

ORIGINAL ARTICLE

REHABILITATION IN PATIENTS AFTER MYOCARDIAL INFARCTION: CLINICAL AND SOCIAL ASPECTS

DOI: 10.36740/WLek202208202

Włodzisław Kuliński¹, Iwona Zięba²¹DEPARTMENT OF REHABILITATION, MILITARY INSTITUTE OF MEDICINE WARSAW, POLAND²COLLEGIUM MEDICUM, JAN KOCHANOWSKI UNIVERSITY, KIELCE, POLAND

ABSTRACT

The aim: To assess the effects of cardiac rehabilitation on the health of myocardial infarction patients, the risk of a relapse and the possibility of restoring full physical fitness.

Materials and methods: The study was conducted in a group of 40 patients after myocardial infarction treated at the Cardiac Rehabilitation Department. The subjective and objective condition of the patients was assessed. Study patients underwent physical therapy and rehabilitation over a period of 3 weeks.

Results: The physical therapy and rehabilitation programme conducted in study patients resulted in an improved physical function and a weight reduction. The cholesterol and blood pressure levels were both decreased. Study patients expressed a very favourable opinion about the effects of physical therapy and rehabilitation.

Conclusions: 1. Myocardial infarction is a clinical and social problem. 2. Physical therapy after myocardial infarction is one of the main elements of treatment of this disorder. 3. Physical therapy should be used more widely in coronary heart disease prevention.

KEY WORDS: myocardial infarction, rehabilitation

Wiad Lek. 2022;75(8 p2):1954-1959

INTRODUCTION

Myocardial infarction (MI) is currently a serious social and medical problem. Cardiovascular disease is the most common cause of death in Poland (over 45% of all deaths), with half the deaths resulting from ischaemic heart disease (infarction) [1-11].

The development of cardiovascular disease depends on two categories of factors. The first category includes factors directly associated with lifestyle while the other category consists of factors that cannot be directly modified. Factors responsible for MI include the following:

- cigarette smoking: affects the cardiovascular system;
- obesity: one of the key factors significantly influencing the probability of MI;
- physical activity: plays a key role in neutralising the risk of MI.

Non-lifestyle risk factors for MI include for example the following:

- age: the risk of MI increases with age;
- sex: the risk of MI is markedly lower in women than in men;
- genetics (hereditary factors): one of the main risk factors for MI.

There has been an enormous development in the treatment of cardiovascular disease in Poland, with cardiac rehabilitation playing an important role. The main goals of cardiac rehabilitation are to reduce disease progression, facilitate the return to full physical fitness, improve mental wellbeing and help patients continue their normal life [12-20].

Cardiac rehabilitation in MI patients can be divided into the following key phases:

- hospitalisation: the initial phase of cardiac rehabilitation;
- early outpatient: phase 2 cardiac rehabilitation may be conducted in specialised centres, such as spa resorts, spa hospitals or clinics, or it may take place at home. Patients are qualified for one of four phase 2 rehabilitation models based on their physical function and risk level (inpatient or outpatient programme). Phase 2 cardiac rehabilitation includes education about healthy living after MI and requires an individual approach that takes the patient's previous lifestyle into consideration;
- extended outpatient: this phase usually lasts several months after the end of phase 2, until the prespecified cardiac rehabilitation goals have been reached;
- maintenance: in this phase, MI patients continue doing exercise based on a training plan prepared individually for them. The effects of their efforts after the end of phase 3 are monitored during regular follow-up visits in a specialist clinic. This phase should continue for the rest of their lives [21-30]. Patients are qualified for an appropriate rehabilitation model based on their physical function and risk level.

Cardiac stress tests in MI patients are performed on a treadmill or cycle ergometer. The workload is increased gradually. The classic Bruce protocol and the modified Bruce protocol are used to determine the patient's tolerance to physical exercise on a treadmill.

Walking training is the easiest form of endurance training.

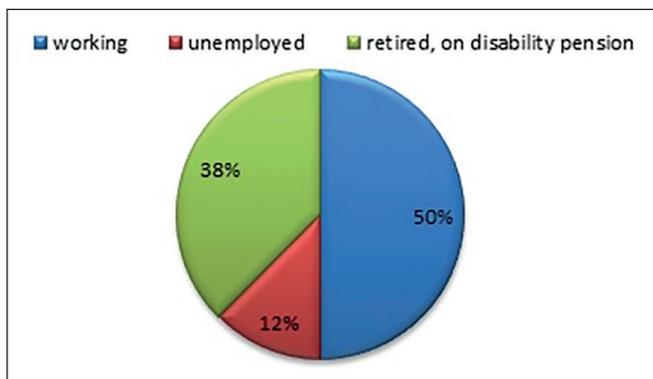


Fig. 1. Occupational activity of respondents [%].

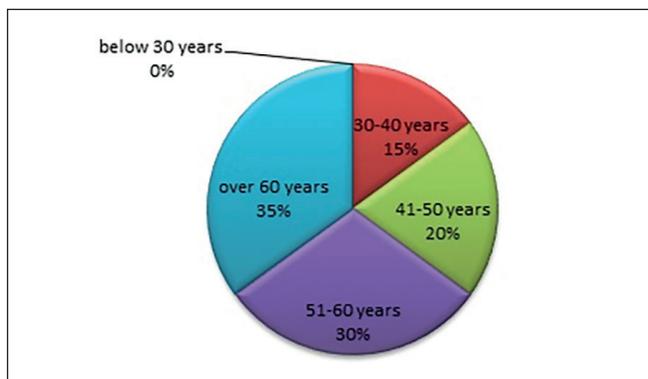


Fig. 2. Age of respondents [%].

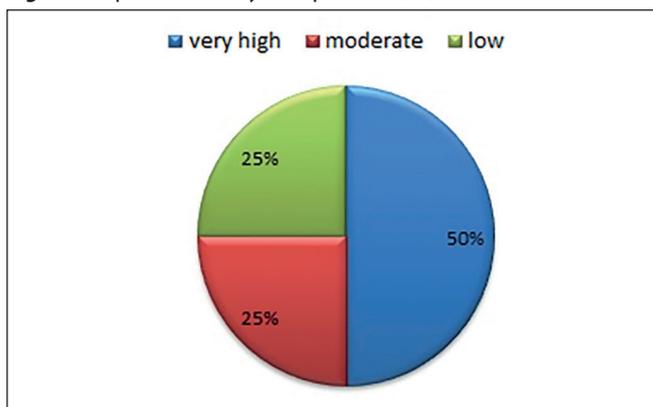


Fig. 3. Stress level at work [%].

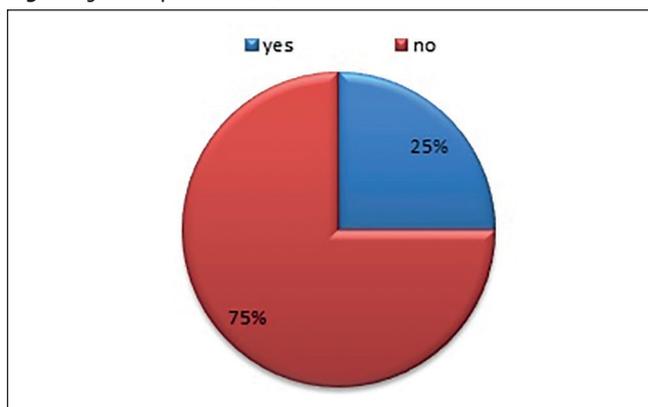


Fig. 4. Practising sports before MI [%].

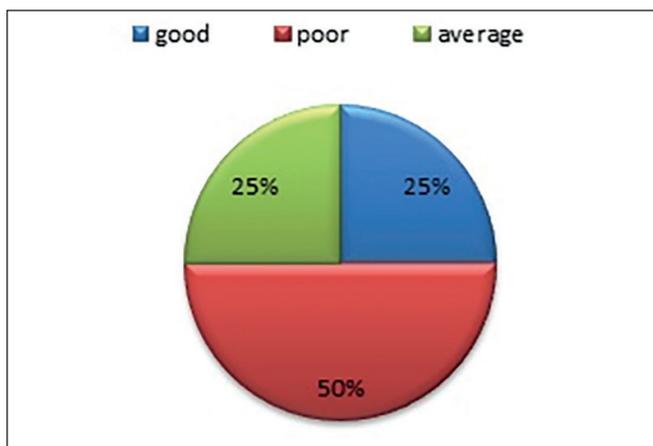


Fig. 5. Patient-reported physical fitness before MI [%].

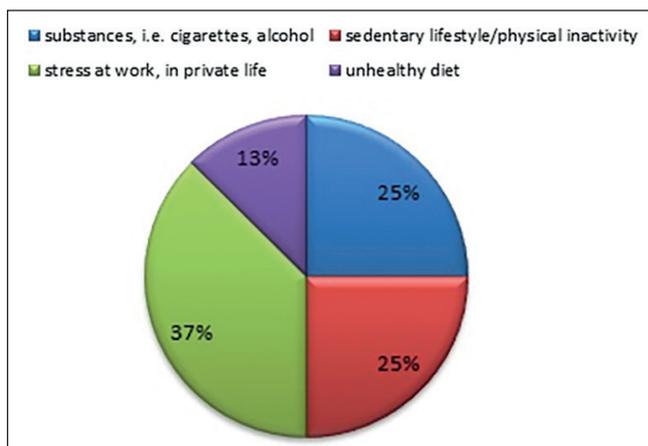


Fig. 6. Causes of MI [%].

Resistance exercise is performed using stationary work-out equipment. For example, patients may undergo interval training on a cycle ergometer performed alternately with rowing on an elliptical machine (Orbitrek), stepper or a treadmill. This type of exercise helps activate multiple muscle groups.

Cardiac rehabilitation incorporates new, alternative forms of physical exercise that contribute to the treatment process in MI patients. New training techniques include for example the following:

a) step aerobics: a set of exercises where patients step on and off a step whose height can be adjusted;

b) TBC: a set of exercises used in patients with a good exercise tolerance. Rehabilitation in the form of ABT training consists in exercise done to music with the use of dumbbells, a ball or resistance bands;

c) water aerobics: a set of low-weight bearing exercises done in a water environment, which help activate many parts of the body.

In order to assess the efficacy of cardiac rehabilitation in MI patients, the study was conducted at the Cardiac Rehabilitation Department of the Regional Polyclinical Hospital (WSZ) in Kielce). Study patients completed an anonymous survey.

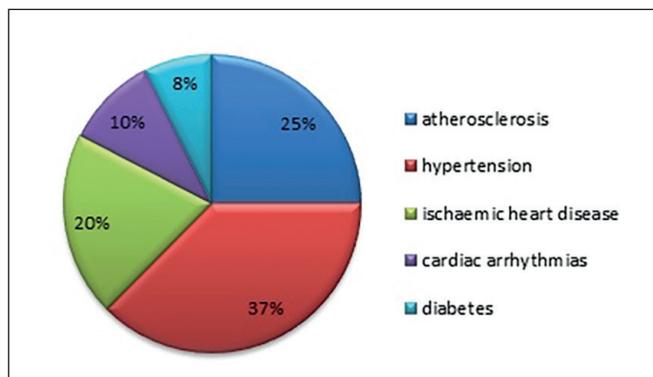


Fig. 7. Concomitant diseases in MI patients [%].

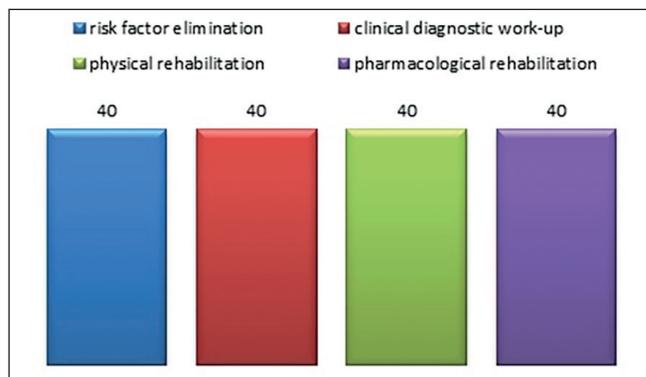


Fig. 8. Forms of cardiac rehabilitation used in study patients [%].

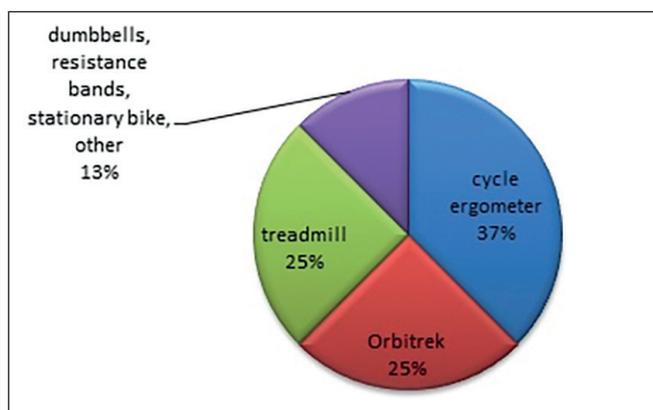


Fig. 9. Types of exercise used as part of cardiac rehabilitation [%].

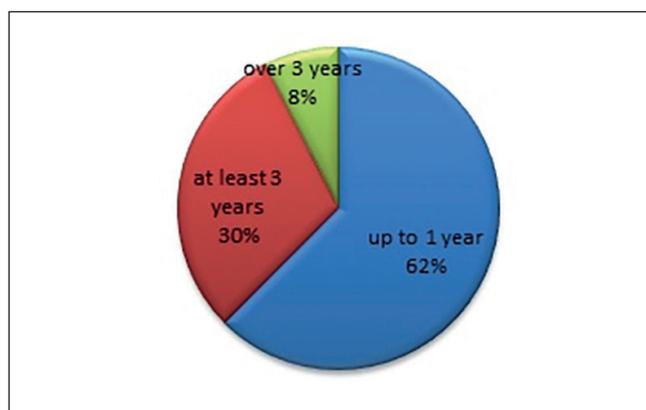


Fig. 10. Duration of cardiac rehabilitation after MI [%].

STATISTICAL METHODS

The data collected in the study was statistically analysed. The following was calculated: arithmetic mean, standard deviation, median, minimum and maximum values. The effectiveness of rehabilitation was determined based on a comparison (using paired-sample Student's t-test) of pre- and post-rehabilitation data at a significance level of $p < 0.01$. Quantitative variables were assessed with Pearson's linear correlation (r). The calculations were performed using Statistica 13.1.

MATERIALS AND METHODS

The study involved 40 patients from the Cardiac Rehabilitation Department of the Regional Polyclinical Hospital in Kielce. Men constituted 75% of the study group and women constituted 25%. The majority of patients (75%) lived in urban areas and 25% lived in rural areas.

With respect to the level of education, 50% of patients had a university degree and 25% had vocational secondary education. Patients with secondary or primary education were the smallest group. The largest group was that of working individuals (50%) while patients who were retired or drawing a disability pension constituted 38% of the study group (Fig. 1).

The high percentage of working and retired patients or patients drawing a disability pension was due to the age of the respondents. Most respondents were over 50 years of age, which meant they were approaching the so-called retirement age (Fig. 2).

The majority of patients (62%) were intellectual workers and 38% were manual workers. Most respondents (75%) described the level of stress they experienced at work as very high or moderate and only 25% of respondents described it as low (Fig. 3). Stress in private life was a feature common to all MI patients participating in the study. The majority of respondents described their level of everyday stress as moderate (62%) or very high (25%).

HEALTH OF STUDY PATIENTS BEFORE THE STUDY

The study showed that 75% of respondents did not practise any sports before their MI (Fig. 4). This means that one out of four patients actively practised sports before their MI. Patient-reported physical fitness was consistent with a low level of physical activity before MI onset.

Half the patients described their physical fitness before MI onset as poor and one in four patients described it as average. Only one in four patients had good physical fitness before their MI event, which resulted from the fact that they actively practised sports.

Three out of four study patients were habitual smokers before their MI. In addition, more than a half used other substances before their MI, such as alcohol. In most cases, patients used alcohol at least twice a month before their MI.

The study showed that 87% of respondents were overweight before MI onset while approximately 13% did not

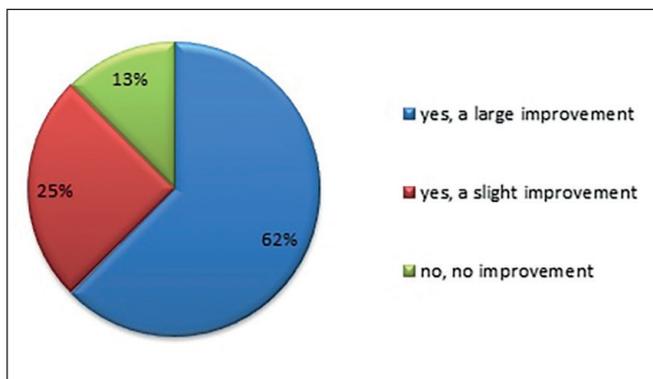


Fig. 11. Influence of cardiac rehabilitation on health [%].

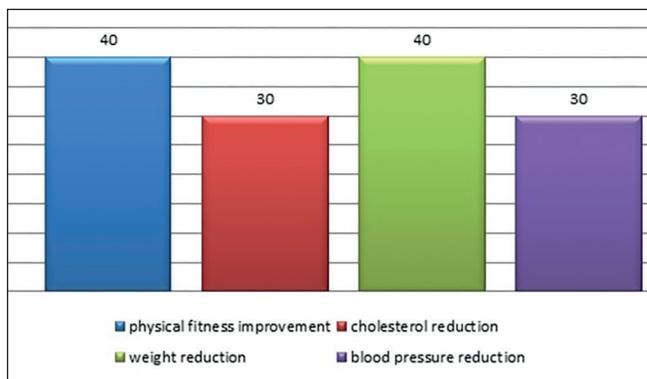


Fig. 12. Effects of cardiac rehabilitation.

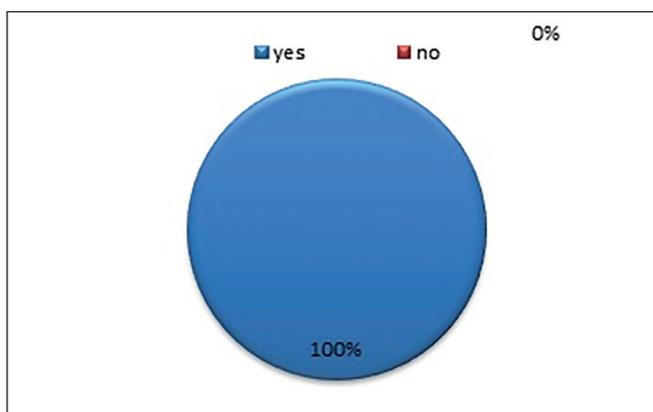


Fig. 13. Patient-reported health status after cardiac rehabilitation [%].



Fig. 14. Current patient-reported health status [%].

have this problem. The high percentage of overweight MI patients may be associated with such factors as age and unhealthy lifestyle; most patients were aged over 50 years and did not practice sports (Fig. 5).

The survey revealed a family history of MI in some study patients. Approximately four out of ten patients said there had been cases of MI among their family members in the past.

The data revealed that the main causes of MI included stress in private life and at work (37%), sedentary lifestyle and substance (i.e. tobacco, alcohol) use (25% each) and unhealthy diet (13%) (Fig. 6).

Seven out of ten patients experienced a single MI event before the study while three out of ten patients experienced at least two MIs in the past. The time since the last MI was between five months and one year in 75% of patients and more than one year in 25% of patients.

Study patients had comorbidities such as hypertension (37%), atherosclerosis (25%) and diabetes mellitus (8%) (Fig. 7).

RESULTS

FORMS OF CARDIAC REHABILITATION USED IN STUDY PATIENTS

The next part of the study identified the forms of rehabilitation used in the respondents. The results confirm the importance of using a broad spectrum of cardiac reha-

bilitation forms for optimum recovery after MI. Cardiac rehabilitation is aimed both at restoring full physical fitness and at mitigating risk factors associated with the possibility of a relapse (Fig. 8).

After discharge from hospital, all study patients underwent rehabilitation conducted in spa resorts or spa hospitals.

Cardiac rehabilitation performed in study patients usually encompassed physical exercise on a cycle ergometer (37%), Orbitrek (25%) and treadmill (25%) or the use of dumbbells, resistance bands, bikes and other stationary equipment (13%) (Fig. 9).

General fitness exercises (40%) and endurance and resistance exercises (25% each) were the most commonly used forms of kinesiotherapy in MI patients.

In most cases, rehabilitation lasted up to 1 year (Fig. 10).

Study patients were asked to rate the influence of cardiac rehabilitation on their health (Fig. 11). A considerable health improvement due to rehabilitation after MI was reported by 62% of patients.

The study showed that cardiac rehabilitation resulted in improved physical fitness and a weight reduction in all patients. Moreover, approximately 75% of respondents experienced a decrease in cholesterol levels and blood pressure values after cardiac rehabilitation (Fig. 12). The effects of posthospitalisation rehabilitation are consistent with the information provided by MI patients, whose health improved due to continued cardiac rehabilitation after discharge from hospital (Fig. 13).

When asked about factors contributing to a health improvement as a result of secondary (posthospitalisation) rehabilitation, study patients listed practising sports (62%) and substance (tobacco, alcohol) use cessation (25%). The majority of patients rated their current health status as good (62%) or excellent (25%) (Fig. 14).

DISCUSSION

The aim of this study was to analyse the effects of cardiac rehabilitation of the health of MI patients and on reducing the risk of a relapse.

The study was conducted at the Cardiac Rehabilitation Department of the Regional Polyclinical Hospital in Kielce and involved a group of 40 patients, whose subjective and objective condition was assessed. The study was performed to help evaluate the effects of cardiac rehabilitation on the patients' ability to have a normal lifestyle. The study yielded the following significant findings:

1) Men over the age of 50 years are at an increased risk of myocardial infarction. MI is less common in women. The risk of MI increases with age irrespective of sex.

2) The main lifestyle risk factors include stress, obesity and physical inactivity. The present study and the available literature indicate that the risk of MI among physically active people is considerably lower than in those who do not practise sports regularly. Stress in private life and at work significantly increases the probability of experiencing an MI event.

3) Exercise using a cycle ergometer, treadmill and Orbitrek were the most popular forms of physical exercise used as part of cardiac rehabilitation in specialised centres. As the rehabilitation moved to the patient's home, the specialised equipment was replaced by dumbbells, resistance bands or a stationary bike.

4) The last phase of cardiac rehabilitation, conducted at home, is key in maintaining the effects of the previous rehabilitation phases through eliminating substance use (i.e. alcohol, tobacco) and following a healthy diet or practising sports. Rehabilitation maintenance at home reduces the risk of another MI and helps return to a normal lifestyle.

To sum up, the present study showed that cardiac rehabilitation allows MI patients to return to full physical fitness. Continuation of cardiac rehabilitation at home, i.e. practising sports, following a healthy diet and avoiding stress and substances, significantly reduces the risk of another MI. The results of the study proved that MI patients had a favourable opinion about the effects of their cardiac rehabilitation programmes on recovery time after an MI event.

CONCLUSIONS

1. Myocardial infarction is a clinical and social problem.
2. Physical therapy after myocardial infarction is one of the main elements of treatment of this disorder.
3. Physical therapy should be used more widely in coronary heart disease prevention.

REFERENCES

1. Sandoval Y, Nowak R, deFilippi CR et al. Myocardial infarction risk stratification with a single measurement of high-sensitivity troponin I. *J Am Coll Cardiol*. 2019 Jul 23;74(3):271-282.
2. Lykov YV, Dyatlov NV, Morozova TE, Dvoretzky LI. In-hospital myocardial infarction: scale of the problem. *Kardiologia*. 2019 Jul 19;59(7):52-60.
3. Poloński L, Gąsior M, Gierlotka M, Kalarus Z. Polish Registry of Acute Coronary Syndromes (PL-ACS). Characteristics, treatments and outcomes of patients with acute coronary syndromes in Poland. *Kardiol Pol*. 2007 Aug;65(8):861-72.
4. Ng R, Sutradhar R, Yao Z et al. Smoking, drinking, diet and physical activity – modifiable lifestyle risk factors and their associations with age to first chronic disease. *Int J Epidemiol*. 2019 Apr 26, 78-86.
5. Ibanez B, Halvorsen S, Roffi M et al. Integrating the results of the Culprit-Shock trial in the 2017 ESC ST-elevation myocardial infarction guidelines: viewpoint of the task force. *Eur Heart J*. 2018 Dec 21;39(48):4239-4242.
6. Mehta SR, Wood DA, Meeks B et al. Design and rationale of the Complete trial: a randomized, comparative effectiveness study of complete versus culprit-only percutaneous coronary intervention to treat multivessel coronary artery disease in patients presenting with ST-segment elevation myocardial infarction. *Am Heart J*. 2019 Sep;215:157-166.
7. Szummer K, Wallentin L, Lindhagen L et al. Improved outcomes in patients with ST-elevation myocardial infarction during the last 20 years are related to implementation of evidence-based treatments: experiences from the Swedeheart registry 1995-2014. *Eur Heart J*. 2017 Nov 1;38(41):3056-3065.
8. Jolly SS, James S, Dzavik V et al. Thrombus aspiration in ST-segment-elevation myocardial infarction: an individual patient meta-analysis: thrombectomy trialists collaboration. *Circulation* 2017 Jan 10;135(2):143-152.
9. Gao M, Qin L, Zhang Z et al. Treatment windows and clinical outcomes in late-presenting patients with ST-segment elevation myocardial infarction. *Am J Med Sci*. 2019 May 7:30181-30188.
10. Siddiqui AJ, Holzmann MJ. Association between reduced left ventricular ejection fraction following non-ST-segment elevation myocardial infarction and long-term mortality in patients of advanced age. *Int J Cardiol*. 2019 Jul 11(19):32530-6.
11. Ibanez B, James S, Agewall S et al. 2017 ESC Guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation. *Kardiol Pol*. 2018;76(2):229-313.
12. Izeli NL, Santos AJ, Crescencio JC et al. Aerobic training after myocardial infarction. Remodeling evaluated by cardiac magnetic resonance. *Arq Bras Cardiol*. 2016 Apr; 106(4):311-318.
13. Ribeiro F, Oliveira NL, Silva G et al. Exercise-based cardiac rehabilitation increases daily physical activity of patients following myocardial infarction: subanalysis of two randomised controlled trials. *Physiotherapy*. 2017 Mar;103(1):59-65.
14. Peersen K, Munkhaugen J, Gullestad L et al. The role of cardiac rehabilitation in secondary prevention after coronary events. *Eur J Prev Cardiol*. 2017 Sep;24(13):1360-1368.
15. Borges JP, da Silva Verdoorn K. Cardiac ischemia/reperfusion injury: the beneficial effects of exercise. *Adv Exp Med Biol*. 2017;999:155-179.
16. Moraes-Silva IC, Mostarda CT, Silva-Filho AC, Irigoyen MC. Hypertension and exercise training: evidence from clinical studies. *Adv Exp Med Biol*. 2017;1000:65-84.
17. McGregor G, Stohr EJ, Oxborough D et al. Effect of exercise training on left ventricular mechanics after acute myocardial infarction – exploratory study. *Ann Phys Rehabil Med*. 2018 May;61(3):119-124.

18. de Gregorio C. Physical training and cardiac rehabilitation in heart failure patients. *Adv Exp Med Biol.* 2018;1067:161-181.
19. Urbinati S, Tonet E. Cardiac rehabilitation after STEMI. *Minerva Cardioangiol.* 2018 Aug;66(4):464-470.
20. Aakre KM, Omland T. Physical activity, exercise and cardiac troponins: clinical implications. *Prog Cardiovasc Dis.* 2019 Mar – Apr;62(2):108-115.
21. Ek A, Ekblom O, Hambraeus K et al. Physical inactivity and smoking after myocardial infarction as predictors for readmission and survival: results from the Swedeheart-registry. *Clin Res Cardiol.* 2019 Mar;108(3):324-332.
22. Sawicka K, Łuczyc R, Laska D. [Physical activity as a health behavior to reduce the risk of coronary incidents]. *J Health Sci.* 2014;4:45-68 [in Polish].
23. Jurkiewicz M, Mianowana V, Wysockiński A. Aktywność fizyczna jako zachowanie zdrowotne zmniejszające ryzyko wystąpienia ponownego incydentu wieńcowego u pacjentów po zawale mięśnia sercowego. *Pol Przegl Kardiol.* 2011; 13(1): 24-30 [in Polish].
24. Piotrowicz R, Wolszakiewicz J. Rehabilitacja kardiologiczna pacjentów po zawale serca. *Fol Card Exc.* 2008; 3(12):559-565 [in Polish].
25. Ferenc K, Zarzycka D, Ślusarska B. Aktywność fizyczna pacjentów po zawale mięśnia sercowego w czasie rehabilitacji uzdrowiskowej i jej wybrane uwarunkowania społeczno-demograficzne. *Med Rodz.* 2015;4:157-164 [in Polish].
26. Fagard RH. Prescriptions and results of physical activity. *J Cardiovasc Pharmacol.* 1995;25(supl. 1):S20-S27.
27. Papademetriou V, Kokkinos FP. The role of exercise in the control of hypertension cardiovascular risk. *Curr. Opin. Nephrol. Hyperens.* 1996;5:459-462.
28. Knapik A, Kocjan J. Lęk i depresja a samoocena zdrowia u pacjentów kardiologicznych – spojrzenie z perspektywy fizjoterapii. *Fizjot Pol.* 2013;13(2):28-32 [in Polish].
29. Wojciechowski K, Kiljański M, Mirecki K, Szczegielniak J. Analiza świadczeń udzielanych w zakresie rehabilitacji kardiologicznej w warunkach stacjonarnych. *Fizjot Pol.* 2015;15(2):100-108 [in Polish].
30. Kuliński W. Fizjoterapia. In: Kowolek A (ed). *Rehabilitacja medyczna.* Edra Urban Partner, Wrocław 2012, pp. 351-411.

ORCID and contribution:

Włodzisław Kuliński: 0000-0002-6419-4030 ^{A,C,D,E,F}

Iwona Zięba: ^{B,C,D}

Conflict of interest:

The Authors declare no conflict of interest.

CORRESPONDING AUTHOR**Włodzisław Kuliński**

ul. K Miarki 11B, 01-496 Warszawa

e-mail: wkulinski52@hotmail.com.pl

Received: 18.03.2022**Accepted:** 22.07.2022

A – Work concept and design, B – Data collection and analysis, C – Responsibility for statistical analysis, D – Writing the article, E – Critical review, F – Final approval of the article