Stabilization of a dislocated coronary sinus electrode by coronary stenting during resynchronization therapy

Kardiyak resenkronizasyon tedavisinde yerinden oynayan koroner sinüs elektrodunun stent ile sabitlenmesi

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Cardiac resynchronization therapy (CRT) is an effective treatment modality in patients with severe refractory heart failure combined with intraventricular conduction disease, which improves quality of life and decreases mortality. In CRT, pacing of the left ventricle is accomplished by a coronary sinus (CS) electrode. The main challenge for this technique is to achieve and maintain an optimal lead position so that no dislocation occurs. Cardiac resynchronization therapy was planned in a 66-year-old male patient with NYHA (New York Heart Association) class 3-4 symptoms and left bundle branch block. After two dislocations of the pacing lead from the posterolateral CS, the lead was implanted in the middle cardiac vein and stabilized by coronary stenting. During a six-month follow-up, no further dislocation occurred and pacing parameters were normal.

Key words: Electrodes, implanted; heart failure/therapy; pacemaker, artificial; prosthesis failure; prosthesis implantation; stents.

Kardiyak resenkronizasyon tedavisi (KRT), ilaç tedavisine dirençli, intra ve/veya interventriküler iletim gecikmesi olan kalp yetersizliği (KY) olgularında yaşam kalitesini artıran ve mortaliteyi azaltan etkili bir tedavi yöntemidir. Bu işlemde sol ventrikül, koroner sinüs elektrodu tarafından uyarılır. Bu tekniğin en önemli sorunu, koroner sinüs elektrodunun tam yerleştirilmesi ve yer değiştirmesinin önlenmesidir. NYHA (New York Heart Association) sınıf 3-4 kronik KY ve sol dal bloku olan 66 yaşında erkek hastaya KRT takılmasına karar verildi. Posterolateral koroner sinüse yerleştirilen elektrodun iki kez yerinden çıkması nedeniyle, elektrot orta kardiyak vene yerleştirildi ve koroner stent ile sabitlendi. Hastanın altı aylık kontrolünde elektrodun yerinde olduğu, ölçüm parametrelerinde sorun olmadığı izlendi.

Anahtar sözcükler: Elektrot yerleştirme; kalp yetersizliği/tedavi; kalp pili, yapay; protez başarısızlığı; protez yerleştirme; stent.

Heart failure (HF) is a frequently encountered worldwide health problem which leads to severe symptoms and which adversely affects quality of life.[1] Intra/interventricular conduction disorders, particularly left bundle branch block which are seen in 30% of the patients with decompensated heart failure result in ventricular asynchronous contraction and worsening of left ventricular function.[2,3] Cardiac resynchronization therapy (CRT) has been shown to be an effective treatment in patients with severe refractory heart failure combined with intraventricular conduction disease, providing ventricular synchronous contraction, improving quality of life, relieving symptoms of heart failure, and decreasing mortality.[4,7] However, in 8-10% of the patients, inability to insert or stabilize the coronary sinus leads is the most important concern encountered due to factors such as noncannulization of the coronary sinus (CS) associated with anatomic inconsistency, high impulse threshold of CS, and phrenic nerve stimulation.[8] In this article we presented a case with advanced heart failure (grade III-IV) and left bundle branch block, in whom the left ventricular (LV) lead which was twice dislocated was stabilized by coronary stenting.

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CASE REPORT

A 66-year-old male patient with New York Heart Association (NYHA) class 3-4 symptoms and ischemic dilated cardiomyopathy (Coronary angiography performed in 2000 revealed three-vessel coronary artery disease) was admitted to the hospital for cardiac resynchronization therapy (CRT). An unsuccessful attempt was made with a standard Biotronic guide wire catheter to enter the coronary sinus during the first intervention session. As a result, an electrophysiology study (EPS) catheter was inserted and advanced through the guide wire catheter in an attempt to reenter the CS, which also failed. A 6F left Amplatz (AL2) catheter was then advanced and placed in the CS (Figure 1). Coronary sinus angiography showed a small lateral branch and an entry attempt was made by a 0.014 floppy guide wire. However, this attempt was unsuccessful due to the inappropriate angle of lateral branch. Thereupon, the Biotronic lead was advanced distally into the middle cardiac vein following a selective angiography for the guide wire catheter and vein. The amplitude of R wave was found to be 13 mV, while the threshold value was 0.6 and resistance was 680 Ohm. A diaphragmatic stimulation could not be achieved by 10V. The right ventricular lead was positioned in the apex of the right ventricle, while the right atrial lead was positioned in the right atrial appendage. After six hours, the CS lead was observed to be dislocated and positioned in the right atrium. As a result the patient was carried to the catheter laboratory where the lead was re-implanted in the middle cardiac vein. However, the lead was dislocated again after a very short time. Thereupon, the patient was immediately carried to the catheter laboratory and the lead was pressed and stabilized between a 3.5/16 mm coronary stent (Nemedi, Turkey) and the venous wall. The amplitude of the R wave was found to be 13 mV, the threshold value was

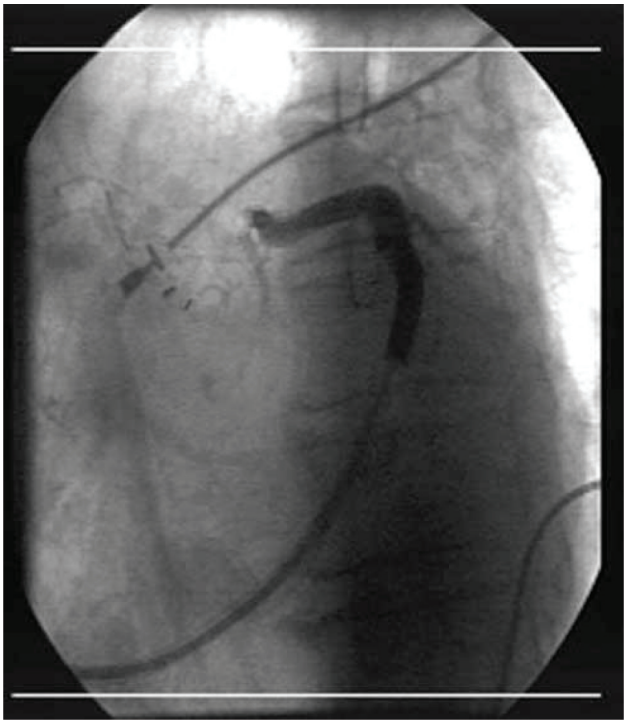

Figure 1. Coronary sinus angiography performed with a left Amplatz catheter.

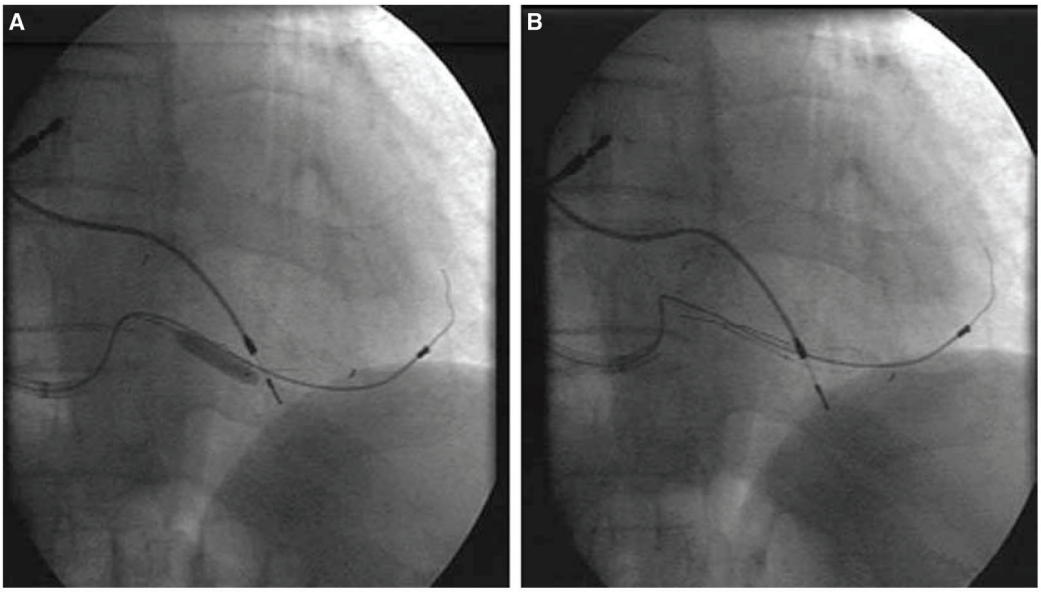

Figure 2. Stabilization of the cardiac resynchronization catheter with a stent. **(A)** Balloon dilatation, **(B)** stent placement.

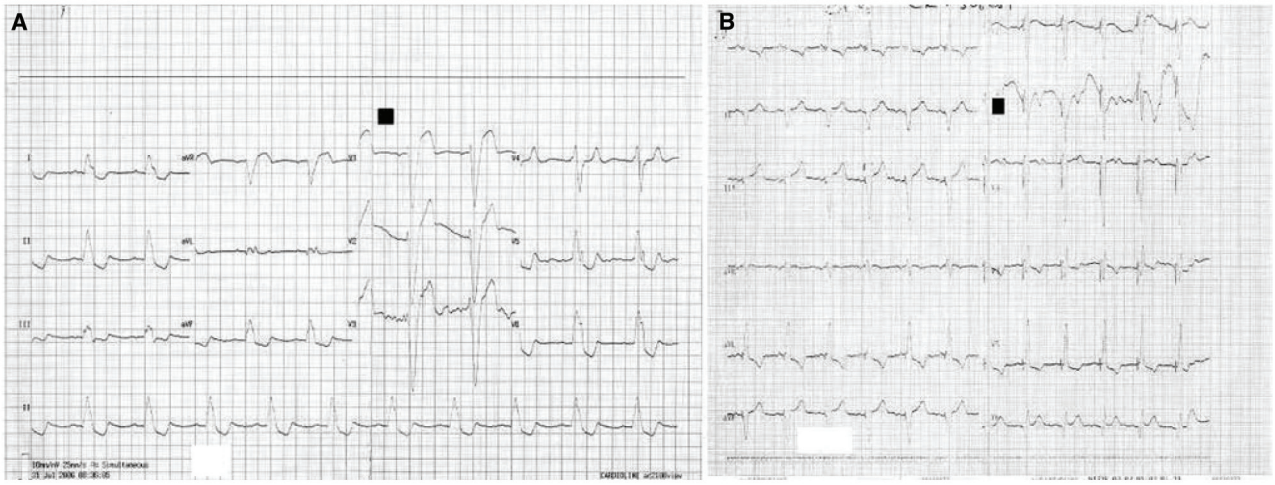

Figure 3. ECG changes (A) before and (B) after cardiac resynchronization therapy.

0.7, while resistance was 780 Ohm (Figure 2). The QRS width decreased from 160 msn to 120 msn after the procedure (Figure 3). The lead was found to be in place after a-three-day follow-up and the patient was discharged from the hospital without any complication.

During the-six-month follow-up, no further dislocation occurred and pacing parameters were found to be normal.

DISCUSSION

Coronary sinus stenting is an important de novo technique which stabilizes the lead in the left ventricle. Despite the current developments in transvenous implantation techniques, the incidence of dislocation of CS leads has been reported to be as high as 5% to 9%.[5] Changes in the position of the lead in the target vein of the coronary sinus may render the CRT ineffective by 20% to 30%.[4,6] Few cases in which the lead was stabilized by coronary stenting have been reported in literature.[9-12] Szilagyi et al.[9] reported the one-year follow-up results of the study involving 36 patients in whom the CS lead was stabilized by conventional stenting procedure. In this study, the stent was implanted following lead dislocation in seven cases, and no other problem related to lead implantation was observed during follow-up. In addition, threshold and impedance values were normal. Gilard et al.[13] reported that the CS anatomy in 75 of the 100 cases who underwent CS angiography was suitable for lead implantation. CS pathologies reported to preclude lead implantation in the said study included the absence of posterolateral veins, CS diameter of <2 mm or a wider angle. In our case, coronary sinus angiography showed a small lateral branch which was inconsistent with the angle, leading to an unsuccessful attempt to penetrate (Figure 2). Thereupon, the left ventricular lead was implanted in the middle cardiac vein by selective venography. However, due to a twice-dislocated lead, it was pressed and fixed between the venous wall and the coronary stent.

In conclusion, stabilization of LV lead by stenting during CRT is an effective and safe method. Stabilization by the stenting procedure may be preferred as an effective method if the lead position changes during or after implantation of the left ventricular lead or if it is not stable enough.

REFERENCES

1. Uyarel H, Onat A, Yüksel H, Can G, Ordu S, Dursunoğlu D. Incidence, prevalence, and mortality estimates for chronic atrial fibrillation in Turkish adults. [Article in Turkish] Türk Kardiyol Dern Arş 2008;36:214-22.
2. Bahar I, Akgül A, Babaroğlu S, Ozatik MA, Turhan H, Göl MK ve ark. Kronik atriyal fibrilasyonda mekanik mitral kapak replasmanı ile birlikte radyofrekans atriyal ablasyonun etkinliği. Anadolu Kardiyol Derg 2006; 6:41-8.
3. Geidel S, Lass M, Boczor S, Kuck KH, Ostermeyer J. Surgical treatment of permanent atrial fibrillation during heart valve surgery. Interact Cardiovasc Thorac Surg 2003;2:160-5.
4. Chen SA, Tai CT. Catheter ablation of paroxysmal atrial fibrillation. Cardiol Rev 2005;13:87-94.
5. Ad N. The maze procedure: past, present and future. In: Sie HT, D'Ancona G, Bartolozzi F, Beukema W, Doty DB, editors. Manual of surgical treatment of atrial fibrillation. Massachusetts: Blackwell Publishing; 2008. p. 102-12.

6. Haïssaguerre M, Shah DC, Jaïs P, Hocini M, Yamane T, Deisenhofer I, et al. Electrophysiological breakthroughs from the left atrium to the pulmonary veins. Circulation 2000;102:2463-5.
7. Haïssaguerre M, Hocini M, Sanders P, Takahashi Y, Rotter M, Sacher F, et al. Localized sources maintaining atrial fibrillation organized by prior ablation. Circulation 2006;113:616-25.
8. Nanthakumar K, Lau YR, Plumb VJ, Epstein AE, Kay GN. Electrophysiological findings in adolescents with atrial fibrillation who have structurally normal hearts. Circulation 2004;110:117-23.
9. Todd DM, Skanes AC, Guiraudon G, Guiraudon C, Krahn AD, Yee R, et al. Role of the posterior left atrium and pulmonary veins in human lone atrial fibrillation: electrophysiological and pathological data from patients undergoing atrial fibrillation surgery. Circulation 2003;108:3108-14.
10. Guang Y, Zhen-jie C, Yong LW, Tong L, Ying L. Evaluation of clinical treatment of atrial fibrillation associated with rheumatic mitral valve disease by radiofrequency ablation. Eur J Cardiothorac Surg 2002;21:249-54.
11. Deneke T, Khargi K, Müller KM, Lemke B, Mügge A, Laczkovics A, et al. Histopathology of intraoperatively induced linear radiofrequency ablation lesions in patients with chronic atrial fibrillation. Eur Heart J 2005;26:1797-803.
12. Laurent G, De Chillou C, Bertaux G, Poull IM, Martel A, Andronache M, et al. Simple and efficient identification of conduction gaps in post-ablation recurring atrial flutters. Europace 2006;8:7-15.
13. Chen MC, Chang JP, Chang HW. Preoperative atrial size predicts the success of radiofrequency maze procedure for permanent atrial fibrillation in patients undergoing concomitant valvular surgery. Chest 2004;125:2129-34.
14. Duran NE, Duran I, Sönmez K, Gençbay M, Akçay A, Turan F. İleri mitral yetersizliğinde atriyal fibrilasyonun sıklığı ve öngördürücüleri. Anadolu Kardiyol Derg 2003;3:129-34.
15. Beukema WP, Elvan A, Sie HT, Misier AR, Wellens HJ. Successful radiofrequency ablation in patients with previous atrial fibrillation results in a significant decrease in left atrial size. Circulation 2005;112:2089-95.
16. Aslan O, Güneri S. Atriyal fibrilasyonun elektrofizyolojik temelleri. Anadolu Kardiyol Derg 2002;2:244-52.
17. Forleo GB, Tondo C, De Luca L, Dello Russo A, Casella M, De Sanctis V, et al. Gender-related differences in catheter ablation of atrial fibrillation. Europace 2007;9:613-20.
18. Chua YL, Schaff HV, Orszulak TA, Morris JJ. Outcome of mitral valve repair in patients with preoperative atrial fibrillation. Should the maze procedure be combined with mitral valvuloplasty? J Thorac Cardiovasc Surg 1994;107:408-15.
19. Martìn-Suàrez S, Claysset B, Botta L, Ferlito M, Pacini D, Savini C, et al. Surgery for atrial fibrillation with radiofrequency ablation: four years experience. Interact Cardiovasc Thorac Surg 2007;6:71-6.
20. Kırali K. Cerrahi ablasyon teknikleri: intraoperatif radyofrekans kateter ablasyon (mono-bipolar). Turkiye Klinikleri J Cardiovasc Surg-Spiecal Topics 2008;1:45-8.
21. Kırali K. Atriyal fibrilasyonun tanımlanması. Turkiye Klinikleri J Cardiovasc Surg-Spiecal Topics 2008;1:4-6.
22. Akpinar B, Sağbaş E, Güden M, Sanisoğlu I. Atriyal fibrilasyonun cerrahi tedavisi. Anadolu Kardiyol Derg 2007;7:65-73.
23. Geidel S, Lass M, Ostermeyer J. A 5-year clinical experience with bipolar radiofrequency ablation for permanent atrial fibrillation concomitant to coronary artery bypass grafting and aortic valve surgery. Interact Cardiovasc Thorac Surg 2008;7:777-80.
24. Hindricks G, Piorkowski C, Tanner H, Kobza R, Gerds-Li JH, Carbucicchio C, et al. Perception of atrial fibrillation before and after radiofrequency catheter ablation: relevance of asymptomatic arrhythmia recurrence. Circulation 2005;112:307-13.
25. Williams MR, Stewart JR, Bolling SF, Freeman S, Anderson JT, Argenziano M, et al. Surgical treatment of atrial fibrillation using radiofrequency energy. Ann Thorac Surg 2001;71:1939-43.
26. Demirkiliç U. Mitral kapak cerrahisinde atriyal fibrilasyonu da tedavi edelim. Editöryel Yorum. Anadolu Kardiyol Derg 2005;5:49-50.