

DAFTAR PUSTAKA

- Aboyans, V., Criqui, M.H., Abraham, P., Allison, M.A., Creager, M.A., Diehm, C., Fowkes, F.G.R., Hiatt, W.R., Jönsson, B., Lacroix, P., Marin, B., McDermott, M.M., Norgren, L., Pande, R.L., Preux, P.M., Stoffers, H.E., and Treat-Jacobson, D. 2012, Measurement and interpretation of the Ankle-Brachial Index: A scientific statement from the American Heart Association, *Circulation*, 126 (24):2890–2909.
- Ae, Y.H., Kim, J.Y., Choi, E.Y., Kim, S.A., Rhee, S.J., Chi, Y.S., Kang, S.M., Ha, J.W., and Chung, N. 2009, Value of ventricular stiffness index and ventriculoarterial interaction in patients with nonischemic dilated cardiomyopathy, *Circulation Journal*, 73 (9):1683–1690.
- Ahmed, A., Aronow, W.S., and Fleg, J.L. 2006, Higher New York Heart Association classes and increased mortality and hospitalization in patients with heart failure and preserved left ventricular function, *American Heart Journal*, 151 (2):444–450.
- Akar, J.G., Al-Chekakie, M.O., Fugate, T., Moran, L., Froloshki, B., Varma, N., Santucci, P., Wilber, D.J., and Matsumura, M.E. 2008, Endothelial dysfunction in heart failure identifies responders to cardiac resynchronization therapy, *Heart Rhythm*, 5 (9):1229–1235.
- Akerman, J.P., Heckman, G.A., and McKelvie, R.S. 2015, Exercise capacity and aging, *American Journal of Lifestyle Medicine*, 9 (4):252–265.
- Alidadi, M., Montecucco, F., Jamialahmadi, T., Al-Rasadi, K., Johnston, T.P., and Sahebkar, A. 2021, Beneficial effect of statin therapy on arterial stiffness, *BioMed Research International*, 2021.
- Allard, N.A.E. *et al.* (2018) ‘Statins Affect Skeletal Muscle Performance: Evidence for Disturbances in Energy Metabolism’, *The Journal of Clinical Endocrinology and Metabolism*, 103(1), pp. 75–84. doi:10.1210/jc.2017-01561.
- Alwi, I. 2014, *Buku ajar ilmu penyakit dalam. Jilid I. Edisi VI. 2014 / FKUI*, Jakarta Interna Publishing.
- Anderson, K.R., Sutton, M.G.S.J., and Lie, J.T. 1979, Histopathological types of cardiac fibrosis in myocardial disease, *The Journal of Pathology*, 128 (2):79–85.
- Anker, S.D. *et al.* (1997) ‘Tumor necrosis factor and steroid metabolism in chronic heart failure: possible relation to muscle wasting’, *Journal of the American College of Cardiology*, 30(4), pp. 997–1001.
- Antonini-Canterin, F., Poli, S., Vrizz, O., Pavan, D., Bello, V., and Nicolosi, G. 2013, The ventricular-arterial coupling: From basic pathophysiology to clinical application in the echocardiography laboratory, *Journal of Cardiovascular Echography*, 23 (4):91–95.
- Arena, R., Myers, J., Williams, M.A., Gulati, M., Kligfield, P., Balady, G.J., Collins, E., and Fletcher, G. 2007, Assessment of functional capacity in clinical and research settings: A scientific statement from the American Heart Association committee on exercise, rehabilitation, and prevention of the council on clinical cardiology and the council on cardiovascular n, *Circulation*, 116 (3):329–343.
- Ariendanie, A., Putranto, J.N.E., and Ranuh, I.G.N.I.R. 2020, Correlation between Osteoprotegerin Serum Levels and Arterial Stiffness Assessed by Cardio-ankle Vascular Index (CAVI) in Hypertensive Patients, *IOP Conference Series: Earth and Environmental Science*, 441 (1).
- Asmar, R. 2017, Principles and usefulness of the cardio-ankle vascular index (CAVI): A new global arterial stiffness index, *European Heart Journal, Supplement*, 19:B4–B10.
- Bajraktari, G., Batalli, A., Poniku, A., Ahmeti, A., Olloni, R., Hyseni, V., Vela, Z., Morina,

- B., Tafarshiku, R., Vela, D., Rashiti, P., Haliti, E., and Henein, M.Y. 2012, Left ventricular markers of global dyssynchrony predict limited exercise capacity in heart failure, but not in patients with preserved ejection fraction, *Cardiovascular Ultrasound*, 10 (1):1–8.
- Bajraktari, G., Dini, F.L., Fontanive, P., Elezi, S., Berisha, V., Napoli, A.M., Ciuti, M., and Henein, M. 2011, Independent and incremental prognostic value of Doppler-derived left ventricular total isovolumic time in patients with systolic heart failure, *International Journal of Cardiology*, 148 (3):271–275.
- Balady, G.J., Arena, R., Sietsema, K., Myers, J., Coke, L., Fletcher, G.F., Forman, D., Franklin, B., Guazzi, M., Gulati, M., Keteyian, S.J., Lavie, C.J., MacKo, R., Mancini, D., and Milani, R. V. 2010, Clinician's guide to cardiopulmonary exercise testing in adults: A scientific statement from the American heart association, *Circulation*, 122 (2):191–225.
- Bauersachs, J., Bouloumié, A., Fraccarollo, D., Hu, K., Busse, R., and Ertl, G. 1999, Endothelial dysfunction in chronic myocardial infarction despite increased vascular endothelial nitric oxide synthase and soluble guanylate cyclase expression: Role of enhanced vascular superoxide production, *Circulation*, 100 (3):292–298.
- Beatty, A.L., Schiller, N.B., and Whooley, M.A. 2012, Six-minute walk test as a prognostic tool in stable coronary heart disease: Data from the heart and soul study, *Archives of Internal Medicine*.
- Becker, L. 2013, Cancer Notes, *Leaving Art*, (January):211–221.
- Beriault, K., Carpentier, A.C., Gagnon, C., Ménard, J., Baillargeon, J.P., Ardilouze, J.L., and Langlois, M.F. 2009, Reproducibility of the 6-minute walk test in obese adults, *International Journal of Sports Medicine*, 30 (10):725–727.
- Berry, C. and Clark, A.L. (2000) 'Catabolism in chronic heart failure', *European Heart Journal*, 21(7), pp. 521–532. doi:10.1053/euhj.1999.188
- Bhatta, A., Yao, L., Xu, Z., Toque, H.A., Chen, J., Atawia, R.T., Fouda, A.Y., Bagi, Z., Lucas, R., Caldwell, R.B., and Caldwell, R.W. 2017, Obesity-induced vascular dysfunction and arterial stiffening requires endothelial cell arginase 1, *Cardiovascular Research*, 113 (13):1664–1676.
- Binkley, P.F., Van Fossen, D.B., Nunziata, E., Unverferth, D. V., and Leier, C. V. 1990, Influence of positive inotropic therapy on pulsatile hydraulic load and ventricular-vascular coupling in congestive heart failure, *Journal of the American College of Cardiology*, 15 (5):1127–1135.
- Björnstad, H., Cohen Solal, A., Dubach, P., Fioretti, P.M., Giannuzzi, P., Hambrecht, R., Hellemans, I., McGee, H., Mendes, M., Perk, J., Saner, H., Verres, G., Brutsaert, D.L., Cleland, J.G.F., Dresler, H., Erhardt, L., Ferrari, R., Van Gilst, W.H., Komajda, M., Madeira, H., Mercadier, J.J., Nieminen, M., Poole-Wilson, P.A., Rieger, G.A.J., Ruzillo, W., Swedberg, K., and Tavazzi, L. 2001, Recommendations for exercise testing in chronic heart failure patients, *European Heart Journal*, 22 (1):37–45.
- Boesen, M.E., Singh, D., Menon, B.K., and Frayne, R. 2015, A systematic literature review of the effect of carotid atherosclerosis on local vessel stiffness and elasticity, *Atherosclerosis*, 243 (1):211–222.
- Bokuda, K., Ichihara, A., Sakoda, M., Mito, A., Kinouchi, K., and Itoh, H. 2010, Blood pressure-independent effect of candesartan on cardio-ankle vascular index in hypertensive patients with metabolic syndrome, *Vascular Health and Risk Management*, 6 (1):571–578.
- Borkowf, C.B., Johnson, L.L., and Albert, P.S. 2018, Chapter 25 - Power and Sample Size Calculations, In: J.I. Gallin, F.P. Ognibene, and L.L. Johnson, eds. *Principles and Practice of Clinical Research (Fourth Edition)*. Boston: Academic Press, 359–372.

- Borlaug, B.A. and Kass, D.A. 2008, Ventricular-Vascular Interaction in Heart Failure, *Heart Failure Clinics*, 4(1):23-36.
- Borlaug, B.A. and Kass, D.A. 2011, Ventricular-Vascular Interaction in Heart Failure, *Cardiology Clinics*, 29 (3):447–459.
- Borlaug, B.A., Lam, C.S.P., Roger, V.L., Rodeheffer, R.J., and Redfield, M.M. 2009, Contractility and Ventricular Systolic Stiffening in Hypertensive Heart Disease. Insights Into the Pathogenesis of Heart Failure With Preserved Ejection Fraction, *Journal of the American College of Cardiology*, 54 (5):410–418.
- Borlaug, B.A., Melenovsky, V., Russell, S.D., Kessler, K., Pacak, K., Becker, L.C., and Kass, D.A. 2006, Impaired chronotropic and vasodilator reserves limit exercise capacity in patients with heart failure and a preserved ejection fraction, *Circulation*, 114 (20):2138–2147.
- Borlaug, B.A., Nishimura, R.A., Sorajja, P., Lam, C.S.P., and Redfield, M.M. 2010, Exercise hemodynamics enhance diagnosis of early heart failure with preserved ejection fraction, *Circulation: Heart Failure*, 3 (5):588–595.
- Boyes, N.G. and Tomczak, C.R. 2018, Predicting the Response to Cardiac Rehabilitation: Identifying the Right Ventricular Predictor of Oxygen Uptake Improvement in Heart Failure Patients, *Canadian Journal of Cardiology*, 34(10):1256-1258.
- Brandes, R.P., Fleming, I., and Busse, R. 2005, Endothelial aging, *Cardiovascular Research*, 66 (2):286–294.
- Briones, A.M., Rodríguez-Criado, N., Hernanz, R., García-Redondo, A.B., Rodríguez-Díez, R.R., Alonso, M.J., Egido, J., Ruiz-Ortega, M., and Salaices, M. 2009, Atorvastatin prevents angiotensin II-induced vascular remodeling and oxidative stress, *Hypertension*, 54 (1):142–149.
- Cahalin, L.P., Mathier, M.A., Semigran, M.J., Dec, G.W., and DiSalvo, T.G. 1996, The six-minute walk test predicts peak oxygen uptake and survival in patients with advanced heart failure, *Chest*, 110 (2):325–332.
- Caldwell, R.W., Rodriguez, P.C., Toque, H.A., Priya Narayanan, S., and Caldwell, R.B. 2018, Arginase: A multifaceted enzyme important in health and disease, *Physiological Reviews*, 98 (2):641–665.
- Cannon, C.P., Brindis, R.G., Chaitman, B.R., Cohen, D.J., Cross, J.T., Drozda, J.P., Fesmire, F.M., *et al.*, 2013 ACCF/AHA Key data elements and definitions for measuring the clinical management and outcomes of patients with acute coronary syndromes and coronary artery disease: A report of the American college of cardiology foundation/American Heart Association, *Circulation*, 127 (9):1052–1089.
- Celermajer, D.S., Sorensen, K.E., Spiegelhalter, D.J., Georgakopoulos, D., Robinson, J., and Deanfield, J.E. 1994, Aging is associated with endothelial dysfunction in healthy men years before the age-related decline in women, *Journal of the American College of Cardiology*, 24 (2):471–476.
- Chambers, D.J. and Wisely, N.A. 2019, Cardiopulmonary exercise testing—a beginner’s guide to the nine-panel plot, *BJA Education*, 19 (5):158–164.
- Chen, C.H., Fetters, B., Nevo, E., Rochitte, C.E., Chiou, K.R., Ding, P.Y.A., Kawaguchi, M., and Kass, D.A. 2001, Noninvasive single-beat determination of left ventricular end-systolic elastance in humans, *Journal of the American College of Cardiology*, 38 (7):2028–2034.
- Chen, Y.Z., Qiao, S. Bin, Hu, F.H., Yuan, J.S., Yang, W.X., Cui, J.G., Zhang, Y., and Zhang, C.L. 2015, Left ventricular remodeling and fibrosis: Sex differences and relationship with diastolic function in hypertrophic cardiomyopathy, *European Journal of Radiology*, 84 (8):1487–1492.
- Chioncel, O., Mebazaa, A., Maggioni, A.P., Harjola, V.P., Rosano, G., Laroche, C., *et al.*,

- ., 2019, Acute heart failure congestion and perfusion status – impact of the clinical classification on in-hospital and long-term outcomes; insights from the ESC-EORP-HFA Heart Failure Long-Term Registry, *European Journal of Heart Failure*, 21 (11):1338–1352.
- Crespo-Leiro, M.G., Anker, S.D., Maggioni, A.P., Coats, A.J., Filippatos, G., Ruschitzka, F., Ferrari, R., Piepoli, M.F., Jimenez, J.F.D., Metra, M., Fonseca, C., Hradec, J., Amir, O., Logeart, D., Dahlström, U., Merkely, B., Drozd, J., Goncalvesova, E., *et al.*. 2016, European Society of Cardiology Heart Failure follow-up outcomes and differences across regions, *ESC heart failure*, 18:613–625.
- Cyberknop, L.J., Farro, I., Americo, C., Martinez, F., Lluberas, N., Parma, G., Aramburu, J., and Armentano, R.L. 2020, Arterial-Ventricular Coupling Evaluation in Individuals with Stress-Evidenced Diastolic Dysfunction: A Pilot Study, *In: Proceedings of the Annual International Conference of the IEEE Engineering in Medicine and Biology Society, EMBS*. Institute of Electrical and Electronics Engineers Inc., 2598–2601.
- Davies, J.I. and Struthers, A.D. 2003, Pulse wave analysis and pulse wave velocity: A critical review of their strengths and weaknesses, *Journal of Hypertension*, 21 (3):463–472.
- Deguchi, I., Horiuchi, Y., Hayashi, T., Sehara, Y., Kato, Y., Ohe, Y., Fukuoka, T., Maruyama, H., Sano, H., Nagamine, Y., and Tanahashi, N. 2014, Effects of rosuvastatin on serum lipids and arteriosclerosis in dyslipidemic patients with cerebral infarction, *Journal of Stroke and Cerebrovascular Diseases*, 23 (8):2007–2011.
- Del Buono, M.G., Arena, R., Borlaug, B.A., Carbone, S., Canada, J.M., Kirkman, D.L., Garten, R., Rodriguez-Miguel, P., Guazzi, M., Lavie, C.J., and Abbate, A. 2019, Exercise Intolerance in Patients With Heart Failure: JACC State-of-the-Art Review, *Journal of the American College of Cardiology*, 73 (17):2209–2225.
- Devereux, R.B., Roman, M.J., Parancas, M., O’Grady, M.J., Lee, E.T., Welty, T.K., Fabsitz, R.R., Robbins, D., Rhoades, E.R., and Howard, B. V. 2000, Impact of Diabetes on Cardiac Structure and Function, *Circulation*, 101 (19):2271–2276.
- Ding, Y., Han, Y., Lu, Q., An, J., Zhu, H., Xie, Z., Song, P., and Zou, M.H. 2019, Peroxynitrite-mediated SIRT (sirtuin)-1 inactivation contributes to nicotine-induced arterial stiffness in mice, *Arteriosclerosis, Thrombosis, and Vascular Biology*, 39 (7):1419–1431.
- Du, H., Wonggom, P., Tongpeth, J., and Clark, R.A. 2017, Six-Minute Walk Test for Assessing Physical Functional Capacity in Chronic Heart Failure, *Current Heart Failure Reports*, 14 (3):158–166.
- Duca, L., Blaise, S., Romier, B., Laffargue, M., Gayral, S., El Btaouri, H., Kawecki, C., Guillot, A., Martiny, L., Debelle, L., and Maurice, P. 2016, Matrix ageing and vascular impacts: Focus on elastin fragmentation, *Cardiovascular Research*, 110 (3):298–308.
- Dunzendorfer, S., Rothbucher, D., Schratzberger, P., Reinisch, N., Kähler, C.M., and Wiedermann, C.J. 1997, Mevalonate-dependent inhibition of transendothelial migration and chemotaxis of human peripheral blood neutrophils by pravastatin, *Circulation Research*. 81(6):963-9.
- Elder, S.G.C. Van. 2009, Association of Aortic Arch Pulse Wave Velocity with Left Ventricular Mass and Lacunar Brain Infarcts in Hypertensive Purpose : Methods : Results : Conclusion :, 253 (3):681–688.
- Faconti, L., Mills, C.E., Govoni, V., Gu, H., Morant, S., Jiang, B., Cruickshank, J.K., and Webb, A.J. 2019, Cardiac effects of 6 months’ dietary nitrate and spironolactone in

- patients with hypertension and with/at risk of type 2 diabetes, in the factorial design, double-blind, randomized controlled VaSera trial, *British Journal of Clinical Pharmacology*, 85 (1):169–180.
- Fahruzi, I., Hardiristanto, S., Elektro, J.T., and Industri, F.T. 2012, Deteksi Kelainan Premature Atrial Contractions (Pacs) Berbasis Kombinasi Baseline Wander Dan Transformasi Wavelet, 2012 (Snati):15–16.
- Fleg, J.L., Cooper, L.S., Levine, B.D., Pfeffer, M.A., Piña, I.L. 2016. Exercise Training as Therapy for Heart Failure: Current Status and Future Directions. *circheartfailure*.113.001420
- Fry, J.L., Al Sayah, L., Weisbrod, R.M., Van Roy, I., Weng, X., Cohen, R.A., Bachschmid, M.M., and Seta, F. 2016, Vascular smooth muscle sirtuin-1 protects against diet-induced aortic stiffness, *Hypertension*, 68 (3):775–784.
- Fujiwara, K., Shimada, K., Nishitani-yokoyama, M., Kunimoto, M., Matsubara, T., Matsumori, R., Abulimiti, A., Aikawa, T., Ouchi, S., Shimizu, M., Fukao, K., Morisawa, T., and Takahashi, T. 2021, Arterial Stiffness Index and Exercise Tolerance in Patients Undergoing Cardiac Rehabilitation, 230–237.
- Ganau, A., Devereux, R.B., Roman, M.J., de Simone, G., Pickering, T.G., Saba, P.S., Vargiu, P., Simongini, I., and Laragh, J.H. 1992, Patterns of left ventricular hypertrophy and geometric remodeling in essential hypertension, *Journal of the American College of Cardiology*, 19 (7):1550–1558.
- Gardin, J.M., Leifer, E.S., Fleg, J.L., Whellan, D., Kokkinos, P., LeBlanc, M.H., Wolfel, E., and Kitzman, D.W. 2009, Relationship of Doppler-Echocardiographic left ventricular diastolic function to exercise performance in systolic heart failure: The HF-ACTION study, *American Heart Journal*, 158 (4 SUPPL.).
- Gevaert, A.B., Boen, J.R.A., Segers, V.F., and Van Craenenbroeck, E.M. 2019, Heart failure with preserved ejection fraction: A review of cardiac and noncardiac pathophysiology, *Frontiers in Physiology*, 10 (MAY).
- Giannitsi, S., Bougiakli, M., Bechlioulis, A., Kotsia, A., Michalis, L.K., and Naka, K.K. 2019, 6-minute walking test: a useful tool in the management of heart failure patients, *Therapeutic advances in cardiovascular disease*. 13:1753944719870084.
- Gitt, A.K., Wasserman, K., Kilkowski, C., Kleemann, T., Kilkowski, A., Bangert, M., Schneider, S., Schwarz, A., and Senges, J. 2002, Exercise anaerobic threshold and ventilatory efficiency identify heart failure patients for high risk of early death, *Circulation*, 106 (24):3079–3084.
- Global Initiative for Chronic Obstructive Lung Disease. 2020, GOLD Report 2020, *Global Initiative for Chronic Obstructive Lung Disease*, 141.
- Gorabi, A.M., Kiaie, N., Hajighasemi, S., Banach, M., Penson, P.E., Jamialahmadi, T., and Sahebkar, A. 2019, Statin-Induced Nitric Oxide Signaling: Mechanisms and Therapeutic Implications, *Journal of Clinical Medicine*, 8 (12):2051.
- Greenberg, B.H. and Massie, B.M. 1980, Beneficial effects of afterload reduction therapy in patients with congestive heart failure and moderate aortic stenosis, *Circulation*, 61 (6):1212–1216.
- Grossman, W., Jones, D., and McLaurin, L.P. 1975, Wall stress and patterns of hypertrophy in the human left ventricle, *Journal of Clinical Investigation*, 56 (1):56–64.
- Grossman, W. and Moscucci, M. 2013, Evaluation of systolic and diastolic function of the ventricles and myocardium, In: *Grossman & Baim's Cardiac Catheterization, Angiography, and Intervention: Eighth Edition*. 467–488.
- Guyatt, G.H., Thompson, P.J., Berman, L.B., Sullivan, M.J., Townsend, M., Jones, N.L., and Pugsley, S.O. 1985, How should we measure function in patients with chronic heart and lung disease?, *Journal of Chronic Diseases*, 38 (6):517–524.

- Hariawan, H., Damarkusuma, A., Ismail, M.T., Nazihah, N., and Setianto, B.Y. 2020, Effect of nitrate administration on peak systolic velocity in peripheral arterial disease patients at Sardjito General Hospital in Yogyakarta, *Vascular Disease Management*, 17 (11):E212–E214.
- Hayashi, K., Yamamoto, T., Takahara, A., and Shirai, K. 2015, Clinical assessment of arterial stiffness with cardio-ankle vascular index: Theory and applications, *Journal of Hypertension*, 33 (9):1742–1757.
- Henry, G., Singer, R., Uprichard, A.C.G., Myers, J., and Froelicher, V.F. 1991, Point of view: Optimizing the exercise test for pharmacological investigations [1], *Circulation*, 83 (6):2144–2145.
- Hitsumoto, T. 2018, Clinical Significance of Cardio-Ankle Vascular Index as a Cardiovascular Risk Factor in Elderly Patients With Type 2 Diabetes Mellitus, *Journal of Clinical Medicine Research*, 10 (4):330–336.
- Holubarsch, C., Ruf, T., Goldstein, D.J., Ashton, R.C., Nicki, W., Pieske, B., Pioch, K., Lüdemann, J., Wiesner, S., Hasenfuss, G., Posival, H., Just, H., and Burkhoff, D. 1996, Existence of the Frank-Starling mechanism in the failing human heart: Investigations on the organ, tissue, and sarcomere levels, *Circulation*, 94 (4):683–689.
- Horinaka, S., Yabe, A., Yagi, H., Ishimura, K., Hara, H., Iemua, T., and Matsuoka, H. 2009, Comparison of atherosclerotic indicators between cardio ankle vascular index and brachial ankle pulse wave velocity, *Angiology*, 60 (4):468–476.
- Horwich, T.B., Fonarow, G.C., Hamilton, M.A., MacLellan, W.R., Woo, M.A., and Tillisch, J.H. 2001, The relationship between obesity and mortality in patients with heart failure, *Journal of the American College of Cardiology*, 38 (3):789–795.
- Houstis, N.E., Eisman, A.S., Pappagianopoulos, P.P., Wooster, L., Bailey, C.S., Wagner, P.D., and Lewis, G.D. 2018, Exercise intolerance in heart failure with preserved ejection fraction: Diagnosing and ranking Its causes using personalized O 2 pathway analysis, *Circulation*, 137 (2):148–161.
- Hu, H., Cui, H., Han, W., Ye, L., Qiu, W., Yang, H., Zhang, C., Guo, X., and Mao, G. 2013, A cutoff point for arterial stiffness using the cardio-ankle vascular index based on carotid arteriosclerosis, *Hypertension Research*, 36 (4):334–341.
- Ichiki, T., Takeda, K., Tokunou, T., Iino, N., Egashira, K., Shimokawa, H., Hirano, K., Kanaide, H., and Takeshita, A. 2001, Downregulation of angiotensin II type 1 receptor by hydrophobic 3-hydroxy-3-methylglutaryl coenzyme A reductase inhibitors in vascular smooth muscle cells. *Arterioscler Thromb Vasc Biol*. 21(12):1896-901.
- Ikonomidis, I., Aboyans, V., Blacher, J., Brodmann, M., Brutsaert, D.L., Chirinos, J.A., De Carlo, M., Delgado, V., Lancellotti, P., Lekakis, J., Mohty, D., Nihoyannopoulos, P., et al., 2019, The role of ventricular–arterial coupling in cardiac disease and heart failure: assessment, clinical implications and therapeutic interventions. A consensus document of the European Society of Cardiology Working Group on Aorta & Peripheral Vascular Diseases, *European Journal of Heart Failure*, 21 (4):402–424.
- Ishimitsu, T., Numabe, A., Masuda, T., Akabane, T., Okamura, A., Minami, J., and Matsuoka, H. 2009, Angiotensin-II receptor antagonist combined with calcium channel blocker or diuretic for essential hypertension, *Hypertension Research*, 32 (11):962–968.
- Issues, S., Test, M.W., Equipment, R., and Preparation, P. 2002, American Thoracic Society ATS Statement : Guidelines for the Six-Minute Walk Test, 166:111–117.
- Izuhara, M., Shioji, K., Kadota, S., Baba, O., Takeuchi, Y., Uegaito, T., Mutsuo, S., and Matsuda, M. 2008, Relationship of cardio-ankle vascular index (CAVI) to carotid and

- coronary arteriosclerosis, *Circulation Journal*, 72 (11):1762–1767.
- Jehn, M., Schmidt-Trucksäss, A., Schuster, T., Weis, M., Hanssen, H., Halle, M., and Koehler, F. 2009, Daily walking performance as an independent predictor of advanced heart failure. Prediction of exercise capacity in chronic heart failure, *American Heart Journal*, 157 (2):292–298.
- Kalantar-Zadeh, K. *et al.* (2004) ‘Reverse epidemiology of conventional cardiovascular risk factors in patients with chronic heart failure’, *Journal of the American College of Cardiology*, 43(8), pp. 1439–1444.
- Kang, S., Fan, H.M., Li, J., Fan, L.Y., Miao, A.Y., Bao, Y., Wu, L.Z., Zhu, Y., Zhang, D.F., and Liu, Z.M. 2010, Relationship of arterial stiffness and early mild diastolic heart failure in general middle and aged population, *European Heart Journal*, 31 (22):2799–2807.
- Kasprzyk, M., Wudarczyk, B., Czyz, R., Szarpak, L., and Jankowska-Polanska, B. 2018, Ischemic heart disease – definition, epidemiology, pathogenesis, risk factors and treatment, *Postępy Nauk Medycznych*, 31 (06):10–13.
- Kawasaki, T., Sasayama, S., Yagi, S.I., Asakawa, T., and Hirai, T. 1987, Non-invasive assessment of the age related changes in stiffness of major branches of the human arteries, *Cardiovascular Research*, 21 (9):678–687.
- Kemenkes, R. 2014, Pedoman Gizi Seimbang. Peraturan Menteri Kesehatan Republik Indonesia No. 41 tahun 2014, *Peraturan Menteri Kesehatan Republik Indonesia No. 41 tahun 2014*.
- Kenchiah, S. *et al.* (2007) ‘Body Mass Index and Prognosis in Patients With Chronic Heart Failure’, *Circulation*, 116(6), pp. 627–636. doi:10.1161/CIRCULATIONAHA.106.679779.
- Kenchiah, S., Gaziano, J.M. and Vasan, R.S. (2004) ‘Impact of obesity on the risk of heart failure and survival after the onset of heart failure’, *Medical Clinics*, 88(5), pp. 1273–1294.
- Kelder, J.C., Cramer, M.J., Van Wijngaarden, J., Van Tooren, R., Mosterd, A., Moons, K.G.M., Lammers, J.W., Cowie, M.R., Grobbee, D.E., and Hoes, A.W. 2011, The diagnostic value of physical examination and additional testing in primary care patients with suspected heart failure, *Circulation*, 124 (25):2865–2873.
- Kementerian Kesehatan RI. 2018, Laporan Nasional RISKESDAS 2018, *Laporan Nasional RISKESDAS 2018*.
- Kemp, C.D. and Conte, J. V. 2012, The pathophysiology of heart failure, *Cardiovascular Pathology*. 21(5):365-71
- Keteyian, S.J., Squires, R.W., Ades, P.A., and Thomas, R.J. 2014, Incorporating patients with chronic heart failure into outpatient cardiac rehabilitation: Practical recommendations for exercise and self-care counseling - A clinical review, *Journal of Cardiopulmonary Rehabilitation and Prevention*, 34 (4):223–232.
- Kim, C.W., Pokutta-Paskaleva, A., Kumar, S., Timmins, L.H., Morris, A.D., Kang, D.W., Dalal, S., Chadid, T., Kuo, K.M., Raykin, J., Li, H., Yanagisawa, H., Gleason, R.L., Jo, H., and Brewster, L.P. 2017, Disturbed flow promotes arterial stiffening through thrombospondin-1, *Circulation*, 136 (13):1217–1232.
- Kim, H., Kim, H., Yoon, H., Park, H., Cho, Y., Nam, C., Hur, S., Kim, Y., and Kim, K. 2014, Association of cardio-ankle vascular index with diastolic heart function in hypertensive patients, 1963 (4):200–205.
- Kinouchi, K., Ichihara, A., Sakoda, M., Kurauchi-Mito, A., and Itoh, H. 2009, Safety and benefits of a tablet combining losartan and hydrochlorothiazide in Japanese diabetic patients with hypertension, *Hypertension Research*. 32(12):1143-7.
- Kinouchi, K., Ichihara, A., Sakoda, M., Kurauchi-Mito, A., Murohashi-Bokuda, K., and

- Itoh, H. 2010, Effects of telmisartan on arterial stiffness assessed by the cardio-ankle vascular index in hypertensive patients, *Kidney and Blood Pressure Research*, 33 (4):304–312.
- Kirigaya, J., Iwahashi, N., Tahakashi, H., Minamimoto, Y., Gohbara, M., and Abe, T. 2019, Impact of Cardio-Ankle Vascular Index on Long-Term Outcome in Patients with Acute Coronary Syndrome. *J Atheroscler Thromb.* 27(7):657-668.
- Kitzman, D.W. and Groban, L. 2011, Exercise Intolerance, *Cardiology Clinics*. 4(1):99-115
- Kitzman, D.W., Herrington, D.M., Brubaker, P.H., Moore, J.B., Eggebeen, J., and Haykowsky, M.J. 2013, Carotid arterial stiffness and its relationship to exercise intolerance in older patients with heart failure and preserved ejection fraction, *Hypertension*. 61(1):112-9.
- Knuuti, J., Wijns, W., Achenbach, S., Agewall, S., Barbato, E., Bax, J.J., Capodanno, D., Cuisset, T., Deaton, C., Dickstein, K., Edvardsen, T., Escaned, J., Funck-Brentano, *et al.*, 2020, 2019 ESC guidelines for the diagnosis and management of chronic coronary syndromes, *European Heart Journal*, 41 (3):407–477.
- Koniari, I., Mavrilas, D., Apostolakis, E., Papadimitriou, E., Papadaki, H., Papalois, A., Poimenidi, E., Xanthopoulou, I., Hahalis, G., and Alexopoulos, D. 2016, Inhibition of atherosclerosis progression, intimal hyperplasia, and oxidative stress by simvastatin and ivabradine may reduce thoracic aorta's stiffness in hypercholesterolemic rabbits, *Journal of Cardiovascular Pharmacology and Therapeutics*, 21 (4):412–422.
- Kothe, H., Dalhoff, K., Rupp, J., Müller, A., Kreuzer, J., Maass, M., and Katus, H.A. 2000, Hydroxymethylglutaryl coenzyme A reductase inhibitors modify the inflammatory response of human macrophages and endothelial cells infected with *Chlamydia pneumoniae*, *Circulation*, 101 (15):1760–1763.
- Kubozono, T., Miyata, M., Ueyama, K., Nagaki, A., Hamasaki, S., Kusano, K., Kubozono, O., and Tei, C. 2009, Association between arterial stiffness and estimated glomerular filtration rate in the Japanese general population., *Journal of atherosclerosis and thrombosis*, 16 (6):840–845.
- Kubozono, T., Miyata, M., Ueyama, K., Nagaki, A., Otsuji, Y., Kusano, K., Kubozono, O., and Tei, C. 2007, Clinical significance and reproducibility of new arterial distensibility index, *Circulation Journal*, 71 (1):89–94.
- Lacolley, P., Regnault, V., and Laurent, S. 2020, Mechanisms of Arterial Stiffening: From Mechanotransduction to Epigenetics, *Arteriosclerosis, Thrombosis, and Vascular Biology*, (May):1055–1062.
- Lam, C.S.P., Shah, A.M., Borlaug, B.A., Cheng, S., Verma, A., Izzo, J., Oparil, S., Aurigemma, G.P., Thomas, J.D., Pitt, B., Zile, M.R., and Solomon, S.D. 2013, Effect of antihypertensive therapy on ventricular-arterial mechanics, coupling, and efficiency, *European Heart Journal*, 34 (9):676–683.
- Lavie, C.J. *et al.* (2003) 'Body composition and prognosis in chronic systolic heart failure: the obesity paradox', *American Journal of Cardiology*, 91(7), pp. 891–894.
- Lavie, C.J., Mehra, M.R. and Milani, R.V. (2005) 'Obesity and heart failure prognosis: paradox or reverse epidemiology?', *European Heart Journal*. Oxford University Press, pp. 5–7.
- Levet, D.Z.H., Jack, S., Swart, M., Carlisle, J., Wilson, J., Snowden, C., Riley, M., Danjoux, G., Ward, S.A., Older, P., and Grocott, M.P.W. 2018, Perioperative cardiopulmonary exercise testing (CPET): consensus clinical guidelines on indications, organization, conduct, and physiological interpretation, *British Journal of Anaesthesia*, 120 (3):484–500.

- Lidder, S. and Webb, A.J. 2013, Vascular effects of dietary nitrate (as found in green leafy vegetables and beetroot) via the nitrate-nitrite-nitric oxide pathway, *British Journal of Clinical Pharmacology*, 75 (3):677–696.
- Little, W.C. and Pu, M. 2009, Left Ventricular-Arterial Coupling, *Journal of the American Society of Echocardiography*, 22(11):1246-8
- Litwin, S.E. and Grossman, W. 1993, Diastolic dysfunction as a cause of heart failure, *Journal of the American College of Cardiology*, 22 (4 SUPPL. 1).
- Long, W. *et al.* (2020) ‘Effect of nitrate treatment on functional capacity and exercise time in patients with heart failure: a systematic review and meta-analysis’, *The Journal of International Medical Research*, 48(8), p. 0300060520939742. doi:10.1177/0300060520939742.
- Mandic, S., Walker, R., Stevens, E., Nye, E.R., Body, D., Barclay, L., and Williams, M.J.A. 2013, Estimating exercise capacity from walking tests in elderly individuals with stable coronary artery disease, *Disability and Rehabilitation*, 35 (22):1853–1858.
- Mant, J., Doust, J., Roalfe, A., Barton, P., Cowie, M.R., Glasziou, P., Mant, D., McManus, R.J., Holder, R., Deeks, J., Fletcher, K., Qume, M., Sohanpal, S., Sanders, S., and Hobbs, F.D.R. 2009, Systematic review and individual patient data meta-analysis of diagnosis of heart failure, with modelling of implications of different diagnostic strategies in primary care, *Health Technology Assessment*, 13 (32).
- Marti, C.N., Gheorghiade, M., Kalogeropoulos, A.P., Georgiopoulou, V. V., Quyyumi, A.A., and Butler, J. 2012, Endothelial dysfunction, arterial stiffness, and heart failure, *Journal of the American College of Cardiology*, 60 (16):1455–1469.
- Mayasari, D.S., Taufiq, N., and Hariawan, H. 2021, Association of monocyte-to-high density lipoprotein ratio with arterial stiffness in patients with diabetes, *BMC Cardiovascular Disorders*, 21 (1):1–10.
- McDonagh, T.A., Metra, M., Adamo, M., Gardner, R.S., Baumbach, A., Böhm, M., Burri, H., Butler, J., Čelutkienė, J., Chioncel, O., Cleland, J.G.F., Coats, A.J.S., Crespo-Leiro, M.G., Farmakis, D., Gilard, M., Heymans, S., Hoes, A.W., Jaarsma, T., *et al.*, 2021 ESC Guidelines for the diagnosis and treatment of acute and chronic heart failure, *European Heart Journal*, 42 (36):3599–3726.
- Meguro, T., Nagatomo, Y., Nagae, A., Seki, C., Kondou, N., Shibata, M., and Oda, Y. 2009, Elevated arterial stiffness evaluated by brachial-ankle pulse wave velocity is deleterious for the prognosis of patients with heart failure, *Circulation Journal*, 73 (4):673–680.
- Mesquita, R., Gonçalves, C.G., Hayashi, D., Costa, V. de S.P., Teixeira, D. de C., de Freitas, E.R.F.S., Felcar, J.M., Pitta, F., Molari, M., and Probst, V.S. 2015, Smoking status and its relationship with exercise capacity, physical activity in daily life and quality of life in physically independent, elderly individuals, *Physiotherapy (United Kingdom)*, 101 (1):55–61.
- Metra, M. *et al.* (2000) ‘Differential Effects of β -Blockers in Patients With Heart Failure’, *Circulation*, 102(5), pp. 546–551. doi:10.1161/01.CIR.102.5.546.
- Mikhin, V.P., Zhilyaeva, Y.A., Vorotyntseva, V. V, Nebieridze, D. V, Akhmedzhanov, N.M., Vasil’Eva, D.A., Chernyatina, M.A., and Gromnatsky, N.I. 2016, Hypolipidemic and pleiotropic efficacy of rosuvastatin in arterial hypertension patients of high cardiovascular risk in long-term outpatient follow-up, *Russian Journal of Cardiology*, 140 (12):90–96.
- Mills, C.E., Govoni, V., Faconti, L., Casagrande, M.L., Morant, S. V., Crickmore, H., Iqbal, F., Maskell, P., Masani, A., Nanino, E., Webb, A.J., and Cruickshank, J.K. 2020, A randomised, factorial trial to reduce arterial stiffness independently of blood pressure: Proof of concept? The VaSera trial testing dietary nitrate and

- spironolactone, *British Journal of Clinical Pharmacology*, 86 (5):891–902.
- Miyashita, Y., Endo, K., Saiki, A., Ban, N., Yamaguchi, T., Kawana, H., Nagayama, D., Ohira, M., Oyama, T., and Shirai, K. 2009, Effects of pitavastatin, a 3-hydroxy-3-methylglutaryl coenzyme a reductase inhibitor, on cardio-ankle vascular index in type 2 diabetic patients, *Journal of Atherosclerosis and Thrombosis*, 16 (5):539–545.
- Miyashita, Y., Saiki, A., Endo, K., Ban, N., Yamaguchi, T., Kawana, H., Nagayama, D., Ohira, M., Oyama, T., and Shirai, K. 2009, Effects of olmesartan, an angiotensin II receptor blocker, and amlodipine, a calcium channel blocker, on cardio-ankle vascular index (CAVI) in type 2 diabetic patients with hypertension, *Journal of Atherosclerosis and Thrombosis*, 16 (5):621–626.
- Miyoshi, T., Doi, M., Hirohata, S., Sakane, K., Kamikawa, S., Kitawaki, T., Kaji, Y., Kusano, K.F., Ninomiya, Y., and Kusachi, S. 2010, Cardio-ankle vascular index is independently associated with the severity of coronary atherosclerosis and left ventricular function in patients with Ischemic heart disease, *Journal of Atherosclerosis and Thrombosis*, 17 (3):249–258.
- Mizuguchi, Y., Oishi, Y., Tanaka, H., Miyoshi, H., Ishimoto, T., Nagase, N., and Oki, T. 2007, Arterial Stiffness Is Associated With Left Ventricular Diastolic Function in Patients With Cardiovascular Risk Factors: Early Detection With the Use of Cardio-Ankle Vascular Index and Ultrasonic Strain Imaging, *Journal of Cardiac Failure*, 13 (9):744–751.
- Moningka, B.L.M., Rampengan, S.H., and Jim, E.L. 2021, Diagnosis dan Tatalaksana Terkini Penyakit Jantung Hipertensi, *e-CliniC*, 9 (1):96–103
- Montero, D. and Haider, T. (2018) ‘Relationship of loop diuretic use with exercise intolerance in heart failure with preserved ejection fraction’, *European Heart Journal - Cardiovascular Pharmacotherapy*, 4(3), pp. 138–141. doi:10.1093/ehjcvp/pvy001.
- Muniyappa, R. and Sowers, J.R. 2013, Role of insulin resistance in endothelial dysfunction, *Reviews in Endocrine and Metabolic Disorders*, 14 (1):5–12.
- Nakamura, K., Iizuka, T., Takahashi, M., Shimizu, K., Mikamo, H., Nakagami, T., Suzuki, M., Hirano, K., Sugiyama, Y., Tomaru, T., Miyashita, Y., Shirai, K., and Noike, H. 2009, Association between cardio-ankle vascular index and serum cystatin C levels in patients with cardiovascular risk factor, *Journal of Atherosclerosis and Thrombosis*. 16(4):371-9.
- Nakamura, K., Tomaru, T., Yamamura, S., Miyashita, Y., Shirai, K., and Noike, H. 2008, Cardio-Ankle Vascular Index is a Candidate Predictor, *Circulation journal : official journal of the Japanese Circulation Society*, 72:598–604.
- Namba, T., Masaki, N., Takase, B., and Adachi, T. 2019, Arterial Stiffness Assessed by Cardio-Ankle Vascular Index. 20(15):366.
- Narang, R., Swedberg, K., and Cleland, J.G.F. 1996, What is the ideal study design for evaluation of treatment for heart failure? Insights from trials assessing the effect of ACE inhibitors on exercise capacity, *European Heart Journal*, 17 (1):120–134.
- Nieminen, M.S., Brutsaert, D., Dickstein, K., Drexler, H., Follath, F., Harjola, V.P., Hochadel, M., Komajda, M., Lassus, J., Lopez-Sendon, J.L., Ponikowski, P., Tavazzi, et al. 2006, EuroHeart Failure Survey II (EHFS II): A survey on hospitalized acute heart failure patients: Description of population, *European Heart Journal*, 27 (22):2725–2736.
- Ogawa, A., Shimizu, K., Nakagami, T., Maruoka, H., and Shirai, K. 2020, Physical function and cardio-ankle vascular index in elderly heart failure patients, *International Heart Journal*, 61 (4):769–775.
- Ohashi, N., Ito, C., Fujikawa, R., Yamamoto, H., Kihara, Y., and Kohno, N. 2009, The impact of visceral adipose tissue and high-molecular weight adiponectin on cardio-

- ankle vascular index in asymptomatic Japanese subjects, *Metabolism: Clinical and Experimental*, 58 (7):1023–1029.
- Ohte, N., Cheng, C.P., and Little, W.C. 2003, Tachycardia exacerbates abnormal left ventricular-arterial coupling in heart failure, *Heart and Vessels*, 18 (3):136–141.
- Oktovianto, A., Laksmi, N.P.A., Yogiarto, R.M., and Putranto, J.N.E. 2020, The correlation between serum TG/HDL-c ratio and arterial stiffness using the cardio-ankle vascular index in overweight or obese patients, *Cardiovascular and Cardiometabolic Journal (CCJ)*, 1 (2):31.
- Okura, T., Watanabe, S., Kurata, M., Manabe, S., Koresawa, M., Irita, J., Enomoto, D., Miyoshi, K.I., Fukuoka, T., and Higaki, J. 2007, Relationship between cardio-ankle vascular index (CAVI) and carotid atherosclerosis in patients with essential hypertension, *Hypertension Research*, 30 (4):335–340.
- Olsson, L.G., Swedberg, K., Clark, A.L., Witte, K.K., and Cleland, J.G.F. 2005, Six minute corridor walk test as an outcome measure for the assessment of treatment in randomized, blinded intervention trials of chronic heart failure: A systematic review, *European Heart Journal*, 26 (8):778–793.
- Pandey, A., Khan, H., Newman, A.B., Lakatta, E.G., Forman, D.E., Butler, J., and Berry, J.D. 2017, Arterial Stiffness and Risk of Overall Heart Failure, Heart Failure with Preserved Ejection Fraction, and Heart Failure with Reduced Ejection Fraction: The Health ABC Study (Health, Aging, and Body Composition), *Hypertension*, 69 (2):267–274.
- Papaioannou, T.G., Stamatelopoulos, K.S., Gialafos, E., Vlachopoulos, C., Karatzis, E., Nanas, J., and Lekakis, J. 2004, Monitoring of arterial stiffness indices by applanation tonometry and pulse wave analysis: Reproducibility at low blood pressures, *Journal of Clinical Monitoring and Computing*, 18 (2):137–144.
- Paravastu, S.C.V., Mendonca, D.A., and da Silva, A. 2009, Beta Blockers for Peripheral Arterial Disease, *European Journal of Vascular and Endovascular Surgery*, 38 (1):66–70.
- Parodi, O., De Maria, R., and Roubina, E. 2007, Redox state, oxidative stress and endothelial dysfunction in heart failure: The puzzle of nitrate-thiol interaction, *Journal of Cardiovascular Medicine*, 8 (10):765–774.
- PERKENI. 2019, *Pedoman Pengelolaan dan Pencegahan Diabetes Melitus Tipe 2 Dewasa di Indonesia 2019*, Perkumpulan Endokrinologi Indonesia.
- PERKI. 2015, *Pedoman tatalaksana sindrom koroner akut*, *Pedoman Tatalaksan Sindrome Koroner Akut*, 88.
- Piepoli, M.F., Conraads, V., CorrÁ, U., Dickstein, K., Francis, D.P., Jaarsma, T., McMurray, J., Pieske, B., Piotrowicz, E., Schmid, J.P., Anker, S.D., Solal, A.C., Filippatos, G.S., Hoes, A.W., Gielen, S., Giannuzzi, P., and Ponikowski, P.P. 2011, Exercise training in heart failure: From theory to practice. A consensus document of the Heart Failure Association and the European Association for Cardiovascular Prevention and Rehabilitation, *European Journal of Heart Failure*. 13(4):347–57.
- Poelzl, G., Frick, M., Huegel, H., Lackner, B., Alber, H.F., Mair, J., Herold, M., Schwarzacher, S., Pachinger, O., and Weidinger, F. 2005, Chronic heart failure is associated with vascular remodeling of the brachial artery, *European Journal of Heart Failure*, 7 (1):43–48.
- Poitras, V.J., Hudson, R.W., and Tschakovsky, M.E. 2018, Exercise intolerance in Type 2 diabetes: Is there a cardiovascular contribution?, *Journal of Applied Physiology*, 124 (5):1117–1139.
- Polychronis Dilaveris, Georgios Giannopoulos, Maria Riga, Andreas Synetos, and Christodoulos Stefanadis. 2007, Beneficial Effects of Statins on Endothelial

- Dysfunction and Vascular Stiffness, *Current Vascular Pharmacology*, 5 (3):227–237.
- Pradhana, A., Ismail, M.T., and Hariawan, H. 2021, Hubungan antara cardio-ankle vascular index dan tingkat keparahan lesi koroner pada pasien infark miokard akut yang dilakukan angiografi koroner di RSUP Dr. Sardjito Yogyakarta. Universitas Gadjah Mada.
- Pradon, D., Roche, N., Enette, L., and Zory, R. 2013, Relationship between lower limb muscle strength and 6-minute walk test performance in stroke patients, *Journal of Rehabilitation Medicine*, 45 (1):105–108.
- Prior, T.W. 2016, Neuromuscular diseases, *Molecular Pathology in Clinical Practice: Second Edition*, 127–138.
- Reddy, Y.N.V., Andersen, M.J., Obokata, M., Koepp, K.E., Kane, G.C., Melenovsky, V., Olson, T.P., and Borlaug, B.A. 2017, Arterial Stiffening With Exercise in Patients With Heart Failure and Preserved Ejection Fraction, *Journal of the American College of Cardiology*, 70 (2):136–148.
- Richardson, T.E., Kindig, C.A., Musch, T.I., and Poole, D.C. 2003, Effects of chronic heart failure on skeletal muscle capillary hemodynamics at rest and during contractions, *Journal of Applied Physiology*, 95 (3):1055–1062.
- Sacco, R.L., Kasner, S.E., Broderick, J.P., Caplan, L.R., Connors, J.J., Culebras, A., Elkind, M.S.V., George, M.G., Hamdan, A.D., Higashida, R.T., Hoh, B.L., Janis, L.S., Kase, C.S., Kleindorfer, D.O., Lee, J.M., Moseley, M.E., Peterson, E.D., Turan, T.N., Valderrama, A.L., and Vinters, H. V. 2013, An updated definition of stroke for the 21st century: A statement for healthcare professionals from the American heart association/American stroke association, *Stroke*, 44 (7):2064–2089.
- Sahu, D. and Das, A. 2019, An update review on autoimmune disease, *International Journal of Psychosocial Rehabilitation*, 23 (6):94–100.
- Sairaku, A., Eno, S., Hondo, T., Teragawa, H., Nakano, Y., Matsuda, K., Kisaka, T., and Kihara, Y. 2010, Head-to-head comparison of the cardio-ankle vascular index between patients with acute coronary syndrome and stable angina pectoris, *Hypertension Research*, (February):1162–1166.
- Sakane, K., Miyoshi, T., Doi, M., Hirohata, S., Kaji, Y., Kamikawa, S., Ogawa, H., Hatanaka, K., Kitawaki, T., Kusachi, S., and Yamamoto, K. 2008, Association of new arterial stiffness parameter, the cardio-ankle vascular index, with left ventricular diastolic function, *Journal of Atherosclerosis and Thrombosis*, 15 (5):261–268.
- Sampaio, R.A.C., Sewo Sampaio, P.Y., Yamada, M., Yukutake, T., Uchida, M.C., Tsuboyama, T., and Arai, H. 2014, Arterial stiffness is associated with low skeletal muscle mass in Japanese community-dwelling older adults, *Geriatrics and Gerontology International*, 14 (SUPPL.1):109–114.
- Sano, T., Kiuchi, S., Hisatake, S., Kabuki, T., Oka, T., Fujii, T., Dobashi, S., and Ikeda, T. 2020, Cardio-ankle vascular index predicts the 1-year prognosis of heart failure patients categorized in clinical scenario 1, *Heart and Vessels*.
- Sasaki, H., Saiki, A., Endo, K., Ban, N., Yamaguchi, T., Kawana, H., Nagayama, D., Ohhira, M., Oyama, T., Miyashita, Y., and Shirai, K. 2009, Protective effects of efonidipine, a T- and L-type calcium channel blocker, on renal function and arterial stiffness in type 2 diabetic patients with hypertension and nephropathy, *Journal of Atherosclerosis and Thrombosis*, 16 (5):568–575.
- Satoh-Asahara, N., Suganami, T., Majima, T., Kotani, K., Kato, Y., Araki, R., Koyama, K., Okajima, T., Tanabe, M., Oishi, M., Himeno, A., Kono, S., Sugawara, A., Hattori, M., Ogawa, Y., and Shimatsu, A. 2011, Urinary cystatin C as a potential risk marker for cardiovascular disease and chronic kidney disease in patients with obesity and

- metabolic syndrome, *Clinical Journal of the American Society of Nephrology*, 6 (2):265–273.
- Scandale, G., Dimitrov, G., Recchia, M., Carzaniga, G., Minola, M., Perilli, E., Carotta, M., and Catalano, M. 2018, Arterial stiffness and subendocardial viability ratio in patients with peripheral arterial disease, *Journal of Clinical Hypertension*, 20 (3):478–484.
- Segers, P., Rietzschel, E.R., and Chirinos, J.A. 2020, How to Measure Arterial Stiffness in Humans, *Arteriosclerosis, Thrombosis, and Vascular Biology*, (May):1034–1043.
- Shirai, K. 2004, Obesity as the core of the metabolic syndrome and the management of coronary heart disease, *Current Medical Research and Opinion*, 20 (3):295–304.
- Shirai, K., Hiruta, N., Song, M., Kurosu, T., Suzuki, J., Tomaru, T., Miyashita, Y., Saiki, A., Takahashi, M., Suzuki, K., and Takata, M. 2011, Cardio-ankle vascular index (CAVI) as a novel indicator of arterial stiffness: Theory, evidence and perspectives, *Journal of Atherosclerosis and Thrombosis*, 18 (11):924–938.
- Shirai, K., Utino, J., Otsuka, K., and Takata, M. 2006, A novel blood pressure-independent arterial wall stiffness parameter; cardio-ankle vascular index (CAVI), *Journal of Atherosclerosis and Thrombosis*, 13 (2):101–107.
- Shirwany, N.A. and Zou, M.H. 2010, Arterial stiffness: A brief review, *Acta Pharmacologica Sinica*, 31 (10):1267–1276.
- Signore, A. 2013, About inflammation and infection, *EJNMMI Research*, 3 (1):1–2.
- Sinha, A.K. and Mehta, J.L. 2007, Modulation of atherosclerosis, blood pressure and arterial elasticity by statins, *Advances in Cardiology*, 44:315–330.
- Starling, M.R. 1993, Left ventricular-arterial coupling relations in the normal human heart, *American Heart Journal*, 125 (6):1659–1666.
- Steele, B. 1996, Timed walking tests of exercise capacity in chronic cardiopulmonary illness, *Journal of Cardiopulmonary Rehabilitation*, 16(1):25–33.
- Sullivan, M.J. and Hawthorne, M.H. 1995, Exercise intolerance in patients with chronic heart failure, *Progress in Cardiovascular Diseases*, 38(1):1–22.
- Suzuki, J., Sakakibara, R., Tomaru, T., Tateno, F., Kishi, M., Ogawa, E., Kurosu, T., and Shirai, K. 2013, Stroke and cardio-ankle vascular stiffness index, *Journal of Stroke and Cerebrovascular Diseases*, 22 (2):171–175.
- Suzuki, T., Palus, S., and Springer, J. 2018, Skeletal muscle wasting in chronic heart failure, *ESC Heart Failure*, 5 (6):1099–1107.
- Tadic, M. and Ivanovic, B. 2014, Why is functional capacity decreased in hypertensive patients? from mechanisms to clinical studies, *Journal of Cardiovascular Medicine*, 15 (6):447–455.
- Takaki, A., Ogawa, H., Wakeyama, T., Iwami, T., Kimura, M., Hadano, Y., Matsuda, S., Miyazaki, Y., Hiratsuka, A., and Matsuzaki, M. 2008, Cardio-ankle vascular index is superior to brachial-ankle pulse wave velocity as an index of arterial stiffness, *Hypertension Research*, 31 (7):1347–1355.
- Takaki, A., Ogawa, H., Wakeyama, T., Iwami, T., Kimura, M., Hadano, Y., Matsuda, S., Miyazaki, Y., Matsuda, T., Hiratsuka, A., and Matsuzaki, M. 2007, Cardio-ankle vascular index is a new noninvasive parameter of arterial stiffness, *Circulation Journal*, 71 (11):1710–1714.
- Takenaka, T., Hoshi, H., Kato, N., Kobayashi, K., Takane, H., Shoda, J., and Suzuki, H. 2008, Cardio-ankle vascular index to screen cardiovascular diseases in patients with end-stage renal diseases, *Journal of Atherosclerosis and Thrombosis*, 15 (6):339–344.
- Tanaka, A., Tomiyama, H., Maruhashi, T., Matsuzawa, Y., Miyoshi, T., Kabutoya, T., Kario, K., Sugiyama, S., Munakata, M., Ito, H., Ueda, S., Vlachopoulos, C., Higashi, Y., Inoue, T., and Node, K. 2018, Physiological diagnostic criteria for vascular

- failure, *Hypertension*, 72 (5):1060–1071.
- Tanisawa, K., Ito, T., Sun, X., Kawakami, R., Oshima, S., Gando, Y., Cao, Z.B., Sakamoto, S., and Higuchi, M. 2014, Cardiorespiratory fitness is a strong predictor of the cardio-ankle vascular index in hypertensive middle-aged and elderly Japanese men, *Journal of Atherosclerosis and Thrombosis*, 22 (4):379–389.
- Taylor, J., Xiao, W., and Abdel-Wahab, O. 2017, Diagnosis and classification of hematologic malignancies on the basis of genetics, *Blood*, 130 (4):410–423.
- Teiger, E., Dam, T.V., Richard, L., Wisnewsky, C., Tea, B.S., Gaboury, L., Tremblay, J., Schwartz, K., and Hamet, P. 1996, Apoptosis in pressure overload-induced heart hypertrophy in the rat, *Journal of Clinical Investigation*, 97 (12):2891–2897.
- Tesfamariam, B. 2006, The effects of HMG-CoA reductase inhibitors on endothelial function, *American Journal of Cardiovascular Drugs*, 6 (2):115–120.
- Thadani, U. 1997, Nitrate tolerance, rebound, and their clinical relevance in stable angina pectoris, unstable angina, and heart failure, *Cardiovascular Drugs and Therapy*, 10 (6):735–742.
- Tissier, F., Mallem, Y., Goanvec, C., Didier, R., Aubry, T., Bourgeois, N., Desfontis, J.C., Dubreuil, M., Le Grand, Y., Mansourati, J., Pichavant-Rafini, K., Plee-Gautier, E., Roquefort, P., Theron, M., and Gilard, M. 2016, A non-hypocholesterolemic atorvastatin treatment improves vessel elasticity by acting on elastin composition in WHHL rabbits, *Atherosclerosis*, 251:70–77.
- Tsujimoto, T. and Kajio, H. (2019) ‘Use of Nitrates and Risk of Cardiovascular Events in Patients With Heart Failure With Preserved Ejection Fraction’, *Mayo Clinic Proceedings*, 94(7), pp. 1210–1220. doi:10.1016/j.mayocp.2018.11.032.
- Uehara, G. and Takeda, H. 2008, Relative effects of telmisartan, candesartan and losartan on alleviating arterial stiffness in patients with hypertension complicated by diabetes mellitus: An evaluation using the cardio-ankle vascular index (CAVI), *Journal of International Medical Research*, 36 (5):1094–1102.
- Ueyama, K., Miyata, M., Kubozono, T., Nagaki, A., Hamasaki, S., Ueyama, S., and Tei, C. 2009, Noninvasive indices of arterial stiffness in hemodialysis patients, *Hypertension Research*, 32 (8):716–720.
- Uliyandari, A. 2009. Pengaruh latihan fisik terprogram terhadap perubahan nilai konsumsi oksigen maksimal (VO₂ max) pada siswi bola voli tugu muda semarang usia 11-13 tahun. Semarang: Fakultas Kedokteran Universitas Diponegoro.
- Vaz, M. *et al.* (1997) ‘Regional sympathetic nervous activity and oxygen consumption in obese normotensive human subjects’, *Circulation*, 96(10), pp. 3423–3429.
- Volders, P.G.A., Willems, I.E.M.G., Cleutjens, J.P.M., Arends, J.W., Havenith, M.G., and Daemen, M.J.A.P. 1993, Interstitial collagen is increased in the non-infarcted human myocardium after myocardial infarction, *Journal of Molecular and Cellular Cardiology*, 25(11):1317-23.
- Wasserman, K., Beaver, W.L., and Whipp, B.J. 1990, Gas exchange theory and the lactic acidosis (anaerobic) threshold, *In: Circulation*. 1990 Jan;81(1 Suppl):II14-30. PMID: 2403868.
- Wassmann, S., Laufs, U., Bäumer, A.T., Müller, K., Ahlbory, K., Linz, W., Itter, G., Rösen, R., Böhm, M., and Nickenig, G. 2001, HMG-CoA reductase inhibitors improve endothelial dysfunction in normocholesterolemic hypertension via reduced production of reactive oxygen species, *Hypertension*, 37 (6):1450–1457.
- Watanabe, K., Yoshihisa, A., Sato, Y., Hotsuki, Y., Anzai, F., Ichijo, Y., Kimishima, Y., Yokokawa, T., Misaka, T., Sato, T., Kaneshiro, T., Oikawa, M., Kobayashi, A., and Takeishi, Y. 2021, Cardio-Ankle Vascular Index Reflects Impaired Exercise Capacity and Predicts Adverse Prognosis in Patients With Heart Failure, *Frontiers in*

- Cardiovascular Medicine*. 8:631807.
- Weber, K.T. and Janicki, J.S. 1985, Cardiopulmonary exercise testing for evaluation of chronic cardiac failure, *The American Journal of Cardiology*, 55 (2).
- Weber, M.A., Neutel, J.M. and Smith, D.H. (2001) 'Contrasting clinical properties and exercise responses in obese and lean hypertensive patients', *Journal of the American college of cardiology*, 37(1), pp. 169–174.
- Webster, M.W.I. and Sharpe, D.N. 1989, Exercise testing in angina pectoris: The importance of protocol design in clinical trials, *American Heart Journal*, 117 (2):505–508.
- Wohlfahrt, P., Melenovsky, V., Redfield, M.M., Olson, T.P., Lin, G., Abdelmoneim, S.S., Hametner, B., Wassertheurer, S., and Borlaug, B.A. 2017a, Aortic Waveform Analysis to Individualize Treatment in Heart Failure, *Circulation: Heart Failure*, 10 (2).
- Wohlfahrt, P., Melenovsky, V., Redfield, M.M., Olson, T.P., Lin, G., Abdelmoneim, S.S., Hametner, B., Wassertheurer, S., and Borlaug, B.A. 2017b, Aortic Waveform Analysis to Individualize Treatment in Heart Failure, *Circulation: Heart Failure*, 10 (2):1–8.
- Xue, Q., Qin, M.Z., Jia, J., Liu, J.P., and Wang, Y. 2019, Association between frailty and the cardio-ankle vascular index, *Clinical Interventions in Aging*, 14:735–742.
- Yamaguchi, T., Miyashita, Y., Ban, N., Kawana, H., Nagayama, D., Nagumo, A., Ohira, M., Saiki, A., Endo, K., Oyama, T., and Shirai, K. 2010, Effects of dose-up of atorvastatin (20 mg/day from 10 mg/day) on non HDL-cholesterol and arterial stiffness in patients with type 2 diabetes, *Therapeutic Research*. 31. 1029-1036.
- Yamashina, A., Tomiyama, H., Takeda, K., Tsuda, H., Arai, T., Hirose, K., Koji, Y., Hori, S., and Yamamoto, Y. 2002, Validity, reproducibility, and clinical significance of noninvasive brachial-ankle pulse wave velocity measurement, *Hypertension Research*, 25 (3):359–364.
- Yancy, C.W., Jessup, M., Bozkurt, B., Butler, J., Casey, D.E., Drazner, M.H., Fonarow, G.C., Geraci, S.A., Horwich, T., Januzzi, J.L., Johnson, M.R., Kasper, E.K., Levy, *et al.*, 2013 ACCF/AHA guideline for the management of heart failure: A report of the American college of cardiology foundation/american heart association task force on practice guidelines, *Journal of the American College of Cardiology*, 62 (16):e147–e239.
- Yoshida, A., Sugiyama, T., and Sagawa, N. 2011, Assessment of the Cardioankle Vascular Index in Pregnant Women Complicated with Hypertensive Disorders, *ISRN Obstetrics and Gynecology*, 2011:1–5.
- Yu, Q. and Stamenkovic, I. 2000, Cell surface-localized matrix metalloproteinase-9 proteolytically activates TGF- β and promotes tumor invasion and angiogenesis, *Genes and Development*, 14 (2):163–176.
- Zern, E.K., Ho, J.E., Panah, L.G., Lau, E.S., Liu, E., Namasivayam, M., Malhotra, R., and Naylor, M. 2021, Exercise Intolerance in Heart Failure With Preserved Ejection Fraction : Arterial Stiffness and Abnormal Left Ventricular Hemodynamic Responses During Exercise, *Journal of Cardiac Failure*, 27 (6):625–634.
- Zhang, C., Ohira, M., Iizuka, T., Mikamo, H., Nakagami, T., Suzuki, M., Hirano, K., *et al.* 2013, Cardio-ankle vascular index relates to left ventricular ejection fraction in patients with heart failure: A retrospective study, *International Heart Journal*, 54 (4):216–221.
- Zieman, S.J., Melenovsky, V., and Kass, D.A. 2005, Mechanisms, pathophysiology, and therapy of arterial stiffness, *Arteriosclerosis, Thrombosis, and Vascular Biology*, 25 (5):932–943.