

# Long-term oncological and functional results of extraperitoneal laparoscopic radical prostatectomy: one surgical team's experience on 1,600 consecutive cases

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Received: 10 February 2013 / Accepted: 1 March 2013 / Published online: 17 March 2013  
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## Abstract

**Purpose** To determine the oncologic and functional outcomes of ELRP on a single surgical team's series.

**Methods** A total of 1,600 consecutive ELRP patients were recorded with a 2-year follow-up. In 778 patients, a 5-year follow-up was available.

**Results** The mean operative time was 125,6 min (PLND not included) and 150,9 min (PLND included). Postoperative stage was pT2a in 282 patients (17.6 %), pT2b in 877 (54.8 %), pT2c in 18 (1.1 %), pT3a in 241 (15 %), and pT3b in 182 (11.3 %). Positive margins were detected in 7.4 and 13.4 % of pT2 and pT3 tumors, respectively. Overall complication rate was 4 %. PSA levels resulted in <0.2 ng/mL in 96.4, 94.9, 92, 90.9, and 81.5 % of the cases at 3, 12, 24, 36, and 60 months after surgery, respectively. BCRFS rates 5 years after ELRP were 88.7 % for patients staged as pT2, 73.9 % for pT3a, and 62.4 % for pT3b. Complete urinary continence rate resulted in 39 and 92 % after 1 and 12 months, respectively, with a further increase from 92 to 98.4 % at 24-month follow-up. A nerve-sparing procedure was performed in 45 % of patients. The overall potency rate at 12-month follow-up was 38.67 % for UNSS patients and 75 % for BNSS patients. Potency recovery was age-dependent, with patients aged <55 years who resulted potent in 46.8 % of UNSS and 95.8 % of BNSS after 24 months.

**Conclusions** ELRP is a standardized and safe procedure that implies advantages of both minimally invasive and extraperitoneal approaches with elevated standards for oncologic and functional outcomes obtained at long-term follow-up.

**Keywords** Prostate cancer · Laparoscopy · Functional outcomes · Long-term follow-up

## Introduction

Laparoscopic radical prostatectomy was first described by Schuessler et al. [1] and Raboy et al. [2] in 1997 and proceeded to be more routinely standardized by Guillonneau et al. in 1999 [3]. Preliminary reports have shown that in the hands of experienced surgeons, ELRP is safe and yields oncologic and functional results equivalent to those of the open approach [4–6].

The technique for ELRP was first described in 2001 by Bollens et al. [7] and offers some advantages over the transperitoneal laparoscopic approach.

The aim of the present study is to describe the technical aspects, complications, and long-term oncologic and functional results of a large surgical series of ELRP interventions performed by a single surgical team over a 10-year period.

## Patients and methods

### Patient selection

Between October 2003 and February 2012, 1,600 consecutive men underwent ELRP for localized prostate cancer

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by the same surgical team who performed operations at two different institutions. All patients were scheduled for follow-up visits at our institutions at 1, 3, and 6 months and subsequently at 6-month intervals. Data collection was performed using a single database. Biochemical recurrence-free survival (BCRFS) was compared based on the Kaplan–Meier method using SPSS. Erectile function was assessed using the International Index of Erectile Function (IIEF) and continence by the International Continence Society questionnaire.

### Surgical procedure

Patients are positioned in the supine position with their legs slightly divaricated, and a 10-cm-thick roll is placed under the sacrum. A 1-cm infraumbilical incision is made, and the fascia is incised over the linea alba. The Retzius' space is delineated by digital sweeping under the posterior rectus muscle, and adequate space is created by balloon dilation. Four other trocars (three 12/10-mm trocars and one 5-mm trocar) are placed in a symmetrical V pattern. A 12-mm double-sealed structural trocar is placed at the level of the first incision and used for the 0° telescope which is held by a second assistant by way of a specific camera holder device.

In cases of patients presenting a Gleason score of >6 and/or PSA level >10 ng/mL, PLND at the level of obturator fossa and external iliac vessels is performed. The periprostatic fat is then removed and the superficial dorsal vein interrupted. The endopelvic fascia is incised, and the prostate freed from its surrounding muscular fibers up to its apex while the puboprostatic ligaments are lowered. The prostate is then dissected from the bladder neck, and the urethra identified and subsequently incised. The dorsal vein complex (DVC) is tied by a 2–0 absorbable suture and then cut. Once the urethra has been sharply cut, the prostatic apex is detached and the specimen is removed through the midline incision. The vesicourethral anastomosis is then created using five interrupted 3–0 absorbable, monofilament sutures.

### Results

Patients' demographics, preoperative tumor characteristics, and intraoperative and postoperative data are reported in Table 1. Conversion to open surgery was needed in only four patients (0.25 %) among the first 20 procedures performed. Table 2 describes the pathological assessment. Location of positive surgical margins was as follows: 21.8 % of the cases ( $n = 41$ ) in the prostate apex, 71.8 % of the cases ( $n = 135$ ) in the postero-lateral aspect, and 42.5 % of the cases ( $n = 80$ ) in the prostate base; 23.4 %

**Table 1** Preoperative patients' characteristics

No. of patients	1,600
Mean age, year (range)	65.3 (45–81)
Clinical stage, $n$ (%)	
T1a	4 (0.2 %)
T1b	69 (4.3 %)
T1c	917 (57.3 %)
T2a	344 (21.5 %)
T2b	152 (9.5 %)
T3a	54 (3.3 %)
T3b	60 (3.7 %)
Mean PSA, ng/mL (range)	8.8 (0.01–131)
Mean prostate volume, mL (range)	43.4 (5–142)
Prior prostate surgery, $n$ (%)	119 (7.4 %)
<i>Intraoperative and postoperative data</i>	
Mean operation time, min (range)	
Overall	145.5 (55–360)
with PLND ( $n = 480$ , 30 %)	150.9 (62–360)
without PLND ( $n = 1,120$ , 70 %)	125.6 (55–300)
Contextual inguinal hernia repair	
Monolateral, $n$ (%)	33 (2 %)
Bilateral, $n$ (%)	3 (0.18 %)
Patients requiring homologous transfusions, $n$ (%)	64 (4 %)
Patients requiring autologous transfusions, $n$ (%)	8 (0.5 %)
Mean preoperative to postoperative day 3 Hb drop, mg/dL (range)	3.4 (0–8)
Cases converted to open surgery, $n$ (%)	4 (0.25 %)
Nerve-sparing surgery, $n$ (%)	320 (20 %)
Unilateral nerve-sparing surgery, $n$ (%)	592 (37 %)
Bilateral nerve-sparing surgery, $n$ (%)	128 (8 %)
Mean hospital stay, days (range)	7.5 (3–20)
Mean catheterization time, days (range)	7.0 (4–30)

PLND pelvic lymph node dissection, Hb hemoglobin

of the cases ( $n = 44$ ) had multiple positive margins. A minimum of 2-year follow-up was available for all 1,600 patients, while a 5-year follow-up was available in 778 cases. BCRFS according to T stage is reported at 24 and 60 months (Fig. 1). In patients staged as pT2, BCRFS rates at 24 and 60 months were 94.8 and 88.7 %, respectively. For those staged as pT3a, the rates were 92.1 and 73.9 %, and for those staged as pT3b, they were 74.1 and 62.4 %, respectively. Functional results in terms of urinary continence and erectile function are reported in Tables 3 and 4, respectively. Overall complications occurred in 65 patients (4.0 %). Intraoperative and postoperative complications, graded according to the Clavien grading system, are described in Table 5. Only two prostatic cancer-specific deaths occurred, while 32 patients died for other causes.

**Table 2** Histological results

Stage	n (%)	PSM n (% <sup>a</sup> )	Gleason score									
			3 n (% <sup>a</sup> )	4 n (% <sup>a</sup> )	5 n (% <sup>a</sup> )	6 n (% <sup>a</sup> )	3 + 4 n (% <sup>a</sup> )	4 + 3 n (% <sup>a</sup> )	8 n (% <sup>a</sup> )	9 n (% <sup>a</sup> )	10 n (% <sup>a</sup> )	
pT2a	282 (17.6)	23 (1.4)	4 (0.2)	16 (1.0)	18 (1.1)	179 (11.1)	24 (1.5)	27 (1.6)	14 (0.8)	2 (0.1)	0 (0)	
pT2b	877 (54.8)	96 (6)	2 (0.1)	18 (1.1)	50 (3.1)	546 (34.1)	85 (5.3)	112 (7.0)	64 (4.0)	4 (0.2)	0 (0)	
pT2c	18 (1.1)	0 (0)	0 (0)	0 (0)	0 (0)	18 (1.1)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	
pT3a	241 (15.0)	94 (5.9)	0 (0)	0 (0)	5 (0.3)	61 (3.8)	89 (5.5)	38 (2.3)	48 (3.0)	10 (0.6)	2 (0.1)	
pT3b	182 (11.3)	120 (7.5)	0 (0)	0 (0)	0 (0)	58 (3.6)	25 (1.5)	39 (2.4)	60 (3.7)	26 (1.6)	2 (0.1)	
Total n (% <sup>a</sup> )	1,600 (100)	333 (20.8)	6 (0.3)	34 (2.1)	73 (4.6)	862 (53.9)	223 (13.9)	216 (13.5)	186 (11.6)	42 (2.6)	4 (0.2)	

PSM positive surgical margin

<sup>a</sup> Percentage of the overall population (n = 1,600)

**Discussion**

We started routinely performing ELRP in 2001 based upon the encouraging initial results reported on laparoscopic radical prostatectomy [8–10].

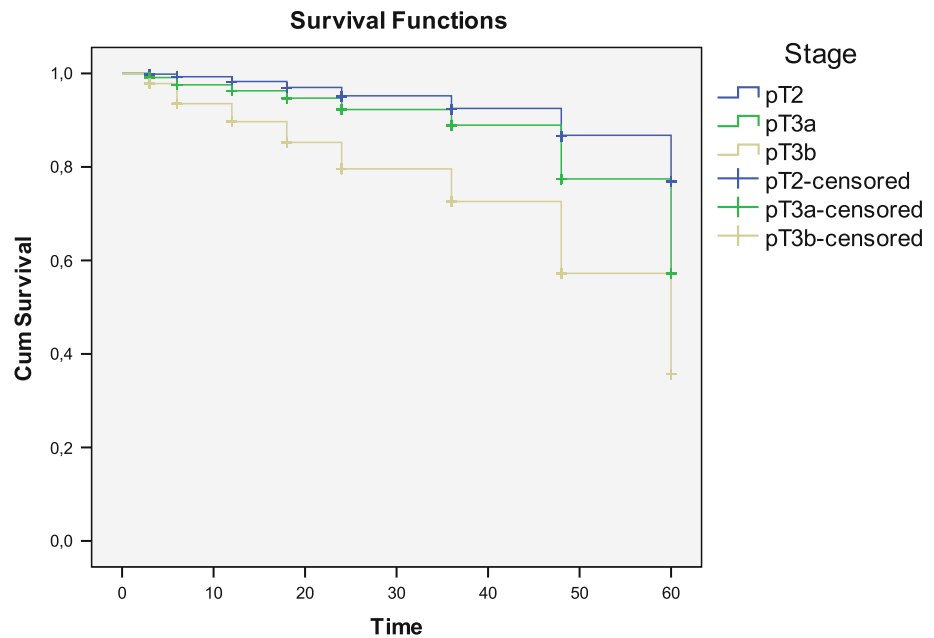
Although several published studies show equivalent results with the transperitoneal approach, all operations were conducted with the extraperitoneal access because of our personal belief that it is a safe approach, avoids potential intraperitoneal complications, and allows to keep the patient in the supine position.

Since our report of our initial experience on 114 ELRP cases [11], we have continued to refine and standardize our technique, and our results are comparable to those of other large published series [12–17].

The mean operative time (125.6 min without PLND and 150.9 min with PLND) is shorter than other published series [13, 16, 17], even though patients who received a contextual laparoscopic inguinal hernia repair (36 cases, 2.25 %) or underwent prior prostate surgery (119 cases, 7.4 %) are included in our study. The reduced operative time could be explained by the adoption of some advantageous surgical maneuvers such as: (1) creating the extraperitoneal space by combining the digital sweep of the muscle plane and the pneumatic dilation using a dilating balloon; (2) placing the trocars by guiding the tip of the device with the index finger; (3) using a central double-sealed structural trocar avoided fastidious and time-consuming lack of gas; (4) employing a special hand-made camera holder device allowed to maintain optimal visualization without interfering with surgeon’s movements; and (5) performing the ureterovesical anastomosis using five separate monofilament absorbable stitches placed at 12, 2, 5, 7, and 10 o’clock positions.

Some major published series confirm that positive surgical margin (PSM) rates between the open and laparoscopic approaches do not differ [4, 18–20]. However, wide variability in PSM rates has been reported particularly for pT2 tumors (range 6.2–27.5 %) within different oncologic series, and these data could be explained by differing surgical experience, patient selection criteria, or the surgical procedures adopted [19]. Our results concerning the PSM rate show a lower value for both pT2 (7.4 %) and pT3 tumors (13.4 %) compared to other published series, although it should be emphasized that the present study includes the very first patients of our series. This positive result can be explained by two main reasons: First of all, we performed a nerve-sparing surgery only in very well-selected patients because of our belief that the risk of detecting a positive surgical margin can expose the patient to higher risk of disease recurrence. Furthermore, the rural population that is mostly served by our hospital willingly accepted the possibility of undergoing a non-nerve-sparing

**Fig. 1** Kaplan–Meier analysis of BCRFS in patients staged at pT2, pT3a, and pT3b



**Table 3** Urinary continence

Months postoperatively	Complete continence <i>n</i> (%)	Grade 1 <i>n</i> (%)	Grade 2 <i>n</i> (%)	Grade 3 <i>n</i> (%)
1	624 (39)	512 (32)	384 (24)	80 (5)
3	1,392 (87)	112 (7)	96 (6)	0 (0)
6	1,440 (90)	99 (6.1)	64 (3.9)	0 (0)
12	1,488 (92.7)	80 (5.3)	32 (2)	0 (0)
24	1,575 (98.4)	13 (0.85)	12 (0.75)	0 (0)

grade 1: one pad per day  
grade 2: up to three pads per day  
grade 3: more than 3 pads per day

**Table 4** Potency rates according to patients' age and type of nerve-sparing surgery

	Patients potent at 12-month follow-up <i>n</i> <sup>a</sup> (% <sup>a</sup> )	Patients potent at 24-month follow-up <i>n</i> <sup>a</sup> (% <sup>a</sup> )
Unilateral nerve-sparing surgery (UNSS)		
<55 years ( <i>n</i> = 282)	127 (45.08)	132 (46.8)
55–65 years ( <i>n</i> = 242)	89 (36.27)	91 (37.6)
>65 years ( <i>n</i> = 68)	14 (21.87)	14 (21.87)
Overall ( <i>n</i> = 592)	230 (38.67)	237 (40.0)
Bilateral nerve-sparing surgery (BNSS)		
<55 years ( <i>n</i> = 48)	40 (83.33)	46 (95.8)
55–65 years ( <i>n</i> = 60)	46 (76.66)	48 (80.0)
>65 years ( <i>n</i> = 20)	10 (50)	11 (55.0)
Overall ( <i>n</i> = 128)	96 (75)	105 (82.0)

<sup>a</sup> Number and percentage of potent patients in the specific age and surgery subgroup

surgery in exchange of a higher possibility of disease control. We therefore always performed an extrafascial approach to achieve optimal oncological outcomes in pT3 tumors.

PSA levels resulted in <0.2 ng/mL in 96.4, 94.9, 92, 90.9, and 81.5 % of the cases at 3, 12, 24, 36, and 60 months after surgery, respectively. At our institution, we considered the presence of biochemical recurrence if

PSA raised >0.2 ng/mL confirmed by a subsequent rising PSA level. Our data concerning BCRFS rates are comparable to that of previously published large series on LRP, except for a more favorable rate for pT3a tumors at both 24 and 60 months [21].

The overall complication rate result was very low (4.0 %), and most importantly, we were able to conservatively manage the vast majority of the intraoperative and

**Table 5** Complications according to Clavien grade

Complication	Clavien grade	n (%)	Management
<b>Intraoperative complications</b>			
Rectal injury	IIIa	2 (0.1)	Two-layer suture and parenteral nutrition
Hemorrhage	II	42 (2.6)	Blood transfusion
Technical impairment	IIIb	4 (0.2)	Conversion to open surgery
<b>Early complications (&lt;1 month postoperatively)</b>			
Anastomotic leakage	I “d”	2 (0.1)	Prolonged urethral catheterization (>14 days)
Perineal hematoma	I	4 (0.2)	Conservative
Preperitoneal hematoma	I	4 (0.2)	Conservative
Temporary obturator nerve apraxia	I	2 (0.1)	Conservative
Symptomatic lymphocele	IIIa, IIIb	40 (2.5)	Drainage and laparoscopic fenestration
Bleeding/hematoma	IIIb	18 (1.1)	Laparoscopic and open revision
<b>Late complications (&gt;1 month postoperatively)</b>			
Anastomotic stricture	IIIb	14 (0.8)	Endoscopic bladder neck incision
Bladder stones	IIIa	3 (0.1)	Endoscopic lithotripsy
Port site hernia	IIIb	2 (0.1)	Open repair

early postoperative cases, except for symptomatic lymphocele (laparoscopic peritoneal fenestration) or major postoperative bleeding (laparoscopic or open revision).

The urinary continence rate resulted in adequate and similar to those of other published large series [13, 22]. Over time, we observed a significant and constant increase in the complete urinary continence rate that resulted in 39 and 92 % after 1 and 12 months, respectively. These data can be explained by the fact that the vast majority of our patients were followed up for a prolonged period at a dedicated outpatient clinic in order to complete an adequate urinary continence rehabilitation course managed by a combined clinical team (urologist and physiotherapist). The further increase in complete continence rate from 92 to 98.4 % at 24-month follow-up is explained by the fact that most of the postoperative incontinent patients underwent a specific surgical treatment for their incontinence with sling procedure.

The overall potency rate at 12-month follow-up was 38.67 % for UNSS patients and 75 % for BNSS patients. A slight but not significant improvement was detected at 24-month follow-up up to 40 % of potency rate in UNSS patients and 82 % in BNSS patients. The percentage of potency recovery resulted in age dependent, with the highest rate achieved in subjects aged <55 years. In this patient subgroup who received a unilateral or bilateral nerve-sparing procedure, the potency rate resulted in 46.8 and 95.8 % after 24 months, respectively. It is worth mentioning that, immediately following catheter removal, all patients who underwent a nerve-sparing procedure were referred to a dedicated outpatient clinic managed by one of our staff urologists specialized in sexual medicine in order

to commence an early sexual rehabilitation course and optimize functional sexual results.

The combination of acceptable oncological and functional results confirms that laparoscopic surgery still has a role as a minimally invasive approach for prostate cancer, especially in that centers where robotic surgery is still not available and waiting for new approaches such as LESS and NOTES to be further developed in prostatic surgery [23, 24].

## Conclusions

The advantageous results of our single surgical team's extensive experience on 1,600 cases of ELRP over the course of a 10-year period are encouraging and confirm that ELRP, as a widely practiced and standardized procedure, combines the advantages of both the minimally invasive and extraperitoneal approaches. On the basis of long-term follow-up data, our experience indicates that adequate oncologic and functional outcomes can be achieved with very low incidence of complications.

**Conflict of interest** All authors certify that there is no actual or potential conflict of interest in relation to this article and that there was no financial support for the present research.

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