated with sick sinus syndrome.

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References

- 1) Cosio FG, López-Gil M, Goicolea A, Arribas F and Barroso JL: Radiofrequency ablation of the inferior vena cava-tricuspid valve isthmus in common atrial flutter. *Am J Cardiol* 71: 705-709, 1993.
- 2) Daoud EG, Weiss R, Augostini RS, Kalbfleisch SJ, Schroeder J, Polsinelli G and Hummel JD: Remodeling of sinus node function after catheter ablation of right atrial flutter. *J Cardiovasc Electrophysiol* 13: 20-24, 2002.
- 3) Elvan A, Wylie K and Zipes DP: Pacing-induced chronic atrial fibrillation impairs sinus node function in dogs. *Circulation* 94: 2953-2960, 1996.
- 4) Goette A, Honeycutt C and Langberg JJ: Electrical remodeling in atrial fibrilla-

- tion: Time course and mechanisms. *Circulation* 94: 2968-2974, 1996.
- 5) Gomes JAC, Kang PS, Matheson M, Gough WB and El-Sherif N: Coexistence of sick sinus rhythm and atrial flutter-fibrillation. *Circulation* 63: 80-86, 1981.
 - 6) Ishikawa T, Sumita S, Kikuchi M, Nakagawa T, Kosuge M, Kuji N, Kimura K, Tochikubo O, Usui T and Umemura S: Incidence of atrial flutter and atrial fibrillation in patients with implanted physiological pacemakers. *Jpn Circ J* 64: 505-509, 2000.
 - 7) JCJ Task Force Report: Guidelines for nonpharmacologic therapy of arrhythmia (in Japanese). *Jpn Circ J* 65 (suppl V) 1127-1175, 2001.
 - 8) Josephson ME: Atrial flutter and fibrillation, In Josephson ME (ed): *Clinical Cardiac Electrophysiology: Techniques and Interpretations*. 3rd ed. pp. 272-321, Wolters Kluwer Co., Philadelphia, 2002.
 - 9) Kleinfeld MJ and Boal BH: Symptomatic improvement in a patient with sick sinus syndrome after the onset of stable atrial flutter. *PACE* 1: 472-475, 1978.
 - 10) Ohba Y, Shimoike E, Ueda N, Maruyama T, Kaji Y, Fujino T and Niho Y: Influence of right atrial structure on outcome of radiofrequency catheter ablation for common atrial flutter. *Jpn Circ J* 64: 741-744, 2000.
 - 11) Olgin JE, Kalman JM and Lesh MD: Conduction barriers in human atrial flutter: Correlation of electrophysiology and anatomy. *J Cardiovasc Electrophysiol* 7: 1112-1126, 1996.
 - 12) Wijffels MCEF, Kirchhof CJHJ, Dorland R and Allessie MA: Atrial fibrillation begets atrial fibrillation: A study in awake chronically instrumented goats. *Circulation* 92: 1954-1968, 1995.

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(和文抄録)

高周波カテテルアブレーション成功後に 明らかとなった洞不全症候群の一例

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高周波カテテルアブレーション成功後に明らかとなった洞不全症候群の一例を経験したので報告する。症例は77歳の男性で、持続性の心房粗動に対して臨床電気生理学的検査を施行した。通常型心房粗動と診断後に右房の解剖学的狭部に対して線状焼灼を行って心房粗動は消失したが、洞房伝導時間の延長とヒス束心電図におけるAH時間の延長を認めた。高周波カテテルアブレーション施行当日夜に、アダムスストークス発作を

呈したため体外式緊急ペーシングを行い、その後永久ペースメーカー植え込み術を行った。本例では持続性の通常型心房粗動が洞房・房室両結節の機能低下を生じた可能性が指摘され、逆に両結節の伝導障害が通常型心房粗動の発生・維持に関与していた可能性も示唆された。さらに高齢者で洞不全症候群を合併した心房粗動に対する高周波カテテルアブレーション施行後には注意深い経過観察が必要であると考えられた。