

Health-related quality of life following heart surgery

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Abstract

This study evaluates the differences in preoperative and postoperative health-related quality of life of the patients following heart surgery and observed the factors that influence quality of life changes. This prospective observational study involved two parameters from the SF-36 questionnaire before and one year after heart surgery in a single surgeon's practice. At the baseline assessment of the study observed 140 patients, predominantly were male in both study groups. The mean age was 56.8 ± 4.2 years, 64.7 ± 7.4 years in Group of patients age ≤ 60 years and age >60 year's respectively. In elderly aged group, patients have greater risk of co-morbidity, operative complications, and low preoperative as well as postoperative quality of life score. There was an overall improvement in all majority health domains of the SF-36 questionnaire among study population. Statistical results from Logistic multivariate analysis demonstrates a greater value of preoperative mental component summary scores ($p=0.08$), and physical component summary scores ($p=0.01$) as potential risk factors for non-improvement following heart surgery. Although, elderly patients (age >60 year's) with greater operative risk have low preoperative quality of life score, but demonstrate an equal improvement in most of the health domains following heart surgery as like as younger study population.

Introduction

Health-related quality of life is an issue of great importance especially for the end result of any surgical procedures.¹ Concurrently people's life span has gone up specifically in recent years, as well as there are a significant number of aged population who are undergoing heart surgery.² For calculating the morbidity and mortality while the cardiac surgery is done, age is an autonomous factor to predict the outcome.^{3,4} However, as the elderly patients are more prone to suffer from postoperative comorbidities, if the operative time is more as well as due to their low physiological reserves.⁵ Different types of conclusion have been made in the studies on postoperative health related quality of life based on age factors. However, in presence of controversial statement, it has been not absolutely certified that there is an effect of age on postoperative health-related quality of life status.⁵⁻⁷

The most common postoperative comorbidities following heart surgery are infection, arrhythmia, neurological impairment as well as renal and respiratory functional impairment.⁸ A higher incidence of preoperative red cell transfusion to older patients may results in a reduced tolerance of hypohemoglobinemia after surgery and insufficient activity of the hemopoietic system.^{9,10} Moreover, a high incidence of red cell unit's transfusion has been identified

as an independent predicting factor in post-operative mortality; but there is insufficient data regarding the impact of postoperative morbidities on health-related quality of life score.¹¹

The SF-36 questionnaire is often used as a tool for assessing the quality of life in various medical fields, where it is valued especially for its ability to capture the social dimensions of life.¹² In cardiology, for example, it has been used in patients with ischemic heart disease, in the course of heart failure, or in the presence of atrial fibrillation.^{13,14} Furthermore, in cardiac surgery an assessment of health-related quality of life by means of using the SF-36 questionnaire in patients undergoing myocardial revascularization surgery, heart valves repair or replacement and surgery involves thoracic aorta, and intracardiac repair for congenital abnormalities was carried out.^{10,12-15}

The aim of this study was to assess the influence of age on health-related quality of life among two study groups by using the SF-36 questionnaire and also to compare clinical data from the preoperative, perioperative, and postoperative periods experienced by these groups. A second aim was to identify the group of patients who do not benefit from the surgery (non-improvers) and to find potential risk factors for unimproved quality of life after heart surgery for further clinical research.



Materials and Methods

A total of 140 patients were evaluated at the Cardiothoracic Surgery Department in a single surgeon practice in the period from January 2015 to December 2016. The study population inclusion criteria were informed written consent, study participation agreement, and elective cardiac surgery. On the other hand, refusal of the patients to participate, complex congenital as well as emergency heart surgery were excluded from this study. A SF-36 questionnaire was also completed before and one year after heart surgery. There are 8 (eight) domains in SF-36 questionnaire which covers social, physical and mental life of each individuals and was applied to assess the health related quality of life for the study populations. These eight domains are known as follows: Role physical, physical functioning,

social functioning, role emotional, mental health, bodily pain, vitality and also general health. Patients answer in response to SF-36 questionnaire, are then transformed on a scale of 0-100 for individual domains, where zero is worst and 100 is the best health status. Moreover, for interpreting the SF-36 questionnaire a standardized technique was used, and all variables including preoperative, perioperative and postoperative data were collected from authorized medical evidence.

Population were divided into two study groups (age ≤ 60 years and age >60 years) and an assessment utilizing health-related quality of life questionnaire were performed one year after surgery. Furthermore, the SF-36 score were divided into 2 meta score- physical component summary (PCS) score and mental component summary (MCS) score. MCS includes social functioning, role emotional, and mental health. PCS includes role physical, physical functioning, bodily pain, vitality and general health. These two sub-scores have used for multivariate analysis and the SF-36 considered from the SF-36 questionnaire, which represented the mental and physical status of study population. However, improvers and non-improvers population were defined when health related quality of life difference between preoperative and postoperative score was >0 and ≤ 0 respectively in both MCS and PCS scores.

Statistical analysis

Chi-squared test and un-paired t-test were utilized to analyze the differences between subgroups, and also observed health-related quality of life relationship between survivors and non-survivors of the study population. Non-parametric Wilcoxon matched-pairs signed-rank test was utilized to evaluate the health-related quality of life differences between the before and after surgery. In this study p-values ≤ 0.05 was considered statistically significant, as well as the logistic regression model utilized for multivariate analysis to evaluate the relationship among preoperative characteristics (age, sex, preoperative MCS and PCS, surgery) and postoperative improvement in health-related quality of life status that is a positive rise in SF-36 score. Online www.euroscore.org utilized to calculate patients risk score, and statistical analyses were performed using SPSS (Statistical Package for the Social Sciences) version 22.

Results

Preoperative study variables of the study patients are shown in Table I. Male patients were predominant in both study groups and the mean age was significantly higher ($p \leq 0.05$) in the older aged group (age >60 years). This observed a higher prevalence of preoperative diabetes ($p=0.03$), arrhythmia

Table I

Pre- and perioperative variables of the study population

Variables	Age ≤ 60 years (n=84)	Age >60 years (n=56)
	%	%
<i>Preoperative variables</i>		
Age (years)	56.8 \pm 4.2	64.7 \pm 7.4
Sex	Male	73.8
	Female	26.2
Hypertension	60.7	80.4
Prior percutaneous coronary intervention	16.7	10.7
History of myocardial infarction	14.3	12.5
Arrhythmia	13.1	32.1
Diabetes mellitus	22.6	39.2
Renal dysfunction	13.1	26.8
Chronic obstructive pulmonary disease	14.3	8.9
History of cerebrovascular accident	4.8	16.1
Cerebral vascular disease	7.1	19.6
Peripheral artery disease	4.8	5.4
Reoperation	6.0	5.4
Anemia	3.6	12.5
EuroSCORE	4.3 \pm .78	10.5 \pm 1.2
Left ventricular ejection fraction (%)	59.6 \pm 11.6	60.9 \pm 10.2
<i>Perioperative variables</i>		
Coronary artery bypass graft	66.7	67.9
Valve surgery	25	23.2
Combined procedures	8.3	8.9
Total anesthesia time (min) (mean \pm SD)	244.5 \pm 50.5	247.2 \pm 48.5
Cardiopulmonary bypass time (min) (mean \pm SD)	77.5 \pm 35.4	81.2 \pm 28.5
Aortic cross-clamp time (min)	58.0 \pm 25.6	57.7 \pm 21.3
Mortality	0	0

Table II**Postoperative complications and additionally assessed variables**

Variables	Age ≤60 years (n = 84)	Age >60 years (n = 56)
Inotropic drug support required	33	26
Myocardial infarction	2	1
TIA/ Stroke	1	6
Supraventricular arrhythmia	33	29
Ventricular arrhythmia	3	2
Renal failure	3	8
Infection	8	14
Re-exploration for bleeding	3	2
Ventilation problems	4	4
Sternal wound infection	3	2
Blood transfusion (units)	1.5 ± 0.5	2.5 ± 0.5
Platelets (units)	0.5 ± 0.0	0.8 ± 0.0
Fresh frozen plasma (units)	1.6 ± 0.2	2.4 ± 0.3
Median intensive care unit stay (hours)	38.2 ± 0.5	39.1 ± 0.8
Median hospital stay (days)	9.5 ± 1.5	10.0 ± 1.5

($p=0.006$), renal dysfunction ($p=0.04$), cerebrovascular disease ($p=0.026$), and also anemia ($p=0.046$) in the older age group. The mean EuroSCORE was also significantly higher ($p<0.001$) in older age group. However, there were no significant statistical differences in cardiopulmonary bypass as well as aortic cross-clamp time, and anesthesia times between the two study groups of patients (Table I). However, postoperative adverse outcome like the prevalence of stroke or TIA ($p=0.011$), renal failure ($p=0.021$), ICU stay ($p<0.0001$), infection ($p=0.013$), and also hospital stay ($p=0.05$) were also higher in the older age population (Table II). Moreover, the total number of packed red blood cells, platelets,

and FFP transfusion was also statistically significant in the older group ($p<0.0001$).

Completed SF-36 questionnaires were returned from 116 (82.86%) patients 1-year after surgery and utilized for the statistical analysis. Unreturned SF-36 questionnaires from 15 patients as well as incomplete SF-36 questionnaires from another 9 patients (5 patients died during study period, and 4 patients did not return the questionnaire) were not considered in the statistical analysis. The statistical results of preoperative and postoperative SF-36 scores difference are presented in Table III. After surgery, the SF-36 scores of the study population improved significantly in all 8 health domains: Role physical, physical functioning, bodily pain, vitality, general health, role emotional, social functioning, and also mental health. Moreover, SF-36 scores differences for evaluation of health-related quality of life were also compared according to age (age ≤60 years and >60 years) of study patient's. Preoperative SF-36 scores for health-related quality of life were slightly greater in young population (Table III), and observed a higher difference of SF-36 scores between before and after surgery health-related quality of life domains in the study group age >60 years.

During analysis of the preoperative SF-36 questionnaire, we observed significant differences in all health-related quality of life domains between the subgroups of survivors and non-survivors (Figure 1). This study revealed, only 14.66% patients are non-improvers, and 85.34% of patients improved in both or either PCS and MCS scores of health-related quality of life domain. The study variables of improvers and non-improvers population are listed in Table IV. In total, 99 (85.7%) patients improve their health-related quality of life following heart surgery which is statistically significant ($p\leq 0.05$). Furthermore, statistical analysis also demonstrates

Table III**SF-36 scores of the study population**

Sub-score	Before surgery (n = 116)		One year after surgery (n = 116)		p value	Age ≤60 years (n = 71)		Age >60 years (n = 45)		p value
	Mean	SD	Mean	SD		Difference	SD	Difference	SD	
Physical functioning	47.1	27.1	64.5	23.1	<0.0001	16.3	30.1	22.4	28.5	0.2800
Role physical	27.7	36.2	50.2	37.9	<0.0001	21.6	48.7	26.8	49.7	0.5793
Bodily pain	58.2	24.9	72.8	22.5	<0.0001	10.8	30.3	20.1	31.6	0.1159
General health	45.8	16.1	52.7	18.8	0.0030	5.1	23.2	7.5	18.5	0.4170
Vitality	47.2	18.8	56.4	17.8	0.0002	9.2	22.3	11.7	21.2	0.5500
Social functioning	65.1	21.1	72.5	21.6	0.0089	7.1	28.2	11.1	27.2	0.4520
Role emotional	43.5	43.4	66.8	36.4	<0.0001	23.8	51.2	31.7	48.6	0.4107
Mental health	58.6	19.4	69.5	15.8	<0.0001	8.9	20.8	14.6	20.8	0.1531

Table IV**Characteristics of improvers and non-improvers study population following heart surgery**

Variables	Improvers (n=99)	Non-improvers (n=17)	p value
	Mean \pm SD	Mean \pm SD	
Age	61.6 \pm 5.5	60.2 \pm 7.1	0.3149
Body mass index	27.2 \pm 3.5	29.0 \pm 2.5	0.0291
Intensive care unit stay (days)	2.1 \pm 1.5	3.2 \pm 1.5	0.0012
Hospital stay (days)	9.0 \pm 2.5	10.5 \pm 3.5	0.0002
Ejection fraction (%)	60.5 \pm 8.4	61.1 \pm 8.6	0.7686
Preoperative MCS	53.1 \pm 24.1	75.8 \pm 21.1	0.0001
Postoperative MCS	72.8 \pm 17.7	53.1 \pm 21.2	<0.0001
Preoperative PCS	41.5 \pm 22.3	65.5 \pm 21.5	<0.0001
Postoperative PCS	65.5 \pm 22.2	45.1 \pm 19.1	<0.0001

PCS- Physical component summary; MCS- Mental component summary

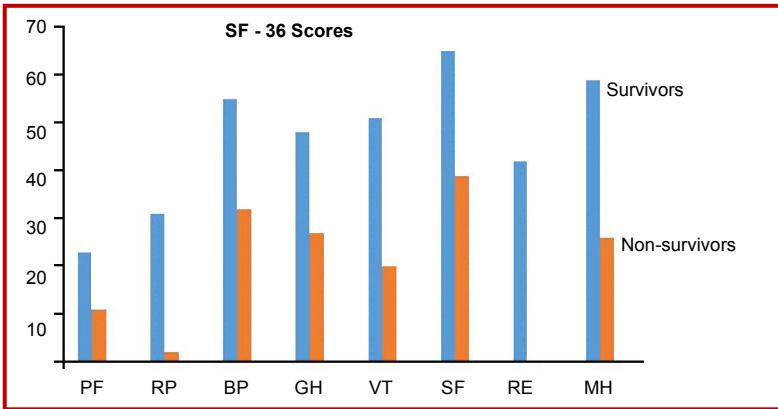


Figure 1: SF-36 score differences in preoperative health-related quality of life among survivors and non-survivors.

Note: Physical functioning (PF), role physical (RP), bodily pain (BP), general health (GH), vitality (VT), social functioning (SF), role emotional (RE), mental health (MH)

Table V**Multivariate analysis on effect of preoperative MCS and PCS scores on postoperative improvement of quality of life**

Variable	Regression coefficient	Odds ratio	Confidence interval (95%)	p value
Age >60 years	-	-	-	
Gender	-	-	-	
Type of surgery	-	-	-	
Preoperative MCS	0.023	1.03	0.998 - 1.01	0.0850
Preoperative PCS	0.027	1.04	1.01 - 1.06	0.0191

MCS - Preoperative mental component summary, PCS - Preoperative physical component summary; p values are from preoperative patient status

that BMI, duration of both ICU and hospital stays, physical component summary and mental component summary were significantly higher ($p \leq 0.05$) in

non-improver group of study population. Multivariate analysis observed that only preoperative health-related quality of life status was a strong predicting factor that associated with significant non-improvement in quality of life following surgery (Table V). Furthermore, patients having higher preoperative PCS and MCS scores greatly influenced the non-improvement in postoperative health-related quality of life status.

Discussion

The principal observation of this study was the results from multivariate analysis, where the provided variables like age, sex, nature of surgery, as well as preoperative PCS and MCS score were evaluated to demonstrate the influence on improvement and non-improvement of health-related quality of life status following heart surgery. Logistic multivariate analysis has shown that, only preoperative data of PCS and MCS score has potential influence on postoperative health-related quality of life changes following heart surgery. The greater chance of improvement in postoperative health related quality of life was observed in patients with lower PCS and MCS scores before operation. This study also shown that survivors had a significantly higher preoperative health-related quality of life score in contrast to non-survivors.

Several published article has demonstrated that the most common postoperative morbidities in elderly group of patients are heart failure, ventricular dysfunction, arrhythmia, hemorrhage, respiratory as well as renal function impairment, and also neurological disorders.^{2,5} In this study, there were also higher incidences of respiratory as well as urinary tract infections and also greater numbers of red cell transfusion given in the elderly group of patients age >60 years which is concordance to other study results.^{6,8} Moreover, in a study, Frelich et al. (2003) found that elderly patients age >70 years required about 15% greater hospital costs in comparison to young patient.⁹ However, Engoren et al. (2002) analyzed the unique clinical situation and they also found that hospital costs was much higher in elderly population (especially >80 years) due to postoperative adverse effects.¹⁰ According to their study results, the treatment costs for elderly patients are significantly higher than are those for younger patients, which is also similar to others findings.^{8,11-14} At present, socioeconomic view on medical practice is rising more significantly in daily practice, and physician's efforts should be directed towards the high-risk patients as because majority of the postoperative adverse effects are interlinked to preoperative clinical status. Furthermore, incidence of postoperative morbidities can be diminished by providing proper preoperative optimization, meticulous surgical techniques, and standard

postoperative care.¹⁰⁻¹⁵ As like other discipline, in cardiac surgery, there should be continuity to develop newer surgical techniques especially minimally invasive procedure, endovascular surgery etc. that are particularly dedicated to elderly population and which methods reduces the chance of postoperative morbidities as well as mortality.^{5, 16, 17}

In a study, Hansen et al. (2010) observed two components both mental and physical status of the SF-36 questionnaire among the survivor and non-survivor patients at first 6 months following coronary artery bypass graft surgery.¹⁸ The study results shown that the preoperative clinical condition was the major influencing factor to change in health related quality of life following surgery. Preoperative factors associated with failure to improve postoperative health-related quality of life score are as follows: preoperative comorbidities and postoperative low cardiac output, left ventricular dysfunction, low ejection fraction, a NYHA functional class 3 or 4, new onset of arrhythmia after surgery, pulmonary hypertension, previous heart surgery, and also history of myocardial infarction.^{12, 17-21} In another study, Noyez et al. observed the economic issues and analysed multiple factors that are associated with rise in hospital expense like high risk patient's according to risk scoring systems, emergency surgery, total red cell units transfusion, invasive monitoring, duration of postoperative ventilation, length of ICU as well as hospital stay, incidence of postoperative arrhythmia and also wound infection.²²

Few studies using the SF-36 questionnaire have presented only summarization of SF-36 scores as well as changes in physical and mental health status.^{16-19, 23} Nonetheless, authors report changes in physical health status (PCS score derived from role physical, physical functioning, bodily pain, and general health) and also in mental health status (MCS score derived from vitality, role emotional, social functioning, and mental health).^{10-15, 19, 22} In this study, we observed preoperative as well as postoperative functional score among all domains of health-related quality of life. Depending on several published articles, researcher can conclude that patients having greater operative risk score (EuroSCORE ≥ 6 score) may have lower preoperative health-related quality of life score and are more likely to develop significant improvement in postoperative outcome if surgical procedure can be done safely.^{3, 5, 18-23} Furthermore, a patient with low or medium operative risk score (EuroSCORE), didn't observed significant changes in SF-36 scores. Moreover, patients with greater preoperative health-related quality of life don't have much space for improvement and their surgery is usually preventive in nature.²⁴ Though SF-36 score difference was higher in elderly population; however, no statistically significant dissimilarity of postoperative

health-related quality of life was diagnosed among the patient aged ≤ 60 years and >60 years, which was similar in the study by Lee and colleagues.²⁵

In this study, preoperative SF-36 scores of the younger population (age ≤ 60 years) was higher, however, their contrast was higher in elderly population in perioperative SF-36 scores. We have observed that, this may be summarized as the period of one year following surgery is more beneficial for older than the younger age group of patients, even the major postoperative complications have been settled down. Nevertheless, all the 8 domains of health related quality of life have been observed and we came to a conclusion that quality of life of study population can be observed in details. As per observation the most convenient and useful tools for prediction of postoperative mortality and morbidity can be the SF-36 score in multivariate analysis. In spite of having some of the limitations like short duration with small sample size; however, this study can be useful for any kind of additional research and also can be beneficial for health-related quality of life advancement following heart surgery, especially for the older group of study population.

Conclusion

The preoperative health-related quality of life assessment using SF-36 questionnaire as well as operative risk scoring system should be a vital issue specifically in high-risk group of patients. Furthermore, in presence of low preoperative health-related quality of life; elderly patients most likely to have significant improvement in postoperative quality of life.

Ethical Issue

An informed written consent has been obtained from all of the participants.

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