



## Rapid firing

# Temporal sinus node modification by high-dose continuous intravenous administration of landiolol in a patient with persistent inappropriate sinus tachycardia

Yuichi Hori, MD, Shiro Nakahara, MD, PhD\*, Naofumi Anjo, MD, Yoshihiko Sakai, MD, PhD, Isao Taguchi, MD, PhD

Department of Cardiology, Dokkyo Medical University Koshigaya Hospital, 2-1-50 Minami Koshigaya, Koshigaya, Saitama 343-8555, Japan

## ARTICLE INFO

## Article history:

Received 7 January 2016

Received in revised form

21 February 2016

Accepted 16 March 2016

Available online 25 April 2016

## Keywords:

Inappropriate sinus tachycardia

Catheter ablation

## ABSTRACT

A 20-year-old woman underwent an electrophysiological study for drug-resistant persistent inappropriate sinus tachycardia (IST). Use of a high-dose continuous intravenous administration of landiolol, a short-acting beta-adrenoreceptor blocker, made the patient's heart rate suddenly drop with a slight change in the P-wave morphology. Three-dimensional right atrial (RA) activation mapping revealed that the earliest activation site moved 8 mm to a lower anterior site around the high lateral RA. Radiofrequency energy applied to the earliest activation site during tachycardia was successful. A temporal sinus node modification with landiolol administration was useful for mapping and for safe catheter ablation of IST.

© 2016 Japanese Heart Rhythm Society. Published by Elsevier B.V. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

## 1. Introduction

Landiolol is an intravenous short-acting beta-adrenoreceptor blocker, and its wide use is exhibited by rapid wash out and a less-sustained effect on cardiac function after decreasing the dose or stopping its administration [1]. We present a patient with drug-resistant and persistent inappropriate sinus tachycardia (IST), who also had palpitations. The patient underwent an electrophysiological study and ablation, and high-dose administration of landiolol played a great role in disease treatment.

## 2. Case report

A 20-year-old woman with persistent palpitations presented to the hospital. The electrocardiogram (ECG) exhibited a heart rate (HR) of 126 beats/min (bpm) with positive P waves in leads II, III, and aVF (Fig. 1). Bisoprolol, 2.5 mg/day, was administered for six months, but the 24-h Holter ECG still showed an average HR of 110 bpm. Ivabradine is recommended as an effective medicine, but unfortunately, it is unavailable in Japan. An electrophysiological study was performed because no improvement was seen after four months of medical treatment.

The session was performed with the assistance of a three-dimensional (3D) electro-anatomic mapping system (EnSite NavX system, St. Jude Medical). A 4-mm tip ablation catheter (Therapy, St. Jude Medical) was used for mapping and ablation. In the electrophysiological testing, the baseline rhythm was tachycardia. The reentrant mechanism was excluded by high-frequency stimulation performed from the right atrium (RA), wherein tachycardia did not stop. The RA mapping was performed, and the earliest activation site was observed on the high lateral side, which was suspected to be around the sinus node (Fig. 2A). The HR decreased from 126 to 116 bpm after starting a continuous intravenous administration of landiolol from 3γ. The HR gradually decreased by increasing the administration rate of landiolol. When landiolol was increased to 8γ, the patient's HR suddenly dropped from 95 bpm to 78 bpm with a slight change in the P wave on the ECG (Fig. 2B). Landiolol was kept at 10γ, and RA mapping was performed again. The earliest activation site moved approximately 8 mm to a lower anterior site from the map performed during tachycardia (Fig. 2A). The systolic blood pressure was monitored carefully during the administration of high-dose landiolol and was approximately 100 mmHg without any symptoms from the patient.

Landiolol was stopped, and tachycardia eventually recurred with the earliest activation site returning to a higher lateral site. Because this patient needed a continuous high-dose intravenous administration of landiolol to maintain a normal HR, delivery of radiofrequency energy was considered. A local potential preceded

\* Corresponding author. Tel.: +81 489 65 1111; fax: +81 489 60 1708.

E-mail address: [nshiro@dokkyomed.ac.jp](mailto:nshiro@dokkyomed.ac.jp) (S. Nakahara).

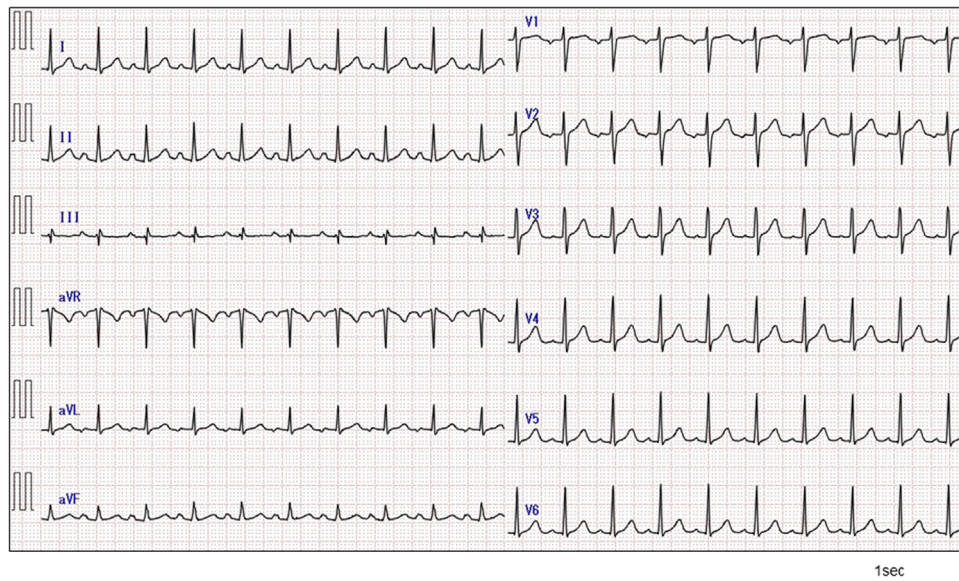


Fig. 1. Electrocardiogram at rest.

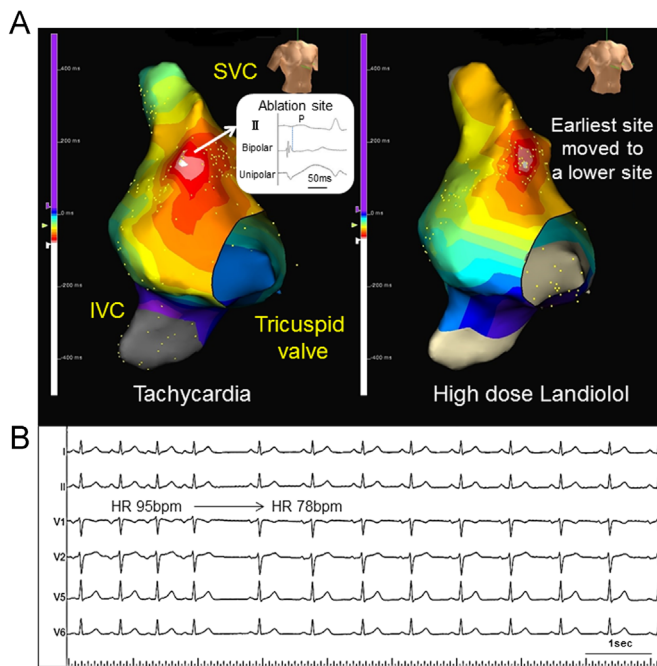


Fig. 2. Influence of a continuous intravenous administration of high-dose landiolol. (A) The activation map during tachycardia and the administration of the high-dose landiolol. The earliest activation site moved to a lower anterior site during the administration of landiolol. (B) A sudden drop in the HR with a slight change in the P wave on the ECG.

the P wave onset by 25 ms at the earliest activation site during tachycardia, and a QS pattern was observed in the unipolar potential. Radiofrequency ablation was performed using a maximum power of 25 W, maximum electrode–tissue interface temperature of 50 °C, and keeping a safe distance from the earliest activation site during the use of landiolol. Three energy applications of 30 s were delivered. The termination of the tachycardia was obtained by radiofrequency applications, but it eventually recurred after a few minutes. The session was finished after anticipating a chronic effect of the radiofrequency energy. Bisoprolol 2.5 mg/day was continued after the session, and the HR was maintained between 70 and 80 bpm, without any palpitations.

### 3. Discussion

High-dose use of beta-adrenoreceptor blockers is difficult due to the risk of the appearance of hypotension and autonomic nervous system disorders. Landiolol was capable of subtle adjustments due to its rapid effect and shorter half-life. Because of the short-acting property of this agent, we could reveal a spatial difference in the earliest site between the IST and normal sinus rhythm in a reversible manner, even during a time-bound procedure.

The underlying mechanism of IST remains poorly understood, and this case was difficult to conclude. The reentrant mechanism was excluded, and tachycardia immediately showed a recurrence after the cessation of landiolol. Thus, cardiac beta-adrenergic receptor disorders, which induce abnormal automaticity, were strongly considered, but 2.5 mg/day bisoprolol was ineffective. As a high dose of the beta-adrenoreceptor blocker was needed to control the HR, several causes of tachycardia such as decrease in the parasympathetic activity may have played a role in the maintenance of tachycardia [2]. Landiolol showed a guide for safe RF application in this case, but various responses may be observed in other IST cases. In addition, acceleration of the automaticity from other sites such as the arterioventricular junction may occur in some IST cases, and landiolol administration may not be an effective method. Thus, further studies focusing on landiolol administration during the IST ablation is needed.

The outcome of sinus node modification with radiofrequency ablation has been reported, but it involves a high invasive risk associated with the ablation. Thus, careful confirmation of the earliest activation site and ablation of that site is important [2,3]. The clinical use of the 3D-mapping system for IST ablation has been reported [3], and our case suggested that a temporal modification of the sinus node tachycardia by landiolol administration combined with 3D mapping is useful to avoid complications.

#### Financial support

The study received no financial support.

#### Conflict of interest

All authors declare no conflict of interest related to this study.

**References**

- [1] Sasao J, Tarver SD, Kindscher JD, et al. In rabbits, landiolol, a new ultra-short-acting beta-blocker, exerts a more potent negative chronotropic effect and less effect on blood pressure than esmolol. *Can J Anaesth* 2001;48(10):985–9.
- [2] Olshansky B, Sullivan RM. Inappropriate sinus tachycardia. *J Am Coll Cardiol* 2013;61(8):793–801.
- [3] Marrouche NF, Beheiry S, Tomassoni G, et al. Three-dimensional nonfluoroscopic mapping and ablation of inappropriate sinus tachycardia. Procedural strategies and long-term outcome. *J Am Coll Cardiol* 2002;39(6):1046–54.