Difficulties in Laparoscopic Simple Prostatectomy

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Rene J. Sotelo Noguera, Juan C. Astigueta Pérez, and David Canes

Introduction

Open surgical simple prostatectomy has traditionally been the treatment of choice for symptomatic benign enlargement of the prostate [1]. In 1894, Eugene Fuller performed a series of suprapubic prostatic adenomectomies in New York city. Eleven years later, he published an investigative work entitled "The question of priority in the adoption of the method of total enucleation suprapubically of the hypertrophied prostate [2]." However, it was not until 1912 that, thanks to the results obtained by Peter Freyer, this approach was popularized using a technique consisting of enucleation of the prostatic adenoma through an extraperitoneal incision in the wall of the bladder. This surgical technique did not change until 30 years later when Terence Millin described his technique for a retropubic simple prostatectomy in 1945. Millin developed the innovative trans-capsular approach, which spared the bladder from unnecessary incisions. This avoided the morbidity and complications associated with the vesicotomy [3].

Later, endoscopic transurethral techniques superseded open surgery for the majority of cases of benign prostatic hyperplasia (BPH) [4–6]. Modifications of the standard transurethral resection, such as the bipolar transurethral resection, holmium laser resection, or potassium-titanyl-phosphate (KTP) laser vaporization have successively been incorporated into clinical practice. These and other minimally invasive techniques are becoming increasingly popular, including transurethral

R.J.S. Noguera, MD (✉)
Department of Urology, University of Southern California Keck School of Medicine, Los Angeles, USA
e-mail: renesotelo@cantv.net

J.C.A. Pérez, MD
Department of Urology, Instituto Regional de Enfermedades Neoplasicas Norte, Trujillo, La Libertad, Peru

D. Canes, MD
Department of Urology, Lahey Clinic Hospital, Burlington, MA, USA

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needle ablation and thermotherapy, although the latter are typically reserved for small volume glands [7].

The choice of technique depends on various factors unique to a given patient, including gland volume, patient age, patient preference, particular glandular anatomy (e.g. presence of median lobe), and institutional access to technology (e.g. availability of holmium laser). Gland volume is far and away the main driving force in the decision process. For instance, transurethral incision of the prostate (TUIP) is effective for small glands (≤ 30cc). For moderate-sized adenomas, transurethral resection of the prostate (TURP) is the gold standard [8].

Minimally invasive techniques have also been developed in an effort to offer ambulatory alternatives to the traditional TURP, including transurethral ablation by microwave thermotherapy (TUMT), and interstitial laser coagulation. Both have resulted in symptomatic improvement in properly selected patients. However, the persistence of irritative symptoms form thermal changes in residual prostatic tissue is not an infrequent occurrence after TUMT. These symptoms, as well as the greater time required with catheterization, unpredictable results, and high rates of secondary procedures, have restricted the use of these techniques [9–11].

In general, open surgery is indicated for prostates that are larger than 100 g, especially if they coexist with other pathologies such as large bladder diverticula, multiple bladder stones, musculoskeletal restrictions that preclude lithotomy positioning. The advantages of the retropubic technique over the suprapubic approach include better exposure of the prostatic anatomy, visualization of the adenoma during the enucleation with the subsequent assurance of complete removal, direct view of the proximal urethra, direct access to the prostatic fossa for post-nucleation hamostasis, and minimal trauma to the bladder. The suprapubic approach offers the basic advantage of excellent exposure to the bladder neck. Finally, the transperineal approach, by which access to the retroperitoneum is avoided, is useful for patients with extensive prior abdominal or retroperitoneal surgery [12, 13].

The use of laparoscopy in urologic surgery continues to expand. High volume centers are exploring new techniques, including outcomes research, with laparoscopic simple prostatectomy, which attempts to duplicate the open approach in a minimally invasive fashion. The laparoscopic technique appears to have decreased morbidity, less pain, shorter hospital stay, and quicker return to regular activities. Laparoscopy combines the advantages of minimally invasive techniques with the favorable results of open surgery [14].

In 2002, Mariano and coworkers performed the first laparoscopic simple prostatectomy for BPH. Final pathology revealed a prostatic adenoma weighing 120 g removed through a longitudinal vesical-capsular incision [15]. Four years later, the same authors published a report on a series of 60 patients treated with the same technique, with average specimen weight of 144.5 g [16].

Other urologists, like Baumert and van Velthoven, have also reported their initial experiences in series with 20 and 18 cases, respectively [17, 18]. Recently, Sotelo and colleagues described their technique for laparoscopic retropubic simple prostatectomy on 17 patients with obstructive BPH for large (>60 cc) glands by TRUS estimate, averaging 93 g on final pathology. The same authors have described the extraperitoneal technique in 71 patients with mean estimated blood loss of 275 mL, operating times of 140. min, and adenoma weights of 65 g [19].

Various experiences with laparoscopic simple prostatectomy are reported in the literature, such as reports by Porpiglia et al., Blew et al., and Rehman et al., among others [20–25]. Laparoscopic techniques have their limitations when compared to open surgery, including difficult learning curves and the requirement for significant previous laparoscopic expertise. Nevertheless, preliminary reports from high volume centers are encouraging [26–29. Robotic surgery, as an extension of laparoscopy, has recently been demonstrated to be a feasible approach to simple prostatectomy as well [30, 31]. In the following chapter, the authors describe the technique they have developed for laparoscopic simple prostatectomy, inculding tips and suggestions that they have found particularly useful in achieving an optimal result.

Equipment and Instruments Required

Equipment

- Olympus laparoscopic video tower (21-in. monitor, EXERA II image processor with light source; Olympus Medical Systems, Tokyo, Japan)
- High definition video laparoscope with chip on the tip (30° EndoEye, Olympus Medical Systems, Tokyo, Japan)
- UHI-3 high flow CO_2 Insufflator (up to 35 L/min) (Olympus Medical Systems, Tokyo, Japan)
- SonoSurg ultrasound generator (Olympus Medical Systems, Tokyo, Japan)
- Electro-surgical unit (monopolar/bipolar)
- Surgipump aspiration/irrigation pump (Olympus Medical Systems, Tokyo, Japan)

Instruments

- Trocars: three 5 mm one 10 mm, and one12 mm
- 5-mm surgical grasper (two crocodile fenestration, one with and one without ratchet; one surgical grasper with ratchet)
- 5-mm suction-irrigator
- Two needle drivers (Olympus Medical Systems, Tokyo, Japan)
- Metzenbaum reusable scissors (Olympus Medical Systems, Tokyo, Japan)
- 5-mm L-shape high frequency hook type monopolar electrode
- SonoSurg ultrasonic 5-mm scissor
- Metal urethral sound 24 Fr
- Carter-Thomason suture passer (CooperSurgical Inc., Trumbull, CT)
- Endopouch laparoscopic extraction pouch (Ethicon Endo-Surgery, Cincinnati, OH)
- Silicone Foley catheter 20 Fr
- Metal urethral catheter guide

- Sutures: 0-Monocryl™ with CT-1 needle (Ethicon, Inc., Somerville, New Jersey); 3-0 Catgut with SH needle (hemostasis); 2-0 Monocryl™ with UR 6 needle (Ethicon, Inc. Somerville, New Jersey) (trigonization); 0-Vicryl™ with CT-1 needle (Ethicon, Inc., Somerville, New Jersey) (capsulotomy closure)
- Blake drain 10 F
- Optional: Endoscopic GYNECARE type Morcellator (Ethicon, Inc., Somerville, NJ)

Preoperative Preparation

1. Routine preoperative testing (including urine culture), pulmonary exercises with incentive spirometer
2. Bowel preparation, magnesium citrate
3. Preoperative antibiotics (1st generation cephalosporin covering skin flora)
4. Review the preoperative ultrasound (estimated volume and expected anatomy of the middle lobe)
5. Cystoscopy (in cases of hematuria, acute urinary retention, or urinary lithiasis)

Patient Positioning

The patient is treated with chemoprophylaxis for deep venous thrombosis or intermittent compression devices on the lower extremities, according to risk factors and institutional practice patterns. With the patient supine, the upper and lower extremities are in adduction with a support behind the shoulders to prevent slipping. A 20F silicone Foley catheter is inserted prior to initial access. Immediately after the first trocar is placed, steep Trendelenburg is initiated. Note that the foley balloon need not be inflated, as the catheter will be subsequently removed.

If there is difficulty in delineating the anatomical structures, the balloon can be inflated to 20 cc and moved back and forth, thus accentuating the prostatovesical junction.

Room Setup

The laparoscopic tower is placed near the patient's feet at a height that is comfortable for clear viewing of the monitor and inflation equipment. The principal surgeon is positioned to the left side near the patient's shoulder, the first assistant to the right side, and the second assistant to the left of the principal surgeon. The instrument technician is positioned diagonally from the principal surgeon (Fig. 14.1).

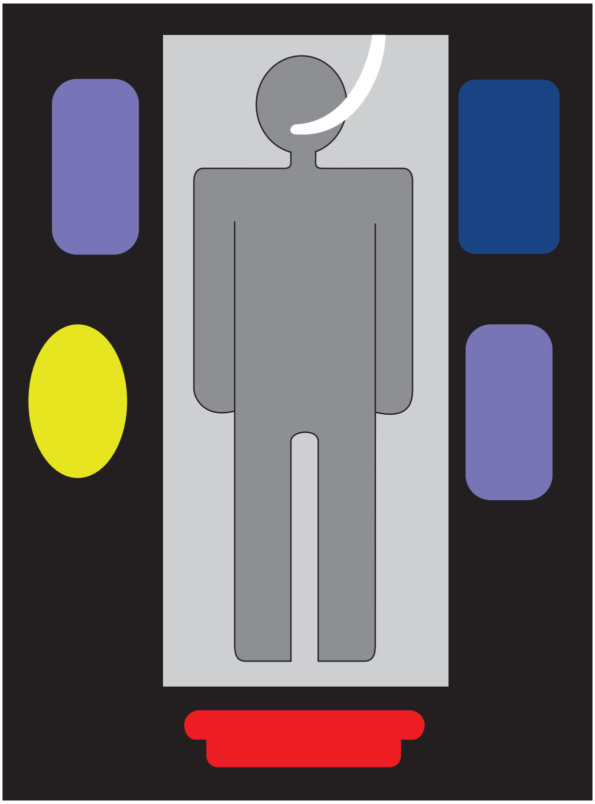


Fig. 14.1 Distribution of the surgical equipment

Approaches

Extraperitoneal

Advantages:

- In theory, operating time is shorter, considering that the dissection of the preperitoneal space is done digitally or with a balloon.
- Lower risk of bowel injury.
- Smaller probability of developing postoperative ileus in case of urine leakage.

Disadvantages:

- Small working space, collapses readily when suction is applied.
- Since the space is bluntly established, increased minor bleeding can diminish visibility.

Transperitoneal

Advantages:

- Even when the bladder is released from the abdominal wall, entering the prevesical space, this is done with sharp dissection thereby limiting bleeding and improving optics (blood does not absorb the light).
- Large working space (useful with large adenomas), resulting in less collapse of the operating field with suction and less interruption of visibility from fluids such as blood or saline solution for irrigation, since gravity forces them into the upper abdomen.
- Allows for the placement of the surgical specimen outside of the work area.

Disadvantages:

- Greater risk of bowel injury.
- Higher probability postoperative ileus.

Transperitoneal with Two Windows

This is an intermediate situation, a technique in which after initiation of the transperitoneal approach two lateral peritoneal windows are created, giving access to the prevesical space. Thus, the advantages of the extraperitoneal approach are obtained as well as the range of space inherent in the transperitoneal approach.

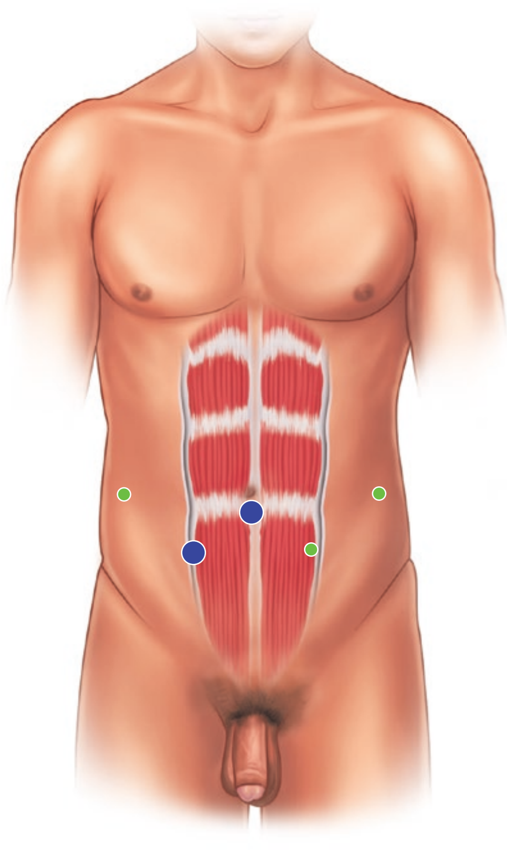
Trocar Placement

Extraperitoneal

The trocars are arranged in a "W," as this is the most correct and comfortable manner (Fig. 14.2). In the extraperitoneal approach, the first 10-mm trocar is placed immediately below the umbilicus. A vertical or horizontal incision is performed in the skin with a scalpel, followed by dissection of the subcutaneous tissue, a horizontal incision in the anterior layer of the abdominal rectus sheath, and lateral displacement of the rectus muscles.

Two ways to gain access to the extraperitoneal space will be described. The first is done by transverse incision of the anterior rectus fascia and then a longitudinal section of the entire midline with scissors, then dissecting the prevesical space digitally or with a balloon. The second involves longitudinal division of the anterior and posterior layer of the rectus sheath, entering the space between the posterior rectus sheath and the peritoneum, dissecting with a lubricated finger in this preperitoneal space, advancing first to the direction of the pubis, and then laterally, being careful

Fig. 14.2 Placement of the trocars



not to accidentally open the peritoneum or tear perforating vessels located principally in the epigastric zone.

Problem: It is important that no perforations are made while dissecting the peritoneum. If this happens, CO_2*will enter the peritoneal cavity, pushing the bladder into the potentialspace, causing difficulty with the surgery.*

Solution: If this occurs, the solution is to expand the peritoneal continuity and create another window on the contralateral side, so that the CO_2 *can circulate freely between the two cavities.*

To create an airtight space, one may use a Hasson trocar. Alternatively, use a large needle and monofilament suture, and place a figure-of-eight stitch through the entire thickness of the abdominal wall (from the skin to the posterior rectus sheath). Loosen the stitch, introduce the trocar without its obdurator, and quickly tie a half hitch, adjusting it with a Kelly clamp to prevent the air leak.

The importance of this type of stitch to prevent the air leak is to easily and quickly reestablish pneumoperitoneum in the event that it is necessary to remove the *specimen during the operation. This may be required when the specimen obstructs the working space and cannot be placed aside (e.g. extraperitoneal approach).*

Next, inflate with CO_2 to a pressure of 15 mmHg, and complete the dissection, using the lens for dissection, with forward and fanning movements. This bluntly expands the extraperitoneal space cephalad.

Tip: The camera tip should be placed 1 cm inside the trocar to maintain a clear optic during blunt extension of the extraperitoneal space using the camera trocar.

The second 5-mm trocar is placed at the pararectal level on the left, slightly below the line that connects the umbilicus and the anterior superior iliac spine. The third 5-mm trocar is located 2 cm above and inside of the left anterior superior iliac spine. The fourth 12-mm trocar is placed contralateral to the left pararectal, and the fifth 5-mm trocar 3 cm above and inside of the right anterior superior iliac spine.

It is important to remember that an adequate dissection of the bladder and the extraperitoneal space must be made so that the trocars do not go across the peritoneal reflection, potentially out of sight, risking unrecognizable bowel injury.

Transperitoneal

The distribution of the trocars is similar to that in the extraperitoneal approach. This can be initiated by using a Veress needle or with the Hasson technique. Once created, the pneumoperitoneum is introduced in the first trocar, which has a safety system with a retractable sleeve. After inserting the laparoscope and exploring the peritoneal cavity, place the other trocars under direct vision.

The depth of the trocars as well as their fixation to the abdominal wall are extremely important to ensure that they do not move, either coming out or going in accidentally. The tips of the more medial pararectal trocars should be 2 or 3 cm (from the inside) so that they do not interfere with the movement of the graspers. In contrast the lateral trocars may be introduced to almost their entire length. This helps to avoid inadvertent small bowel injury by the assistant during instrument insertion, which often occurs outside of the camera view. With both approaches, special attention should be made that the two pararectal trocars have a separation of 18–20 cm between them.

The first assistant uses the transumbilical trocar to introduce the 30° lens, which is manipulated with the left hand, and uses the right hand to introduce the suction-irrigation canula and other instruments in the fifth trocar. The second assistant uses the right hand for retraction of the bladder for countertraction during the adenoma mobilization, and the left hand to manipulate the metallic intraurethral sound.

It should be made clear that the authors use a 30° highdefinition laparoscopic video (EndoEye) for its multiple advantages, as it allows the first assistant to manipulate it just with one hand. Furthermore, the 30° optical allows for a lateral view and a depth perception that is not possible with the 0° angle.

Creation of the Lateral Transperitoneal Windows

In order to overcome the difficulty of peering around the corner as the lateral windows are created on either side of the bladder, take advantage of the angled lens. The 30° lens is introduced through the first trocar, with the camera shaft pointed towards the right lower quadrant, and the 30° lens looking to the left. The surgeon, with the grasper introduced through the left pararectal trocar, applies tension to the urachus and cuts the peritoneum in the external border of the right umbilical ligament with the L-shape hook type monopolar electrode, introducing it through the right pararectal trocar, creating a lateral window in the cranio-caudal direction that goes alongside the umbilical ligament towards the right vas deferens (Fig. 14.3a, b).

The surgeon proceeds in a similar manner on the left side until the two dissection planes meet. For the left lateral dissection, often working through the two left trocars is the optimal approach. The first assistant helps with counter-traction through any of the right ports. In this manner, the surgeon completes the dissection of the Retzius space arriving at the pubis, the avoiding surface of the bladder.

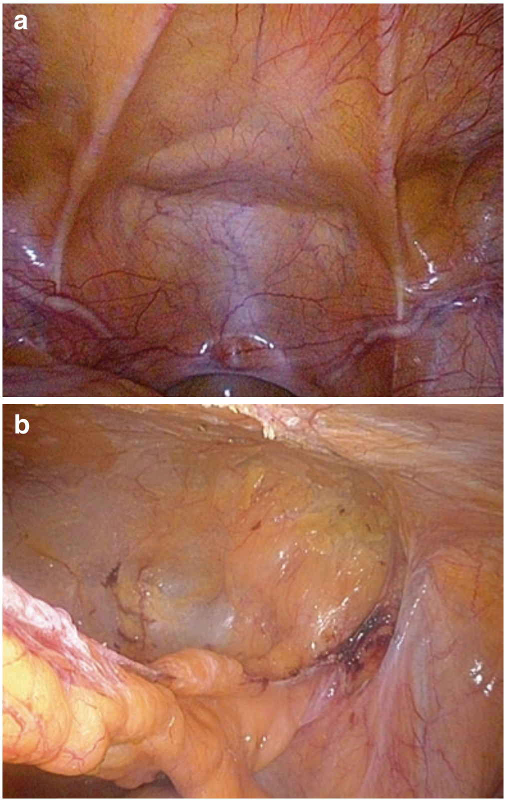


Fig. 14.3 (**a**) Umbilical ligaments and (**b**) prevesical dissection and creation of side windows

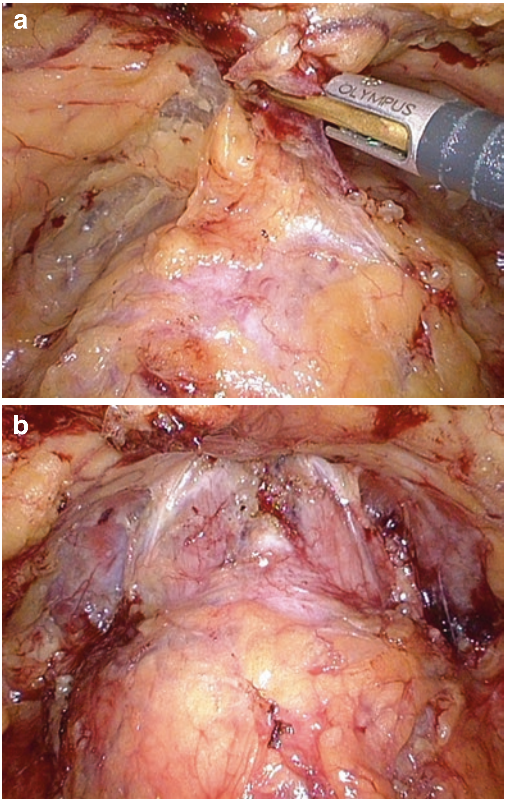


Fig. 14.4 (**a**, **b**) Dissection of the anterior face of the prostate

Access to the Adenoma

Using the grasper and the Ultrasonic scissor, the surgeon dissects the fat located from the anterior surface of the prostatic fascia, back to the expected location of the bladder neck. The procedure does not require opening of the endopelvic fascia, or the ligation of the dorsal venous complex, as in radical prostatectomy (Fig. 14.4a, b).

There are different techniques for gaining access to the prostatic adenoma: (1) through the prostatic capsule with a tranverse incision (Millin), (2) longitudinal transcervical-capsular (Mirandolino), and (3) the technique which the authors favor, a transverse incision in the bladder neck at its junction with the prostate.

Aperture of the Bladder

Once the union between the bladder and the prostate has been identified, the surgeon makes a cut over the bladder using the 5-mm L-shape, high frequency hook type monopolar electrode, performing the initial section at a depth where the bladder mucosa is seen. Then, using the SonoSurg, laterally complete the transverse cystotomy wide enough to allow for the identification of the existence of a prominent middle lobe, visualizing the interior of the bladder and the ureteral orifices (Fig. 14.5).

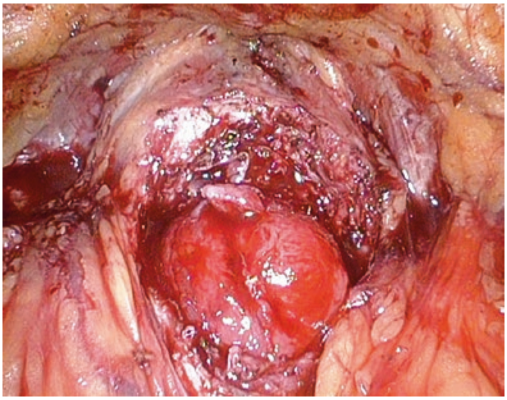


Fig. 14.5 Identification of the bladder-prostate junction and transverse cistotomy

One way to recognize the junction of the prostate and the bladder is by differentiating the characteristic of the fat on the prostatic surface (easily peeled away) and the the bladder (denser and adherent). Alternatively, place gentle traction on the foley catheter with the balloon inflated. The movement of the balloon will delineate the bladder neck.

The reason for first using the monopolar electrode cut is the need to make a clean cut that allows for distinguishing of the detrusor of the bladder until entering it, and the SonoSurg is used on the lateral extension because it is a vascularized area and needs to be kept as bloodless as possible.

Dissection and Enucleation of the Prostatic Adenoma

Once the border between the prostatic adenoma and the posterior vesical mucosa has been recognized, the surgeon cuts with the hook type monopolar electrode and proceeds to outline the entire circumference, starting first in a posterior semicircle and slowly going deeper until reaching the adenoma and completing and the entire circumference.

At the border between the adenoma and the vesical mucosa where the incision should be made, a difference in mucosal color is normally observed. In most patients, an injected appearing strip of hypervascular mucosa can be identified. This serves as a reliable reference for the incision.

The whitened tissue of the prostatic adenoma is easily identifiable and the dissection plane between the surgical capsule and the adenoma is made using the monopolar type hook and the ultrasonic scissors, in addition to blunt with the suction cannula (Fig. 14.6).

If faced with a prostate with a prominent median lobe, before initiating the dissection and enucleation, place a figure-of-eight traction stitch into the median lobe with 1-0 Monocryl™ on a CT needle. Exteriorize the suture ends through the abdominal wall in the suprapubic region using a Carter-Thomason device, and secure them with a Kelly clamp at the skin surface. This will serve to expose the posterior vesical mucosa in the region of your initial incision.

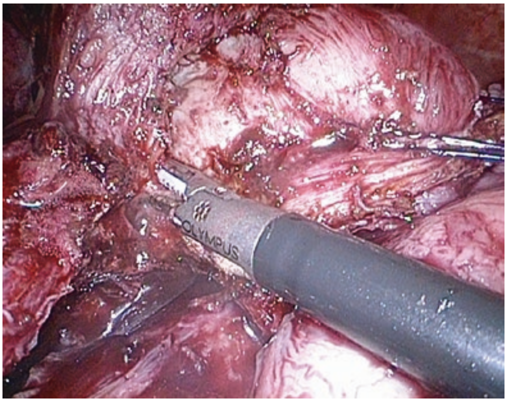


Fig. 14.6 Dissection of prostate adenoma with SonoSurge

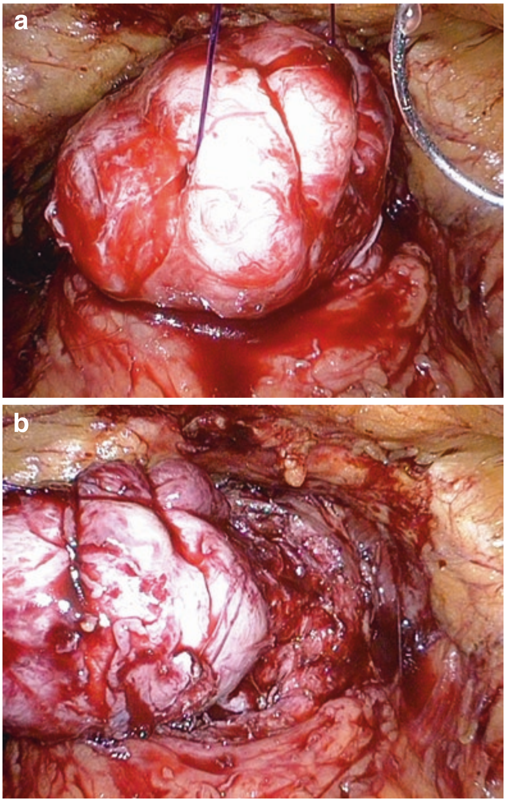


Fig. 14.7 (**a**, **b**) Retraction of prostate adenoma with monofilament suture

In general, when the initial dissection of the adenoma is complete, proceed to place a figure-of-eight suture in the lateral lobes of adenoma with a 1-0 Monocryl™ suture on a CT-1 needle, leaving the ends of the suture long enough to serve as a source of traction (Fig. 14.7a, b).

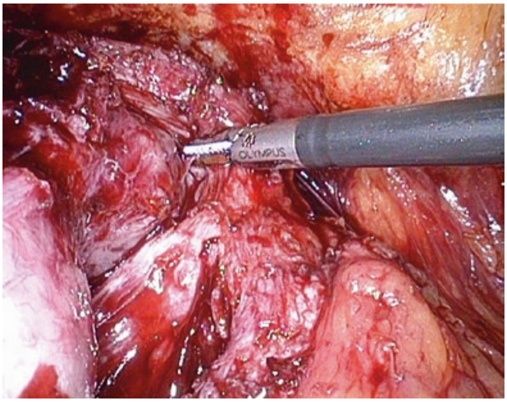


Fig. 14.8 Ligation of intracapsular prostatic pedicles with the SonoSurg

The advantage of using the monofilament suture with a large needle such as the 1-0 Monocryl™, CT-1 is that it allows for deep introduction and easily passes through the adenoma, thus providing firm surfaces that do not come undone from the traction. A very important trick that the authors call "fishing" is to not cut the needle of the traction stitch. As more adenoma is exposed with further dissection, take another "bite" of the adenoma with the original stitch, and repeat as necessary. In this manner, countertraction remains effective as more tissue is exposed.

While manipulating the traction stitch in all directions, small perforating branches will appear; with the use of the monopolar coagulator or the ultrasonic shears, these perforators can be controlled. This allows continued enucleation in a relatively avascular plane.

More attention should be paid to the 4–5 and 7–8 o'clock areas, corresponding to the zones of the lateral prostatic pedicles (Fig. 14.8).

A useful instrument designed specifically for the dissection of the prostatic adenoma is the Sotelo Prostatotomo, which consists of three parts: a Teflon® sleeve, a stainless steel cylinder body, and a distal curve of the same material in a concave shape with sharp edges that aid in the enucleation (Fig. 14.9a, b). Using both its convex and its concave elements, develop the dissection plane. At the smallest sign of difficulty in advancing the dissection, which generally coincides with areas with perforating vessels or adhesions, this tool should be removed and the limiting band either cauterized or divided with ultrasonic shears (Fig. 14.10a, b).

When retracting the adenoma from side to side, it is important not to do so directly with graspers because the adenoma will tear. Tearing the adenoma subsequently makes the dissection more difficult, and finding the correct plane problematic. At times, due to adenoma size obstructing the dissection view, one may deliberately fragment the adenoma. In general, avoid cutting the median lobe since this is what engages the lateral lobes and allows for their enucleation. Usually it is necessary to first enucleate one of the lateral lobes, then cut the urethra laterally and enucleate the other lobe.

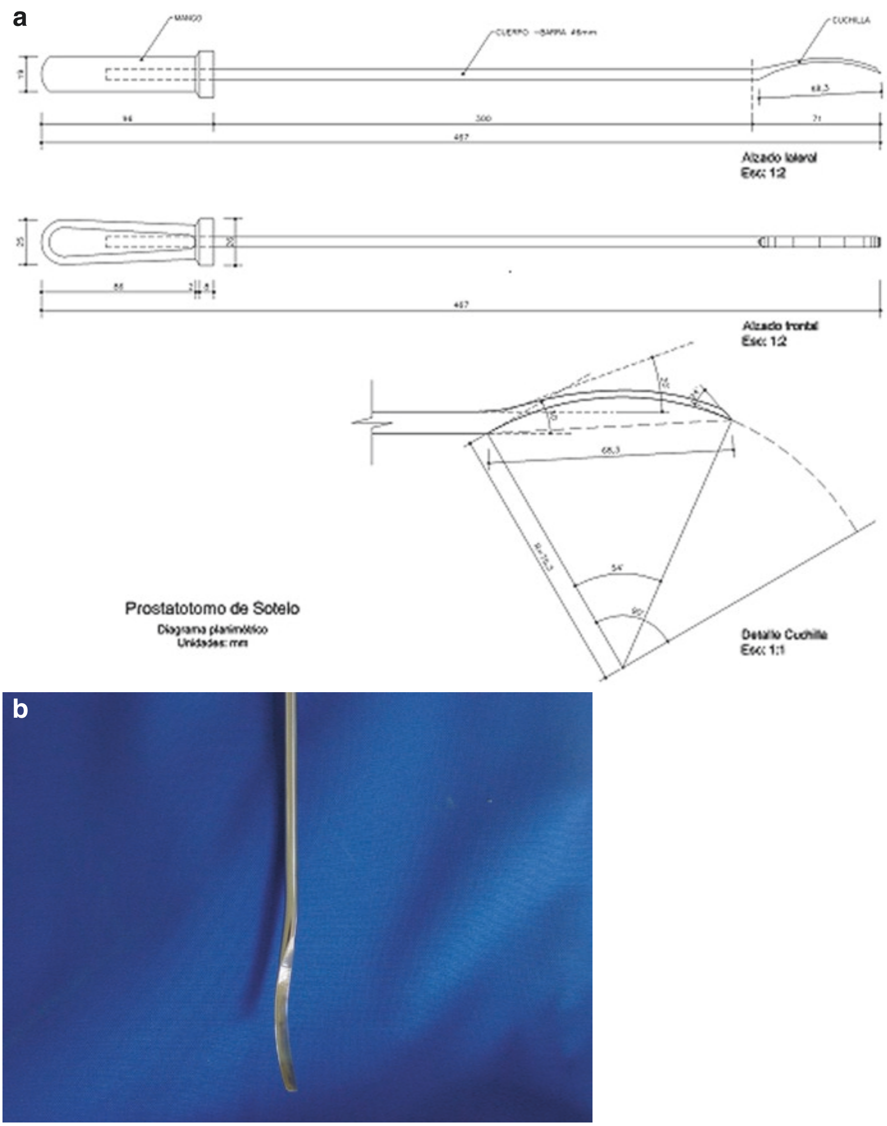


Fig. 14.9 (**a**, **b**) Diagram and photo of the Sotelo Prostatotomo

The urethra can be clearly identified and should be divided sharply with scissors. The metal sound in the urethra can help to identify the borders of the urethra and help to compress it in case of bleeding from the dorsal vein complex.

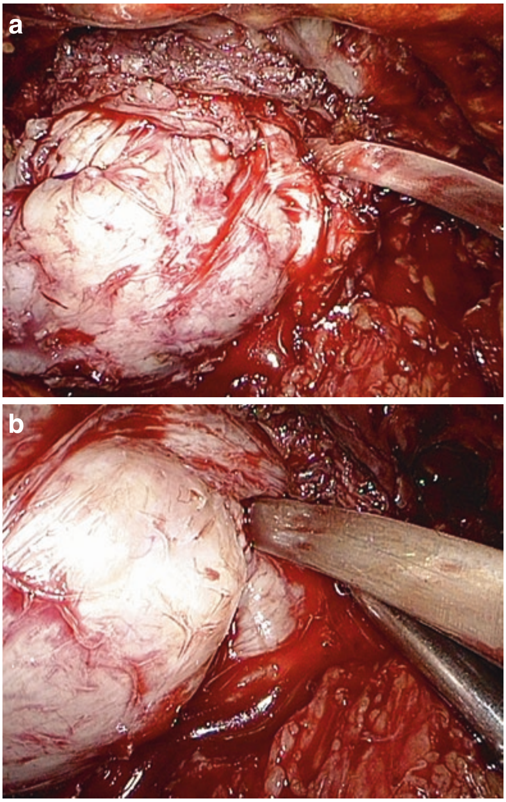


Fig. 14.10 (**a**, **b**) Dissection of prostatic adenoma with the Sotelo Prostatotomo

Hemostasis, Trigonization, and closure of the Bladder

After completing the enucleation, hemostasis should be confirmed and the pneumoperitoneum pressure decreased. Any venous channels that have been compressed under pressure are typically revealed and can be addressed. Then move the lens 30° to see laterally inside the capsule and inspect very carefully, primarily in those areas where bleeding may be expected such as the lateral pedicles and the dorsal venous complex. If there is the slightest doubt, bipolar, ultrasonic shears or fixation sutures should be placed using Catgut 3-0 SH.

Trigonization should then be performed, bringing the vesical mucosa to the posterior prostatic capsule or posterior border of the urethra. This is normally done with two or three stitches, one central and two lateral, with absorbable sutures (2-0 Monocryl™, UR 6). The knots are tied intracorporeally.

Introduce a silicone three-way 24 Fr Foley catheter with a sound and, after finishing closure of the bladder, fill the balloon with 30–50 cc depending on the size of the prostatic fossa, leaving it inside the bladder and connecting to continuous irrigation (Fig. 14.11).

For closure of the bladder, 2-0 Vicryl™, CT1 is used in a running fashion from each corner of the opening, tied to each other in the midline (Fig. 14.12a–d).

It is very important to check for watertightness of the suture line at the end. Additional interrupted sutures must be placed at any focal point of leakage.

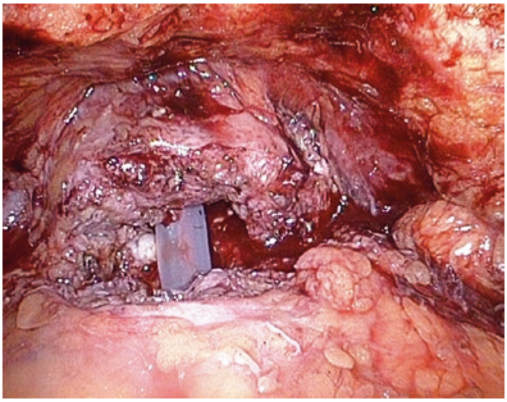


Fig. 14.11 Entering with the Foley catheter guide

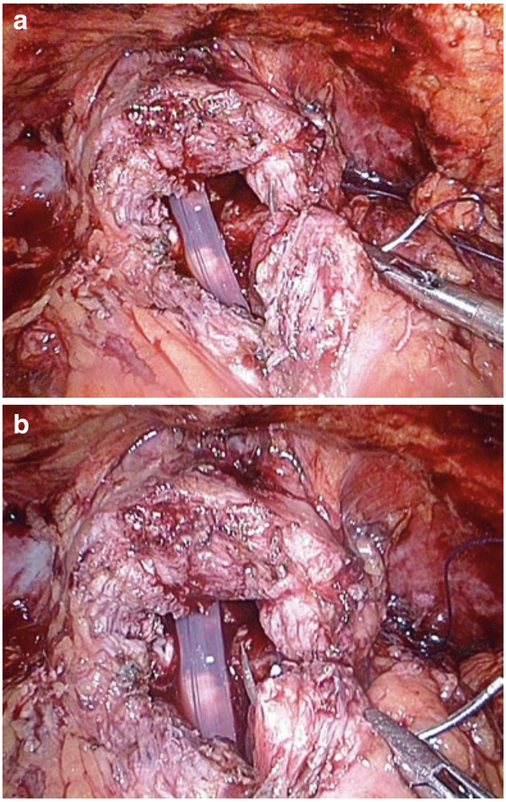
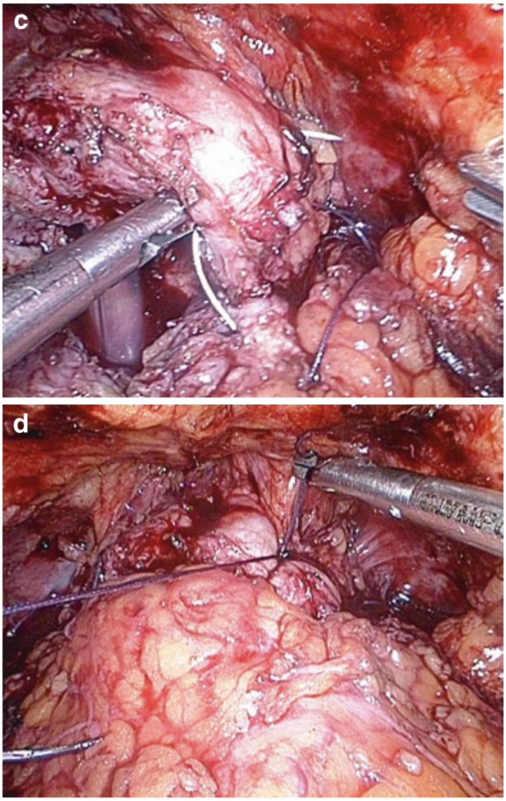


Fig. 14.12 (**a**–**d**) Closure of bladder

Fig. 14.12 (continued)



Drainage

It is important to provide drainage (Blake drain) to aid in the removal of any urine that leaked, exteriorizing it in any one of the lateral incision ports. This should be maintained until no more than 30 cc drains in a 24 h period, which, on average, should occur on the second or third day after the operation.

Extraction of the Operatory Clamp

The mouth of the specimen bag should be exteriorized, and the specimen fragmented (Fig. 14.13a, b). Usually there is no need to extend the umbilical incision.

Postoperative Care

On average, continual irrigation is stopped within 12–24 hs if the urine is clear.

On average, the drain is removed in 48 h once drainage falls below 30cc in an 8 h shift.

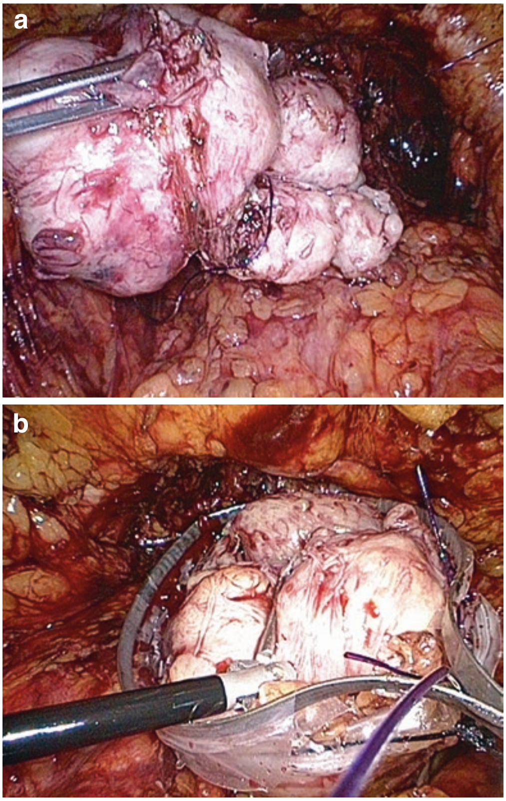


Fig. 14.13 (**a**, **b**) Extraction of the surgical specimen

The Foley catheter is removed in 5–7 days A cystogram is not mandatory but can be performed per the surgeon's discretion.

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