

sledovaných ukazatelů měli pacienti s vlohami pro nižší LDL cholesterol (OR 0,73, 95% CI: 0,70–0,75; $p < 0,001$), pak následovali pacienti s vlohami pouze pro nižší krevní tlak (OR 0,82, 95% CI: 0,79–0,85, $p < 0,001$). Studie prokázala význam délky expozice rizikovým faktorům na osud nemocných a význam aktivního pátrání po rizikovém profilu nemocných (například na základě tabulek SCORE) a včasné korekce (35, 36).

Závěr

Věkem podmíněná remodelace myokardu je dlouhodobý proces, který zahrnuje široké spektrum patogenetických mechanismů. Výsledkem

jsou strukturální a funkční změny, které mohou ústít v rozvoj srdečního selhání, snižovat kvalitu života a zvyšovat tak morbiditu i mortalitu pacientů. Jde o proces, který mohou negativně ovlivnit rizikové faktory kardiovaskulárních onemocnění, řada komorbidit, naopak tento proces lze významně pozitivně ovlivnit změnou životního stylu, včasnou detekcí rizikových faktorů a důslednou léčbou komorbidit.

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LITERATURA

- Magnussen C, Niiranen TJ, Ojeda FM, Gianfagna F, Blankenberg S, Vartiainen E, Sans S, Pasterkamp G, Hughes M, Costanzo S, Donati MB, Jousilahti P, Linneberg A, Palosaari T, de Gaetano G, Bobak M, den Ruijter HM, Jorgensen T, Soderberg S, Kuulasmaa K, Zeller T, Iacoviello L, Salomaa V, Schnabel RB, BiomarCa REC. Sex-Specific Epidemiology of Heart Failure Risk and Mortality in Europe: Results From the BiomarCaRE Consortium. *JACC Heart Fail.* 2019; 7(3): 204–213.
- Redfield MM, Jacobsen SJ, Burnett JC, Jr., Mahoney DW, Bailey KR, Rodeheffer RJ. Burden of systolic and diastolic ventricular dysfunction in the community: appreciating the scope of the heart failure epidemic. *JAMA.* 2003; 289(2): 194–202.
- Cheng S, Fernandes VR, Bluemke DA, McClelland RL, Kronmal RA, Lima JA. Age-related left ventricular remodeling and associated risk for cardiovascular outcomes: the Multi-Ethnic Study of Atherosclerosis. *Circ Cardiovasc Imaging.* 2009; (3): 191–198.
- Fiechter M, Fuchs TA, Gebhard C, Stehli J, Klaeser B, Stahl BE, Manka R, Manes C, Tanner FC, Gaemperli O, Kaufmann PA. Age-related normal structural and functional ventricular values in cardiac function assessed by magnetic resonance. *BMC Med Imaging.* 2013; 13:6.
- Ponikowski P, Voors AA, Anker SD, Bueno H, Cleland JGF, Coats AJS, Falk V, Gonzalez-Juanatey JR, Harjola VP, Jankowska EA, Jessup M, Linde C, Nihoyannopoulos P, Parissis JT, Pieske B, Riley JP, Rosano GMC, Ruschitzka F, Rutten FH, van der Meer P, Group ESCSD. 2016 ESC Guidelines for the diagnosis and treatment of acute and chronic heart failure: The Task Force for the diagnosis and treatment of acute and chronic heart failure of the European Society of Cardiology (ESC) Developed with the special contribution of the Heart Failure Association (HFA) of the ESC. *Eur Heart J.* 2016; 37(27): 2129–2200.
- Nagueh SF, Smiseth OA, Appleton CP, Byrd BF, 3rd, Dokainish H, Edvardsen T, Flachskampf FA, Gillebert TC, Klein AL, Lancellotti P, Marino P, Oh JK, Alexandru Popescu B, Waggoner AD, Houston T, Oslo N, Phoenix A, Nashville T, Hamilton OC, Uppsala S, Ghent, Liege B, Cleveland O, Novara I, Rochester M, Bucharest R, St. Louis M. Recommendations for the Evaluation of Left Ventricular Diastolic Function by Echocardiography: An Update from the American Society of Echocardiography and the European Association of Cardiovascular Imaging. *Eur Heart J Cardiovasc Imaging.* 2016; 17(12): 1321–1360.
- Evin M, Redheuil A, Soulat G, Perdrix L, Ashrafpoor G, Giron A, Lamy J, Defrance C, Roux C, Hatem SN, Diebold B, Mousseaux E, Kachenoura N. Left atrial aging: a cardiac magnetic resonance feature-tracking study. *Am J Physiol Heart Circ Physiol.* 2016; 310(5): H542–549.
- Jalife J, Kaur K. Atrial remodeling, fibrosis, and atrial fibrillation. *Trends Cardiovasc Med.* 2015; 25(6): 475–484.
- Wehrum T, Lodemann T, Hagenlocher P, Stuplich J, Ngo BTT, Grundmann S, Hennemuth A, Hennig J, Harloff A. Age-related changes of right atrial morphology and inflow pattern assessed using 4D flow cardiovascular magnetic resonance: results of a population-based study. *J Cardiovasc Magn Reson.* 2018; 20(1): 38.
- Merz AA, Cheng S. Sex differences in cardiovascular ageing. *Heart.* 2016; 102(11): 825–831.
- Christou DD, Seals DR. Decreased maximal heart rate with aging is related to reduced [beta]-adrenergic responsiveness but is largely explained by a reduction in intrinsic heart rate. *J Appl Physiol (1985).* 2008; 105(1): 24–29.
- Wolsk E, Bakkestrom R, Thomsen JH, Balling L, Andersen MJ, Dahl JS, Hassager C, Moller JE, Gustafsson F. The Influence of Age on Hemodynamic Parameters During Rest and Exercise in Healthy Individuals. *JACC Heart Fail.* 2017; 5(5): 337–346.
- Senyo SE, Steinhauser ML, Pizzimenti CL, Yang VK, Cai L, Wang M, Wu TD, Guerin-Kern JL, Lechene CP, Lee RT. Mammalian heart renewal by pre-existing cardiomyocytes. *Nature.* 2013 Jan; 493(7432): 433–436.
- Bergmann O, Bhardwaj RD, Bernard S, Zdunek S, Barnabe-Heider F, Walsh S, Zupicich J, Alkass K, Buchholz BA, Druid H, Jovinge S, Frisen J. Evidence for cardiomyocyte renewal in humans. *Science.* 2009; 324(5923): 98–102.
- Bergmann O, Zdunek S, Felker A, Salehpour M, Alkass K, Bernard S, Sjoström SL, Szewczykowska M, Jackowska T, Dos Remedios C, Malm T, Andra M, Jashari R, Nyengaard JR, Possnert G, Jovinge S, Druid H, Frisen J. Dynamics of Cell Generation and Turnover in the Human Heart. *Cell.* 2015; 161(7): 1566–1575.
- Li H, Hastings MH, Rhee J, Trager LE, Roh JD, Rosenzweig A. Targeting Age-Related Pathways in Heart Failure. *Circ Res.* 2020; 126(4): 533–551.
- Lindsey ML, Goshorn DK, Squires CE, Escobar GP, Hendrick JW, Mingoa JT, Sweterlitsch SE, Spinale FG. Age-dependent changes in myocardial matrix metalloproteinase/tissue inhibitor of metalloproteinase profiles and fibroblast function. *Cardiovasc Res.* 2005; 66(2): 410–419.
- Tripodikiadis F, Xanthopoulos A, Parissis J, Butler J, Farmakis D. Pathogenesis of chronic heart failure: cardiovascular aging, risk factors, comorbidities, and disease modifiers. *Heart Fail Rev.* 2020 Jun 10.
- Gonzalez-Lopez E, Gallego-Delgado M, Guzzo-Merello G, de Haro-Del Moral FJ, Cobo-Marcos M, Robles C, Bornstein B, Salas C, Lara-Pezzi E, Alonso-Pulpon L, Garcia-Pavia P. Wild-type transthyretin amyloidosis as a cause of heart failure with preserved ejection fraction. *Eur Heart J.* 2015; 36(38): 2585–2594.
- Vaclavik J. Blood vessel ageing and vascular memory. *Vnitř Lek.* 2020; 66(2): 104–110.
- Messerli FH, Rimoldi SF, Bangalore S. The Transition From Hypertension to Heart Failure: Contemporary Update. *JACC Heart Fail.* 2017; 5(8): 543–551.
- López-Sainz A, dH-DMJ, Dominguez F, Restrepo-Cordoba A, Amor-Salamanca A, Hernandez-Hernandez A, Ruiz-Guerrero L, Krsnik I, Cobo-Marcos M. Prevalence of cardiac amyloidosis among elderly patients with systolic heart failure or conduction disorders. *Amyloid.* 2019; 26: 156–136.
- Tripodikiadis F, Xanthopoulos A, Butler J. Cardiovascular Aging and Heart Failure: JACC Review Topic of the Week. *J Am Coll Cardiol.* 2019; 74(6): 804–813.
- Tousoulis D, Oikonomou E, Siasos G, Stefanadis C. Diabetes Mellitus and Heart Failure. *Eur Cardiol.* 2014; 9(1): 37–42.
- Seals DR, Brunt VE, Rossman MJ. Keynote lecture: strategies for optimal cardiovascular aging. *Am J Physiol Heart Circ Physiol.* 2018; 315(2): H183–H188.
- Seals DR, Brunt VE, Rossman MJ. Keynote lecture: strategies for optimal cardiovascular aging. 2018; 315(2): H183–H188.
- Woo JS, Derleth C, Stratton JR, Levy WC. The influence of age, gender, and training on exercise efficiency. *J Am Coll Cardiol.* 2006; 47(5): 1049–1057.
- Roh J, Rhee J, Chaudhari V, Rosenzweig A. The Role of Exercise in Cardiac Aging: From Physiology to Molecular Mechanisms. *Circ Res.* 2016; 118(2): 279–295.
- Fujimoto N, Prasad A, Hastings JL, Arab-Zadeh A, Bhella PS, Shibata S, Palmer D, Levine BD. Cardiovascular effects of 1 year of progressive and vigorous exercise training in previously sedentary individuals older than 65 years of age. *Circulation.* 2010; 122(18): 1797–1805.
- Werner C, Hanhoun M, Widmann T, Kazakov A, Semenov A, Poss J, Bauersachs J, Thum T, Pfreundschuh M, Muller P, Haendeler J, Bohm M, Laufs U. Effects of physical exercise on myocardial telomere-regulating proteins, survival pathways, and apoptosis. *J Am Coll Cardiol.* 2008; 52(6): 470–482.
- Werner C, Furster T, Widmann T, Poss J, Roggia C, Hanhoun M, Scharhag J, Buchner N, Meyer T, Kindermann W, Haendeler J, Bohm M, Laufs U. Physical exercise prevents cellular senescence in circulating leukocytes and in the vessel wall. *Circulation.* 2009; 120(24): 2438–2447.
- Liao PH, Hsieh DJ, Kuo CH, Day CH, Shen CY, Lai CH, Chen RJ, Padma VV, Kuo WW, Huang CY. Moderate exercise training attenuates aging-induced cardiac inflammation, hypertrophy and fibrosis injuries of rat hearts. *Oncotarget.* 2015; 6(34): 35383–35394.
- Vujic A, Lerchenmuller C, Wu TD, Guillermier C, Rabolli CP, Gonzalez E, Senyo SE, Liu X, Guerin-Kern JL, Steinhauser ML, Lee RT, Rosenzweig A. Exercise induces new cardiomyocyte generation in the adult mammalian heart. *Nat Commun.* 2018; 9(1): 1659.
- Ference BA, Bhatt DL, Catapano AL, Packard CJ, Graham I, Kaptoge S, Ference TB, Guo Q, Laufs U, Ruff CT, Cupido A, Hovingh GK, Danesh J, Holmes MW, Smith GD, Ray KK, Nicholls SJ, Sabatine MS. Association of Genetic Variants Related to Combined Exposure to Lower Low-Density Lipoproteins and Lower Systolic Blood Pressure With Lifetime Risk of Cardiovascular Disease. *JAMA.* 2019; 322: 1381–1391.
- Ray KK, Laufs U, Cosentino F, Lobo MD, Landmesser U. The year in cardiology: cardiovascular prevention. *Eur Heart J.* 2020; 41(11): 1157–1163.
- Lim GB. Reductions in LDL-cholesterol and blood-pressure levels have cumulative benefits. *Nat Rev Cardiol.* 2019; 16(11): 650.