Laparoscopic Prostatectomy and Pelvic Lymph Node Dissection

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Fifteen years after the wide introduction of laparoscopy for prostate cancer surgery, there are little debates about the objective advantages of this approach over the open retropubic surgery, but there is still a debate about the best way to teach surgeons who want to dedicate themselves to minimally approaches for radical prostatectomy, this procedure being still one of the most complex procedures in urology at large, and specifically in uro-oncology.

Difficult first because the indications for radical prostatectomy are moving and fuzzy, what was the rule yesterday is in question today, and all these questions will not be answered before a long while. This uncertainty places the uro-oncologist in a peculiar position when he/she sets the indication for radical prostatectomy and engages his/her responsibility.

Responsibility in the indication: Is that today the best therapeutic option for this given patient with his given prostate cancer?, and responsibility in realization: am I in the best situation to perform the optimal care. All these points are becoming prominent today because prostate cancer surgery leads to definitive side effects in patients who are not suffering from any symptoms when surgery is indicated, aiming for an hypothetical benefit in term of survival, many years down the road.

Ultimately, the responsibility of the teachers is therefore essential to highlight these questions, educate young uro-oncologists, and raise aftermath questions about surgical quality: it is with these responsibilities in mind that this chapter was written.

Beyond the technical considerations, since internships and fellowships by experienced mentors are the ultimate best way to learn surgery (in the operative room and not through medias, whatever they are) this chapter emphasizes the questions urologists should have in mind when they decide to perform a laparoscopic radical prostatectomy.

Intraoperative and Perioperative Complications

After the initial introduction of laparoscopic radical prostatectomy (LRP) [1] there was enthusiasm and hope that this technique would have a better safety profile and better functional outcomes without compromising the oncologic outcomes. Like other surgical procedures, LRP is dependent on the expertise and experience of the surgeon.

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Table 5.1 Intraoperative and perioperative complications

MSKCC report for 1,176 patients between 2003 and 2005 [2]	RRP $N=692$	LRP $N=484$	p value
Mean operating room time (min) ($n=946$)	188 (SD 41)	199 (SD 47)	<0.0005
Mean estimated blood loss (cm^3) ($n=1,070$)	1,267 (SD 660)	315 (SD 186)	<0.0005
No. transfused (%)	338 (49 %)	14 (3 %)	<0.0005
Mean length of stay (days) ($n=465$)	3.3 (SD 1.2)	2.0 (SD 1.5)	<0.0005
ER return visit	75 (11 %)	75 (15.5 %)	0.02
Reoperation	3 (0.4 %)	9 (1.9 %)	0.03
No. readmitted (%) ($n=1,162$)	8 (1.2 %)	22 (4.6 %)	0.001

While the functional outcomes have not been shown to be superior to open radical prostatectomy (ORP), LRP offers the advantages of lower intraoperative blood loss, a lower rate of perioperative transfusion, and faster convalescence.

A prospective comparison of LRP and ORP performed between 2003 and 2005 at Memorial Sloan-Kettering Cancer Center (MSKCC) [2] showed that both techniques had similar rates of neurovascular bundle (NVB) preservation (88 % bilateral preservation in LRP compared to 91 % in ORP, 6 % vs. 6 % unilateral preservation, and 5 % and 3 % of bilateral NVB resection for LRP and ORP, respectively), similar rates of positive surgical margins (11 % for both surgical techniques), and a similar median number of lymph nodes retrieved (13 and 12 for LRP and ORP, respectively). The mean operative time was longer for LRP (199 min for LRP vs. 188 min for ORP), but the estimated blood loss (EBL) was significantly lower for LRP (315 mL for LRP vs. 1267 for ORP, $p<0.0005$). The hospital stay was shorter for LRP (2.0 vs. 3.3 days), but patients after LRP had a higher rate of ER visits (15 % and 11 % for LRP and ORP, respectively), higher rate of readmission (4.6 % and 1.2 % for LRP and ORP, respectively), and a higher rate of reoperation (1.9 % and 0.4 % for LRP and ORP, respectively). At a median follow-up of 1.5 years, no difference was seen in rates of biochemical recurrence (HR 0.99 for LRP vs. ORP; 95 % CI, 0.62–1.59; $p=0.9$) (Table 5.1).

Other investigators compared ORP and LRP and have reported similar results with comparable rate of positive surgical margins, comparable rates of biochemical recurrence (BCR), lower EBL, and need for transfusion in LRP-treated patients [3–5]. In a recent review of outcomes after ORP, LRP, and robot-assisted laparoscopic prostatectomy (LARP), Coelho et al. reviewed the contemporary literature from high volume centers and found mean EBLs of 951 mL and 291.5 mL in ORP and LRP, respectively. This review also showed a lower rate of transfusion needed in LRP (20.1 % and 3.5 % for ORP and LRP, respectively) [6]. While it has been recently suggested that EBL does not affect the oncologic outcome [7], this conclusion was made after analyzing the outcome of 1,567 men who underwent ORP, and thus these results do not necessarily reflect a possible advantage of lower EBL in LRP.

While magnification, better accessibility, and the antegrade surgical approach help, the collapse of venous plexuses by the positive intra-abdominal pressure is the main contributor to the lower blood loss during LRP. A temporary increase of the pneumoperitoneum pressure to 20 mmHg during transection of the dorsal vascular complex allows for tamponade and accurate venous closure.

A retrospective review of 4,592 consecutive patients treated at MSKCC with either ORP (3,458 patients) or LRP (1,134 patients) between 1999 and 2007 found a higher overall rate of both medical and surgical postoperative complications in the LRP group (8.8 % and 14.5 % rates of medical complications in ORP and LRP, respectively, and 18.7 % and 24.5 % rates of surgical complications in ORP and LRP, respectively), but a lower rate of major surgical complications (grades III–V), most of which were bladder neck contractures [8]. The lower rate of bladder neck contractures in LRP was also shown by others, as was the need for additional surgical interventions for the correction of these contractures [9].

Oncologic Outcomes

Positive Surgical Margins

A positive surgical margin (PSM) is defined as cancer cells at the inked margin of resection. A positive surgical margin at radical prostatectomy is associated to a higher risk of recurrence and has been associated with an increased risk for both local and systemic recurrence after treatment [10–12]. The goal of any surgical technique used for treatment of cancer is complete excision with negative surgical margins, extended pelvic lymph node dissection whose role is still debated thus lowering or delaying the risk of recurrence.

The rate of positive surgical margins reported in large LRP series ranges between 11 % and 26 % [2, 8, 13–15]. The rate of PSMs varies with pathologic stage and grade and ranges from 9.1 % PSM rate in patients with low risk disease to 36.8 % in a high risk group. This is comparable to previously reported rates of PSMs of 20–27 % in ORP series [16, 17] and those reported in series comparing ORP and LRP (Table 5.2).

PSMs have been shown to be associated with a higher risk of recurrence and shorter recurrence-free survival. Busch et al. recently reported that with a median follow-up of 56 months the 10-year BCR-free survival was 59.2 % vs. 82.9 % in patients with and without PSM, respectively [18]. They also found that clinical stage T2, biopsy Gleason sum >7, and higher preoperative PSA levels were all independent predictors of PSM.

Identifying the risk factors for PSMs (Table 5.3) improves the ability to decrease the percentage of patients with PSMs, and thus improves the outcome of patients. Secin et al. analyzed the preoperative and intraoperative risk factors for PSM in 407 patients treated with LRP [19]. Some of the factors associated with PSMs are well known, such as high preoperative PSA and Gleason score of 7 or more. Also shown, as known from ORP, was that lower prostate volume is a risk factor for PSMs, and that there is a trend for more PSMs on the left side for right-sided surgeons standing to the left of the patient during surgery.

An interesting association was found between the technique of NVB dissection and rate of PSMs. Results of multivariable analysis showed that dissection in the interfascial plane was associated with a fourfold increase in risk for PSMs when compared to intrafascial plane dissection. While this may be counterintuitive, as interfascial dissection is further from the prostate, this probably reflects our inaccurate preoperative assessment of extent of disease.

Table 5.2 Surgical margin analysis

Report	Publish	Number of patients	Surgeons	RRP (%)	LRP
Lepor et al. [16]	2001	1,000	Single	19.9	
Vickers et al. [17]	2010	7,765	72 (multi-institutional)	27	
Guillonneau et al. IMM [13]	2003	1,000	3		6.9 % pT2a 18.6 % pT2b 30 % pT3a 34 % pT3b
Guillonneau et al. MSKCC [28]	2008	1,564	2		13 %
Touijer et al. [2]	2008	1,430	4 (2 RRP and 2 LRP)	11	11 %
Rabbani et al. [8]	2009	4,592	–	14.6	11.3 %
Eden et al. [14]	2009	1,000	Single		13.3 %
Paul et al. [15]	2010	1,115	3		5.5 % pT2a 10 % pT2b 33 % pT3a 40 % pT3b
Busch et al. [31]	2012	1,845	8		29.20 %

Table 5.3 Risk factor for PSM[a] [18–22]

Risk factor for PSM
Clinical stage >T2
Gleason >7
Preop PSA level
Lower prostate volume
Surgeon side of standing[a]
Interfascial dissection of NVB[b]
Apex dissection

[a]Left side for right-sided surgeon standing on left
[b]Fourfold increase in risk

While the significance of apical PSMs, the most common site of PSMs both in ORP and LRP, and their effect on the chance of BCR are controversial [20–22], the aim in performing a prostatectomy for prostate cancer is to avoid them. Leaving the urethra to be cut last improves the anatomical orientation of the surgeon and lowers the rate of apical PSMs.

Posterolateral PSMs hold a higher risk for BCR than apical PSMs. To lower the rate of posterolateral PSMs special attention should be paid when dissection of the NVB is conducted with intent to preserve the nerves.

Pelvic Lymph Node Dissection

The presence of lymph node metastases in prostate cancer is associated with poor outcome. The most accurate way to stage the pelvic lymph nodes is by performing a pelvic lymph node dissection (PLND) at the time of prostatectomy. This allows for better identification of patients with lymph node metastases, allows for better prognostication, and improves the decision making regarding the need for further treatment. While PLND has a prognostic importance by better staging the patients, it has also been shown to have a therapeutic effect. The extent of lymph node dissection has also been shown to be important, as the more extensive a dissection is performed the higher the chances are of finding positive lymph nodes. The lymph node count has also been shown to be an objective indicator of the quality of surgery [23].

The use of prostate-specific antigen (PSA) for screening men for prostate cancer has caused a downward stage shift with an increasing number of patients diagnosed with low risk prostate cancer during the PSA screening era [24]. This has led some surgeons to omit a pelvic lymph node dissection during radical prostatectomy in men with lower risk prostate cancer. This trend found fertile ground among minimally invasive surgeons as a way to shorten surgical time.

A comparison of ORP and LRP performed at MSKCC showed a comparable number of lymph nodes extracted (12 and 13 for ORP and LRP, respectively) [2].

Other groups have reported on different criteria for performing a PLND with varying percentage of patients receiving a PLND and different percentage of patients found to have nodal metastases. The Montsouris group selected patients with cT2b, PSA > 10, and predominant Gleason pattern 4 for PLND. Of 1,000 patients, 216 (21.6 %) underwent a PLND, using these definitions, and 6 (0.6 % of the entire cohort) were found to have nodal metastases [13]. Stolzenburg et al. reported their recent experience of endoscopic extraperitoneal radical prostatectomy in which a PLND was performed on patients with PSA >10 ng/mL and/or a Gleason sum >6. This selection resulted in 1219 PLNDs (50.8 %) with metastases detected in 75 patients (6.1 %). Recently, the Henri Mondor Hospital reported oncologic outcomes based on 1,115 extraperitoneal LRPs. Limited PLNDs were performed in 75 % of the patients (those with biopsy Gleason score >6 and/or PSA >10 ng/mL), yielding a median 3.5 nodes per side and detecting lymph node metastases in 24 patients [15].

The reverse shift of stages seen among patients treated with radical prostatectomy, as more patients with low risk prostate cancer are put on active surveillance protocols [25], supports the importance of performing an extended lymph node dissection instead of omitting it. For these reasons, the MSKCC indications and anatomical template for PLND during LRP have changed from performing no lymphadenectomy for men with low risk of nodal metastases (<2 %) and a limited lymphadenectomy for those with patients with ≥2 % risk (as determined by a nomogram),

Table 5.4 Laparoscopic pelvic lymph node dissection

Report	Number of patients	Underwent PLND	Criteria	Metastases (%)	Median lymph nodes retrieved
Guillonneau et al. IMM [13]	1,000	21.6 %(216)	PSA > 10, cT2b and G 4	0.6	–
Stolzenburg et al. [26]	2,400	50.8 % (1219)	PSA > 10 or G >6	6.1	–
Paul et al. [15]	1,115	41.6 % (464)	PSA > 10 or G >6	2.2	7
Touijer et al. [27]	971	46 % (447)	Nomogram ≥2 %	14.3	13
Guillonneau et al. MSKCC [28]	1,564	58 % (828)	Nomogram >1 %	7	12

to performing an extended PLND dissection in all patients undergoing LRP. This modification has allowed retrieval of higher median nodal counts (13 [IQR 9–18] and 9 [IQR 6–13], respectively, $p<0.001$) and increased threefold the detection of positive lymph nodes (14.3 % and 4.5 %, respectively) [27]. We concluded that a PLND including the external iliac, obturator, and hypogastric lymph node groups yields positive nodes more frequently and retrieves a higher total nodal count than the often-performed lymph node dissection limited to the external iliac nodes [28, 29] (Table 5.4).

Biochemical Recurrence

Most available data show favorable short-term and mid-term oncologic outcomes after LRP.

In a report on 1,564 consecutive patients treated with LRP in L'Institut Mutualiste Montsouris and at MSKCC, by one of two surgeons, the actuarial probabilities of remaining free of BCR at 5 and 8 years postoperatively were found to be 78 % and 71 %, respectively. The median follow-up for patients without BCR in this study was 1.5 years. The 5-year progression-free probability for men with low, moderate, and high risk prostate cancer was 91 %, 77 %, and 53 %, respectively. The 5-year progression-free probability after LRP was 83 % among patients with pathologic organ-confined disease and negative lymph nodes and 69 % among patients with pathologic non-organ-confined disease and negative lymph nodes.

In a summary of the first 1,115 LRP cases at the Hospital Henri Mondor, Paul et al. found a 3-year and 5-year recurrence-free survival rates of 84 % and 83 %, respectively [15]. Most of the patients (60 %) in this cohort had pathologic organ-confined disease, 23 % had extracapsular extension, 10 % had seminal vesical invasion, and 7 % had pathologic T4 disease. Positive lymph nodes were found in 24 (2.2 %) of patients, and 26 % of patients had PSMs. The 5-year progression-free survival rates were 93.4 %, 70.2 %, and 42.7 % for patients with pT2, pT3, and pT4 diseases.

Hruza et al. recently reported on long-term oncologic outcomes in 500 consecutive patients treated with LRP, of which 370 had complete data and were included in the analysis. Of these, 60 % had pathologic stage T2, 21 % had stage T3a, and 19 % had stage T3b/T4. Gleason 6 or less was found in 49 % of patients, while 41 % had Gleason 7, and 10 % had a Gleason sum of 8 or more. With a median follow-up of 105 months, the 10-year BCR-free survival rate was reported to be 70.6 %. When stratified according to pathologic stage, patients with pT2 had a 10-year BCF-free survival rate of 82.3 % while patients with pT3a and pT3b/pT4 diseases had a 10-year BCR-free survival rate of 54.1 % and 52.8 %, respectively [30].

Busch et al. also reported on long-term oncologic outcomes of 1,845 evaluable patients treated with LRP. With a median follow-up of 56 months, a 10-year overall survival rate of 92.5 % and a 10-year BCR-free rate of 75.6 % were found. This cohort included 50 % of patients with low risk disease, 39 % with intermediate risk, and

Table 5.5 Biochemical recurrence

Report	Number of patients	Progression-free stratified risk			Global BCR-free (%)	Time after surgery (years)
Guillonneau et al. [28]	1,564	Low	91 %		78	5
		Int.	77 %			
		High	53 %			
Paul et al. [15]	1,115	pT2	93.4 %		83	5
		pT3	70.2 %			
		pT4	42.7 %			
Hruza et al. [30]	370	pT2	82.3 %		70.6	10
		pT3	54.1 %			
		pT4	52.8 %			
Busch et al. [31]	1,845	Low	1.00	HR	75.6	10
		Int.	2.03			
		High	3.81			

11 % with high risk disease according to D'Amico's risk groups [31] (Table 5.5).

Functional Outcomes

In addition to cancer control, patients with prostate cancer are concerned about functional outcomes after treatment. The main concerns are regarding continence and erectile function and their impact on quality of life, acknowledging that infertility is constant and that sperm banking should be offered to all patients prior to any surgery.

Continence

Urinary incontinence is a bothersome problem after prostatectomy. It has many implications, both social and personal, and is a major contributor to lower quality of life after surgery. Several preoperative measures have been identified to predict postoperative continence, including age, prostate volume, urethral length, BMI, and comorbidities. A previous transurethral resection of the prostate (TURP) has also been implicated as a risk factor for post-prostatectomy incontinence (Table 5.6).

Table 5.6 Incontinence risk factors

Incontinence risk factors
Age
Prostate volume
Urethral length
BMI
Comorbidities
TURP

While it is hard to summarize the continence rates after LRP because of different continence definitions used in the different reports and the reporting of continence at different time points after LRP (Table 5.1), overall the continence rates after LRP are good and comparable to previously reported continence rate after ORP.

Ploussard et al. looked at continence rates in 911 patients treated with LRP, who prospectively completed self-administered questionnaires, using a strict definition of no urine leak or pad use. They found that 94.4 % and 97.4 % were continent 1 and 2 years after surgery, respectively, using these strict definitions [32].

Busch el al. reported on a 74.9 % rate of continence after LRP in a cohort of 1,845 patients with a median follow-up of 56 months. They used a definition of the need for 0–1 pads per day [31].

Eden et al. reviewed their first 1,000 cases of LRP for cT1-3 prostate cancer and found that while only 10 % of patients were continent at the time of catheter removal after surgery, the pad-free rate increased to 94.9 % at a median follow-up of 27.7 months [14] (Table 5.7).

The effect of a previous TURP on continence after LRP has recently been evaluated by several

Table 5.7 Continence rates after laparoscopic radical prostatectomy

Report	Number of patients	Definition of continence	Time after surgery	Rate of continence (%)
Ploussard et al. [32]	911	No pads	12 months	94.40
			24 months	97.40
Busch et al. [31]	1,845	0–1 pads/24 h	Median f/u 56 months	74.90
Eden et al. [14]	1,000	No pads	Catheter removal	10
			Median f/u 27.7 months	94.90
Galli et al. [50]	150	"Completely continent"	Catheter removal	44.30
			12 months	91.70
Guillonneau et al. [51]	255	ICS questionnaire	12 months	82.30
Goeman et al. [52]	550	"No pads and no leakage"	1 month	38
			12 months	82.90
			24 months	90.90

groups [33, 34]. Teber et al. reported on 55 patients treated with LRP for prostate cancer found on TURP and compared them to a matched cohort of 55 patients treated by LRP for prostate cancer detected by transrectal ultrasound-guided prostate biopsies. The continence rate at 3 months after surgery was significantly lower in the first group (49.1 % vs. 61.8 %, $p=0.01$). However the continence rates at 12 and 24 months were not statistically different. At 24 months after surgery continence rates of 92.8 % and 94.5 % were seen in patients after TURP and those not after TURP, respectively. This comparison also found a similar rate of anastomotic strictures in these groups (3.6 % and 1.8 %, respectively, $p=0.9$). Menard et al. also found a similar rate of continence 24 months after surgery (86.9 % and 95.8 % in patients with and without previous TURP, respectively). This report found a statistically significant higher rate of anastomotic strictures in patients treated with LRP after TURP (6.5 % and 1.2 %, respectively, $p=0.02$).

Technical Points to Improve Continence

Transection of the dorsal vascular complex without prior ligation, using the tamponade effect of the pneumoperitoneum, allows for a more accurate transection following the contour of the anterior aspect of the prostate. After transection is completed, and clear margins are assured, the pneumoperitoneum can be lowered to the usual pressure and each vein can be sutured separately. Using this technique allows for diminished disruption of the anterior sphincter complex, the width of the complex is left unchanged and relationship to the urethra is maintained. Because of the division of the puboprostatic ligaments close to the prostate and preservation of the apical aspects of the endopelvic fascia, the anterior aspect of the anastomosis is left suspended by these ligaments, the anatomical position of the vesicourethral anastomosis remains identical as for normal female anatomy.

Erectile Function

The preservation of erectile function is often a concern among patients diagnosed with localized prostate cancer considering the different treatment options. Since the introduction of nerve-sparing prostatectomy, its efficacy has been acknowledged for potency recovery and its positive role in continence has also been established. Therefore, nerve-sparing surgery has become the standard approach in all patients when oncologically possible, without compromising the oncologic outcome [35, 36] when correctly performed.

LRP was introduced with an aim to improve functional outcomes, while maintaining adequate oncologic control. The understanding of the different fascial planes of NVB dissection helped perform different degrees of nerve-sparing sur-

gery. Adjusting the plane of dissection to the extent of disease minimizes the risk of PSMs and maximizes the potential for cavernous nerves preservation. Additionally, a high rate of accessory pudendal arteries has been identified [37]. The preservation of the majority of these accessory arteries can be accomplished without compromising the oncologic outcome [38].

Salomon et al. reported on 235 consecutive men treated with LRP for localized prostate cancer. Urinary continence and erectile function were assessed in all patients using a questionnaire derived from the ICS-male questionnaire. The questionnaire was administered preoperatively and 1, 3, 6, and 12 months postoperatively. At the time of their report, 100 consecutive men completed all questionnaires. Among patients with good preoperative erectile function who had bilateral preservation of the NVB the potency rate at 12 months was 58.8 %. Patients with unilateral NVB preservation or bilateral NVB excision had potency rates of 53.8 % and 38.4 % at 1 year, respectively [39].

Su et al. described a combined retrograde and antegrade laparoscopic approach to NVB dissection during LRP and reported their experience with 177 men treated with this technique [40]. On the basis of their experience 76 % of men sexually active and treated with this technique were reported the ability to engage in sexual intercourse 12 months after surgery. Potency was defined as the ability to achieve an erection sufficient for penetration and intercourse with or without sildenafil citrate.

A recent report by Taniguchi et al. evaluated the erectile function outcome of 27 Japanese men treated with LRP [41]. The evaluation of the erectile function included a subjective assessment by administering two questionnaires (International Index of Erection Function and Erection Hardness Score questionnaires) and an objective assessment of the rigidity and tumescence with a RigiScan in response to audiovisual stimulation. The assessment was done before surgery and at 3, 6, and 12 months after surgery. At 12 months after surgery the subjective erectile function was almost half that of the preoperative one, while the objective assessment showed rigidity of 92.6 % and 96.3 % at the tip and base of the penis, respectively, 1 year after surgery compared to baseline preoperative rigidity. Recovery rates of penile tumescence from baseline at 1 year were 87 % at tip and 76 % at base. The discrepancy between the objective outcomes and the subjective perception of patients could be explained by the low percentage of patients in this study who had sexual intercourse during the 12 months after surgery (33 %). An additional explanation offered by the authors is a cultural feature of Japanese men who underestimate self-potency. In either case, this study shows the difficulty of assessing potency after surgery even when validated questionnaires are used.

In a prospective comprehensive comparative analysis of LRP and ORP performed by experienced surgeons at MSKCC from 2003 to 2005, Touijer et al. reported a comparable extent of NVB preservation between surgery groups: 88 % and 91 % for bilateral preservation, 6 % and 6 % for the unilateral preservation, and 5 % and 3 % for the bilateral NVB resection rate ($p=0.2$) for the LRP and ORP groups, respectively. At 12 months postoperatively, the recovery of sexual function was also comparable between LRP and ORP during the study period. With adjustment for age and nerve-sparing status, there was no significant difference in the recovery of postoperative potency by technique (HR 1.04 for LRP vs. ORP [95 % CI, 0.74–1.46; $p=0.8$]) [2].

Roumeguere et al. compared the erectile function outcome of patients treated with either ORP or LRP using questions 3 (“How often were you able to obtain an erection to be able to penetrate your partner?”) and 4 (“How often were you able to maintain your erection after you had penetrated your partner?”) of the International Index of Erectile Function questionnaire and found similar rates of postoperative potency at 1 year (54.5 % and 65.3 % for ORP and LRP, respectively) [42] (Table 5.8).

The introduction of the laparoscopic approach to radical prostatectomy was accompanied by hope that the magnification, better anatomical visualization, and lower blood loss would translate into better preservation of the NVB and better erectile function outcomes. To date, the

Table 5.8 Erection function rates 12 months after laparoscopic radical prostatectomy

Report	No. patients	Bilateral NVB (%)	Unilateral NVB	No preservation (%)
Salomon et al. [39]	100	58.8	53.8 %	38.4
Su et al. [40]	177	76	–	–
Taniguchi et al. [41][a]	27	87–76	Similar to bil.	–
Goeman et al. [52]	550	64	20.7 %	–
Guillonneau et al. [2]	81	78	–	–
Roumeguere et al. [42]	26	65.3	–	–

[a]Tumescence RigiScan

superiority of LRP in preservation of erectile function has not been proven, but has been shown to be similar to that of ORP.

Trifecta

The combination of oncologic control and a favorable functional outcome is the aim of surgery for prostate cancer. The combination of complete excision of the prostate without BCR and a good functional outcome (potency and continence) has been coined together and termed "trifecta." Trifecta has been used to assess the optimal outcome of patients treated for clinically localized prostate cancer.

Ploussard et al. assessed the oncologic and functional outcomes in 911 consecutive patients treated with LRP and who were continent and potent before surgery [32]. Urinary continence was defined as no use of pads. Potency was defined as the ability to achieve an erection sufficient for penetration with or without the use of PDE5 inhibitors. Two years after surgery 13.3 % of patients had experienced BCR, 97.4 % of patients were continent, and 64.6 % of patients were potent. At 2 years trifecta outcome was achieved 54.4 % of patients.

Although comparison of these two reports cannot be done due to possible difference in case mix, Bianco et al. reported a trifecta rate of 60 % 2 years after ORP [43]. With a median follow-up time of 6 years, 83 % of patients were free of BCR in this report, the actuarial continence recovery probability at 24 months was 95 % and the estimated recovery of potency was 70 % at 24 months in this cohort.

Salvage Laparoscopic RP

BCR after radiotherapy for prostate cancer can be secondary to local recurrent or persistent disease or metastatic disease. A select group of patient with local disease, proven by a prostate biopsy, will benefit from a salvage prostatectomy.

The BCR-free probability 5 years after a salvage prostatectomy was recently reported to be 48 % in a multi-institutional collaborative report of salvage radical prostatectomies for radiation-recurrent prostate cancer [44]. Of 404 patients included in this report 25 % had PSM, 30 % had seminal vesical invasion, and 16 % had lymph node metastases. At a median follow-up of 4.4 years, 195 experienced BCR, 64 developed metastases, and 40 patients died of prostate cancer.

Vallancien et al. were the first to report their experience with laparoscopic salvage prostatectomy [45]. The mean operative time report was 190 min, the EBL was 50–1,100 mL, and no patient was transfused. There were no conversions to open surgery and the average postoperative hospital stay was 6.4 days. At a mean follow-up of 11.2 months five of seven patients were free of BCR, five patients were continent, and all patients were impotent.

Table 5.9 BCR-free after salvage prostatectomy

Report	No. patients	Time	PSM (%)	BCR-free (%)	Continence (%)	Potency (%)
Chad et al. [44]	404	5 years	25	48	–	–
Vallencien et al. [45]	7	11.2 months	28.5	71	100	0
Liatsikos [46]	12	20 months	50	92	83	0
Ahallal et al. [47]	15	12 months	13	73	46	6.70

Since this first report a few additional small series were published. Liatsikos et al. reported on 12 patients treated with salvage LRP after failure of high intensity focused ultrasound (HIFU) or radiotherapy [46]. A mean operative time of 153 min, average EBL of 238 mL, and no need for transfusions were reported. PSM were found in 50 % of patients with a pathologic stage T3 and 12.5 % of those with a pathologic stage T2 (Table 5.9). At a mean follow-up time of 20 months one patient experienced BCR 12 months after surgery. Ten of 12 patients were continent after surgery, while 2 patients needed 1–2 pads per day. All patients were impotent after surgery (three reported on good erectile function before salvage LRP).

The MIS urology group at MSKCC reported their experience on 25 patients on 15 patients treated with salvage LRP after failure of external beam radiation (8 patients), brachytherapy (6 patients) or cryotherapy (1 patient) [47]. There were no perioperative mortalities, no conversions to open surgery, and the mean operative time was 235 min. The median EBL was 200 mL and none of the patients received transfusion. One patient had an intraoperative rectal injury that was primarily repaired and protected with a diverting colostomy, hospital stay was 2–8 days and the average length of urethral catheter was 15 days. The median number of lymph nodes removed at surgery was 16, and 2 of 15 patients had lymph node metastases. Eleven of 13 patients without lymph node metastases were free of BCR at a median follow-up of 8 months. Three patients had persistent PSA after surgery and a fourth patient experienced BCR 21 months after surgery. Seven patients achieved continence at a median time of 8.4 months after surgery and one patient had severe stress incontinence and underwent a successful implantation of an artificial urethral sphincter. The remaining seven patients continued to need 1–2 pads per day at a median follow-up time of 12.6 months after surgery. Erectile dysfunction was present in five patients preoperatively and only one patient could achieve erections after surgery.

Learning Curve

As with any surgical procedure surgeons with more LRP experience have better outcomes. Assessing the learning curve of a surgical procedure necessitates defining an end point by which the improvement will be judged. Most reports on the learning curve of LRP utilized the operative time, EBL, and functional outcomes to assess the improvement in surgical technique with growing numbers of patients treated, while others used the oncologic outcome as the end point used to assess improvement. The use of oncologic outcomes as the end point is compromised by the change in patient characteristics, as an experienced surgeon is more likely to treat patients with higher risk cancer than less experienced surgeons.

Eden et al. reported on their first 1,000 LRP cases. The learning curve was assessed using the operative time, EBL, complication rate, and functional outcome [14]. They found that while the learning curve for operative time and EBL was overcome after 100–150 cases, the learning curve for complication rate and continence took 150–200 cases and the learning curve for erectile function preservation stabilized only after 700 cases. The authors noted that there are different learning curves for LRP which are dependent on the volume of surgical procedures in the department where the procedure is taught. They recommended that LRP not be self taught and that a large surgical volume is probably needed for teaching LRP.

Table 5.10 Learning curve

Report	No. patients	PSM	BCR-free	Continence	Potency	Operative time	EBL
Eden et al. [14]	1,000	–	–	150–200	700	100–150	100–150
Secin et al. [48]	9,336	200–250	–	–	–	–	–
Vickers et al. [49]	4,702	–	750	–	–	–	–

In an international multicenter study assessing the learning curve of LRP Secin et al. used the rate of PSM as the end point for calculating the learning curve [48]. The study cohort included 9,336 patients with clinically localized prostate cancer treated with LRP by 1 of 51 surgeons in 1 of 14 institutes in North America and Europe. Forty-three percent of surgeons included performed less than 50 previous LRPs while 49 % performed at least 100 procedures. Fifty-six percent of patients included were treated by a surgeon who had performed less than 250 previous LRPs while 44 % of patients were treated by a surgeon who had performed 250 or more prior LRPs. Overall, PSMs were reported in 22 % of patients (14 % in patients with organ-confined disease and 42 % in patients with non-organ-confined disease). After controlling for case mix, they found that the rate of PSMs plateaued after 200–250 cases.

Vickers et al. assessed the learning curve for LRP, using BCR as an end point, among 29 surgeons in 7 institutes in North America and Europe [49]. Forty-one percent of surgeons included in this report had a lifetime experience of less than 50 LRP procedures, 7 % had a lifetime experience of 50–99 procedures, 34 % had a lifetime experience of 100–250 procedures, and 17 % of surgeons had a lifetime experience of more than 250 LRP procedures. Thirteen of 29 (45 %) surgeons had no previous experience with ORP while 10 % performed more than 250 ORP procedures before their first laparoscopic procedure. The 5-year BCR-free probability in this cohort was 82 %. In a model adjusted for case mix, greater surgeon experience was associated with a lower probability of recurrence ($p=0.0053$). The risk of recurrence at 5 years decreases from 17 % for surgeons with 10 previous LRPs to 16 % among surgeons with 250 previous LRPs and to 9 % among surgeons with 750 previous LRPs (Table 5.10). In a multivariable model adjusting for case mix they found that surgeon with previous open RP experience correlated with poorer outcome when performing LRP ($p=0.014$).

Conclusion

Surgeons involved in prostate cancer surgery harbor a wide responsibility, not only in performing surgery without immediate complications but at first in deciding the correct indication as well. Experience in radial prostatectomy has a major impact on oncologic and functional outcomes, whatever the approach selected, retropubic, conventional laparoscopy, or with robotic assistance. It is not acceptable to focus on artificial end points, and recognizing the difficulty of such procedure is the best way to seek for improvements. Internships and fellowships are indispensable to shorten and accelerate the learning curve, in full knowledge of the risks associated with this surgery.

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