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Original Article

Clinical study of 3D laparoscopic radical prostatectomy by transperitoneal and extraperitoneal approaches

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Abstract: Objective: Comparison of the clinical effectiveness and safety of three-dimensional transperitoneal laparoscopic radical prostatectomy (3D TLRP) versus 3D extraperitoneal LRP (3D ELRP) for prostate cancer. Materials and methods: To retrospectively analyze the clinical and regular postoperative follow-up data of patients who underwent 3D LRP performed by the same attending surgeon at the Affiliated Hospital of Bengbu Medical College between 2017 and 2022. A total of 82 patients who met the criteria were included. They were divided into 3D TLRP (n = 39) and 3D ELRP groups (n = 43) according to the surgical approach. The preoperative, intraoperative, and postoperative data were compared. Results: There were no statistically significant differences in preoperative characteristics between the two groups. There were also no statistically significant differences between the 3D TLRP and 3D ELRP groups in terms of intraoperative blood transfusion rate (12.82% vs. 2.33%), positive lymph node rate (11.11% vs. 2.38%), positive surgical margin rate (12.82% vs. 6.98%), pathological Gleason score, postoperative clinical stage, perioperative complication rate (10.26% vs. 4.65%), immediate urinary control rate (56.41% vs. 58.14%), 3-month postoperative urinary control rate (76.92% vs. 74.42%), 6-month postoperative urinary control rate (87.18% vs. 83.72%), 6-month postoperative biochemical recurrence rate (7.69% vs. 9.30%), or 6-month postoperative sexual function recovery rate (2.56% vs. 2.33%) ($P > 0.05$). Compared with the 3D ELRP group, the 3D TLRP group had a longer operative time (232.36 ± 48.52 min vs. 212.07 ± 41.76 min), more estimated blood loss (150.000 [100.0, 200.0] vs. 100.000 [100.0, 125.0]), longer recovery of gastrointestinal function (2.72 ± 0.89 vs. 2.26 ± 0.88), longer duration of drainage tube retention (5.69 ± 1.79 vs. 4.28 ± 2.68), and longer hospitalization time (12.54 ± 4.07 vs. 10.88 ± 2.97), with statistical significance ($P < 0.05$). Conclusion: 3D TLRP and 3D ELRP have similar oncologic and functional outcomes. Clinically, physicians can choose a reasonable procedure according to the patient's specific situation and their own surgical experience.

Keywords: 3D laparoscopy, prostate cancer, radical prostatectomy, transperitoneal, extraperitoneal

Introduction

Prostate cancer is the most common malignant tumor of the male genitourinary system, with an incidence second only to lung cancer worldwide [1]. In recent years, with China's economic growth, improved standard of living, longer life expectancy, and increase in China's aging population, the incidence and mortality rate for prostate cancer in China are on a significant rise and the disease burden is increasing. Thus, prostate cancer is gradually becoming one of the most important diseases affecting the health of middle-aged and elderly Chinese men [2, 3].

The primary prostate cancer treatment options currently available include wait-and-see, active surveillance, surgery, radical prostatectomy (RP), radiation, and endocrine therapy [4], of which RP is one of the best treatments for localized prostate cancer.

Billroth et al. [5] conducted the first open RP (ORP) for prostate cancer in 1867. Since that time, ORP has been the main surgical procedure used to treat this disease [5, 6]. The first transperitoneal laparoscopic RP (TLRP) was performed in 1992 by Schuessler et al. [7]. Raboy et al. [8] reported the first extraperitoneal LRP (ELRP) in 1997. Less intraoperative damage, clearer operative field and anatomical structures, as well as fewer postoperative complications are only a few of the benefits of minimally invasive surgery over open reduction and preservation [9-11]. It was not until the introduction and promotion of robot-assisted LRP (RALRP) that minimally invasive prostatectomy began to challenge the status of ORP as the gold standard for the surgical treatment of prostate cancer [12]. There is no significant difference in oncological and functional outcomes between open surgery and endoscopic surgery. Thus, surgical treatment should be selected based on the surgeon's experience, local medical conditions, patient's health status, and patient's willingness. For example, patients with poor lung function may not be able to tolerate the accumulation of carbon dioxide in the pneumoperitoneum, or may switch to open surgery due to factors such as bleeding.

The primary benefits of RALRP are its three-dimensional (3D) vision and the fact that the endoscopic instrument is designed to mimic human wrist articulation, which offers more commodious ergonomic circumstances for surgical procedures [13]. However, China's healthcare system is still in an inadequate and uneven state. Despite the numerous benefits of RALRP, its development has been hindered by the high costs, and it is not widely accessible in China. According to studies, 3D LRP is a good option for RALRP since it is less expensive and has similar oncological and functional outcomes [14-16]. Additionally, 3D imaging overcomes the limitations of 2D imaging and offers better benefits in perceived depth, surgical precision, and ease of spatial orientation, boosting the surgeon's performance and offering advantages for challenging laparoscopic operations [17, 18].

The surgical approach of 3D LRP mainly includes 3D ELRP and 3D TLRP. The choice of surgical method depends on the patient's condition and the surgeon's experience. To date, although there are a considerable number of studies comparing the clinical efficacy of LRP and RALRP, there is no unified conclusion. Furthermore, the literature comparing the two surgical procedures of 3D LRP is scarce. Therefore, this study retrospectively analyzed the clinical and routine postoperative follow-up data of patients who underwent 3D LRP performed by the same operating surgeon between 2017 and 2022 at the Affiliated Hospital of Bengbu Medical College (Anhui Province, China), to compare the intraoperative conditions, postoperative urinary control, tumor control, and complications of the two procedures; and to evaluate the clinical efficacy and superiority of 3D transperitoneal LRP (TLRP) versus 3D extraperitoneal LRP (ELRP) in our hospital. The results of this study are expected to provide some reference for urologists in the selection of 3D laparoscopic surgery procedures for prostate cancer.

Materials and methods

Research subjects

Type of research

This was a retrospective study.

Inclusion of subjects

The clinical and regular postoperative follow-up data of 82 patients who underwent 3D TLRP and 3D ELFP performed by the same surgeon in the Department of Urology, Affiliated Hospital of Bengbu Medical College from 2017 to 2022 were collected. Pelvic lymph node dissection was routinely performed in patients at intermediate and high risk in both groups.

Inclusion criteria

The inclusion criteria were: (1) a clear diagnosis of prostate cancer on both prostate puncture biopsy and pathology after RP; (2) patients who underwent radical prostate cancer surgery in our hospital and had complete case and follow-up information; and (3) patients who met the surgical indications of urological guidelines.

Exclusion criteria

The exclusion criteria were: (1) a combination of medical diseases that seriously affect survival; (2) a combination of other kinds of malignant tumors; (3) intraoperative concurrent other surgeries; (4) patients with a history of prior abdominal surgery; and (5) patients with incomplete or missing case information.

Research methods

Preoperative preparation

The preoperative preparation was as follows. (1) A comprehensive preoperative medical history and physical examination was conducted. Any long-term oral anticoagulants or anticoagulation therapy with low-molecular heparin were stopped for at least 7 days before surgery, blood pressure and blood sugar were controlled, and patients were asked to stop smoking and refrain from drinking alcohol before surgery. (2) Routine blood, urine, blood biochemistry, blood coagulation function, electrocardiogram, chest X-ray, urologic computed tomography, and other investigations were performed in patients prior to surgery to understand the function of all of the patient's vital organs. (3) Cleansing enemas were performed the night before and the morning of surgery, oral laxatives were taken the day before the procedure, and bowel preparation was carried out the day before surgery. Prophylactic antibiotics were also provided 30 min prior to the procedure, and the blood preparation was routine.

Surgical steps

3D TLRP surgery steps: The patient was placed in a modified Trendelenburg position (head high and feet low) and a urinary catheter was inserted. Trocars of 10, 5, 5, 12, and 12 mm were placed at 1 cm below the umbilicus, at the right McBurney's point, at the left reverse McBurney's point, and at the right and left sides of the rectus belli muscle below the umbilicus, respectively. An ultrasonic knife was detached into the Retzius space. The fatty tissue on the surface of the prostate was removed and the pubic prostatic ligament and lateral prostatic ligaments on both sides were severed. The dorsal penile nerve complex was ligated with 2-0 barbed sutures and dissected with an ultrasonic knife, the pelvic fascia was incised, the catheter was pulled, the bladder neck was identified, the base of the prostate was opposed, the bladder neck was peeled out, and the dissected urethra was revealed. The posterior aspect of the bladder neck was incised, the seminal vesicles and vas deferens were freed, the posterior wall of the prostate was tightly ligated towards the distal prostatic apex, and the lateral prostatic ligaments and vascular tissues on both sides were ligated and severed with Hemolok clips. The diaphragm was incised and the tip of the prostate was cut and the prostate was completely removed. A 3-0 barbed wire was performed for the vesicourethral anastomosis with a single stitch continuous bladder neck urethral anastomosis. A three-lumen catheter was left in place, the surgical wound was carefully hemostatic and cleaned, and the bladder was filled with water to check for leaks. Finally, the prostate specimen was removed using a specimen bag, a pelvic drainage tube was placed, and the wound was sutured (pelvic lymph node dissection is routinely performed in intermediate- and high-risk patients).

3D ELRP surgery steps: In the modified Trendelenburg position, a subumbilical incision of approximately 2 cm was made for access to the anterior peritoneal space. The gap was bluntly separated and enlarged with a homemade balloon. Two 12-mm Trocars were placed at two transverse fingers below the umbilicus and at the lateral edge of the rectus abdominis muscle. A 10-mm Trocar was placed in the subumbilical incision, and two 5-mm Trocars were placed under the lumpectomy at approximately two fingers of the bilateral anterior superior iliac spine medially and superiorly. An ultrasonic knife was used to separate the gap into the Retzius hiatus, and the rest of the procedure was performed as in the transperitoneal approach.

Specimen treatment

The specimens were fixed in 10% formaldehyde and sent to the pathology department.

Postoperative treatment

Postoperative prophylactic antibiotics were routinely administered, and intravenous nutritional support was given, with a gradual transition to a normal diet after anal discharge. Patients were encouraged to engage in both active and passive activities in the early postoperative period. The drainage tube was removed when the drainage fluid in the drainage bag was less than 20 mL/d. Any anastomotic leakage was removed after the anastomotic fistula had healed. The catheter was removed 14 days after surgery. Pelvic floor exercises were recommended to all patients after catheter removal to provide urinary continence rehabilitation.

Observation indicators

The clinical data of the two groups were collected and compared, including age, body mass

Table 1. Comparison of patients' preoperative data

	3D TLRP (n = 39)	3D ELRP (n = 43)	P
Age (years), mean ± SD	68.00 ± 7.26	70.58 ± 7.78	0.125
BMI (kg/m^2), mean ± SD	24.48 ± 2.62	24.32 ± 3.57	0.816
PSA (ng/mL), median (range) [Q1-Q3]	15.090 (8.6, 34.0)	12.200 (2.9, 39.6)	0.606
Gleason score (biopsy), % (n)			0.218
≤ 6	30.77 (12)	16.28 (7)	
7	35.90 (14)	34.88 (15)	
≥ 8	33.33 (13)	48.84 (21)	
Primary tumor (T), % (n)			0.824
T1	25.64 (10)	23.26 (10)	
T2	58.97 (23)	65.12 (28)	
T3	15.38 (6)	11.63 (5)	
Abdominal surgery history, % (n)	15.38 (6)	4.65 (2)	0.102
Preoperative ADT treatment history, % (n)	17.95 (7)	20.93 (9)	0.734

ADT = androgen deprivation therapy.

index (BMI), total prostate-specific antigen (tPSA), clinical stage, operative time, estimated intraoperative blood loss, pathological Gleason score, surgical margin, positive rate of lymph node, pathological stage, perioperative complications, hospitalization time, postoperative gastrointestinal function recovery time, urinary control rate, and biochemical recurrence (BCR). Postoperative recovery of gastrointestinal function was defined as the time to first postoperative gas evacuation.

Follow-up

Patients were instructed to visit our outpatient clinic regularly for follow-up, which included monitoring serum tPSA and testosterone levels. The BCR of prostate cancer was defined as: PSA value ≥ 0.2 ng/mL at two consecutive follow-up visits. Urinary control recovery was defined as either not needing to use urinary pads or prophylactic use of urinary pads ≤ 1 pad/day.

Statistical analyses

SPSS 25.0 statistical software was used to analyze the data, and the two-sample independent *t*-test or rank sum test was used to analyze the data. The mean ± standard deviation ($\bar{x} \pm s$) were used to describe normally distributed data, and the median (first quartile, third quartile) was used for non-normal data distribution. Comparisons of the count data were performed using the chi-square test or Fisher's exact test. Differences were considered statistically significant at P < 0.05.

Results

Comparison of preoperative data

The patients were divided into the 3D TLRP group (n = 39) and the 3D ELRP group (n = 43) based on the different surgical approaches. In the 3D TLRP group, the patients had a mean age of 68.00 ± 7.26 years and a BMI of 24.48 ± 2.62 kg/m^2. The preoperative tPSA was 15.09 (8.60, 34.00) ng/mL, with 12 cases having a Gleason score of ≤ 6, 14 cases with a score of 7, and 13 cases with a score of ≥ 8. Among them, 10 cases were classified as T1 stage, 23 cases as T2 stage, and 6 cases as T3 stage. Six patients had a history of previous abdominal surgery, and seven patients received neoadjuvant endocrine therapy before surgery. In the 3D ELRP group, the patients had a mean age of 70.58 ± 7.78 years and a BMI of 24.32 ± 3.57 kg/m^2. The preoperative tPSA was 12.20 (2.90, 39.60) ng/mL, with 7 cases having a Gleason score of ≤ 6, 15 cases with a score of 7, and 21 cases with a score of ≥ 8. Among them, 10 cases were classified as T1 stage, 28 cases as T2 stage, and 5 cases as T3 stage. Two patients had a history of previous abdominal surgery, and nine patients received neoadjuvant endocrine therapy before surgery. There were no significant differences in the above preoperative data between the two groups (P > 0.05; **Table 1**).

Table 2. Comparison of intraoperative and postoperative data of patients

	3D TLRP (n = 39)	3D ELRP (n = 43)	P
Intraoperative blood transfusion, % (n)	12.82 (5)	2.33 (1)	0.068
Lymph node positivity, % (n)	11.11 (4)	2.38 (1)	0.117
Positive surgical margin, % (n)	12.82 (5)	6.98 (3)	0.373
Pathology Gleason score, % (n)			0.754
≤ 6	5.13 (2)	9.30 (4)	
7	53.85 (21)	53.49 (23)	
≥ 8	41.03 (16)	37.21 (16)	
Pathological stage, % (n)			0.135
T1	7.69 (3)	9.30 (4)	
T2	53.85 (21)	72.09 (31)	
T3	38.46 (15)	18.60 (8)	
Perioperative complication, % (n)	10.26 (4)	4.65 (2)	0.330
Operative time (min), mean ± SD	232.36 ± 48.52	212.07 ± 41.76	0.045
Estimated blood loss (mL), median (range) [Q1-Q3]	150.000 (100.0, 200.0)	100.000 (100.0, 125.0)	0.022
Gastrointestinal function recovery time (days), mean ± SD	2.72 ± 0.89	2.26 ± 0.88	0.020
Drainage tube retention time (days), mean ± SD	5.69 ± 1.79	4.28 ± 2.68	0.007
Hospitalization time (days), mean ± SD	12.54 ± 4.07	10.88 ± 2.97	0.020

Comparison of intraoperative and postoperative data

The differences between the 3D TLRP and 3D ELRP groups in terms of intraoperative blood transfusion rate (12.82% vs. 2.33%), positive lymph node rate (11.11% vs. 2.38%), positive surgical margin rate (12.82% vs. 6.98%), pathological Gleason score, postoperative clinical stage, and perioperative complication rate (10.26% vs. 4.65%) were not statistically significant ($P > 0.05$). Regarding complications, one case of urinary fistula, one case of lymphovascular fistula, one case of infectious fever, and one case of intestinal obstruction occurred in the 3D TLRP group; one case of urinary fistula and one case of infectious fever occurred in the 3D ELRP group, and all of these patients recovered through active conservative treatment. Intraoperative hemorrhage and ureteral injury did not occur in either group. The difference between the two groups was not statistically significant (**Table 2**).

Compared with the 3D ELRP group, the 3D TLRP group had a longer operative time (232.36 ± 48.52 min vs. 212.07 ± 41.76 min), more estimated blood loss (150.000 [100.0, 200.0] vs. 100.000 [100.0, 125.0]), longer recovery of gastrointestinal function (2.72 ± 0.89 vs. 2.26 ± 0.88), longer duration of drainage tube retention (5.69 ± 1.79 vs. 4.28 ± 2.68), and longer hospitalization time (12.54 ± 4.07 vs. 10.88 ± 2.97), with statistical significance ($P < 0.05$; **Table 2**).

Comparison of postoperative follow-up data

There were no statistically significant differences in immediate urinary control rate (56.41% vs. 58.14%), 3-month postoperative urinary control rate (76.92% vs. 74.42%), 6-month postoperative urinary control rate (87.18% vs. 83.72%), 6-month postoperative biochemical recurrence rate (7.69% vs. 9.30%), or 6-month postoperative sexual function recovery rate (2.56% vs. 2.33%) ($P > 0.05$; **Table 3**).

Discussion

Prostate cancer is a global health problem that poses a great risk to the life and health of men. In 2003, Salomom et al. [19] proposed the first "trifecta" of tumor control, restoration of urinary control, and preservation of sexual function for the postoperative outcome of RP. Since this criterion can provide a comprehensive overview of the outcomes of patients after RP, it has been widely used to evaluate the outcomes of RP among different surgical procedures. Since then, with the improvement of surgical techniques and equipment and people's demand for a good quality of life, higher standards for the efficacy of RP have been proposed. The previous triple-win evaluation criteria were raised to five-win evaluation criteria of

Table 3. Comparison of patient's postoperative follow-up data

	3D TLRP (n = 39)	3D ELRP (n = 43)	P
Urinary Control Recovery, % (n)			
Immediate	56.41 (22)	58.14 (25)	0.874
3 months	76.92 (30)	74.42 (32)	0.792
6 months	87.18 (34)	83.72 (36)	0.658
BCR after 6 months postoperatively, % (n)	7.69 (3)	9.30 (4)	0.794
Recovery of sexual function 6 months after surgery, % (n)	2.56 (1)	2.33 (1)	0.944

"tumor control, urinary control, sexual function preservation, positive margin rate, and surgical complications". Therefore, in this study, the efficacy of 3D TLRP and 3D ELRP was compared in five aspects: tumor control, urinary control, sexual function recovery, positive margin rate, and surgical complications.

Comparison of surgical outcomes

<u>Tumor control</u>

A commonly used index to assess tumor control after surgery is BCR. According to the standards of urologists' associations in Europe and the United States, the general PSA value for prostate cancer patients undergoing RP can be reduced to 0.2 ng/L. If the PSA value is ≥ 0.2 ng/mL at two consecutive follow-ups after surgery, it is considered PSA recurrence. BCR is a precursor of recurrence and metastasis in prostate cancer and is closely related to patient prognosis [20, 21]. A multicenter study that included 496 patients found biochemical recurrence rates of 9.8% and 8.6% at 3 and 12 months postoperatively, respectively [22]. Yilmazel et al. [16] showed that in the 3D-LRP group, the biochemical recurrence rate was 4% at 3 months postoperatively and 7% at 6 months postoperatively. In our study, the 6-month postoperative biochemical recurrence rates were 7.69% and 9.30% in the 3D TLRP and 3D ELRP groups, without statistical significance. However, due to the small number of cases included in this study, the results have some limitations.

<u>Urinary control</u>

Urinary incontinence is one of the most common complications after RP, which seriously affects patients' physical and mental health and reduces their postoperative quality of life [23-25]. Therefore, urinary control recovery is one of the important indicators to evaluate the surgical efficacy of RP. A 10-year study by Clements et al. [23], which included 3945 patients, showed that 86% and 91% of patients recovered urinary control at 6 and 12 months after RP, respectively. In this study, the rates of urinary control in the 3D TLRP group were 56.41%, 76.92%, 87.18% and in the 3D ELRP group were 58.14%, 74.42%, 83.72% immediately, and at 3 and 6 months postoperatively, respectively. No statistically significant difference was found between the two groups ($P > 0.05$). Based on the current study, it can be found that the effect of whether or not to perform LRP extraperitoneal on the recovery of urinary control in patients after surgery was not significant [26, 27].

<u>Sexual function recovery</u>

Erectile dysfunction (ED) is one of the most common complications in patients after RP and is one of the more difficult aspects to assess postoperatively. There are many influencing factors related to sexual function recovery including age, preoperative erectile function (EF), and the number of nerves preserved by surgery [28]. The results on ED incidence vary widely across the literature due to the large number of influencing factors with differences in the definition of ED [29]. Studies have shown that the incidence of ED after RP varies from 14% to 90% [30]. In this study, there was no statistically significant difference in the recovery rate of sexual function at 6 months after surgery between the 3D TLRP and 3D ELRP groups (2.56% vs. 2.33%), which is consistent with the results of the study by Wang et al. [26]. The recovery time of EF after surgery is long, often lasting more than 1 year and even up to about 4 years. Therefore an adequate systematic long-term evaluation is necessary [30]. The results are limited by the lack of systematic assessment of preoperative sexual function, the short postoperative follow-up period, and the generally high age of patients in this study (69.35 ± 7.60), resulting in a low rate of recovery of sexual function. The surgical procedure preserves the periprostatic nerve and vascular structures, thus facilitating the recovery of EF [31].

Positive surgical margin

Positive surgical margin (PSM) are specimens with cancer cells on the surface or ink-stained margins that can be observed under the microscope after RP. The rate of PSM is an independent risk factor for BCR of prostate cancer after RP and is one of the important indicators of the efficacy of surgery. Postoperative pathology indicates that patients with positive PSM are more likely to suffer biochemical recurrence and clinical progression of tumors [32, 33]. Studies have shown that the rate of PSM after LRP is approximately 20% [34-36]. In this study, the rate of PSM after 3D-LRP was 9.76%, which was lower than the above results, probably due to the small number of cases in this study. It also may have been related to the technical level of the surgeon and the level of pathological diagnosis [37]. In our study, the rates of PSM were 12.82% and 6.98% in the 3D TLRP and 3D ELRP groups, respectively, with no statistically significant difference, indicating that the positive margins were not related to surgical access.

Surgical complications

The surgical complications of 3D-LRP typically include bleeding, infectious fever, intestinal obstruction, rectal injury, anastomotic fistula, urinary incontinence, and ED. In a study by Cao et al. [38], the total complication rate was 11.4% (86/753) in the TLRP group and 9.8% (61/623) in the ELRP group, with no statistically significant difference. In this study, the incidence of surgical complications in the 3D TLRP and 3D ELRP groups was 10.26% and 4.65%, with no statistically significant difference, consistent with the results of the above study. Among them, one case of urinary fistula, one case of lymphovascular fistula, one case of infectious fever, and one case of intestinal obstruction occurred in the 3D TLRP group; and one case of anastomotic fistula and one case of infectious fever occurred in the 3D ELRP group. All of these patients recovered with aggressive conservative treatment. No serious complications such as intraoperative hemorrhage, ureteral, or rectal injury occurred in either group. Due to the retrospective nature of the study, a more comprehensive count of some of the milder complications was not possible, which may have led to the lack of significant difference in the data between the two groups. Based on previous studies, it can be concluded that bowel-related complications are higher after TLRP than ELRP, mainly related to the greater impact of TLRP on the abdominal cavity [26, 39].

Comparison of perioperative data

The perioperative data included the duration of surgery, the amount of surgical bleeding, the duration of drainage tube retention, and the duration of postoperative hospitalization. Re garding operative time, 3D-LRP is 30-40 min shorter than LRP, likely due to the contribution of 3D vision to shorten the vesicourethral anastomosis time [40]. The results of meta analysis by Wang et al. [26] showed no statistically significant difference in operative time between the TLRP and ELRP groups. Cao et al. [38] demonstrated a statistically significant difference of nearly 30 min reduction in operative time in the ELRP group compared to the TLRP group. In this study, the operative time of 3D ELRP (212.07 ± 41.76 min) was significantly shorter than that of the 3D TLRP group (232.36 ± 48.52 min), and the recovery of gastrointestinal function was faster (2.26 ± 0.88 vs. 2.72 ± 0.89). There was a statistically significant difference between the two groups ($P < 0.05$). The shorter time and faster recovery of gastrointestinal function in the 3D ELRP may be related to its lack of access to the peritoneal cavity, which is not affected by abdominal adhesions and intestinal tube decline. The length of surgery time may be related to postoperative recovery and perioperative complication rate. Therefore, 3D ELRP had an advantage over the 3D TLRP group in terms of operative time. Regarding estimated blood loss, the results of a study by Bejrananda et al. [41], which included 266 patients, showed that the ELRP (800.0 [500.0, 1200.0]) group showed more intraoperative volume than the TLRP (400.000 [300.0, 537.5]) group, and the difference was statistically significant. In this study, estimated blood loss was more in the 3D TLRP group (150.000 [100.0, 200.0]) than in the 3D ELRP group (100.000

[100.0, 125.0]), and the difference was statistically significant. Since the surgeon's experience and proficiency largely determine the operative time and the amount of estimated blood loss, the operative time varies widely among reports.

In this study, the 3D TLRP group had longer drainage tube retention time (5.69 ± 1.79 vs. 4.28 ± 2.68) and longer hospitalization time (12.54 ± 4.07 vs. 10.88 ± 2.97) than the 3D ELRP group, with statistical significance. The shorter duration of postoperative drainage tube retention after 3D ELRP may be due to the extraperitoneal route of the procedure, which produces more limited postoperative drainage fluid and facilitates drainage. A shorter hospital stay is associated with surgery without access to the abdominal cavity and faster recovery of postoperative gastrointestinal function.

Prospects and shortcomings

This was a retrospective study that included 82 patients; the small number of cases was prone to bias. Moreover, the follow-up time was short, and the tumor control and long-term complications were unknown. To more accurately assess the clinical effectiveness and safety of 3D TLRP against 3D ELRP, a bigger sample size, long-term, multicenter randomized controlled trial is required.

Conclusion

3D TLRP and 3D ELRP have similar oncologic and functional outcomes. 3D TLRP has the benefits of a larger operating space, more pronounced anatomic landmarks, and less tension in the vesicourethral anastomosis, which facilitates expanded lymph node dissection. 3D ELRP has the advantages of a more relaxed position, shorter operative time, less estimated blood loss, and a shorter hospitalization time and drainage tube retention time. The procedure does not enter the abdominal cavity and is not affected by abdominal adhesions. Both procedures have their own advantages and are worth study, promotion, and application. Clinically, physicians can choose a reasonable procedure according to the patient's specific situation and their own surgical experience.

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All participants have signed informed consent forms.

Disclosure of conflict of interest

None.

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