

Preoperative walking intervention did not appear to improve patient-reported postoperative recovery in older adults with frailty traits

Randomized trial

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Abstract

Objectives: To assess the impact of a preoperative walking intervention on improving postoperative recovery in at-risk frail older adult patients.

Study Type: Unblinded, randomized controlled trial which assigned patients to intervention versus control.

Population: Patients aged 60+ scheduled for surgery 3–8 weeks from randomization scoring 4+ on the Edmonton Frail Scale.

Intervention: Preoperative walking enhanced by goal setting with an activity monitor and telephonic coaching.

Main Outcomes: Quality of Recovery 9-item instrument total score and a modified version of the Abdominal Surgery Impact Scale total score

Results: A total of 83 patients were analyzed. Postoperative recovery scores were similar in intervention vs control – Quality of Recovery-9 item instrument total score 14.1 vs. 14.1 ($P = .94$) and modified Abdominal and Surgery Impact Scale total score 82.8 vs. 79.2 ($P = .93$). Few intervention patients met their daily step count goals. Despite this, intervention patients improved average daily step counts significantly.

Conclusions: Preoperative walking bolstered with activity monitor and remote coaching did not appear to lead to improved postoperative recovery in older adults with frailty traits. Further research is necessary to see if a similar intervention in specific surgery types or a more intense version of the intervention can improve recovery.

Abbreviations: 6MWD = six-minute walk distance, ASA = American Society of Anesthesiologist, AT = athletic trainer, EFS = Edmonton frail scale, POD1 = postoperative day 1, POD2 = postoperative day 2, POD3 = postoperative day 3, QOR-15 = quality of recovery 15-item instrument, QOR-40 = quality of recovery 40-item instrument, QOR-9 = quality of recovery 9-item instrument, SIS = surgery impact scale.

Keywords: frailty, prehabilitation, telemedicine

1. Introduction

Frail older adult surgical patients are at increased risk for postoperative complications and worse recovery. Preoperative/prehabilitation interventions may be able to improve recovery or restoration of health. The American College of Surgeons' Strong for Surgery program includes prehabilitation as one of the eight major areas to target for producing better surgical outcomes, and it recommends starting a daily walking program for

certain patients with poor mobility or diminished endurance.^[1] However, prior studies have not measured recovery in frail older adults in the days following surgery (a phase of care that avoids confounding by heterogeneity in post-acute care rehab and other services).^[2] Previous preoperative/prehabilitation interventions have required in-person therapy sessions and focused on general adult patients and not frail older adults.^[2,3] They also did not include goal setting with an activity monitor or remote coaching. We present the results of a pilot study to assess the impact

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The datasets generated during and/or analyzed during the current study are not publicly available because we do not have the current approvals to share collected data from this trial.

The study has been approved by the local institutional review board (IRB).

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of a preoperative walking intervention using goal setting with an activity monitor and telephonic coaching on recovery measured in the days after surgery in older adults with frailty traits. Supervised walking as a pre-habilitation intervention in trials with large enough cohorts may improve postoperative stamina and mobility in addition to being low-cost and convenient.^[4]

2. Methods

We previously described our methods.^[5]

2.1. Population

Briefly, we enrolled patients scheduled for surgery at a single, academic center who were aged 60+ with frailty traits (i.e., score of 4+ on the Edmonton Frail Scale (EFS) with frailty defined as 8+). The EFS scale range was 0-17, and we excluded patients scoring < 4 (see Table 1, which shows the full distribution of patient traits). Whereas scores of eight or higher typically define the full frailty syndrome, previous research demonstrates that patients scoring 4 or higher (i.e., those with frailty traits) are also vulnerable to postoperative complications.^[6] We excluded patients undergoing lower extremity orthopedic surgery given the unlikelihood of these patients being able to walk significantly before surgery. We also excluded patients with visual impairment which makes walking unsafe, those who have fallen in the past 3 months because of the loss of balance, those with abnormal vital signs (a resting heart rate of greater

than 120, systolic blood pressure greater than 180, or diastolic blood pressure greater than 100) patients who do not walk independently (e.g., wheelchair; cane walking is ok), and those with cardiac disease having received a recommendation not to exercise. We previously determined that an optimal sample size for an additional outcome (i.e., postoperative 6MWD) reported elsewhere^[4] would be 120 patients, with a 33% attrition rate to arrive at a final sample size of 80 (with 40 patients in each arm).^[5]

2.2. Randomization

We then randomized them in 1:1 parallel fashion to receive, unblinded, our intervention versus general walking instructions. Block randomization scheme was stratified on the baseline of six-minute walk distance (6MWD) categories determined during the baseline interview: 0–200 m, 201–300 m, 301–400 m, >400 m. REDCap software was utilized to generate the randomization sequence, and recruiters informed patients of the generated group assignment after the baseline interview.

2.3. Procedure

For the intervention, we issued a wrist-worn activity monitor and a linked smartphone. Through these devices, a certified athletic trainer (AT) reviewed baseline activity (i.e., the first 3 days after randomization), prescribed a daily step count goal, and

Table 1

Frequency of patient traits.

Patient Traits	Total N, (% out of 83 unless specified)	Intervention N, (% out of 44 unless specified)	Control N, (% out of 39 unless specified)
Patient traits			
Age mean ± SD	69 ± 8	68 ± 9	70 ± 6
Female gender	42 (53)	21 (53)	21 (53)
Non-White Race/ethnicity*	9 (11)	5 (11)	4 (10)
Edmonton frail scale			
Less frail (4 or 5)	56 (67)	29 (66)	27 (69)
More frail (6+)	27 (33)	15 (34)	12 (31)
Type of Surgery			
Colorectal	25 (30)	15 (34)	10 (26)
Thoracic	27 (33)	12 (27)	15 (38)
Urological	14 (17)	8 (19)	6 (15)
Other†	17 (20)	9 (20)	8 (21)
Baseline stamina median (min, max)	325 (55, 480)	320 (92, 480)	323 (55, 467)
Baseline stamina (6MWD) category			
Less than 200 m	13 (16)	7 (16)	6 (16)
200–300 m	24 (29)	13 (30)	11 (28)
301–400 m	26 (31)	13 (30)	13 (33)
Greater than 400 m	20 (24)	11 (24)	9 (23)
Preoperative duration median (min, max)‡	33(7,93)	33 (7, 93)	32(11,17)
Preoperative duration categories			
<20 d	11 (13)	6 (14)	5 (13)
20–40 d	46 (56)	22 (50)	24 (61)
>40 d	26 (31)	16 (36)	10 (26)
Length of stay median (min, max)	4(1, 30)	4(1, 19)	4(1, 30)
Length of stay category			
Long stay – ≥2 nights	76 (92)	41 (93)	35 (90)
Short stay – 1 night	7 (8)	3 (7)	4 (10)
ASA classification of physical health			
Mild systemic disease (I)	14 (17)	9 (20)	5 (13)
Severe systemic disease (III)	65 (78)	31 (71)	34 (87)
Severe systemic disease/constant threat to life (IV)	4 (5)	4 (9)	0 (0)

6MWD = 6-minute walk distance, ASA = American Society of Anesthesiologists.

* Includes Black, Hispanic/Latino ethnicity, Asian, Native American, Alaska native, or other.

† Other surgery types included oncology, vascular, and transplant.

‡ Days elapsed from randomization to day of surgery.

then titrated up the goal during weekly check-in calls. Typically, the AT increased the daily step count goal by 10%–20% but had the discretion to titrate less or more. The device had parameters to permit the patient to set an alert when they reached the daily step count goal although we did not require patients to do this. Controls patients received general walking advice but not the monitor or remote coaching.

2.4. Outcomes

2.4.1. Postoperative recovery. To measure in-hospital postoperative recovery, we interviewed patients on the second or third postoperative day (POD2 or POD3) for patients that stayed 2+ nights and POD1 for patients staying one night. Specifically, we administered the Quality of Recovery 9-item (QOR-9) instrument and the 18-item Abdominal Surgery Impact Scale (SIS) modified to account for non-abdominal surgeries depending on the length of stay. This follows expert guidance on use of postoperative recovery instruments.^[7] A short stay was defined as patient staying one (1) night in hospital, whereas a long stay was staying 2+ nights in hospital. The former instrument has a 3-point scale (not at all to most of the time) and the latter has a seven-point scale (strongly disagree to strongly agree). QOR-9 includes 9 items with 0–2 points assigned for each item leading to a range of values 0–18. Items include physiological status, patient-perceived well-being, and support obtained from healthcare professionals. Higher scores correspond with higher recovery. SIS total score ranges from 18–126 with its subscores evaluating physical limitations, functional impairment, pain, visceral function, sleep, and psychological function. Higher scores reflect higher recovery. We also assessed these scores in strata based on preoperative duration.

2.4.2. Adherence and complications. For adherence, we calculated the percentage of days on which patients met their step count goal as well as the change in the average daily step count that they walked in the first 3 days of wearing the activity monitor compared with the week before surgery. Step counts were only available for patients in the intervention group who wore a study-issued activity monitor.

We also collected information about postoperative complications but given small numbers did not perform any statistical testing or association with the outcomes mentioned in this report.

2.4.3. Analysis. For our quality of recovery and surgery impact outcomes, we constructed linear regression models adjusting for potential confounders (i.e., residual after randomization) including patient characteristics such as age, gender, race/ethnicity, frailty score as measured by the EFS, specialty of surgery performed, baseline 6MWD, days elapsed from randomization to surgery, anticipated length of stay, and American Society of Anesthesiologist (ASA) classification. Analysis was intention-to-treat. For adherence, we assessed the significance of the increase in daily steps using a paired *t*-test. The outcome was assessed for 43 of the 44 intervention patients as we were unable to obtain sufficient step count data for one patient.

3. Results

We identified and randomized 104 eligible patients. Twenty-one patients did not undergo surgery, withdrew before outcome assessment, or were not available for outcome assessment. Eighty-three patients remained for outcome assessment (Fig. 1).

As shown in Table 1, the mean patient age was 69 years. The most common surgery types were colorectal (30%) and thoracic (33%). Most patients (67%) had an EFS score of 4 or 5. One patient in the intervention arm had an EFS score of 15. The length of in-hospital stays for many of the patients lasted 2 or

more nights (92%). Although we intended to have 3 weeks or more before surgery for each patient, 13% of patients had surgery rescheduled to an earlier date.

In terms of patient traits, there was balance across the 44 intervention and 39 control patients. Four American Society of Anesthesiologist (ASA) class IV (indicates incapacitating systemic disease that is a constant threat to life for a patient) patients existed in the intervention group relative to none in the control group. This imbalance is counteracted by 31 intervention patients with ASA class III (which indicates a severe systemic disease that limits activity but does not incapacitate a patient) relative to 34 control patients (see Table 1). No eligible patient had an ASA I status.

3.1. Postoperative recovery

Postoperative recovery scores were similar in the intervention vs control without significant change after adjustment for covariates: QOR-9 14.1 vs. 14.1 ($P = .94$) and SIS 82.8 vs. 79.2 ($P = .93$) (see Table 2). Appendix Table S1, Supplementary Digital Content, <http://links.lww.com/MD/H358>, demonstrates full model results for QOR-9 and SIS total scores in addition to *p* values representing significance testing results from mixed linear regression model adjusting for all variables. Among covariates in the model, only baseline 6MWD was independently associated with recovery scores. The intervention performed similarly (no significant difference in the means of patients randomized to intervention or control) across strata based on preoperative duration (see Appendix Table S2, Supplementary Digital Content, <http://links.lww.com/MD/H359> which illustrates outcomes in strata based on preoperative duration).

3.2. Adherence and complications

Intervention patients who wore a study-issued activity monitor walked an average of 3630 steps/day at baseline and 4501 steps in the week before surgery. Few intervention patients met their daily step count goals. Despite this, intervention patients improved average daily step counts significantly by 871 steps \pm standard error of 265 steps from the beginning to the end of the intervention ($P = .002$) (Table 2).

patients suffered serious complications in the 30 days after surgery including pulmonary embolism, pneumonia, return to the operating room, urinary tract infection, wound disruption (two patients), and deep incisional site infection.

4. Discussion

Our preoperative intervention of goal setting with an activity monitor and telephonic coaching did not improve postoperative patient-reported recovery. Exercise training can improve several components of physical function for older adults with frailty traits.^[2,8] One other investigative group measured recovery (QOR-15) after prehabilitation in older adults with frailty traits.^[9] Like us, their intervention did not improve recovery. In general populations, prehabilitation interventions have shown potential for improving recovery. Peng et al, evaluating preoperative limb and abdominal strengthening facilitated with daily check-in with a rehabilitation therapist, reported a significant increase in 2 of 5 QOR-40 sub-scores.^[10] Similarly, Gillis demonstrated improvement in postoperative stamina with addition of anxiety reduction to exercise-based prehabilitation.^[3] Limb/abdominal strengthening or anxiety reduction may warrant retesting in older adults with frailty traits. Our intervention distinguishes itself in its low cost and convenience. Short preoperative duration in many patients and the overall small sample size limited the examination of intervention effectiveness in patient subsets, particularly by surgery type. Future

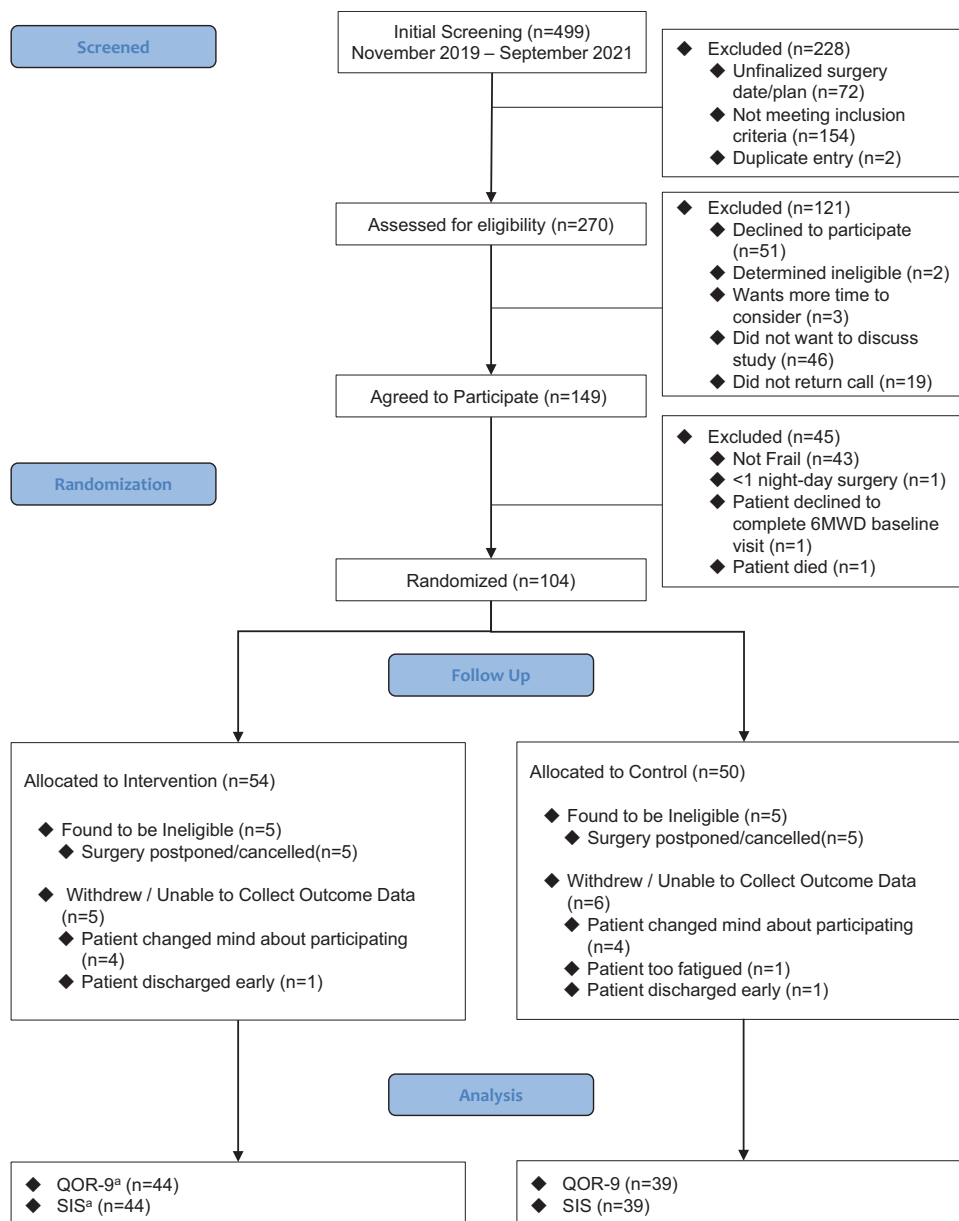


Figure 1. CONSORT Flow Diagram. ^aAdministered on second or third postoperative day (POD2 or POD3) for patients that stayed 2+ nights. For patients staying one night, we administered these instruments on POD1.

Table 2
Postoperative outcomes.

Outcome description	Result
QOR-9 mean for intervention vs control patients	14.1 vs. 14.1, <i>P</i> = .94
SIS mean for intervention vs control patients	82.8 vs. 79.2, <i>P</i> = .93
Difference in daily steps from baseline until week before surgery (intervention group only) – mean ± standard error	871 ± 265, <i>P</i> = .002

Impact scale to include patients with non-abdominal surgeries.
QOR-9 = quality of recovery 9-item instrument, SIS = surgery impact scale adapted from abdominal surgery.

investigations should strive for enrolling larger cohorts to evaluate effectiveness in these subsets. Reconciling our findings with existing American College of Surgeons guidelines will require further investigation to identify which patients

performing which exact exercise regimes will most benefit from a preoperative walking program. Increasing the quality of postoperative recovery may require even more significant improvement in preoperative physical activity perhaps by lengthening the duration of prehabilitation, increasing the frequency of therapist/trainer consultation, or enhancing the preoperative intervention with limb/abdominal strengthening or anxiety reduction.

Author contributions

HS - writing original draft
 SR - writing original draft
 JP - writing original draft
 SC - writing original draft, formal analysis
 MW - writing original draft, conceptualization
 AK - writing original draft, writing review and edit, conceptualization, formal analysis, and supervision

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