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Changes in Health Utility of Patients after Cardiac Surgery

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Abstract

Background: Health utility, which can be assessed by several preference-based utility measures, is an important measure in the analysis of cost effectiveness in health care. We aimed to examine differences in health utility by age following recovery phase II cardiac rehabilitation (CR).

Methods: This longitudinal observational study assessed 62 consecutive cardiac surgery patients who were divided into a middle-aged group (<65 years, n=33) and older-age group (≥ 65 years, n=29). Health utility assessed by mean Short Form-6D (SF-6D) utility score was measured at 1 and 3 months after cardiac surgery and compared.

Results: The mean SF-6D utility scores increased significantly from 1 to 3 months in both the middle-aged group (0.57 ± 0.07 to 0.64 ± 0.09, P<0.001) and the older-aged group (0.59 ± 0.08 to 0.67 ± 0.12, P<0.001). However, no significant period (from 1 to 3 months) by group interactions (middle-aged and older-aged groups) (mean SF-6D utility scores: F [1/60] 0.10, P=0.75) was detected.

Conclusion: Following phase II CR, health utility showed an increase in both middle-aged and older-aged cardiac surgery Japanese patients.

Keywords Age difference; Cardiac rehabilitation; SF-6D

Introduction

Recently, the average life expectancy of Japanese new born has become the highest in the world [1]. In addition, the number of elderly cardiac patients in Japan is also increasing and is becoming a growing public health problem [2,3].

Age-related differences in physiological outcomes such as muscle strength were investigated in a previous report [4]. Physiological outcomes were also previously reported after cardiac surgery in patients undergoing coronary artery bypass grafting and valve replacement [5-8]. The reported goals of cardiac rehabilitation (CR) for these patients are to improve exercise capacity, reduce coronary risk factors, improve health-related quality of life (HRQOL), and reduce subsequent cardiac events, sudden death, all-cause mortality, and hospitalization costs [5–9]. However, with regard to the economic evaluation of hospital costs, several previous studies suggested that health utility, which can be assessed by several preference-based utility measures, is an important measure in the analysis of cost effectiveness in health care [10-13].

One such measure, the short-form 6D (SF-6D), which is an instrument providing a summary score based on the SF-36 measure, was developed recently [10-13]. The reason for developing the SF-6D was to enlarge the bases for economic evaluations while retaining the descriptive richness and sensitivity to change of the SF-36 [10-13].

Economic evaluation of CR has also been reported previously, and the findings have supported the implementation of CR [9,14,15] However, the relation of age-related differences with regard to clinical characteristics and health utility in post-surgery cardiac patients participating in phase II CR is unknown. Thus, we hypothesized that health utility might be related to age in post-surgery cardiac patients following phase II CR. Presently, there is very little evidence on the effects of these differences on health utility in cardiac surgery patients in Japan.

Therefore, the purposes of the present study were to evaluate 1) differences in health utility as related to age at 1 month and 3 months after cardiac surgery, and 2) to determine the longitudinal change of health utility in relation to age in post-cardiac surgery patients following phase II CR.

Methods

Participants

The present longitudinal study comprised 101 consecutive cardiac patients with coronary artery bypass grafting or valve replacement who visited hospital as outpatients 1 month after cardiac surgery and were referred to the Department of Rehabilitation Medicine for first-time evaluation of health utility. Exclusion criteria included patients with neurological, peripheral vascular, orthopedic, pulmonary, and advanced renal disease and that on dialysis.

Patient characteristics evaluated included age, sex, body mass index (BMI), left ventricular ejection fraction (LVEF), etiology, and medications by review of medical records. We evaluated these characteristics in the patients 1 month after cardiac surgery. After that, patients were divided into a middle-aged group (<65 years, n=55) and older-age group (≥ 65 years, n=46). Health utility was assessed at 1 and 3 months after cardiac surgery and was compared by group and term (1 and 3 months), respectively. The present study complied with the principles of the Declaration of Helsinki regarding investigations in humans and was approved by the local institutional review board of our institution. Informed consent was obtained from each patient.

Health utility

Health utility was measured using the mean SF-6D utility scores. The SF-6D was developed as a practical tool for obtaining a preference-based index from SF-36 data [16,17]. First, we assessed the patients with the SF-36. The SF-6D questionnaire was developed to obtain health utility from the SF-36 questionnaire for use in health economic evaluations and links between psychometric and preference/utility-based measures [16,17]. No limitation in any of the dimensions means no subtraction from the baseline value of 1.0, i.e., perfect health [16,17]. The higher the limitation in each domain, the higher the subtraction from the baseline [16,17]. After assessment with the SF-36, SF-36 scores were converted to mean SF-6D utility scores by iHope International (iHope International., Co. Ltd., Kyoto, Japan) based on work in previous studies [10,12,13].

Phase II CR

Following discharge from the hospital, the patients entered the recovery phase II CR outpatient program at 1 month after cardiac surgery, and they continued in the program for 2 months, until 3 months after surgery [4,5]. The patients participated in supervised combined aerobic and resistance exercise training once or twice a week for 1 hour. Each session was composed of a warm-up, aerobic exercise, resistance training, and cool down period. Exercise intensity during aerobic exercise was maintained at anaerobic threshold heart-rate level using treadmill walking or cycle ergometer with a rating of perceived exertion of [11-13] (according to the Borg 6-20 scale) [4,5,8].

Statistical analysis

Results are expressed as mean ± standard deviation (SD). The unpaired t-test, paired t-test, and χ^2 test were used to test for differences between the two groups in clinical characteristics and the mean SF-6D utility scores. In addition, we analyzed differences in age group (middle-age and older-age groups) versus term (1 month and 3 months) using two-way repeated measures (age group versus term) analysis of variance. AP value of<0.05 was considered to indicate statistical significance. Statistical analyses were performed with IBM SPSS 22.0 J statistical software (IBM SPSS Japan, Inc., Tokyo, Japan).

Results

Clinical characteristics of the patients

Of the 101 patients, 39 were excluded from the study because of lack of data on clinical characteristics, patients could not visit the hospital for evaluation of health utility, or it was not measured at 3 months after cardiac surgery. Thus, the remaining 62 patients were divided into two groups by age: middle-aged group (<65 years, n=33) and older-age group (≥ 65 years, n=29). Patient flow during the study is presented in Figure 1. Except for age, patient characteristics were similar between the two groups (Table 1).

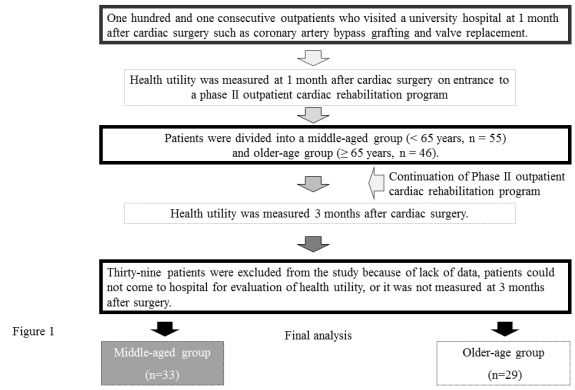

Figure 1: Patient flow during the present study.

Characteristics	Middle-aged group	Older-aged group	t or χ^2 value	P value
No. of patients	33	29		
Age (yrs)	57.2 ± 4.9	70.8 ± 3.7	-11.96	<0.001
Sex (male)	27	23	0.06*	0.52
BMI (kg/m2)	23.0 ± 2.9	22.2 ± 2.4	1.11	0.24
LVEF (%)	51.9 ± 12.8	55.2 ± 10.3	-0.7	0.49
Etiology (n)				
CABG	18	22	2.20*	0.11
VR	15	7	-	-
Medications (%)				
Beta-blockers	42.8	66.7	1.47	0.22
ACEI/ARB	50	50	0	1
Diuretic	57.1	75	0.91	0.42

Table 1: Clinical characteristics [BMI body mass index, LVEF left ventricular ejection fraction, CABG coronary artery bypass grafting, VR valve replacement, ACEI, angiotensin converting enzyme inhibitor; ARB, angiotensin receptor blocker. *χ^2 value].

Health utility	Middle-aged group	Older-aged group	t value	P value
1 month	0.57 ± 0.07	0.59 ± 0.08	-1.07	0.28
3 months	0.64 ± 0.09*	0.67 ± 0.12*	-1.34	0.18

Table 2: Differences in health utility from 1 month to 3 months [*Statistically significant improvements of health utility from 1 month to 3 months after cardiac surgery: both P<0.001].

Health utility at 1 month and 3 months

Health utility data collected from the two groups is presented in Table 2. There were no significant differences the mean SF-6D utility scores for both the middle-aged group and older-aged group at both 1 month and 3 months after cardiac surgery.

Effects of aging following phase II CR

After the phase II CR outpatient program, both the middle-aged group and older-aged group showed a statistically significant increase in the mean SF-6D utility scores from 1 month to 3 months after cardiac surgery ($t=-4.80$, $P<0.001$ and $t=-4.14$, $P<0.001$, respectively) as shown in Table 2. However, no significant period (from 1 month to 3 months) by group interactions (middle-aged and older-aged groups) (mean SF-6D utility scores: F [1/60] 0.10, $P=0.75$) was detected.

Discussion

This is first time, to our knowledge, that health utility assessed using the mean SF-6D scores of Japanese cardiac surgery patients undergoing a phase II CR outpatient program has been evaluated in relation to age. The main findings of this study are that the values of health utility increased significantly from 1 to 3 months in both the middle-aged and the older-aged groups. However, the increase in health utility from 1 to 3 months in the older-aged group was similar to that of the middle-aged group.

Except for age, other clinical characteristics of the patients were almost identical between the middle- and older-aged groups. Thus, clinical characteristics of the patients other than age might not have affected the differences observed in health utility between the two groups.

Other previous reports have also focused on an age bias in the approach to treating elderly cardiac patients [18-20]. However, another recent study also suggested that their results did not differ significantly based on age, sex, emergent status, or history of heart failure or arrhythmias, but CR participation was more beneficial for the patients who underwent cardiac surgery such as mitral valve procedures [21].

No significant differences were present in the mean SF-6D utility scores of our patients in relation to age at 1 and 3 months after cardiac surgery. This indicates that aging might not reflect differences in the average SF-6D utility scores in cardiac surgery patients, and these findings might support those of the previous study [21].

We previously reported that phase II CR outpatient programs for cardiac patients after acute myocardial infarction (AMI) increased psychological outcomes such as HRQOL similar to those found in the present study [8]. Another study also indicated that improvement of psychological outcomes following phase II CR was similar to that of HRQOL in patients undergoing coronary artery bypass grafting and valve replacement [5]. There were significant increases in average SF-6D utility scores from 1 to 3 months in both groups (Table 2). Thus, the findings of this previous study may support our present study results.

One previous report of a baseline and post-intervention study of patients undergoing off-pump or on-pump CABG found no significant difference in median SF-6D scores (0.62-0.63 for off-pump, 0.64–0.63 for on-pump) [11]. Although the etiology and evaluation of the scores (use of mean versus median) were different between this previous study and the present study and thus could not be compared directly, phase II CR may be very important in increasing health utility in cardiac surgery patients.

There was a difference in the recovery process between the middle- and older-aged groups in one of these previous studies 4 in regard to physiological outcomes such as peak oxygen uptake and knee extensor muscle strength and in the physical component summary scores as assessed by SF-36 (except for mental component summary scores) in cardiac patients after AMI, coronary artery bypass grafting, and valve replacement. Physical outcomes and physical component summary scores both showed greater improvements in the middle-aged group than in the older-aged group. Even though the etiology and outcomes of the present study patients were different from those of the patients with AMI, in whom only the physical component summary scores of the SF-36 were assessed, the present study showed that the health utility of cardiac surgery outpatients as evaluated by the mean SF-6D score may not be affected by age.

With regard to a cost-utility analysis alongside a randomized controlled trial using quality-adjusted life years (QALY) based on the SF-6D in learning and coping strategies in CR (825 patients over 18 years who were admitted with ischemic heart disease or heart failure), Dehbarez et al. reported that mean SF-6D scores at baseline, 2 months after intervention, and after 5 months of follow-up were 0.739, 0.798, and 0.794, respectively, and QALY was 0.319.15 Although there were differences between etiologies and CR programs between the Dehbarez et al. and present study, the mean SF-6D utility scores in the middle and older-aged groups at 3 months in the present study were 0.64 and 0.67, respectively, and were lower than those of the cardiac patients studied by Dehbarez et al. Therefore, we need to evaluate whether health utility continues to change over the long term following a phase II CR outpatient program. Moreover, we need to evaluate QALY when performing cost-utility analyses and to discover a new strategy to increase health utility in future trials.

Limitations

Limitations of the present study include its small sample size comprising almost all male cardiac surgery patients. Additional analysis of sex-related differences in health utility in female cardiac patients is also required. We also did not evaluate the effects of postoperative complications or the starting day of the earlier phase I CR program on selection bias or of longer hospital stays. Data on health utility in relation to cardiac-related mortality or re-hospitalization were not assessed due to the limited amount of related data available. Thus, we need to address these deficiencies in future longitudinal studies.

Conclusion

This study tried to identify age-related differences in health utility in Japanese cardiac surgery patients following a phase II CR outpatient program. As a result, no age-related differences were found between middle-aged and older patients upon entrance into a phase II CR program at 1 month after cardiac surgery and at 3 months after cardiac surgery. However, there were similar increases in health utility in both the middle- and older-aged groups. This study lacks long-term follow-up data on health utility, and thus additional study will be required to evaluate long-term outcomes and age-related differences in health utility over longer periods in these patients or increases in other outcomes such as those of the physical function of the patients.

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