Leadless pacing: also an option for the young?

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Editorial accompanying 'Implantation of a leadless pacemaker in young adults'

Leadless pacing: also an option for the young?

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Leadless pacemakers (LPs) were designed to overcome lead- and pocket-related complications. To date, no randomized clinical trials have been performed, but observational trials in large patient groups have demonstrated adequate safety and efficacy up to two years after implantation(1-3). Hence, LPs are incorporated in the latest guidelines on pacing therapy and should be considered for selected patients(4). Young age is currently regarded as an argument against leadless pacing. On the one hand, this is due to limited data on real-world long-term battery longevity and replacement strategies. Retrievability of LPs with a screw-in helix fixation mechanism was acceptable (long-term success rate >80%(5)), but reliable data on retrievability of LPs with a tine-based fixation mechanism is expected in the next years. Co-implantation is feasible with two LPs, but has not yet been described*in vivo* with three of more LPs. On the other hand, data on safety and efficacy in the young is scarce. For instance, the patients studied in trials were typical single-chamber ventricular pacemaker recipients, i.e. well over 70 years old. To date, it is unknown whether the results of those trials also apply to young patients.

The young may, however, specifically benefit from certain advantages of leadless pacing. There are less mobility and sports restrictions and the lack of a pocket is a cosmetic advantage. Further, not only do young patients have a higher yearly risk of lead fractures, they also have more remaining years at risk of lead- and pocket-related complications(6). Hence, the lifetime risk reduction of those complications with LP therapy is expected to be greater in the young. Besides, certain young patients may benefit from general LP advantages, such as patients with an increased infection risk. The lack of experience and limited data on potential disadvantages in the young makes adequate weighing of risks and benefits hard. It is important to unveil those unknowns.

To address this issue, Strick et al. describe an multicenter observational cohort of 35 patients with a mean age of 34±8 years (all 18-40 years old) who underwent Micra VR LP implantation between 2015 and 2021 at four university hospitals in France. Patients were included when the advantages of LP therapy outweighed the current disadvantages (single-chamber behaviour) and unknowns. The indications were mainly sinus node dysfunction (23%), and various degrees of AV block (52%). The implantation was successful in all. The endpoints were shown at 6 months and during complete follow-up. At 6 months, the safety endpoint of no system- or procedure-related major complications was met in 100% and the efficacy endpoint (pacing capture threshold [?]2V and <1.5V increase, similar to the Micra LP landmark trial(7)) was met in 97%, as one patient had a pacing threshold of 2.75V at implantation. During complete follow-up of mean 26+-15 months, the safety endpoint remained 100% and the efficacy endpoint 94% as one patient had a gradual

increase in pacing threshold of 1.87V in the year post-implantation. Further, there was 1 case of pacemaker syndrome in a patient with only 0.1% pacing, but this was resolved by lowering the lower rate. This should be seen as a disadvantage of single-chamber ventricular pacing in patients without atrial fibrillation rather than a specific LP problem.

This is one of the first studies regarding the safety and efficacy of LP therapy in young adults. Because LP therapy in young patients is a rare phenomenon, the authors have added relevant knowledge by bundling the cases they treated. Leadless pacing is a vastly different method of pacing than transvenous pacing, with a different fixation mechanism and overall morphology. Hence, it is reassuring that no unexpected large safety or efficacy concerns related to the LP were found.

This study, however, does have important limitations. Foremost, these findings are observational and not randomized, which makes a direct comparison of safety and efficacy between leadless and transvenous pacemakers in the young difficult. However, this is also the case for all other LP studies and this is the only and best data we have to date. Further, the sample size was small with only 35 implantations and the mean follow-up duration was a little over 2 years. Complications that occur infrequently can be missed by the small sample size and, as the authors mention, certain unexpected complications may reveal themselves later than 2 years post-implantation, for example the Nanostim LP battery problem(8). Lastly, this study does not inform us about the risk of different replacement strategies, while in fact this is a very important part of the safety of LPs in younger patients.

Nevertheless, the data presented is encouraging. Previous large LP studies did not include the presented age group, as the mean age was approximately 75-80 years with a distribution suggesting very few patients younger than 50 years(1-3). From this study it seems that the results of those trials can be extrapolated to younger adults. Compared to those trials, the complication rate in this study was lower and the efficacy was similar. The lower complication rate may be partly explained by the operator learning curve and ongoing improvements in knowledge, such as a preference for septal placement and the strive for a minimum number of repositions(9). An observational study including 73 patients <50 years old with an LP reported results comparable to the study of Strick et al(10). As mentioned, in the young, the benefits of LP therapy compared to transvenous pacemakers will likely manifest itself during long-term follow-up. The younger patients in this study were not at increased risk of complications compared to older LP recipients in previous trials. Studies comparing young and old transvenous pacemaker recipients, though, show mixed results(11, 12). However, there are fundamental differences in replacement strategies, and more experience about this topic may change our perspective.

These results may help clinical decision-making by decreasing our lack of experience. With these results, the risks and benefits of LP therapy in young adults can be better estimated. Yet, until more data is available on the real-world battery longevity and optimal replacement strategy of LPs, in young adults, expected pacing burden should be considered even more in choosing between leadless and transvenous pacemakers.

In conclusion, these small-scale results demonstrate no unexpected safety or efficacy concerns for using LPs in young adults, when replacements are not considered. This study brings LP therapy closer to certain younger patients that will specifically benefit from it.

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