Variations in Surgical Approach: Partial Cystectomy, Vaginal-Sparing, and Prostate-Sparing

8

Anthony N. Hoang, Ashok K. Hemal, and Piyush K. Agarwal

Introduction

Since its first description in the 1950s by Whitmore and Marshall, radical cystectomy (RC) has been the first-line therapy for the treatment of muscle-invasive bladder cancer as well as refractory cases of high grade, non-muscle-invasive transitional cell carcinoma, or carcinoma in situ (CIS) [1]. According to the surveillance, epidemiology, and end results (SEER) database, more than 70,000 Americans will be diagnosed with bladder cancer in 2012 with approximately 25 % presenting with muscle invasion at diagnosis [2]. Radical cystectomy, considered to be the most effective treatment method for localized muscle-invasive disease, is a highly morbid procedure and has been known to adversely impact both urinary and sexual functions [3–5]. Unlike the incidence rate that increases with age, the rate of radical cystectomy can be as high as 58 % among those patients who are less than 65 years of age, which comprises roughly 30 % of newly diagnosed cases [2]. Standard operation requires complete removal of the bladder in addition to bilateral pelvic lymphadenectomy. In men, the seminal vesicles and prostate are also removed; whereas in women, the uterus, vagina, and bilateral ovaries are also removed as these organs may harbor disease and serve as a source for recurrent tumor. Although removal of the sexual/reproductive organs with the bladder and lymph nodes provides the greatest chance for oncologic cure, it comes with the price of functional morbidities such as infertility, sexual dysfunction, impotence, and urinary incontinence [6]. Even in the best hands with nerve-sparing techniques, the rates of urinary incontinence and erectile dysfunction could be as high as 30 % and 80 %, respectively [7, 8]. Furthermore, urinary diversion poses risks for ileus, rapid colonic transit with diarrhea, malabsorption, metabolic derangements, pyelonephritis, and calculi [3, 4, 9, 10]. Concerns about functional outcomes play an important role in the decision-making process, especially in young patients in whom these quality-of-life issues remain a top priority. To minimize the risk of urinary incontinence and impotence without compromising oncological efficacy, many strategies such as partial cystectomy (PC), vaginal-sparing radical cystectomy (VSRC), and prostate-sparing radical cystectomy (PSRC) have evolved.

A.N. Hoang
Urologic Oncology Branch, National Cancer Institute, National Institute of Health, Bethesda, MD 20892, USA

A.K. Hemal
Wake Forest Baptist Health, Winston-Salem, NC 27157, USA

P.K. Agarwal, M.D. (✉)
Urologic Oncology Branch, National Cancer Institute, National Institute of Health, Bethesda, MD 20892, USA

Urologic Oncology Branch, National Cancer Institute, National Institute of Health, Building 10 – CRC, Room 2-5952, 10 Center Drive, MSC 1210, Bethesda, MD 20892-1210, USA
e-mail: piyush.agarwal@nih.gov

E.P. Castle and R.S. Pruthi (eds.), *Robotic Surgery of the Bladder*, DOI 10.1007/978-1-4614-4906-5_8,

While these approaches may not be appropriate for all patients, many contemporary series have reported superior urinary continence and potency rates in addition to comparable oncological outcomes in carefully selected group of patients. In this chapter, we seek to present the indications and techniques of these surgical variations on robot-assisted cystoprostatectomies and anterior pelvic exenterations.

Preoperative Evaluation

Candidates for PC, VSRC, and PSRC undergo extensive medical evaluation that includes detailed medical history, meticulous physical exam, comprehensive blood work, review of outside pathology by the urologist and GU pathologist, and a restaging workup as described below. Those with comorbidities must receive preoperative medical clearance from their respective specialists. All patients must undergo a restaging workup that consists of the following: (1) a bimanual examination to assess for bladder mobility and the potential presence of clinical T3 disease; (2) an endoscopic resection of any bladder tumors or the tumor bed; and (3) a metastatic workup that includes chest, abdominal, and pelvic cross-sectional imaging and in select settings, a bone scan.

For candidates for PSRC, digital rectal exam (DRE), prostate-specific antigen (PSA) levels, and standard transrectal ultrasound-guided (TRUS) prostate biopsy are warranted to rule out the presence of prostate cancer. Specifically for candidates of PC, special attention during endoscopic evaluation should be given to the tumor size, location, and multifocal status in addition to performing random bladder and prostatic urethral biopsies to rule out concomitant presence of CIS and/or urethral involvement. For candidates of VSRC, of particular importance is the exclusion of gynecologic malignancies such as ovarian or cervical cancers.

Additionally, patients also meet with the anesthesiologist for pre-anesthesia clearance, wound ostomy nurse for conduit care or neobladder self catheterization education, and social workers for any other nonmedical-related issues. Lastly, every patient's case is discussed in a multidisciplinary tumor conference where inputs from medical oncologist, radiation oncologist, pathologist, and radiologist are taken into consideration to determine the patient's best course of treatment.

Patient Preparation

Bowel preparation in minimally invasive surgery is evolving to less intense regimens with increasing surgical experience. Traditional mechanical bowel preparation with large volume polyethylene glycol–electrolyte solution and antibiotic preparation is no longer recommended as there are no significant differences in the rates of anastamotic leakage, abdomino-pelvic abscess, or postoperative ileus between those who received and did not receive it. In fact, there is a significant increase in cardiac events among those who received mechanical bowel preparation [11]. Currently, the authors favor one bottle of magnesium citrate in the afternoon on the day prior to surgery along with a clear liquid-only diet. On the morning of the surgery, a broad-spectrum antibiotic, such as a second-generation cephalosporin (cefoxitin), is administered along with deep vein thrombosis (DVT) prophylaxis in the form of 5,000 U of subcutaneous heparin. Recently, we have been administering alvimopan, a peripherally acting mu-opioid receptor antagonist, which has been shown to expedite the return of bowel function after bowel surgery [12, 13].

Positioning

Prior to prepping and positioning the patient, intraoperative preparation includes shaving of the abdomen ± external genitalia, appropriate padding of all pressure points, properly applying bilateral compressive stockings for DVT prophylaxis, and adequately securing the patient to the table. Using stirrups, positioning involves placing the patient in low lithotomy with the legs apart to accommodate the robot. Next, the abdomen and external genitalia are thoroughly prepped and draped in standard sterile fashion with the exclusion of the anus and perianal area. A 20Fr. foley catheter is inserted and left to gravity drainage. The table is then placed in steep Trendelenburg's position.

Partial Cystectomy (PC)

Indications

Partial cystectomy was initially popularized in the 1950s as a means to achieve comparable oncological control while minimizing the significant morbidities associated with radical cystectomy [14]. Retrospective studies have revealed that between 6 and 10 % of patients with muscle invasive urothelial cancer could benefit from a less radical approach without sacrificing cancer control [15, 16]. Historically, partial cystectomy was perceived to be inadequate due to its high rate of loco-regional recurrence, but this likely resulted from suboptimal patient selection [17]. Several areas of concerns regarding partial cystectomy have been raised. These included the multifocal nature of transitional cell carcinoma and carcinoma-in-situ (CIS), the ability to completely resect the tumor with negative margins, the sufficiency of remaining bladder capacity, and the role of lymphadenectomy [18].

Currently, stringent selection criteria which address the above concerns have reduced the recurrence rate to an acceptable level while optimizing overall survival. Importantly, sexual potency and urinary continence are maximized in the process. Just as the name implies, partial cystectomy involves a full thickness, wide surgical excision of the cancer-involved portion of the bladder along with a healthy margin and the overlying fat. In addition, the regional lymph nodes are also removed, permitting accurate staging. However, this approach should only be limited to patients with the following criteria:

- Functional bladder with good capacity.
- Solitary, primary urothelial tumor at the dome, urachal tumor, or tumor residing in a diverticulum.
- No concomitant carcinoma-in-situ.
- No evidence of lymphadenopathy or metastatic disease.

Steps of the Procedure

After prepping and positioning the patient in low lithotomy position, initial endoscopic evaluation of the bladder is performed. For complicated cases, circumferential delineation of the tumor can be performed with a Collins' knife initially to allow for precise tumor delineation (Cook Medical, Bloomington, IN). In most cases, however, this is not necessary. A flexible cystoscope can be left in the patient's bladder, which allows for a continuous internal picture of the bladder using the tile pro feature on the da Vinci S system™ (Intuitive Surgical, Sunnyvale, CA).

Next, the steps of port placement, establishment of pneumoperitoneum, and bladder takedown are as would be performed during a standard robot-assisted radical cystectomy case and are described in detail in other sections of this book. One important point that should be emphasized is that the bladder should be widely mobilized anteriorly and laterally to allow for at least a 2-cm resection margin and closure without tension. This requires division of obliterated umbilical ligaments and the urachus to completely free its dome of all attachments. Once completely mobilized, the bladder is expanded with fluid to help identify the area of the tumor. The fat that lies directly over the tumor should be removed and sent with the specimen.

With endoscopic guidance from a flexible cystoscope and the bladder fully distended, robot-assisted circumscription of the tumor is performed with cautery marking with at least a 2-cm margin around the tumor (Fig. 8.1). Transillumination of the affected area of the bladder by the cystoscope light facilitates this and the light can easily be seen when the robotic light source is decreased in intensity. Cautery is then used to "cut to the light."

Cautery lines are kept superficial until four 2–0 vicryl stay sutures have been placed lateral to the proposed resection area (Fig. 8.2).

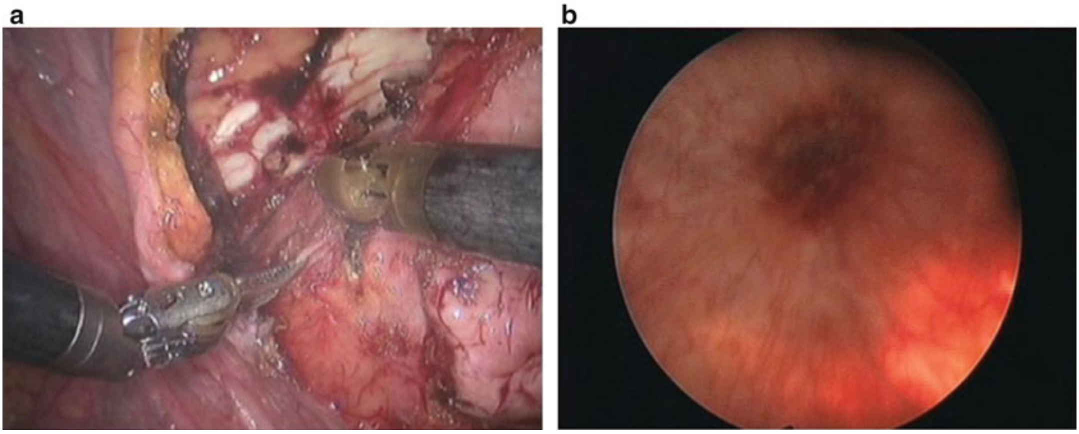

Fig. 8.1 Laparoscopic circumscription (**a**) of the tumor under endoscopic guidance (**b**)

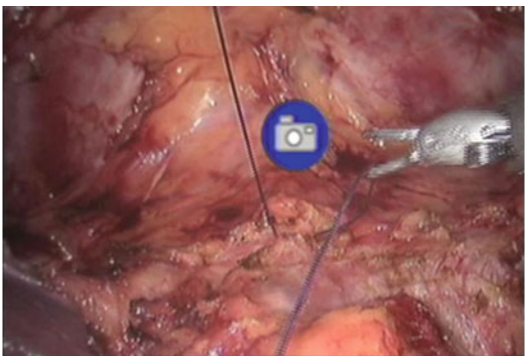

Fig. 8.2 Placement of stay sutures

The bladder is then drained and if possible (e.g., favorable anatomy, lobulated bladder, or bladder diverticulum), a 60-mm Echelon Endopath stapler (Ethicon Endo-surgery, Cincinnati, OH) is brought in through either the left or right 12 mm ports and used to divide the bladder at the proposed lines of resection (Fig. 8.3). If not amenable to the use of a stapler, scissors are used instead to cut sharply along the marked lines of resection with care not to spill bladder fluid/urine into the peritoneum. Pulling up on the stay sutures will facilitate the resection and decrease the risk of fluid spillage into the peritoneal cavity. Multiple specimens are also sent for intraoperative frozen section analysis to ensure negative margins have been achieved. Once negative margins have been confirmed, the specimen is then placed in an Endo-catch bag (Covidien, Mansfield, MA) and removed through an extended port incision at the end of the case.

If the stapler has been used, the remaining suture line on the native bladder is excised while tension is maintained on the stay sutures to prevent any urine spillage and contamination of the peritoneal cavity. This maneuver removes the staples in the suture line that could potentially serve as a nidus for stone formation if left in place. The bladder is emptied completely prior to the resection. Once resected, it is sent for histopathological analysis as the final margin. The bladder is then closed in two watertight layers in a running fashion using 3–0 monocryl/vicryl for the mucosal layer and 2–0 monocryl/vicryl for the outer layer. Moreover, the bladder could be closed in a full thickness, continuous fashion using 2–0 unibarbed V-loc suture (Covidien, Mansfield, MA) [19].

Subsequently, the bladder is tested for any leakage by filling with 250 ml of normal saline while being monitored cystoscopically and laparoscopically (Fig. 8.4). A JP drain is also placed via the 5-mm port.

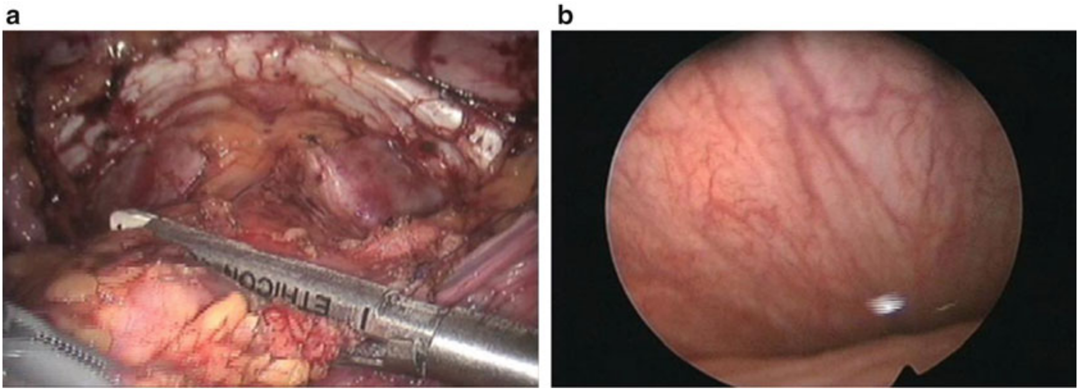

Fig. 8.3 Laparoscopic view (**a**) and endoscopic view (**b**) of bladder resection using Endo-GIA staplers

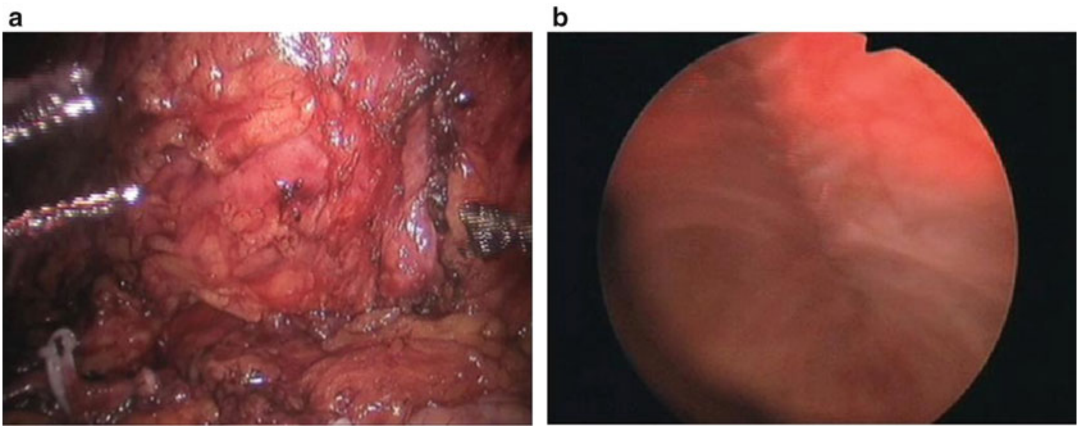

Fig. 8.4 Laparoscopic (**a**) and endoscopic (**b**) monitoring of testing of bladder closure

Finally, bilateral pelvic lymphadenectomy is performed as previously described in other sections of this book.

Postoperative Care and Follow Up

The following standard postoperative care is applied toward all PC, VSRC, and PSRC patients. In our experience, PC patients normally remain hospitalized on average for 1–2 days; while those who undergo VSRC and PSRC remain hospitalized longer (average of 5–6 days). The nasogastric or orogastric tube is typically removed immediately after surgery. Patients are allowed then to chew gum and have ice chips, and their diets are gradually advanced over the course of their hospitalization. Intravenous antibiotic prophylaxis is maintained for at least the first 24 h after surgery, while DVT prophylaxis with subcutaneous heparin is continued after surgery and for the duration of the hospitalization as long as hematocrit levels remain stable. Additionally, patients are encouraged to ambulate as soon as possible, preferably on postoperative day #1. Pain control is initially achieved with ketorolac with IV narcotics for severe breakthrough pain and then quickly converted to oral medications once the patient is tolerating a diet. Daily chemistry and hematocrit levels are routinely checked for the first 48 h and if stable, are then obtained at the surgeon's discretion. JP drain is typically removed after output is minimal and creatinine level of the fluid is consistent with serum creatinine. Urethral foley catheter can be removed in 7–13 days following a normal cystogram.

Follow-up for these patients is dictated by the pathology. Typically, these patients are followed closely every 3–6 months for the first 2 years with history & physical (H&P), voided cytology, labs (CBC, Chemistry, and LFT), and cystoscopic evaluation. Abdominal-pelvic cross-sectional imaging and chest radiographs are dictated by the pathology of the disease and standard NCCN recommendations are followed.

Discussion

Historically, PC had been advocated as a viable alternative to radical cystectomy due to its technical simplicity, decreased perioperative morbidity, and preservation of urinary and sexual functions. However, its popularity was short lived because of its high local rate of recurrence, ranging from 38 to 80 % [20], and low overall 5-year survival [17]. Suboptimal patient selection coupled with advances in surgical techniques associated with radical cystectomy, such as nerve-sparing procedures and continent reservoirs, all contributed to its downfall.

Nevertheless, as society ages and survival from bladder cancer increases, there has been a strong paradigm shift toward improving the quality-of-life issues without sacrificing oncological efficacy. This rekindles the interest in bladder-preserving procedures to be used in the primary setting or as part of a multimodal approach. To avoid the same pitfalls, many experts advocate for stricter selection criteria that include solitary, primary tumors located far away from the ureteral orifices or bladder neck and in an easily resectable area that allows for an adequate resection margin. Additionally, tumor multifocality and the presence of concomitant CIS must be ruled out.

In a retrospective study of 58 patients who had undergone PC from 1995 to 2001, Holzbeierlein et al. reported an overall 5-year survival rate of 69 % at a mean follow up of 33 months and local recurrence rate of only 19 % [16]. Univariate analysis demonstrated that tumor multifocality and the presence of concomitant CIS were significant predictors of recurrence. Similarly, in another retrospective study of 37 patients with a mean follow-up of 72.6 months, Kassouf et al. reported the overall 5-year, disease-specific, and recurrence-free survival rates to be 67 %, 87 %, and 39 %, respectively [21]. On multivariate analysis, higher pathological stage was associated with shorter overall recurrence-free survival; whereas, adjuvant chemotherapy was associated with prolonged advanced recurrence-free survival. In another retrospective study by Fahmy et al. looking at 714 patients with muscle-invasive bladder cancer who had undergone PC from 1983 to 2005 among different institutions, the 5-year overall survival between PC and radical cystectomy groups were similar (49.8 vs. 51 %). At a median of 17.6 months, 23.7 % of these patients recurred and required salvage radical cystectomy [22]. However, these patients had a 50 % increased risk of dying compared to those who underwent radical cystectomy initially.

These selected publications and others all emphasize the importance of optimal patient selection to achieve good oncological control. In carefully selected patients, 5-year overall survival is similar to that of radical cystectomy plus the benefits of decreased morbidity and preservation of urinary and sexual functions. It's worth mentioning that due to the paucity of data, no differences in overall survival, local recurrence rate, and functional outcomes have been demonstrated between different PC approaches [laparoscopic (robotic) versus open]. Rather, the decision to select a specific approach depends on the surgeon's experience and comfort level. However, with the success achieved in robot-assisted prostatectomy, the authors anticipate similar outcomes in robot-assisted PC.

Vaginal-Sparing Radical Cystectomy

Indications

Successes of female radical cystectomy have largely been measured by oncological and urinary outcomes, with little regard to sexual outcomes.

Zippe et al. [23] reported that up to 52 % of female patients experienced sexual dysfunction after RC and that the nature of the dysfunction encompassed both organic and psychosocial domains, such as decreased lubrication, decreased orgasm, lack of sexual desire, and dyspareunia. In a recent review of the literature, Elzevier et al. [24] reported that female sexual dysfunction rate after RC ranged from 20 to 82 % with no difference among the types of urinary diversion. As a result of these data, there has been an increased interest in modifying current surgical techniques to improve sexual outcomes. Anatomic studies have localized the neurovascular bundles to be along the lateral walls of the vagina [25]. Additionally, the removal of the distal urethra is associated with significant devascularization of the clitoris, which could adversely impact sexual arousal and orgasm [26]. Armed with this knowledge, some experts have modified their surgical approaches to include techniques of vaginal-sparing, ovary-sparing, urethral-sparing, neurovascular preserving, and tubular vaginal reconstruction [27–31].

However, the benefits of these organ-sparing approaches must be weighed against the risks of compromising oncologic outcome. Many studies have reported the incidence of urothelial cancer involvement of internal genitalia (vagina, uterus, and ovaries) to be between 2.6 and 5 % and the risk of having concomitant primary genital malignancy to be low as well [32–34]. Therefore, at our center, we only perform vaginal, ovary-sparing, and neurovascular preserving robot-assisted radical cystectomy in those patients who meet the following criteria.

- Good performance status (ECOG≤2) with manual dexterity and willingness to self-catheterize neobladders if needed.
- Non-obese patients (BMI <30) with minimal comorbidities as these could restrict the patient's cardiopulmonary tolerance of the surgery.
- No previous intra-abdominal/pelvic surgeries or prior pelvic radiotherapy.
- Demonstrate T2 disease or better with non-bulky tumors.
- No gynecologic malignancy such as cervical or ovarian cancers.
- Are sexually active with intentions to continue after surgery.

Steps of the Procedures

Port Placement, Establishment of Pneumoperitoneum, Ureteral Mobilization, Posterior Dissection, Control of Round Ligaments, Hysterectomy, and Control of Bladder Pedicles

These steps are as would be performed during anterior pelvic exenteration or female cystectomy and are described in detail in other sections of this book.

Dissection of Vesicovaginal Space

During the posterior dissection step as described in other sections of this book, antegrade dissection through the cul-de-sac allows for the separation of the posterior bladder from the uterus. This dissection plane is carried as far posteriorly as possible, preferably to the junction of the corpus uteri and cervix. The superior portion of the sacro-uterine ligaments along with the round ligaments is transected. However, the cardinal ligaments that attach to the lateral walls of the vagina along with the ovaries are left intact to maintain support to the vagina and to preserve hormonal function, respectively. Next, the bladder is dropped in a standard fashion similar to that of robotic prostatectomy and is described in other section of this book. During this step, the endopelvic fascia is identified and opened to expose the dorsal venous complex (DVC), urethrovesical junction, and lateral walls of urethra. The DVC is controlled using 0-vicryl suture and transected. Using both blunt and sharp dissection, a space between the urethra and the anterior wall of the vagina is created. Control of the bladder pedicles are achieved with Hem-o-lock clips (Teleflex Medical, Research Triangle Park, NC) or a stapler. It's important to know that while the vagina receives its arterial blood supply from multiple sources, vaginal branches from the uterine and inferior vesical arteries are among the important contributors. Additionally, since these branches travel in close proximity to the nerve supply of the vagina and clitoris, it's important to spare them during this step to avoid potential devascularization and denervation.

Using the lateral sulci of the vagina and lateral walls of the urethra as landmarks, dissection of the vesicovaginal space is performed sharply with minimal monopolar coagulation to prevent inadvertent thermal injury to the neurovascular bundles. The authors typically utilize a sponge stick dipped in betadine and inserted into the vaginal vault to help identifying the vaginal apex and anterior vaginal wall during the course of dissection. Hemostasis is obtained with pinpoint monopolar coagulation and suturing. Once the vesicovaginal space is fully developed, the urethra is encountered and transected.

Vaginal Stump Fixation: Variation of the Mansoura Technique

In 2002, Ali-El-Dein et al. [35] introduced the Mansoura modification in hope of preventing postoperative chronic urinary retention or hypercontinence that frequently plagued those who had received a neobladder. The authors demonstrated that by attaching the preserved ends of the round ligaments to the vaginal stump, this effectively fixed and provided support to the vaginal vault as well as prevented posterior and caudal displacement of the neobladder as demonstrated by cystogram. This has resulted in a reported 55 % reduction in the incidence of urinary retention among their patients. Armed with this knowledge, we also perform vaginal stump fixation among all patients who will receive a neobladder. During the standard hysterectomy as described in other section of this book, transection of the round ligaments is made close to its origins in the uterine horns to ensure adequate length for the vaginal fixation. Closure of the vaginal stump is performed horizontally with 2–0 vicryl to prevent narrowing of the vagina. The free ends of the round ligaments are then sutured to both ends of the vaginal apex, in effect suspending and supporting the vagina.

Bilateral Extended Pelvic Lymphadenectomy and Orthotopic Urinary Diversion

These steps are similar to those that have been described in detail in other sections of this book.

Postoperative Care and Follow Up

Postoperative care for VSRC is similar to that of PC except that these patients would have undergone an orthotopic urinary diversion. The ureteral stents of the neobladder are removed at approximately POD #10 and JP drain is maintained to drain any potential extravasation of urine as a result. A pouchogram is performed on POD #14 and if no leakage is noted, both the JP and urethral Foley catheter are removed subsequently. The patient is taught intermittent catheterization and pouch irrigation. Follow-up is similar to that of PC as described above and is also dictated by the pathology. More importantly, patients should continue to follow up with their Ob–gyn for periodic vaginal cytology and gynecologic examination.

Discussion

Standard female exenteration routinely requires the removal of the internal genitalia (vagina, uterus, and ovaries) along with the bladder. However, surgical modifications sparing these internal organs allow for the preservation of fertility and hormonal functions as well as improvement of functional outcomes. Multiple studies have demonstrated the low incidence of recurrence and concomitant urothelial cancer involvement of these organs. In a retrospective review of 609 female radical cystectomy specimens, Ali-el-dein et al. [34] reported the gynecologic organ involvement to be 2.6 % (16/609). Furthermore, no local vaginal recurrence was found at a mean follow-up of 4.3 years. Similarly, Salem et al. and Varkarakis et al. [32, 33] reported the incidence to be 4.4 % and 5.7 %, respectively. Vagina was most commonly involved, with the exception of one uterus. No vaginal recurrence and major sexual problems were encountered at the last follow-up (mean 6 years).

In terms of functional outcomes, it is believed that preservation of the vagina may decrease the risk of neobladder–vagina fistula and improve incontinence by preventing the posterior displacement of the neobladders [35, 36]. Koie et al. [37] reported 80 % (24/30) complete dryness (day and night continence) in those who had undergone vagina-, uterus-, and ovary-sparing radical cystectomy. Likewise, Chang et al. [28] reported 72 % continence rate (daytime and nighttime) in 15 out of 21 patients who had undergone vagina-sparing radical cystectomy. The results of these selected studies demonstrate that successful outcomes can be achieved without compromising oncological control in carefully selected patients.

Prostate-Sparing Radical Cystectomy

Indications

Since its first description, radical cystectomy has gone through various modifications as a means of improving postoperative continence and potency rates. Rossetti et al. [38] first described supra-ampullar cystectomy techniques by sparing the vasa deferentia, seminal vesicles, and prostatic capsule. Spitz et al. [39] reported the first US series of modified radical cystectomies that preserved the vasa deferentia, seminal vesicles, posterior prostate, and most importantly neurovascular bundles in four young men who had non-urothelial malignancy. These and many other series have in common the attempt to minimize dissection near the neurovascular bundles and urinary sphincter. Initially, PSRC was recommended for men without a primary urothelial malignancy. Successful functional outcomes in these patients sparked interest in applying this approach to those patients with primary urothelial malignancies. However, concerns for long-term oncological efficacy of this approach have been questioned. While the exact selection criteria have not been agreed upon, what has been known is that successful oncologic outcomes of PSRC rest mainly with optimal patient selection. Typically, these patients undergo PSRC in conjunction with an orthotopic neobladder. As such, we believe that optimal candidates should include the followings based on the data in the literature, which is discussed in the later section:

- Young, healthy, and potent patients whose potency and fertility remain a priority.
- Good manual dexterity with a willingness to self-catheterize neobladders when needed.
- Demonstrate clinical T2 disease or better without bladder neck, prostatic urethral involvement, or multifocal CIS disease.
- Absence of prostate cancer based on low serum prostate-specific antigen (PSA) levels, negative digital rectal exam (DRE), and negative standard transrectal ultrasound (TRUS)-guided prostate biopsies.

Steps of the Procedures

Standard port placement, pneumoperitoneum establishment, ureteral mobilization, bladder mobilization, control of bladder pedicles, and extended pelvic lymph node dissection are meticulously described in other sections of this book.

Bladder Neck Dissection

After ureteral and posterior bladder mobilizations, the bladder pedicles are carefully controlled as they come off the internal iliac artery using an athermal technique with Hem-o-lock clips (Teleflex Medical, Research Triangle Park, NC) or a stapler to prevent inadvertent thermal injury to the prostatic neurovascular bundles. The dissection is carried towards the prostate base, and only the internal iliac pedicles and superior vesical arteries are clipped and divided while the inferior vesical arteries along with its prostatic branches are spared to promote sexual potency recovery. The bladder is then dropped in a fashion similar to robotic prostate surgery and as described in other chapters of this book. To expose the prostatic–vesical junction in preparation for the bladder neck dissection, one must first develop the lateral pelvic spaces as previously described in

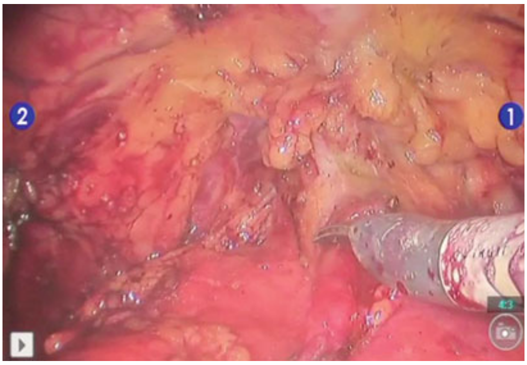

Fig. 8.5 "Defatting" allows for exposure of the urethrovesical junction

Fig. 8.6 The bladder neck is being ligated to prevent inadvertent spillage as one divides the urethrovesical junction

sections on developing the endopelvic space on either side of the prostate. Minimal to no dissection is done at the apex of the prostate. Once completed, this allows for the identification of levator ani muscles on the lateral pelvic side wall and the lateral and posterior bladder walls medially. "Defatting" of the prostatic–vesical junction can be made with a combination of blunt dissection and point cautery. Occasionally, an accessory pudendal artery is encountered and should be spared. Additionally, once the prostatic–vesical junction is cleanly exposed, the bladder neck is dissected circumferentially (Fig. 8.5) and ligated to prevent tumor spillage as it is being dissected (Fig. 8.6). The bladder is transected at the bladder neck and placed in an Endo-catch bag (Covidien, Mansfield, MA) which will later be removed with an extended midline port incision.

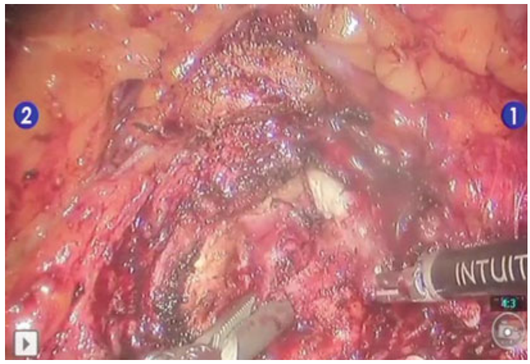

Fig. 8.7 Enucleation of the prostatic adenoma with Harmonic scalpel

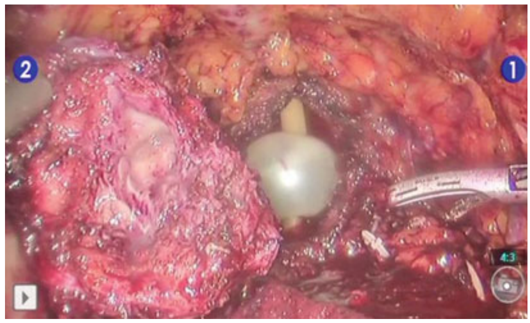

Fig. 8.8 Completed enucleation of prostatic adenoma. Foley inflated in the prostatic capsule to maintain pneumoperitoneum and to tamponade venous oozing

Enucleation of Prostatic Adenoma

Following the specimen removal, attention is directed toward the prostatic adenoma. Using the Harmonic ACE curved shears (Ethicon Endosurgery, Cincinnati, OH), complete, circumferential enucleation of the prostatic adenoma from its capsule is performed with the urethra divided at the prostatic apex (Figs. 8.7 and 8.8). The device is contained within a special carriage produced by Intuitive Surgical (Sunnyvale, CA) and is utilized through the right robotic port. Vessels up to 5 mm in diameter could be coagulated using this device, allowing for great hemostasis. The Harmonic device allows for relatively bloodless enucleation of the adenoma. Following the removal of the adenoma, a 20Fr. Foley catheter with a 30 cm^3 balloon is inserted and inflated maximally to maintain the pneumoperitoneum and to tamponade any venous oozing.

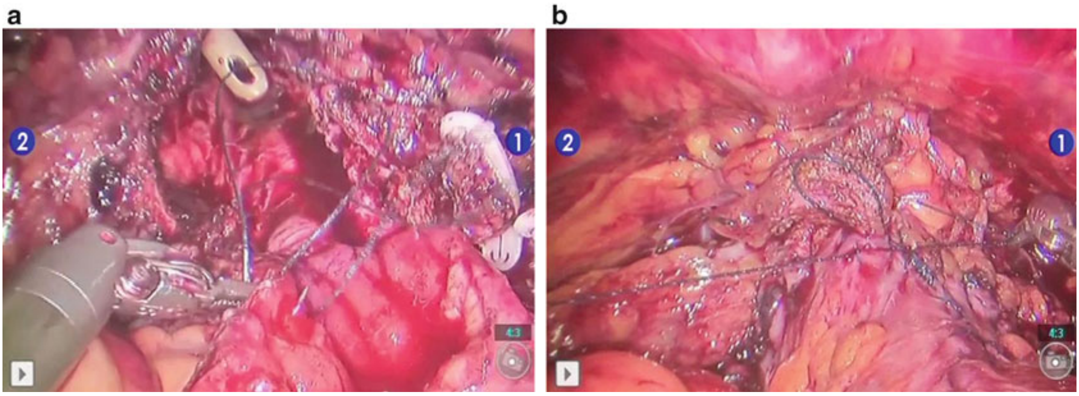

Fig. 8.9 Prostatic capsule–neobladder anastomosis with 3–0 V-loc suture starting at 6 o'clock (**a**) and progressing to 12 o'clock (**b**) using Van Velthoven technique

Urinary Diversion and Urethro-Neobladder Anastomosis

At this point, a 6-cm midline incision extended from the umbilical port is made to remove the bladder and prostatic adenoma. A Studer ileal neobladder urinary diversion is performed extracorporeally through this incision and then placed back within the abdomen after inserting a Foley catheter per the penis that is then tied to the neobladder. The Foley is retracted and used to help guide the neobladder towards the pelvis and towards the prostatic capsule. The fascia around the ports is tightened with sutures and the midline incision is closed around the camera port. Pneumoperitoneum is then reestablished and the patient is placed in reduced Trendelenburg position allowing the neobladder to stay within the pelvis. A watertight prostatic capsule–neobladder anastomosis is executed robotically using a double-armed 3–0 V-loc suture (Covidien, Mansfield, MA) starting at the 6 o'clock position on the prostatic capsule and progressing circumferentially and anteriorly along both sides until the anastomosis is complete (Fig. 8.9) using the Van Velthoven technique. Unlike the classic, urethro-neobladder anastomosis, suturing to the prostatic capsule is less challenging than suturing to the urethral stump due to decreased tension placed on the neobladder in order to make it reach the pelvis. Once completed, a new 20Fr Foley catheter is placed inside the neobladder and tested for watertight anastamosis. A Jackson–Pratt (JP) drain is also placed via a 5-mm port.

Postoperative Care and Follow-Up

Postoperative care is similar to that of PC and VSRC as described above. The ureteral stents of the neobladder are removed at approximately POD #10 while JP drain is kept in to drain any potential extravasation of urine as a result. A pouchogram is performed on POD #14 and if no leakage is noted, both the JP and urethral Foley catheter are removed subsequently. The patient is instructed to perform intermittent catheterization and pouch irrigation as necessary. Follow up is dictated by the pathology. Given that both the prostatic capsule and urethra are preserved and at risk for possible recurrent transitional cell carcinoma and/or prostate cancer, we recommend aggressive follow-up every 3 months for the first 2 years with H&P, voided urine cytology, and blood works (CBC, chemistry, LFTs, and PSA). A DRE is performed every 6 months during these first 2 years. Abdominal-pelvic cross-sectional imaging and chest radiographs are dictated by the pathology of the disease and standard NCCN recommendations are followed.

Discussion

The controversies surrounding PSRC centralize around concerns for prostatic involvement by transitional cell carcinoma (PI-TCC) and occult prostate cancer. In a recent review of literature, Autorino et al. [40] found that the reported PI-TCC incidence varied, from as low as 15 % to as high as 48 %. The majority of these studies were retrospective in nature and CIS was responsible for a significant number of these involved cases. With the application of stricter selection criteria (i.e., no CIS), the incidence of PI-TCC in PSRC was probably lower. Wood et al. [41] retrospectively reviewed 84 radical cystoprostatectomy (RCP) specimens and reported a 43 % incidence of PI-TCC. Among those involved, 94 % exhibited disease in the prostatic urethra with 67 % of these were caused by CIS. Similarly, Richards et al. [42] examined 96 RCP specimens and found that PI-TCC was present in 24 (25 %) patients, including 6 patients with only CIS involvement. Esrig et al. [43] reviewed 489 RCP specimens for PI-TCC and found an overall incidence of 29.2 % (143 patients). Among these, 30 patients had CIS of prostatic urethra and 19 patients had T4 disease where the primary urothelial cancer had extended full thickness through the bladder wall to invade the prostate. Lastly, Nixon et al. [44] found PI-TCC in 30 (15.6 %) out of 192 RCP specimens. Of those patients with CIS of the bladder, 31.3 % (25 of 80) had prostatic involvement.

When looking at risk factors, many studies have found that CIS, multifocal disease, and bladder neck involvement are independent risk factors for PI-TCC. In Nixon et al. [44] series, 34.7 % (25 of 72) of patients with multifocal disease also had concomitant PI-TCC. Multivariate analysis revealed 12- to 15-fold greater risk for PI-TCC when CIS or tumor multifocality was present. Kefer et al. [45] found that none of the 70 patients without CIS, bladder neck involvement, or multifocal disease were found to have PI-TCC. Likewise, Pettus et al. reported only 1 out of 35 patients who did not possess the above risk factors was found to have urothelial involvement of prostatic stroma.

Regarding the incidence of occult prostate cancer on RCP specimens, the reported incidence in the literature also varied widely, ranging from 4 to 60 % [40]. In an attempt to explain these high incidence rates, some authors have attributed them to a higher mean age of bladder cancer patients and the likelihood of diagnostic bias. However, after accounting for the diagnostic bias, Chun et al. and Kurokawa et al. [46, 47] still found a higher incidence of prostate cancer in men with bladder cancer compared to the expected incidence in an age-, sex-, and race-matched general population. Alternatively, some authors have attempted to stratify these occult cancers into clinically significant versus insignificant disease. Revelo et al. reported 50 (41 %) out of 121 specimens had unsuspected prostate cancer but only 24 out of these 50 specimens had clinically significant disease as defined by criteria such as tumor volume (≥0.5 cm^3), Gleason score (≥4 or 5), extracapsular extension, seminal vesicle invasion, lymph node involvement, and positive surgical margins. Similarly, Delongchamps et al. [48] reported the rate of occult prostate cancer on RCP specimens to be 14.2 % (20 out of 141). However, six (30 %) were considered insignificant disease, based on their low grade and microfocal tumor volume.

In summary, the reported incidences of PI-TCC and occult prostate cancer in the literature are highly variable. However, with the application of stricter selection criteria (i.e., no CIS or bladder neck involvement) coupled with surgical prudence (i.e., removal of prostatic urethra/adenoma), the impact of PI-TCC and occult prostate cancer on the patients' overall survival could be minimized.

Conclusion

Results from contemporary series on PC, VSRC, and PSRC are very encouraging. While these surgical variations demonstrate excellent postoperative functional outcomes, concerns raised about their long-term oncological efficacy are valid. It is imperative that any surgical modification must not compromise the primary objective of a good cancer operation in any way. However, in well-selected patients, these surgical variations will play an important role.

Editors' Commentary

Erik P. Castle and Raj S. Pruthi

The authors describe surgical variations and modifications with regard to robotic bladder surgery. A robotic approach is not only feasible for these modifications but also affords a less morbid modification than an open procedure. A great example is a robotic partial cystectomy.

In our practice we have typically performed robotic partial cystectomy to patients with benign conditions (e.g., symptomatic urachal cyst/sinus) or with urachal adenocarcinoma. Urachal adenocarcinoma is a focal condition and not characterized by a polyclonal field defect changes and multiple recurrences characteristic of urothelial carcinomas. As such, we do not typically perform a partial cystectomy (whether open or robotic) for urothelial cancers. However, in urachal cancers and in benign conditions, the robotic partial cystectomy, as described in the chapter, is an excellent which allows for a precise dissection and resection with reduced pain and convalescence. We agree that the use of intraoperative cystoscopy (and with the TilePro multi-input display) can facilitate the accuracy of the dissection—allowing for adequate (but not too wide) margins.

Vaginal-spring and prostate-sparing approaches may also be appropriate in carefully selected patients. The decision to perform such modifications should be driven by the pre and intraoperative oncologic findings and should be done with very careful patient selection. Furthermore, patients must be thoroughly counseled as to the potential risks and benefits of the procedure. Such decisions are irrespective of the surgical approach—whether open or robotic. If a vaginal-sparing or prostate-sparing approach is decided, then the robotic technique remains a viable surgical tool—and the authors describe these approaches skillfully. We commonly perform a vaginal-sparing procedure, barring any oncologic contraindications (discussed in this chapter). Furthermore, we have also performed (albeit uncommonly) a prostate-sparing cystectomy in carefully selected men undergoing the procedure. These men are typically those who are young, potent, and highly motivated to maintain their potency—often to the point of potentially refusing cystectomy. Furthermore, they must meet the careful preoperative analysis to reduce the risk of urothelial carcinoma of the prostate or of prostate cancer [49]. The Montsouris experience with long-term follow-up has given some level of assurance that oncologic outcomes may not be compromised in such carefully selected patients [50].

Acknowledgments Special thanks to Mani Menon, James O. Peabody, Quoc-Dinh Trinh, Jesse Sammon, Shyam Sukumar, Sanjeev Kaul, Sumit De, and Ali Dabaja for the making of prostate-sparing cystectomy video and Manish N. Patel and L. Spencer Krane for the making of partial-cystectomy video.

References

1. Marshall VF, Whitmore Jr WF. Simple cystectomy for cancer of the urinary bladder; 100 consecutive cases; 2 years later. J Urol. 1950;63:232.
2. Fedeli U, Fedewa SA, Ward EM. Treatment of muscle invasive bladder cancer: evidence from the National Cancer Database, 2003 to 2007. J Urol. 2011;185:72.
3. Hautmann RE, de Petriconi RC, Pfeiffer C, Volkmer BG. Radical cystectomy for urothelial carcinoma of the bladder without neoadjuvant or adjuvant therapy: long-term results in 1100 patients. Eur Urol. 2012;61:1039.
4. Kim SP et al. The implications of hospital acquired adverse events on mortality, length of stay and costs for patients undergoing radical cystectomy for bladder cancer. J Urol. 2012;187:2011–7.
5. Yu HY et al. Comparative analysis of outcomes and costs following open radical cystectomy versus robot-assisted laparoscopic radical cystectomy: results from the US Nationwide Inpatient Sample. Eur Urol. 2012;61(6):1239–44.
6. Hart S et al. Quality of life after radical cystectomy for bladder cancer in patients with an ileal conduit, cutaneous or urethral kock pouch. J Urol. 1999;162:77.
7. Turner WH, Danuser H, Moehrle K, Studer UE. The effect of nerve sparing cystectomy technique on postoperative continence after orthotopic bladder substitution. J Urol. 1997;158:2118.
8. Schoenberg MP et al. Local recurrence and survival following nerve sparing radical cystoprostatectomy for bladder cancer: 10-year followup. J Urol. 1996;155:490.

9. Ali-el-Dein B et al. Surgical complications following radical cystectomy and orthotopic neobladders in women. J Urol. 2008;180:206.
10. Parekh DJ, Donat SM. Urinary diversion: options, patient selection, and outcomes. Semin Oncol. 2007; 34:98.
11. Gravante G, Caruso R, Andreani SM, Giordano P. Mechanical bowel preparation for colorectal surgery: a meta-analysis on abdominal and systemic complications on almost 5,000 patients. Int J Colorectal Dis. 2008;23:1145.
12. Becker G, Blum HE. Novel opioid antagonists for opioid-induced bowel dysfunction and postoperative ileus. Lancet. 2009;373:1198.
13. Vaughan-Shaw PG, Fecher IC, Harris S, Knight JS. A meta-analysis of the effectiveness of the opioid receptor antagonist alvimopan in reducing hospital length of stay and time to GI recovery in patients enrolled in a standardized accelerated recovery program after abdominal surgery. Dis Colon Rectum. 2012;55:611.
14. Resnick MI, O'Conor Jr VJ. Segmental resection for carcinoma of the bladder: review of 102 patients. J Urol. 1973;109:1007.
15. Sweeney P, Kursh ED, Resnick MI. Partial cystectomy. Urol Clin North Am. 1992;19:701.
16. Holzbeierlein JM et al. Partial cystectomy: a contemporary review of the Memorial Sloan-Kettering Cancer Center experience and recommendations for patient selection. J Urol. 2004;172:878.
17. Pontes JE, Lopez R. Tumor recurrence following partial cystectomy. Prog Clin Biol Res. 1984;162A:387.
18. Neyyar R, Hemal A. Robotic and laparoscopic partial cystectomy. In: Ghavamian R, editor. Atlas of laparoscopic and robotic urologic oncological surgery. Philadelphia, PA: JP Medical Publishers; 2013. http://www.amazon.com/Laparoscopic-Robotic-Urologic-Oncological-Surgery/dp/9350259583/ref=sr_1_5?s=books&ie=UTF8&qid=1371442261&sr=1-5&keywords=atlas+of+laparoscopic+urologic+surgery#_
19. Shah HN, Nayyar R, Rajamahanty S, Hemal AK. Prospective evaluation of unidirectional barbed suture for various indications in surgeon-controlled robotic reconstructive urologic surgery: Wake Forest University experience. Int Urol Nephrol. 2012;44(3): 775–85.
20. Hollenbeck BK, Taub DA, Dunn RL, Wei JT. Quality of care: partial cystectomy for bladder cancer–a case of inappropriate use? J Urol. Sep, 2005;174:1050.
21. Kassouf W et al. Partial cystectomy for muscle invasive urothelial carcinoma of the bladder: a contemporary review of the M.D. Anderson Cancer Center experience. J Urol. 2006;175:2058.
22. Fahmy N et al. Practice patterns and recurrence after partial cystectomy for bladder cancer. World J Urol. 2010;28:419.
23. Zippe CD et al. Female sexual dysfunction after radical cystectomy: a new outcome measure. Urology. 2004;63:1153.
24. Elzevier HW, Nieuwkamer BB, Pelger RC, Lycklama a Nijeholt AA. Female sexual function and activity following cystectomy and continent urinary tract diversion for benign indications: a clinical pilot study and review of literature. J Sex Med. 2007;4:406–16.
25. Stenzl A, Colleselli K, Bartsch G. Update of urethra-sparing approaches in cystectomy in women. World J Urol. 1997;15:134.
26. Stenzl A et al. Urethra-sparing cystectomy and orthotopic urinary diversion in women with malignant pelvic tumors. Cancer. 2001;92:1864.
27. Hautmann RE, de Petriconi R. Nerve-sparing cystectomy technique in the woman. Urologe A. 1995;34: 221–4.
28. Chang SS, Cole E, Cookson MS, Peterson M, Smith Jr JA. Preservation of the anterior vaginal wall during female radical cystectomy with orthotopic urinary diversion: technique and results. J Urol. 2002;168:1442.
29. Nandipati KC, Bhat A, Zippe CD. Neurovascular preservation in female orthotopic radical cystectomy significantly improves sexual function. Urology. 2006;67:185.
30. Game X et al. Uterus, fallopian tube, ovary and vagina-sparing laparoscopic cystectomy: technical description and results. Eur Urol. 2007;51:441.
31. Menon M, Hemal AK, Tewari A, Shrivastava A, Shoma AM, Abol-Ein H, et al. Robot-assisted radical cystectomy and urinary diversion in female patients: technique with preservation of the uterus and vagina. J Am Coll Surg. 2004;198(3):386–93.
32. Salem H, El-Mazny A. A clinicopathologic study of gynecologic organ involvement at radical cystectomy for bladder cancer. Int J Gynaecol Obstet. 2011; 115:188.
33. Varkarakis IM et al. Pathological review of internal genitalia after anterior exenteration for bladder cancer in women. Evaluating risk factors for female organ involvement. Int Urol Nephrol. 2007;39:1015.
34. Ali-El-Dein B et al. Secondary malignant involvement of gynecologic organs in radical cystectomy specimens in women: Is it mandatory to remove these organs routinely? J Urol. 2004;172:885.
35. Ali-El-Dein B, Gomha M, Ghoneim MA. Critical evaluation of the problem of chronic urinary retention after orthotopic bladder substitution in women. J Urol. 2002;168:587.
36. Bhatta Dhar N, Kessler TM, Mills RD, Burkhard F, Studer UE. Nerve-sparing radical cystectomy and orthotopic bladder replacement in female patients. Eur Urol. 2007;52:1006.
37. Koie T et al. Uterus-, fallopian tube-, ovary-, and vagina-sparing cystectomy followed by U-shaped ileal neobladder construction for female bladder cancer patients: oncological and functional outcomes. Urology. 2010;75:1499.
38. S. Rocca Rossetti, C. Terrone, [Preservation of potency by supra-ampullar cystectomy in patients with bladder neoplasms]. *Archivio italiano di urologia, andrologia : organo ufficiale [di] Societa italiana di ecografia urologica e nefrologica / Associazione ricerche in urologia* **71**, 265 (Sep, 1999).

39. Spitz A, Stein JP, Lieskovsky G, Skinner DG. Orthotopic urinary diversion with preservation of erectile and ejaculatory function in men requiring radical cystectomy for nonurothelial malignancy: a new technique. J Urol. 1999;161:1761.
40. Autorino R et al. Pathology of the prostate in radical cystectomy specimens: a critical review. Surg Oncol. 2009;18:73.
41. Wood Jr DP, Montie JE, Pontes JE, VanderBrug Medendorp S, Levin HS. Transitional cell carcinoma of the prostate in cystoprostatectomy specimens removed for bladder cancer. J Urol. 1989;141:346.
42. Richards KA et al. Developing selection criteria for prostate-sparing cystectomy: a review of cystoprostatectomy specimens. Urology. 2010;75:1116.
43. Esrig D et al. Transitional cell carcinoma involving the prostate with a proposed staging classification for stromal invasion. J Urol. 1996;156:1071.
44. Nixon RG, Chang SS, Lafleur BJ, Smith JJ, Cookson MS. Carcinoma in situ and tumor multifocality predict the risk of prostatic urethral involvement at radical cystectomy in men with transitional cell carcinoma of the bladder. J Urol. 2002;167:502.
45. Kefer JC et al. Risk assessment for occult malignancy in the prostate before radical cystectomy. Urology. 2005;66:1251.
46. Chun TY. Coincidence of bladder and prostate cancer. J Urol. 1997;157:65.
47. Kurokawa K et al. Comparative study on the prevalence of clinically detectable prostate cancer in patients with and without bladder cancer. Urology. 2004;63:268.
48. Delongchamps NB et al. Outcome of patients with fortuitous prostate cancer after radical cystoprostatectomy for bladder cancer. Eur Urol. 2005;48:946.
49. Kefer JC, Campbell SC. Current status of prostate-sparing cystectomy. Urol Oncol. 2008;26(5):486–93.
50. Rozet F, Lesur G, Cathelineau X, Barret E, Smyth G, Soon S, et al. Oncological evaluation of prostate sparing cystectomy: the Montsouris long-term results. J Urol. 2008;179(6):2170–4. discussion 2174–5.