

Permanent cardiac pacing: evidence, beliefs, and habits

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In their study, published in this issue of *Polish Archives of Internal Medicine*, Kuniewicz et al¹ raise important practical issues. Indeed, classic permanent cardiac pacing seems to be a well-established and not very hot topic, but many clinical decisions we make are based on rather old principles with not enough evidence. Paradoxically, the choice of the pacing mode in sick sinus syndrome has a relatively solid scientific background, which supports the use of dual chamber (DDD) pacemaker over single atrial pacing (AAI). Therefore, the study group analyzed by the authors (n = 254) over almost 25 years,¹ should be appreciated even more, as we know from registries that there are just single cases of AAI systems implanted each year in the majority of Polish and European centers.

When this editorial was almost ready, we decided to rewrite it and present it to you in a somewhat provocative way, with deeper analysis of selected evidence available. In the DANPACE trial,² no differences in total mortality (AAIR vs DDDR, where R stands for rate response) was found (29.6% vs 27.3%; $P = 0.53$), either for chronic atrial fibrillation (AF) (11.2% vs 10.7%; $P = 0.93$) or for stroke incidence (5.5% vs 4.8%; $P = 0.59$), but the groups differed in paroxysmal AF (28.4% vs 23%; $P = 0.024$). Finally, postimplant syncope turned out to depend on many clinical factors but not the pacing mode choice.³ The most significant difference in favor of DDDR has been achieved for reoperations (22.1% vs 11.9%; $P < 0.001$), and this difference was significant only for a surgical change of the pacing mode (9.3% vs 0.6%; $P < 0.001$). Also worth noting is the fact that the mean (SD) ventricular pacing rate in the DDDR group was unexpectedly high and reached 65% (33%) solely for sick sinus syndrome, and neither heart failure nor tricuspid valve function were the end points evaluated in that trial.² Post-trial, registry-based, long-term follow-up extension has shown no difference in mortality, risk of hospitalization

for AF, stroke, or heart failure, and further rate of pacing mode change to DDDR in the AAIR group reached 21.4% (4.5% annually).⁴ The unavoidable conclusion is that the incidence of adding the lead appears because... we add it. A decision to upgrade the atrial pacemaker was estimated to be in class I for almost 90% of cases in the DANPACE trial,⁵ but the actual threshold strength for adding a ventricular lead is disputable anyway. Though our knowledge on the unfavorable aspects of permanent pacing has increased significantly over the last 2 decades, and has modified our approach, permanent pacing indications are still based on a few level C statements,⁶⁻⁸ and we find it to be the main problem. In fact, we are not convinced by DDD pacing superiority, as it may just mean that should ventricular lead be inserted in some patients due to general progress of cardiovascular diseases with the population aging, we can monitor them safely until this point is reached. In their previous study, Kuniewicz et al⁹ pointed out that higher rate of reoperations in patients with AAI is mainly related to permanent AF with slow conduction, developing especially after the 4th year of follow-up. This may justify de novo DDD preference over AAI in older patients,¹⁰ and pharmacoeconomic view from the DANPACE trial supports this thesis,¹¹ although health care systems are not directly transferable in various countries. Additionally, some previous or smaller studies reported better AAIR than DDDR outcomes, or at least safe long-term performance of AAI, especially in younger patients or with respect to robust preimplant screening of atrioventricular (AV) and intraventricular conduction.¹²⁻¹⁶ Data on complications related to the compared systems are inconsistent, but even if we assume that upgrades may be associated with their increased risk, the rate of lead-related complications may exceed 10% per 5 years in DDD patients.^{2,5,17}

Even though the current recommendations⁸ clearly emphasize the need for thorough

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diagnostics before a pacemaker insertion, they do not seem to affect our final decisions too much, as we are afraid to deviate from the guidelines. There is little evidence-based information why and whom we should pace in sick sinus syndrome, but it would be very difficult to discern the beginnings of indications for permanent pacing. The applicable guidelines⁸ would be the main ethical and legal limitations, although for most of them the evidence level is C, which is that of beliefs. As a famous surgeon dr. Teodor Kocher said, a real expert knows when not to operate. A decision to use atrial pacing alone may be difficult and may require experience and clinical courage. In fact, it may depend on our beliefs and habits, but legal aspects must be taken into account as well.

The paper by Kuniewicz et al¹ shows numerous areas to be explored in the permanent cardiac pacing. Over the years, the technical capabilities of pacemakers have certainly improved, and a wide range of modifiable parameters have been added to reproduce natural physiological variability of the heart function.¹⁸ These parameters make it possible to adjust the pacing rate to the physical or emotional effort (rate response), as well as to adjust the settings in terms of variability of the AV delay duration. However, despite wide availability of various functions, clinical practice in this area is often empirical, and the evidence regarding effectiveness and strategies of using these settings is incomplete and sometimes contradictory. There is a justified need to conduct further research focused on the effectiveness and optimal methods of using the available options for pacing parameters and modes.¹⁹

Progress is attributed to innovative means, but beyond development of the conduction pathways, emerging leadless and extravascular pacing, the decision whom to implant a pacemaker remains mainly the same.⁸ To summarize, we can compare permanent cardiac pacing to aviation. The first jumbo jet was built in the 1960s, and this model is still in service. Electronics (functions and algorithms) is far more modern, but we can still fly with the same airframe and avionics (basic indications, pacing modes, “leads and device-frame”). Today, a vast majority of patients present with the same indications and pacemakers that we implanted decades ago.

ARTICLE INFORMATION

DISCLAIMER The opinions expressed by the author(s) are not necessarily those of the journal editors, Polish Society of Internal Medicine, or publisher.

CONFLICT OF INTEREST None declared.

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REFERENCES

- 1 Kuniewicz M, Stanek A, Ząbek A, et al. Permanent single-chamber atrial pacing: an obsolete or viable alternative to dual-chamber pacing in

selected patients with sinus node disease? *Pol Arch Intern Med.* 2023; 133: 16509. [↗](#)

2 Nielsen JC, Thomsen PE, Højberg S, et al; DANPACE Investigators. A comparison of single-lead atrial pacing with dual-chamber pacing in sick sinus syndrome. *Eur Heart J.* 2011; 32: 686-696. [↗](#)

3 Ng Kam Chuen MJ, Kirkfeldt RE, Andersen HR et al. Syncope in paced patients with sick sinus syndrome from the DANPACE trial: incidence, predictors and prognostic implication. *Heart.* 2014; 100: 842-847. [↗](#)

4 Brandt NH, Kirkfeldt RE, Nielsen JC et al. Single lead atrial vs. dual chamber pacing in sick sinus syndrome: extended register-based follow-up in the DANPACE trial. *Europace.* 2017; 19: 1981-1987. [↗](#)

5 Kirkfeldt RE, Andersen HR, Nielsen JC; DANPACE Investigators. System upgrade and its complications in patients with a single lead atrial pacemaker: data from the DANPACE trial. *Europace.* 2013; 15: 1166-1173. [↗](#)

6 Vardas PE, Auricchio A, Blanc JJ, et al; European Society of Cardiology; European Heart Rhythm Association. Guidelines for cardiac pacing and cardiac resynchronization therapy. The Task Force for Cardiac Pacing and Cardiac Resynchronization Therapy of the European Society of Cardiology. Developed in collaboration with the European Heart Rhythm Association. *Europace.* 2007; 9: 959-998.

7 Brignole M, Auricchio A, Baron-Esquivias G, 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). *Eur Heart J.* 2013; 34: 2281-2329. [↗](#)

8 Glikson M, Nielsen JC, Kronborg MB, et al; ESC Scientific Document Group. 2021 ESC Guidelines on cardiac pacing and cardiac resynchronization therapy. *Eur Heart J.* 2021; 42: 3427-3520.

9 Kuniewicz M, Rydlewska A, Karkowski G. Effectiveness of atrial versus atrioventricular pacing for sick sinus syndrome during long-term follow-up. *Kardiol Pol.* 2015; 73: 7-16. [↗](#)

10 Dębski M, Ulman M, Ząbek A, et al. Permanent atrial fibrillation in patients with a dual-chamber pacemaker. *Kardiol Pol.* 2019; 77: 1140-1146. [↗](#)

11 Oddershede L, Riahi S, Nielsen JC, et al. Health economic evaluation of single-lead atrial pacing vs. dual-chamber pacing in sick sinus syndrome. *Europace.* 2014; 16: 866-872. [↗](#)

12 Kim WH, Joung B, Shim J, et al. Long-term outcome of single-chamber atrial pacing compared with dual-chamber pacing in patients with sinus-node dysfunction and intact atrioventricular node conduction. *Yonsei Med J.* 2010; 51: 832-837. [↗](#)

13 Velayuthan R, Sukumar SK, Bootla D, et al. Pacing mode survival in patients with single chamber atrial pacemaker for sinus node dysfunction. *Indian Heart J.* 2023 Dec 7. [Epub ahead of print] [↗](#)

14 Mutagaywa RK, Tumaini B, Chin A. A comparison of AAIR versus DDDR pacing for patients with sinus node dysfunction: a long-term follow-up study. *Cardiovasc J Afr.* 2021; 32: 17-20. [↗](#)

15 Kristensen L, Nielsen JC, Pedersen AK, et al. AV block and changes in pacing mode during long-term follow-up of 399 consecutive patients with sick sinus syndrome treated with an AA/AAIR pacemaker. *Pacing Clin Electrophysiol.* 2001; 24: 358-365. [↗](#)

16 Brandt J, Anderson H, Fähræus T, Schüller H. Natural history of sinus node disease treated with atrial pacing in 213 patients: implications for selection of stimulation mode. *J Am Coll Cardiol.* 1992; 20: 633-639. [↗](#)

17 Dębski M, Ulman M, Ząbek A, et al. Lead-related complications after DDD pacemaker implantation. *Kardiol Pol.* 2018; 76: 1224-1231. [↗](#)

18 Świerzyńska E, Oręziak A, Głowczyńska R, et al. Rate-responsive cardiac pacing: technological solutions and their applications. *Sensors (Basel).* 2023; 23: 1427. [↗](#)

19 Świerzyńska E, Głowczyńska R, Sterliński M, et al. Application and optimization of the rate response function in dual-chamber pacemakers: prospective, randomized, cross-over clinical trial study protocol. *Kardiol Pol.* 2022; 80: 1139-1141. [↗](#)