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# Comparison of enhanced recovery after surgery protocol and conventional approach after laparoscopic transperitoneal radical prostatectomy: a retrospective analysis

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## Abstract

**Background:** Although open radical prostatectomy has been used in the treatment of localized prostate cancer for a long time, minimally invasive surgical approaches such as laparoscopic radical prostatectomy and robot-assisted radical prostatectomy have recently gained importance in order to improve postoperative results and shorten hospital stay. Although the enhanced recovery after surgery (ERAS) protocol was first defined for gastrointestinal surgeries in 2001, it has now been used in gynecological, orthopedic, thoracic and urological surgeries. In our study, we aimed to compare the results of the ERAS protocol with the conventional approach in patients who underwent laparoscopic radical prostatectomy.

**Methods:** There is a retrospective analysis of 70 patients who underwent laparoscopic radical prostatectomy at Kayseri City Hospital between May 2018 and January 2021. Data were analyzed using the Statistical Package for the Social Sciences (SPSS) for Windows, version 25.0 (IBM SPSS, Armonk, NY, USA). Seventy patients were included in the study. While 48 patients who underwent perioperative care with the traditional approach were included in the conventional group, 22 patients were included in the ERAS group. Age, comorbidities, preoperative PSA level, digital rectal examination findings, preoperative imaging, extra prostatic spread and lymph node involvement, location of tumors, time between biopsy and surgery, lymphadenectomy status, and histopathological findings of transrectal ultrasound biopsy and prostatectomy specimens were recorded for each patient. Initiation of enteral feeding, time to first defecation, duration of antibiotic use, ileus development rate and length of hospital stay (LOS) were compared for both groups.

**Results:** The mean age of 48 patients in the conventional group was  $63.37 \pm 7.01$  years, while the mean age of 22 patients in the ERAS group was  $66.36 \pm 5.31$  years ( $p = 0.080$ ). Although the first defecation time was shorter in the ERAS group ( $4.75 \pm 3.21$  vs.  $3.73 \pm 2.12$  days,  $p = 0.179$ ), there was no statistically significant difference. Ileus developed in 10 (20.8%) patients in the conventional group and 2 (9.1%) in the ERAS group. Use of antibiotics in the postoperative period in the conventional group ( $5.83 \pm 3.62$  vs.  $3.18 \pm 2.42$  days,  $p = 0.003$ ) and LOS ( $7.92 \pm 3.26$  vs.  $5.91 \pm 2, 15$  days,  $p = 0.011$ ) were statistically significantly longer.

**Conclusion:** In summary, ERAS protocol is associated with short LOS, time to initiation of enteral feeding and duration of antibiotics use. There was no statistically significant difference in the rate of ileus and time to first defecation

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between the two groups. Randomized prospective studies on heterogeneous and larger patient groups are needed to confirm our findings.

**Keywords:** Prostate cancer, Laparoscopic radical prostatectomy, ERAS, LOS, Perioperative patient care

## 1 Background

Prostate cancer (PCa) is the second most common type of cancer in men. The widespread use of prostate-specific antigen (PSA) screening and advances in diagnostic imaging have facilitated the diagnosis of PCa [1]. Although open radical prostatectomy has been used in the treatment of localized prostate cancer for a long time, minimally invasive surgical approaches such as laparoscopic radical prostatectomy (LRP) and robot-assisted radical prostatectomy have recently gained importance in order to improve postoperative results and shorten hospital stay [2].

The enhanced recovery after surgery (ERAS) protocol was first described to shorten hospital stays and improve surgical outcomes in patients undergoing colorectal surgery [3]. In order to improve perioperative patient care, the ERAS protocol precludes long-term fasting of the patient before surgery and recommends a carbohydrate-rich diet, a minimally invasive approach instead of wide incisions, avoidance of overhydration, early drain removal, early mobilization, initiation of enteral nutrition on the day of the operation, reduction of use of opioid analgesics and standardizing the use of prophylactic antibiotics [4]. Although the ERAS protocol was first defined for gastrointestinal surgeries in 2001, it has now been used in gynecological, orthopedic, thoracic and urological surgeries [5].

In our study, we aimed to compare the results of the ERAS protocol with the conventional approach in patients who underwent laparoscopic radical prostatectomy.

## 2 Methods

The data of 89 patients who underwent LRP at Kayseri City Hospital Urology Department between 5/5/2018 and 1/4/2021 were 19 patients with incomplete data were excluded from the study. A total of 70 patients who underwent LRP were included in the study. Patients were divided into two; 48 patients in Conventional group and 22 patients in the ERAS group. Age, comorbidities, preoperative PSA level, digital rectal examination findings, preoperative imaging, extra prostatic spread and lymph node involvement, transrectal biopsy pathology, side of tumors, time between biopsy and surgery, performing lymphadenectomy, and radical prostatectomy pathology were recorded for each patient. Charlson comorbidity index (CCI) [6] was used for comorbidities and Gleason

grading system [7] was used for transrectal ultrasound biopsy and prostatectomy specimen. Initiation of enteral feeding, transrectal ultrasound biopsy and prostatectomy specimen histopathological findings, location of tumor, lymphadenectomy status, time to first defecation, duration of antibiotic use, ileus development rate and length of hospital stay (LOS) were compared for both groups. Statement of the ethical approval; ethics approval was obtained from our hospital research and ethics (Kayseri City Hospital Ethics Committee) on 01/04/2021 with serial number of 360.

### 2.1 ERAS protocol

ERAS is the term used to describe the concept of multimodal, perioperative interventions to improve postoperative outcomes [8]. The preoperative period includes the optimization of medical diseases, cessation of alcohol and cigarette consumption, improvement of nutritional status, avoidance of mechanical bowel preparation, avoidance of long fasting periods and carbohydrate loading, avoidance of long-acting agents in pre-anesthetic medication, and thromboembolism prophylaxis. In the intraoperative period, it is necessary to avoid excessive fluid overload, ensure adequate tissue blood supply, prefer minimally invasive approaches, and avoid unnecessary drainage catheter use. Enteral nutrition is started within the first 24 h after surgery. The patient is mobilized as soon as possible and the use of opioid analgesics is avoided [9]. Prophylactic antibiotic applications should be initiated 1 h before the incision and should be stopped 24 h postoperatively. If there are risk factors for the development of infection or if the operation time is longer than 3 h, antibiotic application can be extended up to 72 h postoperatively [10].

### 2.2 Conventional protocol

In the conventional protocol, there are no standard approaches in perioperative patient care. There are differences according to the surgeon and the center.

### 2.3 Statistical analysis

Data were analyzed using the Statistical Package for the Social Sciences (SPSS) for Windows, version 25.0 (IBM SPSS, Armonk, NY, USA). Normal distribution of the continuous variables was analyzed using the Shapiro–Wilk test and histograms. Continuous variables with normal distribution were expressed as mean  $\pm$  standard

deviation (SD). In independent groups, continuous variables with normal distribution were compared using Student's t test. We compared proportions and odds ratio for categorical data using Chi-square test and Fisher's exact test as and when required. A *p* value of <0.05 was considered significant.

### 3 Results

The demographic and clinical characteristics of the patients are given in Table 1. In the postoperative period, enteral feeding was begun in the conventional group in an average of  $2.71 \pm 1.51$  days, while enteral feeding was initiated in the first 24 h postoperatively for all patients in the ERAS group (*p* = 0.00). Ileus developed in 10 (20.8%) patients in the conventional group and 2 (9.1%) in the ERAS group (*p* = 0.195). Use of antibiotics in the postoperative period in the conventional group ( $5.83 \pm 3.62$  vs.  $3.18 \pm 2.42$  days, *p* = 0.003) and LOS ( $7.92 \pm 3.26$  vs.  $5.91 \pm 2, 15$  days, *p* = 0.011) were statistically significantly longer. Comparison of postoperative data is presented in Table 2.

### 4 Discussion

Although the benefits of the ERAS protocol in perioperative patient care in operations such as gastrointestinal surgeries have been well defined, its safety and effectiveness in LRP are not yet clear. In a meta-analysis of 784 patients who underwent LRP it was found that the ERAS protocol shortened the LOS [11]. Similarly, in a study of 301 patients who underwent LRP, it significantly reduced the LOS. In addition, the hospitalization cost was found to be lower for patients who underwent the ERAS protocol [12]. Implementation of the ERAS protocol shortens the LOS due to the standardization of perioperative patient care. It provides shorter hospitalization time and reduces surgical procedure costs [13]. In addition, it has been shown that the drainage tube was removed earlier in patients who underwent the ERAS protocol. In the conventional approach, the removal time of the drainage catheter differs depending on the hospital and surgeon [14]. In our study, we found that the hospital stay was shorter for patients with whom we applied the ERAS protocol, similar to the literature.

**Table 1** Demographic and clinical characteristics of the patients

		Conventional		ERAS		<i>p</i>
		Mean	n	Mean	n	
Age		63.37 ± 7.01		66.36 ± 5.31		0.080
Comorbidity	CCMI < 4		16 (33.3%)		6 (27.3%)	0.414
	CCMI ≥ 4		32 (66.7%)		16 (72.7%)	
Preoperative PSA (ng/L)		10.79 ± 5.57		9.73 ± 5.42		0.457
Digital rectal examination findings	No		20 (41.7%)		10 (45.5%)	0.483
	Yes		28 (58.3%)		12 (54.5%)	
Extraprostatic involvement in preoperative imaging	Not view		2 (4.2%)		0 (0%)	0.557
	No		40 (83.3%)		20 (90.9%)	
Lymph node status	Yes		6 (12.3%)		2 (9.1%)	0.459
	Not viewed		2 (4.2%)		0 (0%)	
Transrectal biopsy specimen Gleason score	Absent		44 (91.7%)		20 (90.9%)	0.206
	Present		2 (4.2%)		2 (9.1%)	
	Gleason = 6		20 (41.7%)		10 (45.5%)	
Location of tumor	Gleason = 7		14 (29.2%)		10 (45.5%)	0.806
	Gleason = 8		8 (16.7%)		2 (9.1%)	
	Gleason > 8		6 (12.5%)		0 (0%)	
	Right		6 (12.5%)		4 (18.2%)	
Time between biopsy and surgery (days)	Left		4 (8.3%)		2 (9.1%)	0.899
	Bilateral		38 (79.2%)		16 (72.7%)	
		70.67 ± 21.19		71.36 ± 21.07		
Lymphadenectomy status						0.154
	Not done		32 (66.7%)		18 (81.8%)	
Radical prostatectomy specimen Gleason score	Done		16 (33.3%)		4 (18.2%)	0.089
	Gleason = 6		12 (25%)		2 (9.1%)	
	Gleason = 7		12 (25%)		10 (45.5%)	
	Gleason = 8		12 (25%)		8 (36.4%)	
	Gleason > 8		12 (25%)		2 (9.1%)	

**Table 2** Comparison of postoperative data of patients

	Conventional		ERAS		p
	Mean	n	Mean	n	
Time of initial enteral feeding (days)	2.71 ± 1.51		1.00 ± .00		0.000
First defecation time (days)	4.75 ± 3.21		3.73 ± 2.12		0.179
Duration of postoperative antibiotic usage (days)	5.83 ± 3.62		3.18 ± 2.42		0.003
Ileus					
No		38 (79.2%)		20 (90.9%)	0.195
Yes		10 (20.8%)		2 (9.1%)	
LOS (days)	7.92 ± 3.26		5.91 ± 2.15		0.011

Minimally invasive approaches have gained popularity recently to reduce postoperative complications in radical prostatectomy. Complications have decreased significantly with advances in surgical techniques and perioperative patient care. New approaches continue to be tried to reduce complication rates [2]. In a meta-analysis performed with 3803 patients who underwent radical prostatectomy, no significant difference was observed between the ERAS protocol and the conventional group in terms of complications [15]. Similarly, the rate of readmission of patients who underwent the ERAS protocol was similar to that of conventional patient care [13].

Standardization of perioperative patient care is very important for the outcomes of major oncological surgery. The benefits of the ERAS protocol are well known, especially in the field of colorectal surgery. Advantages such as rapid recovery after surgery, shortening of LOS and increased intestinal mobility are provided for patients undergoing the ERAS protocol [16]. The development of surgical techniques and minimally invasive approaches in radical prostatectomy shorten the complication rates and surgical recovery times. In addition, perioperative patient care after radical prostatectomy has not yet been standardized, and differences can be observed between centers. The ERAS protocol is a standardized patient care pathway that aims to reduce perioperative surgical stress, shorten the LOS and accelerate recovery. Recently, although there are centers implementing the ERAS protocol for radical prostatectomy, there is no definite consensus about the results [15]. In our study, we found that patients who underwent the ERAS protocol had a shorter LOS, less use of postoperative antibiotics and earlier defecation. Although the rate of ileus development was less in the ERAS group compared to the conventional group, there was no statistically significant difference.

The effectiveness of antibiotic prophylaxis in radical prostatectomy is not yet clear [17]. It is not possible to recommend specific antibiotic regimens for radical

prostatectomy patients. Instead, it would be a more correct approach to decide according to the individual comorbidity and infection risk. After radical prostatectomy, in addition to urinary infection and pelvic abscess, some patients also have the risk of developing endocarditis. Although oral fluoroquinolones can be used until catheter removal, it is recommended to limit intravenous antibiotic prophylaxis to two doses [18]. In a study conducted with 106 patients, it was shown that there was no significant difference in infectious complications between patient groups using antibiotics for 1 day and 4 days [19]. In another study conducted with 229 patients having radical prostatectomy, 60 patients were given antibiotic prophylaxis until the time of catheter removal. Prophylaxis was terminated by giving a single dose of cephalosporin and aminoglycoside 30 min before surgery to the remaining 169 patients. The catheter-related infection rate was found to be similar in both groups (8.3% vs. 8.9%, respectively,  $p=0.89$ ). While the LOS was 5.8 days for patients who received prolonged prophylaxis, it was found to be 4.5 days for patients who received a single dose of prophylaxis ( $p<0.001$ ). Although prolonged antibiotic prophylaxis does not prevent the development of catheter-related infection, it has been shown to prolong hospital stay [20]. In a prospective study with 60 patients, prophylaxis with a single dose of oral fluoroquinolone was administered before radical prostatectomy. In the analysis performed, no significant difference was observed with prolonged prophylaxis in terms of serious infection [21]. In the study conducted by Pinochet et al. with 729 patients, it was concluded that following the removal of the catheter after radical prostatectomy, giving antibiotic prophylaxis for 3 days decreased the frequency of urinary tract infections [22]. Prolonged antibiotic prophylaxis is traditionally used in some centers. Prolonged prophylaxis may lead to an increased rate of nosocomial infections such as *Clostridium Difficile* [23]. In our study, we found that application of the

ERAS protocol shortens the duration of antibiotic use. Although there has been no previous review in the literature in this respect, the fact that the duration of antibiotic use in the traditional approach varies according to clinicians may cause this situation. Standardization of perioperative patient care may prevent unnecessary use of antibiotics.

The term ileus is defined as the absence or reduction of peristalsis of the gastrointestinal tract. Parenteral nutrition may be required in case of prolongation of the clinical condition of ileus with abdominal distension and vomiting [24]. Postoperative ileus, which causes prolonged LOS, can develop in up to 25% of patients in major abdominal surgery [25]. In a retrospective study of 376 gynecological oncology patients who underwent abdominal surgery, a lower rate of postoperative ileus (2.8% vs. 15.7%,  $p < 0.01$ ) was observed in patients who underwent the ERAS protocol [26]. Similarly, in another study conducted with 110 patients who underwent rectal cancer surgery, ileus was found to be less common in patients who underwent the ERAS protocol [27]. On the other hand, in an analysis examining the data of 3,431,602 patients who underwent major oncological procedures, while the rate of ileus was determined as 8.07%, it was observed that application of the ERAS protocol did not provide a significant decrease in the rate of ileus [28]. Fluid overload in the perioperative period increases the rate of ileus by causing intestinal edema. On the other hand, it is necessary to keep the intravascular volume at adequate levels to ensure adequate tissue perfusion. The principle of avoiding excessive fluid overload in the ERAS protocol may prevent the development of ileus [29]. In our study, however, no superiority was found in patients who underwent the ERAS protocol in terms of ileus rate.

Our study was designed retrospectively, and prospective studies in larger patient populations are needed to evaluate the efficacy and safety of the ERAS protocol in radical prostatectomy. Another limitation is that the cost of the operation, complication rates and readmission rates were not evaluated. It remains to be evaluated whether the ERAS protocol shortens the length of stay and increases the readmission rate.

## 5 Conclusions

In summary, our results showed that the ERAS protocol shortened the LOS and the duration of antibiotic use. In terms of ileus development rate and time to first defecation, there was no difference between ERAS and the conventional approach. Randomized prospective studies with heterogeneous and larger patient groups are needed to confirm our findings.

## Abbreviations

PCa: Prostate cancer; PSA: Prostate-specific antigen; LRP: Laparoscopic radical prostatectomy; ERAS: Enhanced recovery after surgery; LOS: Length of hospital stay.

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## Authors' contributions

ASG involved in design, statistical analysis and writing the manuscript; YB participated in follow-up of the patients and writing the manuscript; MAK involved in hypothesis of the study. All authors have read and approved the manuscript.

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## Availability of data and materials

Material and data will be shared if requested by mail from the corresponding author.

## Declarations

### Ethics approval and consent to participate

For the study, approval was obtained from the ethics committee of Kayseri City Hospital with the date 01/04/2021 and number 360. Written consent was obtained from all participants.

### Consent for publication

Not applicable.

### Competing interests

The authors declare no competing interest.

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