



“New and improved” DBS batteries?

This issue of the journal contains 2 important papers [1,2] from experienced centers, both demonstrating that the battery longevity of the deep brain stimulator (DBS) most commonly implanted in Parkinson disease patients (the original dual channel Medtronic pulse generator, Kinetra™) is significantly longer than that of the newer system (Activa PC™). This has significant clinical and ethical implications to patients, the neuromodulation community, and health care funders.

Those of us who have been replacing these batteries over the past several years have noted this difference in longevity [3–6]. Many have repeatedly complained to Medtronic about their elimination of the Kinetra™ platform. We have been told that there is no difference in battery life, according to all the engineering calculations. It was suggested that the parameters of stimulation might change and that this may account for the change in apparent generator longevity.

The Activa PC™ has new and more features, such as constant current and multiple programming settings with interleaving of these programs. The overall size of the PC casing is marginally smaller than the previous Kinetra™. However, to go from an average lifespan ranging from 4.3–6.5 y with the Kinetra to only 3–4.6 y with the Activa PC places a significant burden on health care resources and increases the risk to patients. If these newer interleaved programs had been demonstrated to be better than the simple monopolar stimulation we applied for years before, then this “improvement” would have been reasonable. However no such evidence has ever been provided, yet these new systems were readily approved by government bodies, allowing the transition. Now many of us have had to implant rechargeable systems because we cannot rationalize re-operating on patients every 3 years to replace batteries. In some health care systems where there is a fixed budget available for DBS and other neuromodulation devices, this has led to patients being denied therapy in a fiscal year because the more expensive rechargeable systems were required to maintain our patients with safe therapy. We have been assured by Medtronic that their rechargeable generator will last 9 years (or potentially 15 years), yet some of us have already had patients complain of worsening symptoms in their 8th year of Activa RC™ use.

Many of us have speculated that the decision to eliminate the Kinetra™ was a marketing decision to generate more profits. It is evident that patients become dependent on DBS in the long term [7], and interrupting its use may provoke severe rebound of symptoms and even death [8,9]. While we realize that the medical device industry is for-profit and publicly traded with obligations to their shareholders, it behooves us to report these issues to our government approval bodies, as part of post-marketing surveillance. The

decisions made by industry do affect patient safety (increased infection risk at subsequent battery changes) [10,11] and our health care systems.

Conflicts of interest

Dr. Hariz has received travel expenses and honoraria from Medtronic and Boston Scientific for speaking at meetings. Dr. Kiss has attended educational dinners sponsored by Medtronic, Boston Scientific and Abbott (previously St. Jude).

References

- [1] Israeli-Korn, S.D., Fay-Karmon, T., Tessler S., Yahalom, G., Benizri, S., Strauss, H., Zibly, Z., Spiegelmann, R., Hassin-Baer, S. Decreasing battery life in subthalamic deep brain stimulation for Parkinson's disease with repeated replacements: just a matter of energy delivered?, *Brain Stimul.* DOI: <https://dx.doi.org/10.1016/j.brs.2019.02.008>.
- [2] Sette, A.L., Seigneuret, E., Reymond, F., Chabardes, S., Castrioto, A., Bousset, B., Moro, E., François, P., Fraix, V. Battery longevity of neurostimulators in Parkinson disease: a historic cohort study. *Brain Stimul.* DOI: <https://dx.doi.org/10.1016/j.brs.2019.02.006>.
- [3] Fisher B, Kausar J, Garratt H, Hodson J, White A, Ughratdar I, Mitchell R. Battery longevity comparison of two commonly available dual channel implantable pulse generators used for subthalamic nucleus stimulation in Parkinson's disease. *Stereotact Funct Neurosurg* 2018;96(3):151–6. <https://doi.org/10.1159/000488684>.
- [4] Helmers AK, Lübbling I, Deuschl G, Witt K, Synowitz M, Mehdorn HM, Falk D. Comparison of the battery life of nonrechargeable generators for deep brain stimulation. *Neuromodulation* 2018 Aug;21(6):593–6. <https://doi.org/10.1111/ner.1272>.
- [5] Niemann M, Schneider GH, Kühn A, Vajkoczy P, Faust K. Longevity of implantable pulse generators in bilateral deep brain stimulation for movement disorders. *Neuromodulation* 2018 Aug;21(6):597–603. <https://doi.org/10.1111/ner.12743>.
- [6] Helmers AK, Birkenfeld F, Deuschl G, Paschen S, Cohrs G, Mehdorn HM, Falk D. Do adaptors shorten the battery life of non-rechargeable generators for deep brain stimulation?. pii: S1878-8750(19)30475-30479 *World Neurosurg* 2019 Apr 8. <https://doi.org/10.1016/j.wneu.2019.02.064> [Epub ahead of print].
- [7] Hariz M. Once STN DBS, always STN DBS?—Clinical, ethical, and financial reflections on deep brain stimulation for Parkinson's disease. *Mov Disord Clin Pract* 2016 Feb 11;3(3):285–7. <https://doi.org/10.1002/mdc3.12292>.
- [8] Reuter S, Deuschl G, Falk D, Mehdorn M, Witt K. Uncoupling of dopaminergic and subthalamic stimulation: life-threatening DBS withdrawal syndrome. *Mov Disord* 2015;30:1407–13. <https://doi.org/10.1002/mds.26324>.
- [9] Rohani M, Munhoz RP, Shahidi G, Parvaresh M, Miri S. Fatal status dystonicus in tardive dystonia due to depletion of deep brain stimulation's pulse generator. *Brain Stimul* 2017 Jan - Feb;10(1):160–1. <https://doi.org/10.1016/j.brs.2016.10.006>.
- [10] Helmers AK, Lübbling I, Birkenfeld F, Witt K, Synowitz M, Mehdorn HM, Falk D. Complications of impulse generator exchange surgery for deep brain stimulation: a single-center, retrospective study. *World Neurosurg* 2018 May;113:e108–12. <https://doi.org/10.1016/j.wneu.2018.01.183>. Epub 2018 Feb 14.
- [11] Pepper J, Zrinzo L, Mirza B, Foltynie T, Limousin P, Hariz M. The risk of hardware infection in deep brain stimulation surgery is greater at impulse generator replacement than at the primary procedure. *Stereotact Funct Neurosurg* 2013;91:56–65. <https://doi.org/10.1159/000343202>.

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