Quality of life and functional capacity one year after coronary artery bypass graft surgery

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Objectives: To analyze functional capacity and quality of life of patients one year after coronary artery bypass graft surgery (CABG) and identify factors that influence them in order to accomplish maximal recovery.

Methods: Observational study included 89 patients undergoing elective CABG, who were tested preoperatively and one year after operation using Short form 12 item health survey (SF-12), Duke Activity Status Index (DASI) questionnaire and questionnaire regarding participation in rehabilitation program.

Results: After one year, DASI and quality of life-physical component summary score (SF-12 PCS) significantly improved (p<0.001; p<0.05). No statistically significant improvement in mental component summary has been registered. In domains of physical component summary, only general health was significantly better (p<0.05). There was moderate correlation of SF-12 PCS postoperatively with SF-12 mental component summary (SF-12 MCS) preoperatively. DASI scores preoperatively and postoperatively are found to be significantly higher in men comparing to women (p<0.05). Multiple regression analysis found DASI preoperatively (R²=0.62, β=0.42, p<0.05) and age (β=-0.53, p<0.05) to be significant predictors of DASI postoperatively in women. Enrollment in rehabilitation program didn’t influence DASI and SF-12 scores one year after CABG.

Conclusions: Although functional capacity and physical component of quality of life improved, factors that influence them still remain unclear. It seems that mental health status and personality profile, as well as the alternative modalities of rehabilitation, might play important role in long lasting effects of improvement.

Key words: cardiac surgery, recovery of function, quality of life

INTRODUCTION

E valuation of patient’s health status after coronary artery bypass graft surgery (CABG) using objective measures such as morbidity and mortality rates or physical benefits only, doesn’t give us appropriate insight into patient’s recovery process. Health related quality of life as important measure of recovery is, nowadays, widely accepted.1-3 It takes into account levels of physical, mental, social and role functioning and includes perceptions and well being.4 In analysis of this important outcome, in this group of patients, many different questionnaires have been used: Nottingham Health Profile Questionnaire5,7,15 Dimensions of Quality of Life3,8 Mac New Heart disease health related quality of life questionnaire9. However, Short form 36 item health survey (SF-36) has most frequently been reported as measure of HRQL.2,3,10-14 Short form 12 item health survey (SF-12) is a measure derived from SF-36. Although it is much shorter and may diminish respondent burden, it has still rarely been used in this cohort.16 Functional status or functional capacity of patients is another measure of their recovery. There is a lot of disagreement in its definition. Some authors consider it the ability to manage daily routine, to perform physically demanding activities of daily living,16 while others use broader definition including physical, mental and social functioning.17 However, in cardiac rehabilitation, functional capacity or functional status is most frequently associated with evaluation of physical capabilities through implementation of different walk tests, exercise stress test or measuring of VO₂ max. Duke Activity Status Index questionnaire (DASI) is another measure of functional status that has been used in researches.18-20 Many factors are shown to influence DASI scores postoperatively (age, sex, co-morbidities)19 and in cohort of women with ischémia syndrome, DASI scores correlated with exercise capacity and predicted adverse effect.21 However, there are
no data on correlation between quality of life and DASI in this group of patients.

Cardiac rehabilitation has important role in patient's recovery process. It is shown that cardiac rehabilitation reduce mortality, but there wasn't difference in health related quality of life among participants and non participants in rehabilitation program. In Cochrane database of systematic reviews influence of cardiac rehabilitation on health related quality of life couldn't be determined because of great diversity among measuring scales. The aim of our study was to evaluate change of functional capacity and quality of life one year after CABG, using DASI and SF-12 questionnaire, to determine their correlation and identify factors that could influence and predict recovery.

MATERIALS AND METHODS

Subjects and study design

Subjects consisted of patients admitted to one of four tertiary hospitals in the same city for elective coronary artery bypass graft surgery in 5 weeks period. The study used longitudinal design and data were collected at two time points: preoperatively in the hospital and one year after CABG by mailed self-administered questionnaire. All subjects signed written informed consent to participate in the study.

Preoperatively, five to seven days before surgery, demographic data (gender, age, and education) and presence of co-morbidity (diabetes, cerebrovascular infarction, peripheral vascular disease, chronic obstructive pulmonary disease, myocardial infarction) were collected. SF-12 and DASI questionnaire were administered in this period, too.

At follow-up, one year after CABG, patients were contacted by telephone prior to sending by mail two self-administered questionnaire, SF-12 and DASI questionnaire, along with request for information regarding their enrollment in second phase rehabilitation program.

MEASURES

12-Item Short-form Health Survey

Short form 12 item health survey (SF-12) is a generic measure of health related quality of life. It consists of twelve items from SF-36 Health Survey measuring 8 health domains: physical functioning, physical role, bodily pain, general health, emotional role, social functioning, mental health and vitality. Each domain is scored and upon it, two summary measures of physical and mental health are obtained: Physical Component Summary (PCS) and Mental Component Summary (MCS). These scores are interchangeable with those from SF-36 in general and specific population. We used Serbian translation derived from SF-36 questionnaire.

Duke Activity Status Index

Duke Activity Status Index (DASI) is a 12-item self-administered questionnaire that estimates functional status upon patient's ability to perform activities of daily living and recreational activities. Upon its value, maximal oxygen consumption can be estimated and metabolic equivalent (MET) can be calculated. Serbian translation questionnaire was used.

Enrollment in rehabilitation program

After the surgery, all patients were included in inpatient rehabilitation program and they were given advices for home activities until commencement of second phase of rehabilitation, which was advised for all eligible patients. At follow-up, one year after surgery, patients were asked to provide answers regarding enrollment in rehabilitation program:

1. if they participated in rehabilitation program
2. when the rehabilitation program started and for how long it lasted
3. their impressions about usefulness of rehabilitation.

Statistical analysis

Categorical variables were expressed as frequencies and compared by chi-square statistics. Continuous variables were expressed as means SD. Differences between pri-
mary and follow up values of DASI, SF-12 PCS and MCS were estimated using paired sample t test analysis. A value of $p<0.05$ was considered statistically significant. Differences between groups were analyzed using independent samples t test. Correlations between variables were computed using Pearson correlation coefficient. Predictors for DASI values were obtained using multiple regression.

**RESULTS**

Ninety eight patients entered the study. After one year, 11 patients were lost to follow-up and 2 died. Patients’ characteristics are shown in Table 1.

Comparing scores of DASI preoperatively (25.1±3.49) with DASI postoperatively (29.05±12.75) we found statistically highly significant improvement ($p<0.001$). Scores of SF-12 PCS (40.63±8.35) postoperatively significantly improved ($p<0.05$) compared with preoperative values (36.18±9.32). There was no statistically significant difference in SF-12 MCS scores in two time periods (41.37; $p>0.05$). Analyzing these outcome variables for gender differences, we found only DASI scores, preoperatively and postoperatively, to be significantly higher in men comparing with women ($p<0.05$). Table 2. Number of bypasses, co-morbidities, age groups, education, didn’t show gender differences. Further analysis by stratifying DASI scores into categories, gave us insight into different pattern of recovery among men and women—figure 2a and 2b.

There were strong correlation between DASI and SF-12 PCS scores preoperatively ($r=0.61$, $p<0.001$) and moderate correlation postoperatively ($r=0.44$, $p<0.001$). Correlation between DASI scores in women postoperatively is found to be strongly correlated with DASI scores preoperatively ($r=0.609$ $p<0.01$) and age ($r=-0.681$ $p<0.01$). There were no significant correlations between any of variables preoperatively and DASI postoperative scores in men (DASI preoperatively $r=0.27$ $p<0.05$, SF-12 MCS $r=0.35$ $p=0.056$). Using multiple regression we found model including DASI preoperatively and age, to be significant predictor of DASI postoperatively in women ($R^2=0.62$, $F_1,1$ (DASI preoperatively) $=0.42$ $p<0.05$, $F_2$ (age) $=0.53$ $p<0.05$). These results are shown in table 2.

Analyzing SF-12 PCS scores postoperatively in all eight domains, we found that scores improved postoperatively in domains of physical functioning, role physical, pain, general health, vitality, mental health and decrease in domains of social functioning and role emotional. Only scores of general health showed highly significant change in scores (from 35.6±3.6 preoperatively to 49.5±3.4 postoperatively, $p<0.05$). Figure 1. SF-12 PCS postoperatively correlated moderately only with SF-12 MCS preoperatively ($r=0.39$ $p<0.001$).

SF-12 MCS postoperatively wasn’t significantly correlated with any of the variables and there were no statistically significant differences between groups (gender, age, co-morbidities, education).

Majority of patients (64%) participated in rehabilitation program. Rehabilitation started after 3.7±1.9 months and lasted for 18.7±1.9 days. Analyzing the answers about sat-
isfaction with rehabilitation program, 77% of patients reported that it had influenced both, physical and psychological recovery, 12% only physical recovery and 11% neither of two. DASI, SF-12PCS and MCS between group with and without enrollment in rehabilitation program postoperatively, didn’t show statistically significant difference (p>0.05). Groups weren’t different regarding any other examined variable (age, gender, education, co-morbidities).

**DISCUSSION**

In our study, one year after coronary artery bypass graft surgery, functional capacity of patients significantly improved. There were differences between men and women in preoperative and postoperative values of DASI scores, with women scoring significantly lower. Analyze of magnitude of change of DASI, revealed that women however, changed much more their score than men. Since there are no gender differences among other subject’s characteristics (age, co-morbidities, number of bypasses, enrollment in rehabilitation program), gender per se, seems to be one of the reasons for diminished functional capacity. That corresponds to previous findings of Koch and colleagues who, after examined a large cohort of patients, concluded that female gender was associated with more postoperative functional impairment. Lower scores in women are due to the largest percentage of patients in the group that scored the lowest preoperatively (DASI score <16.5, which corresponds to 4.7 MET). After one year, reduction of percentage in that group is the largest, but it still includes the majority of patients. In men, the largest percentage of patients preoperatively is in the group scoring the highest (DASI scores >34.6 that corresponds to 9.9 MET). Reduction of percentage in first two groups and enlargement in third and fourth group postoperatively, is without significant difference. Analyzing factors that predict functional recovery, we found age and DASI preoperative values in women, to be the most significant ones. As to men, the only one variable that shows almost significant correlation is SF-12 MCS. These different patterns of recovery are something that hasn’t been evaluated so far. We couldn’t find facts that would explain these differences. It is something that should be further analyzed, because it might suggest different strategies in rehabilitation.

Looking at the correlation between functional capacity and physical composite score of quality of life, we see that it is stronger preoperatively. That suggests that postoperatively other variables interface much more in the variability of those two variables. Despite significant correlation, neither of two variables can be used as predictor of the other one postoperatively. Our results showed that DASI and SF-12 PCS do not provide the same information regarding functional status, since the correlation postoperatively was only moderate. Therefore, both measures should be included in the assessment of recovery of this group of patients.

One year after CABG statistically significant improvement in quality of life is seen only in physical component summary. In spite of improvement in many domains, the only one that showed statistical significance was the domain of general health. These findings are not in agreement with research of Muller-Nordhorn and colleagues who found significantly improvement in both component summaries. Their baseline and follow up values in both composite scores of SF-12 are much higher than ours. Unfortunately, there are no normative data of SF-36 or SF-12 for Serbian population, so comparison with general population’s scores couldn’t be made. Elliott and colleagues in their analysis of cohort of post CABG patients showed improvement in PCS and deterioration in MCS of SF-36, six month postoperatively. In our study, scores of SF-12 MCS improved over time, but the change wasn’t statistically significant. Looking at each of domains we can notice that social functioning and role emotional deteriorated, while other two domains of MCS, vitality and mental health, improved. It is possible that reality isn’t proportional to patient’s expectation of recovery, limiting their better social reintegration and everyday functioning. Reasons for not improving MCS in higher degree have to be further explored, so they can be adequately influenced. Strong correlation between preoperative values of SF-12 MCS and postoperative SF-12 PCS is another finding that should be carefully observed. It points out high degree of influence of mental status on perceived physical status, that has already been reported by other researchers (Falcoz and colleagues). This finding give us the basis for further researches on influence of preoperative management of mental health status on enhancement of quality of life postoperatively.

The majority of our patients participated in rehabilitation program postoperatively. Although in their opinion, rehabilitation influenced physical and psychological recovery, statistical analysis didn’t reveal any significant differences in DASI and SF-12 scores for participants and nonparticipants in rehabilitation program. Benefits of cardiac rehabilitation are shown to be multiple: it improves exercise capacity, lipid profile, autonomic tone, behavioral characteristic and reduce overall morbidity and mortality. Some authors have reported improvement in quality of life after cardiac rehabilitation, but only in observational studies. Randomized control trials failed to reveal difference between groups that has or hasn’t been enrolled in cardiac rehabilitation. There are no researches that evaluate quality of life in relation to various patients’ characteristics and attendance of rehabilitation. King and colleagues emphasized self efficacy, self motivation and social support as important determinants of cardiac recovery and rehabilitation attendance. It seems reasonable to implement estimation of these categories in further research of quality of life of this cohort since that still remains live question in cardiac rehabilitation.

There are a number of limitations in our study. The outcomes achieved were at one center and further studies are needed in order to confirm their generalisability. Assessment of patients is made in two time points, which is im-
sufficient for detecting all changes and influences of interest. Relatively long period between collection of data and termination of rehabilitation program can be the reason for missing its positive effects on quality of life and functional capacity. We omit to analyze adoption and sustenance of healthy behaviors after ending of rehabilitation program, which is of great importance in obtaining long term effect. Our results may also suggest need for implementation of alternative modalities of rehabilitation that would enable greater influence of rehabilitation treatment on patients' quality of life and functional status.

Although our research showed improvement in functional capacity and physical component of quality of life after CABG, factors that influence them still remain unclear. Difference in functional status between genders, which couldn't be explained by any other patient's characteristics, may be due to existence of different psychological profiles. Correlation of MCS preoperatively and PCS postoperatively also supports that assumption. Non significant improvement in MCS could be due to non recognized changes in mental health postoperatively that could be otherwise treated. Further researches must be focused on preoperative and postoperative analysis of patient's personality profile, social support and mental health status. Their influence on health related quality of life and functional status should be further evaluated through randomized control trials.

SUMMARY

KVALITET ŽIVOTA I FUNKCIJONALNI STATUS GODINU DANA POSLE HIRURŠKE REVASKULARIZACIJE MIOKARDA

Uvod: Funkcionalni status i kvalitet života predstavljaju najznačajnije pokazatelje oporavka bolesnika posle hirurške revaskularizacije miokarda. Održavanjem njezinih vrednosti kao i povezanosti sa drugim parametrima i karakteristikama bolesnika, značajno je, jer na toj način možećemo modificirati rehabilitacione postupke u cilju dobićaju najvećih rezultata.

Metod: Istraživanjem je obučavaju 98 bolesnika hospitalisanih u Klinici za vaskularnu hiruriju Kliničkog centra Srbije radi hirurške revaskularizacije miokarda. Preoperativno bolesnici su popunili test za procenu kvaliteta života (SF-12) i funkcionalnog kapaciteta (DASI utipnik). Godinu dana posle operacije bolesnici su popunili iste utipnike uz dodatak utipnika s sprovedenoj rehabilitaciji.

Rezultati: Posle godinu dana rezultati DASI utipnika i SF-12 fizičkog skora su pokazali statistički značajno povećanje (p<0.001, p<0.05). Nije bilo statistički značajne razlike u vrednostima SF-12 PCS nadjena je statistički značajna umjerena pozitivna korelacija (r=0.39, p=0.001). DASI vrednosti su i preoperativno i postoperativno imali statistički značajno više vrednosti kod muškaraca (p<0.05). Mulitvarijansnom regressionskim analizom nadjeno je da su visina DASI skora preoperativno (R²=0.62, β=0,42, p<0.05) i godine starosti (R²=0,53, p<0.05) značajni prediktori postoperativnih vrednosti

REFERENCES


