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CLINICAL EVIDENCE GUIDE

Micra™ AV and Micra VR

Transcatheter Pacing Systems

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SAFETY & EFFICACY
MICRA™ AV
DEVICE TECHNOLOGY
IMPLANT PROCEDURE & CONSIDERATIONS
INFECTION
DEVICE LIFE CYCLE MANAGEMENT
PATIENT CASE STUDIES
QUALITY OF LIFE
BIBLIOGRAPHY — JULY 2020

SAFETY & EFFICACY

STUDY	ANALYSIS OBJECTIVE	FINDING
Duray GZ, et al. Long-term performance of a transcatheter pacing system: 12-Month results from the Micra Transcatheter Pacing Study. *Heart Rhythm.* May 2017;14(5):702-709.	To assess the long-term safety of Micra at 12 months and electrical performance through 24 months (n = 726).	There were 48% fewer major complications with Micra than transvenous pacemakers through 12 months. Pacing thresholds remained low and stable at 24 months.
El-Chami MF, et al. Updated Performance of the Micra Transcatheter Pacemaker in the Real-World Setting: A Comparison to the Investigational Study and a Transvenous Historical Control. *Heart Rhythm.* December 2018;15(12):1800-1807.	To evaluate performance of Micra through 12 months when used in real-world clinical practice (n = 1,817).	Implant success rate was 99.1%. The major complication rate was 2.7% through 12 months post-implant, representing a 63% reduction in risk relative to transvenous systems.
Piccini JP, et al. Need for System Revision With Leadless Pacemakers in Extended Follow-up: Updated Results from the Micra Transcatheter Pacing System Post-Approval Registry. *Heart Rhythm.* 2020;17(5S):S229.	To report major complications and system revisions through 3 years from the worldwide Micra post-approval registry (n = 1,815).	The major complication rate at 36 months was 3.5% and was 58% lower than that for patients with transvenous pacemakers. All-cause system revision revisions were infrequent and occurred 53% less often compared to transvenous systems.
Reynolds D, et al. A Leadless Intracardiac Transcatheter Pacing System. *N Engl J Med.* June 30, 2016;374(26):2604-2605.	To report major complications and electrical performance through 6 months (n = 725).	Implant success rate was 99.2%. 96.0% of patients experienced no major complications at 6 months, zero dislodgements, and zero systemic infections. 98.3% of patients had adequate pacing thresholds at 6 months.

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MICRA AV

STUDY	ANALYSIS OBJECTIVE	FINDING
Chinitz L, et al. Accelerometer-based atrioventricular synchronous pacing with a ventricular leadless pacemaker: Results from the Micra atrioventricular feasibility studies. *Heart Rhythm*. September 2018;15(9):1363-1371.	To characterize the performance of an AV synchronous algorithm (MARVEL) downloaded into previously implanted Micra VR devices (n = 64).	Average AV synchrony during AV algorithm pacing was 87.0% (n = 64). AV synchrony was significantly greater (P < 0.001) during AV algorithm pacing compared to VVI in high-degree block patients, whereas AVS was maintained in patients with intrinsic conduction.
Garweg C, et al. Behavior of leadless AV synchronous pacing during atrial arrhythmias and stability of the atrial signals over time-Results of the MARVEL Evolve subanalysis. *Pacing Clin Electrophysiol*. March 2019;42(3):381-387.	Prospective, single-center study compared AV synchrony and accelerometer-based atrial sensing signals at two visits ≥ 6 months apart to assess performance over time (n = 9).	Both accelerometer signal amplitude (visit 2–visit 1 = 1.4 mG; 95% confidence interval [CI] [-25.8 to 28.4 mG]; P = 0.933) and AVS (visit 1: 90.8%, 95% CI [72.4, 97.4] and visit 2: 91.4%, 95% CI [63.8, 98.5]; P = 0.740) remained stable.
Garweg C, et al. Predictors of Atrial Mechanical Sensing and Atrioventricular Synchrony with a Leadless Ventricular Pacemaker: Results from the MARVEL 2 Study. *Heart Rhythm*. Published online July 24, 2020.	To identify predictors of A4 amplitude and high AV synchrony.	CABG history, E/A ratio, atrial contraction excursion, and atrial strain were associated with low A4 amplitude. High AV synchrony was predicted by an E/A ratio < 0.94 and low sinus rate variability at rest.
Steinwender C, et al. Atrioventricular synchronous pacing using a leadless ventricular pacemaker: Results from the MARVEL 2 Study. *JACC Clin Electrophysiol*. January 2020;6(1):94-106.	To report on the performance of an automated, enhanced accelerometer-based algorithm (MARVEL 2) that provides AV synchronous pacing downloaded into Micra VR devices (n = 75).	Median AV synchrony at rest in patients with complete AV block and normal sinus rhythm was 94.3% (n = 40). Stroke volume increased by 1.7 cm (p = 0.2) or 8.8 + 15.4% during VDD pacing in patients with complete AV block and normal sinus rhythm. There were no pauses or episodes of oversensing-induced tachycardia.

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DEVICE TECHNOLOGY

STUDY	ANALYSIS OBJECTIVE	FINDING
Bari Z, et al. Physical activity detection in patients with intracardiac leadless pacemaker. *J Cardiovasc Electrophysiol.* December 2018;29(12):1690-1696.	To evaluate the short- and mid-term performance of the Micra activity sensor by testing all three available activity vectors during the exercise tests (n = 51).	The three-axis, accelerometer-based rate adaptive pacing feature proved to be feasible after manual selection of an adequate activity vector. Vector testing in Micra patients with chronotropic incompetence appears to be beneficial compared with the use of nominal Vector 1.
Blessberger H, et al. **Monocenter Investigation Micra MRI Study (MIMICRY): Feasibility Study of the Magnetic Resonance Imaging Compatibility of a Leadless Pacemaker System.** *Europace.* January 1, 2019;21(1):137-141.	To assess the safety and feasibility of cardiac magnetic resonance imaging in patients implanted with Micra undergoing either a 1.5 T or 3.0 T cardiac MRI scan (n = 15).	Cardiac magnetic resonance imaging at either 1.5 T or 3.0 T proved feasible and safe in patients implanted with a Micra, with no relevant changes in device parameters within 3 months of follow-up.
Lloyd M, et al. **Rate Adaptive Pacing in an Intracardiac Pacemaker.** *Heart Rhythm.* February 1, 2017;14(2):200-205.	To evaluate the rate adaptive pacing performance of Micra during treadmill tests to maximum exertion in a subset of patients within the Micra Transcatheter Pacing Study (n = 4 2).	Accelerometer-based rate-adaptive pacing was proportional to workload, thus confirming rate adaptive pacing commensurate to workload is achievable with an entirely intracardiac pacing system.
Soejima K, et al. **Safety evaluation of a leadless transcatheter pacemaker for magnetic resonance imaging use.** *Heart Rhythm.* October 31, 2016;13(10): 2056-2063.	To characterize interactions of MRI with the Micra transcatheter pacemaker system using bench testing with Monte-Carlo simulations in combination with a clinical case study.	The MRI safety assessment tests conducted for the Micra pacemaker demonstrate that patients with a single device or multiple devices can safely undergo MRI scans in both 1.5T and 3T MRI scanners. No MRI-related complications were observed in a patient implanted with a Micra pacemaker undergoing a clinically indicated scan.

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IMPLANT PROCEDURE & CONSIDERATIONS

STUDY	ANALYSIS OBJECTIVE	FINDING
El-Chami MF, et al. How to Implant a Leadless Pacemaker With a Tine-Based Fixation . *J Cardiovasc Electrophysiol.* December 1, 2016;27(12):1495-501.	To describe the stages of the implant procedure for the Micra leadless pacemaker.	The critical steps for Micra implant include careful patient selection, careful navigation around the RV to avoid perforation, and careful removal of the tether at the end of the procedure. The procedure can be done in 30–40 minutes at first and then closer to 20 minutes after 5–10 implantations.
El-Chami M, et al. Impact of operator experience and training strategy on procedural outcomes with leadless pacing: Insights from the Micra Transcatheter Pacing Study. *Pacing Clin Electrophysiol.* July 2017;40(7):834-842.	To compare the effectiveness of training modalities utilized in the Micra IDE study on procedural outcomes: laboratory-based or locally in-hospital (n = 726).	Among a large group of operators, implantation success was high regardless of experience. While procedure duration and fluoroscopy times decreased with implant number, complications were low and not associated with case number. Procedure and safety outcomes were similar between distinct training methodologies.
Kiani S, et al. A Predictive Model for Long Term Leadless Pacemaker Performance: Experience with the Micra Transcatheter Pacemaker. *Heart Rhythm.* 2020;17(5S):235.	To formulate a predictive model for describing long-term electrical performance of Micra (n = 1,843).	75 patients (4.1%) had elevated thresholds at 12 months, of which 13 required system revision. Multivariable regression modeling found male, sex, history of diabetes, implant PCT ≥ 2V, and impedance < 800 Ohms were independent predictors of elevated PCT at 12 months ($p < 0.05$).
Lenarczyk R, et al. Peri-procedural management, implantation feasibility, and short-term outcomes in patients undergoing implantation of leadless pacemakers: European Snapshot Survey. *Europace.* May 1, 2020;22(5):833-838.	To assess procedural settings, safety measures, and short-term outcomes associated with implantation of leadless pacemakers (LLPM) by surveying a broad range of tertiary European electrophysiology centers (n = 21 centers, n = 69 patients).	Despite a relatively unfavorable clinical profile of patients (including frequent need for anticoagulation), leadless pacemaker implantation remains safe and is associated with a low risk of complications.
Piccini JP, et al. Long-term outcomes in leadless Micra transcatheter pacemakers with elevated thresholds at implantation: Results from the Micra Transcatheter Pacing System Global Clinical Trial. *Heart Rhythm.* May 31, 2017;14(5):685-691.	To characterize acute elevated thresholds for Micra vs traditional transvenous leads (n = 720).	Pacing thresholds in most Micra patients with elevated thresholds decrease after implant. Micra device repositioning may not be necessary if the pacing threshold is ≤ 2 V.
San Antonio R, et al. Management of anticoagulation in patients undergoing leadless pacemaker implantation. *Heart Rhythm.* December 1, 2019;16(12):1849-1854.	To assess the incidence of bleeding and thromboembolic complications after Micra implantation at a single center with and without therapeutic anticoagulation (n = 107).	Bleeding and thromboembolic complications after receiving Micra TPS are infrequent. The use of anticoagulant therapy, regardless of the type (including vitamin K antagonists, new oral anticoagulants, and enoxaparin), does not increase the complications associated with the procedure.

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INFECTION

STUDY	ANALYSIS OBJECTIVE	FINDING
El-Chami MF, et al. Leadless Pacemaker Implant in Patients with Pre-Existing Infections: Results from the Micra Post-Approval Registry. *J Cardiovasc Electrophysiol.* April 2019;30(4):569-574.	To report implant procedure characteristics and outcomes among patients undergoing Micra implant within 30 days of CIED explant for infection (n = 105).	Implant success rate was 99%. Micra was implanted on same day as CIED explant in 37% of patients. There were no recurrent infections requiring Micra device removal.
El-Chami MF, et al. Leadless pacemakers reduce risk of device-related infection: Review of the potential mechanisms. *Heart Rhythm.* August 2020;17(8):1393-1397.	This publication reviews the current state of evidence regarding the apparent infection resistance of leadless pacemakers.	Several potential design factors, including absence of pocket/lead and parylene coating, were identified that may contribute to apparent bacterial resistance. Positive physiologic effects may also prevent infection including device encapsulation and turbulent blood flow at implant location.
El-Chami MF, et al. Incidence and outcomes of systemic infections in patients with leadless pacemakers: Data from the Micra IDE study. *Pacing Clin Electrophysiol.* August 2019;42(8):1105-1110.	To analyze the incidence and outcomes of serious infectious events (SIEs; e.g., bacteremia or endocarditis) that developed during follow-up post-Micra implantation (n = 720).	16 patients had documented SIEs during follow-up. SIEs occurred at a mean of 4.8 ± 4.5 months after implant, and all events were adjudicated as unrelated to the Micra device or procedure. No persistent cases of bacteremia after antibiotic cessation were seen over the duration of follow-up. No cases required Micra removal due to device related infection.
Kypta A, et al. Leadless Cardiac Pacemaker Implantation After Lead Extraction in Patients with Severe Device Infection. *J Cardiovasc Electrophysiol.* September 1, 2016;27(9):1067-1071.	To assess the safety and feasibility of Micra implant in pacemaker-dependent patients undergoing lead extraction due to severe device infection (n = 6).	Successful lead extraction and implantation of the Micra TPS system was accomplished in all 6 patients, without signs of infection at discharge. All patients remained free of infection during the 12-week follow-up period, with no evidence of infection, including around the Micra device based upon PET scan imaging.

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DEVICE LIFE CYCLE MANAGEMENT

STUDY	ANALYSIS OBJECTIVE	FINDING
Curnis A, et al. First-in-human retrieval of chronically implanted Micra Transcatheter Pacing system. *Pacing Clin Electrophysiol.* July 2019;42(7): 1063-1065.	To characterize the retrieval of a Micra device 29 months post-implant.	The Micra device was successfully retrieved without complications. Despite 29 months of implant duration, the proximal retrieval feature of the device was free from tissue, allowing the retrieval using a snare loop. In the same procedure, a new Micra was implanted in the high right ventricular septum with optimal pacing threshold.
Grubman, et al. **To Retrieve, or Not to Retrieve: System Revisions with the Micra Transcatheter Pacemaker.** *Heart Rhythm.* December 2017;14(12):1801-1806.	To characterize the system revision rate among patients from the Micra IDE and Continued Access trials (N = 989) compared to a historical control group of patients with transvenous pacemakers (N = 2,667).	The overall Micra revision rate was 1.4% at 24 months, 75% lower than that of patients with transvenous pacemakers. Micra was disabled and left in place in 64% of revisions. It was successfully retrieved percutaneously as late as 14 months post-implant.
Kiani S, et al. **Extraction of a 4-year-old leadless pacemaker with a tine-based fixation.** *Heart Rhythm Case Rep.* August 2019;5(8):424-425.	To describe the retrieval of a Micra device 4 years post-implant in a patient needing a CRT upgrade due to a myocardial infarction and decreased EF.	Micra was successfully retrieved with relative ease using a steerable sheath and snare with intracardiac echocardiogram guidance. The device did not appear to be encapsulated. Procedure time was 40 minutes with 11 minutes of fluoroscopy.
Kypta A, et al. Complete Encapsulation of a Leadless Cardiac Pacemaker. *Clin Res Cardiol.* January 2016;105(1):94.	To describe the histopathological appearance of Micra 1 year post-implant assessed via autopsy.	At autopsy, the Micra was found to be located in the right apex, where it was originally implanted, fixed by its nitinol tines. The Micra device was completely encapsulated.
Omdahl P, et al. Right Ventricular Anatomy Can Accommodate Multiple Micra Transcatheter Pacemakers. *Pacing Clin Electrophysiol.* April 1, 2016;39(4):393-397.	To assess the feasibility of implanting multiple Micra devices using cadaver hearts.	Multiple (3) Micra devices could be implanted in clinically acceptable pacing locations within the right ventricle. Micra takes up less than 1% of the volume of a normal right ventricle.

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PATIENT CASE STUDIES

STUDY	ANALYSIS OBJECTIVE	FINDING
Afzal MR, et al. Multicenter Experience of Feasibility and Safety of Leadless Pacemakers Across Bioprosthetic and Repaired Tricuspid Valves. *JACC Clin Electrophysiol.* September 2019;5(9):1093-1094.	To compare the feasibility and safety of Micra implant in patients with repaired and bioprosethetic tricuspid valves (n = 12; TVs) vs. in patients without TV replacement (n = 38).	Implant success was 100% in both groups, with adequate sensing and pacing threshold at implantation. The procedure duration and fluoroscopy time were significantly longer in the operated TV group. Periprocedural complications were similar in the 2 groups. Over a mean follow-up of 13 + 9 months, there was no difference in the composite of death, upgrade to CRT, or development of severe tricuspid regurgitation.
El Amrani A, et al. Performance of the Micra cardiac pacemaker in nonagenarians. *Rev Esp Cardiol (Engl Ed).* April 2020;73(4):307-312.	Prospective observational study designed to evaluate the safety and effectiveness of Micra in patients ≥ 90 years (n = 41) versus those < 90 years (n = 88).	The device was successfully implanted in 97.6% of patients ≥ 90 years and in 98.9% of patients < 90 years. An adequate position was achieved ≤ 2 repositions in 97.5% of patients ≥ 90 years . There were 3 major complications (2.3%), all in the group aged < 90 years. There were no device-related deaths reported.
Breatnach CR, et al. Leadless Micra Pacemaker Use in the Pediatric Population: Device Implantation and Short-Term Outcomes. *Pediatr Cardiol.* April 2020;41(4):683-686.	To report the experience of neonatal patients managed with implantation of the Micra pacemaker in a single tertiary pediatric cardiology center (n = 9).	Micra was successfully implanted with satisfactory thresholds in pediatric patients with a median age (IQR) of 13 years old (12–14) and median weight of 37 kg. There were no procedural complications.
El-Chami MF, et al. Leadless Pacemaker Implantation in Hemodialysis Patients: Experience with the Micra Transcatheter Pacemaker. *JACC Clin Electrophysiol.* 2019 Feb;5(2):162-170.	To report periprocedural outcomes and intermediate-term follow-up of hemodialysis patients undergoing Micra implantation (n = 201).	Micra was successfully implanted in 98.0% of patients. There were 11 major complications in 9 patients (4.5%) adjudicated as related to the Micra device or procedure. No patients had a device-related infection or required device removal because of bacteremia. Micra pacing thresholds and sensing were excellent and remained stable during follow-up.
Garweg C et al. Leadless cardiac pacemaker as alternative in case of congenital vascular abnormality and pocket infection. *EP Europace.* February 18, 2016;18(10):1564.	To report the Micra implant experience in a 60-year-old male with congenital venous abnormalities and infection of a previously implanted transvenous pacemaker.	The infected material was first removed using a subclavian approach, and Micra was successfully implanted in the apex of the right ventricle. The implant procedure was uncomplicated and uneventful. Electrical measurements remained stable at the 3-month follow-up.
Garweg C, et al. Monocentric experience of leadless pacing with focus on challenging cases for conventional pacemaker. *Acta Cardiol,* October 2018;73(5):459-468.	To investigate the safety and efficacy of Micra used in daily clinical activity with a focus on challenging cases for conventional pacing (n = 66).	The device was successfully implanted in 65 patients (98.5%). During follow-up of 10.4 ± 6.1 months, electrical measurements remained stable. One major (loss of function) and 3 minor adverse events occurred. Micra TPS implantation was straightforward for patients with congenital or acquired cardiac and/or vascular abnormalities, previous tricuspid surgery, and after heart transplantation.

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PATIENT CASE STUDIES

STUDY	ANALYSIS OBJECTIVE	FINDING
Johar S, et al. Implant of a left atrial appendage occluder device (Watchman) and leadless pacing system (Micra) through the same venous access in a single sitting. *BMJ Case Rep*. February 16, 2018;2018:bcr-2017-222471.	To describe the experience of a 73-year-old female with persistent atrial fibrillation and symptomatic tachy-brady syndrome implanted with a left atrial appendage occluder device (WATCHMAN™) and Micra from a single right femoral vein access.	The procedure was well tolerated by the patient and there were no complications. At the end of 1 month, both the devices were found to be working well.
Karjalainen PP, et al. Transcatheter leadless pacemaker implantation in a patient with a transvenous dual-chamber pacemaker already in place. *J Electrocardiol*. July-August 2016;49(4):554-556.	To report the Micra implant experience in an 81-year-old female with an 18-year-old ventricular lead with high pacing threshold.	Micra was successfully implanted in the mid-septum with stable electrical parameters and no in-hospital complications. During the implant procedure, the transvenous pacemaker was in VVI mode at a rate of 40 bpm; after the procedure, it was programmed to a rate of 30 bpm.
Martínez-Sande JL, et al. Acute and long-term outcomes of simultaneous atrioventricular node ablation and leadless pacemaker implantation. *Pacing Clin Electrophysiol*. November 2018;41(11):1484-1490.	To evaluate the feasibility of atrioventricular nodal ablation (AVNA) performed immediately following leadless pacemaker implantation through the same sheath and long-term outcomes vs. those not undergoing AVNA (n = 137).	Immediately following leadless pacemaker implantation (LDP), 27 patients (19.7%) underwent concurrent AVNA. There were 6 (5.5%) complications in patients referred for LDP procedures and 3 (11%) in those who underwent a combined approach. None of these complications were solely attributable to the added AVNA component. Pacing and sensing did not differ between the groups.
Montgomery JA, et al. Feasibility of Defibrillation and Pacing Without Transvenous Leads in a Combined MICRA and S-ICD System Following Lead Extraction. *J Cardiovasc Electrophysiol*. February 2017;28(2):233-234.	To describe the experience of a 70-year-old female with atrial fibrillation and complete heart block who underwent extraction of her entire ICD system followed by Micra implant and immediate placement of a subcutaneous ICD (S-ICD).	Defibrillation threshold (DFT) testing was successful at 65 J, and post-DFT pacemaker interrogation showed no changes in sensing or pacing, with a paced QRS duration of 125 ms. While the two systems are not in direct communication in the patient, they both appear to be functioning optimally without any indication of adverse device to device interaction.
Moore SKL, et al. Leadless Pacemaker Implantation: A Feasible and Reasonable Option in Transcatheter Heart Valve Replacement Patients. *Pacing Clin Electrophysiol*. May 2019;42:542-547.	Retrospective, single-center study designed to determine outcomes of leadless pacemakers compared to transvenous single-chamber pacemakers post transcatheter heart valve replacements (n = 10).	Leadless pacemakers were associated with decreased tricuspid regurgitation and decreased blood loss during implantation. Frequency of ventricular pacing was similar between the groups.

PATIENT CASE STUDIES

STUDY	ANALYSIS OBJECTIVE	FINDING
Okabe T, et al. Leadless Pacemaker Implantation and Concurrent Atrioventricular Junction Ablation in Patients with Atrial Fibrillation. *Pacing Clin Electrophysiol*. May 2018;41(5):504-510.	To assess the feasibility and safety of concurrent Micra leadless transcatheter pacemaker implantation and atrioventricular junction (AVJ) ablation (n = 21).	100% of patients underwent successful Micra implantation followed by concurrent AVJ ablation. There was no device dislodgements or malfunctions during the 12-month follow-up, as well as no patients with major device-related complications. Pacing thresholds were stable through 12 months.
Piccini JP, et al. Patient Selection, Pacing Indications, and Subsequent Outcomes with De Novo Leadless Single-Chamber VVI Pacing. *Europace*. November 1, 2019;21(11):1686-1693.	To compare patient characteristics and outcomes of Micra patients with (n = 492) and without (n = 228) a primary pacing indication associated with atrial fibrillation (AF) in the Micra IDE trial.	Nearly one-third of patients selected to receive Micra VVI therapy were for indications not associated with AF. Non-AF patients required less frequent pacing compared to patients with AF. Risk of cardiac failure, pacemaker syndrome, or syncope were low and did not differ in those with and without AF.
Sideris S, et al. **Leadless pacing systems: A valuable alternative for patients with severe access problems.** *Hellenic J Cardiol*. January-February 2018;59(1):36-39.	To report the Micra implant experience in a 72-year old male with restricted access to the superior vena cava (SVC) system, immunocompromization, and a high risk of infection.	Micra was successfully implanted in the septal wall of the right ventricle with no peri-procedural complications reported and the patient was discharged 3 days post-implant. Pacing thresholds remained stable at the 6-month follow-up; additionally, an improvement in functional status was reported, along with no syncopy or presyncopy events reported.

QUALITY OF LIFE

STUDY	ANALYSIS OBJECTIVE	FINDING
Cabanas-Grandío P, et al. **Quality of life of patients undergoing conventional vs leadless pacemaker implantation: A multicenter observational study.** *J Cardiovasc Electrophysiol.* January 2020;31(1):330-336.	To compare quality of life between patients implanted with leadless pacemakers and those implanted with conventional single-chamber pacemakers (n = 106).	At 6-month follow-up, patients in the leadless pacemaker group scored significantly higher on physical function, physical role, and mental health, even after adjusting for covariates. Pacemaker-related discomfort and physical restrictions were significantly lower for the leadless pacemaker group.
Tjong FVY, et al. Health-related quality of life impact of a transcatheter pacing system. *J Cardiovasc Electrophysiol.* December 2018;29(12):1697-1704.	To assess health-related quality of life (HRQoL) impact, patient satisfaction, and activity restrictions among Micra patients from the IDE trial (n = 702).	Micra resulted in post-implant HRQoL improvements at 3 and 12 months and high levels of patient satisfaction at 3 months. Micra was also associated with fewer activity restrictions compared with traditional pacemaker systems.

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JULY 2020

This bibliography includes the relevant publications on transcatheter pacing categorized by topic for easy reference. Please note that this is not a complete list of all publications on transcatheter pacing, and the document may include publications with views and/or opinions that may not represent those of Medtronic.

Safety & Efficacy

Audoubert M, et al. Resistance of the Medtronic Micra Leadless Pacemaker to 60 Hz Electrical Fields. *Can J Cardiol.* October 1, 2017;33(10):S155.

Beurskens NE, et al. Impact of leadless pacemaker therapy on cardiac and atrioventricular valve function through 12 months of follow-up. *Circ Arrhythm Electrophysiol.* May 2019;12(5):e007124.

Bongiorni MG, et al. Feasibility and long-term effectiveness of a non-apical Micra pacemaker implantation in a referral centre for lead extraction. *Europace.* January 1, 2019;21(1):114-120.

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Denman R, et al. Very Early Experience with the Micra Transcatheter Leadless Pacemaker System: A Single Centre Experience. *Heart Lung Circ.* August 1, 2016;25:S159-160.

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Reynolds D, et al. A Leadless Intracardiac Transcatheter Pacing System. *N Engl J Med.* February 11, 2016;374(6):533-541.

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