Journal of Cardiology Cases 13 (2016) 85–86

Contents lists available at ScienceDirect

Journal of Cardiology Cases

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

Editorial

Editorial: Trapped pacemaker lead extraction: Necessity, challenge, and beyond

Keywords:
Trapped lead
Pacemaker-dependence
Pocket infection
Transvenous extraction

The implantation rate of cardiac rhythm devices, such as permanent pacemakers and implantable cardioverter-defibrillators, has increased significantly over the past decades. Owing to this increase, there is a growing rate of transvenous lead extraction (TLE) due to lead failure, device infection, device upgrading, and lead or device recalls. However, TLE is a complex, invasive, and challenging procedure. The troubleshooting experience in operators and the multidisciplinary team formation are determinants of procedural outcome.

The necessity of TLE is divided practically into two cases, i.e. case of device or pocket infection and that of non-infection. The circumstance of non-infection includes malfunctioning, upgrading, or recalled lead or device. Riata™ (St. Jude Medical, St. Paul, MN, USA) and Sprint Fidelis® (Medtronic Inc, Minneapolis, MN, USA) leads were recalled by the US Food and Drug Administration due to an increased rate of failure [1]. There is still a controversy concerning the management of failed, unnecessary, recalled, or redundant leads. Reportedly, the factors influencing the physicians' decision-making of TLE are the patients' age, the presence of damaged leads, and lead dwelling time, according to the European EP Wire survey conducted by the European Heart Rhythm Association [2]. The decision-making and procedural outcomes are dependent also on the volume of the extraction referral centers [3].

On the other hand, the situation is different in the case of lead, device, or pocket infection, because such infections may be fatal and it requires intensive antibiotic therapy and total system removal. In this issue of the *Journal of Cardiology Cases*, Kypta et al. report an interesting case of a 47-year-old female who had undergone tricuspid mechanical valve replacement followed by dual chamber pacemaker implantation due to postoperative complete atrioventricular block. The permanent pacemaker had to be replaced because of battery depletion. She was referred to their institution for TLE because of evident pocket infection [4]. The REPLACE study has demonstrated that cases of device revision or lead addition within a short period of time have high risk of procedure-related infection [5]. These results indicate that careful decision-making and long-term perspective were required in the pacemaker-dependent patients with drug abuse, as in this case when repetitive pacemaker revision and tricuspid valve surgery were performed.

The Heart Rhythm Society/European Heart Rhythm Association (EHRA) Guideline recommends complete lead and device removal [6,7] in the case of pocket infection (Class 1), as in this case evidenced by swab test proven positive for *Staphylococcus epidermidis* [4]. The guideline includes the principles for infected system removal followed by later contralateral implantation of a new system (Class 1) associated with intensive and appropriate antibiotic therapy. However, simultaneous removal of infected system and implantation of a new system is required occasionally in pacemaker-dependent patients. Amraoui et al. compared the outcomes of delayed transvenous implantation of pacemaker on the opposite site with those of immediate surgical epicardial approach in pacemaker-dependent patients undergoing TLE due to device infection [8]. They concluded that there were equivalent outcomes between the two approaches. However, therapeutic strategy is complicated particularly in the pacemaker-dependent patients undergoing mechanical tricuspid valve replacement. To avoid right ventricular (RV) pacemaker lead trapping, authors postulated three options, i.e. (1) minimally invasive left-sided epicardial leads and device implantation, (2) a coronary sinus (CS) and new right atrial (RA) leads placement associated with a new device on the opposite site, (3) temporary CS pacing followed by a new system implantation at opposite side (two-step approach). Option 1 is a high-risk procedure in this patient undergoing several open-chest surgeries. The same is true in option 3 considering fatal temporary CS lead dislodgement. The remaining option 2 requires the CS lead placement at the same session as infected system removal in this pacemaker-dependent case.

A potential proarrhythmic effect has been raised in biventricular pacing using RV and CS leads for heart failure patients [9]. This is partly due to inhomogeneous repolarization caused by focal epicardial activation [10]. Since ventricular transmural excitation propagates from endocardium to epicardium, CS pacing opposes to this physiological activation sequence. Importantly, authors found in this case that QTc interval recorded by single-site pacing at either anterior or posterolateral vein is longer than that recorded by dual-site CS pacing via anterior and lateral veins. Although the reason for this phenomenon is speculative, possible hemodynamic improvement obtained by the dual-site pacing may have abbreviated QRS duration and hence QTc interval. Paced QTc

DOI of original article: http://dx.doi.org/10.1016/j.jccase.2015.10.011

http://dx.doi.org/10.1016/j.jccase.2015.11.003

interval is reported to be a better predictor of mortality in pacemaker patients than the intrinsic QTc interval [11]. In this sense, it is appreciated that the authors strived for minimizing the QTc interval by choosing the dual-site CS pacing modality and seeking the optimal target vein.

In summary, Kypta et al. present a suggestive and rare case of TLE. As opposed to recommendation of the guideline, they performed a one-step procedure of infected system removal and a contralateral new device implantation using two CS leads due partly to lack of decision-making tools in such a complicated case. Empirical decision-making of TLE in pacemaker-dependent patients with tricuspid mechanical valve may be refined in the near future according to the evolution of sophisticated lead extraction techniques and new pacemaker technology, i.e. TLE using excimer laser sheath is available in Japan since 2009, and permanent leadless pacemakers of Nanostim™ (St. Jude Medical, Sylmar, CA, USA) and Micra™ (Medtronic Inc.) have entered clinical investigation (the LEADLESS trial) and application [12,13].

Conflicts of interest

None.

References

[1] Bongiorni MG, Di Cori A, Segreti L, Zucchelli G, Viani S, Paperini L, De Lucia R, Levorato D, Boem A, Soldati E. Transvenous extraction profile of Riata leads: procedural outcomes and technical complexity of mechanical removal. Heart Rhythm 2015;12:580–7.
[2] Bongiorni MG, Dagres N, Estner H, Pison L, Todd D, Blomstrom-Lundqvist C, for the Scientific Initiative Committee, European Heart Rhythm Association. Management of malfunctioning and recalled pacemaker and defibrillator leads: results of the European Heart Rhythm Association survey. Europace 2014;16:1674–8.
[3] Di Monaco A, Pelargonio G, Narducci ML, Manzoli L, Boccia S, Flacco ME, Capasso L, Barone L, Perna F, Bencardino G, Rio T, Leo M, Di Biase L, Santangeli P, Natale A, et al. Safety of transvenous lead extraction according to centre volume: a systematic review and meta-analysis. Europace 2014;16:1496–507.
[4] Kypta A, Blessberger H, Kammler J, Lambert T, Lichtenauer M, Steinwender C. Extraction of a trapped pacemaker lead in a pacemaker-dependent patient. J Cardiol Cases 2016;13:82–4.
[5] Poole JE, Gleva MJ, Mela T, Chung MK, Uslan DZ, Borge R, Gottipaty V, Shinn T, Dan D, Feldman LA, Seide H, Winston SA, Gallagher JJ, Langberg JJ, Mitchell K, et al. Complication rates associated with pacemaker or implantable cardioverter-defibrillator generator replacements and upgrade procedures: results from the REPLACE registry. Circulation 2010;122:1553–61.
[6] Wilkoff BL, Love CJ, Byrd CL, Bongiorni MG, Carrillo RG, Crossley GH, Epstein LM, Friedman RA, Kennergren CEH, Mitkowski P, Schaerf RHM, Wazni OM. Transvenous lead extraction: Heart Rhythm Society expert consensus on facilities, training, indications, and patients management. Heart Rhythm 2009;6:1085–104.
[7] Deharo JC, Bongiorni MG, Rozkovec A, Bracke F, Defaye P, Fernandez-Lozano I, Golzio PG, Hansky B, Kennergren C, Manolis AS, Mitkowski P, Platou ES. Pathways for training and accreditation for transvenous lead extraction: a European Heart Rhythm Association position paper. Europace 2012;14:124–134.
[8] Amraoui S, Sohal M, Li A, Williams S, Scully P, Jackson T, Claridge S, Behar J, Ritter P, Barandon L, Ploux S, Bordachar P, Rinaldi CA. Comparison of delayed transvenous reimplantation and immediate surgical epicardial approach in pacing-dependent patients undergoing extraction of infected permanent pacemakers. Heart Rhythm 2015;12:1209–15.
[9] Basu Ray I, Fendelander L, Singh JP. Cardiac resynchronization therapy and its potential proarrhythmic effect. Clin Cardiol 2007;30:498–502.
[10] Chalil S, Yousef ZR, Muyhaldeen SA, Smith REA, Jordan P, Gibbs CR, Leyva F. Pacing-induced increase in QT dispersion predicts sudden cardiac death following cardiac resynchronization therapy. J Am Coll Cardiol 2006;47:2486–2492.
[11] Lee JM, Janardhan AH, Kang KW, Joung B, Pak HN, Sundaram S, Choe WC, Lee MH, Hwang HJ. Paced QT interval is a better predictor of mortality than the intrinsic QT interval: long-term follow-up study. Heart Rhythm 2014;11:1184–1189.
[12] Reddy VY, Knops RE, Sperzel J, Miller MA, Petru J, Simon J, Sediva L, de Groot JR, Tjong FVY, Jacobson P, Ostrosff A, Dukkipati SR, Koruth JS, Wilde AAM, Kautzner J, et al. Permanent leadless cardiac pacing: results of the LEADLESS trial. Circulation 2014;129:1466–71.
[13] Sperzel J, Burri H, Gras D, Tjong FVY, Knops RE, Hindricks G, Steinwender C, Defaye P. State of the art of leadless pacing. Europace 2015;17:1508–13.

Toru Maruyama (MD, PhD)*
Department of Medicine and Biosystemic Science, Kyushu University, Fukuoka, Japan

Keita Odashiro (MD, PhD)
Heart Center, Kyushu University Hospital, Fukuoka, Japan

*Corresponding author at: Department of Medicine and Biosystemic Science, Kyushu University Graduate School of Medical Sciences, Maidashi, Higashi-ku, Fukuoka 812-8582, Japan. Tel.: +81 92 642 5235; fax: +81 92 642 5247
E-mail address: maruyama@artsci.kyushu-u.ac.jp (T. Maruyama).

13 November 2015