

Bowel Complication during Robotic-assisted Laparoscopic Radical Prostatectomy

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Abstract. *Background: Bowel injury is a devastating complication of radical prostatectomy. The incidence and management of bowel injury occurring during robot-assisted laparoscopic radical prostatectomy (RALP) performed at our institution was reviewed. Patients and Methods: Only three (1.04%) out of 288 RALPs performed at our institution between December 2005 and May 2011 were complicated by bowel injury. The mean patient age was 71 years (range 67 to 79) and mean prostate specific antigen was 19.6 ng/ml (range 6.4 to 30.6). All three patients had received transurethral resection of prostate (TURP) before RALP. Clinical stages were T1b, T1c, T2c, respectively. The mean preoperative Gleason score was 6.7 (range 6 to 7). The mean operative time was 201 minutes (range 170 to 240). Results: Two of the intraoperative injuries were diagnosed and repaired intraoperatively and one was diagnosed postoperatively. In the two cases of intraoperative diagnosis and repair, one patient healed primarily without colostomy and a recto-urinary fistula was evidenced by pneumaturia in the other. That patient underwent a failed fistula repair and required colostomy. The patient with unrecognized bowel injury presented with atypical acute abdomen and required laparotomy and colostomy. No perioperative mortality occurred in these three cases. Conclusion: Bowel injury during RALP can be managed intraoperatively; unrecognized bowel injury may present with atypical acute abdomen and dissemination of the presentation and management of bowel injury, and modifications to avoid complications might help to produce improved outcomes in RALP.*

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Key Words: Bowel injury, laparoscopic radical prostatectomy, LRP, prostatic neoplasm, rectal injury, robotic-assisted laparoscopic prostatectomy, RALP, robotics.

Since the first description of laparoscopic radical prostatectomy (LRP) by Schuessler *et al.* in 1992 (1), and the subsequent diffusion of the Montsouris technique by Guillonnet and Vallancien (2), the technique has been adapted for use with the da Vinci® robotic system (Intuitive Surgical, Sunnyvale, CA, USA). The advantages of surgical robotics include three-dimensional visualization, increased degrees of freedom with instrument movement and absence of the fulcrum effect of conventional laparoscopy. The use of the da Vinci® robot has permitted the execution of robotic-assisted laparoscopic prostatectomy (RALP) worldwide since 2000 (3-5).

Rectal injury is a potential complication of open radical prostatectomy with an incidence of 0.5 to 9% (6-8) and is always a source of concern. The opening of the bowel during prostatectomy converts the surgery from clean to a contaminated wound. Therefore, the risk of septic complications increases, including wound infection, pelvic abscess, peritonitis, recto-urinary fistula and even death.

The management strategies for bowel injury include extensive preoperative bowel preparation, perioperative and postoperative antibiotics, colostomy, and/or primary repair, with or without omental interposition between the rectum and vesicourethral anastomosis (9). The incidence and management of bowel injury in 288 cases of consecutive RALP performed at our institution was retrospectively reviewed.

Patients and Methods

Patients. Among 288 RALPs performed by a single surgeon (YC Ou) between December 2005 and May 2011, three (1.04%) were complicated by bowel injury. Data were collected regarding the patients' preoperative characteristics, operative course and postoperative outcome and are summarized in Table I.

According to our preoperative protocol, all the patients had undergone preoperative bowel preparation consisting of a clear liquid diet the day before surgery and a Fleet's enema the night or morning before surgery. A single dose of intravenous first-generation cephalosporin had been administered before surgery.

Surgical details. RALP was carried out after a minimum 12 weeks after TURP and was performed as previously described (10), using Patel's technique with minor modifications (11). A three-arm

Table I. Preoperative characteristics, operative course, and postoperative outcome in 3 patients experiencing bowel injury during robotic-assisted laparoscopic prostatectomy.

Case/Sequence	Case 1/No. 81	Case 2/No. 125	Case 3/No. 128
Age (years)	79	67	67
BMI (kg/m ²)	21.1	26.5	22.8
ASA score	II	II	II
PSA (ng/mL)	22	6.44	30.57
Previous TURP	yes	yes	Two sets of negative TRUS biopsies; diagnosed confirmed by TURP
Stage clinical/pathological	cT1b/pT2cN0M0	cT1c/pT3aN0M0	cT2c/pT3aN0M0
Gleason score	4+3=7	3+4=7	3+3=6
D'Amico risk classification	High risk	Intermediate risk	High risk
Operative time	4 hours	2 hours 50 minutes	3 hours 15 minutes
Blood loss	150 ml	200 ml	150 ml
Bowel injury	Rectum	Sigmoid colon	Rectum
Diagnosis	Intraoperative repair	Unrecognized	Intraoperative repair
Complications	None	Peritonitis Bowel resection, Colostomy	Rectourethral fistula Colostomy Perineal repair

BMI: body mass index, ASA: American Society of Anesthesiology, PSA: prostate specific antigen, TRUS: trans-rectal ultrasound, TURP: trans-urethral resection of prostate.

approach with five trocars (cases 7-134) and a four-arm approach with six trocars (cases 1-6 and cases 135-288) were used. Dissection of the bilateral pelvic lymph nodes (BPLND) was usually performed. Neurovascular bundle (NVB) preservation procedures were performed according to the preoperative tumor status and the patient's preference. Preservation of NVB was carried out using the VIP technique (4). Urethrovesical anastomosis using two 18-cm 3-0 Monocryl continuous stitches was conducted. An 18-French silicon Foley catheter with a 10-mL balloon was used. Next, intraoperatively the urinary bladder was injected with 200 mL normal saline to confirm watertight anastomosis.

According to our protocol, once a rectal injury was detected intraoperatively by laparoscopic viewing, the prostatectomy was completed and the prostate placed in an EndoCatch bag. Repair of the defect was performed in two layers before vesico-urethral anastomosis, as described by Guillonnet *et al.* (12). The defect was clearly identified and the rectal mucosa and muscular layer of the rectal wall were perfectly individualized. The rectal wall was closed in two layers giving particular attention to the edges of the defect. The inner mucosal and outer seromuscular layers were closed with continuous sutures with a 3-zero polyglactin, tied extra-luminally. The integrity of the repair was checked by filling the pelvic operative field with saline and introducing a rubber catheter through the rectum; then air was insufflated while looking for bubbles in the saline-filled pelvic cavity.

Broad-spectrum intravenous antibiotics (ampicillin, gentamicin and metronidazole) were given for 24 hours postoperatively. The patients resumed oral intake the next day. On postoperative day two, the drain was removed and the patients discharged from the hospital. The urethral catheter was removed at one week if no evidence of anastomosis leakage was present.

Results

Among the 288 cases reviewed, the three injuries occurred in cases # 81, 125, 129, with none observed in the first 50 patients. The mean patient age of the injury cases was 71 years (range 67 to 79) and the mean prostate specific antigen was 19.6 ng/ml (range 6.4 to 30.6). The mean preoperative Gleason score was 6.7 (range 6 to 7) and clinical stages were T1b, T1c and T2c, respectively. None of these three patients had received previous surgery for other abdominal pathology, nor had any of them received preoperative radiotherapy or neoadjuvant hormonal therapy. All three patients had received transurethral resection of prostate (TURP) before RALP. The mean operative time was 201 minutes (range 170 to 240). There was no perioperative mortality.

In these three patients, two rectal injuries were detected and repaired intraoperatively, and the other injury was unrecognized during the operation. The two intraoperatively-detected injuries occurred during dissection of the plane of Denonvilliers fascia near the prostatic apex and the division of the rectourethral muscle. The size of the rectal tear was no more than 2 cm in both cases. In these two patients, one had an uneventful course and was discharged on the 3rd post-operative day without wound infection or rectourethral fistula. However, late rectourethral fistula developed in the other patient and required prolonged urethral catheterization, colostomy, perineal repair and subsequent colostomy takedown.

Table II. Rectal injury during laparoscopic radical prostatectomy (LRP), extraperitoneal laparoscopic radical prostatectomy (ELRP) and robot-assisted radical prostatectomy (RALP).

Investigator (ref.)	Technique	Patients	Rectal injuries (%)	Bowel preparation	Immediate colostomy	Delayed colostomy	Complications (n)
Guillonneau <i>et al.</i> (12)	LRP	1000	13 (1.3)	No	0	3	Fistula (1)
Pelvic abscess (1)							
Türk <i>et al.</i> (13)	LRP	125	3 (2.4)	NR	0	0	None
Rassweiler <i>et al.</i> (14)	LRP	438	3 (0.7)	NR	0	2	None
Katz <i>et al.</i> (15)	LRP	300	6 (2.0)	Yes	1	1	Fistula (1)
Artibani <i>et al.</i> (16)	LRP	71	2 (2.8)	NR	0	0	None
Blumberg <i>et al.</i> (17)	LRP	200	2 (1)	Yes	0	0	Fistula(1)
Castillo <i>et al.</i> (18)	ELRP	110	9 (8.0)	Yes	0	6	Fistula (6)
Poulakis <i>et al.</i> (19)	ELRP	255	3 (1.2)	NR	NR	NR	Fistula (1)
Eden <i>et al.</i> (20)	ELRP	100	1 (1)	NR	NR	NR	NR
Stolzenburg <i>et al.</i> (21)	ELRP	900	6 (0.7)	NR	0	1	Fistula (1)
Hu <i>et al.</i> (22)	LRP	358	9 (2.5)	NR	1	4	Fistula (7)
	RALP	322	0	NR			
Mennon <i>et al.</i> (23)	RALP	1100	2 (0.2)	Yes	0	0	None
Yee <i>et al.</i> (24)	RALP	251	2 (0.8)	Yes	0	0	None
Present series	RALP	288	3 (1.04)	Yes	0	2	Peritonitis (1), Fistula (1)
Total		5751	64 (1.1)		2	19	Fistula (19) Pelvic abscess (1) Peritonitis (1)
			64	Colostomy: 32%			

NR: not recorded.

In the patient whose rectal injury was missed intraoperatively, abdominal distension, decreased urine output and elevated serum creatinine level (from 1.0 to 2.3 mg/dL) was noted on the 1st postoperative day. A cystogram disclosed no evidence of urine leakage. The diagnosis was made after the development of postoperative peritonitis (low grade fever, abdominal distention, periumbilical tenderness). Computerized tomography demonstrated multiple intraabdominal abscesses in the pelvis. In the exploratory laparotomy on the 17th postoperative day, multiple abscesses were found between the bowel loops with severe adhesions of the pelvic cavity. The sigmoid colon was resected with Hartmann's colostomy.

Discussion

Rectal injury remains a feared complication of radical prostatectomy even though incidence is relatively infrequent. In large series' of LRP, incidence of rectal injury was reported as 0.7%-8% and was only 0.2% in a recent RALP series (Table II) (12-24). Most injuries occurred during the early cases while the surgeon was still within the learning curve (18). The incidence of bowel injury found in the present series of RALP was 1.04%, which was slightly higher than more recent reports. Moreover, the bowel complications in this series occurred in the later cases (cases # 81, 125, 129). In our previous report of the first 100 cases of RALP (25), the continence rate and the potency rate

improved with experience. The percentage of high-risk patients was higher in the present population (58% pT3 disease with a mean preoperative PSA around 16 ng/ml) according to the D'Amico classification and the disease stage of locally advanced tumors was associated with bowel injury in our series.

The risk factors for rectal injury include periprostatic fibrosis, previous prostate or rectal surgery, radiotherapy, previous hormonal therapy and infection (26, 27). The disease stage of locally advanced tumors can also result in a difficult dissection and might result in rectal injury during dissection of the ill-defined plane between the prostate and rectum. In addition, non-nerve-sparing prostatectomy may also contribute to rectal injury due to the dissection plane being closer to the rectum and possible over confidence while performing a "simpler" operation than nerve-sparing prostatectomy (10). The prostate weight, however, does not seem to have an impact on the incidence of rectal injury (24).

Yee *et al.* (24) in a series of 251 consecutive patients with RALP reported that two (0.8%, cases # 140 and 149) had rectal injury less than 2cm. Both rectal injuries were detected intraoperatively and treated robotically by closing with two layers of absorbable sutures and imbricating with a nonabsorbable suture. An omental flap was developed and tacked posterior to the urethra to cover the repair. These patients had an uneventful course without wound infections and late rectourethral fistula. According to Katz *et al.* (15),

rectal injury in LRP and RALP usually occurs during transection of the rectourethralis muscle and development of the rectal-prostatic plane and are disclosed near the apex and rectourethralis muscle.

To prevent rectal injury in RALP, dissection of the prostatic apex should be made carefully and sharply with cold scissors by dividing the recto-urethral muscle from the posterolateral angle while the assistant holds the rectum posteriorly with a suction irrigation tip. Also, adequate incision of the posterior layer of Denovillier's fascia is required to avoid entry into the perirectal fat after completing dissection of both seminal vesicles.

In cases with bowel injury unrecognized intraoperatively, thermal tissue damage from the harmonic scalpel, Ligasure™ device, arcing of the monopolar current or inadvertent damage while changing instruments may play a role (18, 22). The rectal defect may have been temporarily sealed off by the thermal device, making it undetectable.

Bowel injury following laparoscopic surgery may have an unusual presentation and devastating sequelae, especially if unrecognized intraoperatively. Ileocolonic injuries may present postoperatively as primarily ileus, abdominal distention and absent peritoneal signs. Failure to recognize and promptly treat a bowel injury results in a high rate of mortality up to 3% (28) and morbidity. If atypical acute abdomen develops postoperatively, prompt computerized tomography and immediate surgical exploration are the critical actions.

Most investigators concur that antibiotic therapy, a low fiber diet and anal dilation may help the healing of a rectal injury in early postoperative care. However, it remains debatable whether managing rectal injury during prostatectomy requires fecal diversion, rectal repair and interposition of healthy fat flap between the rectal repair and vesicourethral anastomosis. In the past, a diverting colostomy was recommended; today, however, primary repair without a diverting colostomy is advocated in most cases. According to the LRP and RALP literature RALP reviewed here, the overall percentage of colostomy applied in cases with rectal injury was only 32%. A diverting colostomy was reserved for cases of previous radiotherapy, inadequate repair, a tense suture line, poor tissue quality, a history of radiation to the pelvis, or significant fecal contamination in the field (17, 26).

Preoperative preparation is also helpful to in reducing bowel injuries, including preoperative group education, operative complication explanation, adequate bowel preparation and antibiotics. However, we believe that the best treatment of bowel injury is injury prevention with intraoperatively meticulous trocar setting, careful dissection, cutting, suturing, and using the thermal device and instrumentation. Complete DVD records of each case are also necessary to retrospectively indentify problems in patients with bowel injury missed intraoperatively.

Bowel injury during RALP is uncommon but can lead to severe postoperative complications. It can be managed robotically with early identification and two-layer rectal wall closure. The best treatment is injury prevention. Unrecognized bowel injury may have atypical presentation. Dissemination of the presentation and management of bowel injury, and modifications to avoid complications might help to produce improved outcomes in RALP.

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