Journal of Cardiology Cases xxx (2018) xxx–xxx

Contents lists available at ScienceDirect

Journal of Cardiology Cases

journal homepage: www.elsevier.com/locate/jccase

Case Report

The utility of atrial overdrive pacing during catheter ablation of premature ventricular contractions originating from the posterior-superior process of the left ventricle

Nobutaka Masunaga (MD), Yasuharu Matsunaga-Lee (MD)*, Sen Matsumoto (MD), Kouichi Tachibana (MD), Yuzuru Takano (MD, FJCC)

Department of Cardiology, JCHO Hoshigaoka Medical Center, Hirakata, Japan

ARTICLE INFO

Article history:
Received 17 February 2018
Received in revised form 13 May 2018
Accepted 29 May 2018

Keywords:
Posterior-superior process of the left ventricle
Atrio-his interval
Catheter ablation
Ventricular premature contraction
Atrioventricular conduction system

ABSTRACT

A 76-year-old man presented with frequent premature ventricular contractions (PVCs). The electrophysiological findings revealed the origin of the PVCs was in the posterior-superior process of the left ventricle (PSP-LV), which is anatomically adjacent to the infero-medial aspect of the right atrium (RA). After a failed ablation from the LV, ablation in the RA eliminated the PVCs. During additional ablation, the atrio-his (AH) interval was monitored by atrial overdrive pacing, and ablation was terminated immediately after the AH interval prolonged to 174 ms. We believe that the atrial overdrive pacing was useful for monitoring the AH interval to prevent atrioventricular block during ablation of PVCs from the PSP-LV.

<**Learning objective:** PVCs from posterior-superior process of the LV (PSP-LV) could be eliminated by radiofrequency ablation at the posterior-septum of the RA. It is important to closely examine the AH interval in order to prevent any atrioventricular block during the ablation of PVCs originating from the PSP-LV. Atrial overdrive pacing is helpful to monitor the AH interval during the ablation of PVCs originating from the PSP-LV.>

Introduction

The posterior-superior process of the left ventricle (PSP-LV) is the most inferior and posterior aspect of the basal left ventricle (LV). The PSP-LV is anatomically adjacent to the infero-medial aspect of the right atrium (RA) [1]. There are few reports of the successful catheter ablation of premature ventricular contractions (PVC) arising from the PSP-LV by using intracardiac echocardiography or by ablation via the coronary sinus [1,2]. The PSP-LV is located near the atrioventricular conduction system. Radiofrequency catheter ablation around this area should be carefully performed to prevent atrioventricular block. We report a case where PVCs were terminated successfully using radiofrequency catheter ablation from the postero-septal region of the right atrium using fluoroscopic imaging aided by electro-anatomical guidance. During additional radiofrequency ablation, the atrio-his (AH) interval prolongation was monitored with atrial overdrive pacing.

Case report

A 76-year-old man was referred to our hospital because of highly symptomatic palpitations. The surface 12-lead electrocardiogram revealed frequent PVCs with a left bundle branch block morphology, left-superior axis deviation in the frontal plane, and transitional zone in precordial leads V_{1-2}. A 24-h Holter electrocardiogram revealed PVCs accounting for 23.7% of the total heart beats per day. Echocardiography revealed a normal LV ejection fraction (75%). Beta-blocker use was attempted (carvedilol 2.5 mg per day), but he experienced dizziness with bradycardia. Catheter ablation of the PVCs was performed.

Electrophysiological tests and catheter ablation were performed using a three-dimensional electro-anatomical mapping system (CARTO 3 system, Biosense Webster, Diamond Bar, CA, USA). Two 10-polar electrode catheters were positioned in the His bundle region and inside the coronary sinus, respectively. A pace map was performed using the CARTO 3 pace mapping software (Paso) in the

* Corresponding author at: Department of Cardiology, JCHO Hoshigaoka Medical Center, 4-8-1, Hoshigaoka, Hirakata-city, Osaka, 573-8511, Japan.
E-mail address: y-matsunaga@osakah.johas.go.jp (Y. Matsunaga-Lee).

https://doi.org/10.1016/j.jccase.2018.05.014
1878-5409/

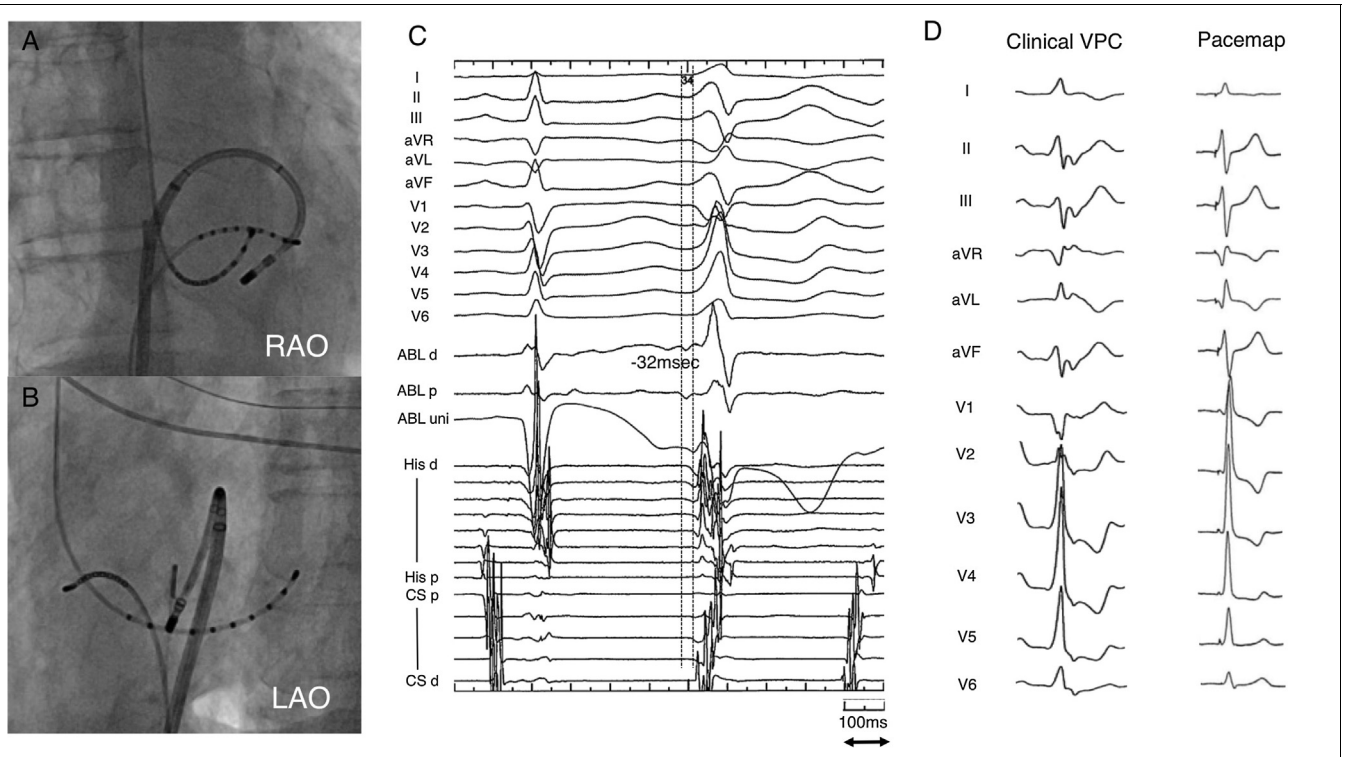

Fig. 1. (A,B) The catheter position during ablation in the LV. (C) The intracardiac electrogram of the earliest activation site recorded in the LV. The earliest activation site preceded the onset of the QRS by 32 ms. (D) An electrocardiogram of the clinical PVC and pace map in the LV. Paso score was 0.778.
RAO, Right anterior oblique view; LAO, Left anterior oblique view; LV, Left ventricle; VPC, Ventricular premature contraction.

RA, right ventricle (RV), and LV. LV mapping was performed following a transseptal puncture navigated by an intracardiac echocardiography catheter (AcuNaV, Acuson, Mountain View, CA, USA). Catheter ablation was performed using an open irrigated contact force catheter (ThermoCoolSmartTouch SF, Biosense Webster).

The best pace map, with a 0.92 on the Paso score, was obtained at the postero-septum of the RA. The earliest activation recorded at the postero-septum of the RA preceded the onset of the QRS by 36 ms. However, we considered the possible risk of atrioventricular conduction system injury from an ablation at that site. Therefore, catheter ablation was initiated from the LV. The earliest activation obtained in the LV preceded the onset of the QRS by 32 ms, and the Paso score during the pace map was 0.778 (Fig. 1). The radiofrequency catheter ablation from the LV was insufficient (35 W, 45–90 s). Subsequently, radiofrequency catheter ablation on the postero-septum of the RA was performed (starting at 20 W and then up to 35 W, 120 s) during atrial pacing (pacing cycle length: 600 ms) and rendered the PVCs non-inducible (Fig. 2). Additional radiofrequency catheter ablation around the successful site was performed (starting at 15 W then up to 30 W) and ceased (27 s) immediately after the AH interval prolonged to 174 ms (Fig. 3). The AH interval then recovered to 132 ms within 15 s. The patient's course after the radiofrequency catheter ablation was good and the 24-h Holter electrocardiogram at 3 months showed no recurrence of the PVCs.

Discussion

Relative to the plane of the mitral annulus, the tricuspid annular plane is inferiorly and apically displaced, as such the annuli are not placed in parallel planes [3,4]. The PSP-LV is the portion of the basal LV wall in its most inferior and posterior aspect, extending above or basal to the plane of the tricuspid valve, and is anatomically adjacent to the infero-medial aspect of the RA [1]. In this case, the PVCs were successfully terminated using fluoroscopic guidance from the postero-septum of the RA. This anatomical relationship made it possible to map and ablate the PVCs from the RA. We determined that the successful ablation site was located in the RA, because we could record atrial potentials even though very slight clockwise torque caused the ablation catheter to easily drop into the coronary sinus (CS). However, it was necessary to use intracardiac echocardiography to correctly examine the catheter position in the RA and RV.

There are some possible mechanisms for the AH prolongation that occurred during the radiofrequency ablation. First, the PSP-LV is located near the atrioventricular conduction system and radiofrequency ablation could damage the anterograde fast pathway. However, the ablation site in the RA was in an area too inferior for the location of the fast pathway. A previous report described that the input to the anterograde fast pathway could be identified by measuring the intervals from the pacing site to His bundle [5], but in our case, we did not perform that pacing maneuver during the index procedure. Second, the atrioventricular nodal and septal arteries ascend onto the PSP-LV crossing the fat. One previous report mentioned the theoretical risk of atrioventricular conduction injury [1]. Third, a previous study showed that the fat pad at the junction of the inferior vena cava and inferior left atrium is an area of convergence of vagal projections into the atrioventricular node region and catheter ablation in that vicinity of the CS can affect the vagal input [6].

There was a concern that atrial burst pacing during ablation would have induced an AH jump-up phenomenon. We did not assess the anterograde AV nodal conduction properties with atrial burst pacing or extrastimulus pacing. However, the AH interval prolonged gradually from 132 ms, then 150 ms, and finally to 174 ms. So we think that it was not a jump-up phenomenon of the AV nodal conduction during the continuous atrial pacing.

In some cases, atrial overdrive pacing is performed to monitor the antegrade fast pathway conduction during slow pathway ablation of atrioventricular nodal reentrant tachycardia. In this case, we

Please cite this article in press as: Masunaga N, et al. The utility of atrial overdrive pacing during catheter ablation of premature ventricular contractions originating from the posterior-superior process of the left ventricle. J Cardiol Cases (2018), https://doi.org/10.1016/j.jccase.2018.05.014