ORIGINAL RESEARCH

Factors influencing leaving the bed in post-gynecological surgery patients: An exploratory study using a "walking diary"

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ABSTRACT

Objective: Early walking post-surgery is vital to prevent surgical complications and enhance recovery. This study aimed to investigate the factors that affect the number of steps taken after leaving the bed by patients following gynecological surgery using a "walking diary" and clinical outcomes.
Methods: Data collected from the walking diary included the target number of steps and general condition of 95 gynecological patients who underwent laparoscopy or laparotomy following clinical pathways. We analyzed the data using logistic regression.
Results: The average number of steps on the first postoperative day of laparoscopy and laparotomy was 878 and 250 steps respectively, and increased to 2,525 and 1,023 steps, respectively, on the second postoperative day. The target number of steps and motivation at the time of waking up increased significantly with the postoperative course, and pain decreased significantly. The amount of bleeding and laparotomy were factors that inhibited the number of steps taken. Additionally, the larger the target number of steps on the two days after surgery, the greater the steps taken may be promoted. The surgical invasiveness of the procedure was a factor that influenced the number of steps taken.
Conclusions: Patients who set a higher target number of steps for themselves took a higher number of steps in practice. They were presented with a guideline for the target number of steps for patients post-surgery: around 900 on post-operative day 1 (POD 1) and 2500 in POD 2. Improving postoperative symptoms might aid patients' feeling of recovery, and reviewing the walking diary may enhance their motivation for walking as well as self-efficacy.

Key Words: Early mobilization, Ambulation, Postoperative patient, Walking steps, Gynecological surgery, Self-efficacy

1. INTRODUCTION

Gynecological surgery is not only narrow and deep in the surgical field of view in the pelvis, but also adjacent to the intestinal tract and urinary system and is rich in blood vessels and nerves.[1] Prolonged postoperative bed rest leads to adverse effects, such as disuse of the respiratory and circulatory system and skeletal muscles, respiratory complications, deep vein thrombosis, and mental disorders.[2] Additionally, paralytic ileus is one of the main complications after gynecological surgery, and early mobilization is considered effective in prevention.[3] In recent years, an increasing number of facilities have gathered evidence on perioperative management and performed perioperative management under Enhanced Recovery After Surgery (ERAS)[4] as a comprehensive preoperative, intraoperative, and postoperative protocol.[5,6] ERAS emphasizes that promoting postoperative mobilization leads to the prevention of complications and strengthens postoperative recovery.

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Leaving the bed refers to sitting and standing positions performed by patients undergoing postoperative bed rest with approval from the doctor. The first postoperative step is always performed with the assistance of two nurses. The need for assistance is examined according to the patient's condition before their second attempt at walking, with walking and early recovery being promoted. However, there is a lack of research evidence on the number of steps taken after leaving the bed, and it is difficult for nurses to provide a consistent and specific explanation for encouraging patients to leave the bed, or the number of steps to take. Previous studies have reported that explanations that help patients imagine postoperative scenarios and interventions that emphasize patient independence are useful for promoting postoperative mobilization.[7] Additionally, it has been reported that the inclusion of an activity diary that records the daily amount of activity and pain for activity goals such as cleaning in postoperative occupational treatment led to a sense of accomplishment and self-efficacy toward the goal, and contributed to the improvement of the activity.[8] Thus, these procedures encourage patients to leave the bed by improving awareness and motivation to leave the bed.

Factors that influence postoperative ambulation include age, surgical trauma, amount of physical activity, and pain.[9, 10] In addition to these factors, this study aims to create and utilize a "walking diary" that lets patients undergoing open or laparoscopic gynecological surgery record their target number of steps and self-recognized general condition, and to clarify the factors that affect leaving the bed from the information obtained from this diary. Additionally, this study aims to identify the number of devices used by patients, based on their walking diary, that may have an impact on their walking (e.g., surgical drainages, intravascular lines, and foley catheters), and clinical factors other than those present in the walking diary that may affect the number of steps taken.

2. METHODS

2.1 Study design

A prospective exploratory observational study of gynecological surgery patients was conducted between August 2019 and March 2020. Relevant data were obtained from patients' walking diaries (see Figure 1), and clinical factors were measured during the perioperative period (e.g., laboratory data, surgical methods, surgery time, and blood loss).

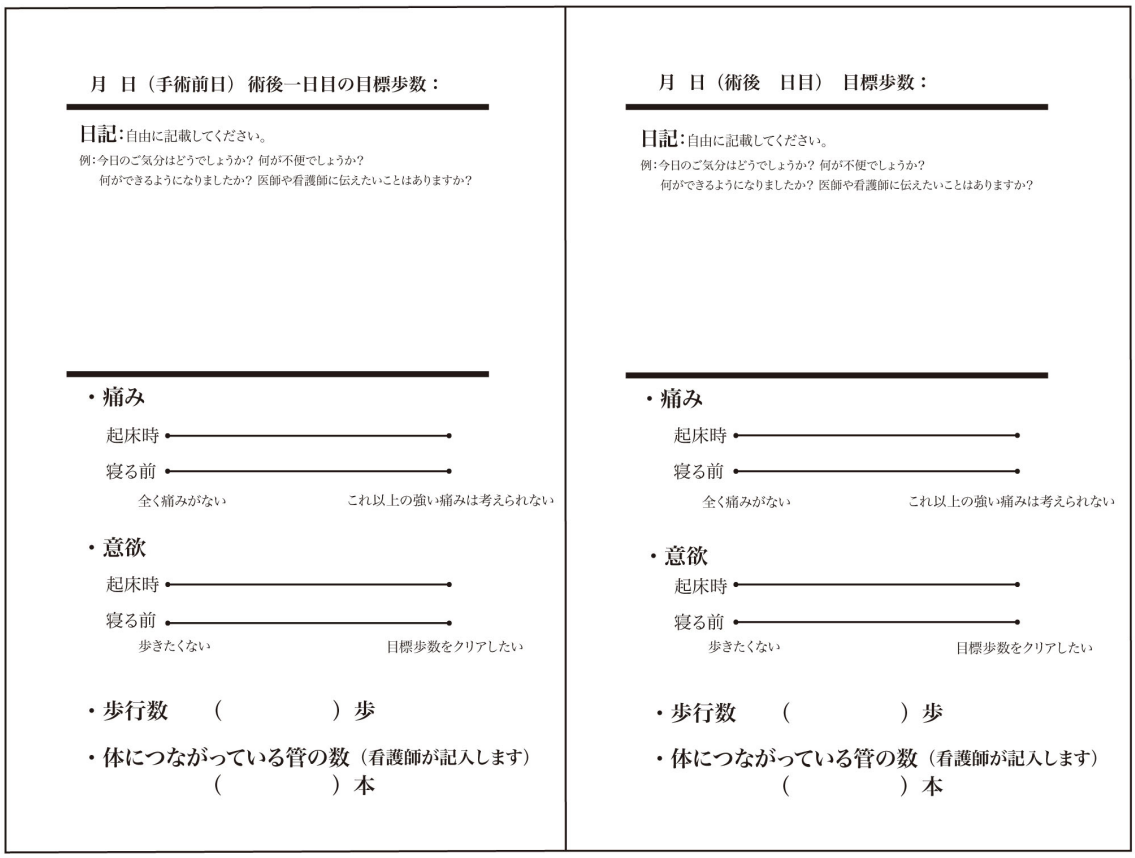

Figure 1. A sample page of the "walking diary"

This figure includes entries written by patients (e.g. free comments, visual analogue score for pain/motivation, target number of steps, number of steps taken , and number of devices used).

2.2 Participants

She was admitted to Ward A of the University Hospital and was scheduled to undergo gynecological surgery on the clinical pathway except for the transvaginal one, and the attending physician judged that his physical and mental condition could be investigated. The participants included 100 patients who were physically and mentally able to write in a walking diary. Participants could walk independently at the time of admission, could read and write Japanese without assistance, received sufficient explanation for participation in this study, and provided written consent.

The exclusion criteria for patients were difficulty walking independently, cognitive decline, difficulty reading and writing without assistance, those not familiarized with the clinical pathway on the day of admission, those excluded by the attending physician, and those judged inappropriate by the principal investigator or co-investigator for other reasons. Additionally, patients who withdrew consent, those who were not recommended to follow the clinical pathway due to the postoperative course, those whose adverse events and postoperative dysfunction were deemed a significant burden on the investigation, and those whose attending physician, principal investigator, or co-investigator judged it appropriate to discontinue the study due to other reasons were discontinued from participation.

2.3 Measurements

2.3.1 *Participant attributes*

Data on age, length of hospitalization, surgical procedure, blood loss, hemoglobin change before and after surgery, and operative time were collected from electronic medical records.

2.3.2 *Physical activity*

The International Standardized Physical Activity Questionnaire (IPAQ) Japanese Short Version[11,12] was used to gauge the number of days and hours of high-intensity and moderate physical activity in one week as a measure of the amount of physical activity before hospitalization. Metabolic equivalents (Mets), which are units of exercise and physical activity scored from the duration (minutes) and frequency (days) of three physical activities, moderate physical activity, and walking, were evaluated.

2.3.3 *Number of steps taken*

The number of steps taken was measured from the day of admission to bedtime (approximately 9 p.m.) using the EX-350 (YAMASA) pedometer with strap. The number of steps was not measured on the day of surgery, and the participant wore the pedometer after waking up (approximately 6 o'clock) till bedtime (approximately 9 p.m.) from the first postoperative day. On the day of discharge from the hospital, steps were measured from the time of waking up (approximately 6 a.m.) till 10 a.m.

2.3.4 *Pain*

The Visual Analogue Scale (VAS), which quantifies postoperative wound pain, was used to evaluate the pain of patients. The pain VAS is a visual evaluation scale of the intensity of pain, in which participants draw a vertical line on a 10 cm long horizontal line with "0" as "no pain" and "10" as "no more severe pain", with the degree of pain measured by length.

2.3.5 *Motivation*

The patient's motivation to walk was also measured using the VAS. Referring to the pain VAS, the motivational VAS is presented as a scale to measure the degree of motivation, with "0" as "I don't want to walk" and "10" as "I want to clear the target number of steps". Similarly, participants indicate motivation by drawing a vertical line on a 10 cm long black horizontal line.

2.3.6 *Qualitative data*

Positive descriptions of recovery and motivation for walking were gathered from a section in the walking diary, where patients freely described changes in their physical condition that day, impressions, and what they wanted to convey to doctors and nurses.

2.4 Methodology

A walking diary is a recording instrument created independently for this research. Specifically, the patient writes their self-determined target number of daily steps from the day before surgery till the day of discharge, the number of steps taken per day measured by the pedometer and indicates their degree of pain and motivation through the VAS.

The following is the flow of the patient after hospitalization.
1) At the time of admission, after the researcher or collaborator obtains consent to participate in the study using the approval form, the IPAQ is used to calculate the approximate daily activity of the research participant.
2) Elucidate the following procedure to the participants (1) (6).

(1) On the day of hospitalization, write the items corresponding to steps, pain, and motivation in your walking diary.
(2) There are no items to be noted on the day of surgery.
(3) Write the items corresponding to steps, pain, and motivation in the walking diary from the first postoperative day till the day of discharge.
(4) The walking diary should be filled at the time of waking up and going to bed from the first postoperative

day, and after waking up on the day of discharge from the hospital.

(5) Instructions for using the EX-350 (YAMASA) pedometer with strap and precautions.

(6) Return the pedometer and walking diary to the attending nurse during discharge from the hospital.

3) The principal investigator and co-investigator explain the purpose and method of the study to the nurse in charge.

(1) When the patient wakes up, check whether their walking diary has mentioned the target number of steps, and the diary entry of the previous day.

(2) Record the number of devices the participant has when they wake up.

(3) Collect the pedometer and walking diary from the participant at the time of discharge.

2.5 Analysis

Of the 100 patients who agreed to participate, 5 patients who were not recommended the clinical pathway were excluded, and data from 95 patients were analyzed. Quantitative data were statistically analyzed using IBM SPSS Statistics Version 26 software, with the significance level set as less than 5%. Laparoscopy patients were discharged at 10 a.m. on the third postoperative day. The average number of steps taken, motivational VAS, and target steps between postoperative days 1, 2, and 3 were compared using t-tests.

Additionally, binomial logistic regression analysis was performed on the factors affecting the number of steps up to the second postoperative day, when all participants had all items in common. Blood loss, hemoglobin change, operative time, preoperative Mets, pain VAS, motivational VAS, and target steps were each divided into two groups based on the median, and age and number of devices were divided into two groups based on the mean. Of these variables, items that were significantly related in univariate analysis were input into logistic regression analysis using the variable reduction method, and the odds ratios and 95% confidence intervals were calculated.

Descriptive data were only analyzed for patients who provided qualitative data in the free entry section of the walking diary during the study period. In this process, similar content was summarized, and descriptions were counted as one unit, which were used to indicate a tendency.

2.6 Ethical considerations

This study was approved by the Clinical Research Review Committee of the university the first author is affiliated to (approval number: NO19R-113). Participants were assured that the obtained data and results would not be used for any purpose other than this study and that consent to participate in the study was voluntary and could be withdrawn. Written consent was obtained from all participants.

3. Results

3.1 Overview of the participants

Table 1 presents the baseline characteristics of the participants. The main diseases were endometrial cancer in 7 cases, cervical cancer in 12 cases, ovarian cancer in 12 cases, uterine sarcoma in 2 cases, uterine fibroids in 18 cases, and ovarian cysts in 18 cases, with 26 patients presenting other diseases.

Table 1. Baseline characteristics of the patients (n = 95)

Variables		Values (Average ± Standard Deviation)
Age in years	< 46	42 (46 ± 11.3)
	≥ 46	53
Days of hospital stay based on surgical procedure	Laparoscopic	52 (5.0 ± 0.0)
	Laparotomy	43 (8.1 ± 1.4)
Bleeding volume	< 170 ml	47
	≥ 170 ml	48
Changes in serum hemoglobin value	< 1.0 g/dL	39
	≥ 1.0 g/dL	56
Operation time (minutes)	< 150	51
	≥ 150	44
Preadmission physical activity	≥ 3.6 Mets	47
	< 3.6 Mets	48
Numbers of devices (POD1)	< 3	60
	≥ 3	35
(POD2)	< 2	51
	≥ 2	44
Pain at waking up in VAS (POD1)	≥ 4.5 cm	49
	< 4.5 cm	46
(POD2)	≥ 3.3 cm	48
	< 3.3 cm	47
Motivation at waking up in VAS (POD1)	≥ 5.5 cm	48
	< 5.5 cm	47
(POD2)	≥ 7.6 cm	49
	< 7.6 cm	46
Target walking steps (POD1)	≥ 250 steps	47
	< 250 steps	48
(POD2)	≥ 500 steps	50
	< 500 steps	45

*POD: post operating dates, Mets: Metabolic equivalents, VAS: Visual Analogue Scale

3.2 Comparison of average values of steps taken, target steps, motivational VAS, and pain VAS

Figure 2 shows the average number of steps taken by participants who underwent laparoscopy or laparotomy. The average number of steps taken was significantly higher for patients undergoing laparoscopy. Figure 3 shows the change in average walking steps taken, which increased significantly over time. Figure 4 presents the change in motivation mea-

sured through the VAS at the time of waking up, which increased significantly over time. Figure 5 presents the intensity of pain at the time of waking up, measured using the VAS. A significant decrease was observed as the number of postoperative days increased.

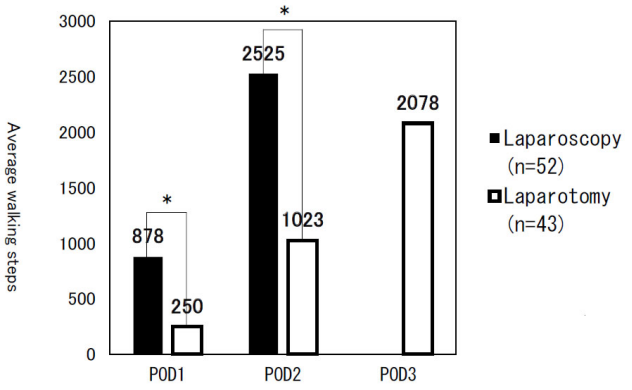

Figure 2. Comparison of average walking steps taken between patients who underwent laparoscopy or laparotomy; POD = post operating day(s); POD3 only showed laparotomy data as patients with laparoscopic surgery were discharged on Day 3; *$p < .05$

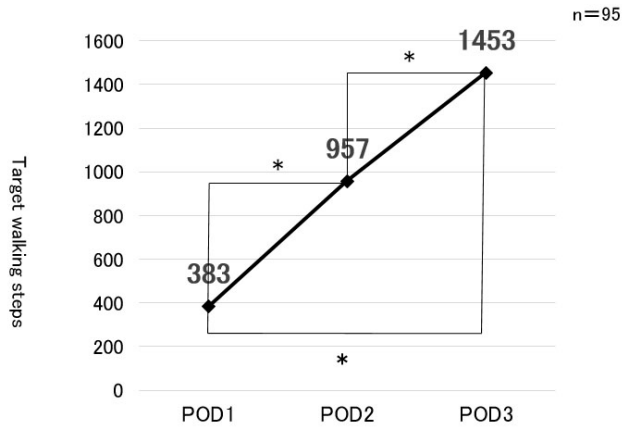

Figure 3. Changes in the patient's target walking steps; POD = post operating day(s); Target walking steps were planned by patients at the time of waking up; *$p < .05$

3.3 Factors affecting the number of steps taken

Table 2 shows the results of factors affecting the number of steps (500 steps or more) on the first postoperative day.

Table 3 shows the results of factors affecting the number of steps (1,000 steps or more) on the second postoperative day. Univariate analysis showed that the factors of surgical method, blood loss, surgical time, number of devices, and target number of steps were significant on both postoperative day 1 and 2. The results of multivariate analysis suggested that low blood loss promoted the steps taken, and the higher the target steps set, the greater the influence on step promotion. Laparotomy inhibited step promotion to a greater degree than laparoscopy.

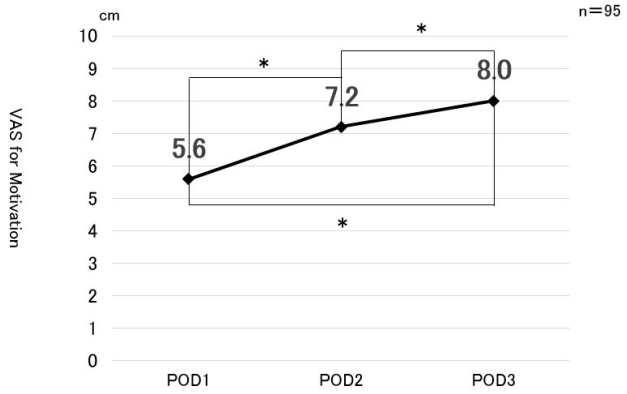

Figure 4. Changes in the motivation strength at the time of waking up; POD = post operating day(s), VAS = visual analog scale; *$p < .05$

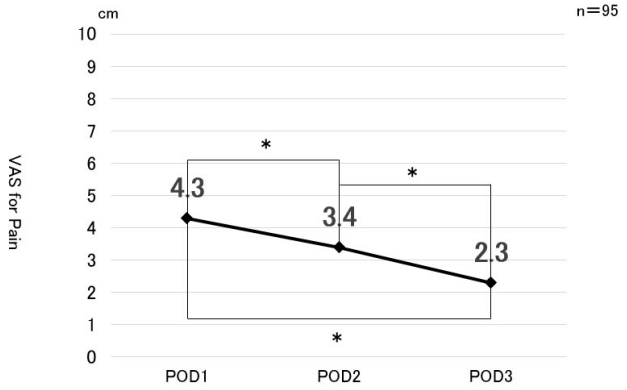

Figure 5. Changes in the intensity of pain at the time of waking up; POD = post operating day(s), VAS = visual analog scale; *$p < .05$

3.4 Analysis of positive statements in the free entry section

Table 4 shows the results of 194 recorded units, derived from the descriptions in the free entry section of the walking diary of 95 participants. "I could feel physical recovery after surgery" refers to the patient feeling recovery over time from an increase in the number of measured steps and target steps through the subjective physical symptoms and the description of the walking diary. In addition to the increased ease of walking due to the improvement of physical symptoms and the decrease in the number of devices, a description of motivation for walking from the walking diary initiative was present. Participants also provided a description of looking back on their period of hospitalization on the 3rd postoperative day, which was when laparoscopy patients were discharged from the hospital.

Table 2. Factors affecting the number of steps (500 steps or more) on the first day after surgery (n = 95)

Variables	Univariate analysis	Multivariate analysis
Age 46y/o and older = 1	0.58 (0.24-1.40)	
Laparoscopic surgery 0/ Laparotomy 1	0.14 (0.05-0.41)	
Bleeding volume more than 170ml = 1	0.14 (0.05-0.38)	0.15 (0.05-0.46)
Changes in serum hemoglobin value more than 1.0g/dL = 1	0.69 (0.29-1.65)	
Operating time of more than 150 minutes = 1	0.23 (0.09-0.61)	
Number of devices more than 3 = 1	0.23 (0.08-0.67)	
Pain severity in VAS at the time of waking up less than 4.5 = 1	1.10 (0.46-2.61)	
Motivation strength in VAS at the time of waking up more than 5.5 = 1	0.97 (0.41-2.30)	
Target walking steps of more than 250 steps ＝ 1	7.13 (2.55-19.97)	6.56 (2.17-19.85)
Physical activity at the preadmission of more than 3.6Mets = 1	0.85 (0.36-2.02)	

*Univariate and multivariate analysis results are presented as odds ratios and 95 % confidence intervals. Variables that were statistically significant in the univariate analysis were included in the multivariate analysis, and variables remaining in the final model were noted.
** VAS: Visual Analogue Scale, Mets: Metabolic equivalents

Table 3. Factors affecting the number of steps (1,000 steps or more) on the second day after surgery (n = 95)

Variables	Univariate analysis	Multivariate analysis
Age 46y/o and older = 1	1.22 (0.53-2.80)	
Laparoscopic surgery 0/ Laparotomy 1	0.10 (0.04-0.26)	0.16 (0.05-0.47)
Bleeding volume more than 170ml = 1	0.15 (0.06-0.38)	
Changes in serum hemoglobin value more than 1.0g/dL = 1	0.51 (0.21-1.21)	
Operating time of more than 150 minutes = 1	0.17 (0.07-0.42)	
Number of devices more than 2 = 1	0.12 (0.05-0.32)	
Pain severity in VAS at the time of waking up less than 3.3 = 1	0.72 (0.31-1.66)	
Motivation strength in VAS at the time of waking up more than 7.6 = 1	2.29 (0.98-5.35)	
Target walking steps of more than 500 steps = 1	11.47 (4.15-31.66)	6.93 (2.31-20.75)
Physical activity at the preadmission of more than 3.6 Mets = 1	0.72 (0.31-1.66)	

* Univariate and multivariate analysis results are presented as odds ratios and 95 % confidence intervals. Variables that were statistically significant in the univariate analysis were included in the multivariate analysis, and variables remaining in the final model were noted.
** VAS: Visual Analogue Scale, Mets: Metabolic equivalents

Table 4. Summary of positive descriptions in the free-form column

Summary of description units	POD1	POD2	POD3	POD4	POD5 or later	Total
I could feel physical recovery after the surgery.	10	33	33	7	16	99
I became motivated to walk.	3	11	14	4	6	38
I was encouraged to reach my step goal.	0	5	3	2	0	10
It was nice to have a walking diary, a pedometer, and a target number of steps.	2	2	7	2	8	21
I was able to leave the bed consciously	9	3	2	1	0	15
It helped me think about walking habits after discharge.	0	2	5	2	2	11

*Laparoscopy patients are discharged on the 3rd day after surgery, hence data from the 4th day onward are limited to laparotomy patients.
**The number in this table shows the number of descriptions. The total number of descriptions was 194.
***POD: post-operating dates

4. DISCUSSION

4.1 Comparison of the average values of items from the walking diary

The number of steps was significantly higher for patients who underwent laparoscopy than those who underwent laparotomy. The number of steps taken was over 2.5 times higher for laparoscopy patients and over 4 times higher for laparotomy on the second postoperative day 2 and more than 4 times on laparotomy on a postoperative day 1. Using the average number of steps taken measured, it is possible to

recommend a target of about 880 steps on the first postoperative day of laparoscopy, and about 2,500 steps on the second postoperative day. Moreover, it is possible to reccomend a target of about 250 steps on the fir st postoperative day of laparotomy, and about 1,000 steps on the second postoperative day. As no previous studies have presented the specific number of steps taken on the first and second postoperative days. Additionally, laparoscopy is considered less invasive in terms of blood loss, postoperative hemoglobin level, number of days of hospitalization, speed of return to daily life, wound infection rate, and postoperative nonspecific infection rate as the wound is smaller than laparotomy. Hence, the number of steps after surgery is significantly higher with less invasive surgery.[13]

The target number of steps and motivational VAS increased significantly by the third postoperative day, and the pain VAS significantly reduced. Previous studies suggest that relief from pain promotes early mobilization, provides a sense of recovery, and motivates recovery.[14] Additionally, descriptions in the free entry column of the walking diary imply an increase in “physical recovery after surgery” and “motivation to walk” with the postoperative course. Therefore, the patient was able to actively engage in walking to achieve the target number of steps, and their set target of steps may have increased due to the postoperative course. A previous study reported that achieving goals while self-managing activities improved pain, self-efficacy, and quality of life after practice.[15,16] In this study, the patient’s self-efficacy was improved by setting a target number of steps, and leaving the bed to achieve that goal. Additionally, interventions that clarify postoperative images and goals are effective for early mobilization.[17] The necessity of early withdrawal was elucidated to the participants by the nurses, and participants walked with a pedometer to track their progress towards their goals.

4.2 Factors affecting the number of steps

The factors affecting the number of steps (500 steps or more) on the first postoperative day were related to blood loss of 170 ml or more and a target of 250 steps or more. The factors affecting the number of steps (1000 steps or more) on the second postoperative day were related to the surgical method and a target of 500 steps or more. As blood loss of 170 ml or more during the first postoperative day and the surgical method on the second postoperative day are factors that affect the number of steps, a significant decrease in the amount of blood loss and a shortening of the postoperative length of hospital stay was observed in the laparoscopy group compared to laparotomy group.[18]

The results of the multivariate analysis suggest that the higher the target number of steps set, the greater the influence on step count promotion. However, there were no quantitative studies that mentioned the specific set of "target steps" in postoperative patients undergoing bedrest. In this study, the successful experience of achieving the self-set target number of steps gave the patient confidence in getting out of bed, which led to the behavior of setting higher targets and promoted leaving the bed.

5. Conclusion

This study investigated leaving the bed and its influencing factors in postoperative gynecological patients and obtained the following conclusions:

(1) The recommended target number of postoperative steps is 880 steps on the first postoperative day and 2500 steps on the second postoperative day for laparoscopy, with 250 steps on the first postoperative day, and 1000 steps on the second postoperative day for laparotomy.

(2) The number of steps increased with minimally invasive surgical methods, which were significantly associated as a factor affecting the number of steps after surgery. The higher the target number of steps, the more postoperative withdrawal was promoted.

(3) Postoperative physical symptoms improve over time, and the patient feels recovery and motivation improve through the walking diary initiative. Hence, achieving the target number of steps also improves self-efficacy.

(4) Leaving the bed after surgery is promoted by intervening before surgery, and by setting a target number of steps higher than the recommended target, after successfully achieving the previous target number of steps.

Limitations and future prospects of study

This study has some limitations. As the study involved a small number of patients at one institution, the extent to which the results explain the outcome is limited. However, this study provides valuable findings that derive influencing factors from the assessment of leaving the bed based on actual measurements of the patient’s steps. Additionally, early postoperative mobilization is painful for invasive patients, but it is desirable to prevent postoperative complications and to use a tool that allows patients to share their own goals with staff according to the situation of the facility.

The comparison was short-term as laparoscopy patients are discharged on the morning of the third postoperative day. This limited the availability of data for all factors to the first and second postoperative days. Although the factors that influence the target number of steps set by patients have not been investigated in this study, it is recommended that future studies clarify these factors, as it will help patients set a tar-

get number of steps that is more suitable for themselves and help professionals conduct nursing interventions according to the postoperative recovery of each patient.

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CONFLICTS OF INTEREST DISCLOSURE

The authors declare that there is no conflict of interest.

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