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Extraperitoneal *v* Intraperitoneal Robotic Prostatectomy: Analysis of Operative Outcomes*

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ABSTRACT

***Background and Purpose*: Robotic prostatectomy can be performed either via an extra- or intraperitoneal approach. The extraperitoneal approach has advantages similar to those of an extraperitoneal open radical prostatectomy, but the potential disadvantages of a small working space. We report our experience using both approaches.**

***Methods*: From July 2003 to June 2004, 55 patients underwent a robot-assisted laparoscopic prostatectomy. During the first 6 months, 21 prostatectomies were performed using an intraperitoneal approach (group 1); 34 were performed using an extraperitoneal approach (group 2) during the next 6 months. Clinicopathologic parameters and perioperative complications were compared in both groups. All patients were categorized as intent-to-treat analysis.**

***Results*: Median surgery time was significantly shorter in the extraperitoneal compared with the intraperitoneal approach (3 hours and 34 minutes *v* 4 hours and 1 minute, respectively, $P = 0.017$). This was because of the shorter time interval between the skin incision and incision of the endopelvic fascia in the extraperitoneal *v* the intraperitoneal approach (55 minutes *v* 74 minutes, respectively, $P < 0.0001$). There was no significant difference in terms of patient age, clinical and pathologic stage, length of hospital stay, and perioperative complications between the two approaches.**

***Conclusion*: Extraperitoneal robot-assisted laparoscopic prostatectomy offers a similar clinical outcome as the intraperitoneal approach. However, the extraperitoneal approach avoids potential bowel injury or complications related to an intraperitoneal urine leak.**

INTRODUCTION

TYPICALLY, A ROBOT-ASSISTED or laparoscopic radical prostatectomy is performed via the intraperitoneal approach because of the perceived improved visualization and larger operating space.[1–5] Although uncommon, complications related to intraperitoneal urine leak or bleeding and bowel injury (especially in patients with previous abdominal surgery) can cause significant morbidity. The concerns of using the extraperitoneal approach are the perceived small working space, difficulty in gaining access to the pelvis, and longer surgical time. Conversely, the extraperitoneal approach has several potential advantages, including recapitulation of the open radical prostatectomy technique with all its implications, including containment of urine or blood in the extraperitoneal space that allows for tamponade, and decreased risk of bowel injury.[6–9]

The objective of this study was to evaluate both operative approaches in performing a robot-assisted laparoscopic prostatectomy (RALP) at our institution in regard to operative time, complications, and perioperative outcome.

MATERIALS AND METHODS

Between June 2003 and June 2004, 55 patients underwent RALP by a single surgeon (DPW). Group 1 included 21 patients who underwent an intraperitoneal approach during the first 6 months of the year, and group 2 included 34 patients who underwent the extraperitoneal approach during the second half of the year. These patients were numbers 31–86 in the surgeon's RALP experience. We decided to evaluate the extraperitoneal approach to recapitulate the open radical prostatectomy tech-

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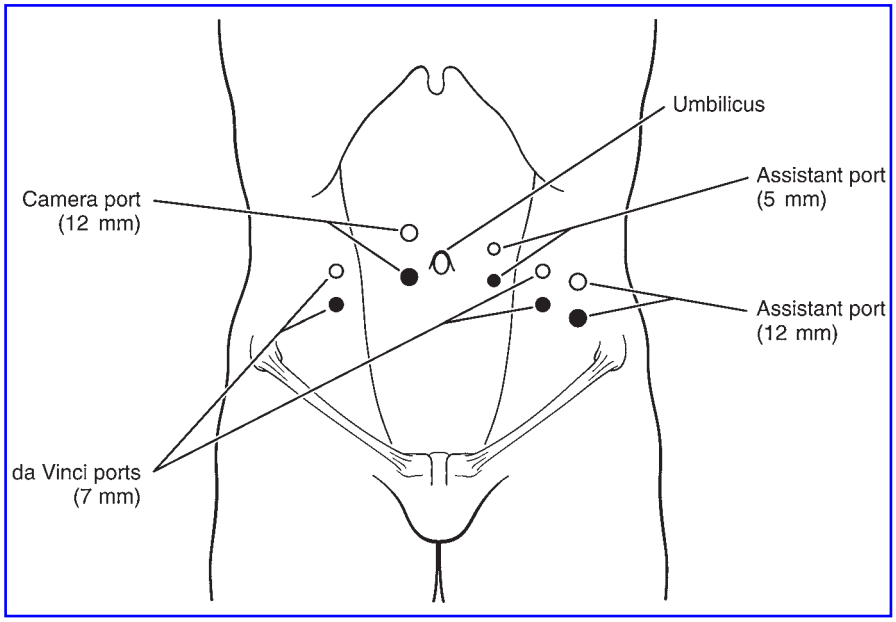

FIG. 1. Port placement for the extra- and intraperitoneal approaches. The Intraperitoneal ports were placed cephalad to the extraperitoneal ports. ○, intraperitoneal; ●, extraperitoneal.

nique. We chose to change approaches at 6-month intervals to partially eliminate patient selection bias. Intraoperative data collected included estimated blood loss (EBL), time to robot attachment, time to endopelvic fascia incision, time to skin closure, and total operative time. The pathologic results as well as postoperative complications were analyzed and compared between the groups.

For the intraperitoneal approach, we used the technique described by Menon et al.[1,2] In the extraperitoneal approach, the patient is placed in the lithotomy position with mild Trendelenburg angulation. Five ports are used as with the intraperitoneal approach but lower in the pelvis (Fig. 1).

The first incision is made 2 cm below and 1 cm to the right of the umbilicus through the anterior rectus fascia. Using finger dissection, a space for the horseshoe balloon dilator is developed (Fig. 2). The balloon is inflated under direct vision, to create enough extraperitoneal space for further trocar placement. Using the camera, the peritoneum is swept away from the anterior abdominal muscle. This allows placement of the four additional trocars under direct vision, as in the intraperitoneal approach. Unlike the intraperitoneal approach that requires both the 0-degree and 30-degree lenses, only the 0-degree lens is used in the extraperitoneal approach because of the lower camera port placement.

The following steps are similar in both approaches. We incise the endopelvic fascia and control the dorsal vein with an 0-vicryl suture. The prostate is dissected from the bladder neck in an antegrade fashion using electrocautery. The seminal vesicles and the vas deferens are resected. For nerve sparing, the prostate pedicles are taken with clips and the neurovascular bundle is dissected off the prostate bluntly using clips to control small perforating vessels. For non–nerve-sparing procedures, the neurovascular bundles are taken with bipolar cautery. The dorsal venous complex is divided, and the urethra is transected sharply at the prostate apex. The urethrovesical anastomosis is completed using 3-0 monocryl in a continuous fashion as described by Van Velthoven et al.[10]

The prostate is removed through the periumbilical camera port. The 4 working ports are removed under vision, but none is sutured closed in the extraperitoneal approach. The 12 mm assistant port is closed with a 0-polyglactin suture in the intraperitoneal approach.

For this study, urinary leak was defined as urinary extravasation that prolonged catheter drainage. Operative time was defined as time from incision to skin closure.

Both groups had a normal distribution of age allowing analysis by the Student *t*-test. Prostate volume, blood loss, and hospital length of stay were compared using the Mann-Whitney-Wilcoxon test. The Fisher's exact test compared the categorical variables between the groups if the value of any individual cell

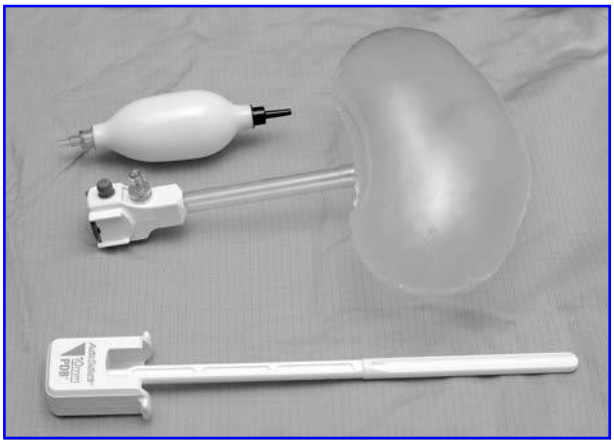

FIG. 2. Horseshoe balloon dilator to expand the perivesical space.

TABLE 1. PATIENTS CHARACTERISTICS

	Intraperitoneal (N = 21)	*Extraperitoneal (N = 34)*	P *value*
Mean age	59.0	59.5	0.76
Median prostate Volume (cc) (range)	37.3 (23–75)	41.1 (29–74)	0.17
Clinical stage			
T1c	18 (85.7%)	28 (82.4%)	0.41
T2a	2 (9.5%)	6 (17.6%)	
T2b	1 (4.8%)	0	
Preoperative PSA (ng/mL)			0.47
0–4	7 (33.3%)	7 (20.6%)	
4–10	12 (57.14%)	25 (73.5%)	
> 10	2 (9.52%)	2 (5.9%)	
Biopsy Gleason Score			0.59
2–6	10 (47.6%)	19 (55.9%)	
7	11 (52.4%)	15 (44.1%)	
8–10	0	0	

PSA = prostate-specific antigen.

was lower than five. Operative times were compared using an analysis of variance model. All analyses were done using SAS software version 9.12 (SAS Institute, Cary, NC), with $P < 0.05$ considered significant in all comparisons.

RESULTS

Perioperative patient characteristics are listed in Table 1. None were converted to open procedure. There were no significant differences between the two groups. Average blood loss was 150 mL for group 1, and 125 mL for group 2 ($P = 0.42$). The pathologic findings did not differ between the 2 groups (Table 2). Median hospital stay was 1 day in both groups; stays ranged from 1 to 20 days for the intraperitoneal group and 1 to 3 days in the extraperitoneal group. Four of the 21 patients in group 1 (two had an inguinal hernia repair and two had a cholecystectomy) and nine of the 34 patients in group 2 (five had an inguinal hernia repair, two had bowel surgery, and two had a cholecystectomy) had previous abdominal surgery. There was no significant difference in operative time or complications between the patients with or without previous abdominal surgery.

Four patients in the extraperitoneal group required that a 5 mm port be inserted into the peritoneal cavity in the upper abdomen during the procedure because of diffusion of CO_2 into the peritoneum that compromised the extraperitoneal working space. There were two short-term complications in both groups. Two patients had urinary extravasation that required prolonged catheter drainage (one in each group). A prolonged ileus in the patient with urinary extravasation in the intraperitoneal group that required a 20-day hospital stay. He did not need surgical intervention, but he did receive total parental nutrition. The patient with urinary extravasation in the extraperitoneal group was treated at home; a Foley catheter was in place for 14 days. One patient in the extraperitoneal group had a skin separation of a port site that was managed with local wound care.

Median total operative time (hours:minutes) was longer when the intraperitoneal approach was used: 4:01 (range 2:48–5:10) in group 1 *v* 3:34 (range 2:32–4:18) in group 2, $P = 0.017$, Fig. 3). When the operative times were analyzed by predetermined steps in the procedure, the time from skin incision to opening the endopelvic fascia (trocar insertion, attaching the robot, and establishing the working space) was significantly

TABLE 2. PATHOLOGIC FINDINGS

	Intraperitoneal (N = 21)	*Extraperitoneal (N = 34)*	P *value*
Positive margin			0.75
Yes	4 (19%)	8 (23.5%)	
No	17 (81.0%)	26 (76.5%)	
Extraprostatic extension			0.46
Yes	2 (9.5%)	7 (20.6%)	
No	19 (90.5%)	27 (79.4%)	
Pathologic Gleason Score			0.14
2–6	5 (25%)	7 (20.6%)	
7	13 (65%)	27 (79.4%)	
8–10	2 (10%)	0	

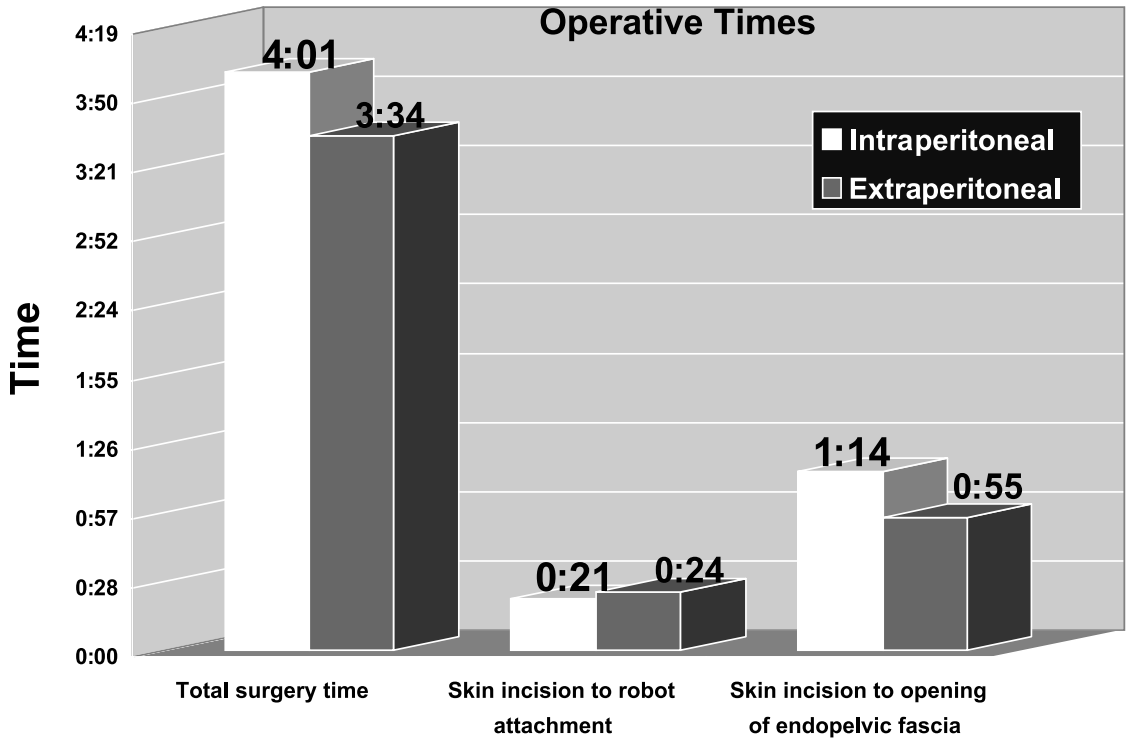

FIG. 3. Operative times for the intra- and extraperitoneal approaches.

shorter in the extraperitoneal approach (74 minutes in group 1 *v* 55 minutes in group 2, $P < 0.001$). Other steps of the procedure did not differ significantly between the groups.

DISCUSSION

RALP is usually performed using the intraperitoneal approach because of the large working space, familiarity with the port placement from other laparoscopic operations, less critical port placement, and minimal tension on the vesicourethral anastomosis. On the other hand, several potential disadvantages can occur, including risk of bowel injury, prolonged ileus with a urine leak, severe Trendelenburg positioning of the patient, and risk of vascular injuries.

The extraperitoneal approach recapitulates the open procedure and offers potential advantages compared with the intraperitoneal approach.[11–14] The primary advantage is that urine and blood are contained in the extraperitoneal space, thus providing a tissue plane for tamponade and preventing ileus that can occur when the bowel is exposed to urine or blood. In addition, the risk of bowel or vascular injury is reduced because of the insertion of all the ports under direct vision, and the patient is placed in a minimal Trendelenburg position because the peritoneum acts as a natural retractor for the bowel and the bladder. The major concerns about the extraperitoneal approach are the limited working space, prolonged operative time because of gaining access, diffusion of CO_2 into the peritoneum compromising the extraperitoneal space, and tension on the vesicourethral anastomosis.

The working space, although smaller, did not interfere with completing the procedure in our series; however, port placement was crucial to prevent inadvertent entry into the peritoneum and to allow adequate range of motion of the arms. If CO_2 diffusion into the peritoneum causes a significant decrease in the extraperitoneal working space, placement of a 5 mm port in the upper abdomen will decompress the peritoneum.

Tension on the vesicourethral anastomosis can be a problem with the extraperitoneal approach because the peritoneum is pushed cephaled by the CO_2 expansion of the prevesical space. To decrease this tension, we lowered the CO_2 pressure in the prevesical space to 10 mm Hg when performing the vesicourethral anastomosis; this allowed the peritoneum and bladder to fall back into the pelvis.

An important finding in our series is the shorter operative time in the extraperitoneal approach primarily because of a decreased time to create the perivesical working space. By using the balloon dilator, the prevesical space is rapidly developed and little additional mobilization is required. In the intraperitoneal approach, lysis of intra-abdominal adhesions and incision of the parietal peritoneum is required to develop the prevesical space. In addition, the extraperitoneal approach minimizes the sequelae from urinary extravasation or bleeding.

Remzi and associates[14] reported a 13.5% incidence of urinary extravasation and a 2.7% incidence of pelvic bleeding using the Intraperitoneal approach. Although both situations are relatively rare with laparoscopic or robot-assisted prostatectomy, they can result in significant morbidity because of subsequent ileus and lack of tamponade from the peritoneum if an intraperitoneal approach is used.

In our series, one patient in each group had urinary leakage. The patient with the intraperitoneal approach to prostatectomy was hospitalized for 20 days because of ileus, while the patient

who underwent the extraperitoneal approach recovered at home without significant ileus.

A potential bias in our study is the nonrandomized nature of the study. We attempted to overcome this problem by performing each approach sequentially at 6-month intervals. The patients who underwent prostatectomy with the extraperitoneal approach were later in the surgeon's experience, and this may have resulted in the shorter operative times. However, the only difference in operative time between the two groups was time from skin incision to opening the endopelvic fascia; this suggests that additional experience did not result in shorter operative times for the steps that were common to the two approaches. Because all the patients who underwent prostatectomy with the extraperitoneal approach are included in this analysis, the learning curve for performing this procedure is included in the operative time. This would bias the results toward longer operative times in the extraperitoneal approach.

CONCLUSION

In our experience with both the extraperitoneal and Intraperitoneal RALP, the extraperitoneal approach is quicker, offers similar clinical outcomes, avoids potential bowel injury, and prevents morbidity from urinary extravasation. It is a technique worth considering, especially in patients with previous abdominal surgeries.

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ABBREVIATIONS USED

RALP = robot-assisted laparoscopic prostatectomy.

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