Ambulation of Hospitalized Gynecologic Surgical Patients

A Randomized Controlled Trial

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OBJECTIVE: To estimate whether specific ambulation goals affect the adequacy or perceived barriers to ambulation in hospitalized surgical patients after major gynecologic surgery.

METHODS: One hundred forty-six surgical inpatients were randomized to specific ambulation goals or routine care. We assessed the number of pedometer-recorded steps in the 24 hours preceding discharge as well as patient-identified barriers to ambulation. Groups were compared using the Mann-Whitney *U* test.

RESULTS: Of the 129 participants with outcome data, 12% were discharged without any pedometer-recorded steps. We did not detect an effect of specific ambulation goals by group (routine care: 87 compared with ambulation goals: 80, $P=.7$). The three main barriers to ambulation from a patient perspective were indwelling catheters (38.5%), intravenous poles (28%), and pain (12.5%) The median number of postoperative steps was higher after minimally invasive surgery (143) compared with laparotomy (27) ($P=.035$).

CONCLUSION: Approximately 12% of gynecologic surgical patients do not walk while hospitalized despite formal encouragement to ambulate. Ambulation is easily quantified and may improve with attention to modifiable barriers, potentially improving postoperative recovery.

CLINICAL TRIAL REGISTRATION: ClinicalTrials.gov, www.clinicaltrials.gov, NCT 01254851.

(Obstet Gynecol 2013;121:533–7)

DOI: http://10.1097/AOG.0b013e318280d50a

LEVEL OF EVIDENCE: I

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Financial Disclosure

The authors did not report any potential conflicts of interest.

ISSN: 0029-7844/13

Early ambulation after surgery is important and desired for most operations.[1–3] The surgical literature documents the favorable effect of postoperative ambulation on reduction of surgical complications such as atelectasis, pneumonia[4] and venous thromboembolism.[5,6] In addition, early ambulation has also been shown to shorten recovery time[7] and to decrease the length of hospital stay.[8]

Ambulation is usually a discharge requirement; however, there is no standard definition of ambulation nor guidelines to determine the adequacy of postsurgical ambulation. Little data are available that quantify how much the average patient ambulates after abdominal surgery. In a study of patients undergoing total knee arthroplasty, Ilfeld et al[9] described sufficient ambulation as at least 30 meters without a time limit as a discharge criteria. In a separate study about enhanced recovery programs, Maessen[10] included ambulation in his discharge criteria measured by independence in activities of daily living but did not define or quantify ambulation. Browning et al[11] recorded upright mobilization in minutes after upper abdominal surgery and concluded that the average postoperative upright mobilization time is low. Another small study found that women especially benefit from the use of an accelerometer and standardized encouragement after laparoscopic cholecystectomy.[12] A recent Cochrane Review about enhanced recovery programs in postoperative care was not informative as a result of the lack of randomized controlled trials.[13] The lack of a quantifiable, standardized definition for adequate ambulation may be an opportunity for health care teams to improve the metrics used for sufficient ambulation. This study was designed to estimate whether enhanced encouragement of ambulation affects the number of pedometer-recorded steps taken in the 24 hours before discharge when compared with the usual postoperative care.

MATERIALS AND METHODS

This randomized controlled trial was approved by the institutional review board at Loyola University and was registered at clinicaltrials.gov (NCT 01254851). Patients who were to undergo gynecologic surgery were enrolled from January 2011 to June 2011 at Loyola University Medical Center. We approached adult (aged 18 years or older) English-speaking women before undergoing major gynecologic surgery who were expected to have at least a 24-hour hospital stay postoperatively. We excluded non-English speakers and women who were not able to walk independently before surgery. All participants provided written and oral consent for research participation.

A Student's *t* test was used to compare proportions of age and body mass index (BMI, calculated as weight (kg)/[height (m)]^2); a χ^2 test was used to compare proportions of type of surgery, gynecologic service, and race and ethnicity; and a Mann-Whitney *U* test was used to compare discharge days (Table 1).

A resident physician enrolled participants before surgery. Randomization occurred after completion of their surgery when the surgeon had determined that no intraoperative events had changed the preoperative plan for the patient to ambulate freely immediately postoperatively. Patients were randomized to usual care or specific ambulation goals using sequentially numbered opaque envelopes that had been prepared by the study biostatistician using a computer-generated list of randomization using a permuted block. The resident physician on service opened the randomization envelope and initiated the intervention when applicable.

Table 1. Demographics

	Usual Care	Enhanced Encouragement	*P*
Age (y)	53	56	.29
BMI (kg/m^2)	30.6	30.5	.95
Type of surgery			.31
Minimally invasive	70.6 (48)	77 (47)	
Robotic	32.4 (22)	44.3 (27)	
Laparoscopic	17.6 (12)	21.3 (13)	
Vaginal	20.6 (14)	11.5 (7)	
Abdominal	29.4 (20)	23.0 (14)	
Gynecologic service			.23
Gynecologic oncology	42.6 (29)	57.4 (35)	
Urogynecology	35.3 (24)	27.9 (17)	
Benign gynecology	22.1 (15)	14.8 (9)	
Race or ethnicity			.79
White	85.3 (58)	83.6 (51)	
Black	8.8 (6)	8.2 (5)	
Hispanic	2.9 (2)	1.6 (1)	
Asian	0	1.6 (1)	
Other	2.9 (2)	4.9 (3)	
Discharge day	1.71	1.54	.388

BMI, body mass index.
Data are mean or % (n) unless otherwise specified.

The primary outcome was the number of pedometer-recorded steps documented in the 24 hours immediately before discharge. The 24 hours before discharge was chosen for ease of comparison between patients regardless of the length of their hospital stay. Furthermore, if ambulation is used as a discharge criterion, a patient's ambulation should be highest in the timeframe immediately before discharge. Steps were recorded with a commercially available pedometer, which was placed around the patient's neck with a lanyard in the postoperative recovery room. The manufacturer reported a precision of step-counting $\pm 5\%$ for this device tested by a vibration-testing machine. Patients were instructed to wear the pedometer at all times except during showers. Placement and retrieval events were documented in the patient's chart and pedometer data were downloaded using the Omron Health Management software.

The study group was given specific ambulation goals as our standardized intervention. We used bedside signs and signs on the patient's hospital room door to reinforce the specific ambulation goal of at least 500 steps before discharge. The health care team (doctors and nurses) was instructed to remind the patients in the intervention group to ambulate with every patient encounter. The control group received standard postoperative care with no extra encouragement for ambulation. In our hospital there is no specific protocol for standard care in terms of ambulation in place. It is the expectation that health care workers are consistently encouraging and aiding patient ambulation; however, this is not quantified in any way.

Patients also completed a visual analog scale (0–10) to rate their difficulty with ambulation both preoperatively and postoperatively immediately before discharge. A Student's *t* test for related samples was used to test for differences in these ratings. We also assessed patient perception of obstacles to ambulation using a 10-question nonvalidated patient survey, which included options such as urinary catheters, lack of privacy, embarrassment from hospital gowns, lack of help from staff, and pain. This questionnaire was developed by the study authors and was completed by study participants on the day of their discharge. Finally, we performed a subgroup analysis that compared open and minimally invasive (vaginal, laparoscopic, and robotic) operative approaches using the Mann-Whitney *U* test for group comparison.

Given the lack of data in the literature, we performed a pilot study to inform our study design. This pilot study involved 25 patients who had major gynecologic surgery to assess the timing, frequency, and amount of postoperative ambulation. This pilot study was able to demonstrate the feasibility of using a pedometer to quantify ambulation in the postoperative setting. The data from this study revealed a wide range of steps (0–3,458) with a surprisingly low median number of steps in the 24 hours before discharge (40). The distribution of steps was highly skewed with just over one-fourth of the participants having no pedometer-recorded steps before hospital discharge. Given these data, we anticipated that a nonparametric test of significance would be needed to examine the effect of ambulation encouragement in our randomized trial.

We also considered that a clinically significant effect of encouragement would be evidenced if 65% of patients in the control group were at or below the median number of steps in the treatment group (as opposed to 50%, which would indicate no treatment effect). From this, calculations indicated that 59 patients per group would be necessary to provide 80% power using a two-tailed Mann-Whitney *U* test with a .05 α level.

RESULTS

Of the 172 patients assessed for eligibility, 146 met eligibility criteria and were consented and randomized (77 allocated to usual care and 69 allocated to goal enhanced postoperative care). Figure 1 displays the flow of patients through the study. Ultimately data from 129 surgical patients were analyzed; 68 in the usual care group and 61 in the goal enhanced ambulation group. The loss of data resulted from loss of the pedometers before downloading the data.

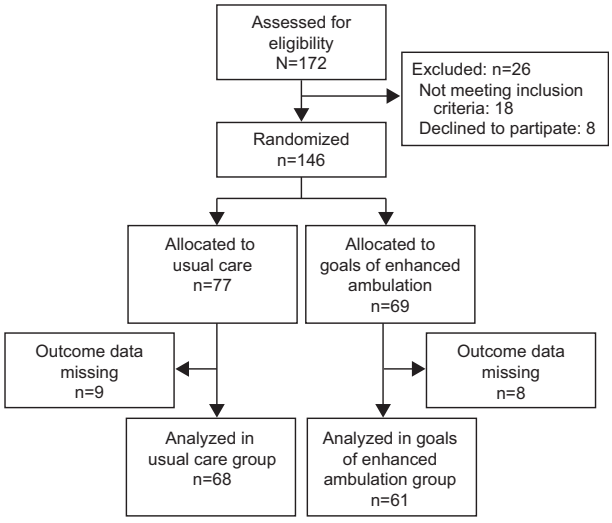

Fig. 1. Flow of patients through the study.

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We did not detect significant group differences in mean age (53 compared with 56 years), mean BMI (30.6 compared with 30.5 kg/m^2), race, type of surgery, gynecologic service, or discharge day (Table 1). Roughly 50% of the study participants were included in the study from the gynecologic oncology service with the primary procedures being robotic or staging laparotomies for endometrial or ovarian cancer. Another 30% of our study patients were undergoing urogynecologic procedures including robotic, laparoscopic, and vaginal hysterectomies with prolapse repair. The final 20% of all study participants underwent hysterectomy for benign indications, including leiomyoma and abnormal uterine bleeding or adnexal procedures for benign reasons.

The majority of all study patients (n=81 [62.8%]) were discharged on postoperative day 1, which means that the number of steps in the 24 hours before discharge corresponds to the total number of steps taken during their entire hospitalization. Twenty-five percent (n=33) of patients were discharged on postoperative day 2, and the remaining patients were discharged on postoperative days 3–9. There was no significant group difference in discharge day between the routine and goal-enhanced care groups (1.71 compared with 1.54, P=.388, Mann-Whitney *U* test). There was no statistically significant group difference between numbers of steps (ambulation goal group: median 80 steps [range 0–2,353] compared with usual care group: median 87 steps [range 0–3,576], Mann-Whitney U test, P=.70) (Fig. 2).

Eight patients (12%) in each group took no pedometer-recorded steps before discharge. There was no significant difference between the group of participants that did not walk (n=16) and the group that walked (n=113) in age, BMI, race, discharge day, type of surgery or preoperative, and postoperative difficulty score (Table 2). Groups were compared with a Student's *t* test for age, BMI, and discharge day; a χ^2 test for race and type of surgery; and a Mann-Whitney *U* test for preoperative and postoperative difficulty walking scale.

Participants reported a mean preoperative ambulation difficulty score of 1.47 out of 10 compared with a mean postoperative difficulty score of 4.79 out of 10 on a visual analog scale. There was a statistically significant difference in these ratings (P<.001). Most (80%) participants returned the ambulation barrier survey. Urinary catheters (38.5%), intravenous poles

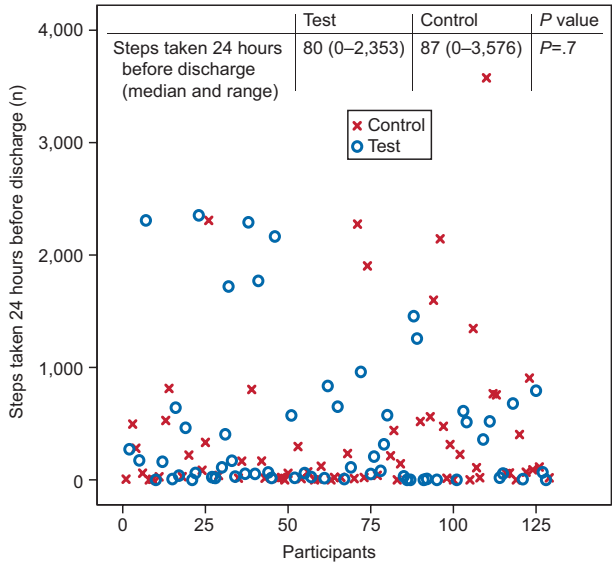

Fig. 2. Distribution, median, and range of steps in 24 hours before hospital discharge.

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(28%), and pain (12.5%) were the most common ambulation barriers overall. There was no significant difference in barrier perception between the intervention group and the control group (indwelling urinary catheters [test: 48%, control: 30%, P=.067%], intravenous poles [test: 31%, control: 25%, P=.479], pain [test: 14.6%, control: 10.7%, P=.552]; χ^2). Based on the group similarity, we tested differences based on type of surgery and detected a clinically and statistically significant difference in the number of steps taken between those who underwent a minimally invasive procedure (median 143, range 0–3,576) and those who had an open abdominal procedure (median 27, range 0–2,275, Mann-Whitney U test, P=.035).

Table 2. Characteristics of Nonwalkers (Zero Steps) and Walkers (One or More Steps)

	Nonwalkers (n=16)	Walkers (n=113)	*P*
Age (y, mean)	52.56	55.32	.405
BMI (kg/m^2, mean)	32.5	30.35	.345
Race (%)			.063
White	68.8	86.7	
Nonwhite	31.2	13.3	
Discharge day	2.25	1.54	.25
Type of surgery (%)			.308
Robotic	43.8	37.2	
Laparoscopic	25.0	18.6	
Vaginal	0	18.6	
Abdominal	31.3	25.7	
Preoperative walking difficulty scale 1–10 (mean)	1.79	1.43	.829
Postoperative walking difficulty scale 1–10 (mean)	5.18	4.73	.411

BMI, body mass index.

DISCUSSION

This study provides baseline data to quantify postoperative ambulation in hospitalized patients recovering from gynecologic surgery. Despite widespread acceptance of ambulation as a discharge criterion, we found that ambulation appears insufficient with at least one in 10 patients taking no pedometer-recorded steps before discharge.

The lack of ambulation and an operational, quantifiable definition of "ambulation" highlight opportunities to improve patient care. We have demonstrated the feasibility of quantifying ambulation in hospitalized postoperative patients. Given the importance of ambulation, we suggest that further research be considered to facilitate an operational definition that is universally accepted. Perhaps ambulation could be treated as a vital sign quantified and reported regularly among health care team members. This study shows one easy way in which physicians can quantify patients' ambulation to decide if they are ready for discharge.

Although ambulation was a discharge criterion, at least one in 10 patients were discharged without pedometer-recorded steps. Although pedometer failure was a possibility, we do not believe that pedometer function is the cause of this finding, because we confirmed pedometer function in each of these situations consistent with our protocol. We did not assess whether the health care team's discharge decision would have been altered with knowledge of insufficient ambulation, but this seems to be an important area for future study.

Although we did not detect improvements in ambulation with specific ambulation goals, we believe that this may be the result of an insufficient intervention, lack of attention to patient-identified barriers, or other factors. We found some easily modifiable barriers to ambulation as identified by patients in a questionnaire. Simple interventions such as early discontinuation of indwelling catheters, discontinuation of intravenous fluids, and improving pain control have the potential to increase postoperative ambulation and thus overall postoperative outcome.

Body mass index and age (factors that are not modifiable at the time of surgery) were not correlated with ambulation. It seems that patients can be categorized into walkers who have an active lifestyle and nonwalkers, patients who have a more sedentary

lifestyle. This seems to be a matter of personality and is not directly correlated to their BMI or age. Older age is often associated with medical comorbidities such as arthritis, visual disturbances, unsteady gait, shortness of breath, and so on. Patients with these types of comorbidities might be more hesitant to freely ambulate in a nonfamiliar environment. There is a possibility that just the intervention of wearing a pedometer could increase the amount of ambulation in hospitalized patients, but this effect was not quantified in this study.

As clinically anticipated, patients who underwent minimally invasive surgery had a statistically significant higher number of steps postoperatively compared with those who underwent an open abdominal procedure. This provides further support for the benefits of a minimally invasive approach to surgery whenever clinically reasonable.

Because our patient population included a wide range of age, BMI, and race, we consider our results as generally valid and reproducible to a larger sample. Weaknesses of this study include the difficulty ensuring that encouragement was given in a uniform manner, because we did not quantify the frequency of encouragement by the health care team. Although the data are generalizable to the entire gynecologic population, the number of patients in each subspecialty is too low to comment on significance in these areas. The study has several strengths. It provides quantifiable baseline data about average postoperative ambulation after modern gynecologic surgery. The feasibility of quantifying ambulation allows many further studies that are likely to enhance patient safety and the quality of postoperative care. Ambulation quantification may also improve the precision of health care team communication regarding an individual patient's postoperative status.

We believe our findings provide a baseline for further research into methods to optimize postoperative ambulation.

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