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Management of postoperative ileus after robot-assisted laparoscopic prostatectomy

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Abstract

To compare different postoperative management methods on the recovery of bowel function after robot-assisted laparoscopic prostatectomy (RALP).

This is a prospective study of 716 patients who underwent RALP at Severance Hospital in Seoul, South Korea, between March 2017 and February 2018. Instructions for the different postoperative management methods (mobilization, abdominal massage, hot pack therapy, and gum chewing) were presented to patients, who subsequently reported when these activities were performed as well as the time to first flatus on a designated form.

There were no significant differences in age, height, weight, body mass index, body surface area, prevalence of hypertension and diabetes mellitus, and in American Society of Anesthesiologists (ASA) scores with respect to early bowel recovery. Prolonged times of surgery and anesthesia significantly caused delays in bowel recovery. The total number and time of mobilization, total time of hot pack therapy, and number of gum chewing were significantly and positively associated with bowel recovery. A Kaplan–Meier analysis showed that all of the postoperative management methods were positively associated with the mean time to first flatus.

Methods of postoperative management (mobilization, abdominal massage, hot pack therapy, and gum chewing) have positive effect on bowel motility after RALP. Furthermore, reductions in the times of surgery and anesthesia could significantly decrease prolonged delays in bowel recovery.

Abbreviations: ASA = American Society of Anesthesiologists, BMI = body mass index, BSA = body surface area, EBL = estimated blood loss, RALP = robot-assisted laparoscopic prostatectomy.

Keywords: management, postoperative ileus, robot-assisted laparoscopic prostatectomy

1. Introduction

Livingston and Passaro[1] define postoperative ileus as an "uncomplicated ileus occurring following surgery, resolving spontaneously within 2 to 3 days." In postoperative ileus, the stomach recovers within 24 to 48 hours, whereas the motility of the colon returns after 48 to 72 hours.[1] Postoperative ileus remains the most common minor postoperative complication to cause morbidity and delays in patient discharge from the hospital, leading to an increased economic burden on the healthcare system.[2] Therefore, many researchers have focused on the management of postoperative ileus: Many studies have investigated treatment approaches such as motility agents, early feeding, gum chewing, nasogastric intubation, fluid restriction, epidural anesthesia and analgesia, mobilization, and physical therapy.[2–7] However, these therapies have not been routinely used in the clinic because of their limited clinical efficacy.[2]

Most studies have focused on colorectal surgery; however, only a few studies have examined the postoperative management of a major urological surgery.[3,8,9] Robot-assisted surgery can better minimize blood loss and morbidity than traditional open surgical techniques.[10] No studies have determined the efficacy of postoperative ileus management after robot-assisted laparoscopic prostatectomy (RALP). The purpose of this study is to compare the effects of different postoperative management methods (mobilization, abdominal massage, hot pack therapy, and gum chewing) on the reduction of postoperative ileus and improved bowel recovery after RALP.

2. Materials and methods

2.1. Study population

This study is a prospective study of patients who underwent RALP at Severance Hospital in Seoul, South Korea, between March 2017 and February 2018. This study was approved by the Institutional Review Board of the Yonsei University Health System (project no: 4-2017-0225). We used the technique described by Menon et al.[11,12] The routine postoperative

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Ethical approval: All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee, and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent was obtained after a full explanation of the study. This study did not involve patient intervention or the use of human tissue samples.

The authors have no conflicts of interest to disclose.

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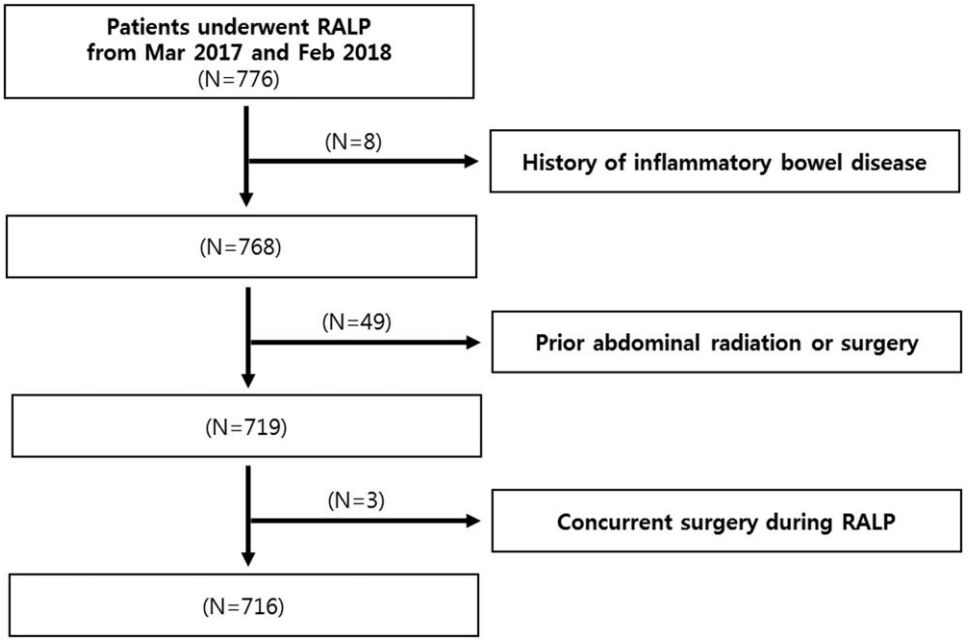

Figure 1. Flow chart of excluding patients for the patients who underwent robot-assisted laparoscopic prostatectomy (RALP).

analgesia was commenced with intravenous pethidine (meperidine) usually by patient-controlled methods (PCA) and oral acetaminophen were used for additional analgesia as required. We removed the transurethral catheter after 2 weeks after the surgery. Patients were excluded for the following reasons: history of inflammatory bowel disease, prior abdominal radiation, or surgery, and concurrent surgery during RALP (Fig. 1). Seven hundred sixteen patients were enrolled in the study. The details of the study were explained to the subjects, and written informed consent was obtained.

2.2. Measurement and classification of variables

The time at the end of surgery was defined as the zero hour. To monitor the recovery of bowel function, all the patients were instructed to write down when a bowel-related event occurred. Instructions for mobilization, abdominal massage, hot pack therapy, and gum chewing were presented to all patients, who were instructed to document the exact time they performed those activities. These management activities were discontinued when the passage of flatus first occurred. The end of postoperative ileus was defined as the passage of flatus in this study, and the study endpoint was the time to the first postoperative passage of flatus.

The time from the first incision to the final closure of the wound was defined as the time of surgery. Demographic data, including patient age, height, weight, body mass index (BMI), body surface area (BSA), American Society of Anesthesiologists (ASA) score, and history of hypertension and diabetes mellitus, were recorded. Intraoperative parameters including time of surgery, time of anesthesia, and estimated blood loss (EBL) were analyzed.

The group with the first postoperative passage of flatus within 24 hours, which is the mean time for the time to first flatus, was classified as the early bowel recovery group, whereas those who had the first postoperative passage of flatus after 24 hours were considered the late bowel recovery group. Patients who performed mobilization, abdominal massage, hot pack therapy, and gum chewing more than once were considered the group who performed that management method and were compared with the control group, which was defined as those who did not perform this management method. Mobilization was further divided into groups who walked more than 30 and 60 minutes per day, respectively.

2.3. Statistical analysis

The results are reported as the mean (standard deviation) for continuous variables and as a percentage for categorical variables. For the univariate analysis, the *t* test was used to compare continuous variables. The multivariate analysis used multivariate models of logistic regression, including all risk factors that were significantly associated in the univariate analysis. The times to the different events were compared among groups using Kaplan–Meier analyses and the log-rank test. SPSS software, version 23.0 (IBM Corp, Armonk, NY), was used for statistical analyses. All statistical tests were 2-tailed, and a *P* value less than .05 was considered statistically significant.

3. Results

The baseline characteristics of the study population are shown in Table 1. The mean age of the patients who participated in this study was 65.9 ± 4.5 years. The prevalence of hypertension and diabetes mellitus were 39.5% and 14.4%, respectively. Most patients were in the ASA score 2 (46.4%) and score 3 (37.6%) groups. The mean time of surgery was 142.6 ± 70.3 minutes. The mean time to the first postoperative passage of flatus was 29.1 ± 16.2 hours.

Five hundred fifty-six (77.7%) patients have undergone lymphadenectomy and the mean number of lymph nodes removed were 11.9 ± 8.3. Most of the patients (70.7%) had nerve sparing surgery on both the sides. One hundred fifty (20.9%) patients had nerve sparing surgery on 1 side and 60 (8.4%) patients did not have nerve sparing surgery. Performance of lymphadenectomy and nerve sparing surgery did not differ

Table 1

Characteristics of the study population.

	Study population (n = 716)
Patient characteristics	
Age, y	65.9 (4.5)
Height, cm	168.3 (5.6)
Weight, kg	69.3 (8.1)
BMI, kg/m^2	24.4 (2.3)
BSA, m^2	1.8 (0.1)
ASA score	
1	115 (16.1%)
2	332 (46.4%)
3	269 (37.6%)
HTN, n, %	283 (39.5%)
DM, n, %	103 (14.4%)
Time to first flatus (hours)	29.1 (16.2)
Intraoperative parameters	
Time of surgery, min	142.6 (70.3)
Time of anesthesia, min	182.8 (66.4)
EBL, cc	421.4 (347.2)
Postoperative management	
Mobilization	
Number	2.6 (2.2)
Total time, min	47.3 (43.8)
Abdominal massage	
Number	0.2 (0.5)
Total time, min	3.0 (9.1)
Hot pack therapy	
Number	0.8 (1.2)
Total time, min	14.7 (25.1)
Gum chewing	
Number	0.8 (1.2)
Total time, min	25.4 (45.8)

Data are shown as the mean (SD) or number of subjects (%).
ASA = American Society of Anesthesiologists, BMI = body mass index, BSA = body surface area, DM = diabetes mellitus, EBL = estimated blood loss, HTN = hypertension.

between early and late bowel recovery group ($P = .120$ and $P = .473$, respectively).

There were no significant differences in age, height, weight, BMI, and BSA between early and late bowel recovery groups, although, as expected, those in the late bowel recovery group were older (Table 2). There were no differences in the prevalence of hypertension and diabetes mellitus between groups. ASA scores were not significantly different between the 2 groups (Table 2). Times of surgery and anesthesia were significantly longer in the late bowel recovery group in the multivariate analysis. EBL was greater in the late bowel recovery group but was not statistically significant in multivariate analysis. The total time of mobilization, abdominal massage, hot pack therapy were significantly associated with bowel recovery in the univariate analysis, and mobilization and hot pack therapy showed significant association in multivariate analyses. The number of gum chewing was significantly associated with improved bowel recovery. The Gleason score and pathological stage of the study population are shown in Table 3. Only the pathological T stage was significantly associated with bowel recovery both in the univariate and multivariate analysis ($P = .019$).

The mean time to first flatus was significantly decreased ($P < .001$) in patients in the mobilization group [38.2 (0.6) hours, n = 668] compared with the control group [56.3 (1.4) hours, n = 48], as shown by the Kaplan–Meier curves in Figure 2A. For the group who walked less than 30 minutes, the mean time to first flatus was significantly prolonged compared with the control group [36.6 (0.7), n = 514 vs. 46.8 (0.9) hours, n = 202, $P < .001$] (Fig. 2B). Similarly, there was significant difference between the group who walked more than 60 minutes and the control group [27.1 (0.2), n = 228 vs. 42.4 (0.6) hours, n = 488, $P < .001$] (Fig. 2C). There were significant differences between the group who performed hot pack therapy or abdominal massage and the control group [37.0 (0.9), n = 320 vs. 42.0 (0.8) hours, n = 396, $P < .001$; 34.3 (1.3), n = 108 vs. 41.3 (0.7) hours, n = 608, $P < .001$] (Fig. 2D and E). Furthermore, the mean time to first flatus was significantly prolonged ($P < .001$) in patients who performed gum chewing [36.2 (1.0) hours, n = 294] compared with the control group [42.8 (0.8) hours, n = 422] (Fig. 2F).

4. Discussion

This is the first study to assess the effects of the different management methods (mobilization, abdominal massage, hot pack therapy, and gum chewing) on reducing postoperative ileus after RALP. Many studies have proven treatment efficacy in the management of postoperative ileus,[2–7] but surgeons are unlikely to suggest such treatments to patients. Postoperative ileus causes patient discomfort and pain. Moreover, it can prolong hospitalization, which leads to increases in hospital costs.[13,14] No studies have evaluated the effects of mobilization, abdominal massage, hot pack therapy, and gum chewing on reductions in postoperative ileus after RALP.

Similar to the results of most studies, mobilization was positively associated with bowel recovery. Kaplan–Meier analyses also showed that the mobilization group had a significantly decreased time to first flatus compared with the control group. The group with more time of mobilization had the faster time for bowel recovery, as shown by the Kaplan–Meier analysis (Fig. 2A–C). Some studies reported that physical exercise does not improve colonic mobility.[15,16] However, this study showed significantly positive relationship between mobilization and bowel recovery time both in multivariate and Kaplan–Meier analysis. There are studies that reported the prolonged immobilization after surgery causing postoperative complications and delayed recovery.[17–19]

No studies have demonstrated the effects of hot pack therapy on the management of postoperative ileus. However, some studies reported that hot pack therapy increases regional blood flow.[20,21] Increases in blood flow to the gastrointestinal tract would result in early recovery of bowel function. Our results showed that the mean time to first flatus in patients who utilized hot pack therapy was significantly decreased. Takayama et al[21] showed that thermal stimulation of the para-umbilical region increased blood flow to the superior mesenteric artery within 20 minutes of thermal stimulation. This finding explains why patients utilizing hot pack therapy passed gas early, as shown by the Kaplan–Meier curve in Figure 2D.

Gum chewing is considered a quick and safe method to enhance the recovery of bowel function after surgery with medium-level evidence.[22,23] Chewing increases the levels of several hormones, such as gastrin, neurotensin, pancreatic polypeptide, and cholecystokinin, which are all associated with indirect vagal afferent stimulation.[2] Moreover, chewing increases salivary and gastric secretions.[3] Asao et al[24] first reported the use of chewing gum after surgery in 2002. These authors described gum chewing as a form of sham feeding, which stimulates the motility of the gastrointestinal tract and results in reductions in the times to first flatus and first bowel

Table 2

Characteristics of the study population according to the first postoperative passage of flatus in 24 h.

	First postoperative passage of flatus			
	Before 24 hours (n = 315)	After 24 hours (n = 401)	*P* value*	*P* value†
Patient characteristics				
Age, y	65.6 (3.9)	66.0 (5.0)	.202	
Height, cm	168.0 (5.6)	168.6 (5.6)	.174	
Weight, kg	69.2 (8.1)	69.3 (8.1)	.907	
BMI, kg/m^2	24.5 (2.3)	24.4 (2.3)	.407	
BSA, m^2	1.8 (0.1)	1.8 (0.1)	.705	
ASA score				
1	50 (15.9%)	65 (16.2%)		
2	151 (47.9%)	181 (45.1%)	.743	
3	114 (36.2%)	155 (38.7%)		
HTN, n (%)	121 (38.4%)	162 (40.4%)	.589	
DM, n (%)	38 (12.1%)	65 (16.2%)	.117	
Intraoperative parameters				
Time of surgery, min	103.1 (23.3)	173.6 (78.9)	<.001	<.001
Time of anesthesia, min	147.8 (24.6)	210.3 (75.4)	<.001	.009
EBL, cc	322.5 (211.9)	499.1 (408.0)	<.001	.605
Postoperative management				
Mobilization				
Number	2.8 (2.7)	2.4 (1.8)	.005	.002
Total time, min	65.1 (56.1)	33.3 (22.7)	<.001	<.001
Abdominal massage				
Number	0.3 (0.6)	0.2 (0.5)	.104	.382
Total time, min	4.9 (12.4)	1.5 (4.9)	<.001	.627
Hot pack therapy				
Number	1.0 (1.2)	0.6 (1.2)	<.001	.014
Total time, min	20.4 (27.0)	10.2 (22.4)	<.001	
Gum chewing				
Number	0.9 (1.3)	0.7 (1.1)	.041	<.001
Total time, min	29.1 (50.1)	22.6 (42.0)	.065	

Data are shown as the mean (SD) or number of subjects (%).

ASA = American Society of Anesthesiologists, BMI = body mass index, BSA = body surface area, DM = diabetes mellitus, EBL = estimated blood loss, HTN = hypertension.

* *P* value calculated using the *t* test (continuous data) and χ^2 test (categorical data).

† *P* value calculated using logistic regression for multivariate analysis.

Table 3

Gleason score and pathological stage of the study population according to the first postoperative passage of flatus in 24 h.

		First postoperative passage of flatus			
	Study population (n = 716)	Before 24 h (n = 315)	After 24 h (n = 401)	*P* value*	*P* value†
Biopsy Gleason score					
Mean (SD)	7.2 (1.0)	7.3 (1.0)	7.2 (1.0)	.270	
≤6	189 (26.4%)	72 (22.9%)	117 (29.2%)	.386	
3+4	164 (22.9%)	79 (25.1%)	85 (21.2%)		
4+3	120 (16.8%)	55 (17.5%)	65 (16.2%)		
8	154 (21.5%)	68 (21.6%)	86 (21.4%)		
9-10	89 (12.4%)	41 (13.0%)	48 (12.0%)		
pT stage					
T2	365 (51.0%)	143 (45.4%)	222 (55.4%)	.019	.019
T3a	223 (31.1%)	117 (37.1%)	106 (26.4%)		
T3b	110 (15.4%)	47 (14.9%)	63 (15.7%)		
T4	18 (2.5%)	8 (2.5%)	10 (2.5%)		
pN stage					
N0	672 (93.9%)	300 (95.2%)	372 (92.8%)	.172	
N1	44 (6.1%)	15 (4.8%)	29 (7.1%)		
pM stage					
M0	696 (97.2%)	304 (96.5%)	392 (97.8%)	.315	
M1	20 (2.8%)	11 (3.5%)	9 (2.2%)		

Data are shown as the mean (SD) or number of subjects (%).

* *P* value calculated using the *t* test (continuous data) and χ^2 test (categorical data).

† *P* value calculated using logistic regression for multivariate analysis.

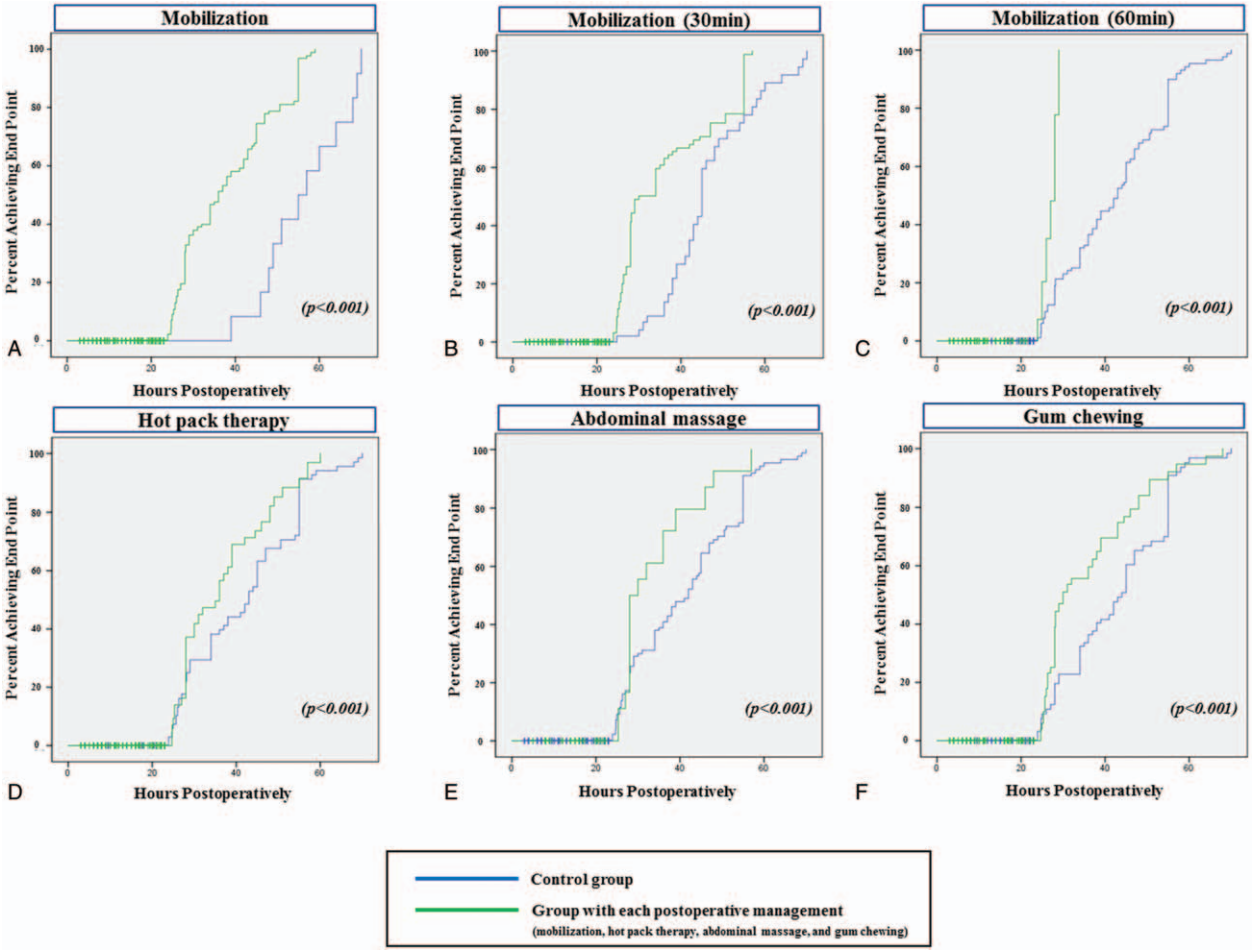

Figure 2. Kaplan–Meier curves of the first passage of flatus postoperatively between the control group and each group performing a type of postoperative management. A, Mobilization. B, Walking more than 30 min. C, Walking more than 60 min. D, Hot pack therapy. E, Abdominal massage. F, Gum chewing.

movement.[24] Our study also showed that gum chewing enhanced the bowel function recovery.

The mean time of abdominal massage was less than 3 minutes, which may be related to the reluctance of patients to perform abdominal massage due to surgical pain. However, our results showed that abdominal massage also supports bowel recovery (Fig. 2E). Prolonged times of surgery and anesthesia resulted in delayed bowel recovery. It is well known that all drugs used for the induction and maintenance of general anesthesia depress bowel motility.[25]

There are several limitations of this study. First, flatus may not be an ideal end point, since it requires a conscious patient who must report its occurrence to investigators. We could not measure times to first bowel movement, the most reliable end point. Many patients have bowel movements almost immediately after the passage of flatus. Moreover, most patients were discharged before having a bowel movement. Second, this study is based on patients' self-reported questionnaires. As patients report the number and duration of mobilization, abdominal massage, hot pack therapy, and gum chewing after surgery, there could be some misreported and/or missing information.

This study showed that the different postoperative management methods (mobilization, abdominal massage, hot pack therapy, and gum chewing) that were recommended to patients to help bowel recovery have positive effects on the recovery of bowel motility after RALP. Prolonged times of surgery and anesthesia resulted in delayed bowel recovery. Surgeons should thus focus on reducing the time of surgery to help patients recover bowel function. Moreover, all postoperative management methods have been found to be effective in reducing bowel recovery time, especially, mobilization has been significantly found to be helpful.

Author contributions

Conceptualization: Jee Soo Park, Won Sik Ham.
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Formal analysis: Jee Soo Park, Won Sik Jang.
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Supervision: Koon Ho Rha, Young Deuk Choi, Won Sik Ham.
Writing – original draft: Jee Soo Park.
Writing – review & editing: Jee Soo Park, Koon Ho Rha, Young Deuk Choi, Won Sik Ham.

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