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Results of robotic radical prostatectomy in the hands of surgeons without previous laparoscopic radical prostatectomy experience*

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Aim: We report our initial experience related with robot-assisted laparoscopic radical prostatectomy (RALRP) performed by a urologic surgeon without previous laparoscopic radical prostatectomy (LRP) experience.

Materials and methods: The data of the first 70 patients who underwent RALRP between February 2009 and February 2010 are presented.

Results: Mean console time was 214 ± 55.5 min with pelvic lymph node dissection (LND) in 14 patients. Mean intraoperative blood loss was 215 ± 227.3 cc. Fourteen patients had positive surgical margins: pT3 (n = 12) and pT2 (n = 2). Lodge drains and urethral catheters were removed at a mean of 2.9 ± 2.7 and 11.6 ± 5.9 days, respectively. Forty-three of 58 patients (82.9%) had urinary control at the 3-month follow-up. Regarding the patients with preoperative IIEF scores ≥ 19 (mean: 47.6 ± 17.0, n = 46), mean IIEF score was 45.3 ± 9.9 (n = 11) at the 9-month follow-up. Regarding patients with preoperative IIEF scores of 13-18 (mean: 16.3 ± 1.1, n = 6), mean IIEF score was 17.0 ± 3.5 (n = 3) at the 9-month follow-up. One patient who could not tolerate CO_2 insufflation was switched to open surgery due to deep acidosis development. Rectal injury occurred in 1 patient and was repaired robotically without postoperative problems.

Conclusion: Previous LRP experience is not essential in order to perform RALRP, which can be learned and performed easily. Additionally, short-term surgical results and pathological outcomes of RALRP are excellent and satisfactory, respectively.

Key words: Robot assisted, laparoscopic, radical prostatectomy, prostate cancer, outcomes

Introduction

Radical prostatectomy (RP) provides long-term cancer control in patients with localized prostate cancer (PCa) (1). Robot-assisted laparoscopic radical prostatectomy (RALRP) has increasingly become a preferred treatment of choice both by patients and urologists since its introduction in 2001 (2). To date several authors with previous experience in laparoscopic RP (LRP) have reported the outcomes of their series of RP by using the da Vinci surgical system (Intuitive Surgical, Sunnyvale, CA, USA) (3-6).

We hypothesized that previous experience in LRP is not essential before starting RALRP. However, complete understanding of the 3-dimensional anatomy of the prostate and its surroundings is a must.

Herein, we report our initial experience of RALRP performed by one of us (MDB) without any previous experience of LRP.

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Materials and methods

Between February 2009 and February 2010, we performed 70 RALRP procedures at our institution. All patients in our series were operated on by one of us (MDB) using a da Vinci-S 4-arm surgical robot (Intuitive Surgical) with no previous experience of LRP but great experience in open RP and additional experience in upper urinary tract laparoscopic surgery.

For our initial experience, patients with a previous history of abdominal surgery were excluded (Table 1).

Operative technique and surgical steps

We used a transperitoneal approach patient in the steep (30°) Trendelenburg position. A total of 5 ports were placed, including a 12-mm port for the camera, three 8-mm ports for the robotic arms, and a 12-mm port for bedside assistance.

We placed the 4th arm on the right side of the patient and controlled it with the right hand. The procedure was started by making an incision on the anterior peritoneal covering of the Douglas pouch, approximately 1 cm proximal to its reflection on the rectum. Vasa deferentia and seminal vesicles were dissected and Denonvilliers' fascia was opened.

Anterior attachments between the bladder and abdominal wall were taken down by monopolar scissors and the Retzius space was entered. After defatting, the endopelvic fascia was opened and levator ani muscle fibers were dissected off all the way along the lateral prostatic fascia.

The dorsal venous complex (DVC) was identified and suture tied distal to the apex of the prostate. Next, the detrusor apron overlying the prostate anteriorly was identified and dissected superiorly until the entrance of the urethra into the prostate at the bladder base was observed where its anterior wall was incised. The posterior neck area was checked for the presence of the median lobe and incision of the urethra at this level was completed. Subsequently, high anterior release and neurovascular bundle (NVB) dissections were carried out. The procedure was completed after division of DVC and vesicourethral anastomosis with the use of the van Velthoven technique with or without posterior Rocco construction.

Bilateral extended pelvic lymphadenectomy was performed in patients who had an intermediate- or high-risk for pelvic lymph node (LN) metastasis according to Partin's tables (7) with an at least 6% risk of LN involvement by PCa (Table 2).

The prostate was extracted from the abdomen after the enlargement of the supra-umbilical port site following inclusion into the endobag. An abdominal drain was left in place. Thereafter, we grossly examined the prostate for any suspicious areas.

Patients were discharged after tolerating an oral diet and sufficient ambulation following removal of the lodge drains. At the end of the first postoperative week, cystography was carried out by filling the bladder with 200 cc of diluted contrast material. If no leakage was seen, the urethral catheter was removed. Otherwise, the urethral catheter was kept for another week for another cystography. Continence was defined as either the use of no pads or use of one protective pad for precautionary measures as a safety pad. Immediate continence was evaluated following removal of the urethral catheter after cystography was performed. Potency was defined as the ability to achieve penetration and complete intercourse with or without the use of oral type-5 phosphodiesterase (PDE-5) inhibitors. Patient characteristics with preoperative measures are summarized in Table 1.

Results

Operative measures, oncologic outcomes, functional outcomes, and quality of lives of patients who underwent RALRP at our institution are summarized in Tables 2, 3, and 4. Currently, of the 70 patients, 10, 58, 41, and 1 had completed 1-, 3-, 6-, and 12-month evaluations, respectively.

We had to switch to open surgery in only one patient (1.4%), solely because of deep acidosis, who could not tolerate further intra-abdominal CO_2 insufflation. Rectal injury occurred in one patient (1.4%), which was repaired robotically, and no problems developed postoperatively. None of our patients developed urethral stricture or bladder neck contracture.

Positive surgical margin (PSM) was detected in 14 patients (20%) (Table 3). In our series, 4 patients had biochemical recurrence with serum prostate

Table 1. Preoperative patient characteristics in patients who underwent robot assisted laparoscopic radical prostatectomy (RALRP) at our institution.

Patients (n)	70
Mean patient age (year)	62 ± 6 (range, 43-73)
Mean BMI (kg/m^2)	27.5 ± 8.9 (kg/m^2) (range, 20-39)
Mean serum PSA (ng/mL)	8.5 ± 5.9 (ng/mL) (range, 0.89-27)
Mean prostate volumes (cc)	52.4 ± 16.4 (cc) (range, 18-100)
Prostate biopsy Gleason Scores, n (%)	
3 + 3	48 (68.6)
4 + 3	4 (5.7)
3 + 4	9 (12.9)
4 + 4	7 (10)
4 + 5	1 (1.4)
5 + 4	1 (1.4)
Clinical stage, n (%)	
cT1c	51 (72.8)
cT2a	14 (20.0)
cT2b	5 (72.0)
Mean ASA score	2
Mean preoperative IIEF score	35.4 ± 23.3 (range, 5-75)
Preoperative mean IPSS	13 ± 6.9 (range, 0-28)

BMI: body mass index, PSA: prostate specific antigen, ASA: American Society of Anesthesiologists, IIEF: International Index of Erectile Function, IPSS: International Prostate Symptom Score.

Table 2. Operative measures of patients who underwent RALRP at our institution. APA: accessory pudendal artery, NVB: neurovascular bundle, LND: lymph node dissection.

Mean surgery (console) time (including bilateral extended pelvic lymph node dissection in 14 patients)	214 ± 55.5 min (range, 60-380)
Estimated intraoperative blood loss	215 ± 227.3 cc (range, 0-1500)
Mean prostate weight measured postoperatively	52.3 ± 16.4 g (range, 18-100)
APAs detected and preserved, n (%)	
Overall	15 (21.4)
Unilateral	13 (18.6)
Bilateral	2 (2.8)
NVB-sparing technique, n (%)	
Bilateral	62 (88.5)
Unilateral	2 (2.9)
Not performed	6 (8.6)
Mean dorsal vein ligation time (minutes)	6.5 ± 4.6 (range, 2-25)
Number of patients with extended pelvic LND, n (%)	14 (20.0)
Mean urethral catheter removal time (days)	11.6 ± 5.9 (range, 7-32)
Mean lodge drain removal time (days)	2.9 ± 2.7 (range, 1-20)
Mean follow-up (months)	7.1 ± 3.2 (range, 0.75-12)

Table 3. Postoperative oncologic outcomes of patients who underwent RALRP at our institution.

Pathologic stage, n (%)					
ASAP + HGPIN			1 (1.4)		
pT0			2 (2.8)		
pT2a			10 (14.3)		
pT2b			3 (4.3)		
pT2c			17 (24.3)		
pT3a			31 (44.3)		
pT3b			6 (8.6)		
Gleason score, n (%)					
2-6			41 (58.5)		
7			19 (27.1)		
8-10			6 (8.5)		
PSM rate, n (%)					
Overall			14 (20.0)		
pT2			2 (6.7)		
pT3			12 (32.4)		
Follow-up	1 month	3 month	6 month	9 month	1 year
Biochemical recurrence, n (%)	2 (2.8)	1 (1.4)	0 (0)	1 (1.4)	0 (0)
Available patients, n (%)	65 (92.8)	58 (82.9)	41 (58.5)	21 (30)	1 (1.4)

ASAP: atypical small acinar proliferation, HPIN: high grade prostatic intraepithelial neoplasia, PSM: positive surgical margin.

Table 4. Functional outcomes and quality of life evaluations of the patients who underwent RALRP at our institution. IIEFS: International Index of Erectile Function Score, Pts: patients, Preop: preoperative.

Continence status n (%)	Total control (No leakage)	1 pad/day	2-3 pads/day	Total incontinence	Available patients
Immediate	49 (70)	8 (11.4)	2 (2.9)	11 (15.7)	70 (100)
3-month	43 (74.1)	11 (19.0)	3 (5.1)	1 (1.7)	58 (82.9)
6-month	38 (92.7)	2 (4.9)	1 (2.4)	0 (0)	41 (58.5)
9-month	20 (95.2)	1 (4.8)	0 (0)	0 (0)	21 (30.0)
1-year	1 (100.0)	0 (0)	0 (0)	0 (0)	1 (1.4)
Erectile function	Preoperative	3-month	6-month	9-month	
IIEFS, mean ± SD	35.4 ± 23.3	8.4 ± 4.3	12.4 ± 8.5	17.8 ± 10.1	
Available pts, n (%)	70 (100.0)	58 (82.9)	41 (58.5)	21 (30.0)	1-year
***Preop IIEFS ≤ 13**	**6.3 ± 1.7**	**6.4 ± 2.1**	**6.4 ± 1.6**	**7.8 ± 2.7**	10 ± 0
n = 18 (25.7%)	*(n = 18)*	*(n = 16)*	*(n = 11)*	*(n = 7)*	1 (1.4)
***Preop IIEFS 13-18**	**16.3 ± 1.1**	**6.2 ± 2.4**	**13.3 ± 0**	**17.0 ± 3.5**	**10 ± 0**
n = 6 (8.6%)	*(n = 6)*	*(n = 5)*	*(n = 3)*	*(n = 3)*	*(n = 1)*
***Preop IIEFS ≥ 19**	**47.6 ± 17.0**	**8.3 ± 5.8**	**13.2 ± 9.0**	**45.3 ± 9.9**	
n = 46 (65.7%)	*(n = 46)*	*(n = 37)*	*(n = 27)*	*(n = 11)*	
Quality of life	Do it again? Yes/No	Life quality Better-same/Worse		Satisfaction Happy/Unhappy	
n/n	64/3	64/3		62/5	
Available patients, n (%)	67 (95.7)	67 (95.7)		67 (95.7)	

specific antigen (PSA) levels between 0.27 and 4.69 ng/mL at 1-9 months of follow-up (Table 3). These patients had the worst pathological features. The pathological evaluation revealed bilateral tumors in all of these patients. Pathological stages and grades on final pathology were pT3 in 3 patients (Gleason scores 4+4, 3+4, and 4+3) and pT3b in another patient (Gleason score 5+4) also with pelvic LN involvement. No patients had disease progression during follow-up.

We saw 15 accessory pudendal arteries (APAs), all of which were preserved (Table 2). All patients with preoperative erectile function (IIEF score > 7) were instructed to use oral phosphodiesterase-5 (PDE-5) inhibitors after removal of the urethral catheter.

Of the 46 patients with mild erectile dysfunction or no dysfunction (preoperative IIEF score was > 19) 37, 27, and 11 patients were examined at the 3-, 6-, and 9-month follow-up with mean IIEF scores of 8.3 ± 5.8 (range, 5-55), 13.2 ± 9.0 (range, 7-55), and 45.3 ± 9.9 (range, 10-65), respectively, at each interval. Improvements in the erectile function and urinary continence of our patients are shown in Table 4 and Figures 1 and 2.

Two patients with preoperative IIEF scores of 55 and 59 who did not benefit from oral PDE-5 inhibitor use were prescribed intracavernosal alprostadil injection therapy in the postoperative period with satisfactory response.

Of the available 21 patients at the 9-month follow-up, 20 (95.2%) had total urine control (Table 4). Functional outcomes (including erectile function and urinary continence) and quality of life evaluations of the patients who were underwent RALRP at our institution are summarized in Table 4.

Discussion

We hypothesized that previous experience in LRP is not necessary before starting RALRP. However, having knowledge of the 3-dimensional anatomy of the prostate and its surroundings is essential.

Incompatibility of clinical and pathological stages of patients with localized PCa has been well documented. Approximately 25%-40% of patients with clinical stage T1c PCa have advanced pathological stage and grade disease following RP (8-10). Firstly, our results confirmed this observation. Despite the fact that we included patients with clinically localized PCa, pathology on final specimen showed that 52.9% of our patients were upstaged to pT3a (n = 31, 44.3%) and pT3b (n = 6, 8.6%). Assessment of the Gleason score on preoperative biopsies also does not correctly reflect the final pathology. In the literature, the Gleason score of standard sextant biopsy was reported to correctly predict the Gleason score of the RP specimen in about 50% of cases and the Gleason score on preoperative extended 12-core biopsies predicted the Gleason score on final pathology in

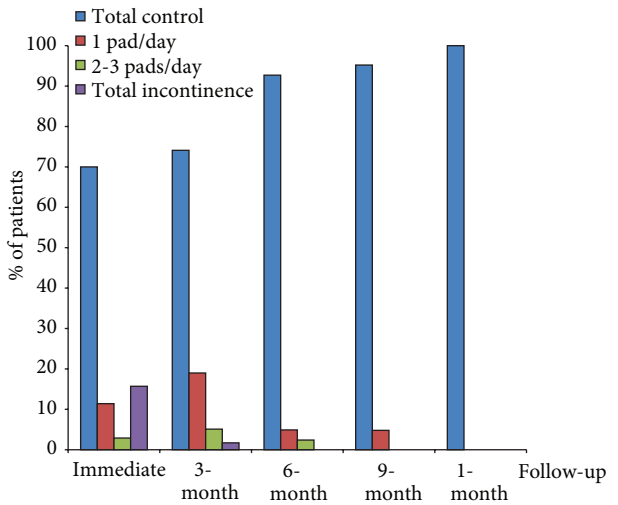

Figure 1. Postoperative urinary continence status of our patients who underwent RALRP at our institution.

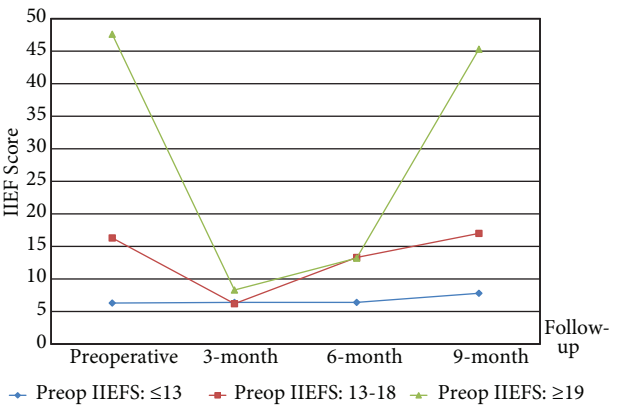

Figure 2. Presentation of preoperative and postoperative erectile functions of our patients who underwent RALRP at our institution due to their IIEFS. IIEFS: International Index of Erectile Function Score.

70% of cases (11). In the presented series, Gleason scores of 3+3 or less were assigned to 48 (68.6%) of our patients preoperatively. However, the final pathological evaluation confirmed only 42 (60%) of these. Twelve (17.1%) of our patients were upgraded, while 16 (22.9%) were downgraded according to the final pathological evaluation.

To date several authors have reported their initial and updated follow-up results on RALRP (6,12-15). In our experience we included patients with localized disease (cT1-2) preoperatively (Table 1). Mean preoperative serum PSA was 8.5 ± 5.9 ng/mL. However, pathological evaluation of the removed prostate specimens revealed that 35 (50%) patients had pT3 disease (Table 3).

Mean surgery (console) time was 214 ± 55.5 min, including bilateral extended pelvic LN dissections in 14 patients, which seems to be similar to the previously published literature (3-6). Mean console time was reported to be somewhere between 105 and 341.9 min by others, which is most probably related to experience (3-6). Comparably, mean estimated intraoperative blood loss was 215 ± 227.3 cc in our series. Others reported similar results ranging between 111 and 339 cc (3-6).

Although we selected smaller sized prostates initially (mean 52.4 ± 16.4 cc) we included patients with larger prostates after successfully performing the first 40 cases. In the literature, Menon et al. and Novara et al. reported that average prostate weight and volume were 49.9 g (range, 13-220) and 35 mL (range, 26-48.7), respectively, in their series (4,5).

Ahlering et al. and Patel et al. reported their PSM rates as 35.5% (n = 45) and 10.5% (n = 200), respectively, in their initial RALRP experience (12,13). Increased experience seems to have a positive impact on the PSM rates in performing RALRP. PSM rates decreased to 20.4% (n = 200) and 9.3% (n = 1500), respectively, in their series with inclusion of a larger number of patients (6,14). Overall PSM rate was 20% in our series (Table 3), which seems reasonable and comparable to those of others.

Regarding organ-confined disease, Ahlering et al. reported a PSM rate of 14.8% following 50 RALRP procedures (12), which decreased to 6.5% following performing 150 procedures (14). Likewise, Patel et al. reported a PSM rate of 5.7% following 200 RALRP procedures, which decreased to 2.5% following performing 500 procedures (13,15). Our PSM rate was 6.7% for patients with organ-confined disease in our initial experience (Table 3).

Concerning pT3 disease, Ahlering et al. reported a PSM rate of 62.5% following 50 RALRP procedures (12), which decreased to 32% following performing 150 procedures (14). Similarly, Patel et al. reported a PSM rate of 26% following 200 RALRP procedures, which decreased to 13.8% following performing 500 procedures (13,15). Our PSM rate was 32.4% for pT3 disease in our initial experience (Table 3).

Preservation of the NVBs was performed in patients with cT1c–T2a disease, a biopsy Gleason score less than or equal to 7, a preoperative IIEF score greater than 26, if NVBs were not stuck on the prostate during dissection, and in patients without significant comorbidities. We performed bilateral NVB preservation in 64 patients in our series (Table 2). We performed interfascial NVB preservation on the tumor side and intrafascial NVB preservation on the nontumor-bearing side of the prostate. All patients with pT3 disease had sufficient erectile function preoperatively (mean preoperative IIEF score: 35.4 ± 23.3) and requested their NVBs to be preserved before the surgery.

The overall average percentage of return to baseline sexual function was 51%, 58%, 66%, and 80% at 1, 3, 6, and 12 months, respectively, as reported by Mikhail et al. in a series of 100 RALRP patients (3). Other authors with larger series of RALRP patients reported their potency rates between 70% and 85% at 1-year follow-up (2,6). Postoperative potency rates of our series are summarized in Table 4 and Figure 2. A dip at the 3-month follow-up occurred regarding the postoperative IIEF scores in Figure 2, which increased to almost preoperative values at the 9-month follow-up. This might be explained by the neuropraxia that might have occurred during NVB preservation, which needs time for recovery in the postoperative period. All but 2 patients in our series used PDE-5 inhibitors in the postoperative period.

It is well established that preservation of the NVBs has a crucial impact on erectile functional recovery following radical prostatectomy. Moreover, erectile tissue oxygenation supplied by the arteries

irrigating the cavernous bodies including the APAs seems to have an additional role in erectile function (16) although Box et al. reported that sacrifice of APAs in normally potent men during RALRP did not impact potency (17). We detected 15 (21.8%) APAs in our series and preserved all of them. We think that preservation of APAs during RALRP may favorably influence the recovery of sexual function in the postoperative course (Table 1, Figure 3). APAs are more frequently detected than previously reported in the surgical literature, particularly following the introduction of laparoscopic procedures (18). The incidence of APAs was reported to vary between 4% and 70% (18).

We performed the vesicourethral anastomosis by using a running suture, as defined by Van Velthoven et al. (19). We randomized our patients prospectively for performing or not performing a posterior reconstruction following the principles described by Rocco et al. (20) before vesicourethral anastomosis for a parallel study yet to be completed in which we are planning to evaluate the impact of performing posterior reconstruction, the results of which will be discussed in the future.

The average percentage of return to baseline urinary function was reported as 52%, 70%, 79%, and 84% at 1, 3, 6, and 12 months, respectively, by Mikhail et al. in a series of 100 RALRP patients (3). Several RALRP series with large numbers of patients reported excellent continence outcomes of

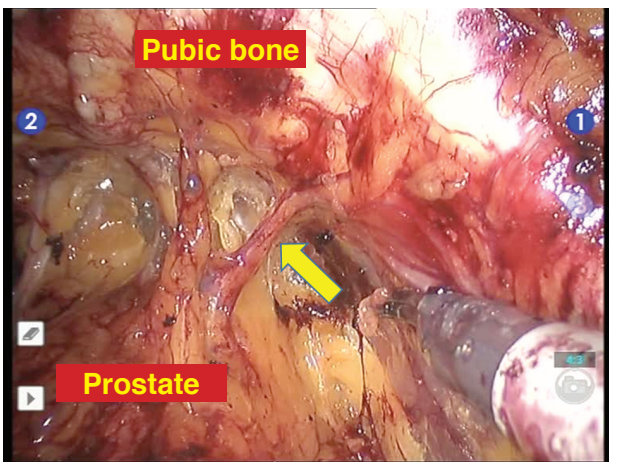

Figure 3. Accessory pudendal artery detected and preserved during performing RALRP in one of our patients (arrow).

90%-95% by defining continence as no pad usage or use of one safety pad/day in their series (2,6,21). In our experience, immediate total urine control was achieved in 70% of the cases in the postoperative period (Table 4). At the 9-month follow-up this rate increased to 95.2% (Table 4).

Diminished hospitalization periods are notable in almost all RALRP series. A range of 1-6 days was reported as the hospital stay in the large series from the USA and Europe (3-6). In our experience, mean lodge drain removal time was 2.9 ± 2.7 days when patients were fit to go home (Table 2). Mean urethral catheter removal time was 11.6 ± 5.9 days in our initial experience, while others reported a median/mean of 5 (range, 4-7), 6.3 ± 2.7 (range, 4-26), 4-7, and 6.3 days (3-6).

Recently, Agarwal et al. reported the safety profile of RALRP including 3317 patients (22). They concluded that RALRP is a safe operation, with an overall complication rate of 9.8% and most complications occurred within 30 days of surgery. In a series of 4400 consecutive RALRP patients, Kheterpal et al. identified rectal injuries in 10 patients (0.2%) (23). Of these 10 patients, 9 had an uneventful postoperative course and 1 patient developed a rectourethral fistula and was treated with colostomy. In our limited experience, we had to switch to open surgery in only one patient (1.4%), due to intraoperative deep acidosis development. Additionally, rectal injury occurred in one patient (1.4%), which we repaired robotically. None of our patients developed urethral stricture or bladder neck contracture in the follow-up.

Lastly, quality of life is a very important issue in patients who undergo surgery. In our series, most of our patients were happy and satisfied (92.5%) with the outcomes of their RALRP procedures with decreased postoperative pain and better cosmetic results compared to open surgery.

In our series, we also demonstrated that accessory pudendal arteries could easily be detected and preserved by RALRP (24). Additionally, it is important to state that robotic malfunction might occur during the robotic approach; therefore, the ability of the surgeon to complete this procedure either laparoscopically or by the open approach is important (25). A surgical robot could also be

used to perform more than one abdominal surgical procedure in the same session as we did in one of our case that included RALRP and cholecystectomy (26).

The weaknesses of our study are as follows. We did not compare our results in robotics and open RP since robotic surgeons are doing the robotic procedures while less experienced surgeons are doing the open procedures. We also did not compare historic results with the present study since they are not comparable. Lastly, our follow-up in robotic cases was too short to allow us to make a conclusion about the biochemical recurrence rate.

In this report, we have presented our initial experience on RALRP. All procedures were performed by one of us (MDB) who had no previous experience in performing LRP but with a great experience in open RP and excellent understanding of the surgical anatomy of the prostate and its surroundings. Oncological and functional outcomes in our series are comparable to those of most experienced surgeons in RALRP. We therefore think that gaining laparoscopic experience is not a must before starting a robotic program for prostate cancer surgery. However, we must emphasize that any surgeon planning to go into robotic surgery has to have a very good understanding of surgical anatomy. We also concluded that clinical staging and any of the parameters including serum PSA, digital rectal examination, and biopsy Gleason score never reflect the pathological status of the patients correctly at least in half of our patients presented in this series. Therefore, surgeons should discuss this issue with their patients beforehand and inform them about the probability of giving adjuvant treatments.

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