

Psychological factors in ischemic heart diseases

Doctoral (PhD) thesis

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1. INTRODUCTION

Cardiovascular diseases are the leading causes of death all over the world in both genders. Ischemic heart disease (IHD) is the most common cardiovascular disorder. In Europe 22% of women and 20% of men die of IHD. In Hungary there are more than twice as many deaths due to IHD than in other countries of the European Union (EU-27).

The pathophysiological basis of IHD is characterized by insufficient blood supply to the heart muscle which is induced by atherosclerosis of the coronary arteries. The most important manifestation of atherosclerotic coronary artery disease is acute myocardial infarction (AMI), marked by mild or severe necrosis of the heart muscle.

The distribution of AMI by age varies; a declining trend can be observed in young people, however, AMI presents markedly in subjects aged forty or above. The proportion of women among cardiac patients has been increasing recently. Although women develop AMI at an older age than men, the progression of the disease and the mortality rate are worse in women than in men.

Traditional risk factors cannot fully explain the development of IHD, psychosocial factors account for 25-40% of all risks. Negative affects, in particular high level of depression, anxiety, vital exhaustion and sleep disturbances, as well as low level of social support are the most important psychosocial risk factors. Negative affects are usually associated with lifestyle factors (inactivity, obesity, smoking and binge drinking) and they have a combined effect on the onset and progression of IHD. Health locus of control is closely related to health behaviour: internal locus of control can lead to health awareness and improved disease outcome.

The above-mentioned findings have led me to study patients admitted for residential cardiac rehabilitation and analyse the relationship of negative affects (anxiety and depression) and health-related control beliefs with health behaviour in patients with IHD ; the association of psychological (anxiety, depression, vital exhaustion and sleep disturbances) and biological factors with subjective quality of life and gender differences in patients with AMI; changes in psychological factors during a two-year follow-up and gender differences in patients with AMI. In addition, I studied how psychological (anxiety, depression, vital exhaustion and sleep disturbances) and biological factors (left ventricular ejection fraction, MET, number of diseased vessels and diabetes) and social support that were present immediately after the acute cardiac event influence the progression of the disease (relapses/mortality) during the two-year follow-up and the quality of life at the end of the second year.

2. AIMS

My study consisted of three parts and they focused on the following relationships:

- I. clinical cross-sectional study** (in Special Hospital of Chest Illnesses in Deszk):
 - Relationship of health-related control beliefs with socio-demographic variables and parameters of subjective health status (illness intrusiveness and self-rated health).
 - Relationship of anxiety and depression with socio-demographic variables and parameters of subjective health status (illness intrusiveness and self-rated health).
 - Relationship between health-related control beliefs and health behaviours.
 - Relationship of anxiety and depression with health behaviours.

- II. clinical cross-sectional study** (in State Hospital for Cardiology in Balatonfüred):
 - Relationship of medical and psychological factors with subjective quality of life in AMI patients.
 - Gender differences in medical and psychological factors associated with subjective quality of life.

- III. clinical two-year follow-up study** (in Special Hospital of Chest Illnesses in Deszk, in State Hospital for Cardiology in Balatonfüred and Erzsébet Hospital in Hódmezővásárhely):
 - Changes in psychological factors (anxiety, depression, vital exhaustion, sleep disturbances) during the two-year follow-up and gender differences in patients with AMI.
 - Changes in social support during the two-year follow-up, and gender differences.
 - Relationship of psychological and medical factors that was present immediately after the acute cardiac event with subjective quality of life at the end of the second year.
 - Relationship of psychological and medical factors that was present immediately after the acute cardiac event with the progression of the disease (relapses/mortality) during the two-year follow-up.
 - Relationship of social support that was present immediately after the acute cardiac event with the progression of the disease (relapses/mortality) during the two-year follow-up and with subjective quality of life at the end of the second year.

3. METHODS

3.1. I. clinical study

Study population

The study sample consisted of 116 patients with IHD who were admitted to residential cardiac rehabilitation without past history of cardiac surgery in Special Hospital of Chest Illnesses in Deszk.

Materials

To examine *health-related control beliefs* we used the Multidimensional Health Locus of Control Scale Form C developed by Wallston and colleagues. The internal reliability of all three subscales was adequate in our sample (Cronbach alphas between 0.54-0.78). To examine *anxiety and depression* we used the Hospital Anxiety and Depression Scale. Both 7-item subscales of the instrument showed good reliability coefficients (alphas of 0.74 and 0.76 for the Anxiety and the Depression subscales, respectively).

To estimate participants' *subjective evaluation of their health status*, two questions were used. The first referred to illness intrusiveness: "Taken as a whole, to what degree does your disease affect your everyday life?" The second question assessed general self-rated health: 'How would you estimate your current state of health?

Health behaviours were evaluated by a 5-item questionnaire assessing the participant's nutritional habits ('Generally to what extent do you pay attention to having a healthy diet?'), dental hygiene ('Generally to what extent do you pay attention to having proper oral hygiene?'), smoking status ('Do you consider yourself as a non-smoker / an occasional smoker / a daily smoker trying to quit / a daily smoker without trying to quit?'), drinking habits ('How often do you drink beverages containing alcohol?'), physical activity ('How often do you take physical exercise, like swimming, running, cycling or playing football?'), and compliance with medical screening and other regimens ('When do you have any health concerns, do you turn to a health professional immediately?').

Statistical analyses

All demographic and survey data were analysed with SPSS for Windows version 20 (SPSS Inc, Chicago, Illinois, USA). Demographic data were analysed with descriptive statistics. The comparison of health-related control beliefs, anxiety and depression with socio-demographic variables and subjective health status (illness intrusiveness and self-rated health) was

conducted with analysis of variance (ANOVA), while the connection of health-related control beliefs, anxiety and depression with health behaviours was analysed with partial correlation. Control variables included: age, gender, marital status, educational level, illness intrusiveness and self-rated health. Ordinal logistic regression model was used to analyse relationships of health-related control beliefs, anxiety and depression with health behaviours. Control included: age, gender, marital status, educational level, illness intrusiveness and self-rated health. The odds ratios (ORs) and 95% confidence interval (CI) were used to assess measurement of effect and statistical significant levels were determined by two-tailed p values of 0.05.

3.2. II. clinical study

Study population

The study sample consisted of 100 patients who were admitted to a phase II residential cardiac rehabilitation programme in State Hospital for Cardiology in Balatonfüred following an AMI. The questionnaires were filled in 8.5 days after AMI on average (3–14 days). Three questionnaires were excluded because we could not evaluate them.

Materials

Psychological factors: The 9-item self-report Beck Depression Inventory was used to assess current depressive symptomatology. The Chronbach-alpha rate of the scale was 0.88 in our sample. The Spielberger State-Trait Anxiety Inventory's Trait Score was used to measure anxiety (Chronbach-alpha: 0.90) and the Shortened Maastricht Vital Exhaustion Questionnaire was used to assess vital exhaustion (Chronbach-alpha: 0.88). To assess sleep disturbances the Athens Insomnia Scale was employed (Chronbach-alpha: 0.92) and we used the WHO Well Being Scale (5 items) to measure subjective quality of life (Chronbach-alpha: 0.90).

Socio-demographic factors: Five questions were used to determine demographic data: gender, age, marital status, education level and working status.

Medical factors: We used medical records to collect medical factors: left ventricular ejection fraction and left ventricular diastolic diameter (both determined by echocardiography); number of diseased vessels (revealed by coronarography); Body Mass Index and MET values (the estimated level of oxygen consumption on exertion).

Statistical analyses

All demographic and survey data were analysed with SPSS for Windows version 20 (Statistical Package for Social Sciences, IBM Corp., 2011.). Demographic data were analysed with descriptive statistics, the comparison of risk factors and test results were conducted with independent sample Student's t-test, while the connection between risk factors and results were analysed with multiple linear regression and Pearson correlation. The alpha level was set to $p < 0.05$.

3.3. III. clinical study

Study population

The study sample consisted of 188 patients who suffered an AMI and took part in cardiac rehabilitation programme in Special Hospital of Chest Illnesses in Deszk, in State Hospital for Cardiology in Balatonfüred and Erzsébet Hospital in Hódmezővásárhely. The questionnaires were filled in 8 days after AMI on average (3–14 days) and after discharge they received a letter with same questionnaires 3 months, 6 months, 12 and 24 months after their acute cardiac event, where they were asked to complete the questionnaires.

Materials

Psychological factors: The 9-item self-report Beck Depression Inventory was used to assess current depressive symptomatology. The Chronbach-alpha rates of the scale were 0.88-0.91 in our sample during the follow-up. The Spielberger State-Trait Anxiety Inventory's Trait Score was used to measure anxiety (Chronbach-alphas: 0.89-0.92) and the Shortened Maastricht Vital Exhaustion Questionnaire (9 items) was used to assess vital exhaustion (Chronbach-alphas: 0.88-0.90). To assess sleep disturbances the Athens Insomnia Scale was employed (Chronbach-alphas: 0.88-0.90) and we used the WHO Well Being Scale (5 items) to measure subjective quality of life (Chronbach-alphas: 0.86-0.90) and the Caldwell Social Support Questionnaire to measure social support..

Socio-demographic factors: Five questions were used to determine demographic data: gender, age, marital status, education level and working status.

Medical factors: We used medical records to collect medical factors: left ventricular ejection fraction (LVEF) (determined by echocardiography); number of diseased vessels (revealed by coronarography); MET values (the estimated level of oxygen consumption on exertion) and the diagnosis of diabetes.

Health behaviours: We analysed them by asking two questions: “Do you smoke?” and “How often do you take exercise?”

End-point assessment: We chose all cause mortality and hospitalization because of cardiovascular events (angina, cardiac arrhythmia, percutaneous coronary angioplasty, AMI, bypass surgery) as clinical end-points.

Statistical analyses:

All demographic and survey data were analysed with SPSS for Windows version 20 (SPSS Inc, Chicago, Illinois, USA). All statistical tests were two-tailed; p values <0.05 were considered statistically significant. Means, standard deviations and percentages were used in descriptive statistics. We assessed the changes in the means of psychological factors (anxiety, depression, vital exhaustion and sleep disturbances) and the means of social support during the follow-up with analysis of variance. Chi-square test was used to measure the changes in percentages of socio-demographic and medical factors, and health behaviours during the follow-up. The relationship between psychological factors immediately after AMI (at baseline) and subjective quality of life 24 months after AMI was analysed with enter multiple linear regression model. The model was adjusted for LVEF, MET and number of diseased vessels. Logistic regression model was used to evaluate the impact of psychological factors at baseline on low level of subjective quality of life at the end of the second year. The model was adjusted for gender, age, marital status, educational level, MET, diabetes, smoking and physical activity. The OR and 95% CI were used to assess measurement of effect.

Forward LR cox proportional hazard models were used to evaluate the prediction of psychological and biological factors at baseline on progression of the disease (hospitalization/mortality). In all models included dependent variables: hospitalization/mortality (in one variable). Independent variables included: psychological variables (anxiety, depression, vital exhaustion and sleep disturbances) and social support as both continuous and dichotomous variables. We constructed two categories with the cut-off of quartile in dichotomous variables. Control variables included in all cox models: gender, age, marital and educational status, MET, diabetes, smoking and physical activity. The hazard ratios (HRs) and 95% CIs were used to assess measurement of effect.

Cumulative survival curve for 24 month progression of the disease was constructed for the dichotomized vital exhaustion scores, using the Kaplan-Meier method.

4. RESULTS

4.1. I. clinical study

1. More than half of the patients in our study sample follow a healthy diet and the same number of patients pay attention to having proper oral health. 70.5% of the patients turn to a health professional immediately if they have any health concerns. In terms of unhealthy lifestyles, 12% of patients are current smokers and 22.4% of patients are heavy drinker.
2. As far as health-related control beliefs concerned we found the highest level in the social-external control dimension and the lowest level in the chance-external control dimension. Only few patients think that their health is determined only by chance, luck or fate, however, most of them believe that their health is influenced by “powerful others” (doctors, nurses, friends and family members).
3. The level of internal control beliefs (26.11 ± 5.23 vs. 23.03 ± 7.13 , $p=0.009$) and social-external control beliefs (28.50 ± 3.92 vs. 25.69 ± 4.28 , $p=0.001$) was significantly higher in men than in women.
4. Examining the level of anxiety and depression we found that women had more severe anxious symptoms (8.43 ± 4.81 vs. 6.39 ± 3.90 , $p=0.045$), than men.
5. Patients with high levels of anxiety (OR=-0.90, CI=0.81-1.01) or depression (OR=-0.83, CI=0.72-1.04) were more likely to follow an unhealthy diet and less likely to take regular exercise (anxious patients: OR=-0.88, CI=0.77-1.01, depressive patients: OR=-0.87, CI=0.77-1.01).
6. Patients with stronger internal control beliefs were more prone to taking regular exercise (OR=1.19, CI=1.07-1.31) and patients with stronger social-external control beliefs were more likely to seek medical attention if they suspected a disease (OR=1.20, CI=1.09-1.33). The chance-external dimension did not associate with any of the health behaviours.

4.2. II. clinical study

7. In female patients with AMI (immediately after the acute cardiac event) the level of anxiety (45.91 ± 11.06 vs. 40.98 ± 9.59 , $p=0.044$) and the level of vital exhaustion (8.47 ± 5.42 vs. 6.27 ± 4.51 , $p=0.027$) were significantly higher than in males and females had more sleep complaints than males (6.96 ± 5.71 vs. 3.87 ± 3.64 , $p=0.003$).

8. Subjective quality of life showed significantly high negative linear correlations with anxiety, depression, vital exhaustion and sleep disturbances. Among the medical factors only Body Mass Index had a mild negative correlation with well-being. After adjustment for psychological risk factors and medical parameters only vital exhaustion ($\beta=-0.37$, $p<0.001$) and anxiety ($\beta=-0.29$, $p=0.020$) were found to have a significant correlation with subjective quality of life. The goodness of fit of the multiple regression model was moderate ($R^2=0.37$).
9. Examining the two genders separately we found that in the male group only the anxiety was associated the subjective quality of life ($\beta=-0.65$), the goodness of fit was moderate ($R^2=0.43$) and the model was significant ($p<0.001$). In the female group only the vital exhaustion was associated the subjective quality of life ($\beta=-0.68$). The model fit was good ($R^2=0.47$) and significant ($p<0.001$).

4.3. III. clinical study

10. AMI patients who survived and took part in our study during the two-year follow-up (N=123) had the following parameters: Psychological factors (anxiety, depression, vital exhaustion and sleep disturbances) did not change significantly during the two-year follow-up. At baseline (immediately after the acute cardiac event) 54% of the patients reported higher than the average anxious symptoms, 33.5 % had depressive symptoms (mild to severe), 46.7% had mild to severe vital exhaustion symptoms and 34.3% reported more frequent sleep complaints. At the end of the second year 48.9% of the patients reported anxious symptoms, 35 % mild to severe depressive symptoms, 42.3% mild to severe vital exhaustion symptoms and 32.8% more frequent sleep complaints.
11. Analysing the gender differences in levels of psychological factors during the follow-up period we found that the mental state of women was more severe almost at each follow-up date. Women had higher level of depression at baseline (6.56 ± 5.02 vs. 3.96 ± 3.93 , $p=0.001$) and 3 months later (6.73 ± 6.42 vs. 4.72 ± 4.55 , $p=0.001$) than men, however, one year later the level of depression were equal in both genders. The level of vital exhaustion in women was higher than in men at baseline (9.94 ± 4.86 vs. 6.10 ± 3.86 , $p=0.032$) and 3 months later (9.82 ± 5.18 vs. 6.46 ± 4.11 , $p=0.048$) and levels of sleep disturbances were significantly higher in women than in men at each follow-up date with the exception of the second year. The same levels of vital exhaustion were observed both in men and women two years after AMI (7.91 ± 5.39 vs.

7.54 \pm 4.84), whereas the level of sleep disturbances remained higher in women (but not significantly) than in men two years after AMI (6.31 \pm 5.18 vs. 4.18 \pm 4.02). There were no significant gender differences in the levels of anxiety during the follow-up period.

12. We did not find significant differences in the levels of social support during the follow-up period (parent, child, spouse/ cohabiting partner, relative and friend). On the other hand, women received significantly less support at baseline (6.23 \pm 3.85 vs. 8.83 \pm 4.32, $p=0.001$), 6 months later (6.92 \pm 3.76 vs. 8.75 \pm 3.71, $p=0.033$) and 12 months later (6.03 \pm 3.8 vs. 9.00 \pm 3.48, $p<0.001$) than men, and women received significantly less support from spouse/ cohabiting partner at each follow-up date.
13. Subjective quality of life at the end of the second year was only predicted by the level of vital exhaustion measured at baseline ($R^2=0.26$, $\beta=-0.52$, $p<0.001$) both in men ($R^2=0.19$, $\beta=-0.44$, $p<0.011$) and women ($R^2=0.44$, $\beta=-0.57$, $p<0.004$) (LVEF, MET, number of diseased vessels, anxiety, depression, sleep disturbances and social support were excluded variables from the multiple linear regression model) .
14. High level of vital exhaustion (OR=5.10, CI=2.20-11.82), high level of sleep disturbances (OR=4.98, CI=2.71-11.41) and low level of social support (OR=1.21, CI=0.94-2.34) at baseline predicted low level of subjective quality of life at the end of the study (two years after AMI) (Control factors included: age, gender, marital status, educational level, MET, diabetes, smoking and physical activity.) When psychological factors also included as control factors in the logistic regression model only high level of vital exhaustion at baseline (OR=6.31, CI=2.44-16.31) predicted low level of subjective quality of life at the end of the study.
15. High level of vital exhaustion (HR=2.76, CI=1.49-4.93) and low level of MET at baseline (HI=0.72, CI=0.60-0.86) predicted progression of the disease (relapses/ mortality) during the two-year follow-up (adjusted for age, gender, marital status, educational level, diabetes, smoking, physical activity, anxiety, depression and sleep disturbances). High level of vital exhaustion before and after the acute cardiac event (analysed both as a continuous and a categorical variable) predicted the progression of the disease whereas high level of MET at baseline reduced the risk of progression of the disease during the two-year follow-up. Low level of social support was associated with the progression of the disease (relapses/mortality) only in the absence of psychological factors in the cox regression model.

5. CONCLUSIONS

IHD patients with high levels of anxiety and depression were more likely to follow an unhealthy diet and less likely to take regular exercise. In terms of health-related control beliefs patients with stronger internal control beliefs were more prone to taking regular exercise, while patients with stronger social-external control beliefs were more likely to seek medical attention if they suspected a disease.

Subjective quality of life was closely related to vital exhaustion and anxiety in patients with AMI immediately after the acute cardiac event. We revealed gender differences as well: subjective quality of life immediately after AMI showed significant association with anxiety in men, and vital exhaustion in women.

In the two-year follow-up study of AMI patients we found that psychological factors in AMI patients did not change significantly during the two-year follow-up. Analysing the gender differences in levels of psychological factors during the follow-up period, we found that the mental state of women was more severe almost at each follow-up date. Women had higher levels of depression and vital exhaustion and more symptoms of sleep disturbances during the first year of follow-up, however, they decreased to a level similar to those in men over the second year.

Subjective quality of life at the end of the second year was only predicted by the level of vital exhaustion at baseline both in men and women.

High level of vital exhaustion and low level of MET at baseline predicted progression of the disease (relapses/mortality) during the two-year follow-up. Low level of social support was associated with the progression of the disease (relapses/mortality) only in the absence of psychological factors in the cox regression model.

To sum up, it is essential to recognise the symptoms of anxiety, depression and inadequate health-related control beliefs in IHD patients, because by reducing these psychological conditions and increasing the internal control beliefs we can improve the quality of life.

In addition, our findings draw attention to the fact, that the high level of vital exhaustion present in acute cardiac events (AMI) is associated with subjective quality of life (at baseline) and can predict the low level of quality of life two years after AMI (at the end of our study). Furthermore, the high level of vital exhaustion present in at acute cardiac event (AMI) can predict progression of the disease (relapses/ mortality) during the two-year period.

Vital exhaustion by prolonged uncontrollable stress might precede AMI (we did not investigate it, however, a lot of studies demonstrated this fact), on the other hand vital exhaustion can be caused by the progression of physical symptoms. It has been proved that the level of vital exhaustion can be reduced by psychotherapy, so by detecting and managing exhaustion we can improve not only quality of life but the survival of cardiac patients.

The findings of our studies highlight that the mental state of women with AMI was more severe almost at each follow-up date. Women had higher levels of depression and vital exhaustion and more symptoms of sleep disturbances during the first-year of follow-up, moreover, women received significantly less social support than men. It would be essential to involve women with AMI in cardiac rehabilitation programmes where we can increase quality of life and chances of survival by improving their mental state.

6. LIST OF PYBLICATIONS MADE IN THE THEME OF THE DISSERTATION

Beatrix Rafael, Attila Simon, Gergely Drótos, Piroska Balog (2014) Vital exhaustion and anxiety are related with subjective quality of life in patients with acute myocardial infarct. J Clin Nurs, 23: 2864-2873.

Barna Konkoly Thege, Beatrix Rafael, Magda Rohanszky (2014) Psychometric properties of the Multidimensional Health Locus of Control Scale Form C in a learned helpless culture. PLOS ONE, 2014; 9(9): e107108.

Rafael Beatrix Konkoly Thege Barna, Kovács Péter, Balog Piroska (2015) Szorongás, depresszió, egészségkontrollhit és az egészség-magatartással való kapcsolatuk ischaemiás szívbetegek körében. Orvosi Hetilap, 156(20): 813-822.