



Functional and perioperative outcomes of extraperitoneal laparoscopic radical prostatectomy versus transperitoneal in university-based hospital

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Background: We aim to compare perioperative and postoperative outcomes between extraperitoneal (ELRP) and transperitoneal laparoscopic radical prostatectomy (TLRP) in localized prostate cancer using retrospective patient reported-outcome measures of functional and perioperative outcomes.

Methods: We conducted a retrospective cohort study between April 2008 and December 2018, 170 patients underwent laparoscopic radical prostatectomy (LRP). During the first period, 102 using ELRP, and 68 using TLRP. The clinical, perioperative, and functional outcomes were collected. The perioperative outcomes between the two study groups were compared. Functional outcomes were urinary function (urinary domain of EPIC) and sexual function (sexual domain of EPIC) at 3 and 12 months and oncological outcome [positive surgical margin (PSM) status and biochemical recurrence (BCR)]. Clinicopathologic parameters and perioperative complications were compared and analyzed using the R program in both groups.

Results: Patient characteristics were similar between the ELRP and TLRP groups. The ELRP was associated with increased overall operative time (270 *vs.* 227.5 min, $P < 0.001$), the TLRP was associated with decreased blood loss (800 *vs.* 400 mL, $P < 0.001$), and hospital length of stay (4.5 *vs.* 7 days, $P < 0.001$) compared to the ELRP. Early urinary continence was not different at 3 and 12 months after surgery (21.5% *vs.* 26.4%, $P = 0.34$). At 12 weeks, the difference in erectile function was better in the TLRP (33.8% *vs.* 15.7%, $P = 0.002$). No statistical difference was observed on early urinary continence at 4 and 12 weeks. PSM rates were similar between the two approaches (20.6% *vs.* 42.2%; $P = 0.006$). The BCR rate occurred at 39.2% in the ELRP and 27.9% in the TLRP ($P = 0.178$). The EPIC questionnaire was used to assess short-term functional outcomes at 3 and 12 months after surgery, that urinary and sexual function scores did not differ significantly between the ELRP and the TLRP groups.

Conclusions: In this retrospective study, transperitoneal LRP was found to be superior to extraperitoneal radical prostatectomy in terms of perioperative outcomes such as decreased operative time, decreased blood loss, shorter hospital stays, lower PSM, and improved sexual function. However, urinary and sexual function evaluations across all timepoints in both groups did not show any differences. Our findings confirm that implementation of transperitoneal LRP may have some benefits.

Keywords: Prostatectomy; transperitoneal; extraperitoneum; perioperative outcome; functional outcome

Received: 08 November 2021; Accepted: 18 January 2022; Published: 25 January 2022.

doi: 10.21037/ls-21-25

View this article at: <https://dx.doi.org/10.21037/ls-21-25>

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Introduction

Nowadays, robotic-assisted laparoscopic radical prostatectomy (RALRP) has been performed worldwide and increasing in number. However, laparoscopic radical prostatectomy (LRP) still be the standard treatment of localized prostate cancer in many countries. Montsouris reported an initial case of the transperitoneal LRP (1) and followed by the extraperitoneal approach was described (2). The approach of LRP still has been debated and depends on surgeon preference. Based on the advantage of the transperitoneal approach created the larger working space and better visualization and others prefer the extraperitoneal approach because without intraperitoneal organs involvement (3-6). Previous studies have shown comparable outcomes between the two approaches. Nevertheless, major groups of surgeons have switched from the transperitoneal to the extraperitoneal approach (7-9). This study aimed to compare the functional and perioperative outcomes resulted from 2 approaches of LRP. We present the following article in accordance with the STROBE reporting checklist (available at <https://ls.amegroups.com/article/view/10.21037/ls-21-25/rc>).

Methods

Study population

We conducted a retrospective cohort study between April 2008 and December 2018, 170 patients with clinically localized prostate cancer at Songklanagarind Hospital underwent either transperitoneal (n=68) or extraperitoneal (n=102) laparoscopic radical prostatectomy (TLRP or ELRP). The surgeons performed both techniques. Each surgeon has conducted over 100 laparoscopic procedures by the time of this study, including partial and radical nephrectomies, donor nephrectomies, adrenalectomies, and pyeloplasties. These were performed in Songklanagarind Hospital, Department of Surgery, Hat Yai, Thailand.

Ethical statement

The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). The study was approved by Institutional Ethics Committee of Songklanagarind Hospital, Prince of Songkla University (No. 62-163-10-1) and individual consent for this retrospective analysis was waived.

Pathological evaluation

All fine-needle biopsies and specimens were evaluated by the uropathologist. The presence of a tumor at the inked margin was defined as a positive surgical margin (PSM). Tumors were graded according to the Gleason score and pathological staging was based on TNM 2000 classification.

Outcomes

The major outcome measures were operational parameters, whereas secondary outcomes were pathological [including PSM and biochemical recurrence (BCR)], functional (erection and continence), and complication rates. On the other hand, a BCR is defined by two consecutive prostate-specific antigen (PSA) levels of more than 0.2 ng/mL. The EPIC questionnaire was completed preoperatively, 3 months and 12 months postoperatively. Primary outcomes included PSM status and BCR. Positive margins were a binary variable. An inked surgical margin transected cancer.

Preoperative, operative, and postoperative data

The following variables were recorded and analyzed: age, BMI, preoperative PSA value, Bx-GS and Pat-GS, clinical and pathological phases, operation time, EBL, rates of minor and major complications according to the Clavien-Dindo classification, BCR, and functional outcomes (continence and erection). After the drain was withdrawn and the oral diet was initiated, patients were discharged if no complications were seen or if they complained. All patients were advised to return to the outpatient clinic 2 weeks following discharge to have the Foley catheter removed.

Functional evaluation

At the 4th and 12th postoperative weeks, patients' continence and erection status were examined. "Continent" was defined as not using a pad, whereas incontinence was defined as requiring at least one pad per day or two pads per day. Sexual Encounter Profile Question 2 ("Were you able to place your penis into your partner's vagina?") was used to assess erection status, and all questionnaire measurements were considered as continuous, including the Expanded Prostate Cancer Index Composite (EPIC). Patients were

Table 1 Demographics and clinical characteristics of the study population: extraperitoneal versus intraperitoneal approach comparison

Characteristics	Group 1: Extraperitoneum (n=102)	Group 2: Transperitoneum (n=68)	P value
Age (years, mean \pm SD)	68.5 (6.2)	69.1 (6.0)	0.549
BMI (median, IQR)	24.2 (23, 26.7)	24.5 (22.3, 26.4)	0.429
PSA (ng/dL)	12.7 (8.2, 24.6)	14.7 (10.7, 23.9)	0.116
Clinical T stage, n (%)			0.107
1b	0	2 (2.9)	
1c	0	2 (2.9)	
2a	9 (8.8)	4 (5.9)	
2b	6 (5.9)	5 (7.4)	
2c	56 (54.9)	30 (44.1)	
3a	7 (6.9)	11 (16.2)	
3b	23 (22.5)	14 (20.6)	
4	1 (1.0)	0	
Gleason score, n (%)			0.616
6 (3+3)	35 (34.3)	16 (23.5)	
7 (3+4)	30 (29.4)	22 (32.4)	
7 (4+3)	20 (19.6)	18 (26.5)	
8 (4+4)	8 (7.8)	5 (7.4)	
9 (5+4)	9 (8.8)	7 (10.3)	

PSA, prostatic specific antigen; BMI, body mass index.

assessed at baseline 3 months, and 12 months.

Statistical analysis

The results are reported as means and SDs or as numbers and percentages. The independent *t*-test was used to compare numerical values, while the Chi-square and Fisher's exact tests were employed to compare categorical outcome variables. Statistical significance was defined as a P value of 0.05. The non-parametric Wilcoxon rank-sum test was used to determine differences in quality-of-life domain scores and other continuous factors between surgical approaches, whereas chi-square testing was utilized for categorical variables. All statistical analyses were conducted using the R programming version 4.1.1.

Results

Between April 2008 and December 2018, 170 men were enrolled, with 102 undergoing extraperitoneal laparoscopic

radical prostatectomy (ELRP) and 68 undergoing transperitoneal laparoscopic radical prostatectomy (TLRP). The intraperitoneal and extraperitoneal groups had comparable patient characteristics, including age, BMI, preoperative PSA levels, clinical T stage, and pathologic outcome (*Table 1*).

In terms of perioperative characteristics, the extraperitoneal approach was associated with an increase in overall operative time (270 *vs.* 227.5 min, $P < 0.001$), while the intraperitoneal approach was associated with a decrease in blood loss (800 *vs.* 400 mL, $P < 0.001$) and hospital length of stay (4.5 *vs.* 7 days, $P < 0.001$). Early urinary continence was comparable across extraperitoneal and intraperitoneal methods at 3 and 12 months following surgery (21.5% *vs.* 26.4%, $P = 0.34$). At 12 weeks, the intraperitoneal group had the greatest difference in erectile performance (33.8% *vs.* 15.7%, $P = 0.002$). There was no statistically significant difference in early urinary continence at 4 and 12 weeks, as shown in *Table 2*.

Overall, perioperative complications, including early

Table 2 Comparison of Intra- and postoperative data

	Group 1: Extraperitoneum (n=102)	Group 2: Transperitoneum (n=68)	P value
Overall operative time, min (IQR)	270 (235, 323.8)	227.5 (178.8, 260)	<0.001
Blood loss (mL)	800 (500, 1,200)	400 (300, 562.5)	<0.001
Time to discharge, day (IQR)	7 (6, 7)	4.5 (4, 5)	<0.001
Erectile function			
Sexual intercourse at 12 weeks			0.002
No	86 (84.3)	45 (66.2)	
Penetrate	16 (15.7)	23 (33.8)	
Continence at 4 weeks			0.34
No pad	22 (21.6)	18 (26.5)	
≥1 pads a day	80 (78.5)	50 (73.5)	
Continence at 12 weeks			0.42
No pad	62 (60.8)	40 (58.8)	
≥1 pads a day	40 (39.3)	28 (41.2)	

and late complications, were not different in both groups; 11.8% in extraperitoneal and 8.8% in the intraperitoneal approach ($P=0.45$) as in *Table 3*. We found 8 (7.8%) minor complications in Group 1 early on, including perineal pain, abdominal wall hematoma, and urinary leakage, and 3 (16.6%) complications in Group 2. Two early major complications (1.9%) occurred in Group 1, represented by two cases of urosepsis and found 1 case in Group 2 (1.4%). The modified Clavien Classification System was used to stratify postoperative complications into five grades. Eighteen complications were encountered in all 170 patients (18%); 12 complications (11.8%) were in the extraperitoneal approach and 6 patients (8.8%) in the intraperitoneal group. No significant differences were noted between the two surgical approaches in each grade of the Modified Clavien Classification ($P=0.45$). The significant adjunctive procedure was hernioplasty in both groups. A few major complications (grade III–V) according to the Clavien-Dindo classification were noted in both groups (*Table 3*).

Post-operative pathologic data, PSM rates were similar between the two approaches (20.6% intraperitoneal *vs.* 42.2% extraperitoneal; $P=0.006$). The BCR rate occurred at 39.2% in the extraperitoneal approach and 27.9% in the intraperitoneal approach ($P=0.178$). Other post-operative pathologic data, as shown in *Table 4*, were similar in both groups.

The EPIC questionnaire was used to assess short-term functional outcomes at 3 and 12 months after surgery, and the results showed that urinary function scores did not differ significantly between the extraperitoneal laparoscopic radical retropubic prostatectomy group and the intraperitoneal laparoscopic prostatectomy group at the third (74.50 *vs.* 72.10; $P=0.19$), and 12th (83.50 *vs.* 81.50; $P=0.49$) post-surgery. The intraperitoneal and extraperitoneal groups demonstrated similar scores for the sexual domain group at 3rd and 12th months post-surgery (32.6 *vs.* 30.4, respectively, $P=0.49$; 37.9 *vs.* 33.0, respectively, $P=0.21$; *Table 5*).

Discussion

Early localized PCa is still treated with RP. With the advancement of technology, LRP and RARP both provide advantages of minimal trauma, minimal postoperative pain, and speedy recovery. RARP also features unique advantages such flexible operation equipment, three-dimensional vision, and a quick learning curve, which many facilities in industrialized countries have adopted (10). PSM, urine continence, and sexual function are all better with RARP than LRP according to several systematic reviews and meta-analyses (11–14). However, several studies have indicated that RARP is more expensive than LRP due to the higher cost of surgical instruments (13,15,16).

Table 3 Comparison of postoperative complications and reoperations

	Group 1: Extraperitoneum (n=102)	Group 2: Transperitoneum (n=68)	P value
Overall complication	12 (11.8)	6 (8.8)	0.45
Early complication (before 30 th post-operative date)	10 (9.8)	5 (7.4)	0.34
Minor, n (%) Perineal pain Abdominal wall hematoma Urinary leakage	8 (7.8)	3 (4.4)	0.13
Major, n (%) Urinary sepsis	2 (1.9)	1 (1.5)	0.36
Late complication (after 30 d)	2 (1.9)	1 (1.5)	0.36
Minor, n (%) Bladder neck stricture Urethral meatus stricture	2 (1.9)	1 (1.5)	0.36
Major, n (%) Reoperation death	0	0	0
Postoperative complications	12 (11.8)	6 (8.8)	0.45
Grade I	5 (4.9)	3 (4.4)	
Grade II	2 (0.2)	1 (1.5)	
Grade IIIa	2 (0.2)	1 (1.5)	
Grade IIIb	2 (0.2)	1 (1.5)	
Grade IVa	1 (0.1)	0	
Adjunctive procedure			0.874
No	97 (95.1)	67 (98.5)	
Hernioplasty	3 (2.9)	1 (1.5)	
Appendectomy	1 (1.0)	0	
Closure colostomy	1 (1.0)	0	

Table 4 Post operative pathologic data

	Group 1: Extraperitoneum (n=102)	Group 2: Transperitoneum (n=68)	P value
T stage			0.789
2a	12 (11.8)	8 (11.8)	
2b	6 (5.9)	7 (10.3)	
2c	50 (49.0)	30 (44.1)	
3a	10 (9.8)	9 (13.2)	
3b	23 (22.5)	14 (20.6)	
4	1 (1.0)	0	
N stage			1
0	96 (94.1)	64 (94.1)	
1	6 (5.9)	4 (5.9)	
M stage			0.062
0	102 (100.0)	65 (95.6)	
1	0	3 (4.4)	
Positive surgical margin	43 (42.2)	14 (20.6)	0.006
Lymphovascular invasion	21 (20.6)	13 (19.1)	0.969
Biochemical recurrence	40 (39.2)	19 (27.9)	0.178

Table 5 Urinary and sexual function evaluation across all timepoints by surgery type

Range	Baseline				3 months				12 months			
	Group 1: Extraperitoneum (n=102)	Group 2: Transp eritoneum (n=68)	P value	Group 1: Extraperitoneum (n=102)	Group 2: Transperitoneum (n=68)	P value	Group 1: Extraperitoneum (n=102)	Group 2: Transperitoneum (n=68)	P value	Group 1: Extraperitoneum (n=102)	Group 2: Transperitoneum (n=68)	P value
	0-100	88.89 (86.64-90.95)	88.58 (86.49-90.50)	0.83	74.50 (72.67-77.27)	72.10 (68.22-74.95)	0.19	83.50 (80.33-87.17)	81.50 (80.13-85.86)	0.49		
EPIC—urinary domain	0-100	58.80 (54.66-63.72)	62.05 (58.32-67.78)	0.26	30.40 (26.28-35.21)	32.60 (27.67-37.80)	0.48	33.00 (29.72-40.08)	37.90 (33.88-43.76)	0.21		
EPIC—sexual domain	EPIC: Expanded Prostate Cancer Index composite.											

LRP is now widely used to treat localized PCa in most developing nations. Extraperitoneal and intraperitoneal surgery remain technically challenging. While TLRP is more common, ELRP has the advantage of no bowel contact and a faster return to normal food. Both strategies have benefits and drawbacks. The absence of bowel contact in E-LRP reduces the risk of intra-abdominal organ harm. The downsides are a smaller operational field and a lower view angle. The transperitoneal method is advantageous for extensive lymph node dissection and imaging. On the functional and perioperative outcomes of two approaches. Age, BMI, preoperative serum PSA, Biopsy Gleason score, Pathology Gleason score, clinical and pathological stages, and specimen did not differ between the groups. Overall perioperative complications, including early and late complications: 11.8% extraperitoneal, 8.8% intraperitoneal (P=0.45). The intraperitoneal technique had shorter operation times, shorter postoperative stays, and less EBL than the extraperitoneal approach. The extraperitoneal technique had a longer operation time from skin incision to skin suture termination (P<0.001). The extraperitoneal space creation may have caused this. In terms of EBL, intraperitoneal patients lost less blood than extraperitoneal patients (800 vs. 400 mL, P<0.001). Thus, the extraperitoneal route is associated with greater EBL. Some earlier research comparing EBL between ELRP and TLRP discovered discrepancies (17-20). One possibility is that the ergonomic space of the intraperitoneal cavity can exert enough pressure on the surrounding tissue to lower the bleeding. In the comparison between TLRP and ELRP, we can conclude that the postoperative length of stay was significantly longer in ELRP. This might be explained by the disadvantages of ELRP performed in the early period of minimally invasive surgery.

Postoperative pathological outcomes were closely linked to PSM and GS. PSM is a predictor of tumor progression that can be avoided by careful patient selection and surgical technique (21), which is closely related to PSA BCR and postoperative adjuvant treatment (22). For perioperative oncological outcomes, our results suggest that the rate of PSM was significantly lower in the intraperitoneal approach (20.6% vs. 42.2%, P=0.006). The difference from the previous results of Hakimi *et al.* (23), which compared PSM in LRP vs. RLRP and ELRP vs. TLRP, showed no statistical significance in the comparison of PSM. Nevertheless, BCR is another critical index of oncological outcomes closely related to PSM. Our conclusion revealed that the BCR of “extraperitoneal” and “intraperitoneal” were 39.2%

and 27.9%, not significantly different ($P=0.178$), but higher compared with the recent literature (24,25), which we have not mentioned about BCR survival. However, the relatively high PSM rate and BCR rate in this series should not be ignored.

Moreover, we reviewed the biopsy GS and pre-operative PSA of all patients included and found that most patients were at or above intermediate risk. Furthermore, the extra-prostatic extension rate suggested similar results in postoperative pathology. No significant differences were observed in postoperative GS in each of the two groups.

The recovery of urinary control is an important factor to consider when assessing the functional prognosis following RP. At 3 and 12 months after surgery, the results of the urinary evaluation were not different between extraperitoneal and intraperitoneal approaches (21.5% *vs.* 26.4%; $P=0.34$, 60.7% *vs.* 58.8%; $P=0.42$, respectively), indicating a stable recovery of urinary continence without increasing the incidence of postoperative urinary incontinence. Furthermore, our findings were consistent with previous literature. Asimakopoulos *et al.* (25) reported urinary control rates were 63.3%, 75.0%, and 83.3% at 3 months, 6 months, and 1 year after LRP, respectively. Ploussard *et al.* (26) found that at 3 months, 6 months, and 1 year, the urine control rates of 1,377 patients with LRP were 39.4%, 58.9%, and 68.5%, respectively. Porpiglia *et al.* (27) reported at 3 months, 6 months, and 1 year were 61.6%, 73.3%, and 83.3%, respectively. Early urine continence was similar for extraperitoneal and intraperitoneal methods at 3 and 12 months (21.5% *vs.* 26.4%, $P=0.34$). At 12 weeks, the intraperitoneal group had a considerably better ability to penetrate (33.8% *vs.* 15.7%, $P=0.002$). This means that any differences in results between different surgical approaches may not be apparent for a long time.

At 3 and 12 months, the EPIC survey rated both groups' urinary and sexual function equally. This was not the major priority. Our research is inaccurate. A lack of randomization may have introduced selection bias based on patient or surgeon preferences. Extraperitoneal method reduced blood loss and surgery time. These variables may influence patient outcomes in a two-surgeon single-institution study. There may be exceptions. This limitation is a plus. We noted the surgeons' different experience and operational approach during the study. Two things stand out about this study. It is crucial to look at longer-term outcomes such as BCR and comorbidities, as well as variations in the two surgical procedures. Contrary to expectations, the extraperitoneal procedure exhibited a similar PSM rate to

the intraperitoneal method. The EPIC questionnaire has shown adequate erectile function following extraperitoneal treatment in few instances. Third, our cohort did not get penile rehabilitation, which may have influenced long-term erectile functioning results in both study groups. In short, both techniques have good early results, with laparoscopic prostatectomy showing minimally invasive benefits. Because urinary and sexual function are expected to improve over time, major functional differences between different surgical techniques may not be apparent until prolonged follow-up.

Finally, the present study comprised a small number of patients in each category. Increasing the patient count would provide better data on complication rates and follow-up. For further research on functional and oncological outcomes, a large prospective randomized controlled study with long-term follow-up is required.

Conclusions

In this retrospective study, transperitoneal laparoscopic radical prostatectomy was found to be superior to extraperitoneal radical prostatectomy in terms of perioperative outcomes such as decreased operative time, decreased blood loss, shorter hospital stays, lower PSM, and improved sexual function. However, urinary and sexual function evaluations across all timepoints in both groups did not show any differences. Our findings confirm that implementation of transperitoneal laparoscopic radical prostatectomy may have some benefits.

Acknowledgments

We thank Ms. Nannapat Pruphetkaew, Epidemiology unit, for her great help with the statistical analysis of this article.

Funding: None.

Footnote

Reporting Checklist: The authors have completed the STROBE reporting checklist. Available at <https://ls.amegroups.com/article/view/10.21037/ls-21-25/rc>

Data Sharing Statement: Available at <https://ls.amegroups.com/article/view/10.21037/ls-21-25/dss>

Peer Review File: Available at <https://ls.amegroups.com/article/view/10.21037/ls-21-25/prf>

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at <https://ls.amegroups.com/article/view/10.21037/ls-21-25/coif>). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). The study was approved by Institutional Ethics Committee of Songklanagarind Hospital, Prince of Songkla University (No. 62-163-10-1) and individual consent for this retrospective analysis was waived.

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doi: 10.21037/ls-21-25

Cite this article as: Bejrananda T, Karnjanawanichkul W, Tanthanuch M. Functional and perioperative outcomes of extraperitoneal laparoscopic radical prostatectomy versus transperitoneal in university-based hospital. *Laparosc Surg* 2022;6:2.