

## Literatur herzmedizin 1/2024

### Kardiologische Rehabilitation bei Patienten bei Herzinsuffizienz

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#### Literatur:

1. Pauschinger M et al. Aufbau und Organisation von Herzinsuffizienz-Netzwerken (HF-NETs) und Herzinsuffizienz-Einheiten (Heart Failure Units [HFUs]) zur Optimierung der Behandlung der akuten und chronischen Herzinsuffizienz – Update 2021. Kardiologe 2022; 16: 142–15
2. Deutsche Herzstiftung. Deutscher Herzbericht 2021. 33. Auflage, DHS e.V., Frankfurt am Main, 2022
3. AHA/ACC/HFSA Guideline for the Management of Heart Failure. Circulation 2022; 145: e895–1032
4. ESC Guidelines for the diagnosis and treatment of acute and chronic heart failure. Eur Heart J 2021; 42: 3599–726
5. AWMF S3-Leitlinie zur kardiologischen Rehabilitation (LL-KardReha) im deutschsprachigen Raum Europas Deutschland, Österreich, Schweiz (D-A-CH). Gesamtversion. Version 1.1, AWMF-Registernummer: 133-001, 2020
6. NVL Nationale Versorgungsleitlinie Chronische Herzinsuffizienz. Langfassung. 3. Auflage, Version 3; AWMF Rg.-Nr. 006, 2019
7. Schwaab B et al. Kardiologische Rehabilitation bei Patienten mit Herzinsuffizienz. Kardiologie 2023; 17: 161–72
8. Bjarnason-Wehrens B et al. Exercise-based cardiac rehabilitation in patients with reduced left ventricular ejection fraction: The Cardiac Rehabilitation Outcome Study in Heart Failure (CROS-HF). Eur J Prev Cardiol 2020; 27: 929–52
9. Kamiya K et al. Multidisciplinary cardiac rehabilitation and longterm prognosis in patients with heart Failure. Circulation Heart Failure 2020; 13: e006798
10. Scalvini S et al. Impact of in-hospital cardiac rehabilitation on mortality and readmissions in heart failure. Eur J Prev Cardiol 2019; 26: 808–17
11. Bozkurt B et al. Cardiac rehabilitation for patients with heart failure. JACC Expert Panel. J Am Coll Cardiol 2021; 77: 1454–69
12. Schwaab B. Kardiologische Rehabilitation. Rehabilitation 2022; 61: 395–407
13. Mebazaa A et al. Safety, tolerability and efficacy of up-titration of guideline-directed medical therapies for acute heart failure (STRONG-HF). Lancet 2022; 400: 1938–952
14. Bjarnason-Wehrens B et al. Resistance Training in Patients With Coronary Artery Disease, Heart Failure, and Valvular Heart Disease. J Cardiopulm Rehab Prev 2022; 42: 304–15
15. Manolis T et al. Neuropsychiatric disorders in patients with heart failure: not to be ignored. Heart Fail Rev 2023; 28: 821–58
16. Albus C et al. Additional effects of psychological interventions on subjective and objective outcomes compared with exercise-based cardiac rehabilitation alone in patients with cardiovascular disease. Eur J Prev Cardiol 2019; 26: 1035–49
17. Kitzman D et al. Physical rehabilitation for older patients hospitalized for heart failure. N Engl J Med 2021; 385: 203–16

18. Wienbergen H et al. Ärztliche Betreuung von ambulanten Herzgruppen. Positionspapier der Deutschen Gesellschaft für Kardiologie-Herz- und Kreislaufforschung (DGK) in Kooperation mit der Deutschen Gesellschaft für Prävention und Rehabilitation von Herz-Kreislauferkrankungen (DGPR). *Kardiologe* 2021; 15: 11–18
  19. Bundesarbeitsgemeinschaft für Rehabilitation, BAR. Rehabilitationssport und Funktionstraining Rahmenvereinbarung. BAR e.V., Frankfurt am Main, 2022
  20. Güder G et al. Establishing a cardiac training group for patients with heart failure: the “HIP-in-Würzburg” study. *Clin Res Cardiol* 2022; 111: 406–15
  21. Taylor R et al. Cardiac rehabilitation for heart failure: “Cinderella” or evidence-based pillar of care? *Eur Heart J* 2023; 44: 1511–18
- 

## **Herzinsuffizienz und Niere: Was muss der Kardiologe über die Niere und ihre Funktion wissen?**

M. Hausberg

### **Literatur:**

1. Brenner B et al. Physiologie. 9., vollständig überarbeitete Auflage. Stuttgart New York: Georg Thieme Verlag; 2019
2. Bergón E et al. Classification of renal proteinuria: a simple algorithm. *Clin Chem Lab Med* 2002; 40: 1143–50
3. Sandokji I, Greenberg JH. Plasma and Urine Biomarkers of CKD: A Review of Findings in the CKiD Study. *Semin Nephrol* 2021; 41: 416–26
4. Ix JH, Shlipak MG. The Promise of Tubule Biomarkers in Kidney Disease: A Review. *Am J Kidney Dis Off J Natl Kidney Found* 2021; 78: 719–27
5. Eriksen BO et al. Comparability of Plasma Iohexol Clearance Across Population-Based Cohorts. *Am J Kidney Dis Off J Natl Kidney Found* 2020; 76: 54–62
6. Selistre L et al. Average creatinine-urea clearance: revival of an old analytical technique? *Clin Kidney J* 2023; 16: 1298–306
7. Levey AS, Stevens LA. Estimating GFR using the CKD Epidemiology Collaboration (CKD-EPI) creatinine equation: more accurate GFR estimates, lower CKD prevalence estimates, and better risk predictions. *Am J Kidney Dis Off J Natl Kidney Found* 2010; 55: 622–27
8. Onopiuk A, Tokarzewicz A, Gorodkiewicz E. Cystatin C: a kidney function biomarker. *Adv Clin Chem* 2015; 68: 57–69
9. KDIGO Group. Kidney Disease: Improving Global Outcomes (KDIGO) CKD Work Group. KDIGO 2012 clinical practice guideline for the evaluation and management of chronic kidney disease. *Kidney Int Suppl* 2013; 3: 1–150
10. Damman K, Testani JM. The kidney in heart failure: an update. *Eur Heart J* 2015; 36: 1437–44

11. McAlister FA et al; Meta-analysis Global Group in Chronic Heart Failure (MAGGIC) Investigators. Renal dysfunction in patients with heart failure with preserved versus reduced ejection fraction: impact of the new Chronic Kidney Disease-Epidemiology Collaboration Group formula. *Circ Heart Fail* 2012; 5: 309–14
12. Esler M, Kaye D. Sympathetic nervous system activation in essential hypertension, cardiac failure and psychosomatic heart disease. *J Cardiovasc Pharmacol* 2000; 35: S1–7
13. Hausberg M. Sympathetic Nerve Activity in End-Stage Renal Disease. *Circulation* 2002; 106: 1974–79
14. Vishram-Nielsen JK, Gustafsson F. Vasopressin and Vasopressin Antagonists in Heart Failure. *Handb Exp Pharmacol* 2017; 243: 307–28
15. Kuwahara K. The natriuretic peptide system in heart failure: Diagnostic and therapeutic implications. *Pharmacol Ther* 2021; 227: 107863
16. Tuegel C, Bansal N. Heart failure in patients with kidney disease. *Heart Br Card Soc* 2017; 103: 1848–53
17. Ronco C, Haapio M, House AA, Anavekar N, Bellomo R. Cardiorenal syndrome. *J Am Coll Cardiol* 2008; 52: 1527–39
18. Subramaniam RM et al. Effectiveness of Prevention Strategies for Contrast-Induced Nephropathy: A Systematic Review and Meta-analysis. *Ann Intern Med* 2016; 164: 406–16
19. Reinecke H et al. A randomized controlled trial comparing hydration therapy to additional hemodialysis or N-acetylcysteine for the prevention of contrast medium-induced nephropathy. *Clin Res Cardiol* 2007; 96: 130–9
20. McDonagh TA et al; ESC Scientific Document Group. 2023 Focused Update of the 2021 ESC Guidelines for the diagnosis and treatment of acute and chronic heart failure. *Eur Heart J* 2023; 44: 3627–39
21. Xie X et al. Renin-Angiotensin System Inhibitors and Kidney and Cardiovascular Outcomes in Patients With CKD: A Bayesian Network Meta-analysis of Randomized Clinical Trials. *Am J Kidney Dis Off J Natl Kidney Found* 2016; 67: 728–41
22. De Vecchis R et al. ACE-inhibitor therapy at relatively high doses and risk of renal worsening in chronic heart failure. *Arq Bras Cardiol* 2011; 97: 507–16
23. Damman K et al. Renal Effects and Associated Outcomes During Angiotensin-Neprilysin Inhibition in Heart Failure. *JACC Heart Fail* 2018; 6: 489–98
24. Mebazaa A et al. Safety, tolerability and efficacy of up-titration of guideline-directed medical therapies for acute heart failure (STRONG-HF): a multinational, open-label, randomised, trial. *Lancet Lond Engl* 2022; 400: 1938–52
25. Kidney Disease: Improving Global Outcomes (KDIGO) Blood Pressure Work Group. KDIGO 2021 Clinical Practice Guideline for the Management of Blood Pressure in Chronic Kidney Disease. *Kidney Int* 2021; 99: S1–S87
26. Downie ML et al. Inherited Tubulopathies of the Kidney: Insights from Genetics. *Clin J Am Soc Nephrol* 2021; 16: 620–30

27. DIMDI. Fachinformation Spironolacton:  
<https://portal.dimdi.de/amispb/doc/2019/04/30/2195617/O9dc874887302485ba16144378ba1d7ab.pdf>. Letzer Zugriff: 26.12.2023
28. van der Aart-van der Beek AB, de Boer RA, Heerspink HJL. Kidney and heart failure outcomes associated with SGLT2 inhibitor use. *Nat Rev Nephrol* 2022; 18: 294–306
29. Neumiller JJ et al. Clinical Evidence and Proposed Mechanisms for Cardiovascular and Kidney Benefits from Sodium-Glucose Co-transporter-2 Inhibitors. *TouchREVIEWS Endocrinol* 2022; 18: 106–15
30. Yeoh SE et al. Dapagliflozin vs. metolazone in heart failure resistant to loop diuretics. *Eur Heart J* 2023; 44: 2966–77
31. Palmer BF, Clegg DJ. Euglycemic Ketoacidosis as a Complication of SGLT2 Inhibitor Therapy. *Clin J Am Soc Nephrol* 2021; 16: 1284–91
32. Campbell DJ. Renin-angiotensin system inhibition: how much is too much of a good thing? *Intern Med J* 2002; 32: 616–20
33. DocCheck Flexikon: [https://flexikon.doccheck.com/de/Tubul%C3%A4rer\\_Transport](https://flexikon.doccheck.com/de/Tubul%C3%A4rer_Transport). Letzter Zugriff: 26.12.2023
34. Eckardt K-U et al. Nomenklatur für Nierenfunktion und Nierenkrankheiten – Durch Präzision und Verständlichkeit zu besserer Erfassung und Prognose. *Dtsch Med Wochenschr* 2022; 147: 1398–406
35. Ketteler M, Biggar PH. Kardiorenales Syndrom. *Nephrol* 2010; 5: 49–57

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## Semaglutid bei Herzinsuffizienz: Eine sinnvolle Therapieergänzung bei Übergewichtigen?

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### Literatur:

1. McDonagh TA et al. 2021 ESC Guidelines for the diagnosis and treatment of acute and chronic heart failure. *Eur Heart J* 2021; 42: 3599–726
2. James SL et al. Global, regional, and national incidence, prevalence, and years lived with disability for 354 diseases and injuries for 195 countries and territories, 1990–2017: a systematic analysis for the Global Burden of Disease Study 2017. *Lancet* 2018; 392: 1789–858
3. McDonagh TA et al. 2023 Focused Update of the 2021 ESC Guidelines for the diagnosis and treatment of acute and chronic heart failure. *Eur Heart J* 2023; 44: 3627–39
4. Dunlay SM et al. Epidemiology of heart failure with preserved ejection fraction. *Nat Rev Cardiol* 2017; 14: 591–602
5. Redfield MM & Borlaug BA. Heart Failure With Preserved Ejection Fraction. *JAMA* 2023; 329: 827

6. Pandey A et al. Relationship Between Physical Activity, Body Mass Index, and Risk of Heart Failure. *J Am Coll Cardiol* 2017; 69: 1129–42
7. Haslam DW & James WPT. Obesity. *Lancet* 2005; 366: 1197–209
8. Health Effects of Overweight and Obesity in 195 Countries over 25 Years. *N Engl J Med* 2017; 377: 13–27
9. Borlaug BA et al. Obesity and heart failure with preserved ejection fraction: new insights and pathophysiological targets. *Cardiovasc Res* 2023; 118: 3434–50
10. Ng ACT et al. Diabesity: the combined burden of obesity and diabetes on heart disease and the role of imaging. *Nat Rev Cardiol* 2021; 18: 291–304
11. Anker SD et al. Empagliflozin in Heart Failure with a Preserved Ejection Fraction. *N Engl J Med* 2021; 385: 1451–61
12. Solomon SD et al. Dapagliflozin in Heart Failure with Mildly Reduced or Preserved Ejection Fraction. *N Engl J Med* 2022; 387: 1089–98
13. van Veldhuisen SL et al. Bariatric surgery and cardiovascular disease: a systematic review and meta-analysis. *Eur Heart J* 2022; 43: 1955–69
14. Reddy YNV et al. A Simple, Evidence-Based Approach to Help Guide Diagnosis of Heart Failure With Preserved Ejection Fraction. *Circulation* 2018; 138: 861–70
15. Kitzman DW et al. Effect of Caloric Restriction or Aerobic Exercise Training on Peak Oxygen Consumption and Quality of Life in Obese Older Patients With Heart Failure With Preserved Ejection Fraction. *JAMA* 2016; 315: 36
16. O'Brien PE et al. Long-Term Outcomes After Bariatric Surgery: a Systematic Review and Meta-analysis of Weight Loss at 10 or More Years for All Bariatric Procedures and a Single-Centre Review of 20-Year Outcomes After Adjustable Gastric Banding. *Obes Surg* 2019; 29: 3–14
17. Cardoso L et al. Short- and long-term mortality after bariatric surgery: A systematic review and meta-analysis. *Diabetes Obes Metab* 2017; 19: 1223–32
18. Wilding JPH et al. Once-Weekly Semaglutide in Adults with Overweight or Obesity. *N Engl J Med* 2021; 384: 989–1002
19. Marso SP et al. Semaglutide and Cardiovascular Outcomes in Patients with Type 2 Diabetes. *N Engl J Med* 2016; 375: 1834–44
20. Savji N et al. The Association of Obesity and Cardiometabolic Traits With Incident HFpEF and HFrEF. *JACC Heart Fail* 2018; 6: 701–9.
21. McHugh K et al. Heart Failure With Preserved Ejection Fraction and Diabetes. *J Am Coll Cardiol* 2019; 73: 602–11.
22. Marx N et al. 2023 ESC Guidelines for the management of cardiovascular disease in patients with diabetes. *Eur Heart J* 2023; 1–98
23. Sattar N et al. Cardiovascular, mortality, and kidney outcomes with GLP-1 receptor agonists in patients with type 2 diabetes: a systematic review and meta-analysis of randomised trials. *Lancet Diabetes Endocrinol* 2021; 9: 653–62
24. Verbrugge FH et al. Heart failure with preserved ejection fraction in patients with normal natriuretic peptide levels is associated with increased morbidity and mortality. *Eur Heart J* 2022; 43: 1941–51
25. Kosiborod MN et al. Semaglutide in Patients with Heart Failure with Preserved Ejection Fraction and Obesity. *N Engl J Med* 2023; 389: 1069–84
26. Green CP et al. Development and evaluation of the Kansas City Cardiomyopathy Questionnaire: a new health status measure for heart failure. *J Am Coll Cardiol* 2000; 35: 1245–55

27. Pinto YM. Heart Failure with Preserved Ejection Fraction — A Metabolic Disease? *N Engl J Med* 2023; 389: 1145–6
  28. Baggio LL et al. GLP-1 Receptor Expression Within the Human Heart. *Endocrinology* 2018; 159: 1570–84
  29. Gulsin GS et al. Effects of Low-Energy Diet or Exercise on Cardiovascular Function in Working-Age Adults With Type 2 Diabetes: A Prospective, Randomized, Open-Label, Blinded End Point Trial. *Diabetes Care* 2020; 43: 1300–10
  30. Warraich HJ et al. Physical Function, Frailty, Cognition, Depression, and Quality of Life in Hospitalized Adults ≥60 Years With Acute Decompensated Heart Failure With Preserved Versus Reduced Ejection Fraction. *Circ Heart Fail* 2018; 11: e005254
  31. Lincoff AM et al. Semaglutide and Cardiovascular Outcomes in Obesity without Diabetes. *N Engl J Med* 2023; published online Nov 11
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## **Leitliniengerechte Therapie der Herzinsuffizienz: von den Diuretika über ARNI zu den SGLT-2-Inhibitoren**

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### **Literatur:**

1. McDonagh TA et al. 2021 ESC Guidelines for the diagnosis and treatment of acute and chronic heart failure. *Europ Heart J* 2021; 42: 3599–726
2. Dunlay SM et al. Type 2 diabetes mellitus and heart failure. *Circulation* 2019; 140: e294–e324
3. Echouffo-Tcheuqui JB et al. Temporal trends and factors associated with diabetes mellitus among patients hospitalized with heart failure: Findings from get with the guidelines – heart failure registry. *Am Heart J* 2016; 182: 9–20
4. Digitalis Investigation Group. The effect of digoxin on mortality and morbidity in patients with heart failure. *N Engl J Med* 1997; 336: 525–33
5. Pitt B et al. The effect of spironolactone on morbidity and mortality in patients with severe heart failure. Randomized aldactone evaluations study investigators. *N Engl J Med* 1999; 341: 709–17
6. Zannad F et al. EMPHASIS-HF study group. Eplerenone in patients with systolic heart failure and mild symptoms. *N Engl J Med* 2011; 364: 11–21
7. Fowler MB Effects of beta blockers on symptoms and functional capacity in heart failure. *Am J Cardiol* 1997; 80: 55L–58L
8. Packer M et al. Effect of carvedilol on the morbidity of patients with severe chronic heart failure: results of the carvedilol prospective randomized cumulative survival (COPERNICUS) study. *Circulation* 2002; 106: 2194–99
9. The CONSENSUS Trial study group. Enalapril for congestive heart failure. *N Engl J Med* 1987; 317: 1349–51

10. Yusuf S et al. SOLVD Investigators. Effect of enalapril on survival in patients with reduced left ventricular ejection fractions and congestive heart failure. *N Engl J Med* 1991; 325: 293–302
  11. Cohn JN, Tognoni G. Valsartan heart failure trial Investigators. A randomized trial of the angiotensin-receptor blocker valsartan in chronic heart failure. *N Engl J Med* 2001; 345: 1667–75
  12. McMurray JJV et al. PARADIGM Investigators and Committees. Angiotensin-neprilysin inhibition versus enalapril in heart failure. *N Engl J Med* 2014; 371: 993–1004
  13. Morrow DA et al. Clinical outcomes in patients with acute decompensated heart failure randomly assigned to sacubitril/valsartan or enalapril in the PIONEER-HF trial. *Circulation* 2019; 139: 2285–88
  14. Zinman B et al. Empagliflozin, cardiovascular outcomes, and mortality in type 2 diabetes. *N Engl J Med* 2015; 373: 2117–28
  15. McMurray JJV et al. DAPA-HF trial committees and investigators. Dapagliflozin in patients with heart failure and reduced ejection fraction *N Engl J Med* 2019; 381: 1995–2008
  16. Packer M et al. EMPEROR-reduced trial investigators. Cardiovascular and renal outcomes with empagliflozin in heart failure. *N Engl J Med* 2020; 383: 1413–24
  17. Anker SD et al. Empagliflozin in heart failure with a preserved ejection fraction. *N Engl J Med* 2021; 385: 1451–61
  18. Solomon SD et al. Dapagliflozin in heart failure with mildly reduced or preserved ejection fraction. *N Engl J Med* 2022; 387: 1a089–98
  19. McDonagh TA et al. 2023 focused update of the 2021 ESC Guidelines for the diagnosis and treatment of acute and chronic heart failure. *Europ Heart J* 2023; 44: 3627–39
- 

## **Arrhythmie-induzierte Kardiomyopathie: eine unterschätzte Ursache der Herzinsuffizienz? – Definition, Grundlagen, Therapieoptionen**

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### **Literatur:**

1. Savarese G et al. Global burden of heart failure: a comprehensive and updated review of epidemiology. *Cardiovasc Res* 2023; 118: 3272–87
2. Neumann T et al. Heart failure: the commonest reason for hospital admission in Germany: medical and economic perspectives. *Dtsch Arztebl Int* 2009; 106: 269–75
3. Störk S et al. Epidemiology of heart failure in Germany: a retrospective database study. *Clin Res Cardiol* 2017; 106: 913–22
4. Gopinathannair R et al. Arrhythmia-Induced Cardiomyopathies: Mechanisms, Recognition, and Management. *J Am Coll Cardiol* 2015; 66: 1714–28

5. Della Rocca DG et al. Novel perspectives on arrhythmia-induced cardiomyopathy: pathophysiology, clinical manifestations and an update on invasive management strategies. *Cardiol Rev* 2015; 23: 135–41
6. Simantirakis EN et al. Arrhythmia-induced cardiomyopathies: the riddle of the chicken and the egg still unanswered? *Europace* 2012; 14: 466–73
7. Sossalla S, Vollmann D. Arrhythmia-Induced Cardiomyopathy. *Dtsch Arztebl Int* 2018; 115: 335–41
8. Gentlesk PJ et al. Reversal of left ventricular dysfunction following ablation of atrial fibrillation. *J Cardiovasc Electrophysiol* 2007; 18: 9–14
9. Hsu L-F et al. Catheter ablation for atrial fibrillation in congestive heart failure. *N Engl J Med* 2004; 351: 2373–83
10. Pizzale S et al. Frequency and predictors of tachycardia-induced cardiomyopathy in patients with persistent atrial flutter. *Can J Cardiol* 2009; 25: 469–72
11. Calò L et al. Tachycardia-induced cardiomyopathy: mechanisms of heart failure and clinical implications. *J Cardiovasc Med (Hagerstown)* 2007; 8: 138–43
12. Huizar JF et al. Arrhythmia-Induced Cardiomyopathy: JACC State-of-the-Art Review. *J Am Coll Cardiol* 2019; 73: 2328–44
13. Pabel S et al. Effects of Atrial Fibrillation on the Human Ventricle. *Circ Res* 2022; 130: 994–1010
14. Körtl T et al. Atrial Fibrillation Burden Specifically Determines Human Ventricular Cellular Remodeling. *JACC Clin Electrophysiol* 2022; 8: 1357–66
15. Santhanakrishnan R et al. Atrial Fibrillation Begets Heart Failure and Vice Versa: Temporal Associations and Differences in Preserved Versus Reduced Ejection Fraction. *Circulation* 2016; 133: 484–92
16. Sugumar H et al. Pathophysiology of Atrial Fibrillation and Heart Failure: Dangerous Interactions. *Cardiol Clin* 2019; 37: 131–38
17. Wyse DG et al. A comparison of rate control and rhythm control in patients with atrial fibrillation. *N Engl J Med* 2002; 347: 1825–33
18. Marrouche NF et al. Catheter Ablation for Atrial Fibrillation with Heart Failure. *N Engl J Med* 2018; 378: 417–27
19. Di Biase L et al. Ablation Versus Amiodarone for Treatment of Persistent Atrial Fibrillation in Patients With Congestive Heart Failure and an Implanted Device: Results From the AATAC Multicenter Randomized Trial. *Circulation* 2016; 133: 1637–44
20. Packer DL et al. Ablation Versus Drug Therapy for Atrial Fibrillation in Heart Failure: Results From the CABANA Trial. *Circulation* 2021; 143: 1377–90
21. Prabhu S et al. Catheter Ablation Versus Medical Rate Control in Atrial Fibrillation and Systolic Dysfunction: The CAMERA-MRI Study. *J Am Coll Cardiol* 2017; 70: 1949–61

22. Hasdemir C et al. Late gadolinium enhancement CMR in patients with tachycardia-induced cardiomyopathy caused by idiopathic ventricular arrhythmias. *Pacing Clin Electrophysiol* 2012; 35: 465–70
  23. Bremilla-Perrot B et al. Predictors and prognostic significance of tachycardiomyopathy: insights from a cohort of 1269 patients undergoing atrial flutter ablation. *Eur J Heart Fail* 2016; 18: 394–401
  24. Fujino T et al. Characteristics of congestive heart failure accompanied by atrial fibrillation with special reference to tachycardia-induced cardiomyopathy. *Circ J* 2007; 1:936–940.
  25. Kusunose K et al. Clinical Utility of Longitudinal Strain to Predict Functional Recovery in Patients With Tachyarrhythmia and Reduced LVEF. *JACC Cardiovasc Imaging* 2017; 10: 118–26
  26. Bergonti M et al. Left ventricular functional recovery after atrial fibrillation catheter ablation in heart failure: a prediction model. *Eur Heart J* 2023; 44: 3327–35
  27. Pokorney SD, Granger CB. Evidence Builds for Catheter Ablation for Atrial Fibrillation and Heart Failure. *Circulation* 2022; 145: 1705–7
  28. Manolis AS et al. Atrial fibrillation-induced tachycardiomyopathy and heart failure: an underappreciated and elusive condition. *Heart Fail Rev* 2022; 27: 2119–35
  29. Brignole M et al. AV junction ablation and cardiac resynchronization for patients with permanent atrial fibrillation and narrow QRS: the APAF-CRT mortality trial. *Eur Heart J* 2021; 42: 4731–39
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## **Der kardiogene Schock: Aktuelle Therapie und Grenzen der mechanischen Unterstützungstherapie**

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### **Literatur:**

1. Harjola VP et al. Clinical picture and risk prediction of short-term mortality in cardiogenic shock. *Eur J Heart Fail* 2015; 17: 501–9
2. Goldberg RJ et al. Thirty-year trends (1975 to 2005) in the magnitude of, management of, and hospital death rates associated with cardiogenic shock in patients with acute myocardial infarction a population-based perspective. *Circulation* 2009; 119: 1211–19
3. Kolte D et al. Trends in incidence, management, and outcomes of cardiogenic shock complicating ST-elevation myocardial infarction in the United States. *J Am Heart Assoc* 2014; 3: 1–17
4. Thiele H, Akin I et al. PCI Strategies in Patients with Acute Myocardial Infarction and Cardiogenic Shock. *N Engl J Med* 2017; 377: 2419–32
5. Hochman JS et al. Cardiogenic shock complicating acute myocardial infarction –

Etiologies, management and outcome: A report from the SHOCK Trial Registry. *J Am Coll Cardiol* 2000; 36: 1063–70

6. Menon V et al. The clinical profile of patients with suspected cardiogenic shock due to predominant left ventricular failure: A report from the SHOCK Trial Registry. *J Am Coll Cardiol* 2000; 36: 1071–76
7. Makki N, Brennan TM, Girotra S. Acute coronary syndrome. *J Intensive Care Med* 2015; 30: 186–200
8. Cecconi M et al. Consensus on circulatory shock and hemodynamic monitoring. Task force of the European Society of Intensive Care Medicine. *Intensive Care Med* 2014; 40: 1795–815
9. Masyuk M et al. Prognostic relevance of serum lactate kinetics in critically ill patients. *Intensive Care Med* 2019; 45: 55–61
10. Fincke R et al. Cardiac power is the strongest hemodynamic correlate of mortality in cardiogenic shock: A report from the SHOCK trial registry. *J Am Coll Cardiol* 2004; 44: 340–48
11. Mebazaa A et al. Acute heart failure and cardiogenic shock: a multidisciplinary practical guidance. *Intensive Care Med* 2016; 42: 147–63
12. Mebazaa A et al. Management of cardiogenic shock complicating myocardial infarction. *Intensive Care Med* 2018; 44: 760–73
13. Hochman JS et al. Early Revascularization in Acute Myocardial Infarction Complicated by Cardiogenic Shock. *N Engl J Med* 1999; 341: 625–34
14. Thiele H et al. One-Year Outcomes after PCI Strategies in Cardiogenic Shock. *N Engl J Med* 2018; 379: 1699–1710
15. Mebazaa A et al. Recommendations on pre-hospital and early hospital management of acute heart failure: a consensus paper from the Heart Failure Association of the European Society of Cardiology, the European Society of Emergency Medicine and the Society of Academic Emergency Medicine. *Eur Heart J* 2015; 36: 1958–66
16. Russ MA et al. Hemodynamic improvement following levosimendan treatment in patients with acute myocardial infarction and cardiogenic shock. *Crit Care Med* 2007; 35: 2732–39
17. Demondion P et al. Predictors of 30-day mortality and outcome in cases of myocardial infarction with cardiogenic shock treated by extracorporeal life support. *Eur J Cardiothorac Surg* 2014; 45: 47–54
18. Prondzinsky R et al. Hemodynamic effects of intra-aortic balloon counterpulsation in patients with acute myocardial infarction complicated by cardiogenic shock: The prospective, randomized IABP shock trial. *Shock* 2012; 37: 378–84
19. Prondzinsky R et al. Intra-aortic balloon counterpulsation in patients with acute myocardial infarction complicated by cardiogenic shock: The prospective, randomized IABP SHOCK Trial for attenuation of multiorgan dysfunction syndrome. *Crit Care Med* 2010; 38: 152–60
20. Thiele H et al. Intraaortic Balloon Support for Myocardial Infarction with Cardiogenic Shock. *N Engl J Med* 2012; 367: 1287–96

21. Werdan K et al. Mechanical circulatory support in cardiogenic shock. *Eur Heart J* 2014; 35: 156–67
  22. Thiele H, Ohman EM, Desch S, Eitel I, De Waha S. Management of cardiogenic shock. *Eur Heart J* 2015; 36: 1223–30
  23. Thiele H et al. Randomized comparison of intra-aortic balloon support with a percutaneous left ventricular assist device in patients with revascularized acute myocardial infarction complicated by cardiogenic shock. *Eur Heart J* 2005; 26: 1276–83
  24. Kar B, Gregoric ID, Basra SS, Idelchik GM, Loyalka P. The Percutaneous Ventricular Assist Device in Severe Refractory Cardiogenic Shock. *J Am Coll Cardiol* 2011; 57: 688–96
  25. Burkhoff D et al. A randomized multicenter clinical study to evaluate the safety and efficacy of the TandemHeart percutaneous ventricular assist device versus conventional therapy with intraaortic balloon pumping for treatment of cardiogenic shock. *Am Heart J* 2006; 152: 469.e1–469.e8
  26. Ouweneel DM, Henriques JPS. Percutaneous cardiac support devices for cardiogenic shock: Current indications and recommendations. *Heart* 2012; 98: 1246–54
  27. Seyfarth M et al. A Randomized Clinical Trial to Evaluate the Safety and Efficacy of a Percutaneous Left Ventricular Assist Device Versus Intra-Aortic Balloon Pumping for Treatment of Cardiogenic Shock Caused by Myocardial Infarction. *J Am Coll Cardiol* 2008; 52: 1584–88
  28. Abrams D, Combes A, Brodie D. Extracorporeal membrane oxygenation in cardiopulmonary disease in adults. *J Am Coll Cardiol* 2014; 63: 2769–78
  29. Pabst D, Foy AJ, Peterson B, Soleimani B, Brehm CE. Predicting survival in patients treated with extracorporeal membrane oxygenation after myocardial infarction. *Crit Care Med* 2018; 46: e359–e363
  30. Cheng R et al. Complications of extracorporeal membrane oxygenation for treatment of cardiogenic shock and cardiac arrest: A meta-analysis of 1,866 adult patients. *Ann Thorac Surg* 2014; 97: 610–16
  31. Sutter R, Tisljar K, Marsch S. Acute neurologic complications during extracorporeal membrane oxygenation: A systematic review. *Crit Care Med* 2018; 46: 1506–13
  32. Ostadal P et al. Extracorporeal Membrane Oxygenation in the Therapy of Cardiogenic Shock: Results of the ECMO-CS Randomized Clinical Trial. *Circulation* 2023; 147: 454–64
  33. Thiele H et al. Extracorporeal Life Support in Infarct-Related Cardiogenic Shock. *N Engl J Med* 2023; 389: 1286–97
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## Akuttherapie des ischämischen Schlaganfalls in einer alternden Gesellschaft

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### Literatur:

1. Ringleb P et al. Akuttherapie des ischämischen Schlaganfalls, S2e-Leitlinien, 2022 Version 1.1., in: Deutsche Gesellschaft für Neurologie (Hrsg), Leitlinien für Diagnostik und Therapie in der Neurologie. Online: [www.dgn.org/leitlinien](http://www.dgn.org/leitlinien) (abgerufen 18.11.2022)
2. Langhorne P et al. Organised inpatient (stroke unit) care for stroke: network meta-analysis. Cochrane Database of Systematic Reviews 2020; 4: CD00197
3. Candelise L et al. Stroke-unit care for acute stroke patients: an observational follow-up study. Lancet 2007; 369: 299–305
4. Wardlaw JM et al. Thrombolysis for acute ischaemic stroke. Cochrane Database Syst Rev 2014; 7: CD000213
5. Bluhmki E et al. Alteplase for acute ischemic stroke in patients aged > 80 years. Stroke 2020; 51: 2322331–6
6. Mishra et al. Thrombolysis in the very elderly people: controlled comparison of SITS International Stroke Registry and Virtual International Stroke Trials Archive. BMJ 2010; 23: 341
7. Gumbiner C et al. Outcome of patients treated with thrombolysis according to prestroke Rankin Scale scores. Neurology 2019; 93: e1-e10
8. Berkhemer OA et al. A Randomized Trial of Intraarterial Treatment for Acute Ischemic Stroke. N. Engl. J. Med. 2015, 372, 11–20
9. Saver JL et al. Stent-Retriever Thrombectomy after Intravenous t-PA vs. t-PA Alone in Stroke. N. Engl. J. Med. 2015, 372, 2285–95
10. Goyal M et al. Randomized Assessment of Rapid Endovascular Treatment of Ischemic Stroke. N. Engl. J. Med. 2015, 372, 1019–30
11. Jovin TG et al. Thrombectomy within 8 Hours after Symptom Onset in Ischemic Stroke. N. Engl. J. Med. 2015, 372, 2296–306
12. Goyal M et al. HERMES Collaborators. Endovascular thrombectomy after large-vessel ischaemic stroke: a meta-analysis of individual patient data from five randomised trials. Lancet 2016; 387: 1723–31
13. Jovin TG et al. REVASCAT Trial Investigators. Thrombectomy within 8 hours after symptom onset in ischemic stroke. N Engl J Med 2015; 372: 2296–306
14. Mocco J et al. Aspiration thrombectomy after intravenous alteplase versus intravenous alteplase alone. Stroke 2016, 47: 2331–8
15. Kastrup A et al. Endovascular therapy versus thrombolysis in patients with large vessel occlusions within the anterior circulation aged ≥ 80 years. J Neurointerv Surg 2018; 10: 1053–1056

16. Meyer L et al. Endovascular Treatment of Very Elderly Patients Aged  $\geq 90$  With Acute Ischemic Stroke. *J Am Heart Assoc* 2020; 9(5): e014447
17. Turc G et al. European Stroke Organisation (ESO)- European Society for Minimally Invasive Neurological Therapy (ESMINT) guidelines on mechanical thrombectomy in acute ischemic stroke endorsed by Stroke Alliance for Europe (SAFE). *Eur J Stroke* 2019, 4: 6-12
18. Arsava EM et al. Severity of leukoaraiosis correlates with clinical outcome after ischemic stroke. *Neurology* 2009; 72: 1403–10
19. Langhorne P et al. Medical complications after stroke: a multicenter study. *Stroke* 2000; 31: 1223–9
20. Wang Q et al. Recanalization treatment of acute ischemic stroke caused by large-artery occlusion in the elderly: a comparative analysis of the elderly and the very elderly. *Dis Markes* 2021; Article ID 3579074
21. Heuschmann P et al. Schlaganfallhäufigkeit und Versorgung von Schlaganfallpatienten in Deutschland. *Akt Neurol* 20120; 37: 333–40
22. Kastrup A et al. Endovascular therapy vs. thrombolysis in pre-stroke dependent patients with alrge vessel occlusions within the anterior circulation. *Front Neuro* 2021; 12: 666596
23. Adamou A et al. Outcome of endovascular thrombectomy in pre-stroke dependent patients with acute ischemic stroke: a systematic review and meta-analysis. *Front Neurol* 2022; 13: 880046
24. Nogueira RG et al. Thrombectomy 6 to 24 hours after stroke with a mismatch between deficit and infarct. *N Engl J Med* 2018; 378: 11–21
25. Albers GW et al. Thrombectomy for stroke at 6 to 16 hours with selection by perfusion imaging. *N Engl J Med* 2018; 378: 708–18
26. Tao C et al. Trial of endovascular treatment of acute basilar-artery occlusion. *N Engl J Med* 2022; 387: 1361–72
27. Jovin TG et al. Trial of thrombectomy 6 to 24 hours after stroke due to basilar-artery occlusion. *N Engl J Med* 2022; 387: 1373–84