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# Reduced Port Extraperitoneal Laparoscopic Radical Prostatectomy

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Additional information is available at the end of the chapter

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## Abstract

Robot-assisted laparoscopic prostatectomy (RALP) is more popular than laparoscopic radical prostatectomy (LRP) in twenty-first century. However, RALP is still an expensive surgery. Open radical prostatectomy (ORP) was a gold standard and not an expensive surgery. However, ORP is not minimum invasive. LRP is relative expensive and minimum invasive. The problem of RALP or LRP is necessary to spread the wound for removing prostate and the pain of wound is often a problem. Using U-shaped incision at umbilicus, spreading the wound is not necessary to remove prostate. Single-port surgery is a challenging procedure for surgeons in spite of faster recovery and higher patient satisfaction than conventional laparoscopy. Adding one or two port, reduced port surgery is easier than single-port surgery. Reduced port LRP is an extension of conventional LRP. The procedure is as same as conventional LRP. Curved or flexible instruments are not always necessary in the reduced port LRP. Reduced port LRP has less pain and better cosmetics than conventional LRP because the prostate is removed from the umbilicus. It is not necessary to spread the wound for removing prostate.

**Keywords:** reduced port LRP, conventional LRP, umbilicus, EZ access

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## 1. Introduction

Nowadays, robot-assisted laparoscopic prostatectomy (RALP) is more popular than laparoscopic prostatectomy (LRP). However, RALP is a most expensive surgery. The overall cost consequence of RALP was estimated at an additional €2459 (95% CI 1377–3540,  $p = 0.003$ ) as compared with ORP and an additional €3860 (95% CI 559–7160,  $p = 0.031$ ) as compared with LRP [1]. Rabenalt et al. reported single-port LRP in 2010 and Amin et al. and Cáceres

et al., reported in 2011 and 2012 [2–4]. Single-port surgery leaves little to no scarring and may reduce complications that commonly occur after traditional open and even traditional laparoscopic abdominal surgery. Patients are reporting less discomfort and faster recovery compared with those undergoing traditional laparoscopy. Tugcu et al. reported that single-port pyeloplasty can offer faster recovery and higher patient satisfaction than conventional laparoscopic pyeloplasty [5].

Ca'ceres et al. reported their 31 case of single-port LRP. In their results, mean operative time was 207 min and mean estimated blood loss was 258 ml. The average length of stay was 2.9 days and visual analog pain score (range: 0 [no pain] to 10) at day 2 was 1.2. Five focal positive margins (16.7%) were encountered. Major complications occurred in two patients (6.5%) (hypercapnia with respiratory acidosis and rectourethral fistula) and minor complications in four (12.9%) (atrial fibrillation, orchitis, transfusion, and vomiting). No case required additional analgesia. Thus, single-port LRP might be a safe procedure for skillful surgeon. However, for common surgeons, the single-port approach is more challenging than traditional laparoscopy because the surgeon has less freedom of movement with all instruments using the same entry point. Specially designed flexible instruments help to overcome that limitation. Sato et al. reported that 469 single-site surgeries were carried out between February 2009 and December 2012 at nine academic institutions in Japan. Radical prostatectomy was carried out in only six cases [6].

However, adding one or two port, reduced port surgery is easier than single-port surgery. Reduced port LRP is an extension of conventional LRP. The procedure is as same as conventional LRP. Recently, we perform several reduced port laparoscopic surgery, such as pyeloplasty, partial nephrectomy, excision of urachal remnant, and prostatectomy. We start reduced port LRP from April 2018. In this chapter, we introduce reduced port LRP. Reduced port LRP has less pain and better cosmetics than conventional LRP. It is not necessary to spread the wound for removing prostate.

## 2. Reduced port LRP

### 2.1. Indications

Radical prostatectomy (RP) is an appropriate therapy for any patients with clinically localized prostate cancer that can be completely excised surgically, who has a life expectancy of 10 years and more and has no serious conditions that would contraindicate an elective operation.

The indications for laparoscopic RP (LRP) are same as that of open radical prostatectomy.

Absolute contraindications to laparoscopic prostatectomy include the inability to undergo general anesthesia or uncorrectable bleeding diatheses.

Patients who had a history of inguinal mesh herniorrhaphy, or primary transurethral resection of prostate (TURP) 3–4 months before LRP, is not an indication of extraperitoneal LRP. Inguinal hernia repair with the incorporation of prosthetic mesh has been reported to create a dense, fibrotic reaction, complicating future pelvic procedures [7]. There have been several reports of surgeons encountering severe fibrosis and scarring during RRP in patients who have

undergone prior mesh hernia repairs, leading to early termination of the procedure [8–10]. Recent several studies have reported that transperitoneal LRP after prior laparoscopic inguinal herniorrhaphy is feasible and does not adversely affect operative and functional results [11–13]. In my experience, adhesions and distortion of normal anatomy is a serious problem of performed extraperitoneal prostatectomy. It is better to consider transperitoneal approach.

Capsular perforation during TURP and extravasation of the irrigation fluid might be periprostatic fibrosis. Fibrosis of the previously resected bladder neck may lead to worse healing at the anastomosis [14, 15]. Menard et al. compare the morbidity and functional results after laparoscopic radical prostatectomy with and without previous TURP [16]. They performed LRP at least 3 months after TURP. They concluded LRP after TURP can be performed without compromising the radical nature of cancer surgery. However, the procedure is associated with worse intraoperative and postoperative outcomes with respect to operative time, length of catheter stay, length of hospital stay, and surgical complication rate. Gellhaus et al. reported the results of RALP after HoLEP. According to their report, the posterior bladder neck and apical dissections were significantly more challenging in the setting of previous HoLEP [17].

## **2.2. Informed consent**

As with open surgery, patients must be counseled on the risk of adjacent organ injury, such as ureter, rectum, bladder, and iliac vessels. Patients undergoing LRP must be aware of the potential for open conversion. The risk of general anesthesia should be presented to the patients.

## **2.3. Bowel preparation**

Considering the risk of rectum injury, a preoperative bowel preparation may be used. The patient diet is limited to clear liquids only after 21'o clock the day before surgery. An enema administered the morning of surgery is recommended. A broad-spectrum antibiotic is administered intravenously 30 min before surgery.

## **2.4. Patient positioning**

The patient is placed in a supine position in slightly Trendelenburg with arms tucked and padded at the sides. Open radical prostatectomy (ORP) was high risk of deep venous thrombosis (DVT). The risk of DVT in LRP is low. However, pelvic lymphadenectomy (PLND) is a risk of DVT in spite of laparoscopic surgery. Sequential compression stocking devices are placed on both legs and activated before surgery. To allow for the access to the rectum, patient's legs are spread apart.

## **2.5. Surgical technique**

### *2.5.1. Trocars insertion*

A right-handed surgeon stands on the left side of the patient. A U-shaped incision is placed on the lower edge of the umbilicus, the subcutaneous fat is divided by the muscle hook, and the rectus abdominal muscle is bluntly peeled off. It is easy to access the space between

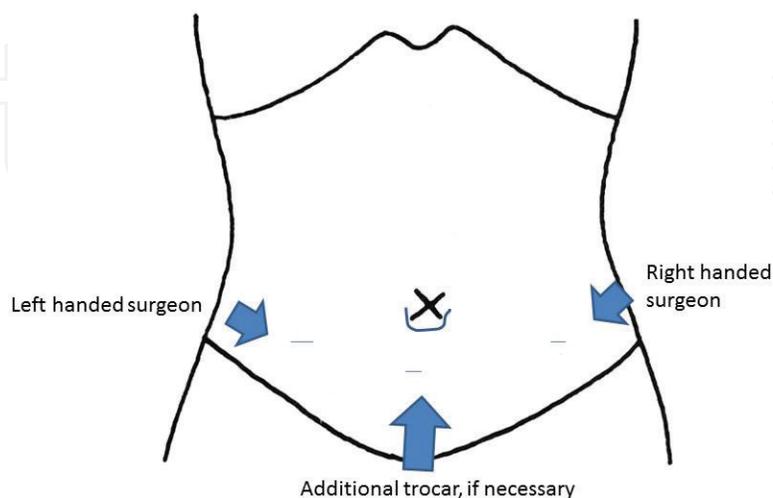
urachal duct and posterior rectus sheath. Middle finger or index finger is inserted and bluntly peeled off to the arcuate line. A balloon dilator device (PDB balloon, A balloon dilator device (PDB balloon, Coviden Autosuture, Mansfield, MA) is inserted into the preperitoneal space and advanced down to the pubis along the midline. Approximately 500–900 ml of the air is inflated to develop the space of Retzius under direct vision of flexible 5 mm endoscope inserted through the balloon trocar. After removing the balloon trocar, special multi-lumen access device was put in the umbilical incision. Various different devices exist of single-port access, including the GelPort (Applied Medical, Rancho Santa, Margarita, CA), the TriPort (Advanced Surgical Concepts, Bray), and EZ access (Hakko Co. Ltd., Tokyo). Usually, we used EZ access oval type (Hakko Co. Ltd., Tokyo). The cost of EZ access is only \$75.7. For example, the price of GelPort is \$299.00. A 12 mm and a one 5 mm trocar are inserted into EZ access (to consider cost, reusable trocar is better). Start pneumoperitoneum at 10 mm Hg; 3 mm or 5 mm trocar is inserted into the left lower abdomen (right-handed surgeon) or the left lower abdomen (left-handed surgeon), and next 5 mm trocar is inserted into middle lower abdomen. If necessary, 3 mm or 5 mm port is inserted opposite side of lower abdomen (**Figures 1 and 2**).

### 2.5.2. Development of Retzius cavity and endo-pelvic fascia incision

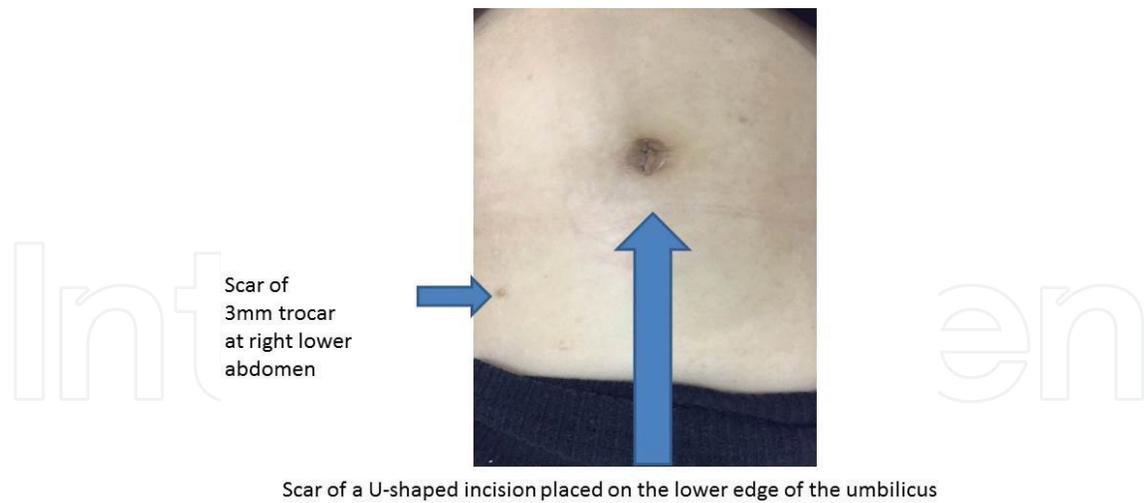
The fat in front of prostate is removed from prostate. Anterior surface of prostate is revealed until the deepest of Retzius cavity. Endo-pelvic fascia is incised along both outsides of the prostate gland and the rectal pre-fat is exposed on the dorsal side (**Figure 3**). Preventing inguinal hernia, peritoneum is dissected from seminal duct and vessels.

### 2.5.3. Dissecting of bladder neck and cutting

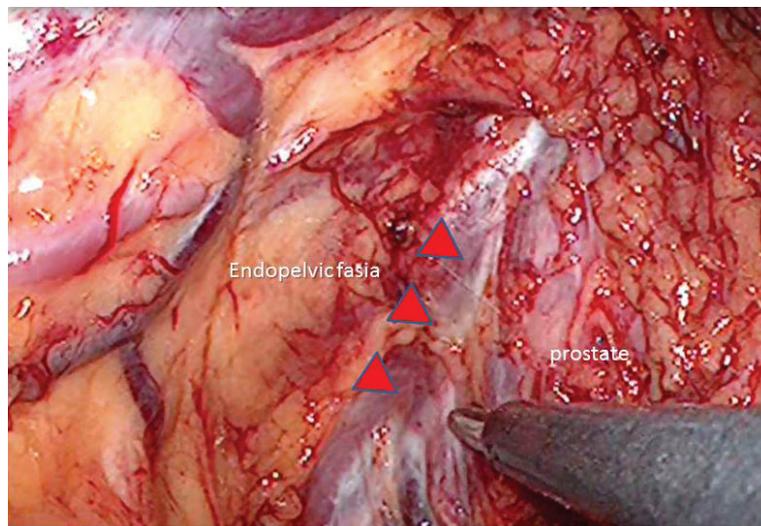
The fat outside the bladder prostate boundary is removed as much as possible. The shape of bladder neck is revealed (**Figure 4**) and lateral part of the seminal vesicles is identified before



**Figure 1.** Schema of trocar placement.



**Figure 2.** A picture of operative scars after surgery.

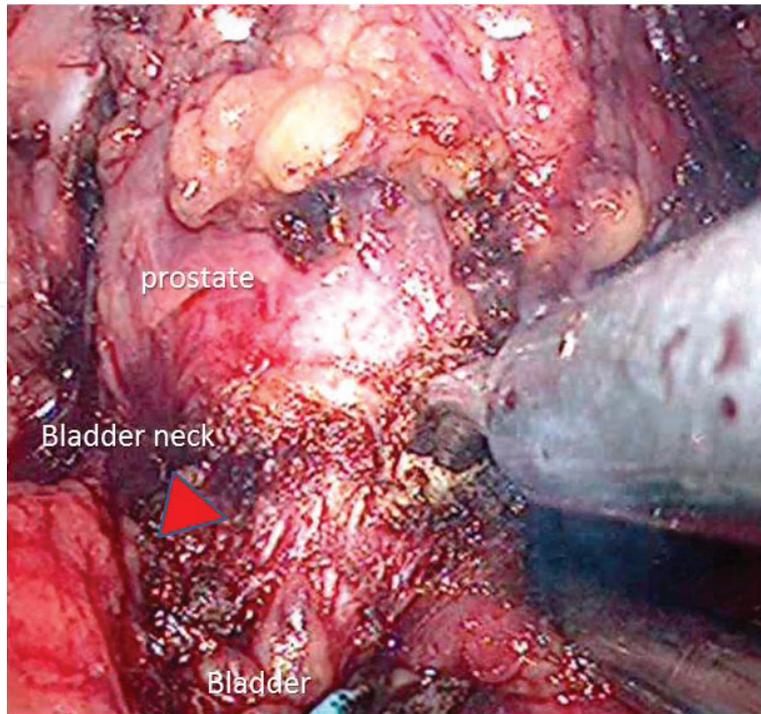


**Figure 3.** Cutting of endo-pelvic fascia.

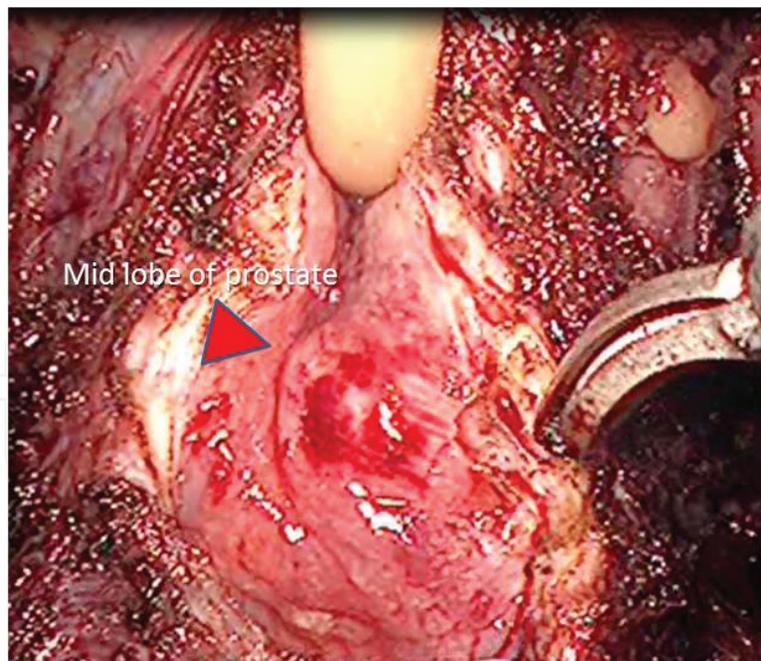
bladder neck cutting. Cutting after the internal urethral meatus (**Figure 5**), the vas deferens is identified and cut (**Figure 6**).

#### 2.5.4. Denonvilliers' fascia incision and cutting the prostatic lateral ligament

After dissection of the seminal vesicles from bladder, the seminal vesicles and the vas deferens are lifted up, the Denonvilliers' fascia was incised carefully. The space between the rectum and the prostate is dissected at the midline. The prostatic lateral ligament remaining on the prostate outer side is coagulated and cut (**Figure 7**). It is easy to use a sealing device to proceed without switching the device. To avoid rectal injury, it is important to take care of the line of cutting prostate lateral ligament.

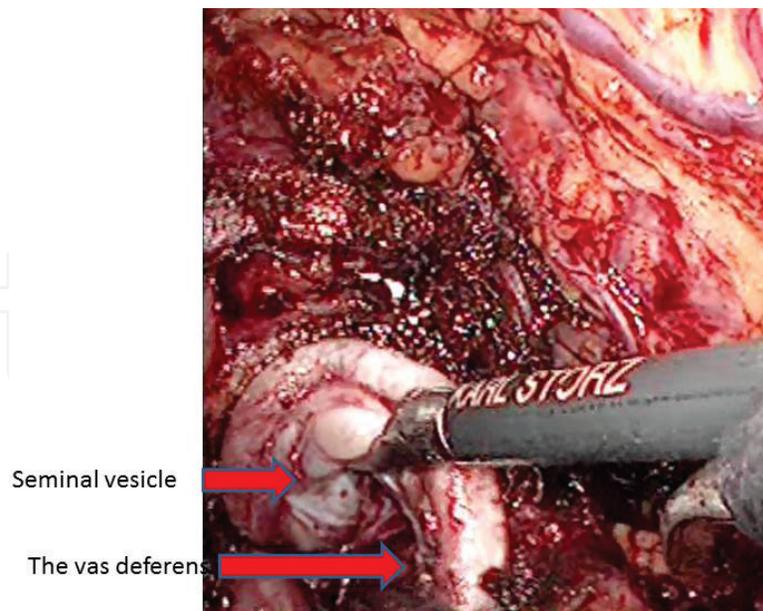


**Figure 4.** Incision of bladder neck.

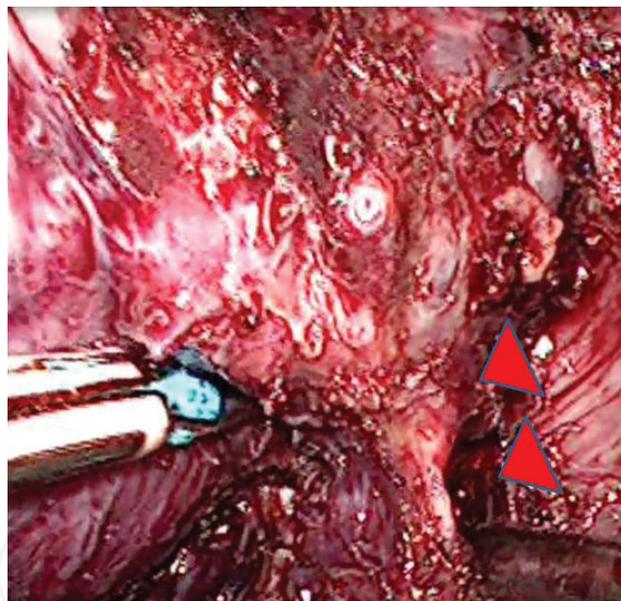


**Figure 5.** Cutting internal urethral meatus.

When preserving neurovascular bundle, to avoid heat damage, use 5 mm clip and cut with scissors. After cutting the lateral ligaments, the lateral side of urethra is identified.



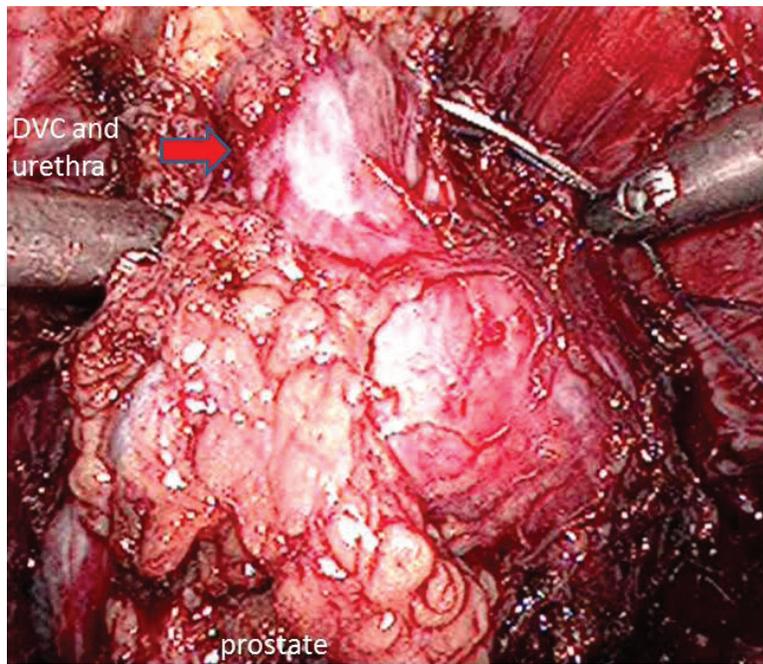
**Figure 6.** Identify of the vas deferens.



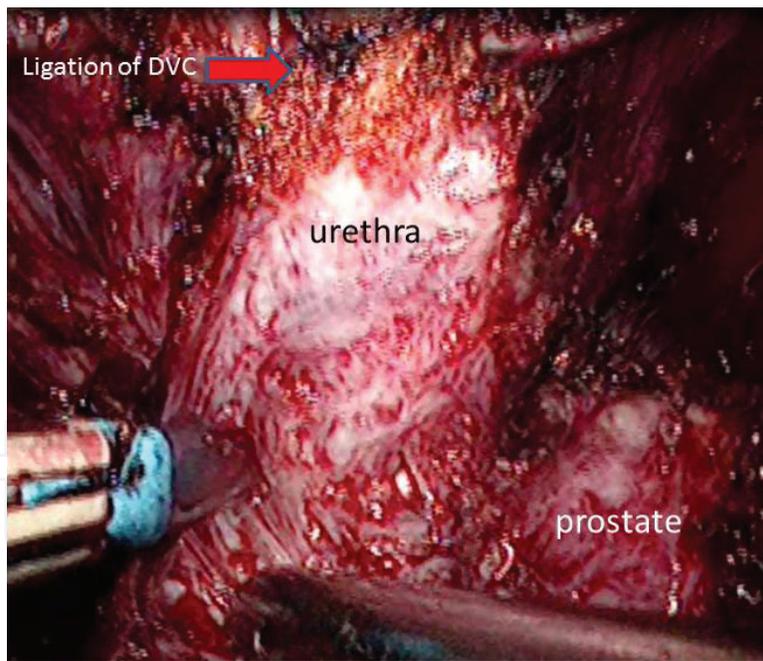
**Figure 7.** The prostatic lateral ligament.

#### 2.5.5. Bunching and cutting of urethra

Bunching of the DVC with Z suture was done (**Figure 8**). After cutting the DVC proximally, prostate is connecting to the pelvic floor only with the urethra (**Figure 9**). The urethra is cut as much as possible to preserve the urethra confirming the shape of the prostate. The bag is inserted from the umbilicus port, the prostate gland is stored in the bag, and prostate is removed from umbilicus port. If prostate is large, urachal duct is ligated and cut under umbilicus, it is easy to remove prostate. If lymphadenectomy is necessary, lymphadenectomy is done.



**Figure 8.** Bunching of DVC.



**Figure 9.** Revealed urethra.

### 2.5.6. Pelvic lymphadenectomy

Nowadays, lymphadenectomy for diagnosis is not necessary. For several patients with a significant risk for a nodal metastasis, PNLND may be useful for treatment.

Therefore, PLND is recommended in patients with intermediate or high risk.

To consider PLND, one more additional trocar is necessary, at middle lower abdomen. To retract the peritoneum, a 5-mm-sized retractor is inserted from the umbilicus port. Seminal duct and vessels are ligated and cut. Cooper's ligaments as a lower edge, adipose tissue is detached along external iliac vein and artery. The outside of LND is along the pelvic floor muscle. Obturator nerve and obturator artery and vein are exposed, and dissection is promoted to the inner iliac artery bifurcation. Next, carefully exfoliate the fat between the obturator vessels and the bladder. A thick lymph duct is treated with a sealing device or 5 mm clip.

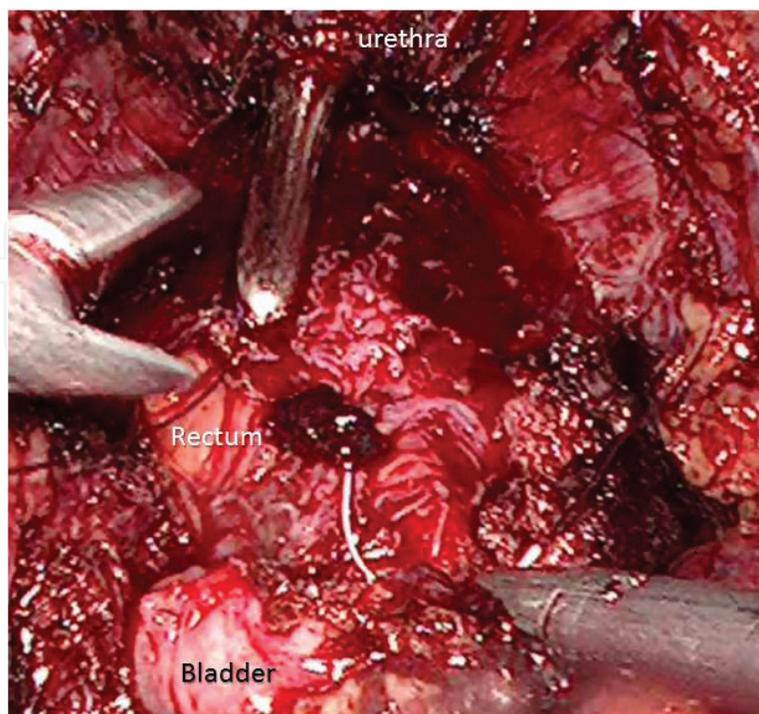
#### 2.5.7. Anastomosis of bladder neck and urethral stump

The bladder neck and urethral stump are anastomosed using 3-0 monofilament surgical suture at both ends. First, Rocco suturing is performed, after Rocco suturing (**Figure 10**), the rear wall is sutured with a horizontal mattress, and after closing it, the side walls are continuously sewn as they are. Approximately 10 needles are sewn. Place the urinary catheter in the bladder, inject saline, and check for leaks (**Figure 11**). Anterior bladder wall is fixed to pubic bone using 3-0 synthetic absorbable surgical suture.

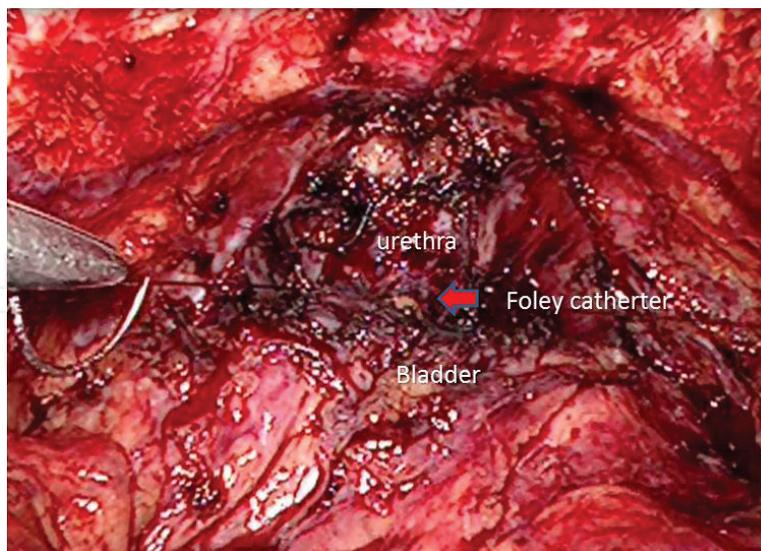
#### 2.5.8. Drain insertion

Inserting the forceps from the left trocar, the tip of the forceps is put the out side of umbilicus port. The end of drain is caught by the forceps and removed from the left trocar. The drain is placed. Usually, drain is removed 2 or 3 days after surgery.

Finally, the wound is closed with buried suture.



**Figure 10.** Rocco suturing.



**Figure 11.** Anastomosis of urethra and bladder.

## 2.6. Complication

There is no prospective study to compare the efficacy and complication between LRP and reduced port LRP. We think that the quality of reduced port LRP is as same as conventional LRP, because surgical procedure is same. In our experience of LRP, rectal injury occurred in 1% of patients and allogeneic blood transfusion rate was 0% [17].

Rassweiler et al. compared early and late groups of LRP and an open radical prostatectomy group. Mean OR time was 218 min for late laparoscopic surgery and 196 min for open surgery. Transfusion rates were 9.6 and 55.7%, respectively. Complications included rectal injuries (1.4 vs. 1.8%), lymphoceles (0 vs. 6.9%), and anastomotic strictures (4.1 vs. 15.9%, respectively) [18]. Katz et al. reported the incidence of rectal injury is 2% during LRP [19]. Intraoperative recognition of rectal injury is important. When recognizing the rectal injury, multilayer primary closure should be performed before bladder and urethral anastomosis. Filling the water in front of rectum and injection of air into the rectum from anus to check the leaks. When fistula between vesicourethral anastomosis and the rectum, putting temporary artificial anus is necessary. After control of the infection, secondary reconstructive surgery using gracilis muscle flaps between rectum and vesicourethral anastomosis.

Injury of iliac vessels may be occurred during the lateral side trocar placement or along the path of instruments from the lateral side trocar.

The incidence of venous thromboembolism (VTE) of LRP and RALP is very low about 0.5%. However, PLND is the risk of VTE in spite of laparoscopic surgery. Tyritzis et al. reported that the risk of VTE in RALP is 7.52 times when LND is done [20]. The AUA guidelines and EAU guidelines do not recommend the use of prophylactic anticoagulants for LRP and RALP unless patients have known risk of VTE [21, 22]. The use of sequential compression stockings are recommended during the operative and postoperative period.

	Reduced port LRP	ORP
No of patients	2	2
Age	67.5 (63-72)	72.5 (72-73)
PSA	5.37 (4.73-6.00)	4.88 (4.51-5.24)
GL score	3+3 / 4+4	3+3 / 4+4
Clinical T	T1c	T1c
Duration of surgery	296 (275-317)	249 (235-258)
Estimated blood loss	225 ( 100-350)	1602 (1562-1642)
No of using painkiller	1 (0-2)	5 (4-6)
Blood transfusion	None	None
Duration of hospital stay	9	12
Complication	None	None

**Table 1.** Comparison between reduced port LRP and ORP.

Urinary stricture is rare. In our experience of LRP, the incidence urinary stricture is 2%. Continence rate of 6 months after surgery is 85.9% in our LRP series.

Complications related to patients positioning, such as pressure injury, are rare. To avoid pressure injury, careful padding of vulnerable body parts (the hips, the shoulders, the knees and the calves) is important.

Open conversion is rare, and it usually occurred during a surgeon's early experience with LRP.

From April 2018 to May 2018, four radical prostatectomies were performed. Two cases were reduced port LRP and others were ORP. Two cases done with ORP had a history of lower abdominal open surgery. The results of radical prostatectomy are shown in **Table 1**. The number of the use of painkillers was less in the patients with reduced port LRP than in those of ORP. Estimated blood loss was smaller in those of reduced port LRP than those of ORP. Hospital stay was shorter in reduced port LRP cases.

### 3. Discussion

The advantages of laparoscopic or robot-assisted radical prostatectomy were significantly decreased blood loss and decreased postoperative pain and shorter convalescence than that of open surgery in spite of similar oncological outcome. However, almost five incisions and one 4–5 cm incision are required. Each incision had a risk of pain, blood loss, internal organs injury, port hernia and infection. According to Chang et al., the number of using analgesic medicine is less in reduced port LRP group than conventional LRP group (3 vs. 19, respectively,  $p = 0.0318$ ) [23]. In 2008, Kaouk et al. reported first laparoendoscopic single-site radical prostatectomy (LESS-RP), which was performed on four patients with low-risk prostate cancer [24]. All four cases were completed without conversion

to a standard laparoscopic approach, and the mean operative time for prostate excision and vesicourethral anastomosis was 3.25 and 1.1 h, respectively. One patient developed a rectourethral fistula that required surgical intervention. The authors concluded that LESS-RP is challenging but feasible. After their report, several studies had also proved its feasibility and safety [23, 25]. However, even with the use of laparoscopic curved or articulating instruments, significant “clashing” with both the camera and other instruments can increase operative times and require significant laparoscopic skills especially for intracorporeal suturing. To overcome the problems, we have focused on reduced port surgery. Akita et al. reported excellent results of 2-port RP comparing with conventional LRP [26]. However, the duration of surgery was longer in 2-port RP than conventional LRP ( $351.8 \pm 72.4$  min in 2-port RP and  $286.5 \pm 63.3$  in LRP,  $P = 0.0019$ ). Therefore, we performed three or four port RP using 3–5 mm trocar. The procedure is same as conventional LRP and clashing with both the camera and other instruments do not increase. To facilitate smooth instrument manipulation along with adequate visualization during laparoscopy, usually trocars are placed in triangular fashion. In our method, triangulation is kept during operation. We have used conventional straight laparoscopic instruments, such as dissectors, monopolar scissors and needle holders, Ligasure sealing device (Medtronic, Minneapolis, MN), WECK Hem-o-lok® ligation clip and applier (Teleflex Medical, NC), 5 mm flexible scope (Olympus, Tokyo). No other special instruments for LESS. The cost of reduced port LRP (single-port access, four trocars, sealing device) is as same as conventional LRP (five trocars, sealing device).

Hughes et al. reported RALP led to cost savings in the postoperative phase after surgery in a hospital when the cost of the index surgery was excluded. However, Hyldgard et al. reported the use of RALP generates a factor 1.3 additional cost when compared with OP and a factor 1.6 additional cost when compared with LP, on average, based on 12 months follow-up [1]. The median direct cost of RALP is \$6752 and that of LRP is \$5687. The main difference was in surgical supply costs for each procedure (\$2015 for RALP, \$725 for LRP) and operation room costs (\$2798 for RALP, \$2453 for LRP, \$1611) [27]. Thus RALP is expensive.

Several authors reported Robot LESS [28–31]. However, it is necessary to buy new da Vinci surgical system for single-port surgery only. It is impossible now because Robot LESS is too expensive surgery however, in the future, Robot LESS become new standard single-port laparoscopic surgery.

#### 4. Conclusion

The procedure of reduced port LRP is the same as conventional LRP. Blood loss is minimal due to tamponade effect of the pneumoperitoneum. The cost of reduced port LRP is cheaper than that of RALP. VTE, rectal injury, and transfusion are rare events. There is no prospective study to compare conventional LRP or RALP with reduced port LRP. Furthermore study is necessary.

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## Conflict of interest

We have no conflict of interest.

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