6.3 Laparoscopic Radical Prostatectomy: The Transperitoneal Antegrade Approach

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Introduction

Laparoscopic radical prostatectomy (LRP) has gained increasing importance in the laparoscopic urologic oncology field and became an established treatment for organ-confined prostate cancer. The initial report of LRP by Schuessler was of nine cases treated through an intraperitoneal approach [1]. Shortly thereafter, a single case of a laparoscopic radical prostatectomy through an extraperitoneal approach was reported [2]. However, in the largest initial series from France, the transperitoneal approach was used [3–6]. With the accumulated experience and worldwide use, variations in the approach and the instrumentation used were introduced. Herein we will discuss the technique of an antegrade transperitoneal LRP as currently performed at the Memorial Sloan-Kettering Cancer Center (MSKCC).

Preoperative Care and Surgical Technique

Indications

LRP has the same indications and contraindications as its open counterpart. There are no specific contraindications to the laparoscopic approach. However, certain conditions such as extensive prior pelvic surgery, prior prostate surgery or pelvic radiation therapy can raise the difficulty level of the procedure.

Preoperative Patient Preparation

Patients receive an enema before surgery. Thromboprophylaxis is ensured with sequential compressive devices on both lower extremities and low-molecular-weight heparin administered prior to surgery, then daily afterwards until discharge from the hospital. Thromboprophylaxis is essential given the presence of three risk factors: cancer surgery, pelvic surgery and laparoscopy. Patients also receive antibiotic prophylaxis with a single preoperative dose of intravenous second-generation cephalosporin.

Patient Positioning

The operation is performed under general anesthesia. The patient is positioned in a low lithotomy position with both arms set along the body to avoid brachial plexus injuries. The shoulders are adequately padded, and the patient is secured to the operating table with surgical tape. A voice-controlled camera holder is used. With both hands free, the assistant can concentrate and actively participate with total involvement in all the steps of the operation. A right-handed surgeon stands on the patient's left with the assistant and the camera holder on the opposite side; the monitor is placed between the patient's legs, at the surgeon's eye level and as close as necessary.

Port Placement

The pneumoperitoneum is obtained through a Veress needle. A 10-mm trocar is inserted through the umbilicus for passage of the 0° laparoscope. Upon entry in the peritoneal cavity, the abdomen and pelvis are explored and the pelvic anatomical landmarks are noted (Fig. 1). Four 5-mm working ports are inserted: in the left iliac fossa, the right iliac fossa, at McBurney's point, and on the midline halfway between the umbilicus and the pubic symphysis. During the prostatectomy part of the operation, the surgeon uses the laparoscopic scissors and the bipolar cautery forceps; the assistant uses the laparoscopic suction device and the graspers.

The surgical technique of LRP includes, if indicated, a transperitoneal pelvic lymph node dissection as previously described [7] and the following standardized steps [4].

Surgical Technique

Approach to the Vesicular Complex

The surgeon incises the posterior vesical peritoneum transversally approximately 1–2 cm above the level of the Douglas cul-de-sac. This exposes the Denonvilliers fascia and the outlines of the seminal vesicles and vasa deferentia. The vasa deferentia are dissected and coagulated with bipolar forceps, then transected. One must be aware and carefully coagulate the deferential artery running along the opposite side. Division of the vasa deferentia allows access to the seminal vesicles. The latter should be dissected along their surface to individualize its vascular pedicle. These arteries are meticulously coagulated with the bipolar forceps facing the seminal vesicles to avoid any thermal injury to the neural plexus in close proximity. The seminal vesicles are then completely mobilized with the prostate as their sole attachment.

The assistant pulls the vasa deferentia upward; the Denonvilliers fascia is then incised medially and horizontally, bringing into view the prerectal fat (Fig. 2). Further dissection toward the prostatic apex or laterally is ill-advised at this time.

Approach to the Retzius Space and Control of the Dorsal Venous Complex

The bladder is filled with approximately 120 cc of saline, to help identify the contours and pull it posteriorly. The anterior parietal peritoneum is incised from

Fig. 1. Transperitoneal view of the pelvic anatomy

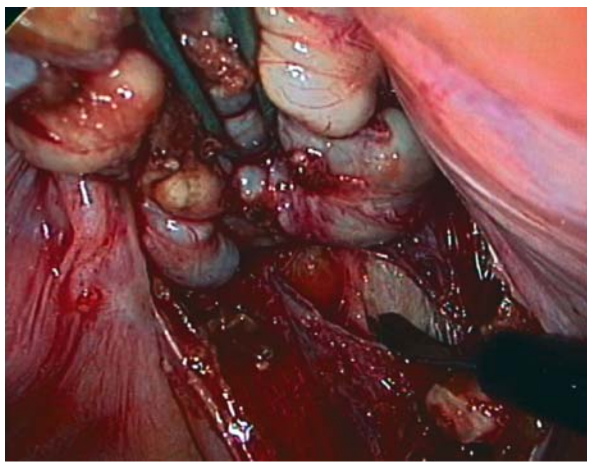

Fig. 2. Transperitoneal opening of Denonvilliers fascia

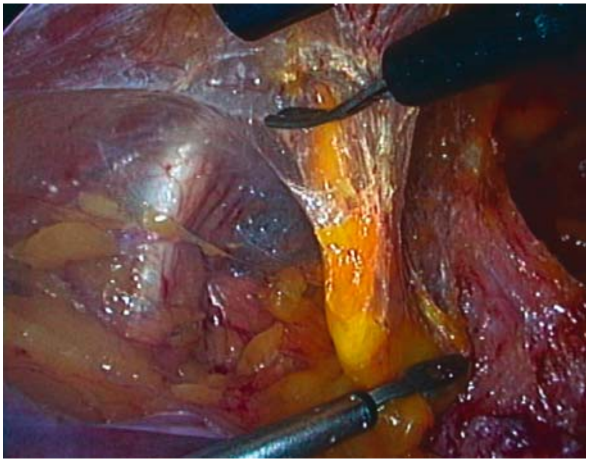

Fig. 3. Transperitoneal development of the Retzius space

one umbilical ligament to the other. It is essential to free the bladder well from its anterior and lateral attachments in order to create a large working space and to allow a tension-free vesicourethral anastomosis at the end of the operation (Fig. 3). The endopelvic fascia is incised, uncovering the levator ani muscle fibers. Incision of the puboprostatic ligaments is done under visual control away from Santorini's venous plexus. The incision can be prolonged toward the fascia that covers the dorsal venous complex laterally. Although delicate, this step will delineate the anatomy and facilitate further dissection and exposure of the dorsal venous complex and the urethra later during the operation.

The dorsal venous complex is ligated but not transected at this time.

Bladder Neck Dissection

The bladder neck is incised transversally and the tip of the catheter is pulled up by a grasper via the suprapubic port, to expose the posterior aspect of the bladder neck, allowing the surgeon to grasp the posterior bladder neck and separate the bladder from the prostate and reach the longitudinal muscular extension of the detrusor between the prostate base and the bladder neck. This layer should be incised in order to gain access to the previously dissected retrovesical space. The vasa deferentia and the seminal vesicles are then simply brought into the operating field by the assistant. This maneuver exposes the lateral prostatic pedicles on both sides.

Lateral Dissection of the Prostate

The lateral prostatic pedicle is controlled high on the base of the prostate, theoretically at a safe distance from the neurovascular elements of the bundle. However, because of the traction on the seminal vesicles, they appear to rise vertically, which facilitates their exposure but distorts their normal anatomical orientation. It is therefore important for the surgeon to reorient himself or herself constantly during the dissection of the pedicles and be cognizant of the exact location of the neurovascular bundle.

Once the pedicle is controlled, the two fascial incisions (superior, periprostatic, and inferior, Denonvilliers fascia) can be joined to develop a plane of dissection of the neurovascular bundle. It is preferable to continue the apical dissection of the bundle after transecting the dorsal venous plexus, which gives mobility to the gland and facilitates the exposure of the apical and the distal third of the prostate.

If nerve sparing is not considered, the prostatic pedicles are transected far from the prostate and the posterolateral attachments of the prostate are not dissected but simply controlled (using bipolar coagulation or clips) and divided. It is important to remember that although this step looks easier, the risk of rectal injury is higher because the dissection is performed close to it, in the perirectal fat.

Apical Dissection of the Prostate

The incision is tangential to the prostate to avoid iatrogenic incision into the prostatic tissue at the apex. Gradually, an avascular plane of dissection situated between the dorsal venous complex and the urethra is developed. The remainder of Denonvilliers fascia connected to the rectourethralis muscle fibers are divided. At the apex, the neurovascular bundles are divergent from the prostate, but must be followed to their entrance into the pelvic floor, below and lateral to the urethra; the key element in this dissection is to follow the anatomic contours of the prostate. At the end of this step, the neurovascular bundles and the rectum are separated away from the prostate, and the only attachment left is the urethra, which is incised sharply.

Urethrovesical Anastomosis

It is not necessary to evert the bladder mucosa or to resize the bladder neck. However, in some cases with a large bladder neck, an anterior or posterior tennis racket reconstruction is required. We perform the anastomosis with interrupted sutures, using a 3-0 resorbable on an RB1 needle. All the sutures are tied intracorporeally. The first three sutures are posterior, placed at the 5, 6 and 7 o'clock positions, going inside-out on the urethra and outside-in on the bladder neck. These sutures are therefore tied intraluminally. Four other sutures are symmetrically placed at the 4 and 8, then the 2 and 10 o'clock positions, and tied outside the lumen. Three final anterior stitches are placed at the 11, 12 and 1 o'clock positions, and placed symmetrical to the posterior stitches. Once the sutures are tied, the Foley catheter is inserted. The bladder is filled with 180 cc of saline to ascertain a watertight anastomosis and confirm the correct position of the catheter.

Morbidity

Blood Loss

The average estimated blood loss in the series from Montsouris was 380 ml and an allogeneic transfusion rate of 4.9% with no autologous blood transfusion for all 550 patients. In the last 350 patients, the mean blood loss and transfusion rate declined to 290 ml and 2.6% [8]. In a contemporary series of transperitoneal LRP at the MSKCC, the average blood loss is 300 ml and the allogeneic transfusion rate is 5%, similar to that reported from other centers worldwide [9–11]. For instance, Eden et al. reported a mean blood loss of 313 ml and an allogeneic transfusion rate of 3% in a series of 100 transperitoneal LRPs [12]. This contrasts with the experience from Heidelberg, which reported an average blood loss of 1,100 ml and a transfusion rate of 30% for their initial 219 patients and 800 ml with 9.6% transfusion rate for the last 219 patients. The authors attributed the relatively higher blood loss and transfusion rate in their series to difficulties encountered with the ascending technique [13]. All these data should be confronted to those reported during radical retropubic prostatectomy (RRP), where the blood loss remains relatively significant, ranging from 818 ml to 1,500 ml with an allogeneic transfusion rate of 9%–19% [14–16].

Thromboembolic Complications

Deep venous thrombosis (DVT) is a rare event after LRP (0.3%) [17] but more frequent in the open experience where fatal pulmonary embolism accounts for most causes of death following RRP. For instance, Catalona et al. reported a 2% rate of thromboembolic accidents [16]. Leandri et al. reported 2.3% rate of deep venous thrombosis (DVT) and 0.8% rate of PE [19]. In older series, the rates of PE and DVT range from 6.9% to 12% and 2% to 2.7%, respectively; in more recent series the thromboembolic events range from 0.8% to 2.7%. In comparison, Rassweiler et al. reported pulmonary embolism (PE) in 0.45% [13]. In the series by Salomon et al., the rate of DVT and PE was 0.6% for both [18], comparable to our experience with a DVT rate of 0.25% at the MSKCC. This relatively low incidence results from early ambulation, the use of sequential compressive devices and prophylactic anticoagulation.

Rectal Injury

Two types of rectal injuries can occur. The first is a rectal tear, which most commonly occurs during the dissection of the posterior surface of the prostatic apex and mainly during non-nerve-sparing prostatectomy, often recognized intraoperatively. The second is diagnosed postoperatively after the patient develops a rectourethral fistula. The latter is secondary to either a microperforation, or thermal or ischemic injury to the anterior rectal wall during a vigorous dissection.

The reported incidence of rectal injury in patients undergoing LRP ranges from 1% to 2.7% [12, 20]. In the initial Montsouris experience of 1,000 LRPs, rectal injury was noted in 13 patients and repaired primarily in 11; in the remaining the diagnosis was made postoperatively and required reoperation and temporary colostomy [21]. In the Créteil experience of 300 LRPs, six rectal injuries were reported, one patient developed a rectourethral fistula was treated by a diverting colostomy [22]. Rassweiler et al. reported three rectal injuries and seven rectal fistulas in a series of 438 LRPs. All of the rectal injuries occurred in the first 219 patients [13]. The incidence of rectal injury in contemporary RRP series ranges from less than 1% to 3.6% [19, 23–25]. This is now a rare event whose occurrence decreases with experience and the rate at the MSKCC is now 0.25%.

Ileus

Postoperative ileus is not commonly reported in postoperative morbidity. Its incidence following the transperitoneal approach was reported at 1% in one study [17]. Some of the arguments in favor of the extraperitoneal approach are the absence of peritoneotomy and therefore a lower risk of bowel injury and peritoneal irritation. In the most recent series of 250 transperitoneal LRPs performed at the MSKCC, per os intake is started the night of surgery in all patients, the hospital stay is 1.9 night with 92.5% of the patients discharged within 48 h after the surgery. Postoperative ileus occurred in two patients with postoperative hemorrhage and pelvic hematoma treated with conservative measures.

Urinary Extravasation and Anastomotic Stricture

Anastomotic urine leakage may be another cause of postoperative ileus but the true incidence of anastomotic leaks after radical prostatectomy is uncertain, as most small leaks remain undiagnosed and resolve spontaneously with bladder drainage. After transperitoneal LRP, a large leak is usually manifested by back pain, uroperitoneum and ileus, with laboratory signs of intraperitoneal urine reabsorption. The reported incidence after LRP ranges from 1% to 10% [10, 17].

The anastomotic stricture after LRP is uncommon, 0% to 3.3% [9, 17, 20], compared to the incidence of urethrovesical anastomotic strictures in modern RRP series, varying from 4.0% to 20.5% [16, 26]. This lower incidence can most likely be attributed to a tension-free anastomosis achieved at best by the bladder mobilization during the transperitoneal approach.

Oncological Results

Positive Surgical Margin Rate

The prognostic significance of a positive surgical margin (PSM) is a higher risk of biochemical, local and systemic progression [28, 29]. The positive surgical margin rate following radical prostatectomy varies widely among series, probably depending on the population selected, the experience of the surgeon, and the pathologist. The PSM rate following RRP in the last 5 years ranges from 11% to 36% [30, 31], and the target recommended by experienced surgeons is to reduce the PSM to 10% or less. In the LRP experience, the PSM rates range from 11.4% to 26.4% [32, 33], with an overall PSM rate of 22.6%. These results represent the authors' initial experience since the inception of LRP. In the large series of 1,000 consecutive LRP from Montsouris, the PSM rate was 19.2% overall, 15.4% in pT2 and 31% in pT3 [34]. In a recent series of LRP at the MSKCC, the positive surgical margin rate by pathological stage was 3.8% for pT2 and 26% for pT3 tumors.

Biochemical-Free Progression

The reported 5- and 10-year PSA nonprogression rates after RRP have been 77%–80% at 5 years and 54–75% at 10 years [35–39]. Because LRP has been performed only within the past 6 years, long-term data on PSA nonprogression after LRP are unavailable. The short-term oncologic data, however, are encouraging. Guillonneau et al. published the short-term follow-up of the first 1,000 LRP performed at the Montsouris institute between 1998 and 2002. With a median follow-up period of 12 months, the 3-year actuarial progression-free probability was 90.5%, progression being defined as a PSA greater than 0.1 ng/ml. According to the pathological stage, the biochemical progression-free survival at 3 years was 91.8% for pT2a N0/Nx, and 88% for pT2b N0/Nx, 77% for pT3a N0/Nx and 44% for pT3b N0/Nx and 50% for pT1–3 N1 ($p < 0.001$).

Functional Results

Interpretation of the functional results following radical prostatectomy needs to take into account the lack of uniformity in the methodology of definition and assessment, as this may lead to biases in comparing results between different series.

Continence

In an evaluation of short-term functional results at the MSKCC, at 3 months after transperitoneal LRP, 49% of the patients had regained urinary continence and did not require the use of any pads, while 22% had mild stress urinary incontinence (SUI) (leakage only with heavy physical activity) and wore one pad a day as a precaution. Later on, at 12 months following LRP, a prospective evaluation of the recovery of continence using the validated self-questionnaire of the International Continence Society found that 82.3% were totally continent [8]. Others [12, 20] defining continence as freedom from any pads, reported a 91% and 90% continence rate at 12 months, respectively.

Potency

Patient age, preoperative potency status and extent of neurovascular bundle preservation are significant predictors of potency recovery following radical prostatectomy and need to be taken into consideration when interpreting the potency results [27]. Most series of LRP include potency data only on a small subset of patients, usually treated after the LRP technique and neurovascular bundle preservation was mastered.

The length of follow-up is another important facet in analysis of sexual function after prostate surgery, since potency can return months or years after surgery. Of their initial 550 patients at Montsouris, Guillonneau et al. reported a subset of 47 consecutive patients less than 70 years of age. Of those patients who were preoperatively potent and underwent bilateral nerve sparing, 31 patients (66%) were able to have intercourse with or without sildenafil [8]. In a contemporary cohort of 110 patients treated at the MSKCC, 58% of the preoperatively fully potent patients were able to have intercourse at 3 months after LRP (with or without sildenafil) when bilateral neurovascular bundle preservation was performed vs 25% after unilateral preservation (p=0.013; odds ratio, 4.1; 95% CI, 1.3–12.6). Among patients with bilateral nerve sparing the outcome was different depending on the quality of preservation. Seventy-one percent of patients with complete bilateral preservation were able to have intercourse vs 57% of the patients who had one nerve completely preserved and possible damage on the other (p=0.003; odds ratio, 12.2; 95% CI, 2.3–65.3) and 16% in patients who had bilateral possible damage (p=0.03; odds ratio, 6.8; 95% CI, 1.2–40.3). On multivariate analysis, the quality of neurovascular bundle preservation was predictive of potency at 3 months after LRP.

Future Horizons

As the LRP technique has become standardized and widespread, it has enabled surgeons to successfully expand the application of pelvic laparoscopy to procedures such as radical cystectomy, salvage LRP and recently building on the laparoscopic experience of sural nerve grafts, as reported by Scardino et al. during open RP [40, 41]: Turk et al. demonstrated the technical feasibility of performing nerve grafting during LRP [42].

Conclusions

A successful laparoscopic prostatectomy program requires advanced laparoscopic skills, but more importantly substantial knowledge of the prostatic anatomy and expertise in surgical oncology. This combined expertise is indispensable to achieve the best surgical, oncologic and functional results.

Short of a randomized trial comparing the transperitoneal and extraperitoneal approaches, and even the retropubic approach, the debate over which approach is best remains futile. Only the surgeon's training and experience and the results offered to the patient should dictate that choice.

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