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ROBOT-ASSISTED VERSUS OPEN RADICAL PROSTATECTOMY: A COMPARISON OF ONE SURGEON'S OUTCOMES

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ABSTRACT

Objectives. To compare internally one surgeon's standard open radical prostatectomy (RP) and robot-assisted laparoscopic RP (RLP) results. RLP, like standard laparoscopic RP, ultimately needs to produce similar or improved results compared with standard RP techniques. Little information comparing RLP with standard RP exists.

Methods. As an internal control, we selected the last 60 standard RPs performed by one surgeon (T.A.) before initiating RLPs. For the RLP group, we selected cases 46 to 105 (n = 60) after the learning curve had adequately matured. We compared the clinical characteristics, perioperative results, and early clinical outcomes.

Results. The study and control groups had similar clinical characteristics (age, body size, preoperative prostate-specific antigen level, clinical stage, and Gleason score). No statistically significant differences were found between groups for prostate size, pT stage, Gleason score, or margin status (16.7% versus 20%; P = nonsignificant). The RLP group had a statistically significant advantage for estimated blood loss (103 versus 418 mL), postoperative hemoglobin change (1.6 versus 3.3 mg/dL), and hospital stay (1.02 versus 2.2 days). Complete continence (0 pads) at 3 months of follow-up and the rate of postoperative complications were similar for the RLP and RP groups (76% versus 75% and 6.7% versus 10%, respectively).

Conclusions. We present the results of RLP and RP performed by one surgeon. With only a 100-case experience, RLP had oncologic and urinary outcomes that were at least equal to those after RP. RLP offers the benefits of minimally invasive surgery and does not compromise clinical or pathologic outcomes. UROLOGY **63:** 819–822, 2004. © 2004 Elsevier Inc.

Radical retropubic prostatectomy (RP) is an established technique with a long record of reported outcomes.[1–3] For a minimally invasive approach to be adopted, it must provide at least equivalent oncologic and functional results to the reference standard surgical therapy. Laparoscopic RP is a technically demanding procedure with a limited number of skilled laparoscopists specifically trained in the technique. For most urologists, the learning curve is unacceptable. Recently, the da Vinci robotic interface has been shown to significantly shorten the laparoscopic learning curve.[4,5]

Little information is available comparing robot-assisted laparoscopic prostatectomy (RLP) with standard RP. Menon *et al.*[6] and Tewari *et al.*[7] reported the experience at one institution between standard RP performed by one group of open surgeons with that of a different group of surgeons performing RLP. Although the study was prospective and covered the same period, the question remained as to how one surgeon would do with the two approaches. The purpose of this report was to compare the results of a fellowship-trained oncologic surgeon with 18 years of experience (T.A.) who had recently learned the RLP approach. After analyzing our previously reported clinical experience[5] (cases 1 to 45), we believed the RLP learning curve was sufficiently mature that cases 46 to 105

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TABLE I. *Patient characteristics*

Characteristic	Robotic	Open	*P* Value
Age (yr)	62.9 (43–78)	62.7 (50–78)	NS
BMI	26.3 (20.6–33.6)	26.5 (20–34.5)	NS
Preoperative PSA (ng/mL)	8.1 (0.1–62)	8.4 (1.1–39.6)	NS
Operative time (min)	231 (160–340)	214 (175–275)	NS
Transfusions (%)	0 (0)	1 (2)	NS
Estimated blood loss (mL)	103 (25–400)	418 (150–1200)	≤0.001
POD 1 Hb change (g/dL)	−1.6 (0.2–3.4)	−3.3 (0.3–6.1)	≤0.001
Hospital stay (hr)	25.9 (18–96)	52.8 (48–192)	≤0.001
Prostate size (g)	52.5 (18–135)	50.7 (30–108)	NS
Complications (%)	4 (6.7)	6 (10)	NS
Catheter time (days)	7	9	NS
Continence at 3 mo (0 pads)	76	75	NS

KEY: BMI = body mass index; PSA = prostate-specific antigen; POD = postoperative day; NS = not significant.
Data in parentheses are ranges, unless otherwise noted.

TABLE II. *Comparison of clinical and pathologic staging results for both groups*

Pathologic Outcome	Robotic (%)		Open (%)	
	Clinical	Pathology	Clinical	Pathology
Gleason score (%)				
≤6	33 (55)	37 (62)	31 (52)	25 (42)
3 + 4	16 (27)	11 (18)	13 (22)	19 (32)
4 + 3	4 (7)	3 (5)	7 (12)	7 (12)
8–10	7 (11)	9 (15)	9 (15)	9 (15)
Stage				
T1c	38 (63)		36 (60)	
T2a	19 (33)	16 (27)	23 (38)	9 (15)
T2b	2 (3.3)	29 (48)		35 (58)
T3a	1 (.7)	10 (17)	1 (2)	9 (15)
T3b		4 (7)		5 (8)
T4a		1 (1)		2 (3)

Data presented as number of patients, with percentages in parentheses.

represented enough development of the surgeon to compare the results with those after open RP.

MATERIAL AND METHODS

A single surgeon (T.A.), who previously had performed all RPs using the standard retropubic approach, successfully transferred to laparoscopic RP using the da Vinci interface. For the control group, we used the last 60 cases of open RP (2001 to 2002). The learning curve was believed to have matured sufficiently to warrant comparison after case 45, and cases 46 to 105 (n = 60) were selected.

The surgical technique[8] is similar to the Vattikuti Institute prostatectomy technique, except that the puboprostatic ligaments and dorsal venous complex are completely dissected and divided with an endovascular stapler. Institutional review board approval (UCI HS 98-84) has been in place since 1998. The operative times were from first incision to final closure. This included port placement, robot installation, and port closures in RLP. Pathologic review (R.E.) was performed according to standards described by the 1997 TNM classification.[9] Surgical margins were considered positive if tumor was present at the inked prostatic margin. Urinary and functional outcomes were attained at clinic visits using patient-reported questionnaires or by telephone surveys performed by a nonclinical research associate (D.S.). Sexual outcome follow-up in the RLP patients was too immature for internal comparison and will be presented in a future report. Statistical analyses were done using the Statistical Analysis Systems, version 8.2, statistical package.

RESULTS

The RLP and open RP groups were comparable for standard clinical factors such as age, body mass index, preoperative prostate-specific antigen (PSA) level, clinical Gleason score, and clinical stage (Tables I and II). The mean operative time, estimated blood loss, hospital stay, and continence rate are shown in Table I. The pathologic stage for the two groups was similar. Although not significantly different statistically, more positive surgical margins were present in the RP group than in the RLP group (12 versus 10). The positive margin rate in 44 Stage pT2 tumors was 4.5% for RLP versus

9.1% in 44 open RP cases. Although the PSA data were immature, the 3-month PSA nondetectable rate (less than 0.1 ng/mL) was 5.3% for RP versus 5.5% for RLP. Sexual function was not assessed, because of insufficient follow-up in the RLP group.

No conversions were required to open RP in the RLP procedures. Neither group had a complication, such as bleeding, that required a return to the operating room. In the RLP group, four complications occurred including one pulmonary embolism, one urine leak that responded to conservative treatment, one prolonged ileus, and one delayed episode of bleeding (14 days postoperatively and 7 days after catheter removal) that was cauterized cystoscopically. The RP group had 6 patients with complications: deep venous thrombosis in 3, a pulmonary complication secondary to asbestosis that responded to conservative therapy after 8 days of hospitalization in 1, and encroachment on the orifice necessitating ureteral stent placement at the initial operation in 2 patients. Both stents were removed at 3 weeks and the patients healed without further complications or intervention.

COMMENT

With their pioneering work, Guillonneau and Vallancien[10] have shown that a minimally invasive approach to RP is possible. However, most urologists do not have sufficient laparoscopic skills to undertake such a technically demanding procedure. Reports by Menon *et al.*[4] and our group[5] have shown that robot assistance can bridge the gap for surgeons experienced in the open approach who wish to transfer their skills to the laparoscopic medium. To date, two prospective reports, from the same investigators and institution, have compared RLP with RP. However, these reports compared the outcomes of several different open surgeons with the outcomes of one robotic surgeon.[6,7] A comparison of two techniques from different surgeons invites bias issues with regard to variability of training and technique plus surgeon experience and skill. The benefit of the present study was the direct comparison of an experienced, fellowship-trained oncologic surgeon performing both procedures. For practical purposes, using one's own experience as an internal control should minimize the biases of training, experience, and skill. However, even with an internal comparison, the preponderance of experience of 18 years with the open procedure potentially benefited the RP group's results.

In the present study, both groups were well matched for standard clinical parameters such as age, body mass index, PSA level, and so forth (Table I). Additionally, the clinical stage and Gleason score were well matched (Table II). Overall, the RLP and RP groups had similar clinical outcomes, including operative time, pathologic stage and positive surgical margin rate, catheterization interval, blood transfusion rate, postoperative complication rate, and 3-month continence rate. These findings contrast with those of Tewari and associates[7] who described significantly better results statistically for the robotic approach for margin rate, catheterization interval, transfusion rate, postoperative complication rate, and return of continence. It is possible that the difference in the outcomes in their study was related more to surgeon skill and experience than to the surgical approach. Two studies have compared RP with laparoscopic RP[11,12]; however, the laparoscopic approach was standard and not robotic. One study, a prospective comparison between different surgeons by Anastasiadis and associates,[11] and another study that was an internal comparison of three surgeons by Rassweiler and associates[12] reported much the same findings as we have. They noted similar surgical margin rates, complication rates, and continence rates. However, as experience with the robotic technique grows and technological advances in equipment accrue, outcomes would be expected to improve.

TABLE III. *Incidence of positive surgical margins*

	Robotic (%)	Open (%)
Positive surgical margin	10 (16.7)	12 (20)
pT2a + 2b	2/44 (4.5)	4/44 (9.1)
pT3a/3b + T4	8/16 (50)	8/16 (50)
Low risk*	1/20 (5)	3/29 (10.3)
High risk	9/40 (22.5)	9/31 (29)

** Less than 3 positive cores, prostate-specific antigen level <10 ng/mL, Gleason score <8.*

Additionally, the study by Tewari *et al.*[7] did not report the surgical margin status for the RP group in the same fashion as for the RLP group. In the RP group, the positive margin rate was 23%, and margins were reported using the standard method of the presence of tumor at the inked margin. The margin rate was 9% in the RLP group; however, positive margins were established by frozen and permanent section analysis of apical soft-tissue biopsies. It is possible that the RP group may have had an equally low margin status if they had used similar apical section margins. Alternatively, the RLP group may have had equally greater margin rates if reported in the standard fashion. In the present study, no statistically significant difference was found between the two groups for positive surgical margin rates (Table III); however, a trend was noted for fewer positive surgical margins in high-risk patients in the robotic group (high risk defined as more than three cores or Gleason score greater than 7 or PSA greater than 10 ng/mL). Furthermore, in patients with organ-confined tumors and

positive surgical margins (presumed iatrogenic), the rate in the robotic group was just 4.6% (2 of 44 cases), which compares very favorably with the best results of open or laparoscopic series.[1–3,10,12] In our initial 45 RLP[5] procedures, the Stage pT2 margin-positive rate was 22.6% (7 of 31); as our technique has matured, this rate has dropped to just 4.6% ($P < 0.03$).

As noted by Lepor and Kaci,[13] the primary surgical objective is the anatomic removal of the prostate with good cancer control and preservation of continence and erectile function. Minimal blood loss, best achieved by a precise anatomic approach, maintains control in the operating field and produces better clinical outcomes. The reduction in blood loss in the RLP group was confirmed by a reduction in the postoperative change in hemoglobin; only 5 patients had an estimated blood loss of between 250 and 400 mL, and 40 patients (67%) had an estimated blood loss of 100 mL or less. The RP group, in contrast, had 8 patients with an estimated blood loss of between 500 and 1200 mL and 5 patients with an estimated blood loss of less than 250 mL. We believe that the reduction in blood loss facilitates a more precise and controlled anatomic dissection and was in large part responsible for our improved margin rates with experience.

CONCLUSIONS

These results demonstrate that with one surgeon serving as an internal control the early results of RLP compare at least equally with RP in terms of urinary and oncologic outcomes. With robotic assistance, an experienced "open" surgeon can perform the laparoscopic prostatectomy without compromising the primary goal of cancer control. The patient benefits from the minimally invasive approach with reduced blood loss and a shorter hospital stay.

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