

Laparoscopic Radical Prostatectomy 10 years' experience

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ABSTRACT

Purpose: The authors assess the morbidity, functional results and oncologic follow-up of their personal series of laparoscopic radical prostatectomies performed in a 10-year period. **Material and Methods:** The data on 780 laparoscopic radical prostatectomies performed between September 1997 and December 2007 were stored in a personal database. The following parameters are described and analyzed critically: operative time, blood transfusions, conversions, length of hospital stay, complications, functional results of sexual potency and urinary continence, surgical margins and oncologic follow-up. **Results:** Operative time averaged 125 minutes, with a mean bleeding volume of 335 ml and mean hospital stay of 4.3 days. The rates of conversion to open surgery amounted to 1.36% and the overall complication rate was 14.24%. The pathology analysis showed pT2 tumors in 82.60% and pT3 tumors in 17.39% of cases. The overall margin positivity rate was 19.58%, with biochemical recurrence of 10.27% with a mean follow-up of 62.5 months. Urinary continence and sexual potency yielded rates of 88% and 61%, respectively, 12 months after surgery. **Conclusions:** Laparoscopic radical prostatectomy is a technically well-defined procedure that provides ideal oncologic and functional results after proper training. Nowadays, it is our treatment of choice for patients with prostate cancer.

Key words: Prostate cancer. Radical prostatectomy. Laparoscopic surgery.

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INTRODUCTION

Even though no consensus exists on the best therapeutic approach to prostate cancer, radical prostatectomy is regarded as the treatment of choice by most urologists. Radical retropubic prostatectomy has been the gold standard treatment worldwide, allowing high rates of cancer control with low rates of incontinence and sexual dysfunction. Laparoscopy has been used as an alternative, combining the principles of anatomic radical prostatectomy with the advantages of minimally invasive surgery (1-6). In this report, the authors describe technical aspects and complications, as well as oncologic and functional results of laparoscopic radical prostatectomy (LRP) within a 10-year period.

MATERIAL AND METHODS

A total of 780 patients with clinically localized prostate cancer were submitted to LRP by one of the authors, between September 1997 and December

2007. The patients were recruited from the authors' private practices or were referred to surgery by other physicians. The data were stored and updated according to outpatient follow-up, and 50 patients were excluded from the analysis due to loss to follow-up and/or inappropriate records.

Postoperative assessments included clinical examination and the prostate-specific antigen (PSA) test, which was requested every three months in the first two years, every six months from the third to the fifth years, and every year thereafter. Radiological examination was requested, if clinically indicated. Biochemical recurrence was defined as two PSA measurements above 0.2 ng/mL.

Pathology data were obtained from pathology reports, and if necessary, the slides were reviewed. The TNM 1997 was used for staging and the Gleason score was employed for cell differentiation (7). A positive surgical margin after radical prostatectomy was defined as spread of the tumor to the inked margin of the surgical specimen on microscopic examination.

Data on sexual potency and urinary continence were obtained from outpatient records. Urinary incontinence was regarded as the use of any protection against urinary leakage, and erectile dysfunction was defined as spontaneous and permanent inability to achieve enough erection for vaginal penetration.

1. Surgical technique

The patient is placed in dorsal recumbency, with his arms at the sides and his legs partially spread apart and comfortably placed in the modified lithotomy position. Safety devices are fastened to the table at the level of the patient's shoulder. A two-way 20 Fr Foley catheter is inserted and fixated.

1.1 Transperitoneal access

The first trocar 11/12 mm is inserted at the level of the umbilical scar using the open technique. The pneumoperitoneum is established and a 0-degree lens is used for inspection of the cavity and placement of other trocars under direct visualization. The additional trocars are placed in an inverted W configuration, with the vertex at the umbilical level towards the lens.

Another two trocars measuring 11/12 mm are placed adjacent to and below the camera for the working clamp and ultrasonic scalpel, respectively. Another two trocars, measuring 6 mm, are inserted laterally close to the anterior superior iliac spines for aspiration and ancillary clamping. The surgical steps are described in table 1.

1.2 Preperitoneal access

The open access is obtained with a small 3-cm incision below the umbilical scar. The anterior

aponeurosis of the abdominal rectus muscle is incised and dissected at midline, thus exposing the posterior aponeurosis. The midline raphe is sectioned. The virtual prepubic space can be created with a digital maneuver or using specific balloons.

The first 11/12-mm trocar is inserted and the aponeurosis around it is sutured to avoid gas leakage, thus establishing the working space. Then the 10-mm and 0-degree lens, used for inspection and placement of other trocars under direct visualization, is inserted. Additional trocars are placed in an inverted W configuration, similarly to the transperitoneal approach. The surgical steps are described in table 2.

RESULTS

A total of 730 patients with mean age of 64.6 years (42 to 76) and clinically localized disease were selected for this review.

The transperitoneal approach, as described above, was used in 559 cases and the preperitoneal approach was used in 171 cases. Pelvic lymphadenectomy was indicated for patients with Gleason score greater than 7 and/or PSA greater than 10 ng/dl, being required in 76 cases (10.41%).

Operative time averaged 125 minutes (90 to 240), with a mean hospital stay of 4.3 days (1.5 to 20). When pelvic lymphadenectomy was performed, operative time increased by 40 minutes.

The mean bleeding volume in the intraoperative period was 335 ml (50-1,150 ml), with transfusion rates of 5.34% (39 cases). None of these patients required reoperation.

The rates of conversion to the open technique amounted to 1.36% (10 cases), with an overall

Table 1 - *Transperitoneal laparoscopic radical prostatectomy – Step-by-step technique.*

1.	Dissection of vas deferens and seminal vesicles
2.	Anterior peritoneotomy for access to the retropubic space with release of the bladder
3.	Bilateral opening of the endopelvic fascia
4.	Separate ligation of the dorsal venous complex
5.	Anterior transection of the bladder neck
6.	Posterior transection of the bladder neck and exposure of the previously dissected vas deferens and seminal vesicles
7.	Section of lateral prostatic pedicles with neurovascular bundle preservation
8.	Section of the dorsal venous complex and urethral section
9.	Urethrovesical anastomosis
10.	Retrieval of the specimen into the endobag and positioning of the drain

Table 2 - Preperitoneal laparoscopic radical prostatectomy – Step-by-step technique.

1. Bilateral opening of the endopelvic fascia
2. Separate ligation of the dorsal venous complex
3. Anterior transection of the bladder neck
4. Posterior transection of the bladder neck
5. Dissection of the vas deferens and seminal vesicles
6. Section of lateral prostatic pedicles with neurovascular bundle preservation
7. Section of the dorsal venous complex and urethral transection
8. Urethrovesical anastomosis
9. Retrieval of the specimen into the endobag and positioning of the drain

complication rate of 14.24% (104 cases). The data are summarized in table 3.

The pathological assessment revealed pT2a tumors in 19.45% of cases (142 patients), pT2b tumors in 63.15% of cases (461 patients), pT3a/b tumors in 14.38% of cases (105 patients) and pT3c tumors in 3.10% of cases (22 patients). The Gleason score was distributed as follows: 2 to 4 in 3.97% (29 cases), 5 to 6 in 44.93% (328 cases), 7 in 46.02% (336 cases) 8 to 10 in 5.06% (37 cases). The mean overall margin positivity rate was 19.58% (143 cases): 7.69% for pT2a (11 cases), 19.08% for pT2b (88 cases), 34.28% for pT3a/b (36 cases) and 36.36% for pT3c (8 cases). The positive surgical margins were located as follows: in the apical region 49.65% (71 patients), at the bladder neck 20.27% (29 patients) and in the posterolateral region 30.06% (43 patients). Table 4 summarizes the data on surgical margins.

In this series with a minimum follow-up of 5 months and maximum follow-up of 120 months (mean of 62.5 months), the overall rate of biochemical recurrence was 10.3% (75 patients).

Urinary continence had a rate of 87.94% (642 patients) 12 months after surgery, and sexual potency yielded a rate of 60.95% (445 patients) in the same period.

DISCUSSION

The mean intraoperative bleeding volume in the present series amounted to 300 ml with transfusion rates up to 5%. The major bleeding in radical prostatectomy, both in the open and laparoscopic techniques, occurs while controlling the dorsal venous complex and while ligating the lateral prostatic pedicles. Laparoscopy offers increased magnification, excellent

Table 3 - Complication rates and results for 730 LRP.

Complications (total)	14.24%	(104 cases)
Mortality	0.13%	(1 case)
Reoperations	0.27%	(2 cases)
Conversion	1.36%	(10 cases)
Deep vein thrombosis	0.68%	(5 cases)
Ureteral injury	0.54%	(4 cases)
Urinary leakage	6.98%	(51 cases)
Urethrovesical stenosis	2.46%	(18 cases)
Rectal injury	0.54%	(4 cases)
Ileocolonic injury	0.13%	(1 case)
Urinary retention	1.09%	(8 cases)
*Urinary incontinence	12.1%	(88 cases)
*Erectile dysfunction	39.1%	(285 cases)

*Not included in the overall analysis of complications.

Table 4 - Oncologic results of the present series.

Criterion	%	cases
Pathological stage		
pT2a	19.45	142
pT2b	63.15	461
pT3a/b	14.38	105
pT3c	3.01	22
Margin positivity rate		
Overall	19.58	143
pT2a	7.74	11
pT2b	19.08	88
pT3a/b	34.28	36
pT3c	36.36	8
Location of the margins		
Apical	49.65	71
Bladder neck	20.27	29
Posterolateral	30.06	43
Biochemical recurrence rate		
Overall	10.27	75

illumination and tamponading effect of CO₂, which facilitates hemostasis and visualization. Safe ligation of the dorsal vein complex is performed under good anterior and lateral visualization of the venous plexus and of its lower limit, close to the urethra. We removed all of the preprostatic fat and approached the endopelvic fascia with clear exposure of puboprostatic ligaments and their lateral limits. Puboprostatic ligaments were not sectioned and, additionally, we used a metallic urethral sound for precise identification of the urethra and its posterior mobilization, thus allowing for the safe passage of two figure of eight 2-0 vycril sutures. The ligation of arterial lateral prostatic pedicles can be safely obtained with the harmonic scalpel, bipolar cautery, using clips or intracorporeal suture at the surgeon's discretion, seeking not to use any form of energy close to them (1-6,8,9-12).

Different types of complications have been reported in up to 35% of the cases, but most of them have negligible clinical consequences (1-18). Mortality has been around 0.5 to 1%, and has been related to heart diseases or cases of pulmonary embolism. All publications on LRP show a tendency towards the reduction of postoperative complication rates, from 25% to approximately 5% after the learning curve has been achieved, and this was also observed in the present series (3,5,6,10,12-17).

Rectal injuries are potential complications of radical prostatectomy, with rates between 0 and 9% being described in LRP series (15,18). These injuries often occur at the end of the excision of the prostate gland, or during the dissection of the lateral pedicles or during the section of the rectourethralis muscle adjacent to the prostatic apex. When these injuries are observed in the intraoperative period, they must be corrected through laparoscopy with primary suture, and the suture must be "strengthened" with omentum or preperitoneal fat. Most cases have a favorable outcome with the primary suture and occasionally with protective colostomy, if necessary, depending on the extent of the injury and level of local contamination. When these injuries are not identified in the intraoperative period or when the primary suture fails, a rectourethral fistula develops, a complication that occurs in 15 to 25% of the times that a rectal injury is sutured laparoscopically. The conservative management with derivative colostomy for up to three months has been the initial approach in these cases, provided that no sepsis is associated. However, spontaneous closure is extremely rare and most patients require surgical treatment. Abdominal (either open or laparoscopic), perineal or posterior transsphincteric approaches have been used to correct these rectourethral fistulas, although no agreement

exists on the best therapeutic approach that should be used. The closure of rectourinary fistulas in our setting have been performed laparoscopically by the abdominal approach, even though we recognize that the sagittal transsphincteric approach is a good alternative. In our patient population, we had four rectal injuries, two of which were identified and sutured in the intraoperative period, resolving uneventfully. One of the injuries was detected when the catheter was removed, and it was treated with derivative colostomy and corrected laparoscopically three months afterwards. The other injury consisted of low output fistula, which closed spontaneously with an indwelling catheter.

Ureteral injuries yield rates of 0.5% in LRP, and predominantly occur in three situations: 1) when we mistake the vas deferens for the ureter, 2) when a previous transurethral resection was made, which prevents the proper visualization of ureteral meatuses at the bladder neck; 3) when the ureter is enveloped by urethrovesical anastomosis (2,5,10,12,15). Treatment usually consists of laparoscopic ureteral reimplantation. In our patient population, we had three cases of ureteral injuries, one during the intraoperative period, corrected with laparoscopic reimplantation, and two cases in which the ureter was enveloped by the anastomosis, whose correction consisted of ureteral reimplantation in a reoperation.

Urethrovesical anastomosis is the most technically challenging step of the procedure. Although laparoscopy provides ideal illumination and increased magnification for the sutures, their accurate placement depends on expertise in intracorporeal suturing, which needs to be standardized. Separate stitches or continuous suture can be used, but we have preferred the latter, since it reduces the number of knots, presumably facilitating the procedure. With regard to complications related to laparoscopic urethrovesical anastomosis, anastomotic leak has occurred in around 10% of the cases, but it usually resolves spontaneously with bladder drainage and maintenance of the suprapubic drain. In our patient population, all cases resolved spontaneously with bladder drainage and maintenance of the drain. One case needed drainage for up to three weeks, with maintenance of the bladder catheter and of the suprapubic drain throughout the period.

Conversion has averaged 2.4% (0 to 14%), and is predominantly required due to technical reasons, such as bleeding, adhesions or excessive operative

time, without severe complications (15). According to our experience, after the conversion of the first 10 cases, there were no other conversions to open surgery.

Urinary continence rates after open radical prostatectomy have ranged from 31% to 92%. In most laparoscopic series, the rates of urinary control at 3, 6 and 12 months have been around 58%, 68% and 82 to 91%, respectively (5,14,15). One should recall that urinary continence rates are higher and better in younger individuals and in those which the neurovascular bundles were preserved. Some authors have shown that patients achieve urinary control earlier after LRP when compared to open retropubic surgery (6,8). Using the experience gained in LRP, some maneuvers have been developed in order to improve urinary control rates. The so-called "urethral stretching" can be performed and consists of dissection of the urethra, proximal to the urinary sphincteric region, allowing for suture with lesser tensile strength without enveloping the pelvic musculature and consequently the striated sphincter. In addition, the preservation of the bladder neck in patients with low risk for cancer may bring some benefit.

Rates of sexual function preservation range considerably from 11% to 85% in the reported series of retropubic radical prostatectomies. Again, sexual function recovery depends on age and on the preservation of neurovascular bundles. There was gradual temporal recovery, according to assessments at 3, 6, 12 and 18 months with rates of 38%, 54%, 73% and 86% in the best series. In reported laparoscopic series, the mean erectile function rate is 59% in 6 months (3,5,12,13,15). Technically, laparoscopy can provide as good results as those of the open surgery in terms of preservation of sexual potency. In addition to excellent anatomic expertise, contributing factors include increased magnification, excellent illumination and reduced local bleeding. The control of lateral prostatic pedicles and vessels at the apices of the seminal vesicles with clips or manual suture, using cold scissors, has been of great value, avoiding the use of thermal energy close to the neurovascular bundle. In our recent cases, we have used only cold scissors close to the seminal vesicles and posterolateral neurovascular bundle, using solely intracorporeal suture or polymer clips for hemostasis.

Margin positivity rates vary widely in the literature, from 5% to 45%, depending on the tumor stage, tumor differentiation, technique used and

surgeon's expertise. Positive surgical margins in retropubic radical prostatectomies yield rates of 16% to 28% for pT2 tumors, and up to 47% to 52% for pT3 tumors. If we consider patients with nonpalpable tumors diagnosed through abnormal PSA levels, margin positivity rates can be as low as 8% (2,6,9,12,15).

In several LRP series, margin positivity rates have been quite similar to those described for retropubic prostatectomies, depending basically on the extent of the disease. The mean margin positivity rates for pT1/pT2 tumors have ranged between 11% and 26%, amounting on average to 4% for pT1/pT2a and to 18% for pT2b. For advanced-stage tumors, the rates increase to 33% to 39% for pT3a and to 81% for pT3b. Positive surgical margins in LRP in most series are located in the apical region (50 to 70%), basal region (10%), posterolateral region (10 to 25%), anterior region (5%) and multiple regions (5%) (2,6,9,12,15). In our patient population, we have an overall margin positivity rate of 19.58%: 7.69% for pT2a, 19.08% for pT2b, 34.5% for pT3a/b and 36,3% for pT3c. With regard to the location of surgical margins, 49.7% of the cases showed apical margins, 29.9% posterolateral margins and 20.3% bladder neck margins.

Based on our experience, apical dissection is a crucial step in LRP since it plays an important role in urinary continence (length of urethral stump, quality of the anastomosis and sphincter control), erectile dysfunction (injury to the neurovascular bundle), surgical margins and risk of rectal injury. We have observed that urethral transection at the end of the procedure after total release of both neurovascular bundles, as well as the preservation of the bladder neck only in cases with safe clinical characteristics of localized disease would be the two most important factors for the reduction of positive margins. Ran et al. demonstrated that good apical dissection with section of puboprostatic ligaments and the nonpreservation of the bladder neck decreased the margin positivity rate to 0% at the bladder neck and from 12% to 6% at the apex (11). Although we have an optimal margin positivity rate, our rate of posterolateral margins is high, perhaps due to considerable concern with sexual potency and its preservation, a fact that we have been reconsidering in some situations.

The biochemical recurrence rates, have amounted to 11% for patients with clinically localized

disease and follow-up of 5 years, outperforming the statistics of large series of retropubic radical prostatectomies (2,6,9,11,12,15). If observed more closely, the rates of biochemical recurrence in LRP have been 8.6% (4 to 15.3%) for pT2 and 17.5% (15 to 20.6%) for pT3 in periods of up to 5 years. The disease-free survival rates have reached 92% for pT2aN0; 88% for pT2bN0; 77% for pT3aN0; 44% for pT3bN0 and 50% for pT1-3N1. Open radical prostatectomies have yielded biochemical control rates of 88% to 93% for pT1-2N0, 75% for pT3aN0 and 47% for patients with invasion of seminal vesicles. Our rate of biochemical control has averaged 10.3% with a mean follow-up of 62.5 months.

CONCLUSIONS

LRP is a standard procedure whose advantages include minimal disfiguration, shorter hospital stay, reduction in blood transfusion rates, lesser postoperative discomfort and quicker return to daily activities. With the additional development of materials, robotics breakthroughs, better qualification of surgeons, patients' preference and tendency towards detecting neoplasms at initial stages, laparoscopy may become the gold standard for radical prostatectomy in the near future.

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