



## Recent highlights from the *International Journal of Cardiology heart & Vasculature*: Comprehensive management of atrial fibrillation

Herein we provide an update on manuscripts focussing on the comprehensive management of atrial fibrillation (AF) recently published in the *International Journal of Cardiology Heart & Vasculature*.

AF is the most common and complex sustained arrhythmia in men and requires a comprehensive management [1,2]. Current treatment options have limited efficacy, largely due to the lack of mechanism-based therapeutic approaches. Although many potential drug targets were identified over the last 20 years [3], there are still many important obstacles in their clinical translation [4,5], with only a few (e.g. SK channels) being successfully translated to the clinical phase of drug development [6,7].

The AF better care (ABC) pathway is one management strategy for AF that incorporates anticoagulation, better rhythm control and comorbidity management. Compliance with this management strategy of AF is associated with general improvements in patient outcomes during follow-up [8].

**Stroke prevention:** Stroke risk management among patients with AF has improved between 2011 and 2019; however, there is still scope for further gains as many high-risk patients remain inadequately anticoagulated [9]. Better stroke risk assessment by clinicians coupled with addressing practitioner concerns about bleeding risk may improve management of high-risk patients [2]. Interestingly, with increasing CHADS2 score, not just the risk of stroke, but also the prevalence of coexisting coronary artery disease increases, which underscores the importance of screening for coexisting coronary artery disease in patients who are at high risk for thromboembolic events [10].

**Rhythm control:** Conceptually, it is logical that maintaining sinus rhythm in patients with AF will permit patients to live longer and better. Accordingly, data from the GARFIELD-AF registry showed that early rhythm control strategy in patients with newly diagnosed non-permanent AF was associated with a lower risk of all-cause mortality and non-haemorrhagic stroke [11].

Recent advances in AF ablation techniques have proved effective in restoring and maintaining sinus rhythm with improved safety profiles. Catheter ablation demonstrated lower rates of atrial tachycardia recurrence over time, as well as a significant reduction in the progression from paroxysmal to persistent AF, with no difference in terms of energy source, complications, and clinical outcomes [12]. Newer studies and an updated meta-analysis show a good acute outcomes of two cryoballoon technologies for pulmonary vein isolation [13–18]. Current randomized clinical trials, including the “Cryoballoon Ablation versus Radiofrequency Ablation in Patients with Persistent Atrial Fibrillation (CRRF-PeAF)”, are comparing the traditional thermal energy sources cryo- vs radiofrequency energy for catheter ablation of AF [19]. Additionally,

novel delivery strategies of radiofrequency energy have been introduced recently. Pulmonary vein isolation solely utilizing a high-power short-duration protocol via a very close-protocol provides fast, safe and effective acute electrical isolation of the pulmonary veins. High rates of chronically isolated pulmonary veins have been detected [20–25].

The best single procedure strategy to treat non-paroxysmal AF remains unclear. In patients with non-paroxysmal AF, the combination strategy of pulmonary vein isolation and ablation of non-pulmonary vein triggers achieved comparable outcomes than pulmonary vein isolation alone, clearly disproving the therapeutic value of empiric ablation of targets outside the pulmonary veins [25]. Identification and characterization of the arrhythmia substrate by modern mapping approaches is emerging and may help to guide personalized targeting of specific arrhythmia mechanisms in the future. Mapping-guided substrate-based ablation has been shown as effective as an anatomically-based ablation in the acute termination of atypical atrial flutter, but yields better rhythm outcome with less recurrence of atypical atrial flutter in patients with atrial cardiomyopathy [26]. Coherent mapping yielded a favorable diagnostic accuracy for macroreentrant atrial tachycardias, though its value for diagnosing other atrial tachycardias may be limited [27]. A small prospective, randomized study showed that even the use of an automated three-dimensional activation mapping algorithm is feasible to lead to atrial tachycardia termination [28]. In addition to the determination of cardiac arrhythmias, also lesion assessment strategies are evolving. Radiofrequency ablation related local impedance drop can serve as a promising surrogate for real-time assessment of lesion generation, which may improve safety profile and success rates in the interventional treatment of cardiac arrhythmias [29]. What further improvements can we expect in the future? Novel advanced algorithm allow accurate alignment of pre-procedural cardiac images with electro-anatomical maps acquired during ablation procedures, which could allow integration of multi-modal information from cardiac imaging and mapping into the ablation procedure [30]. Interventional cardiac magnetic resonance and remote robotic magnetic navigation may revolutionize the way how we treat arrhythmias in the future [31,32].

Irrespective of the catheter or mapping algorithm used, some AF patients still will not respond to the applied treatment. Predicting AF recurrence may help in selecting the right strategy for the right patient in a personalized and tailored manner. AF duration, left atrial volume index and left atrial diameter predict the risk of recurrence of AF [33]. Besides this, right ventricular-pulmonary artery uncoupling was associated with recurrent AF, independent of left atrial function [34]. Some sex-specific factors also appear to impact the recurrence of AF [35,36].

<https://doi.org/10.1016/j.ijcha.2024.101478>

Further studies should specifically address the precise role of sex-dependent differences in the pathophysiology of AF and its treatment. In patients with tachycardia-bradycardia syndrome, right atrial enlargement prior to AF ablation was considered to be one of the risk factors for a pacemaker implantation after catheter ablation of AF, which should be considered in the treatment of these patients [37].

**The treatment of AF does not start and end in the cath lab:** Concerning periprocedural anticoagulation, NOACs should be considered as a first-line therapy in patients undergoing catheter ablation for AF [38]. Transesophageal echocardiogramme for thrombus screening represents the main strategy for thrombus exclusion. However, a cross-sectional survey study showed that most AF patients experience oropharynx pain and discomfort during or after transesophageal echo. Most AF patients preferred a new technology to replace transesophageal echocardiogram for atrial thrombus screening [39].

Due to the extensive widespread of AF ablation and the extensive data collection around it, there is a growing awareness that repurposing catheter ablation work-up may help to improve the management of AF patients undergoing AF ablation. Left atrial appendage doppler velocity determined during transesophageal echocardiogramme for atrial thrombus screening is a predictor of recurrence of AF [40]. Additionally, routine pre-ablation cardiac CT angiogramme can detect pulmonary abnormalities in AF patients with airflow limitation, guiding further pulmonary function assessment [41]. Unexpected relevant findings on routine preprocedural cardiac MRI affected clinical decision-making and management in 8.6 % of patients scheduled for first-time AF catheter ablation [42,43]. However, whether integration of information collected during pre-ablation workup indeed translate into a better clinical outcome requires extensive further research.

**AF almost never comes alone [44]:** One underrecognized and often undiagnosed modifiable risk factor in patients with AF is sleep apnea. Jensen et al. showed that moderate to severe sleep apnea is highly prevalent in patients with AF without known sleep apnea [45]. Interestingly, Lin et al. showed that women with both AF and obstructive sleep apnea have a lower AF burden than men, despite being older and having similar obstructive sleep apnea severity and body habitus. Thus, AF may develop later in women with obstructive sleep apnea than in men [46]. Detecting and managing sleep apnea in patients with AF is important, as a significant proportion of patients undergoing catheter ablation of AF have undiagnosed sleep apnea, which is associated with a two-fold higher risk of AF recurrence [47].

Symptoms in patients with AF are highly diverse. One common symptom in patients with AF, which cannot always be specifically related to AF itself, is dyspnea [48,49]. Van der Velden et al. summarized the potential mechanisms and the clinical assessment and developed an interdisciplinary and integrated care approach to manage dyspnea in patient with AF [50]. Given the different and often complex mechanistic pathways leading to dyspnea, dyspneic AF patients will likely benefit from an integrated multidisciplinary approach to tackle all factors and mechanisms involved. Therefore, the authors propose an interdisciplinary and integrated care pathway for the work-up of dyspnea in patients with AF, which is currently not available at most places [51].

Beyond other concomitant conditions, diastolic dysfunction in patients with AF predicts poor outcomes in patients undergoing AF ablation [52]. Among AF patients, higher cardiorespiratory fitness was independently associated with greater left atrial function and compliance. Obesity was associated with higher left atrial volumes yet preserved mechanical function [53]. Also novel technologies such as remote dielectric sensing can help to identify elevated left atrial pressure in patients with AF [54].

Interestingly, lifestyle changes and interventions such as Yoga and hypnosis may help to maintain sinus rhythm in some patients with AF, and can be specifically advised as part of the management of AF [55,56].

**Rhythm follow-up after AF ablation:** Traditionally, a categorical recurrence of AF (>30 sec) in a holter ECG recording has been

considered as a failure of rhythm control interventions [2]. Despite a shorter measurement time, intermittent ECG recordings paired with a blood pressure monitoring detected recurrent AF more frequently and faster compared with usual care after AF ablation [57]. Additionally, the feasibility and usability of artificial intelligence-enabled electrocardiogramme and multimodal prediction model combining features of 24-hour Holter electrocardiogramme with 12-lead electrocardiogramme in this clinical scenario are currently tested [58,59]. Besides this, reduction in AF burden has been established as the preferred outcome measure over categorical AF rhythm recurrence after AF ablation [2]. Nevertheless, the best way for rhythm monitoring to assess success after AF ablation remains unclear.

The definition and duration (currently 2-3 months) of the “blinking periode” after catheter ablation are under debate. Very early detection of AF after ablation by an ECG-patch predicted AF recurrence during the late blanking period after ablation [60]. Also the probability of experiencing AF recurrence can be predicted by atrial tachyarrhythmia episodes during the second and third months after pulmonary vein isolation [61]. Interestingly, atrial arrhythmia recurrence within 1 year could predict long-term major adverse clinical events, supporting the important role of effective rhythm control to prevent heart clinical outcomes [62].

In conclusion, it is obvious that AF requires a comprehensive management involving optimal anticoagulation, early rhythm management and consequent treatment of concomitant conditions. Novel ablation technologies and mapping approaches, highlighted in this article, may improve the efficacy of rhythm control strategies in the future. Recent evidence pointing to inflammatory signaling as a common motif in AF pathophysiology may offer new opportunities to treat AF [63–65]. Finally, in patients with AF there are socioeconomic inequalities in the use of rhythm control therapies, especially in the use of catheter ablation, which need to be addressed to ensure access to optimal AF management to all patients [66]. Tools to systematically assess health literacy are important to evaluate and guide interventions at a clinical and population level to understand and improve AF health literacy and outcomes [67].

## Sources of funding

Grants from the Novo Nordisk Foundation (NNF Young Investigator Awards 2021, project NNF21OC0066480 to D.L.), Deutsche Forschungsgemeinschaft (Research Training Group 2989, project 517,043,330 to D.D.), National Institutes of Health (R01HL136389, R01HL163277, R01HL131517, R01HL160992, R01HL165704, and R01HL164838 to D.D.), and the European Union (large-scale network project MAESTRIA No. 965,286 to D.D.).

## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## References

- [1] D. Linz, M. Gawalko, K. Betz, J.M. Hendriks, G.Y.H. Lip, N. Vinter, Y. Guo, S. Johnsen, Atrial fibrillation: epidemiology, screening and digital health, *Lancet Reg Health Eur.* 1 (37) (2024 Feb) 100786.
- [2] D. Linz, J.G. Andrade, E. Arbelo, G. Boriani, G. Breithardt, A.J. Camm, V. Caso, J. C. Nielsen, M. De Melis, T. De Potter, W. Dichtl, S.Z. Diederichsen, D. Dobrev, N. Doll, D. Duncker, E. Dworatzek, L. Eckardt, C. Eisert, L. Fabritz, M. Farkowski, D. Filgueiras-Rama, A. Goette, E. Guasch, G. Hack, S. Hatem, K.G. Haeusler, J. S. Healey, H. Heidbuechel, Z. Hijazi, L.H. Hofmeister, L. Hove-Madsen, T. Huebner, S. Käåb, D. Kotecha, K. Malaczynska-Rajpold, J.L. Merino, A. Metzner, L. Mont, G. A. Ng, M. Oeff, A.S. Parwani, H. Puererfellner, U. Ravens, M. Rienstra, P. Sanders, D. Scherr, R. Schnabel, U. Schotten, C. Sohns, G. Steinbeck, D. Steven, T. Toennis, S. Tzeis, I.C. van Gelder, R.H. van Leerdam, K. Vernooij, M. Wadhwa, R. Wakili, S. Willems, H. Witt, S. Zeemering, P. Kirchhof, Longer and better lives for patients

- with atrial fibrillation: the 9th AFNET/EHRA consensus conference, *Europace*. 26 (4) (2024) euae070.
- [3] J. Heijman, J.B. Guichard, D. Dobrev, S. Nattel, Translational Challenges in Atrial Fibrillation, *Circ Res*. 122 (5) (2018 Mar 2) 752–773.
- [4] S. Nattel, P.T. Sager, J. Hüser, J. Heijman, D. Dobrev, Why translation from basic discoveries to clinical applications is so difficult for atrial fibrillation and possible approaches to improving it, *Cardiovasc Res*. 117 (7) (2021 Jun 16) 1616–1631.
- [5] A. Saljic, J. Heijman, D. Dobrev, Recent Advances in Antiarrhythmic Drug Therapy, *Drugs*. 83 (13) (2023) 1147–1160.
- [6] J. Heijman, X. Zhou, S. Morotti, C.E. Molina, L.H. Abu-Taha, M. Tekook, T. Jespersen, Y. Zhang, S. Dobrev, H. Milting, J. Gummert, M. Karck, M. Kamler, A. El-Armouche, A. Saljic, E. Grandi, S. Nattel, D. Dobrev, Enhanced Ca<sup>2+</sup>-dependent SK-channel gating and membrane trafficking in human atrial fibrillation, *Circ Res*. 132 (9) (2023) e116–e133.
- [7] A.G. Holst, J. Tomcsányi, B. Vestbjerg, M. Grunnet, U.S. Sørensen, J.G. Diness, B. H. Bentzen, N. Edvardsson, S.H. Hohnloser, D.L. Bhatt, P. Dorian, Inhibition of the KCa2 potassium channel in atrial fibrillation: a randomized phase 2 trial, *Nat Med*. 30 (1) (2024) 106–111.
- [8] M. Hagjoo, A. Askarinejad, M. Heidarali, H. Bakhshandeh, A. Fazelifar, Z. Emkanjoo, S. Madadi, F. Kamali, F. Noohi, Implementation of an atrial fibrillation better care (ABC) pathway management strategy: Findings from the Iranian registry of atrial fibrillation, *Int J Cardiol Heart Vasc*. 8 (53) (2024) 101461.
- [9] K. Giskes, N. Lowres, J. Orchard, K. Hyun, C. Hespe, B. Freedman, Time trends in stroke risk management among high-risk patients with non-valvular atrial fibrillation in Australia between 2011–2019, *Int J Cardiol Heart Vasc*. 26 (53) (2024) 101443.
- [10] T. Murakami, A. Yagishita, K. Ayabe, S. Sakama, K.H. Lee, M. Amino, K. Yoshioka, Y. Ikari, Correlation between thromboembolic risk and prevalence of coronary artery disease in patients with atrial fibrillation and impaired renal function, *Int J Cardiol Heart Vasc*. 18 (53) (2024) 101454.
- [11] M. Knudsen Pope, T.S. Hall, S. Virdone, D. Atar, A. John Camm, K.S. Pieper, P. Jansky, S. Haas, S. Goto, E. Panchenko, G. Baron-Esquivias, P. Angchaisuksiri, A. K. Kakkar, GARFIELD-AF Investigators, Rhythm versus rate control in patients with newly diagnosed atrial fibrillation - Observations from the GARFIELD-AF registry, *Int J Cardiol Heart Vasc*. 16 (49) (2023) 101302.
- [12] A. Parlavocchio, G. Vetta, G. Coluccia, L. Pistelli, R. Caminiti, M. Ajello, M. Magnocavallo, G. Dattilo, R. Foti, S. Carerj, P. Crea, M. Accogli, G.B. Chierchia, C. de Asmundis, D.G. Della Rocca, P. Palmisano, Catheter ablation in patients with paroxysmal atrial fibrillation and absence of structural heart disease: A meta-analysis of randomized trials, *Int J Cardiol Heart Vasc*. 5 (49) (2023) 101292.
- [13] A. Assaf, R.E. Bhagwandien, T. Szili-Torok, S.C. Yap, Comparison of the acute outcome of two cryoballoon technologies for pulmonary vein isolation: An updated systematic review and meta-analysis, *Int J Cardiol Heart Vasc*. 5 (42) (2022) 101115.
- [14] H. Fukunaga, Y. Sekiguchi, J. Sawaguchi, Y. Hayashi, S. Asano, K. Mabuchi, K. Inoue, K. Tanizaki, J. Umemura, M. Isobe, J. Nitta, Initial clinical experience with the novel POLARx FIT cryoballoon system for pulmonary vein isolation in patients with atrial fibrillation, *Int J Cardiol Heart Vasc*. 18 (50) (2023) 101326.
- [15] A.A. Boehmer, M. Rothe, E. Nussbaum, C. Ruckes, B.C. Dobre, B.M. Kaess, J. R. Ehrlich, Cryoballoon pulmonary vein isolation for atrial fibrillation in obese patients: A non-inferiority analysis, *Int J Cardiol Heart Vasc*. 20 (47) (2023) 101244.
- [16] G. Mugnai, F. Cecchini, E. Stroker, G. Paparella, S. Iacopino, J. Sieira, Y. De Greef, L. Tomasi, B. Bolzan, G. Bala, I. Overeinder, A. Almorad, A. Gauthier, A. Sorgente, F.L. Ribichini, C. de Asmundis, G.B. Chierchia, Durability of pulmonary vein isolation following cryoballoon ablation: Lessons from a large series of repeat ablation procedures, *Int J Cardiol Heart Vasc*. 27 (40) (2022) 101040.
- [17] M. Yokoyama, M. Tokuda, K. Tokutake, H. Sato, H. Oseto, K. Yokoyama, M. Kato, R. Narui, S.I. Tanigawa, S. Yamashita, M. Yoshimura, T. Yamane, Effect of air removal with extracorporeal balloon inflation on incidence of asymptomatic cerebral embolism during cryoballoon ablation of atrial fibrillation: A prospective randomized study, *Int J Cardiol Heart Vasc*. 7 (40) (2022) 101020.
- [18] H. Fukunaga, Y. Sekiguchi, S. Asano, T. Nagase, K. Tanizaki, J. Umemura, J. Nitta, M. Isobe, Impact of monitoring surface temperature during pulmonary vein isolation in a second-generation hot balloon system, *Int J Cardiol Heart Vasc*. 3 (39) (2022) 100967.
- [19] K. Miyamoto, K. Kanaoka, M. Yoh, H. Takahashi, J. Kishihara, M. Ishikura, Y. Sasaki, H. Fukunaga, T. Nagase, S. Asano, S. Mizuno, S. Yamagami, Y. Yazaki, T. Kusume, Y. Takada, K. Yodogawa, W. Shimizu, T. Shigeta, Y. Sagawa, Y. Inoue, S. Nagase, T. Aiba, M. Takagi, H. Fukaya, A. Kabori, J. Nitta, M. Murakami, S. Nishiuchi, K. Satomi, N. Kataoka, Y.K. Iwasaki, K. Ashikaga, Y. Yamauchi, K. Kusano, Cryoballoon ablation versus radiofrequency ablation in patients with persistent atrial fibrillation (CRRF-PeAF): Protocol for a prospective, multicenter, randomized, controlled study, *Int J Cardiol Heart Vasc*. 25 (41) (2022) 101074, <https://doi.org/10.1016/j.ijcha.2022.101074>.
- [20] C.H. Heeger, S.S. Popescu, B. Kirstein, S. Hatahet, A. Traub, H.L. Phan, M. Feher, G. D Ambrosio, A. Keelani, M. Schlüter, J. Vogler, C. Eitel, K.H. Kuck, R.R. Titz, Very-high-power short-duration ablation for treatment of premature ventricular contractions - The FAST-AND-FURIOUS PVC study, *Int J Cardiol Heart Vasc*. 4 (40) (2022) 101042.
- [21] C.H. Heeger, B. Subin, C. Eitel, S. Ștefan Popescu, H.L. Phan, R. Mamaev, L. Bartoli, N. Große, S. Reincke, A. Traub, D. Lopez, B. Kirstein, S. Hatahet, K.H. Kuck, J. Vogler, R.R. Titz, Pulmonary vein isolation durability after very high-power short-duration ablation utilizing a very-close protocol - The FAST AND FURIOUS redo study, *Int J Cardiol Heart Vasc*. 20 (50) (2023) 101325.
- [22] S.M. Chaldoupi, J. Luermans, D. Linz, Very high-power short-duration ablation for treatment of premature ventricular contractions: Truth or Dare? *Int J Cardiol Heart Vasc*. 13 (40) (2022) 101053.
- [23] S.M. Chaldoupi, J. Luermans, K. Vernooij, D. Linz, High-power short-duration ablation: The new standard for pulmonary vein isolation? *Int J Cardiol Heart Vasc*. 2 (36) (2021) 100865.
- [24] Y. Kondo, T. Kajiyama, T. Chiba, M. Nakano, Y. Kobayashi, Continuous RAPID-mode ablation with a third-generation laser balloon, *Int J Cardiol Heart Vasc*. 17 (43) (2022) 101137.
- [25] G. Nitta, J. Nitta, O. Inaba, A. Sato, Y. Inamura, T. Takamiya, M. Goya, T. Sasano, Optimal single procedure strategy of pulmonary vein isolation with cryoballoon or radiofrequency and non-pulmonary vein triggers ablation for non-paroxysmal atrial fibrillation, *Int J Cardiol Heart Vasc*. 4 (40) (2022) 101021.
- [26] A. Pott, Y. Teumer, K. Weinmann, M. Baumhardt, C. Schweizer, D. Buckert, C. Bothner, W. Rottbauer, T. Dahme, Substrate-based ablation of atypical atrial flutter in patients with atrial cardiomyopathy, *Int J Cardiol Heart Vasc*. 18 (40) (2022) 101018.
- [27] A. Yagishita, S. Sakama, K. Ayabe, M. Amino, Y. Ikari, K. Yoshioka, Utility and limitations of coherent mapping algorithm utilizing vectors and global propagation patterns in atrial tachycardia, *Int J Cardiol Heart Vasc*. 7 (45) (2023) 101193.
- [28] R. Spittler, N. Witte, B.A. Hoffmann, A. Marx, H. Mollnau, B. Quesada-Ocete, T. Konrad, T. Rostock, Automated three-dimensional activation versus conventional mapping for catheter ablation of atrial tachycardia - A prospective randomized trial, *Int J Cardiol Heart Vasc*. 24 (47) (2023) 101222.
- [29] E. Pesch, L. Riesinger, N. Vonderlin, J. Kupusovic, M. Koehler, F. Bruns, R. A. Janosi, S. Kochhäuser, D. Dobrev, T. Rassaf, R. Wakiili, J. Siebermair, Role of catheter location on local impedance measurements and clinical outcome with the new direct sense technology in cardiac ablation procedures, *Int J Cardiol Heart Vasc*. 8 (42) (2022) 101109.
- [30] B.J.M. Hermans, G.P. Bijvoet, R.J. Holtackers, C. Mihil, J.G.L.M. Luermans, B. Maesen, K. Vernooij, D. Linz, S.M. Chaldoupi, U. Schotten, Multi-modal characterization of the left atrium by a fully automated integration of pre-procedural cardiac imaging and electro-anatomical mapping, *Int J Cardiol Heart Vasc*. 11 (49) (2023) 101276.
- [31] G.P. Bijvoet, R.J. Holtackers, H.M.J.M. Nies, C. Mihil, S.M. Chaldoupi, The role of interventional cardiac magnetic resonance (ICMR) in a typical atrial flutter ablation: The shortest path may not always be the fastest, *Int J Cardiol Heart Vasc*. 28 (41) (2022) 101078.
- [32] R.B. Gagyai, A.M.E. Noten, S. Wijchers, S.C. Yap, R.E. Bhagwandien, M. G. Hoogendijk, T. Szili-Torok, Dipole charge density mapping integrated in remote magnetic navigation: First-in-human feasibility study, *Int J Cardiol Heart Vasc*. 21 (42) (2022) 101095.
- [33] D. Raniga, M. Goda, L. Hattingh, S. Thorning, M. Rowe, L. Howes, Left atrial volume index: A predictor of atrial fibrillation recurrence following direct current cardioversion - A systematic review and meta-analysis, *Int J Cardiol Heart Vasc*. 23 (51) (2024) 101364.
- [34] M. Yano, Y. Egami, K. Ukita, A. Kawamura, H. Nakamura, Y. Matsuhira, K. Yasumoto, M. Tsuda, N. Okamoto, Y. Matsunaga-Lee, M. Nishino, J. Tanouchi, Clinical impact of right ventricular-pulmonary artery uncoupling on predicting the clinical outcomes after catheter ablation in persistent atrial fibrillation patients, *Int J Cardiol Heart Vasc*. 5 (39) (2022) 100991.
- [35] D. Veen, C. Schram-Serban, M. van Schie, F. van Schaagen, P. Knops, M. Kavousi, Y. Taverne, N.M.S. de Groot, How sex affects the sinus rhythm heartbeat, *Int J Cardiol Heart Vasc*. 27 (49) (2023) 101314.
- [36] D. Veen, E.C. Verbeek, M. Kavousi, J. Huigen, A. Mijnen-Schra, R. Cocchieri, M. Khan, N.M.S. de Groot, Sex differences in characteristics of atrial fibrillation recurrence post surgical pulmonary vein isolation, *Int J Cardiol Heart Vasc*. 25 (48) (2023) 101262.
- [37] T. Arai, Y.K. Iwasaki, H. Hayashi, N. Ito, M. Hachisuka, S. Kobayashi, Y. Fujimoto, K. Hagiwara, H. Murata, K. Yodogawa, W. Shimizu, K. Asai, Enlarged right atrium predicts pacemaker implantation after atrial fibrillation ablation in patients with tachycardia-bradycardia syndrome, *Int J Cardiol Heart Vasc*. 10 (49) (2023) 101297.
- [38] K. Miyamoto, S. Murata, M. Takegami, K. Nakajima, T. Kamakura, M. Wada, K. Ishibashi, Y. Inoue, S. Nagase, T. Aiba, K. Nishimura, K. Kusano, Real-world comparison of in-hospital complications after catheter ablation for atrial fibrillation between non-antithrombotic K anticoagulants and warfarin: A propensity-matched analysis using nation-wide database, *Int J Cardiol Heart Vasc*. 11 (44) (2023) 101174.
- [39] M. Raval, A. Jain, R. Desai, S. Siddiq, Left atrial appendage doppler velocity as a predictor of recurrence of atrial fibrillation after transesophageal echocardiogram guided electrical cardioversion, *Int J Cardiol Heart Vasc*. 8 (48) (2023) 101268.
- [40] R. Zeng, X. Pu, S. Chen, C. Chen, Y. Chen, W. Chen, H. Fu, Oropharynx pain, discomfort, and economic impact of transesophageal echocardiography for planned radio-frequency catheter ablation in patients with atrial fibrillation: A cross-sectional survey study, *Int J Cardiol Heart Vasc*. 10 (48) (2023) 101266.
- [41] M.J.M. Hereijgers, R.M.J. van der Velden, N. El Moussaoui, D.V.M. Verhaert, Z. Habibi, J. Luermans, D. den Uijl, S.M. Chaldoupi, K. Vernooij, U. Schotten, M. Baumert, H.A. Gietema, C. Mihil, L. Koltowski, F.M.E. Franssen, S.O. Simons, D. Linz, Repurposing catheter ablation work-up to detect expiratory airflow limitation in patients with atrial fibrillation, *Int J Cardiol Heart Vasc*. 17 (49) (2023) 101305.
- [42] M. Ebert, R. Karrengarn, C. Jahnke, S. Kircher, S. Oebel, M. Döring, G. Hindricks, I. Paetsch, S. Richter, Major incidental findings on routine cardiovascular magnetic resonance imaging prior to first-time catheter ablation of atrial fibrillation, *Int J Cardiol Heart Vasc*. 29 (38) (2021) 100939.

- [43] C.A.J. van der Heijden, S. Verheule, J.R. Olsthoorn, C. Muhl, L. Poulina, S.M.J. van Kuijk, S. Heuts, J.G. Maessen, E. Bidar, B. Maesen, Postoperative atrial fibrillation and atrial epicardial fat: Is there a link? *Int J Cardiol Heart Vasc.* 21 (39) (2022) 100976.
- [44] Y. Shen, G. Ma, M. Sun, M. Li, M. Chen, Low plasma renin activity is associated with "Apparently" idiopathic atrial fibrillation, *Int J Cardiol Heart Vasc.* 24 (49) (2023) 101286.
- [45] M.H. Jensen, F. Dalgaard, R. Rude Laub, V. Gottlieb, O.W. Nielsen, J. Hansen, M. L. Hansen, P. Jennum, M. Lamberts, DAN-APNO investigators, Prevalence of sleep apnea in unselected patients with atrial fibrillation by a home-monitoring device: The DAN-APNO study, *Int J Cardiol Heart Vasc.* 18 (47) (2023) 101219.
- [46] C.H. Lin, Y.B. Liu, L.Y. Lin, H.C. Huang, L.T. Ho, Y.W. Wu, L.P. Lai, W.J. Chen, Y. L. Ho, C.C. Yu, Sex-based differences in obstructive sleep apnea and atrial fibrillation: Implication of atrial fibrillation burden, *Int J Cardiol Heart Vasc.* 6 (50) (2023) 101320.
- [47] S.A. Wijchers, T. Szili-Torok, F. Zijlstra, M.J. Lenzen, S.C. Yap, Impact of undiagnosed obstructive sleep apnea on atrial fibrillation recurrence following catheter ablation (OSA-AF study), *Int J Cardiol Heart Vasc.* 24 (40) (2022) 101014.
- [48] M.J.M. Hereijgers, K. Betz, S.O. Simons, D. Linz, Undiagnosed sleep apnea in patients with atrial fibrillation: An underutilized opportunity for antiarrhythmic management, *Int J Cardiol Heart Vasc.* 16 (40) (2022 May) 101050.
- [49] J.M. Hendriks, G. Lee, D. Linz, Sleeping Beauty unravelled - Detection of sleep apnoea in patients with atrial fibrillation, *Int J Cardiol Heart Vasc.* 3 (47) (2023) 101237.
- [50] R.M.J. van der Velden, A.N.L. Hermans, N.A.H.A. Pluymaekers, M. Gawalko, A. Elliott, J.M. Hendriks, F.M.E. Franssen, A.M. Slats, V.P.M. van Empel, I.C. Van Gelder, D.H.J. Thijssen, T.M.H. Eijsvogels, C. Leue, H.J.G.M. Crijns, D. Linz, S. O. Simons, Dyspnea in patients with atrial fibrillation: Mechanisms, assessment and an interdisciplinary and integrated care approach, *Int J Cardiol Heart Vasc.* 19 (42) (2022) 101086.
- [51] R.M.J. van der Velden, M.J.M. Hereijgers, N. Arman, N. van Middendorp, F.M. E. Franssen, M. Gawalko, D.V.M. Verhaert, Z. Habibi, K. Vernooij, L. Koltowski, J. M. Hendriks, H. Heidebuchel, L. Desteghe, S.O. Simons, D. Linz, Implementation of a screening and management pathway for chronic obstructive pulmonary disease in patients with atrial fibrillation, *Europace* 25 (7) (2023) eua193.
- [52] T. Koike, K. Ejima, S. Kataoka, K. Yazaki, S. Higuchi, M. Kanai, D. Yagishita, M. Shoda, N. Hagiwara, Prognostic significance of diastolic dysfunction in patients with systolic dysfunction undergoing atrial fibrillation ablation, *Int J Cardiol Heart Vasc.* 4 (41) (2022) 101079.
- [53] R.S. Mishima, J.P. Ariyaratnam, B.M. Pitman, V. Malik, M. Emami, O. McNamee, M.B. Stokes, D.H. Lau, P. Sanders, A.D. Elliott, Cardiorespiratory fitness, obesity and left atrial function in patients with atrial fibrillation, *Int J Cardiol Heart Vasc.* 6 (42) (2022) 101083.
- [54] Remote dielectric sensing predicts elevated left atrial pressure in patients with atrial fibrillation XXX.
- [55] M. Wahlström, J. Medin, M.R. Karlsson, Gender differences in health-related quality of life, blood pressure and heart rate among patients with paroxysmal atrial fibrillation after performing MediYoga, *Int J Cardiol Heart Vasc.* 22 (49) (2023) 101274.
- [56] A. Berner, C. Tobler, M. Reinmann-Assouline, S. Degrauwe, M. Coen, Arrhythmia conversion to sinus rhythm during a hypnosis: Is hypnosis a normal bystander or a guilty accomplice? *Int J Cardiol Heart Vasc.* 28 (38) (2021) 100930.
- [57] K. Senoo, A. Yukawa, T. Ohkura, H. Iwakoshi, T. Nishimura, S. Shimoo, K. Inoue, T. Sakatani, K. Kakita, T. Hattori, H. Kitajima, K. Nakai, S. Nishiuchi, M. Nakata, S. Teramukai, H. Shiraishi, S. Matoba, The impact of home electrocardiograph measurement rate on the detection of atrial fibrillation recurrence after ablation: A prospective multicenter observational study, *Int J Cardiol Heart Vasc.* 19 (44) (2023) 101177.
- [58] O. Baqal, E.A. Habib, E.A. Hasabo, F. Galasso, T. Barry, R. Arsanjani, J.P. Sweeney, P. Noseworthy, F.F. David, Artificial intelligence-enabled electrocardiogram (AI-ECG) does not predict atrial fibrillation following patent foramen ovale closure, *Int J Cardiol Heart Vasc.* 15 (51) (2024) 101361.
- [59] T. Nishimura, K. Senoo, M. Makino, J. Munakata, N. Tomura, S. Shimoo, H. Iwakoshi, H. Shiraishi, S. Matoba, Prediction model for the new onset of atrial fibrillation combining features of 24-hour Holter electrocardiogram with 12-lead electrocardiogram, *Int J Cardiol Heart Vasc.* 18 (47) (2023) 101245.
- [60] M. Marques Antunes, P. Silva Cunha, B. Lacerda Teixeira, G. Portugal, B. Valente, A. Lousinha, A.S. Delgado, S. Alves, C. Guerra, R. Cruz Ferreira, O.M. Martins, Very-early detection of atrial fibrillation after ablation evaluated by a wearable ECG-patch predicts late blanking period recurrence: Preliminary data from a prospective registry, *Int J Cardiol Heart Vasc.* 21 (51) (2024) 101369.
- [61] P. Silva Cunha, G. Portugal, S. Laranjo, M. Alves, A. Luísa Papoila, B. Valente, A. Sofia Delgado, A. Lousinha, M. Paulo, M. Brás, C. Guerra, R. Cruz Ferreira, O. M. Martins, The atrial fibrillation burden during the blanking period is predictive of time to recurrence after catheter ablation, *Int J Cardiol Heart Vasc.* 14 (43) (2022) 101138.
- [62] H. Ishiguchi, Y. Yoshiga, A. Shimizu, M. Fukuda, M. Hisaoka, S. Hashimoto, T. Omuro, T. Okamura, S. Kobayashi, M. Yano, Association between the atrial tachyarrhythmia recurrence period and long-term major adverse clinical events following catheter ablation for atrial fibrillation, *Int J Cardiol Heart Vasc.* 29 (47) (2023) 101228.
- [63] J. Heijman, A.P. Muna, T. Veleva, C.E. Molina, H. Sutanto, M. Tekook, Q. Wang, I. H. Abu-Taha, M. Gorka, S. Künzel, A. El-Armouche, H. Reichenspurner, M. Kamler, V. Nikolaev, U. Ravens, N. Li, S. Nattel, X.H.T. Wehrens, D. Dobrev, Atrial myocyte NLRP3/CaMKII nexus forms a substrate for postoperative atrial fibrillation, *Circ Res.* 127 (8) (2020) 1036–1055.
- [64] L. Scott Jr, A.C. Fender, A. Saljic, L. Li, X. Chen, X. Wang, D. Linz, J. Lang, M. Hohl, D. Twomey, T.T. Pham, R. Diaz-Lankenau, M.G. Chelu, M. Kamler, M.L. Entman, G. E. Taffet, P. Sanders, D. Dobrev, N. Li, NLRP3 inflammasome is a key driver of obesity-induced atrial arrhythmias, *Cardiovasc Res.* 117 (7) (2021) 1746–1759.
- [65] D. Dobrev, J. Heijman, R. Hiram, N. Li, S. Nattel, Inflammatory signalling in atrial cardiomyocytes: a novel unifying principle in atrial fibrillation pathophysiology, *Nat Rev Cardiol.* 20 (3) (2023) 145–167.
- [66] K. Teppo, J. Jaakkola, F. Biancari, O. Halminen, M. Linna, J. Haukka, J. Putaala, P. Mustonen, J. Kinnunen, A. Luojus, S. Itäinen-Strömberg, J. Hartikainen, A. L. Aro, K.E. Juhani Airaksinen, M. Lehto, Socioeconomic disparities in use of rhythm control therapies in patients with incident atrial fibrillation: A Finnish nationwide cohort study, *Int J Cardiol Heart Vasc.* 13 (41) (2022) 101070.
- [67] G. McMichael, L. Cusack, D. Andina Munawar, M. Boyd, L. Palmer, H.S. Lim, R. Mahajan, Atrial Fibrillation health literacy questionnaire (AFHLQ): The development of an AF-specific health literacy questionnaire, *Int J Cardiol Heart Vasc.* 21 (50) (2023) 101322.

Dominik Linz\*

*Department of Cardiology, Maastricht University Medical Centre and Cardiovascular Research Institute Maastricht, Maastricht, the Netherlands*  
*Department of Biomedical Sciences, Faculty of Health and Medical Sciences, University of Copenhagen, Copenhagen, Denmark*  
*Centre for Heart Rhythm Disorders, University of Adelaide and Royal Adelaide Hospital, Adelaide, Australia*

Dobromir Dobrev

*Institute of Pharmacology, West German Heart and Vascular Center, University Duisburg-Essen, Essen, Germany*  
*Department of Medicine and Research Center, Montreal Heart Institute and Université de Montréal, Montréal, Canada*  
*Department of Integrative Physiology, Baylor College of Medicine, Houston, TX, USA*

\* Corresponding author at: Maastricht UMC+, Maastricht Heart+Vascular Center Universiteitssingel 50, 6229 ER Maastricht, the Netherlands.

E-mail address: [dominik.linz@mumc.nl](mailto:dominik.linz@mumc.nl) (D. Linz).