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Original article

A comparative study of laparoscopic and robotic assisted radical prostatectomy performed by a single surgeon

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ABSTRACT

Objective: To present the transition from laparoscopic radical prostatectomy (LRP) to robotic-assisted laparoscopic radical prostatectomy (RALP) over 10 years in a medium volume center by a single surgeon.
Materials and methods: We retrospectively reviewed 140 prostate cancer patients who underwent LRP (100 patients) or RALP (40 patients) between May 2005 and May 2015. Preoperative parameters included age, body mass index, and serum prostate specific antigen. Operative course parameters included operative time, estimated blood loss, intraoperative blood transfusion, conversion to open surgery, hospitalization days, duration of Foley catheterization, and complications. Pathological stage, surgical margin status, biochemical recurrence (BCR) rate, and continence rate at 12 months after surgery were reviewed and compared between the LRP and RALP groups.
Result: The operative outcomes revealed significantly less blood loss (143 mL vs. 306 mL, $p < 0.001$), shorter hospital stay (6.9 days vs. 8.7 days, $p = 0.006$), and shorter duration of Foley catheterization (9.3 days vs. 11.3 days, $p < 0.001$) in patients who underwent RALP. Major perioperative complications occurred in four LRP patients (4%), and none were observed in RALP patients. LRP and RALP had similar positive surgical margin rates ($p = 0.285$) and BCR rates ($p = 0.88$). RALP resulted in better continence recovery than LRP (55% vs. 82.5%, $p = 0.003$).
Conclusion: Patients who underwent RALP had better perioperative and functional outcomes. Oncologic outcomes were similar compared to patients who underwent LRP.

1. Introduction

Laparoscopic radical prostatectomy (LRP) was first performed in 1992.[1] However, it was not widely adopted because of the difficult technique and longer operative times when compared to conventional retropubic prostatectomy. The procedure gained attention again in 2000 owing to a modified technique introduced by Guillonneau and Vallancien[2] and Abbou et al,[3] which resulted in markedly decreased operative time and hospital stay. Robotic assisted laparoscopic radical prostatectomy (RALP) was first introduced in 2000.[4] The three-dimensional display and wristed instrumentation provide a better surgical experience. RALP rapidly gained popularity as an increasing number of studies confirmed the efficacy and safety of this procedure.

LRP has been performed at the Mackay Memorial Hospital since 2005, and we started to perform RALP with the da Vinci Si system (Intuitive Surgical, Sunnyvale, CA, USA) in 2010. In this study, we present the experience of a single surgeon with laparoscopic and robotic-assisted radical prostatectomy in a medium volume center.

2. Materials and methods

We retrospectively reviewed 140 consecutive patients with clinically localized and locally advanced prostate cancer who underwent radical prostatectomy between May 2005 and May 2015. None of the patients had a history of pelvic surgery and all patients underwent computed tomography or magnetic resonance imaging before surgical intervention. None of the patients had clinical

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evidence of lymph node or bone metastasis. One hundred patients underwent LRP and 40 patients underwent RALP. The preoperative parameters included age, body mass index (BMI), serum prostate specific antigen (PSA), and clinical stage. The primary procedures were performed by a single surgeon. For the LRP procedure, a transperitoneal posterior approach was used in the first 30 patients, with dissection of the seminal vesicles and vas deferens through the vesicorectal pouch. An anterior approach with dissection of the seminal vesicles after transecting the bladder neck was used in the subsequent 70 patients. In all 100 patients, standard monofilament sutures were used for urethrovesical anastomosis as described by Van Velthoven et al.[5] For the RALP procedure, the transperitoneal approach generally followed the Vattikuti Institute prostatectomy technique.[6] The operative parameters included operative time, estimated blood loss, intraoperative blood transfusion, and conversion to open surgery. The operative time was defined as the time from the start of dissection to the end of wound closure. Data on the estimated blood loss and need for intraoperative blood transfusion were obtained from the anesthesiology records. Postoperative Foley catheterization time was approximately 10 days. Cystography was not performed unless urinary leakage was suspected. Major perioperative complications were defined as Clavien-Dindo classification Grade III or above that required surgical or endoscopic reintervention.

Pathological stage, specimen Gleason score, surgical margin status, and postoperative PSA were recorded. We used the seventh edition (2010) of the American Joint Committee on Cancer staging system for clinical and pathological staging. Biochemical recurrence (BCR) within 12 months after surgery was defined as a rise in PSA to $\geq$ 0.2 ng/mL during the first year of follow up. Continence was defined as no need for pad use at 12 months after surgery.

The data were analyzed by IBM SPSS Statistics 22.0 (IBM Corp., Armonk, NY, USA). Differences between groups were analyzed using the t-test and Chi-square test with $p < 0.05$ considered statistically significant.

3. Results

The clinicopathological features are shown in Table 1. There was no significant difference in mean age, BMI, preoperative PSA, and specimen Gleason score between patients who underwent LRP and RALP. The perioperative outcomes are shown in Table 2. The mean operative time was 331.8 minutes for patients who underwent LRP and 353.1 minutes for patients who underwent RALP ($p = 0.079$). Patients who underwent RALP had significantly less estimated blood loss (143 mL vs. 306 mL, $p < 0.001$), a shorter hospital stay (6.9 days vs. 8.7 days, $p = 0.006$), and shorter duration of Foley catheterization (9.3 days vs. 11.3 days, $p < 0.001$) compared to those who underwent LRP. Five patients who underwent LRP required intraoperative blood transfusion. There were no conversions to open surgery.

Table 1
Clinicopathological features.

	Total ($n = 140$)	LRP ($n = 100$)	RALP ($n = 40$)	p
Age, y	64.7 ± 6.1	64.5 ± 5.9	65.2 ± 6.5	0.352
BMI, kg/m^2	24.6 ± 3.2	24.8 ± 2.9	24.4 ± 3.3	0.851
Preoperative PSA, ng/mL	16.3 ± 19.0	16.4 ± 20.6	15.9 ± 14.2	0.809
Clinical T stage				
T1	74 (52.9%)	49 (49%)	25 (62.5%)	
≥T2	66 (47.1%)	51 (51%)	15 (37.5%)	
Pathological T stage[a]				
T2a–c	86 (63.2%)	60 (62.5%)	26 (65%)	
T3–4	50 (36.8%)	36 (37.5%)	14 (35%)	
Specimen Gleason score	6.8 ± 1.0	6.7 ± 1.1	6.9 ± 0.8	0.26

Data are presented as mean ± SD or *n* (%).
BMI = Body Mass Index; LRP = laparoscopic radical prostatectomy; PSA = prostate specific antigen; RALP = robotic-assisted laparoscopic radical prostatectomy.
[a] Four patients diagnosed via transurethral resection of the prostate showed no residual tumor in the specimen after LRP.

Table 2
Perioperative outcomes.

	LRP	RALP	p
Mean operating time, min	331.8 ± 70.6	353.1 ± 74.3	0.079
Mean estimated blood loss, mL	306.3 ± 177.9	143.1 ± 119.2	<0.001*
Intraoperative blood transfusions	5 (5%)	0 (0%)	0.321
Conversions to open surgery	0 (0%)	0 (0%)	
Mean hospitalization days	8.7 ± 3.8	6.9 ± 2	0.006*
Mean duration of Foley catheterization, d	11.3 ± 4.6	9.3 ± 1.9	<0.001*

Data are presented as mean ± SD or *n* (%).
*Indicates statistical significance.
LRP = laparoscopic radical prostatectomy; RALP = robotic-assisted laparoscopic radical prostatectomy.

No surgical mortality occurred. Major postoperative complications occurred in four LRP patients (Table 3). Rectal injury occurred in two patients. One of these patients had rectal laceration identified intraoperatively, and immediate repair and temporary intestinal diversion by colostomy were performed. The other patient developed a recto-vesical fistula two weeks after the operation and required intestinal diversion by colostomy. Because of poor fistula healing, cystostomy and fistula repair were performed four months later. Ileus developed in one patient (0.7%). This patient had persistent abdominal distension without flatus passage despite medical treatment. Exploratory laparotomy on postoperative Day 14 revealed small bowel entrapment in the femoral canal without bowel strangulation. Enterolysis and bowel decompression were performed. Trocar injury to the inferior epigastric artery caused massive bleeding that required surgical intervention in one patient. The bleeding was controlled with an Endo Clos suturing device (Covidien, Mansfield, MA, USA). No patient who underwent RALP had major postoperative complications.

Table 4 shows the oncologic and functional outcomes. The positive surgical margin (PSM) rate was 39% in patients who underwent LRP and 50% in patients who underwent RALP ($p = 0.285$). There was no significant difference in BCR rate within 12 months after surgery between patients who underwent LRP and RALP (16% vs. 15%, $p = 0.88$). However, the urinary continence rate at 12 months was significantly higher in patients who underwent RALP compared to patients who underwent LRP (82.5% vs. 55%, $p = 0.003$).

4. Discussion

LRP was not widely accepted until improved operative time, efficacy, and safety of the procedure were proven after 2000.[2,3] This procedure is difficult to master and the expected learning curve is about 40–60 cases per surgeon.[7] We started performing LRP at our

Table 3
Perioperative major complications.

Clavien grade	LRP	Comments	RALP	Comments
IIIa	0 (0%)	NA	0 (0%)	NA
IIIb	3 (3%)	Rectal laceration, Ileus, Trocar site bleeding	0 (0%)	NA
IV	1 (1%)	Recto-vesical fistula	0 (0%)	NA
Total	4 (4%)		0 (0%)	

Data are presented as *n* (%).
LRP = laparoscopic radical prostatectomy; NA = not applicable; RALP = robotic-assisted laparoscopic radical prostatectomy.