ORIGINAL ARTICLE

Changes and Factors Influencing Health-related Quality of Life After Hysterectomy in Premenopausal Women with Benign Gynecologic Conditions

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Background/Purpose: A hysterectomy affects a woman's health. This study was performed to identify the factors that affect health-related quality of life (HRQoL) before and after hysterectomy in premenopausal women.

Methods: This prospective follow-up study recruited 38 women (age range, 33–52 years) who underwent abdominal hysterectomy for nonmalignant causes. SF-36 and self-rated health status were used to assess HRQoL before and after hysterectomy. Data were analyzed using descriptive statistics, nonparametric tests and the generalized estimating equation method for modeling the repeatedly measured responses.

Results: Patients' attitudes toward hysterectomy and subsequent sexual activity were influenced by the surgery. All patients showed significant improvements in the physical component summary (PCS) of SF-36 (mean, 42.1–51.0), but there was no significant difference in the mental component summary (MCS). The significant improvements were found from the five repeated measurements of the self-rated health status (mean, 6.0–7.3). Hemoglobin level was the most important predictor of HRQoL before surgery. Women in employment, with more years of education and previous blood transfusion had high MCS scores after surgery.

Conclusion: The overall self-rated health status and PCS showed significant improvements after hysterectomy. Having had a blood transfusion, being educated and employed were positively associated with MCS score after surgery. These findings are vital for preoperative counseling for women undergoing hysterectomy.
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Key Words: abdominal hysterectomy, generalized estimating equation modeling, health-related quality of life, SF-36

Hysterectomy is one of the most frequently performed operations in Taiwanese women, second only to cesarean section.[1] Previous studies have shown that most women received hysterectomy due to nonmalignant symptoms such as menstrual pain, menorrhagia, unexplained uterine bleeding and chronic pelvic pain.[2–5] All of these symptoms have an adverse effect on a woman's quality of life. Most women reported a reduction in physical symptoms and pain and an increase in health perceptions after hysterectomy.[4] However, hysterectomy may also result in the development of new problems such as pelvic/abdominal pain, urinary problems, constipation,

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weight gain, fatigue, lack of interest or enjoyment in sex, depression, anxiety and negative feelings about oneself as a woman.[2,3] Women who had higher depression scale scores prior to hysterectomy expressed more fears of aging, weight gain and loss of femininity.[6] Femininity has been proposed as a positively valued quality, thus, the perception of losing one's femininity is a serious and threatening event in a woman's life.[7] Therefore, hysterectomy may function as a stressor, adding to the general dissatisfaction with life or triggering preexisting health problems. Due to the rate of complications and mortality after hysterectomy, and the significant number of surgeries that do not relieve pain, nonsurgical therapy may be more appropriate initially. When nonsurgical management fails,[3] however, hysterectomy can be performed to treat nonmalignant conditions, hopefully enhancing the quality of life and relieving discomfort.[4,5] The only hysterectomy characteristic that was significantly associated with poor outcome was bilateral salpingo-oophorectomy (BSO). BSO, rather than hysterectomy, may be associated with mild increases in depression scores.[8] In comparison with women without oophorectomy or with unilateral oophorectomy, women with BSO had significantly lower scores in energy, pain and general health change on the SF-36 4 months after hysterectomy.[9] Hot flashes were a more frequent adverse event in women who had BSO, but the procedure type (BSO *vs.* no BSO) did not have a significant influence on quality of life indices.[2] In Maryland study, it was found that hysterectomy was not an effective treatment for all women. Baseline depression and therapy for emotional problems were significantly associated with poor outcome. Some of these women who had changed in life circumstances were associated with posthysterectomy depression, but it is also possible that for some, hysterectomy instigated depression.[10] However, research has shown no evidence linking the removal of the uterus to psychologic disturbances.[11]

Health-related quality of life (HRQoL) has been increasingly recognized as an important outcome variable in clinical research, in addition to the more traditional biomedical measures.[12] HRQoL is a multidimensional concept, which encompasses physical, emotional and social aspects associated with a given disease or its treatment.[13] Also, HRQoL refers to an individual's total wellbeing, an important concept for gynecologic medical and nursing staff to understand in order to provide patients with accurate information during pre- and postsurgical counseling, thereby enhancing the appropriateness of treatment and care. Several recent studies of hysterectomy outcome in Taiwan have shown improvements in HRQoL or at least short-term effectiveness after the procedure.

Two basic approaches characterize the measurement of HRQoL: generic instruments (including single indicators, health profiles and utility measures) and specific instruments. A health profile is an instrument that attempts to measure all important aspects of HRQoL.[14] The SF-36 is an example of such an instrument that was constructed to survey health status and to apply the findings to clinical practice and research, health policy evaluations and general population survey.[15] Utility measures of quality of life are the other type of generic instrument, which is summarized as a single number along a continuum scale of the net change in HRQoL. Utility measures are useful for determining if patients are, overall, better off, but they do not show the domains in which improvement or deterioration occurs. The instruments used to assess HRQoL may be specific to a disease, patient population, certain function or problem. Specific measures have the advantage of relating closely to areas routinely analyzed by clinicians.[14] Most previous research used the SF-36, a generic instrument, to measure HRQoL in women who have undergone hysterectomy.[10,15–18] Ideally, the instruments used should comprise a generic and disease-specific questionnaire so that comparisons can be made at a generic level and specifically to that disease or condition.[19] In a review of the literature, Jones et al[20] found that 26% of the tools used to measure HRQoL in women with benign gynecologic conditions were

not based on established psychometric properties and, therefore, were inappropriate for the measurement of HRQoL. However, a specific instrument for the assessment of HRQoL in women with benign gynecologic disorders who undergo hysterectomy has yet to be developed.[20] The purposes of this study were as follows: (1) to determine if women's perceived HRQoL improved after hysterectomy; (2) to investigate what aspects of HRQoL are affected by hysterectomy during the recovery period; (3) to examine the relationship between women's self-rated health (utility measures) and HRQoL; and (4) to assess the factors influencing HRQoL during the year after hysterectomy.

Methods

This was a prospective follow-up study. A sample of 40 women undergoing hysterectomy for nonmalignant reasons was enrolled. The sample size required for this study was determined based on the following assumptions. The probability of a type I statistical error (two-sided) is 0.05 and of a type II statistical error is 0.10. Under the difference of hypotheses not less than 0.6 standard deviation σ, the sample size of this test is approximately 36. The process of data collection combined with interview methods was used to validate the data interpretation and to control the measurement errors. The participants had regular menstrual cycles, and were scheduled for abdominal hysterectomy, either with or without BSO. The final sample used in the data analysis comprised 38 women (mean age, 44.6 ± 6.1 years; range, 33–59 years), all of whom completed 1 year of postoperative follow-up.

During a preoperative visit after recruitment, the informed consent form was signed by all participants. Each participant received a self-rated health questionnaire and completed it five times (before and immediately after surgery, and 1, 6 and 12 months postsurgery). The SF-36 Health Survey was completed by the participant on three different occasions (before surgery, and 6 and 12 months after surgery). Permission to conduct this study was obtained from the Human Subjects Committee of National Taiwan University Hospital. To ensure participant anonymity and confidentiality, an identification number was assigned to each woman in place of her name. Questionnaires were also coded using identification numbers.

Data were analyzed using SPSS version 11.0 (SPSS Inc, Chicago, IL, USA) and SAS version 8.2 (SAS Institute Inc, Cary, NC, USA). Descriptive statistics such as frequencies and percentages provided a general description of sample characteristics. Nonparametric tests such as the Wilcoxon signed rank test and Friedman's test were used to examine the effect of time on HRQoL and self-rated health status. The generalized estimating equation (GEE)[21,22] method for modeling the marginal means of longitudinal data was used to examine the effects of the factors on subjects' physical and mental HRQoL before, and at 6 and 12 months after hysterectomy. Due to the relatively small sample size, a normality assumption was made on the response variables to obtain the maximum likelihood estimates of the regression coefficients, and the model-based variances of the regression coefficient estimates (according to the chosen AR(1) correlation structure for the response errors) were used. Given the relatively small sample size, any statistically significant findings deserve further attention. Backward variable selection, goodness of fit assessment and basic regression diagnostics were conducted. A two-tailed significance level of 0.05 was used in all statistical tests.

Self-rated health questionnaire

This questionnaire was designed by the investigators to gather subjective information from participants about their health and concerns before surgery and during the recovery period. Data collection was performed using personal interview in order to obtain the participants' perception at specific times. All the interview data were collected by one well-trained interviewer. The questionnaire covers four parts: (1) the patient's attitudes and emotional reactions to having and

not having a uterus; (2) the patient's concern with their current health problems; (3) the patient's perceived interest or enjoyment in sex after hysterectomy; and (4) the patient's self-rated health status. Patients pointed out their subjective perceptions using a single-item numeric rating scale of 1–10. The clinical data were obtained from each patient's medical records. The relevance of the content of the questionnaire was verified through a review of the literature and by a panel of expert nurses and gynecologists.

SF-36 Health Survey

The SF-36 Health Survey measures generic health concepts that assess HRQoL outcomes.[23] The Taiwan version of the SF-36 Health Survey appears to be a practical and reliable instrument for use in the general population.[24] The SF-36 measures eight health concepts: (1) physical functioning (PF); (2) role limitations due to physical health problems (RP); (3) bodily pain (BP); (4) general health (GH); (5) vitality/fatigue (VT/FT); (6) social functioning (SF); (7) role limitations due to emotional problems (RE); and (8) mental health (MH). The SF-36 was constructed to represent two major dimensions of health—the physical component summary (PCS) and the mental component summary (MCS).[25] A second-order factor analysis (principal component analysis) of the eight SF-36 scale scores was carried out to test the assumption that there were two underlying factors in the SF-36. Two factors with eigenvalues greater than 1 were extracted and rotated to an orthogonal simple structure using the varimax method,[25] which accounted for 81.5% of reliable variance in SF-36 scales.[26] Reliability estimates (Cronbach's α) of the eight SF-36 (Taiwan version) scales met or exceeded the 0.7 level, with the exception of the SF scale ($\alpha = 0.57$).[24] Linear transformations were performed to convert original scores (0–100) to a mean of 50 with a standard deviation of 10.[23] Higher scores represented a perception of better health.

Permission to use the SF-36 Taiwan version was obtained from the principal investigator for the Taiwan team and the IQOLA project director Dr JR Lu. The reliability estimates (Cronbach's α) of the eight health concepts of SF-36 in this study were: PF = 0.95, RP = 0.98, BP = 0.92, GH = 0.88, VT/FT = 0.74, SF = 0.69, RE = 0.97, MH = 0.74. The correlation coefficient (r) ranged from 0.23 to 0.7 between the eight health concepts.

Results

The most common primary condition in the participants was leiomyoma (84.2%), followed by leiomyoma with adenomyosis (7.9%), endometriosis (5.3%) and adenomyosis (2.6%), while menorrhagia (19.1%), abdominal pain (14.5%), blood clot (14.5%) and frequent urination (14.5%) were the main complaints. All participants were married and premenopausal at the time of surgery. Patients' demographic and clinical characteristics are summarized in Table 1.

Table 1. Demographic and clinical characteristics of premenopausal women undergoing hysterectomy ($n = 38$)

Characteristic	Mean ± SD	Frequency, *n* (%)
Age (yr)	44.6 ± 6.1	
Years of education	12.4 ± 3.2	
Occupational status		
Employed		22 (57.9)
Unemployed		16 (42.1)
Primary indication		
Leiomyoma		32 (84.2)
Leiomyoma with adenomyosis		3 (7.9)
Endometriosis		2 (5.3)
Adenomyosis		1 (2.6)
Previous treatment/ medication		
Never		25 (65.8)
Western medical care		10 (26.3)
Chinese medical care		3 (7.9)
Number of children	2.2 ± 0.8	
Number of symptoms	3.5 ± 2.2	

Out of 40 participants, 18 (48.7%) considered the uterus to be a reproductive organ since that is its general classification regardless of whether the woman is fertile before hysterectomy (Table 2). After hysterectomy, most of the patients expressed a feeling of detachment towards their uterus, and that it no longer represented something important. Their attitude towards the hysterectomy shifted from passive (following doctor's advice, feeling this was their only choice) or neutral (feeling indifferent) at 1 month after surgery, to assertive (a right choice) at 6 months after surgery. Attitudes toward hysterectomy and the resulting effect on their sex life differed greatly at 1 and 6 months postsurgery, with the latter results being more similar to the presurgery evaluation. This may be due to a miscomprehension of the changes and adaptive needs that a woman experiences after hysterectomy. While some participants cited wound healing and the need for additional time for adjustment as reasons for the delay of sexual activity, others had resumed their normal sexual life within 2 or 3 months after hysterectomy. Sexual problems such as lack of orgasm, dyspareunia and vaginal dryness were reported 6 months after surgery.

Significant differences in the PCS of SF-36 scores measuring the time effect were found between presurgery and 6 and 12 months postsurgery for three of the separately examined health concepts, role limitations due to physical health problems being the exception. Measuring the time effect in the MCS of SF-36, only social functioning and role limitations due to emotional problems had significant differences between presurgery and 6 and 12 months postsurgery. There were no significant differences in health concepts between 6 and 12 months after hysterectomy. Similar findings were made in the analysis of results for the physical components of SF-36 (Table 3). Analysis of the interview data supported that the participants felt much better at 1 month after surgery and continued to feel better in the physical and emotional aspects of health at 6 and 12 months after surgery. There were no significant changes in the

Table 2. Attitude and perception toward hysterectomy before and after surgery

Item/time	Preoperative, *n* (%)	Postoperative at 1 mo, *n* (%)	Postoperative at 6 mo, *n* (%)
Attitude towards having a uterus			
None	8 (21.6)	29 (80.6)	17 (53.1)
Important organ	4 (10.8)	1 (3.0)	2 (6.3)
Reproductive organ	18 (48.7)	1 (3.0)	10 (31.3)
Related to sexuality	2 (5.4)	2 (6.1)	1 (3.1)
Useless organ	4 (10.8)	3 (8.3)	2 (6.3)
Feminist	1 (2.7)	0 (0)	0 (0)
Attitude towards the hysterectomy			
Passive	10 (30.3)	14 (36.8)	7 (19.4)
Assertive	17 (51.5)	7 (18.4)	18 (50.0)
Neutral	6 (18.2)	17 (44.7)	11 (30.6)
Perception of the impact on sexual life pre-hysterectomy			
Positive effect	1 (3.2)	0 (0)	3 (9.1)
No effect	23 (74.2)	10 (47.6)	29 (87.9)
Not applicable	7 (22.6)	11 (52.4)	1 (3.0)
Postoperative sequelae			
No		32 (86.5)	28 (77.8)
Yes		2 (5.4)	6 (16.7)
None, but worried		3 (8.1)	2 (5.6)

Table 3. Health-related quality of life before and at 6 and 12 months after hysterectomy

Items	Preoperative (I) M (SD)	Postoperative at 6 mo (II) M (SD)	Postoperative at 12 mo (III) M (SD)	Friedman's test (χ^2)	Wilcoxon signed rank test (Z)
Physical functioning	45.2 (12.0)	53.0 (7.5)	53.1 (7.5)	22.4*	II > I (4.4†) III > II (0.7) III > I (3.3†)
Role limitations due to physical health problems	42.3 (13.9)	49.5 (2.4)	43.7 (12.9)	10.1*	II > I (2.7‡)
Bodily pain	43.6 (14.9)	56.5 (7.7)	55.5 (6.8)	26.2*	II > I (4.1†) II > III (0.5) III > I (3.7†)
General health perception	38.1 (12.4)	49.9 (13.2)	48.0 (12.3)	21.1*	II > I (3.8†) II > III (1.0) III > I (3.5†)
PCS	42.1 (13.1)	52.5 (8.7)	51.0 (9.1)	23.3*	II > I (5.0†) II > III (1.5) III > I (3.8†)
Vitality, energy/fatigue	50.0 (8.6)	54.0 (7.5)	53.2 (6.5)	5	
Social functioning	47.5 (10.0)	54.4 (6.8)	53.8 (5.6)	19.9*	II > I (3.9†) II > III (0.1) III > I (3.5†)
Role limitations due to emotional health problems	43.3 (15.0)	52.5 (9.4)	52.2 (9.7)	11.5*	II > I (3.1†) III > II (0.9) III > I (2.6‡)
General mental health	47.2 (8.0)	50.8 (7.5)	51.5 (5.7)	4	
MCS	47.7 (12.5)	52.1 (7.7)	52.4 (6.6)	0.4	

**p < 0.01, Friedman's test; †p < 0.003 and ‡p < 0.017, Wilcoxon signed rank test. M = mean; SD = standard deviation; PCS = physical component summary; MCS = mental component summary.*

participants' overall HRQoL (SF-36) as a result of hysterectomy. This finding may be attributable to the diversity of symptoms, age, educational level, diagnosis or occupational status of the women in this sample.

The difference between symptom types and HRQoL was analyzed using the *t* test. The results showed that women with menorrhagia before hysterectomy had a lower PCS score ($t = -2.3$, $p < 0.05$) and a higher MCS score ($t = 2.1$, $p < 0.05$) compared to women without this symptom. At 6 and 12 months after hysterectomy, no statistically significant differences in PCS and MCS scores were found between women with and without menorrhagia. In addition, comparison of the related differences (score before surgery subtracted from score at 6 months postsurgery) between before and 6 months after hysterectomy showed significant improvements in PF in the women who had menorrhagia ($t = 2.5$, $p < 0.05$) and also in PCS ($t = 3.2$, $p < 0.05$) compared to the women without this symptom. But these women still showed less improvement in SF ($t = -3.0$, $p < 0.01$) and MCS ($t = -2.5$, $p < 0.05$) compared to the women without menorrhagia. There were significant differences between patients with and without abdominal pain in PCS ($t = -2.5$, $p < 0.05$) and bodily pain ($t = -4.9$, $p < 0.00$) before surgery. However, there was no significant difference in PCS after surgery between these groups. Additional comparison of the related differences (score at 6 months minus score before surgery) between before and 6 months after hysterectomy revealed that women who had abdominal pain had

Table 4. Comparison of self-rated health score preoperatively, at discharge, and at 1, 6 and 12 months postoperatively

Item	Preoperative (I)	Discharge (II)	Postoperative at 1 mo (III)	Postoperative at 6 mo (IV)	Postoperative at 12 mo (V)
Self-rated health score	6	6.3	7.3	7.4	7.4
M (SD)	(2.6)	(1.5)	(1.2)	(1.4)	(1.2)
Friedman's test (χ^2)			43.3*		
Wilcoxon signed rank test	II > I ($Z = 1.6$)	III > I ($Z = 4.0^{\dagger}$)	IV > I ($Z = 4.1^{\dagger}$)	V > I ($Z = 4.1^{\dagger}$)	
	III > II ($Z = 3.6^{\dagger}$)	IV > II ($Z = 3.8^{\dagger}$)	V > II ($Z = 3.5^{\dagger}$)		
	IV > III ($Z = 0.8$)	V > III ($Z = 1.0$)			

$p < 0.01$, Friedman's test; †$p < 0.0025$, Wilcoxon signed rank test. M = mean; SD = standard deviation.

Table 5. Correlation of eight health concepts in the SF-36 and self-rated health score preoperatively and at 6 and 12 months postoperatively

Self-rated health score/ eight concepts in SF-36	Preoperative (I)	Postoperative 6 mo (II)	Postoperative 12 mo (III)
Physical function	0.2	0.5*	0.7*
Role limitations due to physical health problems	0.2	0.5*	0.6*
Bodily pain	–0.3	0.4†	0.0
General health	0.6*	0.8*	0.7*
Vitality/fatigue	0.4*	0.6*	0.6*
Social functioning	0.4*	0.7*	0.5*
Role limitations due to emotional problems	0.0	0.5*	0.4†
Mental health	0.5*	0.6*	0.5*
PCS	0.1	0.7*	0.6*
MCS	0.3	0.6*	0.3

$p < 0.01$; †$p < 0.05$. PCS = physical component summary; MCS = mental component summary.

significant improvements in RP ($t = 2.5$, $p < 0.05$), BP ($t = 3.2$, $p < 0.01$), GH ($t = 2.0$, $p < 0.05$) and PCS ($t = 3.5$, $p < 0.01$) compared to women without this symptom. Categorizing patients according to hemoglobin (Hb) level before hysterectomy, Hb level at 10.5 mg/dL using the 50th percentile as the cut-off point revealed that PCS ($t = -2.4$, $p < 0.05$), MCS ($t = 2.4$, $p < 0.05$) and RE ($t = 2.3$, $p < 0.05$) were different between these two strata. Hb level did not show any significant association with self-rated health score.

The mean score in self-rated health status increased from 6.0 at presurgery to 6.3 at discharge, 7.3 at 1 month after surgery, and 7.4 at 6 and 12 months after surgery. Using Friedman's test, significant differences were found between the five health status measurements at these time points ($p < 0.01$) (Table 4). Additionally, while no difference was found between presurgery and at discharge, a significant difference was found between discharge and 1 month after surgery ($Z = 3.2$, $p < 0.01$), between discharge and 6 months ($Z = 3.1$, $p < 0.01$), and between discharge and 12 months ($Z = 3.2$, $p < 0.01$) after hysterectomy. No significant differences were found in the five health status measurements between 1, 6 and 12 months after hysterectomy. The health score postsurgery was significantly correlated with PCS (at 6 months, $r = 0.66$, $p < 0.01$; at 12 months, $r = 0.64$, $p < 0.01$) and MCS (at 6 months, $r = 0.59$, $p < 0.01$) (Table 5).

Multiple regression analyses were performed with the following factors as independent variables: age, years of education, occupational

Table 6. Marginal linear regression models of the health-related quality of life by the generalized estimating equation method

Covariate	Estimate	Model-based standard error	95% CI		*p*
			Lower	Upper	
A. The *physical* component summary (PCS) model					
Intercept	9.4	9.0	−8.3	27.1	0.3
6 mo postoperative *vs*. preoperative	48.5	7.9	33.0	64.1	<0.0001
12 mo postoperative *vs*. preoperative	61.4	13.7	34.6	88.2	<0.0001
Years of education					
16 *vs*. 12	−5.2	3.0	−11.1	0.7	0.1
18 *vs*. 12	−15.6	8.2	−31.5	0.4	0.1
Hb (preoperative)	3.3	0.9	1.6	5.0	0.0001
Age × 12 mo postoperative *vs*. preoperative	−0.4	0.2	−0.8	0.1	0.1
Hb (preoperative) × 6 mo postoperative *vs*. preoperative	−3.6	0.7	−5.1	−2.2	<0.0001
Hb (preoperative) × 12 mo postoperative *vs*. preoperative	−3.4	0.9	−5.3	−1.6	0.0003
B. The *mental* component summary (MCS) model					
Intercept	35.1	10.6	14.5	55.8	0.0009
Age	0.3	0.2	−0.0	0.6	0.0536
Years of education: 18 *vs*. 12 and 16	16.0	5.7	4.8	27.1	0.005
Employed: yes *vs*. no	10.3	2.6	5.1	15.5	0.0001
Knowing the part of body to be removed before surgery *vs*. not knowing	7.1	4.1	−0.8	15.1	0.0799
Hb (preoperative)	−2.5	0.6	−3.8	−1.3	<0.0001
Having blood transfusion *vs*. none	6.3	2.2	2.1	10.5	0.0035
Years of education: 16 *vs*. 12 and 18 × 6 mo postoperative *vs*. preoperative	5.9	2.6	0.8	11.1	0.024
Employed: yes *vs*. no × 6 mo postoperative *vs*. preoperative	−5.8	2.4	−10.6	−1.1	0.0152
Employed: yes *vs*. no × 12 mo postoperative *vs*. preoperative	−10.0	2.9	−15.7	−4.3	0.0005
Knowing the part of body to be removed before surgery *vs*. not knowing × 6 mo postoperative *vs*. preoperative	−9.2	4.2	−17.3	−1.0	0.0274
Knowing the part of body to be removed before surgery *vs*. not knowing × 12 mo postoperative *vs*. preoperative	−9.8	4.9	−19.5	−0.1	0.0480
Hb (preoperative) × 6 mo postoperative *vs*. preoperative	1.9	0.5	0.9	2.9	0.0002
Hb (preoperative) × 12 mo postoperative *vs*. preoperative	2.9	0.6	1.7	4.1	<0.0001

Hb = hemoglobin level; $X_j \times X_k$ = statistical interaction between the covariates X_j and X_k.

status, knowledge of which body part(s) will be removed, self-rated health score and Hb level before surgery, with HRQoL acting as the dependent variable before surgery. The analysis showed that the adjusted R^2 for PCS in HRQoL was 0.26, with Hb level being the most powerful predictor. It also showed that the adjusted R^2 for MCS in HRQoL was 0.36, with Hb level and occupational status being the most powerful predictors.

An additional multiple regression analysis was performed; this time with the following factors as independent variables: age, years of education, occupational status, knowledge of which

body part(s) will be removed, Hb level before surgery, blood transfusion during and after surgery, and self-rated health score, HRQoL again being the dependent variable at 6 and 12 months after surgery. The analysis showed that the adjusted R^2 for this model was 0.36, with the self-rated health score contributing 62% of the variance in the PCS of HRQoL. The adjusted R^2 for the MCS in HRQoL was 0.54, with the self-rated health score, receiving blood transfusion after surgery and age showing significant differences in this model. The analysis also showed that the adjusted R^2 for this model was 0.29, with the self-rated health score contributing 59% of the variance in the PCS of HRQoL at 12 months after surgery. A regression model could not be found for MCS.

Moreover, the GEE method for modeling the repeated measures data was used to identify the statistically significant influencing factors of HRQoL before and after hysterectomy and to assess their relative importance (Table 6). The following factors were independent variables: age, years of education (divided into five levels), occupational status, knowledge of which body part(s) will be removed, Hb level before surgery, blood transfusion during and after surgery, plus with the interaction variables by each two of these independent variables. HRQoL (PCS or MCS) was the dependent variable in each model. The final model showed that the R^2 for this model was 0.35 in the PCS of HRQoL. Statistically significant improvement in PCS was identified. Women with more than 12 years of education or lower Hb levels had lower PCS scores before surgery. Older patients had lower PCS scores at 12 months after hysterectomy. Age had a negative effect on PCS after surgery. Given that the values of other covalues are fixed, the effect of Hb (presurgery) on PCS is (3.3 – 3.6 PCST2 – 3.4 PCST3), where PCST2 and PCST3 are two dummy variables (PCST2 = 0 and PCST3 = 0 is the PCS before surgery, the first time point; PCST2 = 1 and PCST3 = 0 is the PCS at 6 months after surgery, the second time point; PCST2 = 0 and PCST3 = 1 is the PCS at 12 months after surgery, the third time point) representing three time points. Thus, at the first time point, the effect of Hb on PCS is 3.3, at the second time point, it is –0.3 (3.3 – 3.6), and at the third time point, it is –0.1 (3.3 – 3.4). Therefore, Hb level before surgery had positive impact only on PCS at presurgery ($\hat{\beta} = 3.3$, $p = 0.0001$), but had no effect at 6 and 12 months after hysterectomy. The interpretation of the other interaction terms in Table 6 followed the same principle (as Hb).

The R^2 of the marginal regression model for MCS in HRQoL was 0.48. There was no significant change in MCS after hysterectomy. Age ($\hat{\beta} = 0.3$, $p = 0.0536$) and having blood transfusion ($\hat{\beta} = 6.3$, $p = 0.0035$) always positively affected the MCS score. More years of education also positively affected the MCS score, especially at 6 months after hysterectomy. Women who were employed had a positive effect on the MCS score ($\hat{\beta} = 10.3$, $p = 0.0001$), but that effect decreased to half ($\hat{\beta} = 10.3 - 5.8 = 4.5$, $p < 0.05$) at 6 months after hysterectomy, and then diminished to none ($\hat{\beta} = 10.3 - 10.0 = 0.3$, $p > 0.05$) at 12 months after hysterectomy. If the patient was an employee, she had higher score in MCS before and after surgery. Similarly, knowing the part of the body to be removed before surgery only positively affected the MCS score before surgery ($\hat{\beta} = 7.1$, $p = 0.0799$). In contrast, Hb level before hysterectomy only negatively affected the MCS score before surgery ($\hat{\beta} = -2.5$, $p < 0.0001$), but its effect gradually diminished after surgery.

Discussion

This study showed that postsurgery, overall self-rated health status and HRQoL were significantly improved at 6 months and then remained constant throughout 1 year after hysterectomy. Within 6 months after hysterectomy, patients had returned to normal health and bodily functions, a finding compatible with related research.[2,3,9,27] Symptom relief after hysterectomy is associated with a marked improvement in HRQoL.[17] The results support previous findings that patients with

severe excess menstrual bleeding experienced the greatest improvement in physical health but surgical treatment had no significant effect on the women's psychological health dimensions of SF-36. This finding is in contrast to a study by Ruta et al,[28] who found that the major impact of menorrhagia was on social functioning. The probable explanation is that the participants perceived menorrhagia as a normal physical change that affected their physical health but did not affect their role expectation and performance. They might have been proud that they still performed their roles in life so well despite this physical impairment. However, not all women who have undergone a hysterectomy benefit from this procedure, and almost 8% of the women who underwent hysterectomy in a previous study reported the same or increased number of symptoms.[10] In this study, 5.4% of patients had sequelae at 1 month and 16.7% at 6 months after hysterectomy, which supports this previous finding.

Interpretation of the SF-36 (Taiwan version) scores in this study population may be facilitated by comparison with the available normative data. The advantage of the SF-36 (Taiwan version) is that the norm used in the validation of the instrument was different age groups of women.[29] In this study, the participants' HRQoL in each of the eight health concepts of SF-36 was lower than the norm before hysterectomy. Jones et al proposed that benign gynecologic conditions had a negative impact on HRQoL, which is even greater when comparisons are made to women with nongynecologic conditions.[20] At 6 and 12 months after hysterectomy, patients had significantly higher scores than the norm standard in six of the eight health concepts of SF-36, with the exception of physical functioning and role limitation due to physical problems. In addition, role limitations due to physical health problems and general health exhibited high coefficients of variation postsurgery. This demonstrates that patients had widely differing recovery processes, with some not fully recovering and thereby experiencing limitations in life performance. An active life, which included more than childbearing and motherhood roles, defined middle-aged women and was reported as the major expectation from the hysterectomy.[28] In this study, patients usually inquired as to how long it would take before they could go back to normal life and daily activities after the surgery. One year after the surgery, six patients (18.2%) reported that they had less energy than before, while two noted emotional disturbances due to unsatisfactory physical recovery. Thus, it seems that limitations in physical activity reduced their social role performance, impacting their general health perception.

The results of this study indicate that role function and sexual life adjustment are very important aspects of HRQoL in women who have undergone hysterectomy. A negative impact on sexual functioning has also been reported in women with endometriosis,[18] dysfunctional uterine bleeding[16] and menorrhagia.[30] However, the instrument we used for measuring HRQoL, the SF-36, is lacking in these health concepts. A previous study also noted that generic tools did not include the components of health that were specific to women with menorrhagia.[31] Thus, generic questionnaires are insufficient for the evaluation of clinical changes in HRQoL in women with benign gynecologic disorders.[20] One limitation of the use of generic measures is that they may not be sensitive enough to assess changes in specific conditions because they are designed to measure HRQoL across a wide variety of diseases. This most likely explains our finding of low variance of HRQoL at 12 months after hysterectomy, even though it was not possible to build up an adequate prediction model in the MCS of HRQoL. At 12 months after surgery, these patients had not only recovered from the hysterectomy, but had also reached a new equilibrium in their life and health.

It has been argued that it is best to use more than one instrument when HRQoL is being measured.[19] In this study, two generic instruments (SF-36 and self-rated health score) were used to measure HRQoL in women before and after hysterectomy. This allowed confirmation of improvements in self-rated health status and HRQoL postsurgery, and of the high correlation

of self-rated health status with PCS and MCS in SF-36. The single-item self-rated health score was shown to be a valid and reliable predictor of PCS at 6 and 12 months after hysterectomy. This is consistent with Shadbolt's findings that self-rated health was subject to change in physical health status in middle-aged Australian women.[32]

There is a clear need for incorporation of more patient-generated, disease-specific questionnaires into the clinical assessment of patients with benign gynecologic conditions, preferably in conjunction with generic measures. The measurement of HRQoL in women with benign gynecologic conditions before and after hysterectomy should also consider aspects of women's role, family and sexual function. The related variables and measurement time scale should be increased during the follow-up process.

This study used a prospective follow-up design, and collected data on HRQoL and influencing factors before surgery and during a 1-year recovery period. This contemporaneous collection of information also limited recall biases, thus improving the reliability and accuracy of information about the condition and needs of the patients during recovery. The findings of this study may be useful in assessments of the appropriateness and outcome of hysterectomy, and provide additional insight into the surgery's potential impact on HRQoL and what patients can expect during recovery.

This study had several limitations. First, the severity of symptoms and the effects of distress due to symptoms on HRQoL were not measured, which might have been valuable in predicting variables related to HRQoL. Colwell et al[33] found that women with severe endometriosis-associated pain had worse functioning on each HRQoL scale than women whose pain was mild to moderate. The rehabilitation period for women who had undergone hysterectomy in their study, however, did not exceed 6 months. The critical time period for assessing HRQoL recovery from hysterectomy remains unclear. Future study with the use of additional measurements during the interval between 1 and 6 months after surgery may uncover early trends. Finally, the sample size of this study was small. Future studies with more participants may provide clearer implications, and improve the accuracy of results.

Conclusion

Menstrual symptoms such as menorrhagia and abdominal pain had negative effects on HRQoL after a hysterectomy. During the recovery period, HRQoL and self-rated health score improved. This study identified a regression model of the relationship between hysterectomy and HRQoL over time. Hysterectomy effectively improves the physical domain of patients' HRQoL. No direct effect of hysterectomy on patients' mental domain of HRQoL was found in this study, but the data suggested that it may have had positive associations with role function and performance. Knowledge of these potential effects of hysterectomy is important for gynecologists and nurses to provide preoperative counseling to women undergoing this procedure.

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