

Evolution of Robotic Radical Prostatectomy

Assessment After 2766 Procedures

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BACKGROUND. Robotic-assisted radical prostatectomy (RAP) is the dominant minimally invasive surgical treatment for patients with localized prostate cancer. Only a few large series have been published to date, with few long-term data available. The current study presents what to the authors' knowledge is the largest series of patients undergoing RAP with the longest follow-up to data available to date. Using a continuous quality improvement initiative, several technical refinements were adopted, evaluating the impact of this on patient outcome.

METHODS. Over a 6-year period, 2766 consecutive men underwent RAP at the study institution. Data were collected prospectively including demographic, surgical, oncologic, and functional outcomes with up to 5-year follow-up. The first 200 and most recent 200 patients were compared to determine the impact of experience and quality improvement for patients.

RESULTS. The mean age of the patients was 60.2 years and the mean prostate-specific antigen (PSA) level at time of diagnosis was 6.43 ng/mL; 42.4% and 64.2% of patients, respectively, had a biopsy and pathologic Gleason sum of ≥ 7 . The mean surgical and console time was 154 minutes and 116 minutes, respectively. Estimated blood loss was 100 mL; 96.7% of patients were discharged within 24 hours of surgery. At a median follow-up of 22 months, 7.3% of men had a PSA recurrence. The 5-year actuarial biochemical free survival rate was 84%.

CONCLUSIONS. To the authors' knowledge, the current study is the first report of 5-year outcomes in men undergoing RAP. These data demonstrate that RAP can be performed with favorable outcomes while minimizing complications. As experience increases, further improvements in clinicopathologic and functional parameters are achieved. *Cancer* 2007;110:1951-8. © 2007 American Cancer Society.

KEYWORDS: prostate, robotics, laparoscopy, daVinci, prostate-specific antigen recurrence, adenocarcinoma.

Radical prostatectomy is an effective treatment option for men with prostate cancer and offers the best long-term cancer control in patients with localized disease.^{1,2} Robotic-assisted radical prostatectomy (RAP) has increasingly become a treatment of choice both by patients and physicians alike since its introduction in 2001. Greater than 35,000 RAPs were performed in the U.S. in 2005 and several centers have published reports regarding short-term outcomes in small select groups of patients.³⁻⁶ Although the early results of this approach are encouraging, to our knowledge there are no reports in the literature of intermediate or long-term outcomes after RAP.

Our robotic prostatectomy program began in November 2000 and we have performed > 2700 RAPs to date. In the current study, we present what to our knowledge is the first report of patients with

up to 5 years of available outcome data in a large unselected cohort of men. The current study is the largest single-center series with the longest follow-up presented to date in the literature regarding the outcome of men undergoing RAP. We previously reported our early outcome results and now update this series to compare our surgical, pathologic, and functional outcomes on our latest patient cohort.⁷ Based on high surgical volume and resultant increasing experience, we have continually modified our technique over time in an effort to improve on pathologic and functional outcomes for our patients. To evaluate the impact of this modification, we compare our most recent 200 patient cohort against our previously published first 200 patients.⁸

MATERIALS AND METHODS

Patients

Between November 2000 and December 2006, 2766 consecutive patients with clinically localized prostate cancer underwent RAP using the Vattikuti Institute Prostatectomy (VIP) technique.⁴ All procedures were performed by 1 of 3 urologists at our institution (1935 cases, 609 cases, and 222 cases per surgeon). All patients completed a urinary (International Prostate Symptom Score [IPSS]) and sexual (Sexual Health Inventory in Men [SHIM]) questionnaire preoperatively. Patients from the local metropolitan area were discharged home; out-of-state patients were encouraged to stay in the local area until removal of their catheter. Patients were followed for up to 5 years postoperatively (mean follow-up of 25.8 months).

Tumor Stage and Grade

Digital rectal examination under anesthesia was performed and clinical stage was determined according to the 1992 American Joint Committee on Cancer Staging guidelines.⁹ Serum prostate-specific antigen (PSA), pathologic characteristics of biopsy, and radiographic imaging results were recorded. Prostate specimens were whole-mounted and serially sectioned (whole-mount processing was available beginning in 2005; before that, the specimens were divided into quadrants and serially sectioned). The presence of tumor cells at the inked margin of resection was considered a positive surgical margin (SM) for all specimens. Pathologic Gleason score, SM status, presence of extracapsular extension (ECE), seminal vesicle involvement (SVI), and pelvic lymph node positivity were recorded.

Evolution of Technique

The VIP technique has undergone several technical modifications and refinements over the years. We employed a running vesicourethral anastomosis in 2001,¹⁰ as well as approached the bladder neck initially (antegrade dissection). We modified our apical dissection to preserve the puboprostatic ligaments and periurethral soft tissue support.¹¹ In addition, we abandoned initial bulk ligation of the dorsal venous complex in favor of precise suturing after division of the urethra. We originally described our athermal technique of nerve preservation in 2002, and subsequently extended it to lateral prostatic fascia and anterolateral prostatic fascia nerve-sparing techniques.¹² Low-risk to intermediate-risk patients (primary Gleason score of 3, PSA < 10 ng/mL, clinical stage T1c) underwent prostatic fascia-sparing (Veil of Aphrodite) nerve-sparing RAP. High-risk patients underwent conventional nerve-sparing RAP. Other recent modifications include endopelvic fascia preservation, athermal technique using titanium clips, and 5-mm robotic instruments.

Follow-up Evaluation

Postoperative follow-up included serial PSA measurements and mailed questionnaires. A data manager placed phone calls at 30 days postoperatively to assess complications (unscheduled visits, hospital admission), as well as urinary (number of pads) and sexual function (status of erectile function) status. Automatically generated E-mail questionnaires were delivered at 3 months, 6 months, 9 months, and 12 months after surgery. Those who did not respond were sent a mailed follow-up questionnaire. Data were collected and assessed by a nonclinical research assistant. The proportion of out-of-state patients increased from 6.4% to 47.3% from 2001 to 2005, respectively, as our experience expanded. Cancer progression was defined as any detectable serum PSA (≥ 0.2 ng/mL), local recurrence, or metastatic disease. Perioperative complications were defined as any deviation from the standardized robotics pathway and recorded according to the classification described by Clavien et al.¹³ Briefly, the Clavien system classifies postoperative complications into 5 grades: grade I, deviation from the normal postoperative course but without the need for therapy; grade II, complication requiring pharmacologic or bedside treatment; grade III, complication with the need for surgical, endoscopic, or radiologic intervention (further IIIa/b: without/with the need for general anesthetic); grade IV, life-threatening complication requiring intensive care with residual disability; and grade V, death.

TABLE 1
Preoperative, Perioperative, and Pathologic Parameters in 2766 RAP Patients

Parameter	Overall (3 surgeons)
Mean age (range), y	60.2 (39–80)
Mean PSA (range), ng/mL	6.43 (0.1–77.2)
< 2.5	152 (6.8)
2.5–4	294 (13.3)
4.1–10	1527 (69.2)
> 10	236 (10.7)
No. in each clinical stage (%)	
T1a	4 (0.3)
T1b	0 (0)
T1c	1713 (77.3)
T2a	407 (18.4)
T2b	80 (3.6)
T3	6 (0.4)
No. of each biopsy Gleason score (%)	
5	7 (0.3)
6	1263 (57.2)
7	768 (34.7)
8	131 (5.9)
9–10	41 (1.8)
No. in each D'Amico risk group (%)	
Low	1492 (69.1)
Intermediate	491 (22.7)
High	177 (8.2)
Mean BMI (range), kg/m ²	27.6 (19–44)
No. with prior abdominal surgery (%)	637 (30.1)
Surgical time, min	
Mean (range)	154 (71–387)
Median	148
Console time, min	
Mean (range)	116 (45–331)
Median	111
Estimated blood loss	
Mean (range)	142 (10–1350)
Median	100
No. of postoperative blood transfusions	41 (1.5)
Mean no. of units transfused (range)	2.6 (2–8)
No. in each pathologic stage (%)	
T2a	344 (15.5)
T2b	879 (39.8)
T2c	497 (22.4)
T3a	372 (16.9)
T3b	112 (5.1)
T4	6 (0.3)
No. with each pathologic Gleason score (%)	
5	23 (1)
6	764 (34.6)
7	1185 (53.6)
8	113 (5.1)
9	122 (5.5)
Could not be assessed	17 (0.7)
Mean prostate weight (range)	49.91 (13–220)
Mean tumor volume (range) (%)	17.2 (1–90)
Mean hospital stay (range)	1.14 (0–35)
Mean duration of catheterization (range)	10 (4–36)
No. of cystograms with no evidence of leakage (%)	1951 (88.3)

(continued)

TABLE 1
(continued)

Parameter	Overall (3 surgeons)
No. of complications (%)	
Clavien I	221 (8)
Clavien II	102 (3.7)
Clavien III	13 (0.5)
Clavien IV	2 (0.01)
Clavien V	1 (< 0.01)
No. of PSA recurrences (%)	95 (7.27)
No. of positive surgical margins	
pT2 (%)	170 (13.0)
pT3 (%)	169 (35)
No. of conversions (%)	2 (0.1)
No. aborted (%)	8 (0.3)
No. of positive lymph nodes (%)	20 (9.0)

RAP indicates robotic-assisted radical prostatectomy; PSA, prostate-specific antigen; BMI, body mass index.

Follow-up Database and Statistical Analysis

The database was created at inception of the robotics program (inception cohort study design). Data were entered prospectively into the database as it became available for all available patient demographics (ie, age, body mass index [BMI], comorbidities, and family history), preoperative characteristics (PSA, Gleason score, clinical stage, sexual function [SHIM], and urinary function [IPSS]), surgical parameters (surgical and console time, estimated blood loss [EBL], type of nerve-sparing performed, frozen section results, bladder neck reconstruction, and blood transfusion), and postoperative parameters (hospital stay, catheter duration, and cystogram result). A third-party research assistant performed all data entry and provided the raw data for analysis.

The chi-square test was used to compare the first 200 patient group with the most recent 200 patients and test categoric clinical and pathologic characteristics. A Student *t* test was used to compare continuous variables in the 2 groups. For univariate analysis, we calculated actuarial 5-year biochemical progression-free survival (BFS) using Kaplan-Meier estimates. Multivariate analysis was calculated using the Cox proportional hazards model to determine independent predictors of biochemical recurrence. All data was analyzed using the SPSS software package (version 13.0; SPSS Inc., Chicago, Ill).

RESULTS

Table 1 demonstrates the clinical, surgical, and pathologic data for the overall patient cohort. Table 2 compares these characteristics for the initial 200 patients undergoing RAP versus the most recent 200

TABLE 2
Comparison of First and Last 200 Patients in Our Cohort of 2766 Patients

Parameter	First 200 cases	Last 200 cases	P
Mean age (range), y	59.9 (40–72)	60 (44–80)	NS
Mean PSA (in ng/mL) (range)	6.4 (0.6–41)	6.14 (0.87–27.5)	NS
No. with clinical stage (%)			
T1a	1 (0.5)	0	<.05
T1b	NA	0	
T1c	98 (49)	133 (66.5)	
T2a	20 (10)	57 (28.5)	
T2b	78 (39)	8 (4)	
T3	3 (1.5)	1 (0.5)	
No. with a biopsy Gleason score (%)			
5	0	0	<.01
6	132 (66)	76 (38)	
7	56 (28)	98 (49)	
8	8 (4)	19 (9.5)	
9–10	4 (2)	7 (3.5)	
Mean BMI (range), kg/m ²	27.7 (19–38)	28.17 (20–40)	NS
No. with prior abdominal surgery (%)	40 (20)	90 (45)	<.05
Surgical time, min			
Mean (range)	160 (71–315)	131 (83–242)	<.05
Median	NA	135	
Console time, min			
Mean (range)	121 (53–280)	97 (40–204)	<.05
Median	119	96	
Estimated blood loss			
Mean (range)	153 (25–750)	133 (50–250)	NS
Median	NA	100	
No. with each pathologic stage (%)			
T2a	30 (15)	19 (9.5)	<.05
T2b	144 (72)	0 (0)	
T2c	0	105 (52.5)	
T3a	14 (7)	60 (30)	
T3b	12 (6)	15 (7.5)	
T4	0	1 (0.5)	
No. with each pathologic Gleason score (%)			
5	1 (0.5)	2 (1)	<.01
6	86 (43)	60 (30)	
7	80 (40)	108 (54)	
8	16 (8)	15 (7.5)	
9	5 (2.5)	7 (3.5)	
Cannot be assessed	NA	8 (4)	
Mean prostate weight (range)	43 (11–117)	45.58 (80.18)	NS
Mean tumor volume (range) (%)	20.3 (1–80)	23 (1–100)	NS
Mean hospital stay (range)	1.2 (<1–5)	1.09 (1–5)	NS
Mean duration of catheterization (range)	7 (1–18)	8.1 (5–36)	NS
No. of cystograms with no leakage (%)	176 (88)	183 (91.5)	NS
No. of PSA recurrences (%)	8	0 (at 3 mo of follow-up)	NA
No. of positive surgical margins			
pT2 (%)	12 (7.0)	5 (4)	<.05
No. of conversions (%)	0 (0)	0 (0)	NA
No. aborted (%)	1 (0.5)	1 (0.5)	NS
No. of positive lymph nodes (%)	2 (1.0)	1 (0.5)	NS

NS indicates not significant; PSA, prostate-specific antigen; NA, not available; BMI, body mass index.

patients undergoing the procedure with a single surgeon.

Patient Characteristics

The mean age of our cohort was 60.2 years. The mean PSA at time of diagnosis was 6.43 ng/mL and 10.7% of patients had a PSA level > 10 ng/mL. Clinically palpable disease was present in 22% of these men. Because 42.4% of patients had a biopsy Gleason score of ≥ 7 , 30.9% were considered to be at intermediate to high risk for disease progression. A history of prior abdominal surgery was present in 30.1% of cases, with the majority undergoing prior umbilical hernia repair (21 patients), appendectomy (197 patients), and mesh hernia repair (open or laparoscopic; 228 patients). Other procedures included colectomy (14 patients), total proctocolectomy with ileoanal bypass (4 patients), and inflatable penile prosthesis (2 patients).

When comparing our first 200 patients (Group 1) with our last 200 men (Group 2), there was no statistically significant difference in patient age, clinical disease stage, or preoperative PSA level; however, Group 2 had higher biopsy Gleason score (62% with a Gleason score of ≥ 7 vs 34% in Group 1). Group 2 also had more prior abdominal surgery (45% vs 20%), as would be expected as our experience increased.

Surgical Parameters

For the entire cohort, the mean surgical and console time was 154 minutes and 116 minutes, respectively. Surgical time was calculated from the time of Veress needle placement to skin closure. For Group 2, the mean times were 131 minutes and 97 minutes, respectively. The robotic setup and docking time also decreased from 45 minutes in Group 1 to 8 minutes in Group 2. Overall EBL was 100 mL, and was estimated by recording the amount of saline irrigation subtracted from total amount in suction canister at the conclusion of surgery. In all, 96.7% of patients were discharged within 24 hours of surgery and 1.5% were hospitalized for > 3 days.

Pathologic Parameters

Prostate specimens were evaluated by a urologic pathologist using the Stanford protocol. The average prostate weight was 49.91 g and the mean tumor volume was 17.2%. A Gleason score of ≥ 7 was reported in 64.2% of men and 22.3% had ECE, SVI, or T4 disease.

The trend at our institution over time has demonstrated that surgery is performed on more aggressive disease; therefore, we found that Group 2

had worse pathologic characteristics than Group 1, with a T3 rate of 37.5% for Group 2 and 13% for Group 1. The pT3 margin rate for the overall cohort was 35%, further confirming a trend toward performing surgery on patients with more aggressive disease. A Gleason score of ≥ 7 for Group 2 was 65% versus 50.5% for Group 1. SMs were 4% positive in the last 200 patients with organ-confined disease (pT2; Group 2).

Complications

Two patients were converted to an open procedure due to inability to enter the space of Retzius secondary to extensive peritoneal adhesions. The procedure was aborted in 8 patients: 2 for macroscopically positive lymph nodes, 2 for disease involving the bladder trigone, and 4 for pulmonary comorbidity and an inability to maintain minute ventilation and/or obesity. Our threshold for postoperative transfusion was low; patients with a serum hemoglobin < 10 ng/dL or orthostatic hypotension were transfused a minimum of 2 U of packed red blood cells per the established clinical care pathway (1.5% of all patients). In all, 0.9% of men had a complication determined to be Clavien grade II or greater. There were 14 patients who underwent surgical reexploration: 4 for bowel injury, 4 for port site hernia, 2 for persistent bleeding, 1 for persistent ileus, and 3 for anastomotic complications. Both Groups 1 and 2 had 1 patient each who was aborted and there were no conversions, despite the increased number of patients with previous abdominal surgery in Group 2. The incidence of unscheduled postoperative visits was 5.8%.

Functional Outcomes

Patients required a minimum follow-up of 12 months for the evaluation of sexual and urinary function outcomes; a mean follow-up of 28 months and a median follow-up of 27 months (76.1% of entire patient cohort; range, 12–71 months). Of 2766 patients, data were obtained from 1889 patients who had a minimum of 1 year of follow-up, with complete erectile data available for 910 patients and urinary continence data available for 1110 patients.

Sexual function

Erectile function was measured with the SHIM questionnaire. Complete follow-up erectile function data were available for 910 patients at this time. Preoperative SHIM scores were > 17 in 721 of 910 patients. Of these, 79.2% reported successful sexual intercourse postoperatively (defined as a SHIM score of at least 2 on Question 2 of the SHIM questionnaire: "When you had erections with sexual stimulation,

how often were your erections hard enough for penetration (entering your partner?"). Phosphodiesterase-5 inhibitors (PDE5) were used in 44.2% of patients. The use of penile injections or vacuum erection device was not included in this analysis. Patients were given the option of using PDE-5I and there was no established protocol for duration and scheduled dosing.

Urinary function

In all, 93% of patients (1032 of 1110 patients) were wearing ≤ 1 pad per day and 23.7% of these men reported having complete urinary control immediately at the time of catheter removal (0 pads). The median time to complete urinary control (< 1 pad per day or a security liner) was 3 weeks (range, 0–120 weeks). When stratifying patients according to year of surgery, we found that those patients operated on in 2001 and 2002 had a longer median time to continence (on average, 5 weeks), whereas no difference was demonstrated in those operated on in 2003 to 2005 (on average, < 3 weeks). We can conclude that the impact of experience and learning curve resulted in reproducibility of return to continence.

Oncologic Outcome

Nine patients (0.5%) died during 71 months of follow-up: 2 of metastatic prostate cancer and the remaining patients of nonprostate cancer-related death. At a median follow-up of 22 months (range, 6–71 months), 95 patients (7.3%) had a PSA recurrence. The 5-year actuarial BFS rate was 84%. The BFS for rates for patients with organ-confined disease and ECE was 84.2% and 66.3%, respectively. For patients with a Gleason score of 6, 7, and 8 through 10, the BFS rates were 87.5%, 79.7%, and 52.8%, respectively. On a multivariate Cox regression model we found preoperative PSA, pathologic Gleason sum, and pathologic stage to be independent predictors of biochemical disease recurrence after RAP. Thirty-three patients (2.5%) received adjuvant radiation and/or androgen ablation treatment.

DISCUSSION

Despite the popularity that RAP has attained over the past several years, the primary criticism of RAP is the lack of long-term outcome data in a large patient cohort. The current study is a follow-up to our initial series and continuing evaluation of a large cohort of unselected men undergoing RAP over the past 5 years with an emphasis on surgical parameters, potency, continence, and complications. Although the early data were encouraging, longer patient follow-

up and continuous technical modification of the procedure was required to critically evaluate this surgery. These outcomes confirm the favorable results reported earlier in this series, and, more important, demonstrate improvements in these parameters in the most recent patient group.

Several centers have published favorable results on their early cohort after successful establishment of a RAP program. The University of California at Irvine began their program in May of 2002. For their initial cohort of 45 patients, the mean surgical time ranged from 2.5 hours to 5.2 hours with an EBL of < 300 mL.⁵ This group performed > 100 cases utilizing a single assistant.¹⁴ Patel et al.⁶ reported on a large community-based practice series of 200 patients. The mean operative time was 141.2 minutes, with an EBL of 75.1 mL, a hospital stay of 1.1 days, and no transfusions or open conversions. A compilation of 10 large RAP series with a total of 373 patients was reported by El-Hakim et al.,¹⁵ in which the mean surgical time was 222 minutes, EBL was 231 mL with no major transfusion rates, and the mean hospital stay was 1.4 days. Our current series consists of > 2700 patients with up to 6 years of follow-up (range, 6–71 months).

The learning curve for RAP has been studied by several centers as well. Menon et al.¹⁶ and Ahlering et al.,⁵ both with extensive 'open' surgical experience, were able to accomplish comparable surgical times in 18 cases and 12 cases, respectively. This demonstrates the successful transfer of open surgical skills to the robotic platform while performing minimally invasive surgery. Patel et al.,⁶ with fellowship-trained laparoscopy skills, reported similar surgical times after an experience of 18 cases. The criteria evaluated to define success in these studies are largely based on surgical time. We demonstrate that with continuous quality improvement and technical refinement during RAP, we can improve outcomes well after the initial learning curve. The mean console time has decreased by 19% between the first 200 and last 200 patients, despite a 100% increase (20% vs 45%) in prior abdominal surgery history requiring laparoscopic and/or robotic adhesiolysis that negatively impacted operative time. The EBL has remained constant at 100 mL; however, the range is much narrower in our last 200 patients (Table 2).

Our patient selection has changed significantly over time. During our early experience, we carefully selected patients with regard to BMI, prostate weight, prior surgical history, and low D'Amico risk patients. In analysis of our contemporary series, the preoperative age, PSA, and BMI were comparable to those of other series; however, 62% of our last 200 patients

had D'Amico intermediate-risk or high-risk stratification, 34% had clinical stage T2 to T3 disease, and 62% had a biopsy Gleason score of > 6 , nearly double that reported in previous studies. Pathologic outcomes confirmed the aggressive disease in our cohort: 22.4% of patients had \leq pT3 disease (38% in our last 200 patients) and 64.2% had a pathologic Gleason score of ≥ 7 or greater (65.4% in the last 200 patients).

The decline in positive SM rates in our recent cohort of patients is attributed to several factors; importantly, despite using a more stringent pathologic analysis of the specimens using the whole-mount technique in June 2005, our positive SM rates have declined. This is likely a result of increasing experience of the technical aspects of performing RAP along with a growing familiarity of laparoscopic anatomy and, in addition, the technical aspects of pathologic reporting and processing. The processing of our prostate specimens changed in 2005, when completely embedded whole-mount step-sectioning was performed. Before this, the prostates were divided based on size to fit onto standard-sized cassettes. Small glands were divided in half and larger glands were divided into quarters. During our early series, we had more 'cautery artifact' during dissection resulting in accurate SM status reporting more difficult to determine with indeterminate specimens considered positive; the trend over time has been to utilize less electrocautery in those performing RAP. We now perform the lateral neurovascular bundle dissection, anterior, and apical transection without cautery, whereas in the early series, these areas would have significant electrocautery trauma. Our bladder neck dissection continues to be performed with monopolar cautery, and very rarely is there artifact noted on pathology readings. These factors, in tandem with our increasing experience performing RAP, has resulted in the improved SM rate.

The results of the current study demonstrate what to our knowledge is the only example of 5-year follow-up on oncologic outcome for RAP. At a median follow-up of 22 months, overall biochemical recurrence was noted in 7.2% of patients. The 5-year actuarial BFS rate was 84% for our cohort. These interim results are unexpectedly low and longer follow-up will be required to assess progression to metastatic disease and prostate cancer-related death.

Preservation of potency is a primary concern in most men undergoing RAP. In patients with normal preoperative erections (SHIM > 22), 82.1% reported sexual intercourse postoperatively, whereas 76.7% of men with mild erectile dysfunction reported sexual intercourse after RAP; 44% and 43% of men in the 2

groups required PDE5 therapy, respectively. These results reflect the overall cohort, irrespective of the type of nerve-sparing performed. Further analysis needs to be performed to evaluate the improvement in sexual function in those patients substratified by level of enhanced nerve-sparing (Veil of Aphrodite) versus those undergoing a standard nerve-sparing or wide excision.

Overall, 93% of men achieved urinary control at 1 year, as defined by wearing 0 pads or 1 liner for security purposes only. When a more stringent definition of continence was used, 82.1% of men had absence of any urinary leakage even on stress maneuvers. The urinary dissection has continually evolved over the years to minimize dissection of periurethral tissue and puboprostatic ligaments. This has resulted in a quicker return to continence in our latter patient group. We conclude that the learning curve for functional outcomes may be longer than for operative parameters previously studied (ie, operative time, EBL, perioperative complications) and should be assessed separately when determining the learning curve for RAP.

Our institution is a tertiary referral center and 45% of our patients are not local to the area. Follow-up on such a cohort can prove challenging; therefore, it is conceivable that our complication rate is underrepresented in this study. We place a phone call at 30 days postoperation and sequential 3-month questionnaires so that we can capture these data accurately; however, some patients may not report unscheduled visits to their local urologist for minor reasons.

Our experience is unique in that our series spans > 5 years (with > 2700 patients undergoing RAP), allowing critical assessment of mechanical and software-related failures of the da Vinci system. There were 5 (0.2% of the cases) irreversible faults of the system, 2 of which were resolved by rebooting the system. Two required technical troubleshooting by the company, and 1 was a failure of the console monitor requiring docking of our second robotic system. In the rare event of system failure, it is our practice to de-dock the system and reboot the robot. It is important to counsel patients preoperatively that this is a rare possibility.

Conclusions

The results of this large series of 2766 patients confirm the promising outcomes reported in earlier RAP series. Perioperative complications remain low and long-term oncologic outcomes are favorable. Continued experience and technical refinements of the procedure demonstrate further improvements in

operative parameters and functional results. RAP remains a safe and reproducible treatment for men with clinically localized prostate cancer.

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