

DAFTAR PUSTAKA

1. McDonagh TA, Metra M, Adamo M, Gardner RS, Baumbach A, Bohm M, et al. 2021 ESC guidelines for the diagnosis and treatment of acute and chronic heart failure. *Eur Heart J*. 2021;00:1–128.
2. Groenewegen A, Ruten FH, Mosterd A, Hoes AW. Epidemiology of heart failure. *Eur J Heart Fail*. 2020;22:1342–56.
3. Ni H, Xu J. Recent trends in heart failure-related mortality: United States, 2000–2014. *NCHS Data Brief*. 2015;231:1–8.
4. Siswanto. Riset kesehatan dasar (Riskesdas) 2018. Badan Penelitian dan Pengembangan Kesehatan Kementerian RI. 2018;1:1–581.
5. Gevaert AB, Boen JR, Segers VF, Craenenbroeck EM. Heart failure with preserved ejection fraction: a review of cardiac and noncardiac pathophysiology. *Front Physiol*. 2019;10(638):1–14.
6. Takashio S, Takahama H, Nishikimi T, Hayashi T, Okatani CN, Matsuo A, et al. Superiority of proatrial of natriuretic peptide in the prognostic power in patients with acute decompensated heart failure on hospital admission: comparison with B-type natriuretic peptide and the other natriuretic peptide forms. *BMJ*. 2019;6:1–9.
7. Krupicka J, Janota T, Hradec J. Natriuretic peptides in heart failure. *Cor Et Vasa*. 2013;55:370–6.
8. Yancy CW, Jessup M, Bozkurt B, Butler J, Casey DE, Colvin MM, et al. 2017 ACC/AHA/HFSA focused update of the 2013 guideline for the management of heart failure. *JACC*. 2017;70(96):777–803.
9. Park JJ, Mebazaa A, Hwang IC, Park JB, Park JH, Cho GY, et al. Phenotyping heart failure according to the longitudinal ejection fraction change: myocardial strain, predictors, and outcomes. *JAHA*. 2020;9:1–17.
10. Lang RM, Badano LP, Avi VM, Afilalo J, Armstrong A, Ernande L, et al. Recommendations for cardiac chamber quantification by echocardiography in adults: an update from the american society of echocardiography and the european association of cardiovascular imaging. *J Am Soc Echocardiogr*. 2015;28(1):1–39.

11. Omar AM, Bansal M, Sengupta PP. Advances in echocardiographic imaging in heart failure with reduced and preserved ejection fraction. *Circ Res*. 2016;119:357–74.
12. Ito H, Ishida M, Makino W, Goto Y, Ichikawa Y, Kitagawa K, et al. Cardiovascular magnetic resonance feature tracking for characterization of patients with HFpEF: correlation of global longitudinal strain with invasive diastolic functional indices. *J Cardiovasc Magn Reson*. 2020;4(22):1–42.
13. Krainer EK, Shah AM, Gupta DK, Santos A, Clagget B, Pieske B, et al. Impaired systolic function by strain imaging in heart failure with preserved ejection fraction. *J Am Coll Cardiol*. 2014;63(5):447–56.
14. Vecchis RD, Baldi C, Biase GD. The relation between global longitudinal strain and serum natriuretic peptide is more strict than that found between the latter and left ventricular ejection fraction. *J Clin Med Res*. 2015;7(12):979–88.
15. Islam MN, Chowdhury MS, Paul GK, Debnath RC, Shakil SS. Association of diastolic dysfunction with N-terminal pro-b-type natriuretic peptide level in heart failure patients with preserved ejection fraction. *Mymensingh Med J*. 2019;28(2):333–46.
16. Maia RJ, Brandao CS, Leite J, Parente GB, Pinheiro F, Araujo BT, et al. Global longitudinal strain predicts poor functional capacity in patients with systolic heart failure. *Arq Bras Cardiol*. 2019;113(2):188–94.
17. Sengelov M, Jorgensen PG, Jensen JS, Bruun NE, Olsen FJ, Hansen TF, et al. Global longitudinal strain is a superior predictor of all-cause mortality in heart failure with reduced ejection fraction. *JACC*. 2015;8(12):1351–9.
18. DeVore A, McNulty S, Alenezi F, Ersboll M, Vader JM, Anstrom KJ, et al. Impaired left ventricular global longitudinal strain in patients with heart failure with preserved ejection fraction: insights from the RELAX trial. *Eur J Heart Fail*. 2017;19:893–900.
19. Borlaug BA. The pathophysiology of heart failure with preserved ejection fraction. *Nat Rev Cardiol*. 2014;11:507–15.
20. Segers, VF, DeKeulenaer GW. Pathophysiology of diastolic dysfunction in chronic heart failure. *Futur Cardiol*. 2013; 9:711–720.

21. Reddy YN, Andersen MJ, Obokata M, Koepp KE, Kane GC, Melenovsky, V, et al. Arterial stiffening with exercise in patients with heart failure and preserved ejection fraction. *J Am Coll Cardiol*. 2017;70:136–48.
22. Borlaug BA, Olson TP, Lam CS, Flood KS, Lerman A, Johnson BD, et al. Global cardiovascular reserve dysfunction in heart failure with preserved ejection fraction. *J Am Coll Cardiol*. 2010;56:845–54.
23. Paulus WJ, Tschope C. A novel paradigm for heart failure with preserved ejection fraction: comorbidities drive myocardial dysfunction and remodeling through coronary microvascular endothelial inflammation. *J Am Coll Cardiol*. 2013;62(4):263–71.
24. Zhang Q, Yu CM. Clinical implication of mechanical dyssynchrony in heart failure. *J Cardiovasc Ultrasound*. 2012;20(3):117–23.
25. Lim SL, Lam CS, Segers VF, Brutsaert DL, Keulenaer GW. Cardiac endothelium–myocyte interaction: clinical opportunities for new heart failure therapies regardless of ejection fraction. *Eur Heart J*. 2015;36:2050–60.
26. Leucker TM, Jones SP. Endothelial dysfunction as a nexus for endothelial cell–cardiomyocyte miscommunication. *Front Physiol*. 2014;5:328–37.
27. Linke WA, Hamdani N. Gigantic business: titin properties and function through thick and thin. *Circ Res*. 2014;114:1052–68.
28. Heerebeek VL, Borbély A, Niessen HW, Bronzwaer JG, Velden J, Stienen GJ, et al. Myocardial structure and function differ in systolic and diastolic heart failure. *Circulation*. 2006;113:1966–73.
29. Kirali K, Ozer T, Ozgur MM. Pathophysiology in heart failure. *Intech*. 2017;1:1–22.
30. Mohammed SF, Hussain S, Mirzoyev SA, Edwards WD, Maleszewski, JJ, Redfield MM. Coronary microvascular rarefaction and myocardial fibrosis in heart failure with preserved ejection fraction. *Circulation*. 2015;131:550–9.
31. Kendall RT, Feghali BC. Fibroblasts in fibrosis: novel roles and mediators. *Front Pharmacol*. 2014;5:123–34.
32. Westermann D, Lindner D, Kasner M, Zietsch C, Savvatis K, Escher F, et al. Cardiac inflammation contributes to changes in the extracellular matrix in

- patients with heart failure and normal ejection fraction. *Circ.Heart Fail.* 2011;4:44–52.
33. Jia G, Aroor AR, Hill MA, Sowers JR. Role of reninangiotensin-aldosterone system activation in promoting cardiovascular fibrosis and stiffness. *Hypertension.* 2018;72:537–48.
34. Cao Z, Jia Y, Zhu B. BNP and NT-proBNP as diagnostic biomarkers for cardiac dysfunction in both clinical and forensic medicine. *Int J Mol Sci.* 2019;20:1–16.
35. Weber M, Hamm C. Role of b-type natriuretic peptide (bnp) and nt-probnp in clinical routine. *Heart.* 2006;92:843–9.
36. Januzzi JL. Natriuretic peptides as biomarker in heart failure. *J Investig Med.* 2013;61(6):950–5.
37. Sodi R. N-terminal pro b-type natriuretic peptide (NT-proBNP). *ACB.* 2014:1–11.
38. Tanase DM, Radu S, Shurbaji SA, Baroi GL, Costea CF, Turliuc MD, et al. Natriuretic peptides in heart failure with preserved left ventricular ejection fraction: from molecular evidence to clinical implications. *Int J Mol Sci.* 2019;20:1–23.
39. Kang SH, Park JJ, Choi DJ, Yoon CH, Oh IY, Kang SM, et al. Prognostic value of NT-proBNP in heart failure with preserved versus reduced EF. *Heart.* 2015;0:1–8.
40. Konstam MA, Kramer DG, Patel AR, Maron MS, Udelson JE. Left ventricular remodeling in heart failure. *JACC.* 2011;4(1):98–108.
41. Lee G, Ryan M. National laboratory book: laboratory testing for natriuretic peptides (NP) - BNP / NT-proBNP. *Nat Clin Prog Pathol.* 2019,1:1–17.
42. Rogic D. NT-proBNP diagnostic significance and recommended clinical applications. *Signa Vitae.* 2015;10(1):89–91.
43. Ibrahim NE, Januzzi JL. Established and emerging roles of biomarkers in heart failure. *Circ Res.* 2018;123:614–29.
44. Rivera M, Visconti RT, Salvador A, Bertomeu V, Miro V, Burgos FG, et al. Hipertension y valores de NT-pro BNP. Su importancia en el diagnostic de insuficirncia cardiac. *Rev Esp Cardiol.* 2004;57(5):396–402.

45. Marie R, Philippe M. B-type natriuretic peptide and obesity in heart failure: a mysterious but important association in clinical practice. *Cardiovasc Med.* 2020;23:1–5.
46. Yingchoncharoen T, Agarwal S, Popovic ZB, Marwick TH. Normal ranges of left ventricular strain: a meta-analysis. *J Am Soc Echocardiogr.* 2013;26:185–91.
47. Voigt JU, Cvijic M. 2- and 3- dimensional myocardial strain in cardiac health and disease. *JACC.* 2019;12(9)1849–63.
48. Tadic M, Cuspidi C, Bombelli M, Grassi G. Hypertensive heart disease beyond left ventricular hypertrophy: are we ready for echocardiographic strain evaluation in everyday clinical practice?. *J Hypertens.* 2017;35:1–10.
49. Vijayaraghavan G, Sivasankaran S. Global longitudinal strain: a practical step-by-step approach to longitudinal strain imaging. *J Indian Acad Echocardiogr Cardiovasc Imaging.* 2020;4:22–8.
50. Yingchoncharoen T, Agarwal S, Popovic ZB, Marwick TH. Normal ranges of LV strain: a meta-analysis. *J Am Soc Echocardiogr* 2013;26:185–91.
51. Kocabay G, Muraru D, Peluso D, Cucchini U, Mihaila S, Padayattil-Jose S, et al. Normal left ventricular mechanics by two-dimensional speckle-tracking echocardiography. *Rev Esp Cardiol (Engl Ed).* 2014;67:651–8.
52. Takigiku K, Takeuchi M, Izumi C, Yuda S, Sakata K, Ohte N, et al. Normal range of left ventricular 2-dimensional strain: japanese ultrasound speckle tracking of the left ventricle (JUSTICE) study. *Circ J.* 2012;76:2623–32.
53. Rodríguez I, Navarro MF, González P, García OR, Morillo VE, Teresa GE, et al. Left ventricular deformation and two-dimensional echocardiography: temporal and other parameter values in normal subjects. *Rev Esp Cardiol.* 2010;63:1195–9.
54. Bussadori C, Moreo A, Di Donato M, De Chiara B, Negura D, Dall'Aglio E, et al. A new 2D-based method for myocardial velocity strain and strain rate quantification in a normal adult and paediatric population: assessment of reference values. *Cardiovasc Ultrasound.* 2009;7:1–8.
55. Avi MV, Lang MR, Badano LP, Belohlavek M, Cardim NM, Derumeaux G, et al. Current and evolving echocardiographic techniques for the quantitative

- evaluation of cardiac mechanics: ASE/EAE consensus statement on methodology and indications endorsed by the Japanese Society of Echocardiography. *J Am Soc Echocardiogr*. 2011;24:277–313.
56. Voigt J, Pedrizetti G, Lysyansky P, Marwick TH, Houle H, Baumann R, et al. Definitions for a common standard for 2d speckle tracking echocardiography. *Eur Heart J*. 2015;16:1–11.
 57. Stokke TM, Hasselberg NE, Smedrud MK, Sarvari SI, Haugaa KH, Smiseth OA, et al. Assessing ventricular systolic function: comparison between ejection fraction and strain. *J Am Coll Cardiol*. 2017;70(8):942–54.
 58. Karlsen S, Dahlslett T, Grenne B, Sjøli B, Smiseth O, Edvardsen T, et al. Global longitudinal strain is a more reproducible measure of left ventricular function than ejection fraction regardless of echocardiographic training. *Cardiovasc Ultrasound*. 2009;17(1):1–18.
 59. Santos BA, Foppa M, Bertoluci C, Branchi TV, Fuchs SC, Fuchs FD. Stage I hypertension is associated with impaired systolic function by strain imaging compared with prehypertension. *J Clin Hypertens*. 2019;21:1705–10.
 60. Negishi K, Borowski AG, Popovic ZB. Effect of gravitational gradients on cardiac filling and performance. 2017;30:1180–8.
 61. Donal E, Bergerot C, Thibault H, Ernande L, Loufoua J, Augeul L, et al. Influence of afterload on left ventricular radial and longitudinal systolic functions: a two-dimensional strain imaging study. *Eur J Echocardiogr*. 2009;10(8):914–21.
 62. Lumens J, Tayal B, Walmsley J, Montero AD, Huntjens PR, Schwartzman D, et al. Differentiating electromechanical from non-electrical substrates of mechanical discoordination to identify responders to cardiac resynchronization therapy. *Circ Imaging*. 2015;8:1–10.
 63. Tromp J, Teng T, Tay WT, Hung CL, Narasimhan C, Shimizu W, et al. Heart failure with preserved ejection fraction in Asia. *European Journal of Heart Failure*. 2018;5:1–14.
 64. Tromp J, Claggett BL, Liu J, Jackson AM, Jhund PS, Kober L, et al. Global differences in heart failure with preserved ejection fraction. *Circ Heart Fail*. 2021;4:468–77.

65. Tromp J, Shen L, Jhund PS, Anand IS, Pitt D, Carson PE, et al. Age-related characteristics and outcomes of patients with heart failure with preserved ejection fraction. *JACC*. 2019;74(5):601–13.
66. Heidenreich PA, Bozkurt B, Aguilar D, Allen LA, Byun JJ, Colvin MM, et al. 2022 AHA/ACC/HFSA guideline for the management of heart failure: a report of the American College of Cardiology/American Heart Association Joint Committee on Clinical Practice Guidelines. *Circulation*. 2022;145:859–1032.
67. Pieske B, Tschope C, Boer RA, Fraser AG, Anker SD, Donal E, et al. How to diagnose heart failure with preserved ejection fraction: the HFA PEFF diagnostic algorithm: a consensus recommendation from the Heart Failure Association (HFA) of the European Society of Cardiology (ESC). *European Heart Journal*. 2019;00:1–21.
68. Bshiebish HA, Musawi AH, Khudeir SA. Role of global longitudinal strain in assessment of left ventricular systolic function in patients with heart failure with preserved ejection fraction. *J Saudi Heart Assoc*. 2019;31:100–5.
69. Shah MA. Ventricular remodeling in heart failure with preserved ejection fraction. *Curr Heart Fail Rep*. 2013;10(4):341–9.
70. Gupta DK, Shah AM, Castagno D, Takeuchi M, Loehr LR, Fox ER, et al. Heart failure with preserved ejection fraction in African Americans: the ARIC (Atherosclerosis Risk in Communities) study. *J Am Coll Cardiol HF*. 2013; 1:156–63.
71. Solomon SD, Zile M, Pieske B, Voors A, Shah A, Kraigher-Krainer E, et al. The angiotensin receptor neprilysin inhibitor LCZ696 in heart failure with preserved ejection fraction: A phase II randomized-controlled trial. *Lancet*. 2013; 380:1387–95.
72. Veld AE, Man FS, Rossum AC, Hondoko ML. How to diagnose heart failure with preserved ejection fraction: the value of invasive stress testing. *Neth Heart J*. 2016;24:244–51.
73. Penicka M, Bartunek J, Trakalova H, et al. Heart failure with preserved ejection fraction in outpatients with unexplained dyspnea: a pressure-volume loop analysis. *J Am Coll Cardiol*. 2010;55:1701–10.

74. Lam CS, Roger VL, Rodeheffer RJ, Borlaug BA, Ender FT, Redfield MM. Pulmonary hypertension in heart failure with preserved ejection fraction. *JACC*. 2009;53(13):1119–26.
75. Reddy YN, Carter RE, Obokata M, Redfield MM, Borlaug BA. A simple, evidence-based approach to help guide diagnosis of heart failure with preserved ejection fraction. *Circulation*. 2018;138:861–70.
76. Chen H, Chhor M, Rayner BS, McGrath K, McClement L. Evaluation of the diagnostic accuracy of current biomarkers in heart failure with preserved ejection fraction: a systematic review and meta-analysis. *Arch Cardiovasc Disc*. 2021;114(12):793–804.
77. Menet A, Greffe L, Ennezat P, Delelis F, Guyomar Y, Castel AL, et al. Is mechanical dyssynchrony a therapeutic target in heart failure with preserved ejection fraction? *American Heart Journal*. 2014;12:910–6.
78. Kosmala W, Rojek A, Kosmala M, Mysiak A, Karolko B, Marwick TH, et al. Contributions of nondiastolic factors to exercise intolerance in heart failure with preserved ejection fraction. *JACC*. 2016;67(6):659–70.
79. Iwano H, Kamimura D, Fox ER, Hall ME, Vlachos P, Little WC, et al. Presence and implication of temporal nonuniformity of early diastolic left ventricular wall expansion in patients with heart failure. *J Cardiac Fail*. 2016;1:1–9.
80. Yang WL, Hawley C, Cho Y, Johnson DW, Pascoe EM, Johnson DW, et al. NT-proBNP concentration and early cardiac dysfunction in patients receiving dialysis: a prospective cohort study. *Cardiorenal Med*. 2020;0:1–10.
81. Uraizee I, Cheng S, Hung CL, Verma A, Thomas JD, Zile MR, et al. Relation of N-terminal B pro B-type natriuretic peptide with diastolic function in hypertensive heart disease. *Am J Hypertension*. 2013;26(10):1234–41.
82. Almeida P, Rodrigues J, Lourenco P, Maciel MJ, Bettencourt P. Left atrial volume index is critical for the diagnosis of heart failure with preserved ejection fraction. *Italian Federation of Cardiology*. 2018;0:1–6.
83. Azizi MS, Nasution SA, Setiati S, Shatri H. Global longitudinal strain in elderly and its associated factors. *Acta Med Indones*. 2020;52(1):47–54.

84. Hung CL, Goncalves A, Shah AM, Cheng S, Kitzman D, Solomon SD, et al. Age- and sex-related influences on left ventricular mechanics in elderly individuals free of prevalent heart failure. *Circ Cardiovasc Imaging*. 2017;10:1–9.

