# Laparoscopic Radical Prostatectomy: The Technique

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Christopher Eden and Anthony Hutton

## Introduction

Radical prostatectomy (RP) is the most effective treatment for localized prostate cancer and the treatment recommended by the majority of urologists to their patients [1]. The retropubic route is most commonly used as the anatomy is more familiar and it allows synchronous pelvic lymphadenectomy and always permits removal of a large prostate intact. In contrast with perineal prostatectomy, the retropubic approach is not associated with an incidence of postoperative fecal incontinence. The motivation behind developing laparoscopic RP (LRP) lay in the wish to expand the number of patients who might benefit from the claimed generic advantages of laparoscopic surgery, namely, less postoperative pain and a shorter convalescence. LRP also appeared to greatly reduce intraoperative blood loss and provided the surgeon with a consistently evenly illuminated and magnified view of the pelvic anatomy and suggested the possibility of superior results through superior vision. Subsequent publications have quashed this hope [2] and have demonstrated a clear link between surgical volume and patient outcomes but no advantage of LRP or robot-assisted LRP in terms of oncological or functional superiority.

## Historical Perspective

Increasing experience with laparoscopic renal surgery more than a decade ago made it inevitable that attempts would eventually be made to replicate RP laparoscopically. Schuessler's initial series of LRP failed to inspire other surgeons to follow his example, chiefly because of the very long operating time (mean = 564 min), and led him to incorrectly conclude that a laparoscopic approach for radical prostatectomy conferred no advantage over open surgery, despite good oncological and early functional results [3]. The seminal paper published in 2000 by Vallancien and Guillonneau demonstrated for the first time that LRP could be performed in an operating time similar to that of open surgery with significantly less blood loss compared to open RP (ORP), good oncological and early functional results, and all the generic advantages of laparoscopic surgery [4]. The Montsouris series inspired a number of urologists to begin their own program of LRP, but some of the initial results served only a reminder that poor surgery produces poor outcomes [5] and others, since updated, that even well-prepared surgeons face a steep learning curve when embarking on a new program of complex surgery [6, 7]. LRP has undergone a great deal of development since the initial cases, and although certain technical details are common between contemporary series, alternative options exist for a number of steps, depending on surgeon preference.

## Patient Positioning

Procedures are typically carried out using a five-port open access laparoscopic approach with exaggerated Trendelenburg tilt. The patient's legs are abducted to allow access to the rectum and are held in leg supports which allow the knees to be flexed by 90° to minimize the risk of lower limb ischemia. Patient's arms are secured by their sides with the elbows and hands protected by padding. An orogastric tube is used to empty the stomach, and the eyes are taped shut for protection. Two assistants stand opposite the surgeon with the scrub nurse standing on the same (left) side as the surgeon. The camera stack is placed between the patient's legs, although the author places the stack on the right side of the patient and a multimedia projector between the legs for projection of the laparoscopic view onto a large screen. Little acuity is lost but the resulting significantly

C. Eden, M.B.B.S., M.S., FRCS (Urol) (✉)
A. Hutton, FRACS (Urol)
Department of Urology, The Royal Surrey County Hospital, Egerton Road, Guildford, Hampshire GU2 7XX, UK
e-mail: edenchristopher@gmail.com

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enlarged image allows the operative team's eyes to focus at infinity, rather than at 3 ft, which is less tiring. After preparing the patient's skin and draping, the bladder is emptied using a 16F Foley catheter.

## Transperitoneal Versus Extraperitoneal Access

The choice of surgical route of access depends chiefly on surgeon preference, but other factors will determine the final choice, so familiarity with both approaches is preferable. Transperitoneal LRP offers the appeal of an abundance of anatomical landmarks and a larger workspace within which to operate. It also allows access to the internal iliac artery for extended pelvic lymphadenectomy (PLND) and by virtue of its greater bladder mobilization reduces anastomotic tension during reconstruction. Lymphocele formation is also less frequent using this approach. Disadvantages of the transperitoneal route include a less direct approach, mandating dissection of the bladder from the anterior abdominal wall in order to access the prostate, the need to lyse adhesions from previous transperitoneal surgery, the greater risk of intestinal injury during dissection (1.8 % of complications in a series reported by Guillonneau were attributed to the adoption of the transperitoneal route [8]) and access in some previously operated patients, and the lack of containment of blood and urine offered by extraperitoneal LRP. The advantages of extraperitoneal access are the familiarity of this approach to open surgeons and the disadvantages of transperitoneal LRP. The disadvantages of this approach are the inability to perform an adequate extended PLND and greater anastomotic tension. Lack of workspace is not a disadvantage in practice. Both approaches are equally difficult but feasible in patients who have had laparoscopic mesh hernia repair.

## Transperitoneal Access

The use of a Veress needle to create a pneumoperitoneum is associated with a risk of visceral injury of 1/1,000. This, together with the prospect of occasional insufflation of the omentum or abdominal wall and the ease and rapidity of open surgical access (especially in previously operated abdomens), tips the balance firmly in the direction of the latter technique. It may also become difficult to defend the adverse consequences of using a Veress needle medicolegally, if this is not already the case. Once the primary port has been placed just below the umbilicus, it is connected to the $CO_2$ supply, and the abdomen is inflated to 15 mmHg pressure. Subsequent ports are placed under direct vision according to Fig. 56.1. If an extended PLND is indicated, as is the author's practice for patients in the intermediate- and high-risk groups, it is performed at this stage.

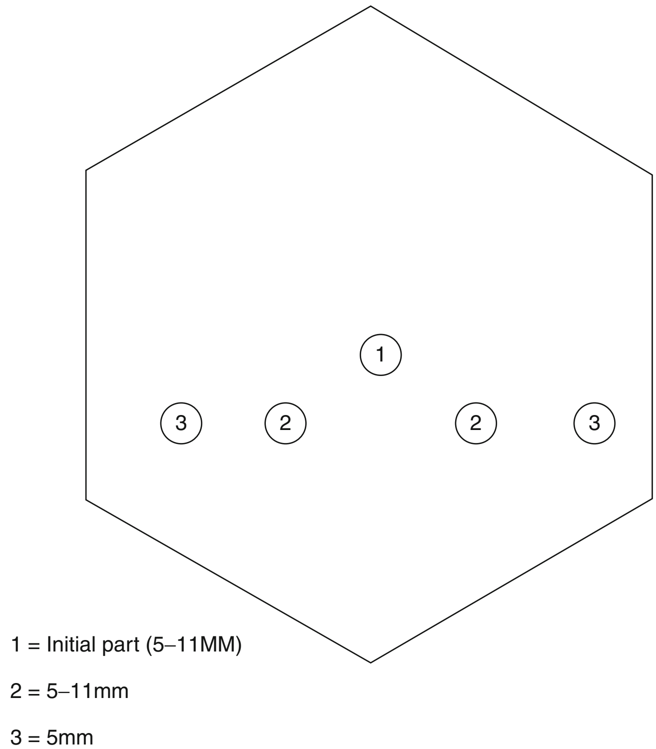


**Fig. 56.1** Port placement

### Extended PLND

The congenital adhesions attaching the sigmoid colon to the left pelvic sidewall are divided to expose the pelvic vasculature and ureter. The peritoneum is incised in a "V" shape with apex starting where the ureter passes over the common artery and extending anteriorly to just medial to the internal inguinal ring, with the lower limb of the "V" passing just anterior to the ureter over 5 cm. The cut peritoneal edge is retracted medially by an assistant's forceps as the tissue overlying the midpoint of the external iliac artery is dissected medially toward the free edge of the external iliac vein. This dissection is continued anteriorly up to Cloquet's node, which forms the superior extent of the lymphadenectomy. This tissue is clipped at this point and divided. The nodal packet is then retracted posteriorly, exposing the back of the pubis and, further posteriorly still, the obturator vessels and nerve. The lymphatic packet is dissected carefully off these structures, clipping vessels and lymphatics where encountered. The nodal packet is next swept laterally off the medial-cut peritoneal edge to expose the medial umbilical ligament (which leads to the proximal internal iliac artery). While the assistant retracts the ureter medially with a sucker to protect it, the lymphatic packet is separated from the anterior aspect of the internal iliac artery from its commencement, past the origin of the medial umbilical ligament and forward until the previous dissection in the obturator fossa is encountered. The obturator nerve is once again identified at its proximal limit in the obturator fossa, medial to the external iliac vein.

The packet is placed anterior to the rectum, and the field inspected for the completeness of the dissection and hemostasis. All nodal tissues are entrapped in a sac and retained for later removal. The left side is differentiated from the right-sided specimen by tying a loop in its string ("L" as in loop and left). Before the same procedure is performed on the right side of the pelvis, a 2/0 nylon suture is inserted through the abdominal wall under vision, passed twice through an appendix epiploicae on the right side of the rectum, and then back through the abdominal wall to be clipped on the outside. This significantly improves access for the right extended PLND.

### Dissection of the Bladder

The bladder is dissected off the back of the anterior abdominal wall using hook diathermy, as the assistant uses the sucker for countertraction of the tissues. The dissection of the peritoneum is started in the midline and extended laterally toward the already exposed pubic bone before the bladder is swept off the abdominal wall.

## Extraperitoneal Access

The initial incision is made just below the umbilicus and is deepened to expose the anterior rectus sheath. This is incised longitudinally to the left of the midline, exposing the left rectus muscle. An oval balloon dilator (Tyco, Mansfield, USA) is introduced under the free medial edge of the left rectus muscle and advanced in the midline. It is inflated to dissect a preperitoneal workspace. A structural balloon trocar (Tyco, Mansfield, USA) is then exchanged for the balloon dilator, the foam collar cinched onto the skin to create a gas-tight seal, and the extraperitoneal workspace then distended with $CO_2$. The four secondary ports are then inserted, as in Fig. 56.1. If the surgeon wishes to perform a standard (external iliac and obturator) PLND, this is done next.

## Common Steps of LRP

The connective tissue on either side of the prostate is gently, bluntly dissected with the sucker to fully expose the back of the pubis, the fat overlying the prostate and the endopelvic fascia on either side. The fat is dissected off the front of the prostate with hook diathermy, dividing it laterally where it intersects the endopelvic fascia, over the bladder neck and anteriorly after coagulating the superficial dorsal vein. The fat is then removed. If either neurovascular bundle (NVB) is to be sacrificed, the endopelvic fascia on that side may be incised and the levator ani fibers swept off the side of the prostate to serve as a marker.

### Bladder Neck Management

The Foley catheter is removed and an 18/22F curved sound is inserted into the urethra. The anterior bladder neck is incised with hook diathermy at the vesicoprostatic junction, which is recognized by the following: (1) the point at which fat is adherent, (2) where a triangle of detrusor muscle fibers is seen, and (3) where the Foley catheter balloon stopped when pulled inferiorly. Once the anterior bladder neck has been incised to reveal the bladder mucosa, the sound is used to elevate the prostate (a cut Foley catheter with the balloon still inflated can be used as an alternative). Posterior countertraction of the anterior bladder neck with a sucker exposes the posterior bladder neck, which is also incised with hook diathermy. It is important to maintain the same thickness of (posterior bladder neck) tissue being dissected to prevent either inadvertent entry into the prostate (indicated by the emergence of white prostatic sections) or buttonholing or thinning the posterior bladder neck. Arrival at the anterior layer of Denonvillier's fascia is indicated by a loss of resistance to the sucker, which is used to retract the bladder neck posteriorly, exposing the vasa in the midline. In nerve-preserving cases, the vessels overlying the vas are controlled with bipolar diathermy and the seminal vesicle arteries with clips. If nerve preservation is not envisaged on that side, the vasa and seminal vesicles are dissected using hook diathermy.

Bladder neck preservation can be achieved by alternating diathermy and blunt dissection of the bladder base off the prostate base, working on either side from a lateral to a medial direction, until a tube of prostatic urethra is encountered at the prostate base, which can then be divided. It has the appeal of obviating the need for bladder neck reconstruction but risks a positive base margin, is difficult to achieve if a median lobe is present, and does not contribute toward postoperative continence [9].

### NVB Management

The decision as to whether to nerve preserve on both, one, or neither sides needs to be taken in the light of the patient's age, potency, expectations, priorities, PSA, Gleason grade, number and percentage of positive biopsy cores involved, preoperative imaging, and clinical stage. The decision is an important one as it may affect cancer control, continence, and potency. A number of nomograms are available to aid this decision-making process. The surgeon and his patient initially need to decide whether to nerve preserve (in low- and intermediate- risk potent patients), nerve damage (in intermediate-risk impotent patients), or widely excise a NVB (in patients with high-risk, especially T3, tumors) on each side. The process of nerve preservation can be further classified by the plane in which the body of the NVB is separated from the prostate: between the prostate capsule and the lateral prostatic fascia (intrafascial), between the layers of the lateral prostatic fascia (interfascial), or leaving a rim of variable thickness of NVB on the prostate (partial nerve preservation). However, the nerve sparing is done, no energy must be applied to the pelvic plexus or NVB, the NVB should be pushed off the prostate rather than pulled off it, and accessory pudendal arteries on either side of the prostate must be preserved. Nerve preservation is usually performed in an antegrade direction as that is the direction in which the laparoscope, and therefore the surgeon, looks. Retrograde NVB dissection, as described by Rassweiler, has failed to gain popularity, possibly because of the greater blood loss with which it is associated [10].

Nerve preservation starts with high incision (just lateral to the dorsal vein complex) of the lateral prostatic fascia, which allows appreciation of the lateral contour of the prostate. Once Denonvillier's fascia has been incised, the medial aspect of the prostate can also be seen, allowing the structures posterolateral to the prostate (at this stage: the remaining fibers of detrusor, the lateral pedicle of the prostate, and the NVB itself) to be separated from it at precisely the level at which they abut each other. These first two structures are divided between clips before the NVB is reached. In patients with higher-risk prostate cancer, the lateral prostatic fascia may be incised just above the NVB to leave more tissue covering the antero- and posterolateral aspects of the prostate. Clips are used to secure vessels passing from the NVB toward the prostate with minimal retraction of the NVB. Once the correct intrafascial plane has been reached between the prostate and the NVB, the latter structure can be pushed off the prostate with blunt dissection. In contrast, interfascial and partial nerve-preserving techniques mandate the use of sharp dissection along the length of the prostate. The curve of the prostate prevents easy access to the terminal 1 cm of NVB from below, and this is best performed after division of the urethra.

The author's practice is to dissect the right-sided posterior structures (vas, seminal vesicle, and NVB), followed by the left-sided posterior structures, and then to separate the prerectal fat and rectum from the posterior surface of the prostate as far forward as is possible. Other surgeons prefer to incise Denonvillier's fascia and separate the rectum from the prostate in the midline before either NVB is dissected. Both approaches achieve the same aim.

If wide excision of a NVB is deemed to be necessary, the lateral pedicle of the prostate is first divided using LigaSure (Covidien, Mansfield, USA) or ENSEAL (Ethicon, USA). The anterolateral aspect of the rectum is then laid bare, by separating the adjacent prostate and NVB from it using the chosen energy source proximally and metal clips further anteriorly where the rectum and prostate lie in contact with one another to prevent thermal rectal injury. The end result is a rectum which is naked anterolaterally with exposed ischiorectal fat lateral to it. A nerve-damaging technique, rarely used by the author, involves liberation of the prostate from its posterolateral attachments in a more anterior plane and is easier to perform as less soft tissue is left on the gland.

At this stage, only the DVC, urethra, and terminal 1–2 cm of NVB on each side remain attached.

### Dissection of the Apex of the Prostate

An 18/22F sound is placed in the urethra, and the $CO_2$ pressure is increased to 20 mmHg. The DVC is divided with scissors, using the sound to easily identify the urethra. Little bleeding is usually encountered: arterial bleeding is controlled by bipolar diathermy and venous bleeding by the Trendelenburg tilt, pneumoperitoneum, and by avoiding using the sucker while the veins of the DVC are open. The DVC is oversewn using 3/0 POLYSORB on a 5/8 needle (Covidien, Mansfield, USA). The author prefers this technique to the "blind" placement of a large needle posterior to the DVC to ligate because of the concern regarding tethering of the anterior aspect of the urethra by such a suture and because of the frequency of ligature slippage when the DVC is wide.

Once the DVC has been sutured, the $CO_2$ pressure is decreased to 15 mmHg to check for hemostasis. Additional sutures are placed if needed. The urethra is divided at this stage, until the rectourethralis muscle can be seen posteriorly, to prevent traction injury of the external sphincter, which may occur during manipulation of the prostate during the apical dissection.

The prostate is displaced medially and upward on each side using tissue forceps applied to the ipsilateral seminal vesicle to allow a clear view of the terminal NVB and its relationship with the prostate apex and the pelvic floor. The NVB is pushed off the prostate apex with blunt and sharp dissection, as appropriate, using clips to control the apical branches of the NVB.

### Specimen Retrieval and Examination

Once the prostate is free, it is entrapped in a small impermeable retrieval bag. If NVB preservation has been carried out on either side, the prostate (and lymph node specimens, if present) may be removed at this stage through the subumbilical incision for visual and tactile inspection. If concern exists regarding the surgical margin, further tissue (in practice, usually the ipsilateral NVB) can be excised. The author does not use frozen section analysis to determine involved surgical margins because of its frequently poor correlation with paraffin section histology.

### Reconstruction

Eversion of the bladder neck mucosa [11] reduces the incidence of bladder neck stenosis, facilitates insertion of the catheter, and aids construction of the bladder neck by allowing easy identification of its proximal margin. The authors routinely reconstruct the bladder neck posteriorly, in "racket-handle" fashion, with interrupted sutures as this moves the ureteric orifices further away from the anastomosis. In cases of a widely open bladder neck, especially while using an extraperitoneal laparoscopic approach, it might be preferable to close the bladder neck (at least partly) anteriorly to avoid excessive anastomotic tension. Steps that are useful in reducing anastomotic tension include reducing the degree of Trendelenburg tilt, transverse incision of the connective tissue anterior to the bladder (extraperitoneal approach), and the use of a continuous monofilament for at least the posterior aspect of the urethrovesical anastomosis which acts as a winch, evenly distributing tension between tissue bites and reducing the likelihood of them cutting through the tissues.

Either a continuous or an interrupted anastomotic technique can be employed, according to personal preference. The former technique, popularized by Van Velthoven et al. [12], employs two cut sutures which are tied together and are run from the posterior midline around the clockface to the 12 o'clock position before being tied together again. The theoretical disadvantage of this is ischemia. The authors use an interrupted technique with five or six 3/0 POLYSORB sutures carried on a 27 mm 5/8 circle needle. Laterally, the prostate "pillars" are reconstructed, and anteriorly the DVC is incorporated, both to provide some support to the underlying stump. A 16F catheter is placed using a catheter introducer to facilitate direction of its tip into the bladder once the posterior sutures have been placed. When the anastomosis is complete, 120 ml saline is instilled using a catheter-tip syringe via the catheter to check integrity of the reconstruction. An Endo Close (Covidien, Mansfield, USA) device is used to close 10-mm port sites after transperitoneal LRP before a 20F drain is inserted through the right iliac fossa 10-mm port. Wounds are closed in layers and are infiltrated with local anesthetic.

Antibiotic prophylaxis is continued for 48 h and DVT prophylaxis (subcutaneous low molecular weight heparin, thromboembolic deterrent stockings, and encouraging ambulation) until discharge. Oral fluids and diet are introduced as tolerated. The drain is removed when drainage was <100 ml/24 h. Patients are discharged home when comfortable. Timing of catheter removal is influenced as much by patient expectations, logistics, and habit as by sound reasoning. Although the catheter can be removed in 3 days, this is associated with the unacceptably high rate of recatheterization of 50 %. Conversely, 2 weeks after surgery, the risk of needing to reinsert the catheter is 1–2 %. Cystography prior to catheter removal is not necessary except following salvage prostatectomy.

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