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Robotic or open radical prostatectomy after previous open surgery in the pelvic region

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Purpose: We sought to evaluate the feasibility and safety of open or robotic radical prostatectomy (RP) after rectum, sigmoid, or colon surgery.

Materials and Methods: Sixty-four patients with a median age of 65 years (range, 46–73 years) who underwent RP after previous pelvic surgery were included. Twenty-four patients (38%) underwent robotic RP and 40 patients (62%) underwent open RP. Bilateral lymph node dissection and nerve preservation were performed in 50 patients (78%) and 35 patients (55%), respectively. Variables evaluated included demographic characteristics, perioperative complications, and functional and oncological outcomes. The median hospitalization and follow-up periods were 2 days (range, 1–12 days) and 21 months (range, 1–108 months), respectively.

Results: No conversions from robotic to open surgery were performed and there were no intraoperative complications. Surgical margins were positive in 13 patients (20%), seminal vesicle involvement was detected in 6 patients (9%), and lymph node involvement was found in 2 patients (3%). Postoperative complications included lymphocele in 1 patient, urethral stricture in 1 patient, and bowel obstruction and persistent bladder leakage in 2 patients. Eighty-eight percent of the patients were continent at 7 months and 80% of patients were able to achieve erection with or without medical aid.

Conclusions: Open or robotic RP can be done safely and effectively in patients who have previously undergone pelvic surgery. Although prior pelvic surgery of the large intestine was associated with increased morbidity, it should not be considered a contraindication for robotic or open RP.

Keywords: Prostate; Prostate neoplasms; Prostatectomy; Robotics; Surgery

INTRODUCTION

Radical prostatectomy (RP) for clinically localized prostate cancer is a safe procedure and has been successful in reducing the risk of cancer-related death [1]. Many factors, including previous lower abdominal or prostate surgery or pelvic radiation, alter the anatomy, and surgeon experience will influence whether successful RP is possible. In particular, previous surgery or radiotherapy in this region can result in fibrous scaring that alters tissue layers, thus making it more difficult to perform RP [2]. Autopsy studies have revealed that up to 90% of patients who undergo open surgery develop intra-abdominal adhesion [3] and that patients who undergo laparoscopic surgery typically have fewer adhesions than do patients who undergo open surgery [4]. However, whether adhesions due to a previous surgery increase the risk or complicate the performance of future surgeries is unclear. Seifman

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et al. [5] reported that previous abdominal surgery increases the overall risk of transperitoneal renal and adrenal surgery. In contrast, Parsons et al. [6] found that previous abdominal surgery did not adversely affect the performance of urological laparoscopy. Some investigators have asserted that previous extensive transabdominal or pelvic surgery is a contraindication for laparoscopic RP [7]. However, recent studies have suggested that RP can be performed safely after radiotherapy [8,9], ileal pouch-anal anastomosis [10], and prostate surgery [11,12], even if extensive fibrosis is present and dissection planes are absent. Thus, there is both abundant information and conflicting reports in the current literature with respect to the outcomes of laparoscopic and open RP in patients who had previously undergone pelvic surgery [10,13,14]. To our knowledge, however, no previous study has evaluated the feasibility and safety of robotic or open RP in patients who have previously undergone surgery in the rectum, sigmoid, or colon specifically. In the current study, therefore, we investigated the surgical, oncological, and functional outcomes following open or robotic RP in patients who had previously undergone major surgery for oncological or nononcological diseases in the rectum, sigmoid, or colon.

MATERIALS AND METHODS

We reviewed the medical records of all patients who underwent RP between 1998 and 2011 at the University of Texas MD Anderson Cancer Center. We identified 64 patients who underwent open or robotic RP after prior pelvic surgeries involving the large intestine. Twenty-four patients (37.5%) underwent robotic RP, and 40 patients (62.5%) underwent open RP. The patients' median age was 65 years (range, 46–73 years). The median period between previous pelvic surgery and open or robotic RP was 8 years (range, 0.41–50 years). Twenty-eight patients (43.7%) had previously undergone pelvic surgery for oncological reasons and 36 patients (56.2%) had previously undergone surgery for nononcological reasons.

Data on the kinds of pelvic surgeries are summarized in Table 1. Eighty-eight percent of the patients who underwent robotic RP and 32.5% of the patients who underwent open RP had clinical stage T1c prostate cancer. Twelve patients (18.8%) received radiotherapy before surgery: nine patients because of oncologic diseases of the pelvic region and three patients because of prostate cancer. Six patients (9.3%), all of whom had received previous radiotherapy for oncological disease in the large intestine (five patients) or prostate (one patient), underwent urinary diversion; two patients (3%) underwent radical cystoprostatectomy ileal loop owing to bladder neck involvement; and four patients (6.2%) underwent RP and augmentation cystoplasty with Yang-Monti appendicovesicostomy. Neurovascular bundle (NVB) preservation and pelvic lymph node dissection (PLND) were performed in 35 (54.6%) and 50 patients (78.1%), respectively. The performance of NVB preservation and PLND was dependent on the patient's preoperative serum prostate-specific antigen (PSA) levels, clinical stage of prostate cancer, and Gleason score. The extended lymph adenectomy included obturator, hypogastric, and external iliac lymph nodes. The median operative time was 4.5 hours (range, 2.3–13.8 hours): 4.8 hours (range, 3.2–7.6 hours) for robotic RP and 3.7 hours (range, 2.3–13.8 hours)

Table 1. Kinds of pelvic surgeries prior to radical prostatectomy

Kinds of pelvic surgery	No. of cases	No. of oncologic cases	Radiotherapy
Colectomy	30	14	4
Rectal surgery	5	2	0
Sigmoid-colectomy	4	3	0
Sigmoid resection	1	0	0
Sigmoid-rectal resection	1	1	0
Colon-rectal resection	1	1	1
Bowel resection	6	1	1
Colectomy ileal anal anastomosis	1	1	0
Colon resection with ileostomy	1	1	0
Transanal resection of rectum cancer	1	1	1
Colectomy T-pouch	1	0	0
Colon resection and colostomy closure	1	1	1
Miscellaneous pelvic surgeries	11	2	1
Total	64	28	9

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for open RP. The median hospitalization and follow-up periods were 2 days (range, 1–12 days) and 21 months (range, 1–66 months), respectively. Three patients were followed at another institution and one patient did not come for follow-up. Biochemical recurrence (BCR) after RP was defined as a detectable level of serum PSA after RP. Patients were considered to be continent if they used only 1 pad or a small liner daily for security purposes only. Patients were considered to have erectile function if they could achieve erections with or without medication that were adequate for penetration intercourse.

The SPSS ver. 10.0 (SPSS Inc., Chicago, IL, USA) was used for the statistical analysis. A p-value of greater than 0.05 was accepted as insignificant. Comparison between the parameters of subgroups was calculated by use of Student t-test, the Mann Whitney U test, and chi-square tests.

RESULTS

The patients' preoperative demographic data are shown in Table 2. All patients underwent RP without intraoperative complications or conversion from robotic to open surgery. Forty-five patients (70%) had pathologic stage pT2 prostate cancer. Most patients (88%) who underwent robotic RP had clinical stage T1, whereas most patients (60%) who underwent open RP had clinical stage T2 prostate cancer. No patient who underwent robotic RP received a blood transfusion during surgery; however, 13 patients (13/40, 32.5%) who underwent open RP received blood transfusion. Median blood loss was 700 mL (range, 50–3,500 mL).

The oncological and functional outcomes are shown in Table 3. Surgical margins were positive in 13 patients (20.3%). Seminal vesicle involvement was detected in six patients (9.3%); five of these six patients were bilateral and only one patient was from the patient group who had undergone robotic RP.

Data on BCR were available for 60 patients. Serum PSA levels were detected immediately after open or robotic RP in two of these patients. Two patients had detectable immediate postoperative serum PSA values, and BCR was detected at a median follow-up of 31.5 months in eight of these patients (12.5%). Two of the patients who developed BCR had undergone robotic RP; one patient received radiotherapy to the prostatic fossa, and the other patient underwent watchful waiting because an increment in his serum PSA of 0.2 ng/mL was not observed. Of the six patients who developed BCR after open RP, two patients underwent successful salvage therapy, three patients did not respond to salvage therapy and subsequently developed distant metastasis, and one patient receiving adjuvant hormonal therapy was recently found to have a detectable serum PSA level (0.2 ng/mL) 36 months after surgery. The rates of incontinence and stricture following RP were 80.7% and 6.2%, respectively. Continence data at the 7-month follow-up were available for 49 patients; the rates of continence in patients who underwent robotic RP (88.9%) and in patients who underwent open RP (83.9%) were similar. None of the patients who underwent robotic RP had stricture.

Erectile function data were available for 40 patients. Thirty-two patients (80%) were able to achieve erection with or without medical aid (i.e., phosphodiesterase-5 inhibitors, intracavernous injection, or vacuum). Of the 35 patients who underwent NVB preservation (data on 5 patients were not available), 27 (90%) could achieve erection; of these 27 patients, 15 (15/17, 88.2%) had undergone

Table 2. Preoperative clinical variables in patients who underwent robotic or open radical prostatectomy

Variable	Robotic RP	Open RP	Total	p-value
No. of patients	24 (37.5)	40 (62.5)	64 (100)	
Age (y)	65.5 (51–73)	65 (46–73)	65 (46–73)	>0.05
Interval between pelvic surgery and RP (y)	9 (1–50)	7.7 (0.4–47)	8 (0.4–50)	>0.05
Pelvic surgery due to oncologic reasons	7 (29.0)	21 (52.5)	28 (43.7)	>0.05
Pelvic surgery due to nononcologic reasons	17 (70.8)	19 (47.5)	36 (56.2)	>0.05
Serum PSA (ng/mL)	6 (2.7–16.9)	6 (2.8–142.0)	6 (2.7–142.0)	>0.05
Gleason score	7 (6–8)	7 (6–9)	7 (6–9)	
Clinical stages				<0.05
T1	21 (87.5)	13 (32.5)	34 (53.1)	
T2	3 (12.5)	24 (60.0)	27 (42.2)	
T3	0 (0)	3 (7.5)	3 (4.7)	

Values are presented as number of patients (%) or median (range).
RP, radical prostatectomy; PSA, prostate-specific antigen.

Table 3. Oncological and functional outcomes in patients who underwent robotic or open radical prostatectomy (RP)

Variable	Robotic RP	Open RP	Total	p-value
Margins positive	5 (20.8)	8 (20.0)	13 (20.3)	>0.05
Gleason score at specimen	7 (6–9)	7 (7–9)	7 (6–9)	>0.05
Lymph node dissection	16 (66.7)	34 (82.5)	50 (78.1)	>0.05
No. of lymph nodes dissected	9.5 (3–21)	10 (2–30)	10 (2–30)	>0.05
Lymph node involvement	1 (4.2)	1 (2.5)	2 (3.1)	
Seminal vesicle involvement	1 (4.16)	5 (12.5)	6 (9.3)	
Pathological stages				>0.05
pT2	21 (87.5)	24 (60.0)	45 (70.3)	
pT3	3 (12.5)	14 (35.0)	17 (26.5)	
pT4	0 (0)	2 (5.0)	2 (3.1)	
Biochemical recurrence[a]	2 (9.5)	6 (15.4)	8 (13.3)	
Nerve preservations	22 (91.7)	13 (32.5)	35 (54.7)	<0.05
Continence[b]	16 (76.2)	26 (83.8)	42 (80.8)	>0.05
Continence at 7 months postoperatively[c]	16 (88.9)	26 (83.9)	42 (85.7)	>0.05
Stricture[d]	0 (0)	4 (10.2)	4 (6.3)	
Erection without medication[e]	4 (23.5)	3 (13.0)	7 (17.5)	
Erection with vacuum[e]	3 (17.6)	10 (43.5)	13 (32.5)	
Erection with medical therapy[e] (PDE or cavernous injection)	8 (47.0)	4 (17.4)	12 (30.0)	
Penile prosthesis or no erection[e]	2 (11.8)	6 (26.1)	8 (20.0)	
Follow-up (mo)	8 (1–44)	28 (1–108)	21 (1–108)	<0.05

Values are presented as no. of patients (%) or median (range).
PDE, phosphodiesterase -5 inhibitor.
[a]:Biochemical recurrence data were available for 21 of the 24 patients who underwent robotic RP and 39 of the 40 patients who underwent open RP. [b]:Continence data were available for 21 of the 24 patients who underwent robotic RP and 31 of the 40 patients who underwent open RP. [c]:Continence data at 7 months were available for 18 of the 24 patients who underwent robotic RP and 31 of the 40 patients who underwent open RP. [d]:Stricture data were available for 39 of the 40 patients who underwent open RP. [e]:Erection function data were available for 17 of the 24 patients who underwent robotic RP and 23 of the 40 patients who underwent open RP.

robotic RP and 12 (12/13, 92.3%) had undergone open RP.

Postoperative complications occurred in seven patients; three patients developed mild complications (i.e., minimal bowel distention and prolonged bladder leakage) and four patients developed clinically significant complications. One patient developed gall bladder cancer 2 months after surgery that was not related to RP. Among the patients who had clinically significant complications, two patients had bowel obstruction and persistent vesical fistula that mandated exploration laparotomy followed by urinary diversion ileal loop, one patient had persistent severe urethral stricture that required urinary diversion 41 months after surgery, and one patient had a lymphocele that required percutaneous drainage. Except for the lymphocele, all clinically significant postoperative complications occurred in patients who had received previous radiotherapy before undergoing open RP.

DISCUSSION

It is common for men who are diagnosed with prostate cancer to have previously undergone surgery in the pelvic region. Such surgery may negatively impact outcomes following RP. For example, periprostatic adhesions secondary to healing-related inflammatory changes following a previous surgery may increase the risk of blood loss and rectal injury during RP. Fibrosis surrounding the adhesion may make it difficult to identify and preserve sufficient urethra to perform a proper urethrovesical anastomosis, which could lead to long-term incontinence. Periprostatic adhesion owing to previous surgery may also complicate seminal vesicle dissection and NVB identification, thereby increasing the risk of surgery-induced impotence. Lymph nodes may also become enlarged in response to reactive changes following previous surgery and may thus be more difficult to dissect during RP.

Several studies have suggested that the outcomes of RP in men who have previously undergone pelvic or prostate surgery are relatively poorer than those in men who have not previously undergone such surgery [13,15,16]. However, many studies have reported that RP is feasible

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and safe in patients who have previously undergone pelvic surgery. Stolzenburg et al. [13] reported that previous pelvic surgery did not seem to affect the overall operative time, complication rate, or reintervention rate in patients undergoing RP and that minimally invasive hernia repair with mesh placement made RP more difficult to perform but was not a contraindication for RP. Umbreit et al. [10] reported that previous pelvic ileal pouch-anal anastomosis should not be a contraindication for open radical retropubic prostatectomy. The oncological and functional outcomes of radical retropubic prostatectomy that Umbreit et al. [10] reported were comparable to those of standard open RP. BCR occurred in three patients (19%) and 94% of patients regained urinary continence within 3 months. Nerve preservation was performed in 11 patients (69%), 8 of whom (73%) reported achieving erection adequate for sexual intercourse.

Previous studies of patients who underwent other surgeries before undergoing open or robotic RP included patients who had undergone various kinds of abdominal surgeries [13,14]. In our study, however, we included patients who had undergone previous pelvic surgery involving the rectum, sigmoid, or colon, which to our knowledge has not been done. Robotic or open RP was performed without significant intraoperative complications, such as rectal injury, in all patients. There were no conversions from robotic RP to open RP. Thirteen patients who underwent open RP received blood transfusions; five of these patients underwent augmentation cystoplasty and Yang-Monti catheterizable stoma in addition to RP and one patient underwent radical cystoprostatectomy ileal loop. Seven of these 13 patients had previously received radiotherapy, and 8 patients had previously undergone surgery of the large intestine for oncologic reasons. Because these patients underwent highly complicated surgeries, blood transfusion was to be expected. In Table 4, we separately evaluated the patients who had received radiotherapy in the pelvic region because of oncologic disease of the large intestine. These patients had higher rates of urinary diversion, a longer operative period and hospital stay, and a higher rate of blood loss and transfusion. The oncological and functional outcomes were also poorer in comparison with the study group; BCR was 33.3%. PLND could be done only in four patients (44.4%) and nerve preservation was done only for one patient (Table 4). The advanced oncological stage of these patients may explain the bad oncological outcomes, and radiotherapy is the most suspected factor for poor intraoperative and postoperative parameters. One patient (2%) who underwent robotic RP developed a lymphocele that resolved with percutaneous drainage. In comparison, Stolzenburg et al. [13] reported a lymphocele rate of 4.2% following endoscopic extraperitoneal RP in patients who had previously undergone pelvic surgery.

Table 4. Data on patients who underwent previous radiotherapy owing to oncologic disease in the large intestine

Variable	Value
No. of patients	9
Age (y)	65 (53–72)
Clinical stages	
T2	2
T3	5
T4	2
Patients had urinary diversion	5
Median operative time (h)	5.3 (3.4–13.8)
Blood loss (mL)	1,200 (600–1,500)
Blood transfusion[a]	6
Hospital stay (d)	3 (1–10)
Lymph node dissection	4
Biochemical recurrence	3
Nerve preservation	1

Values are presented as median (range).
[a]:Transfusion data were available for 7 patients.

Functional outcomes after RP may be directly related to previous pelvic surgery. For example, surgical disruption of the anterior pelvis may denervate the pelvis, thereby substantially increasing the risk of urinary incontinence and diminishing a surgeon's ability to preserve the NVB [17]. In our study, NVB preservation was technically demanding but was achieved in 35 patients, including all but 2 of the patients who underwent robotic RP despite the presence of adhesions and fibrosis. The low rate of NVB preservation in patients who underwent open RP was due to the lack of indications for the procedure; these patients tended to have late-stage prostate cancer and an advanced age. That 90% of those who underwent NVB preservation and for whom data were available on erection recovered their erectile function was also encouraging. The continence rates in our study were 89% and 87% in patients who underwent robotic RP or open RP, respectively, which were comparable to other rates reported in the literature. Umbreit et al. [10] reported an incontinence rate of 94% at 3 months, and Gupta et al. [12] reported that patients who underwent robotic RP after previous prostate surgery had a continence rate of 86% at 6 months. These findings suggest that functional outcomes in patients who undergo robotic or open RP after previous pelvic surgery are comparable to those in patients who

undergo robotic or open RP without previous pelvic surgery.

High rates of positive surgical margins have been reported in patients who undergo RP after previous prostate surgery. Hampton et al. [18] reported that patients who underwent RP after previous prostate surgery had higher rates of positive surgical margins than did patients who underwent RP without previous surgery. Other studies have suggested that previous prostate surgery does not affect the oncological efficacy of laparoscopic RP [12,19]. In our study, the rates of positive surgical margins in patients who underwent robotic or open RP were similar. Thirteen patients (20.3%) had a positive surgical margin; six of these patients had pathological stage pT3 prostate cancer, and four patients had a Gleason score of 9, which may explain why the patients in our study had higher rates of positive surgical margins than did patients who had not previously undergone pelvic surgery. However, the rate of positive surgical margins in the current study was comparable to or even less than those reported by previous studies for patients who underwent RP after previous pelvic surgery. Stolzenburg et al. [13] reported that 26% of patients who had previously undergone abdominal surgery had positive margins following RP, and Gupta et al. [12] reported that 22% of patients who had previously undergone prostate surgery had positive surgical margins following RP. The majority of the patients in the study by Stolzenburg et al. [13] had not undergone abdominal surgery involving the large intestine; taken together with the current study's findings, this suggests that previous pelvic surgery involving the colon, sigmoid, or rectum seems to have no adverse effects on oncological outcomes following robotic or open RP.

In the current study, all clinically significant complications occurred in highly complicated cases in which the patients had previously undergone major surgery and received radiotherapy. We believe that the complications were not only due to previous pelvic surgery but also due to open or robotic RP-associated surgeries and radiation. Two of the four patients who had clinically significant complications underwent appendicovesicostomy revisions that, aside from the adhesion lysis performed during the procedures, were not directly related to the patients' previous pelvic surgery. One of the four patients had persistent stricture, a condition that is also related to radiotherapy, which the patient had received before undergoing RP. Diversion was done in six patients, and all of these patients except one had undergone previous pelvic surgery for an oncologic reason, and all of them had received RT. We believe that these findings indicate that although previous pelvic surgery for a nononcologic reason in the absence of radiation makes open or robotic RP more difficult to perform, it does not cause major complications.

In one of the largest multicenter studies to date, which was carried out by Davis et al. [20], one of the coauthors of the present study, intraoperative and postoperative parameters for standard open and robotic RP were evaluated. The study group consisted of 71,312 RPs performed at more than 300 U.S. hospitals including our center. The operative periods were 3.4±1.5 hours and 4.4±1.7 hours for open and robotic RP, respectively [20]. In the present study, the median operative time was 3.7 hours (range, 2.3–13.8 hours) for open RP and 4.8 hours (range, 3.2–7.6 hours) for robotic RP, which is comparable to the operative time of standard RP. Median hospital stay was 2 days; 2 days for robotic RP and 3 days for open RP in our series. Similarly, in the study mentioned above, it was 2.2 days and 3.4 days for robotic RP and open RP, respectively. Lymph node dissection was performed in 60% of open RP cases and in 45% of robotic RP cases. In our study, we performed even more lymph node dissection; 82.5% and 67% of the patients who underwent open or robotic RP, respectively, had lymph node dissection. The blood transfusion rate was 32.5% in our open RP cases; no blood transfusion was performed with robotic RP. In the multicenter study by Davis et al. [20], blood transfusion rates were 11.5% and 2.3% for open RP and robotic RP, respectively. The high rate of blood transfusion in our study group was due to the advanced stages of prostate cancer, pelvic radiation, and pelvic surgery. It is difficult to compare the oncological outcomes of our complicated cases with those of patients who underwent standard RP, for which surgeons select the healthiest patients. Functional outcomes were not evaluated in the multicenter study; in our study, we had good functional outcomes in terms of continence and the erection rate.

CONCLUSIONS

Robotic or open RP is feasible and can achieve good overall results in patients who have previously undergone pelvic surgery. Previous pelvic surgery involving the rectum, sigmoid, or colon, however, makes the surgery more difficult than other kinds of abdominal surgery, although bilateral PLND and NVB preservation can be done safely and effectively. Previous pelvic surgery done for oncologic reasons associated with RT might affect the incidence of perioperative complications but should not be

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a contraindication for robotic or open RP.

CONFLICTS OF INTEREST

The authors have nothing to disclose.

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