

ORIGINAL ARTICLE

Risk factors for postoperative ileus after urologic laparoscopic surgery

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Purpose: Although its incidence has decreased with the widespread use of less invasive surgical techniques including laparoscopic surgery, postoperative ileus remains a common postoperative complication. In the field of urologic surgery, with the major exception of radical cystectomy, few studies have focused on postoperative ileus as a complication of laparoscopic surgery. The present study aims to offer further clues in the management of postoperative ileus following urological laparoscopic surgery through an assessment of the associated risk factors. **Methods:** The medical records of 267 patients who underwent laparoscopic surgery between February 2004 and November 2009 were reviewed. After excluding cases involving radical cystectomy, combined surgery, open conversion, and severe complications, a total of 249 patients were included for this study. The subjects were divided into a non-ileus group and an ileus group. The gender and age distribution, duration of anesthesia, American Society of Anesthesiologists Physical Status Classification Score, body mass index, degree of operative difficulty, presence of complications, surgical procedure and total opiate dosage were compared between the two groups. **Results:** Of the 249 patients, 10.8% (n = 27) experienced postoperative ileus. Patients with ileus had a longer duration of anesthesia (P = 0.019), and perioperative complications and blood loss were all correlated with ileus (P = 0.000, 0.004, respectively). Multiple linear regression analysis showed that the modified Clavien classification was an independent risk factor for postoperative ileus (odds ratio, 5.372; 95% confidence interval, 2.084 to 13.845; P = 0.001). **Conclusion:** Postoperative ileus after laparoscopic urologic surgery was more frequent in patients who experienced more perioperative complications.

Key Words: Urology, Laparoscopy, Complication, Ileus

INTRODUCTION

Postoperative ileus is a frequent complication of abdominal surgery and is defined as temporary impairment in gastrointestinal motility after surgery. Although studies vary in their findings, the readmission rate for postoperative ileus was 10% among the 161,000 cases of major bowel resection listed on the Health Care Financing

Administration database as having been carried out between 1999 and 2000 [1]. An analysis of 17,896 cases of partial large intestinal resection by Iyer and Saunders [2] showed an incidence rate of 17.4% for postoperative ileus and an extension of hospital stay in these cases (13.33 to 13.75 days with postoperative ileus vs. 8.85 to 9.49 days without postoperative ileus; P < 0.001). Ileus is characterized by abdominal distension, lack of bowel sounds,

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nausea, vomiting, accumulation of gas and fluids in the bowel, and delayed passage of flatus and defecation [3]. It is associated with delayed recovery, prolonged hospital stays, reduced patient satisfaction, and increased economic burden.

Postoperative ileus is an inevitable consequence of abdominal surgery, and although the standards for differentiating uncomplicated ileus from pathologic paralytic ileus vary, the majority of studies define the latter as requiring a recovery period of six days or longer [4,5]. The causative factors of postoperative ileus are complex, including responses to surgical trauma, intraoperative complications, various postoperative complications, and postoperative opiate use [6]. In the field of urologic surgery, postoperative ileus is the main complication following radical cystectomy with urinary diversion [7-9]. However, no study to date has examined the causative factors of postoperative ileus in urologic laparoscopic procedures excluding radical cystectomy. In this retrospective study, the authors examined the risk factors for postoperative ileus in urologic laparoscopy, excluding radical cystectomy with urinary diversion

METHODS

The medical records of 267 patients who underwent laparoscopic surgery carried out by the same operator between February 2004, the time of introduction of laparoscopic surgery in our Department, and November 2009 were reviewed. Due to direct manipulation of the ileum required during the procedure, cases of radical cystectomy were excluded. After excluding all cases involving combined surgery with another department, open conversion, and severe complications which had an influence on postoperative management, a total of 249 patients were selected. The patients that were excluded were five patients who were switched to open surgery due to severe adhesions or bowel injury, eight patients whose operations were carried out jointly with the department of general surgery or the department of obstetrics/gynecology, four patients who were transferred to other departments due to severe complications such as gastrointestinal bleed-

ing, angina, adrenal insufficiency or cerebral infarction, and one patient with ileus prior to surgery. All patients were instructed to fast for one day prior to surgery. They were also instructed to ingest polyethylene glycol solution (Colyte, Reed & Carnick, Piscataway, NJ, USA) diluted in 4 liters water and four vials of oral kanamycin the day before surgery. All patients also received one fleet enema and one enema with 500 mL kanamycin-containing fluid.

Postoperatively, ingestion of water was allowed after passage of flatus was observed or after active bowel sounds were heard with a stethoscope. Ingestion of water was followed by progression to soft food and then to solid food. The tolerance of a solid diet was used as the endpoint of observation. Postoperative ileus was defined as cases in which intolerance of a solid diet continued into the sixth postoperative day and beyond, combined with symptoms such as abdominal distension, nausea, and vomiting and findings consistent with obstructive or paralytic ileus on simple abdominal radiographs.

The laparoscopic procedures performed included radical prostatectomy, radical nephrectomy, simple nephrectomy, donor nephrectomy, partial nephrectomy, renal cyst marsupialization, pyeloplasty, nephroureterectomy, adrenalectomy, ureterolithotomy, and partial cystectomy (Table 1). All procedures were carried out through transperitoneal approaches. The level of difficulty was graded from 1 to 6 based on the European Scoring System (Table 2) [10]. The procedures examined in the present study were categorized into pelvic surgeries, which consisted of prostatectomy and partial cystectomy, and nonpelvic surgeries, which consisted of all the other procedures.

Factors thought to be relevant to the incidence and severity of postoperative ileus were assessed and included the duration of anesthesia, patient age, estimated blood loss, body mass index, anesthesia risk score, perioperative complications, and total opiate dosage.

The estimated blood loss was assessed through clinical means, involving weighing of blood-soaked mops and gauze pieces and measurement of blood present in suction bottles [11]. The anesthesia risk score was assessed using the American Society of Anesthesiologists physical status classification system on a scale from 1 to 5 [12].

The duration of anesthesia was defined as the time

Table 1. Characteristics of patients and surgical results

Characteristic	
No. of patients (%)	
Male	148 (59.4)
Female	101 (40.6)
Age (yr)	55.1 ± 15.3 (6-82)
BMI (kg/m ²)	24.3 ± 3.6 (13.29-42.43)
Classification of operation (no. of operations)	
Simple nephrectomy	28
Donor nephrectomy	18
Radical prostatectomy	39
Radical nephrectomy	77
Renal cyst marsupialization	22
Partial nephrectomy	11
Nephroureterectomy	18
Adrenalectomy	5
Pyeloplasty	14
Ureterolithotomy	16
Partial cystectomy	1
Total	249
Surgical results	
Mean anesthetic time (min)	362.1 ± 119.8 (120.0-940.0)
EBL (mL)	240.9 ± 232.6 (0-1,200)

Values are presented as number (%) or mean ± SD (range).

BMI, body mass index; EBL, estimated blood loss.

Table 2. Classification of operative difficulty

ESS	Operation	No. of cases
1	Renal cyst marsupialization	22
2	Ureterolithotomy	16
3	Adrenalectomy	33
4	Simple nephrectomy	109
	Radical nephrectomy	
	Pyeloplasty	
5	Nephroureterectomy	11
	Partial nephrectomy	
6	Donor nephrectomy	58
	Radical prostatectomy	
	Partial cystectomy	

ESS, European scoring system.

elapsed from commencement of operation to reversal of anesthesia. Perioperative complications except postoperative ileus were classified from 1 to 5 according to the modified Clavien classification system [13]. Class 1 was defined as normal postoperative progress requiring no medication and no surgical or radiological intervention. Class 2 was defined as treatment such as medication or transfusion. Class 3 was defined as surgical, radiological, or endoscopic intervention. Class 4 was defined as involv-

ing near lethal complications including central nervous system complications. Class 5 was defined as patient death.

The dosage of opiate used for postoperative pain control was considered to be a crucial factor and was quantified as the amount of fentanyl administered per unit body weight (kg) [4,14,15]. In order to assess the relationship between the incidence of postoperative ileus and the factors examined, Student's t-test, Fisher exact test, and Pearson chi-square test were used. Multiple logistic regression analysis was performed to discern which factors were most relevant. The software package SPSS ver. 17.0 (SPSS Inc., Chicago, IL, USA) was used for statistical analyses, and a P-value of less than 0.05 was considered to indicate statistical significance.

RESULTS

The mean age of the subjects was 55.1 years (range, 6 to 82 years), and the mean body mass index was 24.3 (range, 13.29 to 42.32). The mean duration of anesthesia and the estimated average blood loss were 362 minutes (range, 120 to 940 minutes) and 240.9 mL (range, 0 to 1,200 mL), respectively (Table 1). The mean duration of time elapsed before tolerance of solid food was 4.24 days (range, 2 to 9 days). The number of patients who experienced postoperative ileus was 27 (10.8%). 24 of 27 patients (89%) experienced symptoms such as nausea and abdominal distension following gas passage, while a delay in gas passage and return of bowel sound was observed in the other patient groups. The longest duration of ileus observed was 9 days, and resolution was achieved through conservative management in all patients with ileus.

The risk factors were divided into continuous and categorical variables prior to analysis. Table 3 presents comparisons of continuous variables between the ileus and the non-ileus groups. The estimated blood loss and duration of anesthesia were significantly different between the two groups ($P < 0.05$ for all factors). Table 4 presents comparisons of categorical variables. Modified Clavien classification was significantly different between the two groups ($P < 0.05$). Multiple logistic regression analysis

Table 3. Comparison of risk factors between non-ileus and ileus groups (continuous variable)

Variable	Non-ileus (n = 222, 89.2%)	Ileus (n = 27, 10.8%)	P-value ^{a)}
Age (yr)	54.6 ± 15.5	59.0 ± 13.4	0.169
BMI	24.3 ± 3.7	25.0 ± 2.8	0.309
Blood loss (mL)	226.3 ± 226.2	362.2 ± 255.1	0.004
Fentanyl dose per kg	0.013 ± 0.008	0.016 ± 0.008	0.199
Duration of anesthesia	355.4 ± 118.6	417.9 ± 119.4	0.019

BMI, body mass index.

^{a)}Student's t-test.

Table 4. Comparison of risk factors between non-ileus and ileus groups (categorical variable)

Variable	Non-ileus (n = 222, 89.2%)	Ileus (n = 27, 10.8%)	Total (n = 249, 100.0%)	P-value
ASA classification				
1	29 (13.1)	3 (11.1)	32 (12.9)	0.962 ^{a)}
2	165 (74.3)	21 (77.8)	186 (74.7)	
3	28 (12.6)	3 (11.1)	31 (12.4)	
ESS				
1	59 (26.6)	2 (7.4)	61 (24.5)	0.087 ^{b)}
2	106 (47.7)	17 (63.0)	123 (49.4)	
3	57 (25.7)	8 (29.6)	65 (26.1)	
Modified Clavien classification				
0	170 (76.6)	10 (37.0)	180 (72.3)	0.000 ^{a)}
1	27 (12.2)	9 (33.4)	36 (14.5)	
2	25 (11.2)	8 (29.6)	33 (13.2)	
Transfusion				
No	190 (85.6)	19 (70.3)	209 (84.0)	0.053 ^{a)}
Yes	32 (14.4)	8 (29.7)	40 (16)	
Pelvic surgery	35 (15.7)	5 (18.5)	40 (16)	0.781 ^{a)}
Non-plevic surgery	187 (84.3)	22 (81.5)	209 (84)	

Values are presented as number (%).

ASA classification, American Society of Anesthesiologists physical status classification score; ESS, European scoring system.

^{a)}Fisher exact test, ^{b)}Pearson chi-square.

showed that the modified Clavien classification was an independent risk factor of postoperative ileus (odds ratio, 5.372; 95% confidence interval, 2.084 to 13.845; P = 0.001) (Table 5).

DISCUSSION

While not normally a life-threatening complication, postoperative ileus is responsible for lengthened hospital

Table 5. Multiple logistic regression analysis for predicting risk factors of postoperative ileus

Variable	OR	95% CI	P-value
Duration of anesthesia	1.002	0.998-1.006	0.399
Blood loss	1.002	1.000-1.004	0.057
Modified Clavien classification			
0	Referent		
1, 2	5.372	2.084-13.845	0.001

OR, odds ratio; CI, confidence interval.

stays and is often blamed for escalations in healthcare costs [1]. Although laparoscopic procedures do possess various advantages over open procedures, superiority with respect to postoperative ileus remains under debate. Of the four notable studies on postoperative ileus following laparoscopic surgery considered by the authors during the preparatory phase of this study, two suggest that the laparoscopic approach offers reduced risks of ileus while the other two do not [16-19]. While several studies have dealt with postoperative ileus following radical cystectomy [7-9], no investigation to date has focused on postoperative ileus associated with other urologic laparoscopic procedures. In this study, the authors analyzed the factors associated with postoperative ileus following urologic laparoscopic procedures excluding radical cystectomy. The aim was to devise a set of guidelines for minimizing the incidence of postoperative ileus.

Postoperative ileus is defined as the transient impairment of bowel movement following major surgical procedures [3], and it is widely known to influence in-patient morbidity and mortality [20,21]. While the duration of impairment of bowel movement required to constitute a postoperative ileus varies, studies by several investigators, including Artinyan et al. [4] and Livingstone and Passaro [5] have used a duration of six days to constitute the temporal definition of postoperative ileus. Likewise, the authors of this study used the criterion of a minimum duration of six days in their working definition of postoperative ileus.

In the field of urology, Hollenbeck et al. [22] studied patients who underwent radical cystectomy and found that in patients of advanced age, the risk of postoperative ileus increases by a factor of 1.3 for every decade of life. They al-

so found that the incidence increases significantly in cases lasting six hours or longer, in patients with a past history of respiratory distress, in patients who received transfusions within the first postoperative hours, and when general anesthesia is used as opposed to an epidural block. However, no statistically significant relationship was found between the incidence of postoperative ileus and the American Society of Anesthesiologists physical status classification score [22]. This study identified significant correlations between postoperative ileus and the modified Clavien classification. However, a relationship between postoperative ileus and the total dose of opiates administered, which has been identified in a number of studies [4,14,15], was not confirmed in this study. Opiates were used postoperatively for a maximum duration of 3 days, and the dosage employed was lower than that published in previous studies; these differences may account for the differences in the results. Likewise, a significant relationship was not observed between postoperative ileus and the American Society of Anesthesiologists physical status classification score, European scoring system, or transfusions. The aforementioned studies were carried out several years prior to the present study, and developments in surgical technique during the intervening period and the associated reduction in transfusion rate may have affected the outcome observed in the present study.

In the present study, the procedure for bowel preparation was identical for all patients, so variations in the incidence of postoperative ileus with respect to differences in bowel preparation could not be assessed. Additionally, a nasogastric tube was inserted immediately following induction of anesthesia and was removed just prior to termination, so the relationship between nasogastric intubation and the incidence of postoperative ileus could not be examined. While the effect of early ambulation is still under debate, the influence of ambulation on the incidence of postoperative ileus could not be assessed because the records examined in the present study lacked precise ambulation information.

Aside from the aforementioned shortcomings, we were only able to examine several potential risk factors because this study was retrospective. There are also limitations in generalizing the findings of the present study because all

of the surgical procedures were performed by a single surgeon at one institution. However, the authors of this study believe it is significant that this is the first report to date concerning postoperative ileus following urologic laparoscopy, excluding radical cystectomy. This study shows that the incidence of postoperative ileus increases with the presence of perioperative complications. As such patients tend to have extended hospital stays, provision of sufficient preoperative information to the patient and more focus on treating postoperative ileus are expected to improve patient satisfaction and reduce the lengths of hospital stays.

In conclusion, in the present study, the modified Clavien classification was an independent risk factor of the postoperative ileus. In patients expected to experience perioperative complications, provisions of sufficient information to the patient and improved treatment of postoperative ileus would be helpful in reducing the incidence of postoperative ileus, reducing hospital stays, and improving patient satisfaction.

CONFLICTS OF INTEREST

No potential conflict of interest relevant to this article was reported.

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