

Robotics/Laparoscopy

# Advantages of Robot-Assisted Laparoscopic Radical Prostatectomy in Obese Patients: Comparison with the Open Procedure

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**Purpose:** Obesity has been suggested as a risk factor for worse perioperative outcomes, especially in radical prostatectomy, in several studies. However, the impact of obesity on perioperative outcomes has not yet been well elucidated for robot-assisted laparoscopic radical prostatectomy (RALP). We evaluated whether obesity had an adverse effect on outcomes following RALP compared with retropubic radical prostatectomy (RRP).

**Materials and Methods:** From April 2008 to May 2011, 181 patients underwent radical prostatectomy (RALP, 111; RRP, 70). These patients were subdivided into two groups according to body mass index (BMI): the nonobese group (BMI, 25 kg/m<sup>2</sup> or less) and the obese group (BMI, greater than 25 kg/m<sup>2</sup>). Perioperative outcomes in RALP and RRP were retrospectively compared between the two groups.

**Results:** In RRP, patients in the obese group (n=20) showed greater blood loss and a higher complication rate than did those in the nonobese group (n=50). However, in RALP, no statistically significant differences in perioperative outcomes were observed between the obese (n=37) and the nonobese (n=74) groups. RALP showed less blood loss and a lower complication rate in both the obese and nonobese groups than did RRP.

**Conclusions:** RALP is thought to be a more effective and safer procedure in obese patients compared with traditional open radical prostatectomy. In the management of obese patients with localized prostate cancer, RALP should be considered as a primary choice for treatment.

**Key Words:** Obesity; Prostatectomy; Robotics

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## INTRODUCTION

Obesity quantified as body mass index (BMI) is beginning to replace undernutrition and infectious disease as the most significant contributor to ill health [1]. Obesity can lead to serious health problems, including diabetes, hypertension, and coronary artery disease. In addition, it may also affect the surgical and clinical outcomes of patients undergoing various surgical procedures [2,3]. Given the increasing incidence of obesity in men, it is imperative to understand the impact of BMI on surgical outcomes for patients with prostate cancer.

In general, radical prostatectomy is the treatment of choice for patients with clinically localized prostate cancer

and a life expectancy > 10 years [4]. However, obesity may be a complicating factor in retropubic radical prostatectomy (RRP), resulting in higher complication rates, greater blood loss, higher transfusion rates, and worse functional results [5-8].

Robot-assisted laparoscopic radical prostatectomy (RALP) is gaining in popularity for the treatment of clinically localized prostate cancer [9]. RALP offers several advantages, compared with traditional open methods, including decreased blood loss, shorter hospital stay, and less perioperative morbidity [10-13]. However, the impact of obesity on surgical outcomes in RALP has not been well defined. Several previous studies have attempted to characterize this effect, with somewhat conflicting results

[14-16].

In this study we evaluated the impact of obesity on perioperative outcomes, including operative time, estimated blood loss (EBL), complications, and time to oral intake in patients undergoing RALP compared with RRP.

**MATERIALS AND METHODS**

From April 2008 to May 2011, 181 patients with prostate cancer underwent a radical prostatectomy performed by a single surgeon at our center. Standard preoperative assessment included age, height, weight, baseline serum prostate-specific antigen (PSA), Gleason score, clinical stage, and prostate volume. Intraoperative parameters consisted of total operative time and EBL. Postoperative data included time to oral intake and postoperative complications. All patients had adenocarcinoma of the prostate proved by prostate needle biopsy. Upon admission, the height and weight of the patients were measured directly by admission nursing staff. Clinical stage was based on prostate magnetic resonance imaging approved by the radiologist. Total operative time was regarded as the time between initiation of the skin incision and end of wound closure according to operative records. All complications occurring during the perioperative period were classified according to the modified Clavien classification system (CSS). According to the modified CSS, low-grade complications (grade I or II) were regarded as minor complications and high-grade complications (grade III to V) as major complications [17]. Patients were subdivided into two BMI groups according to the World Health Organization (WHO) recommendation for Asians: patients with BMI of 25 kg/m<sup>2</sup> or less were considered nonobese and those with BMI greater than 25 kg/m<sup>2</sup> were considered obese [18].

All of the 111 RALP procedures were performed by using the transperitoneal approach, as described by Menon et al. [19], with a few minor modifications [20]. Briefly, pneumo-

peritoneum was created by using a Veress needle introduced by a supraumbilical puncture. Six ports, one 12-mm port for the scope, three 8-mm ports for the instrument arms, and 10-mm and 5-mm ports for the assistant, were placed. A transverse inverted U peritoneal incision was made, followed by entry into the space anterior to the peritoneum and space of Rezius. Bilateral lymph node dissection was performed in the external iliac and obturator area. The deep dorsal venous complex was ligated and bladder neck and seminal vesicle dissection, posterior dissection, and urethral transection were sequentially performed. Finally, urethrovesical anastomosis was performed.

Chi-square test and Fisher exact test for proportions and Student's t-test for continuous variables were used for statistical comparison of the groups. For all results, we calculated the p-value for whether the differences between the

**TABLE 1.** Comparison of characteristics of the RALP and RRP groups across all BMIs

Characteristic	RRP (n=70)	RALP (n=111)	p-value
Mean age (yr)	66.07±5.04	65.39±6.64	0.440
BMI (kg/m <sup>2</sup> )	23.13±2.68	23.96±2.30	0.028
T stage			0.493
T1-T2	32 (45.7)	45 (40.5)	
T3	38 (54.3)	66 (59.5)	
PSA (ng/ml)	15.86±17.99	15.96±16.17	0.967
Gleason score			0.591
6	18 (25.7)	22 (19.8)	
7	32 (45.7)	58 (52.3)	
≥8	20 (28.6)	31 (27.9)	
Prostate volume (ml)	28.83±13.62	33.39±15.53	0.045

Values are presented as mean±SD or number (%). RALP, robot-assisted laparoscopic radical prostatectomy; RRP, retropubic radical prostatectomy; BMI, body mass index; PSA, prostate-specific antigen.

**TABLE 2.** Overall comparison of the characteristics of all patients

Characteristic	RRP (n=70)			RALP (n=111)			Overall p-value
	Nonobese (n=50)	Obese (n=20)	p-value	Nonobese (n=74)	Obese (n=37)	p-value	
Mean age (yr)	66.4	65.2	0.334	66.1	64.1	0.15	0.309
BMI (kg/m <sup>2</sup> )	21.9±2.1	26.2±1.1	<0.001	22.8±1.5	26.4±1.7	<0.001	0.740
T stage			0.544			0.412	0.740
T1-T2	24 (48)	8 (40)		32 (43.2)	13 (35.1)		
T3	26 (52)	12 (60)		42 (56.8)	24 (64.9)		
PSA (ng/ml)	15.7±19.2	16.2±15.0	0.923	15.2±15.4	17.4±17.7	0.510	0.938
Gleason score			0.240			0.659	0.471
6	11 (22)	7 (35)		13 (17.6)	9 (24.3)		
7	26 (52)	6 (30)		39 (52.7)	19 (51.4)		
≥8	13 (26)	7 (35)		22 (29.7)	9 (24.3)		
Prostate volume (ml)	29.9±15.5	26.1±6.4	0.152	34.1±15.7	31.9±15.3	0.488	0.141

Values are presented as mean±SD or number (%). RRP, retropubic radical prostatectomy; RALP, robot-assisted laparoscopic radical prostatectomy; BMI, body mass index; PSA, prostate-specific antigen.

**TABLE 3.** Perioperative outcomes of patients who underwent RRP or RALP

	RRP (n=70)			RALP (n=111)		
	Nonobese (n=50)	Obese (n=20)	p-value	Nonobese (n=74)	Obese (n=37)	p-value
Operative time (min)	244.9±73.6	258.4±86.5	0.545	233.6±57.4	231.4±40.1	0.807
EBL (ml)	379.8±192.4	486.4±158.5	0.032	231.1±211.8	254.3±374.7	0.677
Complication rate	12 (24.0)	10 (50.0)	0.034	8 (10.8)	6 (16.2)	0.545
Major complication rate	3 (6.0)	4 (20.0)	0.097	1 (1.4)	1 (2.7)	1.000
Time to intake (day)	2.16±0.82	2.2±0.83	0.932	1.85±0.90	1.89±0.61	0.692
Positive surgical margin	10 (20.0)	7 (35.0)	0.186	9 (12.2)	5 (13.5)	0.840

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

RRP, retropubic radical prostatectomy; RALP, robot-assisted laparoscopic radical prostatectomy; EBL, estimated blood loss.

**TABLE 4.** Perioperative outcomes of obese and nonobese patients who underwent RRP or RALP

	Nonobese (n=124)			Obese (n=57)		
	RRP (n=50)	RALP (n=74)	p-value	RRP (n=20)	RALP (n=37)	p-value
Operative time (min)	244.9±73.6	233.6±57.4	0.365	258.4±86.5	231.4±40.1	0.199
EBL (ml)	379.8±192.4	231.1±211.8	0.001	486.4±158.5	254.3±174.7	0.011
Complication rate	12 (24.0)	8 (10.8)	0.049	10 (50.0)	6 (16.2)	0.012
Major complication rate	3 (6.0)	1 (1.4)	0.302	4 (20.0)	1 (2.7)	0.047
Time to intake (day)	2.16±0.82	1.85±0.90	0.055	2.2±0.83	1.89±0.61	0.117
Positive surgical margin	10 (20.0)	9 (12.2)	0.235	7 (35.0)	5 (13.5)	0.062

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

RALP, robot-assisted laparoscopic radical prostatectomy; RRP, retropubic radical prostatectomy; EBL, estimated blood loss.

groups were statistically significant;  $p < 0.05$  indicated statistical significance.

## RESULTS

Of 181 patients, 70 patients underwent RRP and 111 patients underwent RALP. In the RALP group, 74 (66.7%) patients were nonobese and 37 (33.3%) patients were obese. The RRP group included 50 (71.4%) nonobese patients and 20 (28.6%) obese patients. The characteristics of the obese and nonobese patients in both groups are shown in Tables 1, 2. All 4 subgroups were statistically comparable for age, PSA, Gleason score, clinical stage, and prostate volume, respectively. In the RRP group, EBL was higher (486.4±158.5 vs. 379.8±192.4 ml) and the total complication rate was higher (50% vs. 12%) in obese patients than in nonobese patients ( $p=0.032$  and  $0.034$ , respectively). The major complication rate was also higher in obese patients (20%) than in nonobese patients (6%), but without significance ( $p=0.097$ ). Operative time and time to oral intake were similar between obese and nonobese patients. In contrast, in patients who underwent RALP, there were no significant differences in EBL (254.3±374.7 vs. 231.1±211.8 ml), total complication rate (16.2% vs. 10.8%), or major complication rate (2.7% vs. 1.4%) between obese and nonobese patients ( $p=0.677$ ,  $0.545$ , and  $1.000$ , respectively) (Table 3).

Mean EBL and the total complication rate were higher in the RRP group than in the RALP group across all BMIs,

as reported in several previous studies. In the obese group, a decreased major complication rate was observed for RALP compared with RRP ( $p=0.047$ ). There were more positive surgical margins for RRP (35%) when compared with RALP (13.5%) for obese patients, but without significance ( $p=0.062$ ) (Table 4). All complications were classified according to the modified CSS (Table 5).

## DISCUSSION

Obesity is a major health problem in Korea and elsewhere. Obesity is closely associated with diabetes, cardiovascular disease, metabolic syndrome, and other medical problems associated with increased mortality from disease [21]. With over 30% of Koreans being obese, mirroring a worldwide phenomenon, urologists will have to deal with the ramifications of this epidemic [22].

For international use, the WHO has defined obesity as a BMI greater than  $30 \text{ kg/m}^2$  and overweight as a BMI greater than  $25 \text{ kg/m}^2$  and less than  $30 \text{ kg/m}^2$ . However, whereas Asians have had a lower BMI than Caucasians, the prevalence of diabetes, cardiovascular disease, and metabolic syndrome in Asians is similar to that of Caucasians with higher BMI. Because the original WHO definition of obesity does not reflect the risk and incidence of metabolic syndrome and ischemic heart disease, a new definition of obesity was established for Asians. For Asians, the WHO classification of obesity is a BMI higher than 25

**TABLE 5.** Perioperative complications classified according to the modified CSS

	Nonobese (n=124)		Obese (n=57)	
	RRP (n=50)	RALP (n=74)	RRP (n=20)	RALP (n=37)
Overall complication	12 (24.0)	8 (10.8)	10 (50.0)	6 (16.2)
Minor complication	9 (18)	7 (9.4)	6 (30.0)	5 (13.5)
Grade I	1	2	1	0
Grade II	8	5	5	5
Major complication	3 (6.0)	1 (1.4)	4 (20)	1 (2.7)
Grade III	3 <sup>a</sup>	1 <sup>b</sup>	3 <sup>c</sup>	1 <sup>d</sup>
Grade IV	0	0	1 <sup>e</sup>	0
Grade V	0	0	0	0

Values are presented as number (%).

CSS, Clavien classification system; RRP, retropubic radical prostatectomy; RALP, robot-assisted laparoscopic radical prostatectomy.

<sup>a</sup>:Two wound infections, 1 rectal injury, <sup>b</sup>:One wound infection, <sup>c</sup>:Two wound infection, 1 anastomosis site disruption, <sup>d</sup>:One rectal injury, <sup>e</sup>:One pulmonary embolism.

kg/m<sup>2</sup> and that of overweight is a BMI higher than 23 kg/m<sup>2</sup> and lower than 25 kg/m<sup>2</sup>.

Obesity has been associated with the incidence and progression of prostate cancer in molecular biology studies [23]. Clinically, Freedland et al. [24] reported that obesity was associated with a 98% increased odds of prostate cancer risk. Several studies have reported a correlation of obesity with higher grade prostate cancer and progression that increases death from prostate cancer [25,26]. Considering the treatment of obese patients with prostate cancer, several studies of the impact of obesity on radical prostatectomy as the primary option for localized prostate cancer have been conducted. Obesity increased operative time and blood loss, elevated the transfusion rate, and made radical prostatectomy challenging [27]. Elevated BMI was associated with higher positive surgical margins and capsular incision in radical prostatectomy. Obese patients can present a technical challenge for RRP because of excess abdominal fat, which makes access to the prostate and pelvic organs more difficult. A technically inferior operation contributes to the increased progression and recurrence after radical prostatectomy [28-30].

RALP that incorporates the benefits of minimally invasive surgery with wide and 3-dimensional vision and delicate control of instruments is considered a reasonable and effective treatment modality for localized prostate cancer, instead of traditional radical prostatectomy [10-13].

An area of concern is the ability to perform RALP effectively in obese patients. However, surgical outcomes in obese patients undergoing RALP are not yet clear. In this study, therefore, we evaluated the question of whether higher BMI (greater than 25 kg/m<sup>2</sup>) might cause technical difficulties and have an adverse effect on operative time, EBL, perioperative complications, time to oral intake, and positive surgical margin compared with those variables in

patients undergoing RRP.

Our findings of greater EBL in obese patients who underwent RRP are similar to those of previous studies [5-8]. Castle et al. [27] reported a significant difference in operative time and blood loss according to BMI in 140 patients undergoing RALP. Ahlering et al. [15] reported similar results. In contrast, Khaira et al. [16] reported their results for 285 RALP procedures and noted that the surgical outcomes of RALP in both the obese and nonobese group were similar; however, operative steps were longer during urethral dissection and anastomosis, and overall time was not significantly different.

In our study, the mean EBL of obese patients undergoing RRP was 486.4 ml and that of nonobese patients was 379.8 ml. This finding is associated with technical difficulties such as suboptimal visualization of deep pelvic organs and a narrow pelvic space resulting from excess fat tissue. In contrast, comparing EBL between the two groups undergoing RALP, the mean EBL of obese patients was 254.3 ml and that of nonobese patients was 231.1 ml, without a statistically significant difference. We suggest two reasons for this finding. One is a robotic system that provides a superior view and master-slave precise hand motion. These might be helpful in reducing the technical difficulty resulting from excess fat tissue. The other is the tamponade effect that results from pneumoperitoneum.

When we analyzed perioperative complications, we found a higher complication rate for obese patients who underwent RRP, but no significant difference between obese and non-obese patients who underwent RALP. Furthermore, the obese patients who underwent RALP had a lower major complication rate than did those who underwent RRP. Major complications are associated with high invasiveness and cost of therapy used to correct the complication, with high mortality, long hospital stay, and stress to the patients.

In this study, patients having a BMI greater than 25 kg/m<sup>2</sup> according to the WHO classification for Asians were considered obese. This classification is based on medical morbidity, not surgical morbidity, such as diabetes, metabolic syndrome, and cardiovascular disease. In fact, obese patients in our study (BMI > 25 kg/m<sup>2</sup>) might have had less fat tissue in the abdominal cavity or abdominal wall than Western obese patients (BMI > 30 kg/m<sup>2</sup>) and similar fat tissue to overweight patients. There were only two patients with a BMI > 30 kg/m<sup>2</sup> in our study. We suggest that RALP is a feasible procedure in obese Korean patients with localized prostate cancer.

## CONCLUSIONS

The advantages of RALP compared with RRP and the disadvantages of obesity in the surgical treatment of prostate cancer are already well known and well established. Few published studies, however, have dealt with the benefit of RALP in obese patients. In our study, RALP was a more effective and safer procedure in obese patients than was tra-

ditional open radical prostatectomy. In the management of obese patients with localized prostate cancer, RALP should be considered as a primary choice for treatment.

### CONFLICTS OF INTEREST

The authors have nothing to disclose.

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