

CASE REPORT

Permanent His bundle pacing and atrioventricular node ablation in a case with drug-refractory atrial fibrillation

İlaça dirençli atriyal fibrilasyon olgusunda kalıcı His demeti uyarısı ve atriyoventriküler nod ablasyonu

İB Serkan Saygı, M.D., İB Emre Ertürk, M.D., İB Caner Topaloğlu, M.D., İB Mohammed Abusharekh, M.D.

Department of Cardiology, Medical Park İzmir Hospital, İzmir, Turkey

Summary– Permanent His bundle pacing (HBP) activates the ventricles through the normal conduction system and has become a useful technique for patients with a high ventricular pacing rate. Presently described is a case of drug-refractory atrial fibrillation (AF) with a high ventricular rate that was treated with atrioventricular (AV) node ablation and permanent HBP. A 62-year-old woman with persistent AF and a drug-refractory high ventricular response was referred for exercise intolerance and palpitation. She had a history of failed catheter ablation attempts and amiodarone toxicity. Permanent HBP and AV node ablation was planned to achieve rate control with a stepwise approach. Initially, implantation of a permanent pacemaker was performed. The His lead and right ventricular back-up leads were implanted successfully, in the manner described previously. The His lead was connected to the atrial channel of the pacemaker battery and programmed to AAI pacing mode. The AV node was ablated successfully 3 weeks later without any threshold changes in the His lead. No His lead threshold changes were observed during or after AV node ablation and the patient was subsequently asymptomatic with twice daily apixaban 5 mg. Permanent HBP after AV node ablation can be a beneficial treatment option to prevent pacing-induced ventricular dyssynchrony and heart failure in patients who are not eligible for cardiac resynchronization therapy.

Permanent His bundle pacing (HBP) has become an advantageous option for patients with a high ventricular pacing rate by activating the ventricles through the normal conduction system. This is a case of drug-refractory atrial fibrillation (AF) with a high ventricular rate successfully treated with atrioventricular (AV) node ablation and permanent HBP.

Özet– Kalıcı His demeti uyarısı (HBP), ventrikülleri normal uyarı sistemi üzerinden aktive ederek, yüksek oranda ventriküler uyarı ihtiyacı olan hastalarda, faydalı bir yöntem haline gelmiştir. Olgumuz, atriyoventriküler (AV) nod ablasyonu ve kalıcı HBP ile tedavi edilen, ilaç tedavisine dirençli, yüksek ventrikül hızlı atriyal fibrilasyon hastasıdır. Altmış iki yaşında, persistan atriyal fibrilasyon (AF) ve ilaca dirençli yüksek ventrikül hızı olan kadın hasta, egzersiz intoleransı ve çarpıntı şikayetiyle başvurdu. Hastanın başarısız kateeter ablasyon girişimi ve ritim kontrolü amaçlı amiodaron toksisitesi öyküsü mevcuttu. Hız kontrolü için, sırayla kalıcı HBP ve AV nod ablasyonu planlandı. İlk olarak, kalıcı pacemaker implantasyonu uygulandı. His kablosu ve sağ ventrikül destek kablosu, başarılı şekilde implante edildi. His kablosu, pacemaker jeneratörünün atriyal kanalına bağlandı ve AAI uyarı moduna programlandı. AV nod, üç hafta sonra His kablosunda herhangi bir eşik değişikliği gözlenmeksizin ablate edildi. Üç aylık gözlem sonucunda, akut ya da kronik herhangi bir eşik değişimi izlenmedi ve hastamız günde iki kez apiksaban 5 mg tedavisi ile asemptomatikti. Atriyoventriküler nod ablasyonu sonrası kalıcı HBP, kardiyak resenkronizasyon tedavisi için uygun olmayan hastalarda, pacemaker kaynaklı ventriküler disenkroni ve kalp yetersizliğinin önlenmesi açısından uygun bir tedavi seçeneği olabilir.

A 62-year-old woman with persistent AF and a drug-refractory high ventricular response was referred for exercise intolerance and palpitations. She had a history of failed catheter ablation attempts and amiodarone toxicity in response to efforts to achieve rhythm control. Permanent HBP and AV node ablation was planned in a stepwise approach. Initially, perma-

Received: December 03, 2018 Accepted: March 04, 2019

Correspondence: Dr. Emre Ertürk. Medical Park İzmir Hastanesi, Kardiyoloji Kliniği, 35575 İzmir, Turkey.

Tel: +90 232 - 399 50 50 e-mail: emerturk@gmail.com

© 2019 Turkish Society of Cardiology



nent pacemaker implantation was performed. The His lead and right ventricular (RV) back-up leads were implanted successfully using previously described methods. The His lead was connected to the atrial channel of the pacemaker battery and programmed to AAI pacing mode. The AV node was ablated successfully 3 weeks later without any threshold changes in the His lead. No acute or chronic threshold changes were observed during 3 months of follow-up and the patient was asymptomatic with twice daily apixaban 5 mg. Permanent HBP after AV node ablation can be a helpful treatment option to prevent pacing-induced ventricular dyssynchrony and heart failure in patients who are not eligible for cardiac resynchronization therapy (CRT).

CASE REPORT

Permanent His bundle pacing (HBP) is now an alternative used especially in patients with a high ventricular pacing percentage; it activates the ventricles via the normal conduction system and prevents ventricular dyssynchrony.^[2] The patient in this case had 4 previous unsuccessful catheter ablation attempts, symptomatic drug-refractory AF, and atrial tachycardia (AT) with a high ventricular rate and was successfully

treated with AV node ablation and permanent HBP.

A 62-year-old woman with persistent AF was referred for exercise intolerance and palpitations. The patient had previously undergone catheter ablation 4 times with a cryoballoon

and radiofrequency (RF) energy; however, longstanding rhythm control was not achieved, even with antiarrhythmic drugs. An electrocardiogram demonstrated AF and AT with a ventricular rate of 130–150 bpm. An echocardiogram revealed normal left ventricular systolic function and dilated left and right atria. The patient was on a drug treatment regimen of metoprolol 200 mg, digoxin 0.125 mg, and diltiazem 180mg daily, and apixaban 5 mg twice daily. She also had a history of hypothyroidism as a result of the amiodarone therapy. AV node ablation and permanent HBP were planned.

The AV node ablation was performed 3 weeks after the permanent HBP procedure. Medtronic implant equipment that includes a delivery sheath was used

Abbreviations:

AF	Atrial fibrillation
AV	Atrioventricular
AT	Atrial tachycardia
CRT	Cardiac resynchronization therapy
HBP	His bundle pacing
PSA	Pacing analyzer system
RF	Radiofrequency
RV	Right ventricular

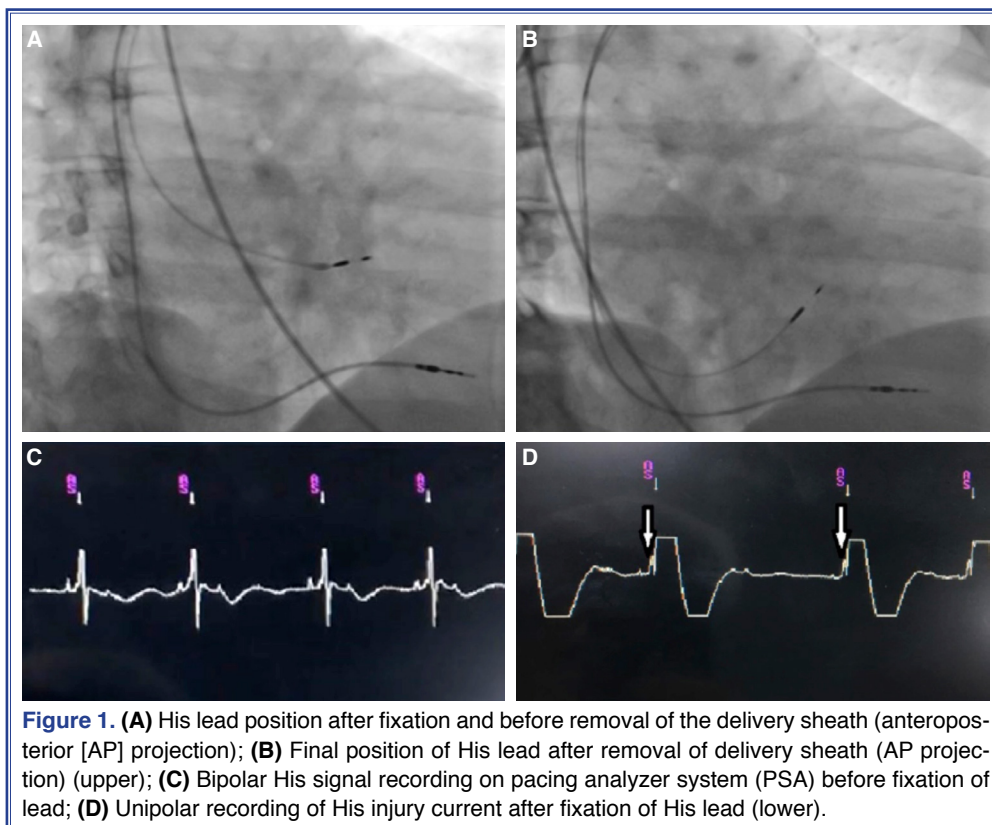


Figure 1. (A) His lead position after fixation and before removal of the delivery sheath (anteroposterior [AP] projection); (B) Final position of His lead after removal of delivery sheath (AP projection) (upper); (C) Bipolar His signal recording on pacing analyzer system (PSA) before fixation of lead; (D) Unipolar recording of His injury current after fixation of His lead (lower).

(C315 His; Medtronic, Inc., Minneapolis, MN, USA) and an active fixation, lumenless His lead (SelectSecure 3830; Medtronic, Inc., Minneapolis, MN, USA). A backup ventricular lead was placed at the RV septum. The His lead was inserted through the delivery sheath. The His bundle electrogram was recorded using a Medtronic pacing analyzer system (PSA) (Medtronic, Inc., Minneapolis, MN, USA) at 50–100mm/second and the pacing QRS morphology was recorded simultaneously. Unipolar mapping was used to create a His bundle electrogram recording. After identifying the His bundle potential, the lead was fixed (Fig. 1a, b). Following fixation, the His injury current was observed with the PSA (Fig. 1c, d). An electrophysiology recording and a 12-lead electrocardiogram confirmed nonselective His bundle capture with a pseudo-delta wave at the beginning of the QRS (Fig. 2a, b). The His bundle threshold at implant was 0.8 V at a 0.40 millisecond pulse width. An Advisa MRI SureScan DDD pacemaker battery (Medtronic, Inc., Minneapolis, MN, USA) was implanted. The His lead was connected to the atrial channel and programmed to AAI pacing mode.

AV node ablation was performed using an 8-mm non-irrigated tip RF catheter (RF Conductr MC; Medtronic, Inc., Minneapolis, MN, USA) 3 weeks after the permanent HBP procedure. Ablation was initiated from the mid-septum and the catheter tip was moved upwards toward the His lead. Successful ablation was performed near the ring electrode of the His lead (Fig. 2c). The His lead threshold measured after RF ablation was <1.0 V. The pacemaker was programmed to a lower rate limit of 80 beats/minute, and a 5 V at 1.0 millisecond pulse width for 2 months. There were no threshold changes during 3 months of follow up and the patient was asymptomatic.

DISCUSSION

AV node ablation and VVI pacemaker implantation is recommended in patients with AF when drug and catheter-based therapy fail to control a high ventricular rate and symptoms.^[3] Studies have shown that a high RV pacing percentage (>40%) can worsen left ventricular systolic function.^[1] Patients with chronic RV pacing may be candidates for CRT; however, permanent HBP has favorable results when compared with RV pacing methods in patients with a high ventricular pacing percentage.^[4] Patients with normal or moderately reduced left ventricular ejection fraction and who are not eligible for CRT are thought to be good candidates for permanent HBP after AV node ablation.^[5] In this case, we achieved nonselective His bundle pacing, which is defined as simultaneous capture of the local myocardium and the His bundle.^[6] There is no isoelectric interval between the stimulus and the QRS complex because of a pseudo-delta wave and the electrical axis of paced QRS and intrinsic QRS will be the same, as was achieved in our patient.^[6] Nonselective His bundle pacing has been shown to be sufficient to provide electrical synchrony and local myocardial capture may provide a safety margin against acute and chronic threshold elevations.^[7] We performed the entire procedure using a stepwise approach; however, recent data has shown that both elements can be implemented simultaneously.^[8] We did not observe any threshold changes during or after AV node ablation in our case. It has been suggested that ablation be performed below or at the level of the ring electrode rather than near the tip of the His lead electrode to prevent acute rises in threshold values.^[8] Vijayaraman et al.^[8] utilized an RV back-up lead if the His lead threshold was greater than 2V. However,

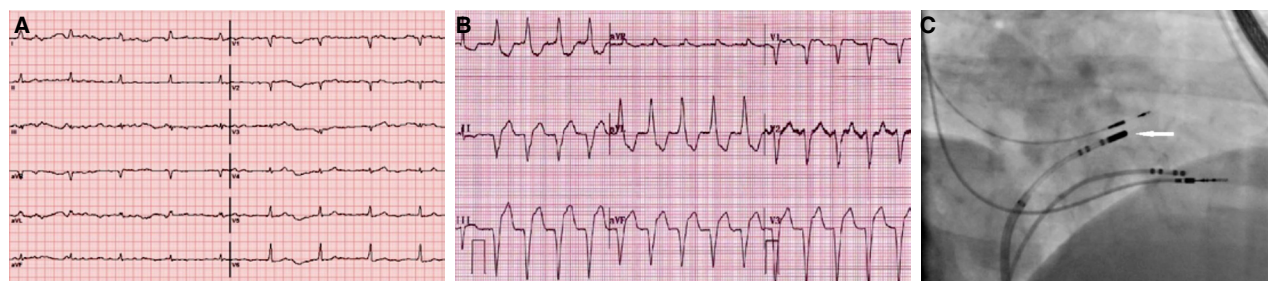


Figure 2. (A) A 12-lead electrocardiogram (ECG) of pure His bundle pacing at the third month showing pseudo-delta wave and QRS duration of 102 ms (78 ms before ablation); (B) A 12-lead ECG of pure right ventricular septal pacing (upper); (C) Fluoroscopic view of successful ablation point near the ring electrode of the His lead in right anterior oblique projection (lower).

there is no definitive suggestion or consensus on this issue yet, and we preferred to implant a back-up RV lead. We think that an acute threshold rise during or after AV node ablation or dislodgement of the His lead could cause catastrophic results in cases with iatrogenic total AV block.

Permanent HBP after AV node ablation can be a reasonable option for patients with AF who are unresponsive or intolerant to rhythm/rate control therapy.

Peer-review: Externally peer-reviewed.

Conflict-of-interest: None.

Informed Consent: Written informed consent was obtained from the patient for the publication of the case report and the accompanying images.

Authorship contributions: Concept: S.S.; Design: E.E.; Supervision: S.S.; Materials: C.T.; Data collection: M.A., C.T.; Literature search: M.A.; Writing: E.E.

REFERENCES

1. Sweeney MO, Hellkamp AS, Ellenbogen KA, Greenspon AJ, Freedman RA, Lee KL, et al; MOde Selection Trial Investigators. Adverse effect of ventricular pacing on heart failure and atrial fibrillation among patients with normal baseline QRS duration in a clinical trial of pacemaker therapy for sinus node dysfunction. *Circulation* 2003;107:2932–7. [CrossRef]
2. Dandamudi G, Vijayaraman P. History of His bundle pacing. *J Electrocardiol* 2017;50:156–60. [CrossRef]
3. Kirchhof P, Benussi S, Kotecha D, Ahlsson A, Atar D, Casadei B, et al; ESC Scientific Document Group. 2016 ESC Guidelines for the management of atrial fibrillation developed in collaboration with EACTS. *Eur Heart J* 2016;37:2893–962.
4. Abdelrahman M, Subzposh FA, Beer D, Durr B, Naperkowski A, Sun H, et al. Clinical Outcomes of His Bundle Pacing Compared to Right Ventricular Pacing. *J Am Coll Cardiol* 2018;71:2319–30. [CrossRef]
5. Kronborg MB, Nielsen JC. His Bundle Pacing: Techniques and Outcomes. *Curr Cardiol Rep* 2016;18:76. [CrossRef]
6. Vijayaraman P, Dandamudi G, Zanon F, Sharma PS, Tung R, Huang W, et al. Permanent His bundle pacing: Recommendations from a Multicenter His Bundle Pacing Collaborative Working Group for standardization of definitions, implant measurements, and follow-up. *Heart Rhythm* 2018;15:460–8.
7. Upadhyay GA, Tung R. Selective versus non-selective his bundle pacing for cardiac resynchronization therapy. *J Electrocardiol* 2017;50:191–4. [CrossRef]
8. Vijayaraman P, Subzposh FA, Naperkowski A. Atrioventricular node ablation and His bundle pacing. *Europace* 2017;19(suppl_4):iv10–iv16. [CrossRef]

Keywords: Ablation; atrial fibrillation; atrioventricular node; His; pacing; refractory atrial fibrillation.

Anahtar sözcükler: Ablasyon; atriyal fibrilasyon; atriyoventriküler nod; His; pacemaker; refrakter atriyal fibrilasyon.