Heutige Embolieprophylaxe bei Vorhofflimmern

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Literatur:

- 1. Virani SS et al. Heart Disease and Stroke Statistics-2021 Update: A Report From the American Heart Association. Circulation 2021; 143(8): e254–e743
- 2. Hindricks G et al. 2020 ESC Guidelines for the diagnosis and management of atrial fibrillation developed in collaboration with the European Association for Cardio-Thoracic Surgery (EACTS). *Eur Heart J* 2021; 42(5): 373–498
- 3. Pisters R et al. Stroke and Thromboembolism in Atrial Fibrillation Systematic Review of Stroke Risk Factors and Risk Stratification Schema. *Circ J* 2012; 76(10): 2289–2304
- 4. Alkhouli M & Friedman PA. Ischemic Stroke Risk in Patients. J Am Coll Cardiol 2019; 74(24)
- 5. Lip GYH et al. Refining clinical risk stratification for predicting stroke and thromboembolism in atrial fibrillation using a novel risk factor-based approach: The Euro Heart Survey on atrial fibrillation. *Chest* 2010; 137(2): 263–272
- 6. Hart RG et al. Meta-analysis: antithrombotic therapy to prevent stroke in patients who have nonvalvular atrial fibrillation. Ann Intern Med 2007; 146(12): 857–867
- 7. Benz AP et al. Biomarker-Based Risk Prediction with the ABC-AF Scores in Patients with Atrial Fibrillation Not Receiving Oral Anticoagulation. *Circulation* 2021: 1863–1873
- 8. Chao TF et al. Incident Risk Factors and Major Bleeding in Patients with Atrial Fibrillation Treated with Oral Anticoagulants: A Comparison of Baseline, Follow-up and Delta HAS-BLED Scores with an Approach Focused on Modifiable Bleeding Risk Factors. *Thromb Haemost* 2018; 118(4): 768–777
- 9. Esteve-Pastor MA et al. Long-term bleeding risk prediction in 'real world' patients with atrial fibrillation: Comparison of the HAS-BLED and abc-bleeding risk scores: The murcia atrial fibrillation project. *Thromb Haemost* 2017; 117(10): 1848–1858
- Weijs B et al. Idiopathic atrial fibrillation patients rapidly outgrow their low thromboembolic risk: a 10-year follow-up study. *Netherlands Hear J* 2019; 27(10): 487–497
- 11. Steffel J et al. 2021 European Heart Rhythm Association Practical Guide on the Use of Non-Vitamin K Antagonist Oral Anticoagulants in Patients with Atrial Fibrillation. *Europace* 2021; 23(10): 1612–1676
- 12. Murthy SB et al. Restarting Anticoagulant Therapy after Intra-cranial Hemorrhage: A Systematic Review and Meta-Analysis. *Stroke* 2017; 48(6): 1594-1600
- Karthikeyan G et al. The INVICTUS rheumatic heart disease research program: Rationale, design and baseline characteristics of a randomized trial of rivaroxaban compared to vitamin K antagonists in rheumatic valvular disease and atrial fibrillation. *Am Heart J* 2020; 225: 69–77
- 14. Wan Y et al. Anticoagulation control and prediction of adverse events in patients with atrial fibrillation: A systematic review. *Circ Cardiovasc Qual Outcomes* 2008; 1(2): 84–91
- 15. Själander S et al. Dabigatran, rivaroxaban and apixaban vs. high TTR warfarin in atrial fibrillation. *Thromb Res* 2018; 167(2017): 113–118
- 16. Manesh R et al. Rivaroxaban versus Warfarin in Nonvalvular Atrial Fibrillation. *N Engl J Med* 2011; 365: 883–891
- 17. Connolly SJ et al. Dabigatran versus Warfarin in Patients with Atrial Fibrillation. *N Engl*

J Med 2009; 361: 1139–1151

- 18. Christopher B et al. Apixaban versus Warfarin in Patients with Atrial Fibrillation. *N Engl J Med* 2011; 365: 981–992
- 19. Giugliano RP et al. Edoxaban versus Warfarin in Patients with Atrial Fibrillation. *N Engl J Med* 2013; 369(22): 2093–2104
- 20. Gibson CM et al. Prevention of Bleeding in Patients with Atrial Fibrillation Undergoing PCI. *N Engl J Med* 2016; 375(25): 2423–2434
- 21. Lopes RD et al. Stent thrombosis in patients with atrial fibrillation undergoing coronary stenting in the augustus trial. *Circulation* 2020: 781–783
- 22. Vranckx P et al. Edoxaban-based versus vitamin K antagonist-based antithrombotic regimen after successful coronary stenting in patients with atrial fibrillation (ENTRUST-AF PCI): a randomised, open-label, phase 3b trial. *Lancet* 2019; 394(10206): 1335–1343
- 23. Cannon CP et al. Dual Antithrombotic Therapy with Dabigatran after PCI in Atrial Fibrillation. *N Engl J Med* 2017; 377(16): 1513–1524
- 24. Calkins H et al. 2017 HRS/EHRA/ECAS/APHRS/SOLAECE expert consensus statement on catheter and surgical ablation of atrial fibrillation. *Europace* 2018; 20(1): e1-e160
- 25. Biase L Di et al. Periprocedural stroke and bleeding complications in patients undergoing catheter ablation of atrial fibrillation with different anticoagulation nagement results from the role of coumadin in preventing thromboembo-lism in atrial fibrillation (AF) patients u. *Circulation* 2014; 129(25): 2638–2644
- 26. Kirchhof P et al. Apixaban in patients at risk of stroke under-going atrial fibrillation ablation. *Eur Heart J* 2018; 39(32): 2942–2955
- 27. Hohnloser SH et al. Uninterrupted edoxaban vs. Vitamin K antagonists for ablation of atrial fibrillation: The ELIMINATE-AF trial. *Eur Heart J* 2019; 40(36): 3013–3021
- 28. Cappato R et al. Uninterrupted rivaroxaban vs. uninterrupted vitamin K antagonists for catheter ablation in non-valvular atrial fibrillation. *Eur Heart J* 2015; 36(28): 1805–1811
- 29. Calkins H et al. Uninterrupted Dabigatran versus Warfarin for Ablation in Atrial Fibrillation. *N Engl J Med* 2017; 376(17): 1627–1636

Interventionelle Schlaganfallprophylaxe bei Vorhofflimmern

A. Keelani, H. L. Phan, C.-H. Heeger, M. Antz, R. R. Tilz

Literatur:

1. Wolf PA et al. Atrial fibrillation as an independent risk factor for stroke: the Framingham Study. *Stroke* 1991; 22: 983–8

2. Guichard JB & Nattel S. Atrial Cardiomyopathy: A Useful Notion in Cardiac Disease Management or a Passing Fad? *J Am Coll Cardiol* 2017; 70: 756–765

3. Glikson M et al. EHRA/EAPCI expert consensus statement on catheter-based left atrial appendage occlusion – an update. *EP Europace* 2019

4. Reddy VY et al. Safety of percutaneous left atrial appendage closure: results from the Watchman Left Atrial Appendage System for Embolic Protection in Patients with AF (PROTECT AF) clinical trial and the Continued Access Registry. *Circulation* 2011; 123: 417–24

5. Reddy VY et al. Percutaneous left atrial appendage closure vs warfarin for atrial fibrillation: a randomized clinical trial. *Jama* 2014; 312: 1988–98

6. Holmes DR et al. Prospective randomized evaluation of the Watchman Left Atrial Appendage Closure device in patients with atrial fibrillation versus long-term warfarin therapy: the PREVAIL trial. *J Am Coll Cardiol* 2014; 64: 1–12

7. Reddy VY et al. 5-Year Outcomes After Left Atrial Appendage Closure: From the PREVAIL and PROTECT AF Trials. *J Am Coll Cardiol* 2017; 70: 2964–2975

8. Grygier M O-WA et al. The Watchman FLX – a new device for left atrial appendage occlusion – design, potential benefits and first clinical experience. *Postepy Kardiol Interwencyjnej* 2017: 62–66

9. Gagan D et al. Watchman FLX: Early "Real World" Experience in Search for the Perfect Closure. *JACC: Cardiovascular Interventions* 2020; 13: 2742–2744

10. Landmesser U et al. Left atrial appendage occlusion with the AMPLATZER Amulet device: one-year follow-up from the prospective global Amulet obser-vational registry. *EuroIntervention* 2018; 14: e590–e597

11. Lakkireddy D et al. Amplatzer Amulet Left Atrial Appendage Occluder Versus Watchman Device for Stroke Prophylaxis (Amulet IDE): A Randomized, Controlled Trial. *Circulation* 2021; 144: 1543–1552

12. Ali M et al. Systematic review on left atrial appendage closure with the LAmbre device in patients with non-valvular atrial fibrillation. *BMC Cardiovasc Disord* 2020; 20: 78

13. Lakkireddy D et al. Short and long-term outcomes of percutaneous left atrial appendage suture ligation: Results from a US multicenter evaluation. *Heart Rhythm* 2016; 13: 1030–1036

14. Vuddanda VLK et al. Incidence and causes of in-hospital outcomes and 30-day readmissions after percutaneous left atrial appendage closure: A US nationwide retrospective cohort study using claims data. *Heart Rhythm* 2020; 17: 374–382

15. Afzal MR et al. Impact of left atrial appendage exclusion using an epicardial ligation system (LARIAT) on atrial fibrillation burden in patients with cardiac implantable electronic devices. *Heart Rhythm* 2015; 12: 52–9

16. Kanderian AS GA et al. Success of surgical left atrial appendage closure: assessment by transesophageal echocardiography. *J Am Coll Cardiol* 2008; 52: 924–9

17. Hindricks G et al. 2020 ESC Guidelines for the diagnosis and management of atrial fibrillation developed in collaboration with the European Association for Cardio-Thoracic Surgery (EACTS): The Task Force for the diagnosis and management of atrial fibrillation of the European Society of Cardiology (ESC) Developed with the special contribution of the European Heart Rhythm Association (EHRA) of the ESC. *Eur Heart J* 2020; 42: 373–498

18. Coppens M et al. Efficacy and safety of apixaban compared with aspirin in patients who previously tried but failed treatment with vitamin K antagonists: results from the AVERROES trial. *Eur Heart J* 2014; 35: 1856–63

19. Osmancik P HD et al. PRAGUE-17 Trial Investigators. Left Atrial Appendage Closure Versus Direct Oral Anticoagulants in High-Risk Patients With Atrial Fibrillation.. *J Am Coll Cardiol* 2020 Jun:30; 75(25): 3122–3135

20. Alkhouli M et al. Incidence and Clinical Impact of Device-Related Thrombus Following Percutaneous Left Atrial Appendage Occlusion: A Meta-Analysis. *JACC Clin Electrophysiol* 2018; 4: 1629–1637

21. Tzikas A et al. Left atrial appendage occlusion for stroke prevention in atrial fibrillation: multicentre experience with the AMPLATZER Cardiac Plug. *EuroIntervention* 2016; 11: 1170–9.

22. Pillarisetti J et al. Endocardial (Watchman) vs epicardial (Lariat) left atrial appendage exclusion devices: Understanding the differences in the location and type of leaks and their clinical implications. *Heart Rhythm* 2015; 12: 1501–7

23. Bokhari SS et al. Percutaneous mechanical thrombectomy of left atrial appendage thrombus with bilateral neuro-embolic protection followed by closure of left atrial appendage. *EuroIntervention* 2012; 8: 408–9

24. Meincke F et al. Percutaneous left atrial appendage closure in patients with left atrial appendage thrombus. *EuroIntervention* 2015; 10: 1208

25. Bellmann B et al. Left atrial appendage closure in a patient with left atrial appendage thrombus using a novel fish ball technique. *Int J Cardiol* 2017; 234: 146–149

26. Jalal Z et al. Extending percutaneous left atrial appendage closure indications using the AMPLATZER[™] Cardiac Plug device in patients with persistent left atrial appendage thrombus: The thrombus trapping technique. *Arch Cardiovasc Dis* 2016; 109: 659–666

27. Del Furia F et al. First-in-man Percutaneous LAA Closure With an Amplatzer Amulet and TriGuard Embolic Protection Device in a Patient With LAA Thrombus. *J Invasive Cardiol* 2017; 29: E51–e52

28. Kapadia SR et al. Protection Against Cerebral Embolism During Transcatheter Aortic Valve Replacement. *Journal of the American College of Cardiology*. 2017; 69: 367–377

29. Heeger CH et al. Cerebral Protection During Catheter Ablation of Ventricular Tachycardia in Patients With Ischemic Heart Disease. *J Am Heart Assoc* 2018; 7

30. Sharma SP et al. Feasibility of Left Atrial Appendage Occlusion in Left Atrial Appendage Thrombus: A Systematic Review. *JACC Clin Electrophysiol* 2020; 6: 414–424

Katheterablation von Vorhofflimmern 2022: Welche Technologien gibt es?

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<u>Literatur</u>

1. Schnabel RB et al. Atrial fibrillation: its prevalence and risk factor profile in the German general population. Dtsch Arztebl Int 2012; 109(16): 293–9

- 2. Hindricks G et al. 2020 ESC Guidelines for the diagnosis and management of atrial fibrillation developed in collaboration with the European Association for Cardio-Thoracic Surgery (EACTS). Eur Heart J 2021; 42(5) 373–498
- 3. Richard Tilz R et al. Very high-power short-duration temperature-controlled ablation versus conventional power-controlled ablation for pulmonary vein isolation: The fast and furious AF study. Int J Cardiol Heart Vasc 2021; 35: 100847
- Pak, H.N et al. Cryoballoon Versus High-Power, Short-Duration Radiofrequency Ablation for Pulmonary Vein Isolation in Patients With Paroxysmal Atrial Fibrillation: A Single-Center, Prospective, Randomized Study. Circ Arrhythm Electrophysiol 2021; 14(9): e010040
- 5. Winkle, R.A. HPSD ablation for AF high-power short-duration RF ablation for atrial fibrillation: A review. J Cardiovasc Electrophysiol 2021. 32(10): 2813–2823
- 6. Xu, M et al. Meta-analysis of high power short duration in atrial fibrillation ablation a superior efficient ablation strategy. Acta Cardiol 2021: 1–19
- 7. Piringer, R et al. Incidence of ablation-induced esophageal injury associated with high-power short duration temperature-controlled pulmonary vein isolation using a specialized open-irrigated ablation catheter: A retrospective single-center study. J Cardiovasc Electrophysiol 2021. 32(3): 695–703
- 8. Kuck, K.H et al. Cryoballoon or Radiofrequency Ablation for Paroxysmal Atrial Fibrillation. N Engl J Med 2016. 374(23): 2235–45
- 9. Heeger, C.H et al. Efficacy and safety of cryoballoon ablation in the elderly: A multicenter study. Int J Cardiol 2019. 278: 108–113
- 10. Heeger, C.H et al. Second-generation cryoballoon-based pulmonary vein isolation: Lessons from a five-year follow-up. Int J Cardiol 2020. 312: 73–80
- Inaba, O et al. Radiofrequency or cryoballoon ablation for index pulmonary vein isolation: What is the impact on long-term clinical outcomes after repeat ablation? J Cardiovasc Electrophysiol 2020. 31(5): 1068–1074
- 12. Wazni, O.M et al. Cryoballoon Ablation as Initial Therapy for Atrial Fibrillation. N Engl J Med 2021. 384(4): 316–324
- 13. Andrade, J.G et al. Cryoablation or Drug Therapy for Initial Treatment of Atrial Fibrillation. N Engl J Med 2021. 384(4): 305–315
- 14. Heeger, C.H et al. Phrenic Nerve Injury During Cryoballoon-Based Pulmonary Vein Isolation: Results of the Worldwide YETI Registry. Circ Arrhythm Electrophysiol 2021: CIRCEP121010516
- 15. Casado-Arroyo, R et al. Phrenic nerve paralysis during cryoballoon ablation for atrial fibrillation: a comparison between the first- and second-generation balloon. Heart Rhythm 2013. 10(9): 1318–24
- 16. Furnkranz, A et al. Incidence and characteristics of phrenic nerve palsy following pulmonary vein isolation with the second-generation as compared with the first-generation cryoballoon in 360 consecutive patients. Europace 2015. 17(4): 574–8
- 17. Kuhne, M et al. Phrenic nerve palsy during ablation of atrial fibrillation using a 28-mm cryoballoon catheter: predictors and prevention. J Interv Card Electrophysiol 2013.
 36(1): 47–54; discussion 54
- Tohoku, S et al. Phrenic nerve injury in atrial fibrillation ablation using balloon catheters: Incidence, characteristics, and clinical recovery course. J Cardiovasc Electrophysiol 2020. 31(8): 1932–1941

- 19. Chun, J.K.R et al. Cryoballoon Versus Laserballoon: Insights From the First Prospective Randomized Balloon Trial in Catheter Ablation of Atrial Fibrillation. Circ Arrhythm Electrophysiol 2021. 14(2): e009294
- 20. Heeger, C.H et al. Rapid pulmonary vein isolation utilizing the third-generation laserballoon The PhoeniX registry. Int J Cardiol Heart Vasc 2020. 29: 100576
- 21. Reynolds, M.R Q. Zheng, and G. Doros, Laser balloon ablation for AF: A systematic review and meta-analysis. J Cardiovasc Electrophysiol 2018. 29(10): 1363–1370
- 22. Heeger, C.H et al. Second-Generation Visually Guided Laser Balloon Ablation System for Pulmonary Vein Isolation: Learning Curve, Safety and Efficacy- The MERLIN Registry. Circ J 2019. 83(12): 2443–2451
- 23. Reddy, V.Y et al. Pulsed Field Ablation in Patients With Persistent Atrial Fibrillation. J Am Coll Cardiol 2020. 76(9): 1068–1080
- Reddy, V.Y et al. Pulsed Field Ablation of Paroxysmal Atrial Fibrillation: 1-Year
 Outcomes of IMPULSE, PEFCAT, and PEFCAT II. JACC Clin Electrophysiol 2021. 7(5):
 614–627
- 25. Reddy, V.Y et al. Pulsed Field Ablation for Pulmonary Vein Isolation in Atrial Fibrillation. J Am Coll Cardiol 2019. 74(3): 315–326
- 26. Kaminska, I et al. Electroporation-induced changes in normal immature rat myoblasts (H9C2). Gen Physiol Biophys 2012. 31(1): 19–25
- 27. Ramirez, F.D et al. Emerging Technologies for Pulmonary Vein Isolation. Circ Res 2020. 127(1): 170–183
- 28. Kodali, S. and Santangeli, How, When, and Why: High-Density Mapping of Atrial Fibrillation. Card Electrophysiol Clin 2020. 12(2): 155–165
- 29. Balt, J.C et al. High-density versus low-density mapping in ablation of atypical atrial flutter. J Interv Card Electrophysiol 2021. 62(3): 587–599
- 30. Latcu, D.G. and N. Saoudi, High-resolution/Density Mapping in Patients with Atrial and Ventricular Arrhythmias Card Electrophysiol Clin, 2019. 11(3): 511–524
- 31. Seifert, M et al. Impact of mapping points in high-density mapping of the left atrium. J Interv Card Electrophysiol 2020. 58(3): 347–353

Embolieprophylaxe bei Vorhofflimmern und terminaler Niereninsuffizienz

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Literatur:

1. Marcello Tonelli PM et al. Risk of coronary events in people with chronic kidney disease compared with those with diabetes: a population-level cohort study,. The Lancet 2012; 380: 807–814

2. Kumar S BR & Banerjee D. Why do young people with chronic kidney disease die early?. World J Nephrol 2014; 3: 143–155

3. Hindricks G et al. 2020 ESC Guidelines for the diagnosis and management of atrial fibrillation developed in collaboration with the European Association for Cardio-Thoracic Surgery (EACTS): The Task Force for the diagnosis and management of atrial fibrillation of the European Society of Cardiology (ESC) Developed with the special contribution of the European Heart Rhythm Association (EHRA) of the ESC. European Heart Journal 2020; 42: 373–498

4. Reinecke H et al. Dilemmas in the Management of Atrial Fibrillation in Chronic Kidney Disease. Journal of the American Society of Nephrology 2009; 20: 705–711

5. Shankar Kumar EL et al. Anticoagulation in Concomitant Chronic Kidney Disease and Atrial Fibrillation: JACC Review Topic of the Week. Journal of the American College of Cardio-logy 2019; 74: 2204–2215

6. Connolly SJ. Preventing stroke in patients with atrial fibrillation: current treatments and new concepts. Am Heart J 2003; 145: 418–23

7. Hart RG PL et al. Warfarin in atrial fibrillation patients with moderate chronic kidney disease. Clin J Am Soc Nephrol 2011; 6: 2599–2604

8. Steffel J et al. 2021 European Heart Rhythm Association Practical Guide on the Use of Non-Vitamin K Antagonist Oral Anticoagulants in Patients with Atrial Fibrillation. EP Europace 2021; 23: 1612–1676

9. January CT et al. 2019 AHA/ACC/HRS Focused Update of the 2014 AHA/ACC/HRS Guideline for the Management of Patients With Atrial Fibrillation: A Report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines and the Heart Rhythm Society. Journal of the American College of Cardiology 2019; 74: 104–132

10. Shen JI M-RM et al. Outcomes After Warfarin Initiation in a Cohort of Hemodialysis Patients With Newly Diagnosed Atrial Fibrillation. Am J Kidney Dis 2015; 66: 677–88

11. Bonde AN et al. Net Clinical Benefit of Antithrombotic Therapy in Patients With Atrial Fibrillation and Chronic Kidney Disease: A Nationwide Observational Cohort Study. Journal of the American College of Cardiology 2014; 64: 2471–2482

12. PJ Phelan POK et al. Warfarin use in hemodialysis patients: what is the risk? Clinical Nephrology 2011; 75: 204–211

13. Shah M et al. Warfarin Use and the Risk for Stroke and Bleeding in Patients With Atrial Fibrillation Undergoing Dialysis. Circulation 2014; 129: 1196–1203

14. Winkelmayer WC et al. Effectiveness and Safety of Warfarin Initiation in Older Hemodialysis Patients with Incident Atrial Fibrillation. Clinical Journal of the American Society of Nephrology 2011; 6: 2662–2668

15. Chen J-J et al. Anti-platelet or anti-coagulant agent for the prevention of ischemic stroke in patients with end-stage renal disease and atrial fibrillation 2014; A nation-wide database analyses. International Journal of Cardiology 2014; 177: 1008–1011

16. Chan KE et al. Warfarin Use Associates with Increased Risk for Stroke in Hemodialysis Patients with Atrial Fibrillation. Journal of the American Society of Nephrology 2009; 20: 2223– 2233

17. Olesen JB et al. Stroke and Bleeding in Atrial Fibrillation with Chronic Kidney Disease. New England Journal of Medicine 2012; 367: 625–635

18. Nochaiwong S et al. Efficacy and safety of warfarin in dialysis patients with atrial fibrillation: a systematic review and meta-analysis. Open Heart 2016; 3: e000441

19. Kunitoshi Iseki KK et al. Evidence for high risk of cerebral hemorrhage in chronic dialysis patients. Kidney International 1993; 44: 1086–1090

20. Yang F et al. Warfarin utilisation and anticoagulation control in patients with atrial fibrillation and chronic kidney disease. Heart 2017; 103: 818–826

21. Limdi NA et al. Kidney Function Influences Warfarin Responsiveness and Hemorrhagic Complications. Journal of the American Society of Nephrology 2009; 20: 912–921

22. Galloway PAG et al. Vitamin K Antagonists Predispose to Calciphylaxis in Patients with End-Stage Renal Disease. Nephron 2015; 129: 197–201

23. Wheeler DS et al. Anticoagulation-related nephropathy. Journal of Thrombosis and Haemostasis 2016; 14: 461–467

24. Malhotra K et al. Oral anticoagulation in patients with chronic kidney disease. A systematic review and meta-analysis 2019; 92: e2421–e2431

25. Siontis KC et al. Outcomes Associated with Apixaban Use in End-Stage Kidney Disease Patients with Atrial Fibrillation in the United States. Circulation 2018; 138

26. Chokesuwattanaskul R et al. Safety and efficacy of apixaban versus warfarin in patients with end-stage renal disease: Meta-analysis. Pacing and Clinical Electrophysiology 2018; 41: 627–634

27. Coleman CI et al. Rivaroxaban Versus Warfarin in Patients With Nonvalvular Atrial Fibrillation and Severe Kidney Disease or Undergoing Hemodialysis. The American Journal of Medicine 2019; 132: 1078–1083

28. Reddy VY et al. 5-Year Outcomes After Left Atrial Appendage Closure: From the PREVAIL and PROTECT AF Trials. J Am Coll Cardiol 2017; 70: 2964–2975

29. Osmancik P HD et al. PRAGUE-17 Trial Investigators. Left Atrial Appendage Closure Versus Direct Oral Anticoagulants in High-Risk Patients With Atrial Fibrillation. J Am Coll Cardiol 2020; 75(25): 3122–3135

30. Fastner C et al. Left atrial appendage closure in patients with a reduced left ventricular ejection fraction: results from the multicenter German LAARGE registry. Clin Res Cardiol 2020; 109: 1333–1341

31. Genovesi S et al. Outcomes on safety and efficacy of left atrial appendage occlusion in end stage renal disease patients undergoing dialysis. Journal of Nephrology 2021; 34: 63–73