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The incidence of postoperative ileus in patients who underwent robotic assisted radical prostatectomy

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Introduction Our aim was to examine the incidence and risk factors of postoperative ileus among patients who underwent robot–assisted radical prostatectomy (RARP).

Material and methods We retrospectively reviewed 239 patients who underwent RARP transperitoneally between February 2009 and December 2011. Patients switched to open surgery were excluded. We defined postoperative ileus as intolerance of a solid diet continued until the third postoperative day and beyond. By Clavien classification, we evaluated the perioperative complications that cause or contribute to postoperative ileus. Similarly, we analyzed the impact of anesthesia risk score on the incidence of postoperative ileus.

Results The study included 228 patients. The mean period to tolerate solid food was 1.24 days. Only 6 patients experienced postoperative ileus, all of whom were treated with a conservative approach. The two groups differed significantly in the duration of abdominal drainage, hospital stay, modified Clavien classification, and the presence of comorbidity diabetes mellitus (P <0.5 for all factors). Multiple logistic regression analysis revealed that diabetes mellitus was an independent risk factor for postoperative ileus.

Conclusions We suggest that diabetes mellitus is an independent risk factor for postoperative ileus in patients undergoing robot–assisted radical prostatectomy.

Key Words: morbidity ‹› postoperative ileus ‹› prostate cancer ‹› robot-assisted radical prostatectomy

INTRODUCTION

Postoperative ileus is a frequent complication of abdominal surgery and is defined as the temporary impairment of gastrointestinal motility after surgery. Despite the advancements in surgical techniques and preoperative care for abdominal pathologies, postoperative ileus is a common complication after abdominal surgery [1]. Although results from studies of postoperative ileus vary, the incidence of postoperative ileus ranges from 5–25%, which prolongs the duration of hospital stay, reduces patient satisfaction, and increases overall costs [2, 3, 4]. Although postoperative ileus is traditionally accepted as a physiological response to abdominal surgery, the causative factors are complex and an exact underlying pathophysiology has not yet been elucidated. However, several etiologies, such as physiologic response to surgical trauma, visceral manipulation, intra– and/or postoperative complications, and postoperative opiate usage, may play a role in its occurrence [5, 6].

In urologic surgery, postoperative ileus is one of the most common postoperative complications, especially following radical cystectomy with urinary diversion [7, 8, 9]. To our knowledge, no study to date has investigated the incidence and predisposing factors for postoperative ileus in patients who have undergone robot–assisted laparoscopic procedures.

Our aim was to examine the incidence and risk factors for postoperative ileus among patients who underwent robot–assisted radical prostatectomy (RARP).

MATERIALS AND METHODS

Study population

The medical records of 239 patients who underwent RARP between February 2009 and December 2011 were retrospectively reviewed. Exclusion criteria included patients switched to open surgery due to severe adhesions, patients with intra–abdominal bleeding or patients with organ injury. All patients were hospitalized one day before surgery.

Surgical technique and early postoperative care

Prior to each procedure, patients received a second–generation cephalosporin with continued administration at least for 24 hours after surgery. Moreover, all patients received Fleet enema by rectal route before the operation. All RARPs were performed transperitoneally with a 4–arm robot (da Vinci Surgical System, Intuitive Surgical, Sunnyvale, CA, USA) with 1 assistant port for a total of 5 ports used for the procedures. Postoperative pain management included oral non–steroidal analgesics. Urethral catheters were removed between days 7 to 21 postoperatively due to the cystographic findings. Postoperatively, ingestion of water was allowed after the return of active bowel sounds on auscultation (2–5 times per minute) or passage of flatus. Afterwards, the nutrition of the patients was gradually progressed from soft to solid food. The tolerance of a solid diet was used as the endpoint of the observation.

Main outcome measures

We defined postoperative ileus as intolerance of a solid diet, continued until the postoperative 3rd day and beyond. Intolerance is defined as the presence of nausea and vomiting, abdominal distension at physical examination and simple abdominal radiograph findings consistent with obstructive or paralytic ileus [10, 11]. We assessed factors relevant to the incidence and severity of postoperative ileus, including patients' age, body mass index (BMI), comorbidities (e.g. hypertension, diabetes mellitus type 2, chronic obstructive pulmonary disease, coronary artery disease, hyperlipidemia), intraoperative and/or postoperative blood transfusion, duration of operation and anesthesia, estimated blood loss (EBL), duration of intra–abdominal drainage, and hospital stay. In addition, we evaluated the perioperative complications by Clavien classification [12]. Complications that may cause or contribute to postoperative ileus were classified from 1 to 5 according to the modified Clavien classification system. Class 1 was defined as normal postoperative progress requiring no medication and no surgical or radiological intervention. Class 2 was defined as requiring medication and/or transfusion. Class 3 was defined as surgical, radiological, or endoscopic intervention. Class 4 was defined as involving near lethal complications, including central nervous system complications. Class 5 was defined as the death of a patient. Similarly, anesthesia risk score was assigned according to the American Society of Anesthesiologists (ASA) physical status classification system and its impact on the development of postoperative ileus was determined [13].

Data analysis

Statistical comparisons included the student's t–test, Fisher's exact test and Pearson chi–square tests. Multiple logistic regression analysis allowed identification of the relevant factors. We used SPSS 17.0 (SPSS Inc., Chicago, IL, USA) for statistical analyses, with a P value <0.5 considered statistically significant.

Table 1. *Comparison of risk factors between non–ileus and ileus groups*

Variable	Non–ileus (n=222)	Ileus (n=6)	Total (n=228)	P–value*
Age (year)	61.44 ±6.27	59.83 ±8.81	61.40 ±6.33	0.865
BMI	26.80 ±2.88	25.65 ±2.82	26.76 ±2.88	0.514
tPSA	8.73 ±6.03	9.93 ±4.79	8.77 ±5.99	0.308
fPSA	1.25 ±1.04	1.93 ±1.97	1.27 ±1.07	0.403
Gleason score	6.40 ±0.82	6.60 ±0.89	6.40 ±0.82	0.629
Mean operation time (min)	164.72 ±66.93	174.16 ±74.92	164.97 ±66.98	0.613
Mean anesthetic time (min)	176.35 ±68.79	182.50 ±78.15	176.51 ±68.86	0.723
EBL (mL)	201.63 ±178.96	251.73 ±113.89	207.31 ±146.61	0.665
Drain time	3.03 ±2.98	8.20 ±6.79	3.14 ±3.17	<0.0001
Hospitalisation	4.18 ±2.65	8.83 ±4.26	4.30 ±2.79	<0.0001

*Student's t–test. BMI – body mass index, tPSA – total prostate specific antigen, fPSA –free prostate specific antigen, EBL – estimated blood loss

RESULTS

The study included 228 patients with the mean age of 61.4 ±6.3 years (range 43–74). Table 1 and 2 display patient characteristics. The mean duration to tolerate solid food was 1.24 days (range: 1 to 6 days). Only 6 patients (2.6%) experienced postoperative ileus and were treated conservatively (i.e. nasogastric tube placement, mobilization). Three of these 6 patients in the ileus group (50%) experienced anastomotic leakage, which developed in 24 of total 228 patients (10.5%), and all resolved spontaneously (Clavien 1). Two of the 6 patients developed haematuria (33.3%), while one of these patients (16.6%) also developed anastomotic leakage and fewer, resolved spontaneously (Clavien 1).

Table 2. *Comparison of risk factors between non–ileus and ileus groups*

Variable	Non–ileus (n=222) n (%)	Ileus (n=6) n (%)	Total (n=228) n (%)	p–value*
ASA classification				
1	31 (14.0)	1 (16.7)	32 (14.0)	0.884
2	183 (82.4)	5 (83.3)	188 (82.5)	
3	8 (3.6)	–	8 (3.5)	
Comorbidity				
Yes	90 (40.5)	3 (50)	93 (40.8)	0.690
No	132 (59.5)	3(50)	135 (59.2)	
HT				
Yes	82 (36.9)	3 (50)	85 (37.3)	0.514
No	140 (63.1)	3(50)	143 (62.7)	
DM				
Yes	35 (15.8)	5 (83.3)	40 (17.5)	**0.010**
No	187 (84.2)	1 (16.7)	188 (82.5)	
COPD				
Yes	12 (5.4)	–	12 (5.3)	1.000
No	210 (94.6)	6 (100)	216 (94.7)	
CAD				
Yes	28 (12.6)	–	28 (12.3)	1.000
No	194 (87.4)	6 (100)	200 (87.7)	
HL				
Yes	6 (2.7)	–	6 (2.6)	1.000
No	216 (97.3)	6 (100)	222 (97.4)	
Intraoperative transfusion				
Yes	11 (5.0)	–	11 (4.8)	1.000
No	211 (95.0)	6 (100)	217 (95.2)	
Postoperative transfusion				
Yes	11 (5.0)	–	11 (4.8)	1.000
No	211 (95.0)	6 (100)	217 (95.2)	
Modified Clavien classification				
1	153 (68.9)	–	153 (67.1)	**<0.0001**
2	29 (13.1)	6 (100)	35 (15.4)	
3	15 (6.8)	–	15 (6.6)	
4	21 (9.5)	–	21(9.2)	
5	4 (1.89)	–	4 (1.8)	

*Chi–square test; ASA – American Society of Anesthesiologists (physical status classification system); HT – hypertension, DM: diabetes mellitus, COPD: chronic obstructive pulmonary disease; CAD – coronary arterial disease; HL – hyperlipidemia

Table 3. *Multiple logistic regression analysis for predicting risk factors of postoperative ileus*

Variable	OR	95% CI	p–value
Diabetes mellitus (+/–)	36.96	2.10–649.560	0.014
Modified Clavien classification(0/≥1)	8.11	0.00–10.13	0.995
Drain time	1.165	0.87–1.56	0.657
Hospitalisation	0.04	0.781–1.480	0.993

OR – odds ratio; CI – confidence interval

There was no statistically significant difference in patients' age, BMI, total and free serum prostate specific antigen (PSA) levels, preoperative Gleason scores, ASA scores, duration of operation and anesthesia times, EBL, or perioperative and postoperative transfusion rates. The duration of abdominal drainage, hospital stay, modified Clavien classification, and the existence of the comorbidity diabetes mellitus were significantly different between the two groups (P <0.05 for all factors). Multiple logistic regression analysis revealed that diabetes mellitus was an independent risk factor of postoperative ileus (odds ratio 36.96; 95% confidence interval, 2,10 to 649.5613.845; P = 0.014; Table 3).

DISCUSSION

Postoperative ileus is the transient impairment of bowel movement following major surgical procedures, or the retardation of normal bowel activity to the uncoordinated motility of gastrointestinal system in this period [14, 15]. Though not a life–threatening complication, it is the most common problem requiring prolonged hospitalization after major urologic surgeries, such as radical prostatectomy [16]. It also raises healthcare costs [2]. There are several mechanisms that play a role in the pathophysiology of postoperative ileus. Potential contributing factors include responses to the surgical trauma and perioperative care [17–20]. Generally, functions of small intestine normalize within several hours after surgery [21, 22]. However, this period extends up to 24 to 48 hours for the stomach, and a couple of days for the colon [21, 23, 24].

The point at which postoperative ileus becomes abnormally prolonged has not been clearly established. Ileus normally resolves within approximately 4 days after an abdominal surgical procedure; however, it may last 2 days or less following laparoscopic surgery and may continue more than one week after major laparotomies [25]. Although the standards to distinguish uncomplicated ileus from pathologic paralytic ileus vary, studies by several investigators defined an "uncomplicated ileus" as one that lasts 3 days or less and a "pathologic paralytic ileus" (or "prolonged ileus") that lasts more than 3 days after surgery [11]. Several investigators used the duration of six days to constitute the temporal definition of postoperative ileus; however, this study used the criterion of a minimum duration of 3 days to define postoperative ileus [11, 17].

Although minimally invasive surgical approaches offer several potential advantages compared to open surgery, superiority with respect to postoperative ileus remains debated. While several investigators studied postoperative ileus following radical cystectomy and urologic laparoscopic procedures, no investigation focused on the incidence of postoperative ileus following robotic surgery [5, 7, 8, 9, 26]. Pierorazio et al. [27] studied perioperative morbidity in open and minimal invasive radical prostatectomy operations and found an increased rate of ileus in patients undergoing RARP compared with open and laparoscopic techniques. This may be related to the transperitoneal approach that alters peritoneal integrity with abdominal CO^2 insufflation and a steep Trendelenburg position. Moreover, irritation from extravasated urine, where a urine leak was present, may be another reason for this situation.

Kim et al. demonstrated that the modified Clavien classification is an independent risk factor for postoperative ileus in patients who underwent urologic laparoscopic surgery [25]. Significant associations exist between ileus and advanced age, duration of the operation, previous history of respiratory distress, transfusions within the first postoperative hours, and type of anesthesia [28].

In our study, we determined a 2.6% incidence of postoperative ileus, and diabetes mellitus was an independent risk factor for this condition. Normal bowel function requires the coordination of motility, mucosal transport, and evacuation reflexes with the integrated process of the electrophysiological activity of smooth muscle cells, neural input from the intrinsic and autonomic nervous systems, hormonal interactions, and coordinated smooth muscle contraction [11, 29, 30]. Diabetes mellitus may negatively affect these neurogenic, inflammatory and hormonal mechanisms. Similarly, increased blood loss can potentially lead to a greater traumatic sympathetic and endocrine stress response, which, in turn, may inhibit gastrointestinal transit [17]. In this study, the relationship between postoperative ileus and EBL was not confirmed. The lesser blood loss and reduced transfusion rate associated with robotic surgery may have affected the outcomes of the present study. Additionally, we did not observe significant relationships between postoperative ileus

and age, ASA score, or Clavien classification, possibly due to the lack of a wide deviation in the age, comorbidities and complications of the patients who underwent RARP.

Since no patients received narcotic analgesics, the relationship between postoperative ileus and the total dose of opiates administered, which has been identified in a number of studies, could not be assessed in our study [15, 17, 31]. Moreover, the procedure for bowel preparation was identical for all patients; therefore, variations in the incidence of postoperative ileus with respect to differences in bowel preparation could not be assessed.

To our knowledge, this is the first study to report the risk factors for ileus following RARP, which demonstrated an increased incidence in patients with diabetes mellitus. Since diabetic patients tend to have extended hospital stays, provision of sufficient preoperative information to the patient and focus on postoperative ileus treatment is expected to improve patient satisfaction and reduce the length of hospital stays.

CONCLUSIONS

Diabetes mellitus is an independent risk factor for postoperative ileus in patients undergoing RARP. Taking additional precautions for diabetic patients prior to surgery may be helpful in reducing the incidence of postoperative ileus, resulting in reduced hospital stays and improved patient satisfaction.

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