Changes in health-related quality of life following percutaneous coronary intervention: A longitudinal study

Man Sin Wong[a], Sek Ying Chair[b],*

[a]Department of Medicine, Queen Mary Hospital, Pokfulum, Hong Kong
[b]The Nethersole School of Nursing, The Chinese University of Hong Kong, Rm 825 Esther Lee Building, Sha Tin, New Territories, Hong Kong

Abstract

Background: Coronary artery disease (CAD) is a major cause of mortality and morbidity in developed countries. The percutaneous coronary intervention (PCI) is a frequently used treatment for CAD. In order to manage the disease more effectively and to promote the health-related quality of life (HRQoL) of these patients, understanding the current status of HRQoL before and after PCI procedure is essential.

Objectives: This study was to examine the changes of HRQoL from before PCI to the first 3 months after PCI on Hong Kong Chinese.

Design: A longitudinal, one-group observational design was used.

Setting: Data collected from cardiac patients admitted into a regional public hospital at Hong Kong Island for PCI.

Participants: Between August 2003 and February 2004, all patients admitted for non-emergency PCI at the study site and met the inclusion criteria were invited to take part in the study. Seventy-eight out of 85 eligible patients agreed to participate. However, 13 patients dropped out during data collection period.

Methods: HRQoL data using the Medical Outcomes Study 36-Item Short Form 36 (SF-36) and Seattle Angina Questionnaire (SAQ) were collected before PCI, 1 and 3 months after PCI.

Results: Sixty-five patents completed the study. All domains in SF-36 and SAQ improved at 1 month but the improvements did not continue in all domains at 3 months. The HRQoL measured by SF-36 improved significantly over time ($p < 0.05$) for six out of the eight domains. Scores of all domains of SF-36 improved at 3 months when compared with baseline. Moreover, all five domains of SAQ changed significantly over time ($p < 0.05$); however, the score of angina stability at the third month was lower than that at baseline.

Conclusions: The results of this study quantify the benefits of PCI procedure on HRQoL of patients. Although PCI improved the HRQoL 1 month after PCI, the effect did not last long. Nursing interventions are needed to maintain and further enhance the HRQoL of these patients and the interventions should be introduced immediately post-PCI.
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Keywords: Angioplasty; Percutaneous coronary intervention; Health-related quality of life; Chinese

What is already known about the topic?

- Quality of life of coronary heart disease patients improved at 6 and 12 months after percutaneous coronary interventions (PCIs).

*Corresponding author. Tel.: +852 26096225; fax: +852 26035935.
E-mail address: sychair@cuhk.edu.hk (S.Y. Chair).

- Patients received coronary artery by-pass treatment had less episodes of angina and better quality of life than patients received PCIs at 3 and 6 months after the procedure.
- Baseline physical function and angina frequency were strong predictors of quality of life at 1 year after PCIs.

What this paper adds

- Quality of life of coronary heart disease patients improved at 3 months when comparing with baseline but deteriorated when comparing with the quality of life at 1 month after PCI.
- The levels of quality of life (general and disease-specific) during the first 3 months after PCI were identified for Chinese patients.
- The efficacy of PCI for quality of life improvement on Chinese coronary artery disease patients was supported especially during the first month after PCI.

1. Introduction

Coronary artery disease (CAD) is a major cause of mortality and morbidity in developed countries (Murray and Lopez, 1997; Brorsson et al., 2001). Since 1960s, heart disease has been the second leading cause of death in Hong Kong (Department of Health, 2003). In 2002, the proportionate mortality by disease groups related to heart disease was 28.1% (Department of Health, 2003). With the westernization and the ageing problem, Hong Kong population is even more vulnerable to CAD.

Before developing the technique of PCI, coronary artery bypass graft (CABG) had been the standard and the only revascularization procedure (Woods et al., 2005). Besides, CABG is proved to be effective in improving angina symptoms for at least 1 year after the operation (Edéll-Gustaffsson, 2002). However, CABG is a major operation which requires large amount of medical resources, and patients need relatively long time to recover. Although with the improvement in treatment, CAD patients can survive longer after surgery, risks for subsequent cardiac events and quality of life after treatment cannot be guaranteed (Denollet et al., 2000). Thus, patients' post-surgical health status, including physical symptoms, functional ability and quality of life should be considered carefully in the decision making when selecting the choice of treatments (Borkon et al., 2002). Fortunately, there is an alternative treatment for CAD, the PCI, which is an effective, safe, less disabling and less expensive revascularization procedure compared with CABG (Woods et al., 2005).

The PCI had become a more frequently used treatment than CABG for CAD in most western countries as well as in Hong Kong. Though the total number of PCI carry out each year in Hong Kong was not available, a regional public hospital in Hong Kong Island had documented that PCI was performed for more than 600 cases between April 2001 to March 2002 (Queen Mary Hospital, 2002). However, the use of PCI is not purely a choice that can be determined by patients but depends on the status of the disease as well. For example, patients with significant left main coronary artery stenosis, three-vessel coronary disease, and two-vessel coronary disease but with an ejection fraction less than 50% are indicated for CABG rather than PCI (Woods et al., 2005).

Although the survival rate and functional status are commonly used as the outcome measures for evaluating treatments of CAD, clinicians agreed that CAD can affect one's psychological, social and emotional health (Mayou and Bryant, 1993; Treasure, 1999). Symptoms of anxiety and depression after an acute myocardial infarction have been associated with reinfarction and death due to cardiac disease (Romanelli et al., 2002). Patients with continued anxiety, uncertainty and depression are less likely to return to work and tend to have higher hospital readmission rate and mortality rate (Webster and Christman, 1988). According to Hlatky (2000), some patients considered certain outcomes and complications of CAD such as a disabling stroke and intractable pain were worse than death. For others, cardiac symptoms like chest pain and dyspnea may be so severe that they preferred to accept outcomes of some treatments despite higher risk of death would be resulted. Therefore, in considering the effectiveness of a treatment, it is not enough to assess the mortality rate alone; the effect of a therapy on patients' quality of life should also be taken into account.

In recent years, other than biochemical endpoints, health-related quality of life (HRQoL) is considered as an important indicator of health outcome in chronic diseases such as CAD (Benzer et al., 2003). HRQoL has been extensively studied in populations with cardiovascular diseases and those who had been undergone PCI. The most commonly used generic and disease-specific instruments to capture such comprehensive and sensitive changes in HRQoL of the cardiac patients in these studies were the Medical Outcomes Study 36-Item Short-Form (SF-36) (Fraund et al., 2005; Mortensen et al., 2005; Szygula-Jurkiewicz et al., 2005) and Seattle Angina Questionnaire (SAQ) (Borkon et al., 2002; Spertus et al., 2004, 2005; Zhang et al., 2005).

2. Background

HRQoL refers to the experience and the different domains of health that are affected by disease and treatment (Kane, 1997). HRQoL is multidimensional in

nature considering both positive and negative aspects of health that included physiological, psychological, emotion and social components (Bowling, 1995; Karlsson et al., 2000; Roebuck et al., 2001). According to Ferrans (1992), the common elements conceptualizing HRQoL in cardiovascular research had five categories. These included social utility, happiness, satisfaction, achievement of personal goals and normal life. Therefore, in order to capture the different aspects of quality of life, a multidimensional research instrument should be used.

Benzer et al. (2003) conducted a study on 158 CAD patients to compare the impact of the three therapeutic strategies: continued medical treatment (CMT), PCI and coronary artery bypass grafting (CABG) on HRQoL at 12 months after treatment. In this study, there were 78 CMT patients, 52 PCI patients and 28 CABG patients. After 12 months, there were significantly greater improvements in two of the four subscales of HRQoL, the global and the emotional subscales, after PCI and CABG than after CMT. However, the unequal number of samples in each group reduced the reliability of the results. Moreover, this study assessed the HRQoL only at baseline and after 1 year. Thus, the changes of HRQoL of CAD patients shortly after a cardiac event need for investigation.

Many studies had compared the HRQoL of PCI patients with CABG patients. Both groups of patients had significantly improved HRQoL at 6 months. However, CABG patients had fewer episodes of angina and better HRQoL than PCI patients at 6 months (Skaggs and Yates, 1999; Brorsson et al., 2001) as well as 12 months after the procedure (Borkon et al., 2002; Szygula-Jurkiewicz et al., 2005). On the other hand, Plach and Heidrich (2001) compared patients' social role perception after CABG and PCI and found that CABG patients had significantly lower social role performance and more negative role perception than patients in PCI group after the procedure.

In addition, Stuart et al. (2000) used the SF-36 questionnaire to compare the HRQoL between PCI patients and medically treated patients for angina at 3 months, 1 year and 3 years. A total of 1018 patients were randomly assigned to each group (PCI group, $N = 504$; medical therapy group, $N = 514$). The authors reported that the PCI group had significantly greater improvement in physical functioning, vitality and general health at 3 months and 1 year compared to the medical group, but not at 3 years.

Apart from the efficacy of PCI for HRQoL improvement, some studies had investigated the predictors for changes of HRQoL after PCI. Patients' baseline physical function and angina frequency were the strongest predictors of HRQoL improvement at 1 year after PCI (Fitzgerald et al., 1996; Spertus et al., 2004).

Although many studies had examined the changes of HRQoL of CAD patients after PCI, not all of them had focused on both psychological and physical aspects of HRQoL. Knowing the information on individuals as a whole person including physical, psychological and social aspects, as well as cultural beliefs may facilitate patients' compliance with health care advice provided by the health care professionals (Murray et al., 2000). Moreover, most studies evaluated the changes of HRQoL of PCI patients during 3–12 months after the intervention; information on HRQoL less than 3 months was limited. Thus, health care providers are unable to incorporate this information when recommending treatment strategies, designing rehabilitation program and giving counsel to these patients. Besides, studies conducted on the Hong Kong Chinese patients after PCI cannot be found. The findings of HRQoL of Chinese CAD patients before and after PCI especially during the early recovery period can contribute to the existing knowledge for the health care professionals to discuss that information with patients regarding options for the treatment and management of CAD. In addition, examining the HRQoL after PCI may help health care providers to understand how CAD patients perceive the multifaceted problems they have to cope with especially during the early recovery period and to identify potential areas for specific nursing interventions.

3. Method

3.1. Aim

The aim of this study was to examine the changes of HRQoL before, during and after 3 months of the PCI procedure in Hong Kong Chinese patients.

3.2. Design

A longitudinal, one-group observational design was used. HRQoL data were collected before PCI, and at 1 and 3 months after PCI.

3.3. Sample and procedures

For this study, alpha (α) was set as 0.05 to keep the type I error small; beta (β) was set at 0.2 to limit the chance of making a type II error. In order to study an effect that likely to be visible in the naked eyes of observers, a medium effect size was used (Cohen, 1992). To analysis the changes of HRQoL before, during and after 3 months of PCI procedure, repeated measures of analysis of variance tests were used. Hence, based on Cohen (1988), using an analysis of variance test with 0.05 significant level and power of 80%, and with medium effect size of 0.25 association, 64 subjects were needed for the sample.

Between August 2003 and February 2004, all patients admitted for non-emergency PCI in a regional public hospital in Hong Kong Island and met the inclusion criteria were invited to take part in the study. The inclusion criteria were the Chinese aged 21 or older, without mental disorder, no prior PCI was done, able to understand and speak Cantonese, and without severe medical illness such as stroke and cancer. Seventy-eight out of 85 eligible patents agreed to participate. Of those participants, 13 dropped out during data collection period. Thus, a total of 65 patients comprise the study population.

Ethical approvals were obtained from the ethics committees of the university and the study hospital. Permission for using of the instruments was granted from the respective copyright holders. Only those subjects who voluntarily participated were recruited for study with informed consents. Before obtaining consents, the aim and data collection procedure of the study, together with the right to withdraw from the study at any time without any penalty was explained. After their permission, data were collected from subjects at three occasions by the principle investigator. Baseline data of HRQoL were gathered through face-to-face interview following the patients' admission and before the PCI procedure. For the second and the third sets of data, the information was collected at 1 and 3 months time after the procedure, respectively, through telephone interview. The second set of data was collected at 1 month post-PCI because clinical observations suggested that patients usually required 1 month to recover from the procedure both physically and psychologically and were able to resume normal daily activities. The third set of data was collected at 3 months after PCI since the aim of the study was to evaluate the HRQoL of PCI patients during the early recovery phase in the first 3 months. During telephone interview, data were collected by asking the participants to select the answers among the available options, and the questions and choices were repeated when necessary without probing to ensure the investigator had no inference on the study results. Demographic data and clinical characteristics, including gender, age, marital status, comorbidities and smoking status, were also collected from patients or through medical records.

3.4. Instruments

HRQoL in this study was measured by one generic and one disease-specific instruments, with the Chinese Hong Kong (HK) version of the Medical Outcomes Study 36-Item Short Form (SF-36) being the generic one, and the Chinese version of SAQ the disease-specific one.

The SF-36 measured eight domains of health including physical functioning, role limitation as a result of physical problem, bodily pain, general health percep-

tion, vitality, social functioning, role limitation resulting from emotional problems and general mental health. In this study, the scores of the SF-36 were transformed and weighted according to the instructions developed by Ware et al. (1993). The summation scores were calculated for each of the eight domains that expressed from 0 to 100, with higher scores indicating better-perceived health or functioning.

The internal reliability of SF-36 was supported by McHorney et al. (1994) with the values of Cronbach's α exceeded 0.8 for all scales except for 'general health perception' which was 0.78. A study conducted by Lam et al. (1998) claimed that the Chinese (HK) version of the SF-36 was equivalent in concepts to the original US version SF-36. The questionnaire was also well understood and accepted by the Chinese people with different demographic characteristics in Hong Kong. In addition, this study confirmed that the scaling assumptions and construct validity of the Chinese (HK) version of SF-36. The internal reliability of the Chinese (HK) version of SF-36 was established with Cronbach's α coefficients above 0.7 for all subscales except for 'social functioning scale' which was 0.65 (Lam et al., 1998).

The SAQ is a disease-specific instrument and is developed by Spertus (Spertus and Winder, 1995). The use of SAQ in this study allowed sensitive assessment of the impact of CAD on patients' daily living. A disease-specific instrument like SAQ is able to detect minor changes on HRQoL of CAD patients after PCI. Therefore, SAQ was used to collect the study outcomes that a general assessment of health instrument like SF-36 might have missed (Borkon et al., 2002). The SAQ contains 19 items to quantify five clinically relevant domains of CAD including physical limitations due to symptoms of angina, angina stability, angina frequency, treatment satisfaction and disease perception. Scores obtained in these domains are transformed and expressed from 0 to 100, where higher scores indicate better quality of life. Because each domain monitors a unique dimension of CAD, no summation of score is generated (Spertus and Winder, 1995).

Each SAQ domain has been independently demonstrated to be valid, reproducible and sensitive to clinical change; all five domains correlated significantly with other measures and patient function scales ($r = 0.31$–0.70) (Spertus and Winder, 1995). The internal consistency for each domain in the SAQ was above 0.62 (Streiner and Norman, 1995). The Chinese SAQ was equivalent in concepts to the original US version, and the test–retest reliability of the Chinese SAQ was 0.95 (Liu et al., 1997; Gao and Liu, 2003).

3.5. Statistical analysis

All data were analyzed using SPSS-PC (version 11). Descriptive summaries were presented as mean and

standard deviation for continuous variables, such as age and scale scores of SAQ and SF-36. Percentage was used to present the results of categorical variables, such as marital status and disease severity. Repeated measures of ANOVAs were performed to compare the HRQoL measured by SF-36 and SAQ before PCI, and 1 and 3 months after PCI. When the Mauchly's test of sphericity was not significant, the univariate results were reported as the assumption of compound symmetry had been met; otherwise, the multivariate results were presented (Munro, 2001). For this study, any two-tailed probability value $\leqslant 0.05$ was considered as statistical significance.

4. Results

A total of 78 patients were enrolled in the study. However, 13 patients were excluded because they were unable to be contacted at 1 or 3 months after PCI. Thus, 65 patients completed the whole data collection process. All those who were unable to be contacted were living in the Mainland China for recovery during the second or the third data collection time.

Among the 65 subjects, 49 (75.4%) were male and 16 (24.6%) were female. Their ages ranged from 41 to 80 years (mean $= 66.0 \pm 9.7$). Fifty-eight (89.2%) were married, and only 44 (67.7%) of them could afford the payment of PCI, and the remaining 21 (32.3%) subjects required financial support from the Hong Kong Social Welfare Department for payment of the procedure. The diagnoses of subjects undergoing PCI were post-myocardial infarction, post-CABG evaluation and chest pain. Sixty (92.3%) subjects were deployed with intracoronary stents and only 5 (7.7%) subjects were solely performed with the percutaneous trasluminal coronary angioplasty (PTCA) (Table 1).

4.1. HRQoL results from SF-36

The internal reliability of SF-36 ranged from 0.77 to 0.9 for all domains at 1 month time after the PCI. The SF-36 scores changed significantly ($p < 0.05$) over time for six out of the eight domains (role limitation due to physical problem, bodily pain, general health perception, vitality, role limitation due to emotional problem and general mental health). The results showed that patients undergoing PCI achieved greater HRQoL especially at the first month after receiving the procedure (see Table 2).

The mean scores for all the eight domains were improved 1 month after PCI. For physical functioning, bodily pain and general health perception, the scores continued to improve 3 months after PCI; however, despite the continue improvement, the change for physical functioning was not statistically significant

Table 1
Demographic data ($n = 65$)

Male/female[a]	49 (75.4%)/16 (24.6%)
Mean age (years)[b]	66.0 (41–80)
Marital status[a]	
Married	58 (89.2%)
Never married	2 (3.1%)
Widow	5 (7.7%)
Smoking status[a]	
Smoker	10 (15.4%)
Non-smoker	55 (84.6%)
Medical history[a]	
Hypertension	32 (49.2%)
Diabetes mellitus	19 (29.2%)
Hypercholesterolaemia	38 (58.5%)
Previous revascularizaton	12 (18.5%)
Previous MI	17 (26.2%)
Disease severity (number of disease vessels)[a]	
1- Vessel disease	20 (30.8%)
2- Vessel disease	31 (47.4%)
3- Vessel disease	14 (21.5%)
Stent implanted	60 (92.3%)

[a]Number (percentage).
[b]Mean (range).

($p = 0.560$). For the remaining five domains (role limitation due to physical problem, vitality, social functioning, emotional problem and general mental health), the scores slightly declined at 3 months compared to 1 month's results. Nevertheless, the third month scores were still higher than the baselines (see Table 2). Compared with baseline scores, the mean scores of SF-36 at 3 months for physical functioning, role physical, bodily pain, general health perception, vitality, social functioning, role emotional and mental health was increased by 3.2, 16.6, 17.4, 5.5, 15.3, 2.7, 22 and 11.4, respectively.

4.2. HRQoL results from SAQ

In this study, the internal consistency of the Chinese SAQ ranged from 0.76 to 0.78 for domains of physical limitation, angina frequency and treatment satisfaction at 1 month time. For disease perception, the Cronbach's α was 0.65; as for the domain of angina stability, since there was only one question, the internal consistency could not be computed.

As recommended by the author who developed the SAQ, no summation of score of each scale should be generated because each scale in SAQ monitors a unique dimension of CAD. The five domains of SAQ scores changed significantly across time (all p values < 0.05) (see Table 3). Scores of all the five domains in SAQ improved at 1 month after PCI. However, only the scores of

Table 2
HRQoL of PCI patients measured by SF-36 across time

	Before PCI (mean, SD)	1-month after PCI (mean, SD)	3-months after PCI (mean, SD)	With-in subject effects
Physical functioning	72.3 ($\pm$20.7)	72.7 ($\pm$22.3)	75.5 ($\pm$26.6)	$F_{(2, 62)} = 0.6$, $p = 0.56$
Role physical	44.6 ($\pm$40.4)	63.1 ($\pm$41.2)	61.2 ($\pm$46.2)	$F_{(2, 125.9)} = 5.1$, $p = 0.008$
Bodily pain	66.4 ($\pm$29.5)	81.7 ($\pm$25.5)	83.8 ($\pm$26.1)	$F_{(2, 63)} = 8.5$, $p = 0.001$
General health	57.2 ($\pm$13.2)	61.2 ($\pm$11.2)	62.7 ($\pm$13.3)	$F_{(2, 126.5)} = 4.1$, $p = 0.019$
Vitality	53.4 ($\pm$27.0)	69.2 ($\pm$26.8)	68.7 ($\pm$27.8)	$F_{(2, 123.1)} = 12.3$, $p < 0.001$
Social functioning	74.4 ($\pm$28.9)	81.0 ($\pm$31.7)	77.1 ($\pm$35.6)	$F_{(2, 124.6)} = 0.98$, $p = 0.378$
Role emotional	47.7 ($\pm$43.7)	75.4 ($\pm$39.7)	69.7 ($\pm$45.9)	$F_{(2, 127)} = 10.4$, $p < 0.001$
Mental health	65.7 ($\pm$26.1)	78.3 ($\pm$21.6)	77.1 ($\pm$27.9)	$F_{(2, 124.9)} = 9.5$, $p < 0.001$

The higher the mean of SF-36, the better the HRQoL.

Table 3
HRQoL of PCI patients measured by SAQ across time

	Before PCI (mean, SD)	1-month after PCI (mean, SD)	3-months after PCI (mean, SD)	With-in subject effects
Physical limitation	67.6 ($\pm$18.6)	74.2 ($\pm$26.2)	70.8 ($\pm$22.9)	$F_{(2, 63)} = 5.0$, $p = 0.009$
Angina stability	62.5 ($\pm$29.2)	65.5 ($\pm$22.6)	50.5 ($\pm$20.0)	$F_{(2, 125.8)} = 4.6$, $p = 0.012$
Angina frequency	74.2 ($\pm$27)	91.5 ($\pm$6.2)	87.2 ($\pm$21.5)	$F_{(2, 125.8)} = 4.6$, $p = 0.012$
Treatment satisfaction	75.5 ($\pm$12.2)	85.6 ($\pm$15.4)	87.1 ($\pm$23.4)	$F_{(2, 63)} = 5.3$, $p = 0.008$
Disease perception	55.8 ($\pm$23.7)	77.1 ($\pm$22.2)	83.1 ($\pm$26.3)	$F_{(2, 125.8)} = 4.6$, $p = 0.012$

The higher the mean of SAQ, the better the HRQoL.

treatment satisfaction and disease perception domains continued to improve at 3 months after the PCI. The mean scores for the other three domains such as physical limitation, angina stability and angina frequency were declined after one month of PCI, but that for physical limitation and angina frequency at 3 months time remained higher than the baseline (Table 3). At 3 months after PCI, the mean scores for SAQ physical limitation, angina frequency, treatment satisfaction and disease perception increased by 3.2, 13, 11.6 and 27.3, respectively, compared with baseline. The mean score of angina stability was 50.5 at the third month assessment, which was lower than the baseline.

5. Discussion

The aim of this study was to compare the changes of self-perception HRQoL of Hong Kong Chinese patients before, during and after 3 months of PCI performed. Findings from this longitudinal comparative study suggested that almost all domains of HRQoL of CAD patients had been improved after PCI by showing better results on the third month comparing with the baseline, though some of the 3 months results were worse than assessments done at 1 month. The improvements of HRQoL in all domains in generic and disease-specific

measures at one month were supported by this study, and this information contributes to the existing knowledge base. The results of this study also supported the efficacy of PCI for quality of life improvement on Chinese CAD patients. The general HRQoL improved at 3 months despite the mean scores of role physical, vitality, social functioning, role emotion and mental health were slightly lower than that obtained at 1 month after PCI but all scores were higher than the baselines. For the domains of physical functioning, bodily pain and general health perception, the scores continued to improve at 1 and 3 months.

Angina stability was improved at 1 month post-PCI but declined below the baseline after 3 months. In fact, angina stability revealed and compared the angina symptoms of the previous month. The better score for angina stability at 1 month reflected the dramatic improvement in angina symptoms compared with the condition before PCI. The declined in angina stability score at 3 months indicated that angina symptoms in the third month of PCI were worse than that at the second month after PCI. Since angina stability compared only the results of previous month, the finding of this study was unable to differentiate even if the angina stability at three months was better than the baseline.

The results of this study quantify the benefits of PCI procedures and provide valuable local information for

nurses and other health care professionals to discuss with patients about the outcomes of PCI especially in determining the choices of treatment for CAD. In addition, studying the general as well as the disease-specific HRQoL of CAD patients after PCI promoted the understanding of the functional, social and emotional status consequence to the changes of health status after PCI. Also, the declines of HRQoL at 3 months indicated that more nursing interventions that could address the needs and facilitate recovery for the CAD patients are required so that the HRQoL after the procedure can be improved continuously. In addition, these nursing interventions should be implemented early after PCI to prevent the decline of HRQoL shortly after the procedure. Nurses are in the key roles to promote patients' knowledge on heart disease process as well as its prevention. Strategies to empower patients' ability in self-care after PCI may contribute to the further improvement of HRQoL.

CAD is a chronic illness that will recur if the patient only attempts a mechanical intervention such as revascularization but not practicing healthy lifestyle. Without following healthy lifestyle, restenosis will eventually resulted though this varies in the period of time among individuals (Brorsson et al., 2001). Therefore, the gradual decline in HRQoL over time and recurrence of angina symptoms especially 1 month after PCI may possibly be related to recurrent obstruction of coronary arteries (Brorsson et al., 2001). Thus, in order to promote the long-lasting effect on HRQoL after PCI for these patients, nursing measures that prevent restenosis of coronary arteries are of paramount important.

The current medical practice aims at shortening the inpatient period and reducing readmission rate of CAD patients. Therefore, introducing cardiac rehabilitation program such as comprehensive exercise, education and counseling to patients immediately after PCI is necessary so that cardiac symptoms and adverse effect of treatments can be prevented and identified early. Cardiac rehabilitation should be provided to all patients undergoing PCI (Wenger, 1991) so that patients can be better prepared to return to community and to resume normal daily living. Cardiac rehabilitation is a critical component for improving the long-term HRQoL. The effect of an 8-week cardiac rehabilitation program on improvement in quality of life could be maintained for 2 years (Yu et al., 2004). According to Wenger et al. (1999) and Yu et al. (2004), cardiac rehabilitation should be started after discharge from hospital, and patient education should focus on prevention and treatment of CAD and its risk factor modification, such as smoking cessation, controlling cholesterol and blood pressure, reducing weight, and managing stress. Aerobic cardiovascular training exercise that reached 65–85% of the age-adjusted heart rate reserve of the patients is encouraged during the first 3–4 months of recovery period (Wenger et al., 1999; Yu et al., 2004).

Thirteen (16.7%) patients dropped out from this study. The baseline characteristics regarding age, income level, education level and baseline SF-36 and SAQ scores of these patients and the other 65 patients who completed the data collection process were similar (all p values > 0.05). The main reason for leaving out the 13 patients was that they lived in the Mainland China after hospital discharge so that the follow-up data was unable to obtain. Despite the living condition of the Mainland China was poorer than Hong Kong, the cost of living is relatively low. Besides, more than 30% of the studied patients received financial supports from the government. This implied that the economical and social needs of these patients should be addressed. Since healthy lifestyle is associated with higher employment status and higher education (Marmot et al., 1991), the financial status of the studied sample may be a burden to them, which may further affect their psychological health and their ability to maintain a healthy lifestyle. Thus, nurses may promote the HRQoL of these patients by reducing the impact of financial influences. Appropriate referrals to the Social Welfare Department as well as informing patients with the existing social resources may be helpful.

6. Limitations

Using the Likert-type self-reported questionnaires in this study may introduce bias, as patients prefer to give either socially desirable responses or extreme choices on the Likert scale (Polit and Beck, 2004). In addition, different interview methods were used for data collection, with face-to-face interview for baseline data and telephone interview for 1- and 3-month sets of data. Face-to-face interview is considered as the most valuable method for gathering information whereas telephone interview is often less effective in generating quality of data (Polit and Beck, 2004). During telephone interview, although timing of pauses were provided to allow each patient to ask questions and give response to each item, data collected by differing methods may still lead to diverse responses from the same interviewees and inevitably biased the results. Therefore, the study results should be interpreted with caution. In addition, the study was conducted in a single center, which raised the possibility of selection bias. Hence, the findings of the study may have been affected.

Patients in this study were followed-up for 3 months only. Therefore, the long-term impact of PCI on HRQoL of the Hong Kong Chinese patients cannot be investigated. Also, information on patients' educational level, type of occupation and religion were not collected so that the relationships of these factors with HRQoL

cannot be identified. However, these factors may possibly influence the HRQoL of patients and ultimately affecting the results of the study. Lastly, there was no control group (CAD patient with medical treatment only) in this study so comparison of HRQoL in patients with and without PCI cannot be examined. Thus, the results could not support the assumption that observed changes were solely due to the PCI.

7. Recommendation

Replication of this study using a larger sample and involving multiple hospitals in Hong Kong is needed to generate results that could represent the post-PCI patients. Adding the control group in the study may be necessary so that the efficacy of PCI can be compared. In addition, more knowledge may be regenerated by using a qualitative approach in identifying factors impacting HRQoL of CAD patients undergoing PCI. The needs for education of PCI patients can also be identified in qualitative study so that appropriate educational interventions can be developed to meet the needs of these patients. Detailed demographic data should be collected and examined in the future study since social background and personal characteristics may have great influences on an individual's perception of HRQoL. Furthermore, studies examining the effect of nursing interventions aimed at improving HRQoL, reducing angina symptoms and enhancing mental health of patients receiving PCI are recommended.

8. Conclusion

The results of this study quantify the benefits of PCI procedures and provide valuable local information for health care professionals in managing CAD patients. Findings of this study suggest that PCI improved HRQoL of CAD patients. However, nursing interventions are needed to maintain and further enhance the HRQoL of this group of patients especially 3 months after PCI. Patient educational programs that focus on dietary control, exercise compliance, stress reduction and positive mood maintenance are essential for these patients. These programs should be implemented immediately after PCI procedure to prevent the decline of HRQoL at 3 months.

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