Kaohsiung Journal of Medical Sciences (2011) 27, 280–288

available at www.sciencedirect.com

ScienceDirect

journal homepage: http://www.kjms-online.com

ORIGINAL ARTICLE

Health-related quality of life in patients undergoing cholecystectomy

Li-Na Hsueh [a], Hon-Yi Shi [b], Tsai-Fan Wang [a], Chiung-Ying Chang [c], King-Teh Lee [b,d,*]

[a] *Division of Operation Room, Department of Nursing, Kaohsiung Medical University Hospital, Kaohsiung Medical University, Taiwan*
[b] *Graduate Institute of Healthcare Administration, Kaohsiung Medical University, Kaohsiung, Taiwan*
[c] *Department of Nursing, Kaohsiung Medical University Hospital, Kaohsiung Medical University, Taiwan*
[d] *Division of Hepatobiliary Surgery, Department of Surgery, Kaohsiung Medical University Hospital, Kaohsiung, Taiwan*

Received 6 October 2010; accepted 21 January 2011
Available online 22 April 2011

KEYWORDS
Cholecystectomy;
Gastrointestinal Quality of Life Index;
Health-related quality of life;
Short-Form 36 Health Survey

Abstract This large-scale prospective cohort study of a Taiwan population applied generalized estimating equations to evaluate predictors of health-related quality of life (HRQOL) after open cholecystectomy (OC) and laparoscopic cholecystectomy (LC) procedures performed between February 2007 and November 2008. The Gastrointestinal Quality of Life Index and Short Form-36 were used in a preoperative assessment and in 3rd month and 6th month postoperative assessments of 38 OC and 259 LC patients. The HRQOL of the cholecystectomy patients were significantly improved at 3 months and 6 months postsurgery ($p < 0.05$). At 3 months postsurgery, HRQOL improvement was significantly larger in LC patients than in OC patients. Patient characteristics, clinical characteristics, and health care quality were also significantly related to HRQOL improvement ($p < 0.05$). Additionally, after controlling for related variables, preoperative health status was significantly and positively associated with each subscale of the Gastrointestinal Quality of Life Index and Short Form-36 throughout the 6 months ($p < 0.05$). Patients should be advised that their postoperative HRQOL may depend not only on their postoperative health care but also on their preoperative functional status.

* Corresponding author. Division of Hepatobiliary Surgery, Department of Surgery, Kaohsiung Medical University Hospital, 100, Zihyou 1st Road, Kaohsiung 807, Taiwan.
E-mail address: hshi@kmu.edu.tw (K.-T. Lee).

1607-551X/$36
doi:10.1016/j.kjms.2011.03.002

Introduction

Cholecystectomy can be categorized as open cholecystectomy (OC) or laparoscopic cholecystectomy (LC). The first LC was performed by Pillipe Mouret in France in 1987. In Western countries, more than 75% of patients who suffer from cholelithiasis combined with acute or chronic cholecystitis undergo LC surgery [1], and about 6,000 patients undergo LC surgery annually in Taiwan. This procedure is now a standard treatment for cholelithiasis because of its short operation time, minimal invasiveness, good patient tolerance, rapid recovery, and short hospitalization time [2—4].

Health-related quality of life (HRQOL) is a critical consideration when evaluating treatment options for cholelithiasis. Therefore, understanding the postoperative physical, psychological, and social outcomes associated with cholecystectomy is essential [5,6]. When evaluating HRQOL outcomes, especially after cholecystectomy, accurate data collection by longitudinal survey is essential [5—7]. Accurately evaluating treatment efficacy generally requires a generic outcome measure, such as a general HRQOL improvement and a disease-specific measure of clinical improvement.

Until now, most studies of cholecystectomy outcome have only evaluated patients at 3 months postoperatively after they had received only one or two postoperative assessments [4—6]. Additionally, studies of treatment efficacy in patients who have received cholecystectomy in countries elsewhere have been limited to procedures performed in only one medical institution [7]. Hence, this follow-up study focused on dimensions, such as patient demographics, clinical characteristics, health care quality, and preoperative health status to provide guidance in performing related medical treatments and to establish reliable HRQOL measures. Longitudinal changes in each HRQOL subscale were evaluated in terms of predictive value for cholecystectomy outcome. This study is, to our knowledge, the first to apply generalized estimating equations (GEEs) in a large-scale prospective cohort study of HRQOL change and predictors in a Taiwan population of cholecystectomy patients.

Materials and methods

Participants and data collection

The participants of this study were patients who had received OC or LC at two southern Taiwan medical centers between February 2007 and November 2008. For accurate assessment of postoperative outcome measures, only patients who had been treated by highly experienced surgeons were analyzed [8]. That is, the participants were patients who had undergone cholecystectomy performed by directors of surgery in a medical institution or by senior attending doctors specializing in cholecystectomy surgery or treatment. Inclusion criteria were the following: (1) history of OC or LC after initial diagnosis of cholelithiasis alone; (2) ability to communicate in Chinese and Taiwanese; and (3) agreement to participate in questionnaire survey in the hospital ward or by telephone. Exclusion criteria were postoperative diagnosis of any disease other than cholelithiasis or polyp and failure to complete postoperative questionnaires. The final study population of 297 patients included 38 OC patients and 259 LC patients.

Patient characteristics (including age, gender, education level, marital status, and body mass index (BMI), Charlson comorbidity index (CCI), history of abdominal surgery, duration of illness, reason for surgery, administration type, history of tobacco, and alcohol use), clinical characteristics (including duration of surgery and classification of anesthetic risk), health care quality [including rehospitalization within 30 days postsurgery, average length of stay (ALOS), and complications], and preoperative health status were collected through structured questionnaires and by review of patient records. All involved institutions approved this study of human subjects before initiating the survey.

Measures of HRQOL

The Gastrointestinal Quality of Life Index (GIQLI) was administered to evaluate social function and psychological and physical symptoms. The Short Form-36 (SF-36) Health Survey was administered to assess self-reported general health preoperatively and at 3 months and 6 months postsurgery.

The GIQLI gives a total score based on scores for four dimensions: symptoms, emotional function, physical function, and social function. The index includes 35 four-point questions with a maximum score of 140, where higher scores represent better health conditions postoperatively. The SF-36 measures eight dimensions: physical (PF), role physical (RP), bodily pain (BP), general health (GH), vitality (VT), social functioning (SF), role emotional (RE), and mental health (MH). The maximum score for each dimension is 100, and higher scores indicate better postoperative health conditions. The SF-36 also includes a physical component summary dimension and a mental component summary dimension. Based on the formula suggested by Ware [9] and on nationwide data collected by researchers in Taiwan [10], each score was converted to obtain a mean of 50 and a standard deviation of 10. Briefly, physical component summary or mental component summary scores higher than 50 and lower than 50 indicated better and worse general bodily or psychological function, respectively, compared with the "nationwide" normal group.

Statistical analysis

The unit of analysis in this study was the individual patient. The data structure of the sample was first established by statistical analysis of demographic data. Improved postoperative outcomes in different dimensions were then assessed by calculating effect size (ES). Improved postoperative HRQOL at each time point was analyzed by GEE modeling. Risk factors that significantly correlated with outcome dimensions or variables were identified by univariate analysis. The related risk factors were then entered into the GEE model for multivariate regression analysis as described in the literatures [11—13].

The model was constructed by first performing multiple regression analyses to find the best predictors of HRQOL at

different time points when using preoperative measures as baseline. Dependent variables (mean value of each GIQLI and SF-36 subscale) were modeled as a function of time and effect predictors. These significant independent variables were further included in the longitudinal analysis. Restated, these effective predictive variables were included as covariates in the GEE approach because they were statistically significant in the multivariable models and are the

Table 1 Demographic and clinical characteristics of participants

Characteristics	OC ($n = 38$)	LC ($n = 259$)	Total ($n = 297$)
Characteristics, mean (SD)			
Age	61.47 (15.32)	53.27 (14.78)	54.32 (15.08)
BMI	24.79 (3.78)	24.53 (3.67)	24.56 (3.67)
Duration of symptoms	5.33 (11.49)	14.45 (34.10)	13.30 (32.27)
Number of comorbidities	1.58 (1.65)	0.89 (1.48)	0.98 (1.52)
Gender, *n* (%)			
Male	28 (73.68)	105 (40.54)	13 (44.78)
Female	10 (26.32)	154 (59.46)	164 (55.21)
Education, *n* (%)			
No formal education	6 (15.79)	30 (21.62)	36 (12.12)
Primary school	11 (28.95)	56 (21.62)	67 (22.55)
Junior high school	4 (10.53)	35 (13.51)	39 (13.13)
Senior high school	4 (10.53)	87 (33.59)	91 (30.64)
College	13 (34.21)	51 (19.69)	64 (21.55)
Marital status, *n* (%)			
Single	—	36 (13.90)	36 (12.12)
Married	38 (100.00)	223 (86.10)	164 (87.88)
Previous abdominal surgery, *n* (%)			
Yes	15 (39.47)	84 (32.43)	99 (33.33)
No	23 (60.53)	175 (67.57)	198 (66.67)
Surgical factors, *n* (%)			
Symptomatic gallstones	20 (52.63)	162 (62.55)	182 (61.28)
Acute cholecystitis with gallstones	18 (47.37)	97 (37.45)	115 (38.72)
Administration type, *n* (%)			
OPD	28 (73.68)	195 (75.29)	223 (75.08)
ED	10 (26.32)	64 (24.71)	74 (24.92)
Current drinker, *n* (%)			
Yes	8 (21.05)	34 (13.13)	42 (14.14)
No	30 (78.95)	225 (86.87)	255 (85.86)
Current smoker, *n* (%)			
Yes	9 (23.68)	39 (15.06)	48 (16.16)
No	29 (76.32)	220 (84.94)	249 (83.84)
Quality of care, mean (SD)			
ALOS	9.43 (4.89)	4.54 (3.28)	5.16 (3.87)
Rehospitalization within 30 days, *n* (%)			
Yes	—	10 (3.86)	10 (3.37)
No	38 (100.00)	249 (96.14)	287 (96.63)
Current complications, *n* (%)			
0	38 (100.00)	234 (90.35)	272 (91.58)
≥ 1	—	25 (9.65)	25 (8.42)
Clinical characteristics, mean (SD)			
Operation time	138.68 (62.78)	85.33 (41.76)	92.15 (48.29)
ASA score	2.43 (0.60)	2.04 (0.64)	2.09 (0.65)

ASA = American Society of Anesthesiologists; ALOS = average lengths of stay; BMI = body mass index; ED = emergency department; LC = laparoscopic cholecystectomy; OC = open cholecystectomy; OPD = outpatient department; SD = standard deviation.

Table 2 HRQOL before and after cholecystectomy (mean ± SD)

Variable	OC			LC		
	Preoperation	3-mo postsurgery (*p*)	6-mo postsurgery (*p*)	Preoperation	3-mo postsurgery (*p*)	6-mo postsurgery (*p*)
GIQLI						
Symptom	63.11 ± 2.82	58.90 ± 3.93 (0.290)	72.68 ± 4.33 (0.001)	58.17 ± 0.63	68.42 ± 0.77 (<0.001)	71.14 ± 0.89 (<0.001)
Emotion	14.92 ± 0.82	14.91 ± 0.99 (0.994)	18.52 ± 1.11 (0.001)	13.21 ± 0.24	17.47 ± 0.29 (<0.001)	18.02 ± 0.33 (0.095)
Physical	17.89 ± 1.22	16.60 ± 1.40 (0.357)	22.96 ± 1.57 (<0.001)	18.17 ± 0.32	20.54 ± 0.42 (<0.001)	24.31 ± 0.48 (<0.001)
Social	13.39 ± 0.86	11.17 ± 0.99 (0.026)	16.48 ± 1.12 (<0.001)	8.83 ± 0.16	10.57 ± 0.18 (<0.001)	10.98 ± 0.21 (<0.001)
Total	110.74 ± 5.12	103.49 ± 6.88 (0.292)	132.09 ± 7.60 (<0.001)	100.92 ± 1.26	120.49 ± 1.51 (<0.001)	128.08 ± 1.74 (<0.001)
SF-36						
PF	84.53 ± 1.88	89.34 ± 2.46 (0.050)	92.48 ± 2.46 (<0.001)	76.56 ± 1.15	91.13 ± 1.46 (<0.001)	96.27 ± 1.46 (<0.001)
RP	57.61 ± 6.30	57.84 ± 8.62 (0.979)	92.51 ± 8.62 (<0.001)	56.37 ± 1.99	86.49 ± 2.60 (<0.001)	92.02 ± 2.60 (0.033)
RE	72.43 ± 5.26	83.83 ± 6.86 (0.096)	95.17 ± 6.86 (0.098)	54.01 ± 2.10	86.06 ± 2.77 (<0.001)	92.49 ± 2.77 (<0.001)
SF	89.14 ± 2.88	81.58 ± 3.70 (<0.001)	94.52 ± 3.70 (<0.001)	74.61 ± 1.14	87.66 ± 1.34 (<0.001)	91.55 ± 1.34 (<0.001)
BP	52.03 ± 3.23	84.48 ± 4.12 (<0.001)	92.63 ± 4.12 (<0.001)	57.76 ± 1.06	84.06 ± 1.42 (<0.001)	93.26 ± 1.42 (<0.001)
VT	64.47 ± 2.86	69.10 ± 3.57 (0.194)	78.61 ± 3.57 (<0.001)	56.31 ± 1.08	65.99 ± 1.28 (<0.001)	67.36 ± 1.07 (0.285)
MH	75.79 ± 2.54	84.33 ± 2.91 (<0.001)	82.91 ± 2.91 (0.625)	60.73 ± 1.12	70.15 ± 1.17 (<0.001)	73.19 ± 1.17 (<0.001)
GH	57.45 ± 3.05	66.52 ± 3.23 (<0.001)	68.13 ± 3.23 (0.618)	59.60 ± 1.12	66.27 ± 1.19 (<0.001)	73.52 ± 1.19 (<0.001)
PCS	45.15 ± 1.00	51.22 ± 1.38 (<0.001)	51.38 ± 1.38 (0.906)	48.80 ± 0.44	53.95 ± 0.56 (<0.001)	56.47 ± 0.56 (<0.001)
MCS	44.08 ± 2.38	51.00 ± 3.02 (0.022)	48.89 ± 3.02 (0.486)	29.24 ± 1.04	43.07 ± 1.19 (<0.001)	45.96 ± 1.19 (0.015)

BP = bodily pain; GH = general health; GIQLI = gastrointestinal quality of life index; HRQOL = health-related quality of life; LC = laparoscopic cholecystectomy; MCS = mental component summary; MH = mental health; OC = open cholecystectomy; PCS = physical component summary; PF = physical function; RE = role emotional; RP = role physical; SF = social function; SF-36 = Short-Form 36 Health Survey; VT = vitality.

conventional HRQOL predictors applied in the literature [11–13]. The GEE procedure under XTGEE in Stata, version 9.0 (StataCorp, College Station, TX, USA), was used for statistical analyses in this study.

Results

In the 297 cholelithiasis patients analyzed in this study, average age was 54.32 ± 15.08 years, average BMI was 24.56 ± 3.67 kg/m^2, average illness duration was 13.30 ± 32.27 months, and average CCI was 0.98 ± 1.52. Of the analyzed patients, 55.21% were female, 30.64% had a high school education or above, 87.88% were married, 66.67% had a history of abdominal surgery, 61.28% had a history of surgery for symptomatic cholelithiasis, 75.08% had been treated in clinics, 85.86% were drinkers, 83.84% were smokers, 96.63% did not require rehospitalization within 30 days, and 91.58% had no complications. ALOS was 5.16 ± 3.87 days, average surgery duration was 92.15 ± 48.29 minutes, and average anesthetic risk classification was 2.09 ± 0.65 (Table 1).

By 3 months postsurgery, the OC patients had significantly ($p < 0.05$) improved in GIQLI social score; and, by 6 months postsurgery, they had significantly ($p < 0.05$) improved in other dimensions as well. The LC patients, however, exhibited significant improvement in all dimensions at both 3 months and 6 months postsurgery ($p < 0.05$) (Table 2). By 3 months postsurgery, the OC patients had significantly improved in all SF-36 dimensions except for RP, VT, and RE. By 6 months postsurgery, the OC patients had significantly ($p < 0.05$) improved in all dimensions. The LC patients, however, exhibited significant improvement in all dimensions at both 3 months and 6 months postsurgery ($p < 0.05$). Additionally, patients who had complications in LC and those who did not have any complications throughout the 6 months did not statistically differ in preoperative or in any of the aforementioned postoperative HRQOL parameters (data not shown).

Table 3 compares the HRQOL improvement between OC and LC in different dimensions and time points. The OC patients exhibited negative change in all GIQLI dimensions at 3 months postsurgery with ES ranging from −0.01 (psychological function) to −2.58 (social function), whereas all changes were positive at 6 months postsurgery with ES ranging from 3.51 (symptoms) to 5.36 (social function). Additionally, the HRQOL changes in LC patients were uniformly positive at 3 months postsurgery with ES ranging from 7.41 (physical function) to 17.75 (psychological function) and also uniformly positive at 6 months postsurgery with ES ranging from 1.90 (psychological function) to 8.98 (physical function). Analysis of total GIQLI indicated that the largest HRQOL change occurred at 6 months postsurgery in OC patients and at 3 months postsurgery in LC patients. Except for the SF dimension of the SF-36, HRQOL changes in the OC patients were uniformly positive at 3 months postsurgery with ES ranging from −2.63 (SF) to 10.05 (BP). Except for the MH dimension of the SF-36, HRQOL changes in OC patients were uniformly positive at 6 months postsurgery with ES ranging from −0.49 (PF) to 4.02 (RP). Meanwhile, the HRQOL changes in LC patients were uniformly positive at both 3 months and 6 months postsurgery with ES ranging from 5.96 (GH) to 24.81 (BP) and from 1.07 (VT) to 6.48 (BP), respectively.

Table 4 shows the results of multivariate analysis of effective HRQOL predictors. Each time point was significantly related to the GIQLI subscales throughout the

Table 3 Effect sizes of HRQOL in different time sequences before and after cholecystectomy

Variables	OC		LC	
	Preoperatively *vs.* 3-mo postsurgery	3-mo postsurgery *vs.* 6-mo postsurgery	Preoperatively *vs.* 3-mo postsurgery	3-mo postsurgery *vs.* 6-mo postsurgery
GIQLI				
Symptom	−1.49	3.51	16.27	3.53
Emotion	−0.01	3.65	17.75	1.90
Physical	−1.06	4.54	7.41	8.98
Social	−2.58	5.36	10.88	2.28
Total	−1.42	4.16	15.53	5.03
SF-36				
PF	2.56	1.28	12.67	3.52
RP	0.04	4.02	15.14	2.22
RE	2.17	1.65	15.26	2.32
SF	−2.63	3.50	11.45	2.55
BP	10.05	1.98	24.81	6.48
VT	1.62	2.66	8.96	1.07
MH	3.36	−0.49	8.41	2.60
GH	2.97	0.50	5.96	6.09
PCS	6.07	0.11	11.7	4.50
MCS	2.91	0.70	13.3	2.43

BP = bodily pain; GH = general health; GIQLI = gastrointestinal quality of life index; HRQOL = health-related quality of life; LC = laparoscopic cholecystectomy; MCS = mental component summary; MH = mental health; OC = open cholecystectomy; PCS = physical component summary; PF = physical function; RE = role emotional; RP = role physical; SF = social function; SF-36 = Short-Form 36 Health Survey; VT = vitality.

Table 4 Multivariate regression analysis: factors affecting postoperative HRQOL of patients receiving OC and LC (GIQLI)

Variables	OC					LC				
	Symptom coefficient	Emotion coefficient	Physical coefficient	Social coefficient	Total coefficient	Symptom coefficient	Emotion coefficient	Physical coefficient	Social coefficient	Total coefficient
Intercept	55.21*	15.10*	21.11*	12.94*	104.81*	69.48*	17.14*	24.01*	11.80*	125.67*
Time[a]										
3-mo postsurgery	−4.43*	−0.12	−1.39	−2.20*	−7.66*	10.27*	4.26*	2.38*	1.74*	19.60*
6-mo postsurgery	9.64*	3.58*	5.22*	3.04*	21.66*	13.23*	4.89*	6.23*	2.18*	27.61*
Gender[a]										
Female	0.86	0.18	2.03	−0.67	2.43	−1.85	−0.71*	−0.82	−0.40	−3.89*
0.5										
Age	0.13	0.01	−0.03	−0.01	0.11	−0.05	−0.02	−0.03*	−0.01	−0.12
Reason for surgery[a]										
Cholelithiasis combined with acute cholecystitis	—	—	—	—	—	−5.58	−1.81*	−2.64*	−1.61*	−12.10*
CCI	—	—	—	—	—	0.55	0.40*	0.24	0.15	1.38
Type of admission[a]										
Emergency	4.00	0.16	1.53	−0.34	5.91	—	—	—	—	—
Complications[a]										
≥1	—	—	—	—	—	−4.30*	−1.93	−1.07	−0.56	−8.10*
Average length of stay (d)	−0.15	−0.04	−0.26	0.16	−0.36	—	—	—	—	—
Anesthesia risk classification	−0.01	−0.01	−0.01	0.01	−0.01	—	—	—	—	—
Preoperative health status (GIQLI score)	63.11*	14.92*	17.89*	13.39*	110.74*	58.17*	13.21*	18.17*	8.83*	100.92*

[a] Reference group: preoperative, male, symptomatic cholelithiasis, clinics, with no complication.
*A p value <0.05.
CCI = Charlson comorbidity index; GIQLI = gastrointestinal quality of life index; HRQOL = health-related quality of life; LC = laparoscopic cholecystectomy; OC = open cholecystectomy.

Table 5 Multivariate regression analysis: factors affecting postoperative QOL in patients receiving OC and LC (SF-36)

Variables	OC								LC							
	PF coefficient	RP coefficient	RE coefficient	SF coefficient	BP coefficient	VT coefficient	MH coefficient	GH coefficient	PF coefficient	RP coefficient	RE coefficient	SF coefficient	BP coefficient	VT coefficient	MH coefficient	GH coefficient
Intercept	108.45*	75.99*	122.34*	83.31*	47.77*	63.71*	83.06*	33.49*	99.05*	71.53*	67.99*	83.23*	63.41*	55.99*	64.95*	54.54*
Time[a]																
3-mo postsurgery	4.99*	0.23	11.71	−7.09	32.71*	5.43	9.31*	9.72*	14.75*	31.33*	33.74*	13.42*	26.64*	9.91*	9.58*	6.54*
6-mo postsurgery	8.27*	33.35*	23.56*	5.41	40.56*	14.86*	7.49*	10.53*	19.87*	36.32*	38.80*	17.42*	35.95*	11.25*	12.47*	13.38*
Gender[a]																
Female	−0.47	0.22	−14.72	−3.21	1.01	2.07	−7.61	5.95	−5.45*	−9.14*	−7.55*	−5.72	−3.19*	−1.74	−3.63*	−5.02*
Age	−0.23*	0.13	−0.38	0.13	0.19	0.05	−0.09	−0.44*	−0.25*	0.02	−0.06	−0.02	−0.09	−0.12	−0.09	−0.07
Previous abdominal surgery[a]																
No	—	—	—	—	—	—	—	—	0.60	−0.01	1.53	−4.78*	−1.52	3.16	1.29	3.61
Reason for surgery[a]	—	—	—	—	—	—	—	—								
Cholelithiasis combined with acute cholecystitis	—	—	—	—	—	—	—	—	−4.69*	−2.41	−2.37	−1.38	−0.63	−2.03	−4.55*	1.10
BMI	−0.01	0.02	−0.04*	−0.04*	−0.02	−0.01	0.01	−0.01	—	—	—	—	—	—	—	—
Education[a]																
Primary	−3.18	−5.17	−10.74	−2.01	−10.15	−5.35	−5.47	7.72	—	—	—	—	—	—	—	—
Junior high	−1.15	−2.89	−1.69	0.39	−5.14	−4.25	−4.10	5.89	—	—	—	—	—	—	—	—
Senior high	1.97	−1.37	−0.75	7.37	−9.09	16.10*	7.94	27.08*	—	—	—	—	—	—	—	—
College and above	−5.61	−20.83	21.94*	−6.48	−3.07	−4.71	−4.96	19.35*	—	—	—	—	—	—	—	—
Illness duration	—	—	—	—	—	—	—	—	0.04	0.04	0.09*	0.05*	0.03	0.04	0.08*	0.03
CCI	−0.25	−2.73	−0.75	−0.36	−2.51	−1.04	0.67	−3.85*	−0.35	−1.12*	0.38	−0.37	0.84	−0.16	0.57	−1.16*
Rehospitalization in 30 d[a]																
No	—	—	—	—	—	—	—	—	2.66	4.68	4.26	8.65*	5.37	10.48*	11.07*	7.97
Average length of stay (d)	−0.74*	−1.14	−0.97	0.23	−0.04	0.01	0.20	−1.42*	−0.41	−0.51	−0.67	−0.16*	−0.06	−0.09	0.29	−0.01
Surgery duration	—	—	—	—	—	—	—	—	−0.01	−0.12*	−0.08*	−0.10	−0.04*	−0.02	−0.07*	0.02
Preoperative health status (SF-36 score)	84.53*	57.61*	72.43*	89.14*	52.03*	64.47*	75.79*	57.45*	76.56*	56.37*	54.01*	74.61*	57.76*	56.31*	60.73*	59.60*

[a] Preoperative characteristics of reference group: male, with history of abdominal surgery, current symptomatic cholelithiasis, no formal education, with rehospitalization in 30 days.
*A p value <0.05.
BMI = body mass index; BP = bodily pain; CCI = Charlson comorbidity indexGH = general health; LC = laparoscopic cholecystectomy; MH = mental health; OC = open cholecystectomy; PF = physical function; QOL = quality of life; RE = role emotional; RP = role physical; SF = social function; SF-36 = Short-From 36 Health Survey; VT = vitality.

6 months ($p < 0.05$). After controlling for related variables, HRQOL revealed a significant and negative association with female gender, current cholelithiasis combined with acute cholecystitis, and any current complication. Additionally, preoperative health status was significantly and positively associated with each subscale of the GIQLI throughout the 6 months ($p < 0.05$). Table 5 shows the results. Each time point was significantly related to the SF-36 subscales throughout the 6 months ($p < 0.05$). Female gender; advanced age; current cholelithiasis combined with acute cholecystitis; education level lower than junior high school; rehospitalization within 30 days; and high values for BMI, CCI, ALOS, and surgery duration were significantly and negatively associated with HRQOL. Additionally, preoperative health status was significantly and positively associated with each subscale of the SF-36 throughout the 6 months ($p < 0.05$).

Discussion

Comparison of HRQOL improvements between different time points indicated that the GIQLI and SF-36 scores for LC patients were significantly improved by 6 months postsurgery. The improvement in LC patients after 6 months was also much larger than that in OC patients after 6 months, which is consistent with the literatures [11—13].

At 3 months postsurgery, the ES for all GIQLI dimensions correlated negatively with improvements in OC patients, which suggests that their health status was relatively poorer than that at baseline. Possible explanations for the relatively poorer health status of the OC patients include their relatively older average age, the larger percentage of males, the larger percentage of patients with only primary school education level, and the larger average wound size [11—13]. The older average age of the OC patients (61.47 years *vs.* 53.27 years in LC patients) correlated with slower recovery from surgery, which is consistent with reports that age is a significant factor in HRQOL [7,11—13].

The baseline scores for the disease-specific measure (GIQLI) were lower in LC patients than in OC patients. The average total scores for LC patients were higher than those of OC patients at 3 months postsurgery, indicating that LC improvement in general gastrointestinal function is faster in LC patients than in OC patients. Pain relief and symptom improvement may also improve bodily function and emotional function, which may in turn improve social function [7,12].

Unlike previous reports [11—14], the average duration of illness in LC patients (14.45 months) was longer than that in OC patients (5.33 months). Duration of gall bladder disease is also reportedly shorter after LC than after OC. The data in this study suggest that gall bladder disease, which is often accompanied by abdominal pain, is easily misdiagnosed as stomach disease, which delays treatment time. Another possibility is that the poorer health status of females compared with males causes a cognitive discrepancy in these patients [15,16].

ALOS (9.43 days) for the OC patients in this study was also longer than that reported in the literature [17]. Carbonell et al. [17] found that, compared with females, males have a longer ALOS (6.6 days) after OC; Steven et al. [18] reported a 7.4-day ALOS after OC whereas Rosenmüller et al. [19] reported a 7.9-day ALOS after OC. Differences in national health conditions may explain the discrepancy. An earlier Taiwan study of cholecystectomy patients reported that percutaneous transhepatic gallbladder drainage may be a major cause of increased ALOS [20]. A longer preoperation hospital day may also increase ALOS. A final possibility is that ALOS is longer in Taiwan populations than in Western populations because of different treatment protocols or cultural differences.

Although all research questions were satisfactorily addressed, one limitation should be noted. Prospective data were collected for a cohort in which the earliest patients were enrolled in 2007. Therefore, varying follow-up periods may have caused selection bias. Nonetheless, HRQOL did not significantly differ between patients who did and did not complete the entire 6-month study (data not shown). Additionally, without analyzing long-term HRQOL, it is unclear whether short-term benefits yield improved long-term outcomes. Previous studies indicate that sustained evaluations exceeding 1 year [21,22] are needed to accurately appraise patients who receive cholecystectomy.

The HRQOL improvement was generally larger in LC patients than in OC patients at 3 months postsurgery, but both groups had significantly improved by 6 months postsurgery. In conclusion, factors other than surgical outcome should be considered when evaluating post-cholecystectomy quality of life. All the significant factors identified in this study can be addressed in preoperative consultations to educate cholecystectomy candidates regarding the expected course of recovery and functional outcomes. Medical professionals and families of patients must also be advised that the HRQOL improvement for patients who receive such surgeries is determined not only by the clinical characteristics of the patient and by the quality of healthcare received but also by preoperative health status. Patients should be advised that postoperative HRQOL depends on preoperative functional status and demographic profile.

References

[1] Shamiyeh A, Wayand W. Current status of laparoscopic therapy of cholecystolithiasis and common bile duct stones. Digest Dis 2005;23:119—26.

[2] Hsu CE, Lee KT, Chang CS, Chiu HC, Chao FT, Shi HY. Cholecystectomy prevalence and treatment cost: an 8-year study in Taiwan. Surg Endosc 2010;24:3127—33.

[3] Avgerinos C, Kelgiorgi D, Touloumis Z, Baltatzi L, Dervenis C. One thousand laparoscopic cholecystectomies in a single surgical unit using the "critical view of safety" technique. J Gastrointest Surg 2009;13:498—503.

[4] Shi HY, Lee HH, Chiu CC, Chiu HC, Uen YH, Lee KT. Responsiveness and minimal clinically important differences after cholecystectomy: GIQLI versus SF-36. J Gastrointest Surg 2008;12:1275—82.

[5] Feldman LS, Kaneva P, Demyttenaere S, Carli F, Fried GM, Mayo NE. Validation of a physical activity questionnaire (CHAMPS) as an indicator of postoperative recovery after laparoscopic cholecystectomy. Surgery 2009;146:31—9.

[6] Hogan AM, Hoti E, Winter DC, Ridgway PF, Maguire D, Geoghegan JG, et al. Quality of life after iatrogenic bile duct injury: a case control study. Ann Surg 2009;249:292—5.

[7] Shi HY, Lee KT, Lee HH, Uen YH, Tsai JT, Chiu CC. Post-cholecystectomy quality of life: a prospective multicenter cohort study of its associations with preoperative functional status and patient demographics. J Gastrointest Surg 2009;13: 1651—8.
[8] Katz JN, Phillips CB, Baron JA, Fossel AH, Mahomed NN, Barrett J, et al. Association of hospital and surgeon volume of total hip replacement with functional status and satisfaction three years following surgery. Arthritis Rheum 2003;48:560—8.
[9] Ware JE. Conceptualization and measurement of health-related quality of life: comments on an evolving Field. Arch Phys Med Rehabil 2003;84:S43—51.
[10] Tseng HM, Lu JFR, Tsai YJ. Assessment of health-related quality of life in Taiwan (II): norming and validation of SF-36 Taiwan version. Taiwan J Public Health 2003;22:512—8.
[11] Gurusamy K, Samraj K, Gluud C, Wilson E, Davidson BR. Meta-analysis of randomized controlled trials on the safety and effectiveness of early versus delayed laparoscopic cholecystectomy for acute cholecystitis. Br J Surg 2010;97: 141—50.
[12] Geiger TM, Awad ZT, Burgard M, Singh A, Davis W, Thaler K, et al. Prognostic indicators of quality of life after cholecystectomy for biliary dyskinesia. Am J Surg 2008;74:400—4.
[13] Ahmad NZ, Byrnes G, Naqvi SA. A meta-analysis of ambulatory versus inpatient laparoscopic cholecystectomy. Surg Endosc 2008;22:1928—34.
[14] Mallon P, White J, McMenamin M, Das N, Hughes D, Gilliland R. Increased cholecystectomy rate in the laparoscopic era: a study of the potential causative factors. Surg Endosc 2006; 20:883—6.
[15] Holtzman JM, Saleh K, Kane R. Gender differences in functional status and pain in a Medicare population undergoing elective total hip arthroplasty. Med Care 2002;40:461—70.
[16] Quintana JM, Arostegui I, Oribe V, Lo'pez de TI, Barrios B, Garay I. Influence of age and gender on quality-of-life outcomes after cholecystectomy. Qual Life Res 2005;14: 815—25.
[17] Carbonell AM, Lincourt AE, Kercher KW, Matthews BD, Cobb WS, Sing RF, et al. Do patient or hospital demographics predict cholecystectectomy outcomes? Surg Endosc 2005;19: 767—73.
[18] Steven LZ, Robert SS, Robert R, Robert S, Brown JR. A population-based cohort study comparing laparoscopic cholecystectomy and open cholecystectomy. Am J Gastroenterol 2002; 97:334—40.
[19] Rosenmüller M, Haapamäki MM, Nordin P, Stenlund H, Nilsson E. Cholecystectomy in Sweden 2000-2003: a nationwide study on procedures, patient characteristics, and mortality. BMC Gastroenterol 2007;7:35.
[20] Lee KT, Chang WT, Huang MC, Chiu HC. Influence of surgeon volume on clinical and economic outcomes of laparoscopic cholecystectomy. Digest Surg 2004;21:406—12.
[21] Puzziferri N, Austrheim-Smith IT, Wolfe BM, Wilson SE, Nguyen NT. Three year follow-up of a prospective randomized trial comparing laparoscopic versus open gastric bypass. Ann Surg 2006;243:181—8.
[22] Kaafarani HM, Smith TS, Neumayer L, Berger DH, Depalma RG, Itani KM. Trends, outcomes, and predictors of open and conversion to open cholecystectomy in Veterans Health Administration hospitals. Am J Surg 2010;200:32—40.