Original Article

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Robot-Assisted Laparoscopic Versus Retropubic Radical Prostatectomy: Comparison of Functional and Oncological Outcomes, A Single-Center Experience

Muhammed Arif İbiş[1], Çağrı Akpınar[2], Eralp Kubilay[3], Sümer Baltacı[3], Kadir Türkölmez[3], Evren Süer[3]

[1]*Ankara Keçiören Training and Research Hospital, Clinic of Urology, Ankara, Turkey*
[2]*Çubuk Halil Şıvgın State Hospital, Clinic of Urology, Ankara, Turkey*
[3]*Ankara University Faculty of Medicine, Department of Urology, Ankara, Turkey*

Abstract

Objective: This study aimed to investigate the effect of robot-assisted laparoscopic radical prostatectomy (RARP) and open retropubic radical prostatectomy (RRP) on perioperative functional and oncological outcomes.

Materials and Methods: This single-center retrospective study analyzed data of 443 patients who had undergone radical prostatectomy (RP) with localized prostate cancer. Surgical and clinicopathologic data, oncological and functional outcomes, and complications were compared between RRP and RARP groups. The comparison was made by the Mann-Whitney U test, chi-square test, and t-test for qualitative and quantitative variables, as appropriate. Log rank test was used to determine the biochemical recurrence-free survival of both surgical methods. Kaplan-Meier analysis was performed to estimate survival rates.

Results: The RRP and RARP groups included 231 and 212 patients, respectively. Blood loss, indwelling catheter duration, and hospitalization rates were low in the RARP group. Although the continence rates were better in the RARP group at 3 months, they were comparable at 12 months. In both groups, erection sufficient for sexual intercourse was comparable at 3 and 12 months. The mean lymph node yield was higher in the RRP group than in the RARP group. On median 28-month follow-up, no difference was found in the oncological results.

Conclusion: Although the oncological and functional results of RRP and RARP are comparable, RARP is a more minimally invasive procedure. In our opinion, the surgeon's experience is more effective than the chosen technique.

Keywords: Retropubic radical prostatectomy, prostate cancer, robotic prostatectomy, surgical technique

Introduction

Radical prostatectomy (RP), a curative treatment option for prostate cancer (PCa), was first described by Young in 1904 (1). After Young described the perineal approach, the retropubic approach, which is widely used today, was described by Millin in 1947 (2). Following the popularity of the dorsal vein complex and neurovascular bundle anatomy, the first nerve-sparing radical prostatectomy (NS-RP) was performed by Walsh in 1982 (3). Significant improvements in RP have been achieved in the last 30-40 years, and for the first time in 2001, this operation was performed by a robot-assisted laparoscopic approach (4).

RP is a treatment option widely used in clinically localized and locally advanced disease. The main purpose of RP is to remove the tumor tissue by preserving continence and potency. Currently, no specific data can show the superiority of any approach in terms of oncological and functional results after RP. Given the minimally invasive nature of robot-assisted laparoscopic radical prostatectomy (RARP), it may be associated with less blood loss and blood transfusion requirements, shorter hospitalization duration, and less pain.

In this study, we compared the preoperative, perioperative, and postoperative oncological and 3rd month and 12th month functional results of RARP and open retropubic radical prostatectomy (RRP).

Materials and Methods

Patient Selection

The study included patients who underwent RRP or RARP with a diagnosis of localized PCa between January 2016 and March

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Address for Correspondence: Muhammed Arif İbiş, Ankara Keçiören Training and Research Hospital, Clinic of Urology, Ankara, Turkey
Phone: +90 541 624 04 50 **E-mail:** m.arifibis@hotmail.com **ORCID-ID:** orcid.org/0000-0001-8581-2101
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2019, followed by at least 1 year, and whose data were fully available. The local ethical committee's registration number is I3-192-20. The study was conducted in a single center, and data of 443 patients were analyzed retrospectively. After a suspected digital rectal examination or a high prostate-specific antigen (PSA) value, diagnosis was made by transrectal ultrasound-guided prostate biopsy. If there are indications, bone scintigraphy, computed tomography, and multiparametric magnetic resonance imaging were performed. After the diagnosis was made, treatment options such as active surveillance, radiotherapy (RT), and RP were explained to the patients. The life expectancy of the patients was evaluated by the Charlson comorbidity index, and the risks of anesthesia were evaluated by using the American Society of Anesthesiologists score. The operation was planned for patients who had a life expectancy of at least 10 years and preferred RP as a treatment. Patients were informed about RRP and RARP by the surgeons who would perform the surgery. Patients decided whether the surgical approach was RRP or RARP. RP was performed at least 6 weeks after prostate biopsy to reduce possible surgical complications. On the night before the operation, enema as bowel preparation was performed and compression stockings were applied for all patients. Some of the RARP cases were performed by surgeons who were in the early phase of the learning curve. During the operation, extended lymph node (LN) dissection was performed in patients whose preoperative positive LN rate was more than 5%. Nerve-sparing surgery was not performed on patients with a high risk of extracapsular diseases, such as any cT3a or cT3b PCa or any International Society of Urologic Pathology (ISUP) grade >3 on biopsy. Penile rehabilitation with phosphodiesterase-5 inhibitors was recommended to patients with sufficient erection capacity for sexual intercourse in the preoperative period, after the indwelling catheter was withdrawn in the postoperative period. Patients who had received RT as definitive therapy and then underwent salvage RP and those who performed transurethral prostatectomy before RP were excluded. The patients were divided into the RRP and RARP groups to compare selected parameters. The preoperative characteristics of the patients are shown in Table 1.

Preoperative Parameters

Age, body mass index, inguinal hernia or abdominal surgery history, potency and continence conditions, PSA value, biopsy ISUP grade, and clinical T stages were recorded.

Intraoperative and Pathological Parameters

Nerve-sparing LN dissection and intraoperative blood loss were recorded. NS-RP surgery was not performed on patients at high risk of extracapsular disease. Pathology specimens were evaluated by a single pathologist. Surgical margin positivity, pathology ISUP grade, and T stage were recorded in the examined pathology samples.

Postoperative Parameters

The postoperative parameters of the patients, such as hospitalization and catheterization time, and biochemical recurrence (BCR) were examined. In follow-up measurements, PSA >0.2 ng/mL in two consecutive measurements were accepted as BCR (5). Functional results, such as continence and erectile function, were questioned during the outpatient clinic controls performed at 3 and 12 months. Patients using more than one protective pad were considered incontinent, and patients who were unable to achieve a sufficient erection in more than half of their sexual intercourse were considered impotent. Patients using 2-3 protective pads daily were considered to have mild incontinence, and patients using more than 3 protective pads were considered to have serious incontinence.

Statistical Analysis

IBM SPSS® Statistics version 25 was used for statistical analysis. The normal distribution of the continuous variables was tested using the Kolmogorov-Smirnov test. Independent group t-test, Mann-Whitney U test, and chi-square test were used to compare independent variables with normal distribution, independent variables without normal distribution, and categorical data, respectively. Log rank test was used to determine the BCR-free survival of both surgical methods. Kaplan-Meier analysis was performed to estimate survival rates. P-values of <0.05 in the 95% confidence interval were considered significant.

Results

In total, 231 and 212 of the patients underwent RRP and RARP, respectively. The demographic characteristics of the patients were generally comparable in both surgical groups (Table 1). Only, the PSA value was lower in the RARP group (Table 1).

Intraoperative blood loss was less in the RARP group (540 mL vs 265 mL; p<0.001) (Table 2). The mean hospitalization

Table 1. Preoperative patient characteristics

Variables	RRP (n=231)	RARP (n=212)	p-value*
Mean age at surgery ± SD (yr)	**65.54±6.57**	**69.59±6.51**	**0.372**
Body mass index (kg/m²)			0.874
<30 (kg/m²)	171 (74%)	160 (75.5%)	
≥30 (kg/m²)	60 (26%)	52 (24.5%)	
History of inguinal hernia	21 (9.1%)	22 (10.3%)	0.614
History of abdominal surgery	45 (19.5%)	46 (21.6%)	0.490
Preoperative erection sufficient for sexual intercourse	153 (66.2%)	142 (67%)	0.780
Preoperative continent	231 (100%)	212 (100%)	-
Median preoperative PSA (ng/mL) (IQR)	13.22 (5.68-17.98)	9.30 (5.19-12.5)	0.018*
Biopsy ISUP grade			0.112
ISUP grade 1	119 (51.5%)	121 (57.1%)	
ISUP grade 2-3	59 (25.5%)	54 (25.5%)	
ISUP grade 4-5	53 (22.9%)	37 (17.4%)	
Clinical T-stage			0.767
cT1	120 (51.9%)	109 (51.4%)	
cT2	111 (48.1%)	103 (48.6%)	

*Mann-Whitney U test, IQR: Interquartile range, RRP: Retropubic radical prostatectomy, RARP: Robot-assisted radical prostatectomy, PSA: Prostate-specific antigen, SD: Standard deviation, ISUP: International Society of Urologic Pathology

duration was 5.62 days in the RRP group and 4.24 days in the RARP group, and the difference was significant (p=0.046) (Table 2). The indwelling catheter duration was shorter in the RARP group (15.11 vs 8.75; p<0.001) (Table 2). The modified Clavien classification system was used to evaluate postoperative complications (6). In total, 28 complications were observed, including 17 (7.4%) in the RRP group and 11 (5.2%) in the RARP group. The number of patients with grade 3 complications was 2 (0.8%) in the RRP group and 1 (0.5%) in the RARP group. Clavien 4-5 complications were not observed in any patient. The number of patients with postoperative complications was not significantly different (p=0.224) (Table 2).

Better continence rate was found in the RARP group at 3 months postoperatively (58.9% vs 74.5%; p=0.021). Despite the higher continence rate in the RARP group at 12 months postoperatively, this difference was not significant (79.2% vs 84.9%; p=0.398) (Table 3).

While the potency rates of the patients were lower at 3 months postoperatively (10.5% vs 10.6%), the potency rates improved at 12 months postoperatively (39.2% vs 42.3%). Although better potency rates were recorded in the RARP group, the difference was not significant (p=0.695) (Table 3).

Table 2. Intraoperative and pathological parameters

Variables	RRP (n=231)	RARP (n=212)	p-value*
Pathology ISUP grade			0.064
ISUP grade 1	101 (43.7%)	82 (38.7%)	
ISUP grade 2-3	84 (36.4%)	90 (42.4%)	
ISUP grade 4-5	46 (19.9%)	40 (18.9%)	
Pathology T-stage			0.517
pT2	184 (79.7%)	177 (83.5%)	
pT3a	42 (18.2%)	31 (14.6%)	
pT3b	5 (2.1%)	4 (1.9%)	
Mean pathology prostate weight ± SD	48.08±17.84	47.92±21.09	0.769
Lymph node dissection performed	145 (62.8%)	126 (59.4%)	0.390
Mean lymph node yield ± SD	13.36±6.18	11.19±5.79	0.044*
Nerve sparing	174 (75.3%)	165 (77.8%)	0.419
Pathology negative surgical margin	178 (77.1%)	172 (81.1%)	0.259
Blood loss ± SD (mL)	540±67	265±41	<0.001*
Indwelling catheter ± SD (day)	15.11±3.14	8.75±3.05	<0.001*
Hospitalization ± SD (day)	5.62±1.78	4.24±1.73	0.046*
Postoperative complication			0.224
Grade 1	10 (4.3%)	6 (2.8%)	
Grade 2	5 (2.2%)	4 (1.9%)	
Grade 3a	1 (0.4%)	1 (0.5%)	
Grade 3b	1 (0.4%)	-	

*Independent simple t-test; SD: Standard deviation, RRP: Retropubic radical prostatectomy, RARP: Robot-assisted radical prostatectomy, ISUP: International Society of Urologic Pathology

Table 3. Functional and oncological results

	RRP (n=231)	RARP (n=212)	p-value*
Erection sufficient for sexual intercourse			0.695
Postoperative 3 mo	16 (10.5%)	15 (10.6%)	
Postoperative 12 mo	60 (39.2%)	60 (42.3%)	
Continence at postoperative 3 mo			0.021*
0-1 pads	136 (58.9%)	158 (74.5%)	
2-3 pads	69 (29.9%)	39 (18.4%)	
>3 pads	26 (11.2)	15 (7.1%)	
Continence at postoperative 12 mo			0.398
0-1 pads	183 (79.2%)	180 (84.9%)	
2-3 pads	40 (17.3%)	26 (12.3%)	
>3 pads	8 (3.5%)	6 (2.8%)	
Median follow-up (IQR) (mo) for biochemical recurrence	28 (20-36)	27 (18-35)	0.782
Biochemical recurrence rate	22 (9.5%)	17 (8.1%)	0.280
Overall mortality rate	3 (1.2%)	2 (0.9%)	0.271

*Chi-square test, IQR: Interquartile range, RARP: Robot-assisted radical prostatectomy, RRP: Retropubic radical prostatectomy

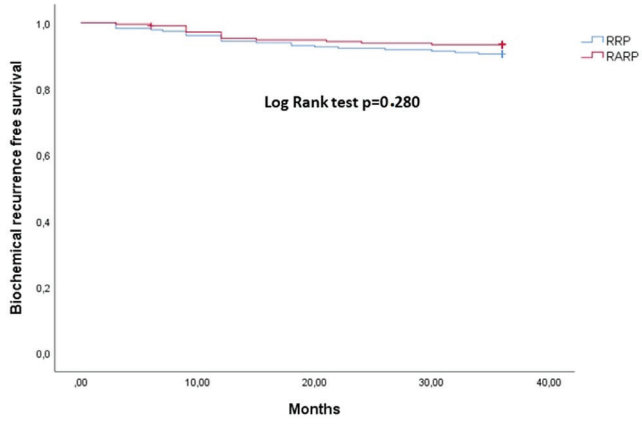

Figure 1. Kaplan-Meier curves for biochemical recurrence-free survival

Biochemical recurrence-free survival was 90.5% in the RRP group versus 91.9% in the RARP group. Kaplan-Meier analysis did not show a significant difference between biochemical recurrence-free survival rates of the two groups (p=0.280) RARP: Robot-assisted radical prostatectomy, RRP: Retropubic radical prostatectomy

The median follow-up for BCR was 28 (20-36) and 27 (18-35) months in the RRP and RARP groups, respectively. The mean follow-up time of both groups was comparable (Table 3). The BCR-free survival rate was 90.5% in the RRP group versus 91.9% in the RARP group. Kaplan-Meier analysis did not demonstrate any significant difference between BCR-free survival rates of both groups (p=0.280) (Figure 1).

NS-RP was performed at comparable rates in both surgical arms (75.3% vs 77.8%; p=0.419) (RRP arm: unilateral NS-RP, 54; bilateral NS-RP, 120; RARP arm: unilateral NS-RP, 50; bilateral NS-RP, 115). NS-RP was not performed on patients with cT3 or ISUP grade >3. Patients with positive surgical margins were similar in both surgical groups (22.9% vs 18.9%; p=0.259) (Table 2).

The rates of patients who underwent pelvic LN dissection (PLND) among the groups were close to each other (75.3% vs 77.8%; p=0.419). The mean number of LN yield was 13.36 and 11.19 in the RRP and RARP groups, respectively, and the difference was significant in favor of RRP (p=0.044) (Table 2).

Discussion

In this study, we evaluated oncological results with total PSA measurements in the postoperative follow-up. We found that the proportion of patients with BCR was higher in the RRP arm than in the RARP arm, but this difference was not significant. Some of the risk factors for BCR include pathology with ISUP grade ≥2, positive surgical margin, extracapsular spread, seminal vesicle involvement, and positive LN. Providing negative surgical margin is very important for cancer control. The detection of surgical margin positivity in patients with pT2 increases the risk of BCR by 12% (7). Surgeon's experience, prostate volume, risk group of tumor, tumor volume, and degree of excision of the neurovascular bundle may affect surgical margin positivity (8). In both groups with a similar rate of NS-RP, more than 80% negative surgical margins were achieved. Despite a proportionally small difference in favor of RRP, this difference was not significant. A study compared the positive surgical margin in both surgical arms, which revealed favorable results of RARP, but the patient population was worse in the RRP arm (8). However, results of a large-scale meta-analysis on this topic are similar to our results (9). Similarly, a prospective randomized controlled study comparing RRP and RARP did not find a difference between the two groups in terms of receiving additional oncological treatments such as RT or androgen deprivation therapy (10).

In PCa, PLND is important for ensuring correct staging, providing information about prognosis, and determining adjuvant treatment needs. In addition, the number of LN yield in patients with positive LN and cancer-specific survival was correlated (11). The probability of LN invasion in high-risk PCa is 20% (12). While LN metastasis is detected in 10-24.1% of patients with extended PLND, this rate decreases to 0-5.2% in standard PLND (13). Owing to the variable lymphatic drainage of the prostate, extended PLND is recommended for all patients with PLND indication (14). Although the rates of patients with extended PLND in our study were similar in the RRP and RARP groups, the number of LN yield was significantly higher in the RRP group. Studies with large patient populations using the Surveillance Epidemiology and End Results medicare-linked database have shown that extended PLND is less common in patients undergoing RARP (15,16). These results may be due to limited movements of the robot arms, difficulty of the learning curve, and RARP performed by urologists with little experience in uro-oncology.

In studies comparing continence, the lack of standardization due to the definition of continence and differences in research makes it difficult to evaluate these results. In the literature, post-prostatectomy incontinence rates were 7-39% and 4-31% in the RRP and RARP groups, respectively (17,18). The wide range of these ratios was related to both the lack of a standard definition for incontinence and the surgeon's experience. According to our study, although a difference was found between the two groups for the continence rates at 3 moths postoperatively, the rates were comparable at 12 months postoperatively. Some studies have shown that it is better to report continence in the RARP group; however, in meta-analysis of long-term prospective studies, the two groups showed a similar rate of continence. (10,18). Bladder neck protector technique, neurovascular bundle dissection, and prolonged urethra can be made easier in RARP with high magnification. This may explain that early continence is better in the RARP group.

In studies comparing the two surgical approaches in terms of potency, there is no standard definition for potency. While some used symptom scores for potency, such as IIEF-5, some defined potency as a coit ability. We considered patients who were able to provide adequate erections for sexual intercourse as potent. The rates of patients who were potent at the 3 and 12 months postoperatively were very comparable in both groups. Preoperatively, the rate of achieving erection sufficient for sexual intercourse in all patients who underwent RP was 66.6% (RRP group, 66.2%; RARP group, 67%). Regardless of the surgical approach, the 3- and 12-month potency rates of all patients who underwent NS-RP were 10.5 and 40.7%, respectively. In other words, 59.3% of the patients who underwent NS-RP developed erectile dysfunction. This high rate may be attributed to our preference for the rate of achieving erection sufficient of sexual intercourse rather than the IIEF-5 score when evaluating erectile function. Studies have shown that 25-75% of patients who performed RP develop erectile dysfunction later (19). A meta-analysis showed that RARP is a superior procedure than RRP in terms of the 12-month potency rates (20). However, 2-year results of a randomized controlled study reported no difference in sexual function between both surgical techniques (10). The postoperative sexual function is thought to be related to patient age, surgeon experience, and neurovascular bundle preservation (21,22).

The hospitalization duration of patients who underwent RARP was shorter. In accordance with our routine practice, the catheters were removed on average in 14 days in patients with RRP and in 7 days in patients with RARP. Therefore, the duration of catheterization was shorter in the RARP group.

There was more blood loss in the RRP group than in the RARP group. Generally, blood loss is less in the RARP arm due to the buffering effect of the intra-abdominal pressure and the ability of the robot arms to be used under the good vision of the surgeon. The fact that the hospitalization duration, catheterization time, and amount of blood loss is less in the RARP arm is caused by the fact that RARP is a more minimally invasive procedure.

The total complication rates were 7.3% and 5.2% in the RRP and RARP groups, respectively. Complication rates were comparable. Different complications may occur in patients undergoing RARP depending on the patient position (Trendelenburg), intra-abdominal pressure, and robotic arms, unlike RRP.

Study Limitations

This study has some limitations. This study is a retrospective study from a single center with multiple surgeons. This may cause differences between surgical indications, techniques, and managements. The short follow-up period is also another

limitation, especially for the monitoring of oncological outcomes. Nevertheless, our functional outcomes were similar to those of previous studies (10,23).

Conclusion

Although the oncological and functional results of RRP and RARP are comparable, perioperative adverse events tend to be less common in RARP because of the minimally invasive characteristics of the procedure. We believe that the surgeon's experience has larger effect than the chosen technique on oncological and functional results.

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Ethics

Ethics Committee Approval: The local ethical committee's registration number is I3-192-20.

Informed Consent: Retrospective study.

Peer-review: Externally peer-reviewed.

Authorship Contributions

Concept: M.A.İ., Design: M.A.İ., S.B., K.T., Data Collection or Processing: E.K., K.T., Analysis or Interpretation: S.B., Literature Search: Ç.A., E.K., E.S., Writing: M.A.İ.,

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