overestimated. Irrespectively, it is important to point out that there is little information with regards to real-life battery longevity for the studied CRT-D device (Quadra Assura MP, St Jude) given its fairly recent commercialization. Nonetheless, we believe the main value of the present study lies in the reported proportional differences in battery longevity between the different pacing programming protocols. Our results may therefore help clinicians make more informed decisions when considering MPP activation, given the current scarcity of information regarding its impact on battery longevity.

## Conclusions

In most cases, MPP activation significantly reduces battery longevity compared with that for conventional CRT configuration. However, when reasonable MPP LV vector PCTs ( $\leq$ 4.0 V) are achieved, the decrease in battery longevity is relatively small and this may prompt the clinician to activate MPP in such scenarios.

## Conflict of interest: none declared.

## References

- Brignole M, Auricchio A, Baron-Esquivias G, Bordachar P, Boriani G, Breithardt OA et al. 2013 ESC guidelines on cardiac pacing and cardiac resynchronization therapy: the task force on cardiac pacing and resynchronization therapy of the European Society of Cardiology (ESC). Developed in collaboration with the European Heart Rhythm Association (EHRA). Europace 2013;15:1070–118.
- Daubert JC, Saxon L, Adamson PB, Auricchio A, Berger RD, Beshai JF et al. 2012 EHRA/HRS expert consensus statement on cardiac resynchronization therapy in heart failure: implant and follow-up recommendations and management. *Europace* 2012;**14**:1236–86.
- Daubert C, Behar N, Martins RP, Mabo P, Leclercq C. Avoiding non-responders to cardiac resynchronization therapy: a practical guide. *Eur Heart J* 2017;38:1463–72.
- Gold MR, Singh JP, Ellenbogen KA, Yu Y, Wold N, Meyer TE et al. Interventricular electrical delay is predictive of response to cardiac resynchronization therapy. J Am Coll Cardiol EP 2016;2:438–47.
- Liang Y, Yu H, Zhou W, Xu G, Sun YI, Liu R et al. Left ventricular lead placement targeted at the latest activated site guided by electrophysiological mapping in coronary sinus branches improves response to cardiac resynchronization therapy. J Cardiovasc Electrophysiol 2015;26:1333–9.
- Tomassoni G, Baker J, Corbisiero R, Love C, Martin D, Niazi I et al. Postoperative performance of the Quartet® left ventricular heart lead. J Cardiovasc Electrophysiol 2013;24:449–56.

- Arias MA, Pachon M, Puchol A, Jimenez-Lopez J, Rodriguez-Padial L. Acute and mid-term outcomes of transvenous implant of a new left ventricular quadripolar lead versus bipolar leads for cardiac resynchronization therapy: results from a single-center prospective database. *Cardial J* 2012;**19**:470–8.
- Forleo GB, Santini L, Giammaria M, Potenza D, Curnis A, Calabrese V et al. Multipoint pacing via a quadripolar left-ventricular lead: preliminary results from the Italian registry on multipoint left-ventricular pacing in cardiac resynchronization therapy (IRON-MPP). Europace 2016; doi:10.1093/europace/euw094.
- Osca J, Alonso P, Cano O, Andres A, Miro V, Tello MJ et al. The use of multisite left ventricular pacing via quadripolar lead improves acute haemodynamics and mechanical dyssynchrony assessed by radial strain speckle tracking: initial results. *Europace* 2016;**18**:560–7.
- Zanon F, Marcantoni L, Baracca E, Pastore G, Lanza D, Fraccaro C et al. Optimization of left ventricular pacing site plus multipoint pacing improves remodeling and clinical response to cardiac resynchronization therapy at 1 year. *Heart Rhythm* 2016;**13**:1644–51.
- Pappone C, Calovic Z, Vicedomini G, Cuko A, McSpadden LC, Ryu K et al. Improving cardiac resynchronization therapy response with multipoint left ventricular pacing: twelve-month follow-up study. *Heart Rhythm* 2015;**12**:1250–8.
- Pappone C, Calovic Z, Vicedomini G, Cuko A, McSpadden LC, Ryu K et al. Multipoint left ventricular pacing improves acute hemodynamic response assessed with pressure-volume loops in cardiac resynchronization therapy patients. *Heart Rhythm* 2014;11:394–401.
- Poole JE, Gleva MJ, Mela T, Chung MK, Uslan DZ, Borge R 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.
- McElderly HT, Evans JC, Keeney JA, Osorio J. Pacemaker systems: the basics of pulse generator design and engineering. In Al-Ahmed AA, Ellenbogen KA, Natale A, Wang PJ (eds). Pacemakers and Implantable Cardioverter Defibrillators: An Expert's Manual. Minneapolis, MI: Cardiotext Publishing, 2010. pp. 79–115.
- Jame S, Kutyifa V, Aktas MK, McNitt S, Polonsky B, Al-Ahmad A et al. Bipolar left ventricular pacing is associated with significant reduction in heart failure or death in CRT-D patients with LBBB. *Heart Rhythm* 2016;**13**:1468–74.
- Kirkfeldt RE, Johansen JB, Nohr EA, Jorgensen OD, Nielsen JC. Complications after cardiac implantable electronic device implantations: an analysis of a complete, nationwide cohort in Denmark. *Eur Heart J* 2014;**35**:1186–94.
- Deshmukh A, Patel N, Noseworthy PA, Patel AA, Patel N, Arora S et al. Trends in use and adverse outcomes associated with transvenous lead removal in the United States. *Circulation* 2015;**132**:2363–71.
- Alam MB, Munir MB, Rattan R, Adelstein E, Jain S, Saba S. Battery longevity from cardiac resynchronization therapy defibrillators: differences between manufacturers and discrepancies with published product performance reports. *Europace* 2017;**19**:421–4.
- Alam MB, Munir MB, Rattan R, Flanigan S, Adelstein E, Jain S et al. Battery longevity in cardiac resynchronization therapy implantable cardioverter defibrillators. *Europace* 2014;16:246–51.

## Corrigendum

doi:10.1093/europace/euy070 Online publish-ahead-of-print 21 March 2018

**Corrigendum to:** 2018 EHRA expert consensus statement on lead extraction: recommendations on definitions, endpoints, research trial design, and data collection requirements for clinical scientific studies and registries: endorsed by APHRS/HRS/LAHRS [*Europace* 2018; **20**:1217].

This paper was corrected online and in print to adapt the spelling of one of the author names. The correct spelling is Christoph Starck.

Published on behalf of the European Society of Cardiology. All rights reserved. © The Author(s) 2018. For permissions, please email: journals.permissions@oup.com.