Radical perineal prostatectomy – the contemporary resurgence of a genuinely minimally invasive procedure: Procedure outline. Comparison of the advantages, disadvantages, and outcomes of different surgical techniques of treating organ-confined prostate cancer (PCa). A literature review with special focus on perineal prostatectomy

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KEY WORDS

prostate carcinoma ◗ radical prostatectomy ◗ outcomes of prostatectomy

ABSTRACT

Introduction. Surgery plays a central role in the management of organ-confined prostate cancer (PCa). Four types of prostatectomy are currently practiced: perineal, retropubic, laparoscopic, and robot-assisted. The qualification criteria for all types are similar. Radical perineal prostatectomy (RPP) was the first method introduced into clinical practice, however, it has been neglected in favor of other procedures. Its resurgence has been facilitated by a multitude of advantages. Unfortunately, nowadays most urologists are not familiar with the perineal approach though many centers have begun to implement it.

Materials and methods. This manuscript presents the technique of RPP used in the author's institution. It also reviews a vast body of literature on the four techniques of prostatectomy including their advantages and outcomes. The data was collected from the literature and medical databases.

Conclusion. RPP proves to be a very efficacious, cost-effective treatment option for localized PCa. The outcomes of RPP, as defined by continence, potency, and complication rate, are equivalent to those accomplished by other methods.

INTRODUCTION

Adenocarcinoma of the prostate (PCa) is the second most common non-skin, male malignancy. Nowadays, worldwide screening has significantly reduced the number of advanced cases. The majority of tumors are detected at an organ-confined stage in younger men. So far either surgery or radiotherapy is an acceptable option for radical treatment in such patients. Until recently, radical prostatectomy has been the cutting edge in the management of localized PCa in generally healthy patients with localized tumor with at least 10-years life expectancy. Yet, one should keep in mind that radiotherapists commend radiotherapy. However, recently published data concerning PCa progression has revealed an indolent course of most cases. On the strong basis of these results, a significant subset of patients at 'favorable risk' may effectively undergo active surveillance and escape the side effects of the treatment while a minority copes with PCa progression [1]. Actually only the latter group may take full advantage of radical prostatectomy. Yet, no reliable proven methods to define threatened patients have been compiled. Moreover, the heterogeneity of PCa significantly distorts prognosis in specific cases.

Nowadays, a tendency to minimize surgical injury prevails even in rationally groundless circumstances. It seems that a certain number of decisions are based on surgeon and/or patient emotions rather than on reasons [2, 3]. A subtle incision and reduction of surgical specimen extent have become the hallmarks of contemporary surgery, which is sometimes dubious and difficult to accept as 'seminal vesicle sparing prostatectomy' or even 'focal prostatectomy' in selected cases [2, 4]. The phrase – 'minimally-invasive prostatectomy' fully describes those trends. Conventional wisdom has it - especially in the eyes of patients or less aware professionals - that 'minimally-invasive procedures' are performed only by a kind of sophisticated equipment. Such surgery has become a buzzword topic for popular mass-media [2].

Perineal access was first described by Celsus (for removal of bladder stones) and next revived by Demarquay in 1852. Its use in the treatment of PCa originates from Kuchler, who in 1866 advocated partial removal of the gland. Leisrink performed the first procedure with bladder neck-urethral re-anastomosis in 1883. Suprasphincteric radical perineal prostatectomy (RPP) as we know it today was developed by Young and performed with Halsted-assistance in 1904. Belt prepared a subsphincteric modification and Hudson a transsphincteric one. Dillon, Weldon, and Tavel also made further improvements [5 ,6, 7].

Currently, RPP is in a period of resurgence for its surgical elegance, cost-effectiveness, and technique development [8]. The procedure provides a small incision, perfect access to the prostate (especially the apex), urethra, and neurovascular bundles, omits large muscles and vessels, and yields excellent cosmesis. The operation time is short in reality, while vesico-urethral anastomosis is "surgeon-friendly" – easy, very precise, fast, and watertight. The procedure is successful even in cases that are hardly suitable for other prostatectomies, such as cases in obese patients, patients after large abdominal operations or transurethral procedures, and those with a large prostate. RPP can be easily performed in a nerve-sparing manner as well [3, 6-9]. Newly developed operative techniques have made simultaneous transperineal lymphadenectomy perfectly feasible [9]. Such node sampling is practiced at our institution as well. A severe limitation of hip rotation is the only strict contraindication.

Fig. 1. The recto-urethralis muscle extending from the urethra to the rectum is visible as a centrally placed red-white strand. Forceps presents the external anal sphincter.

Fig. 2. The prostate coated with white posterior layer of the Denonvillier's fascia is visible at the center of the wound.

Fig. 3. For nerve-sparing purposes, Denonvillier's fascia has been incised in the midline and separated together with the neurovascular bundles.

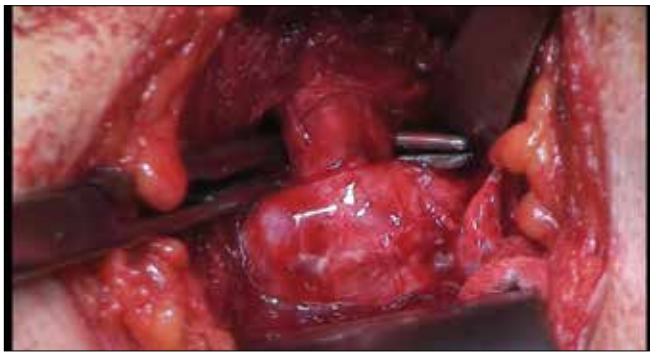

Fig. 4. The urethra is perfectly visible and easily separated from the apex, up to the intra-prostatic segment to preserve striated sphincter and to make the urethral stump as long as possible.

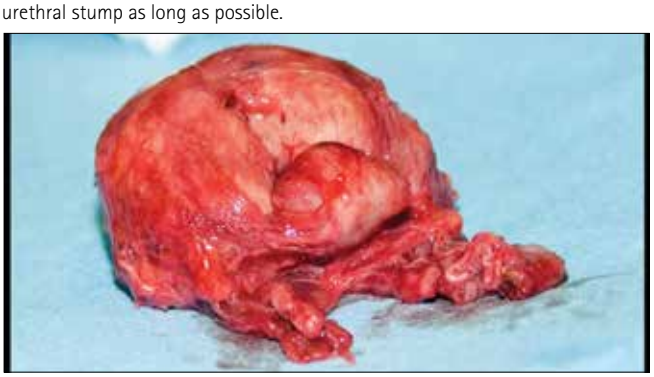

Fig. 5. The prostate with seminal vesicles and small, additional third lobe

Fig. 6. Bladder neck ready for reanastomosis. Urethral stump with Foley catheter visible above this orifice.

MATERIALS AND METHODS

Technique of radical perineal prostatectomy

The curved Lowsley retractor is the only truly essential instrument. Also, a deep knowledge of pelvic anatomy is crucial. The course of procedure is distinguished by three main stages.

Preparation of the prostate

First the patient is placed in the lithotomy position with highly elevated pelvis and hips rotated outwards. The incision runs around the anal rim. Subcutaneous fascia and fat tissue are cut away and divided. The operator's finger crosses over the central tendon securing the anal sphincter. The tendon is transected and the ischiorectal fossa is created bluntly with the fingers. The anal levators are retracted laterally and recto-urethralis muscle extending from urethra to the rectum is dissected (Fig. 1). The rectum is mobilized and retracted downward. A curved Lowsley retractor placed into the bladder brings the prostate to the perineal plane. The white posterior layer of Denonvillier's fascia became visible (Fig. 2). The final target of the procedure is suitably exposed.

Removal of the prostate

Secondly, for nerve-sparing purposes, Denonvillier's fascia should be incised midline and separated together with the neurovascular bundles (Fig. 3). Otherwise the fascia is widely incised along the prostate contour together with the adjacent fibro-fatty tissue. The prostatic pedicles identified laterally to the seminal vesicles are dissected. The seminal vesicles are mobilized. The prostate remains attached only to the urethra and bladder neck. The dorsal veins and pubo-prostatic ligaments are bluntly separated from the apex. The urethra might be easily separated from the apex up to the intraprostatic segment to preserve striated sphincter and make the urethral stump as long as possible, but surgical margins should not be violated (Fig. 4). The urethra is dissected and four to five sutures (4-0/5-0 monofilament) are placed at the stump. The posterolateral surfaces of the prostate are bluntly separated from the bladder base and neck up to the proximal urethra, which can be preserved for urethro-urethral anastomosis. The prostate with seminal vesicles is resected (Fig. 5). A rectal inspection is recommended to reveal any unintentional lacerations.

Table 1.

Prostatectomy approaches in outline. Synopsis of article issues				
Contributory factor	**Perineal prostatectomy**	**Retropubic prostatectomy**	**Laparoscopic prostatectomy**	**Robot-assisted prostatectomy**
Indications and patients selections	Not limited in every respect	Previous abdominal surgery or unfavorable body habitus are the main constraints		
Invasiveness	Minimal	Contemporary not very extensive	Minimal	Minimal
Concurrent lymphadenectomy	Technically demanding, only as staging procedure	Without limits as curative and/or staging procedure		
Average time of procedure	The shortest 35-120 min	Comparable 110–197 min	170-270 min	141-160 min
Transfusion rate	Low and comparable, up to 3%			
Intraoperative rectal laceration	The highest rate among all approaches 1-11%	Comparable and less than 10%. Rectal fistulas develop in 1.5-3.6% of patients		
Wound infection	Approximately 5%	Approximately 5-9%	Approximately 1%	
Length of catheterization	Mostly 7-14 days regardless of approach			
Avg. hospitalization (days, in Europe)	Considerable differences between centers 7.9	12.1	6.8	4.3
Perioperative mortality rate	Comparable and low, ranging 0.3-1%			
Positive surgical margins rate	16.3-24.7%	12-25%	11-30%	Up to 27.3%
SM+ sites specific for approach	25% anterior, 16% posterolateral	48-58% apex, 19-40% posterior aspect, 19% prostate base	50% apical, 30% posterolateral, 20% prostate base	50% apical and posterolateral site
Postoperative risk of anastomotic stricture	1-3.8%	5.5%	0.6-4.1%	up to 4%
Late oncological outcomes PSA-recurrence	equivalent in organ-confined, specimen-confined, and SM+ groups of patients for all prostatectomy techniques			
Continence return 1 year after surgery	Depends on definition of continence			
	81-96%	61-97.1%	80.7-91.9%	86.3-91.8%
Return of potency for nerve sparing procedures	Depends on definition of postoperative potency (no uniform and unambiguous criteria for classification)			
	41-80%	50-55%	52.5-65%	53-81%
Patient's satisfaction with chosen treatment	Up to 95%	87.1-89.2%	Up to 98%	80.1% (the highest rate of disappointment)
Approximate costs of procedure per case	Less than $5,000	Fundamental differences between countries, health-care systems and centers. The following financial reports from Texas Southwestern Medical Center		
		$3,989-5,141 + $185 + $1,611	$4,941-5,905 + $725 + $2453	$6,283-7,369 + $2,015 + $2,798 + $2,698
Charges for cash-payers (USA)	$11,600	$34,000	Not reported	$42,000
Learning curve (as compared with RRP)	Longer	Frame of reference	Longer	Longer (but shorter than laparoscopic)

Vesico-urethral anastomosis and wound closure

Finally, the relative simplicity and exceptional quality of anastomosis is a distinctive feature of radical perineal prostatectomy (Fig. 6). Urethro-urethral re-anastomoses can be performed when the proximal urethral stump is preserved. Otherwise, urethro-vesical anastomosis incorporating the recto-urethralis muscle is performed. Anastomosis with running or interrupted sutures is convenient, fast, and watertight. A Redon drain catheter is placed without direct contact with the anastomosis or rectal wall. The anal levators are re-approximated without tension. Seven to eight skin sutures for wound closure are sufficient. The patient can drink and eat light in the late evening following the procedure and walk the following day. It is our practice to maintain the catheter for 7-10 days, although others have reported to remove it earlier. We decidedly avoid any dressings at the crotch, leaving the wound uncovered. After the procedure, men are advised to wash the wound several times a day with a mild disinfectant and instructed on how to correctly proceed after defecation. Patients may be discharged home of the 3rd or 4th post-op day.

DISCUSSION

Comparison of advantages, disadvantages, and perioperative and late outcomes of four prostatectomy techniques

The following review relies on a search of a vast body of literature. However, some issues remain to be addressed to avoid misinterpretations. Typically, minimally-invasive procedures are selected for patients with favorable body habitus, without previous surgical history, and with less advanced tumor while others are subjected to open techniques. "Many patients with low-risk disease may not need any definitive treatment, yet they are the ones classified by some as ideal cases for RARP" [10-11]. Henceforth, large comparative studies are limited to the lack of clear selection bias and dissimilarity of the following: health-care customs, socio-demographic features, surgical practices, oncological status, personnel experience, definitions, and evaluation methods [12, 13]. Not to mention, some articles are an outright manifestation of commercialized medicine.

Indications and patients selection

Obviously, the selection of a candidate for an individual procedure is driven by the surgeon's conviction and experience, institution's bias, and patient's expectations. Excision of the prostate with seminal vesicles within appropriate margins and, if possible and clinically justified, protection of the neurovascular bundles is the principle of prostatectomy. The same indications apply to retropubic (RRP), laparoscopic (LRP), and robot-assisted radical prostatectomies (RARP), all of which can be categorized into one coherent "retropubic complex", and radical perineal prostatectomy (RPP) as a distinct kind of procedure [3, 4, 8, 14]. The differences among these procedures reside in the access to the prostate, as all procedures result the same with no significant superiority [3, 8, 12, 14-20]. The current trend towards 'minimalism', however, should not challenge the principles of radical prostatectomy. Minimally-invasive procedures should be characterized by: a small incision, the preservation of muscles and blood vessels, a reduction of pain, enhanced recovery, and decent cosmesis. Widespread opinion holds that such expectations are only met by laparoscopic or robotic prostatectomy. Furthermore, many publications manifest personal opinions that lack the foundations of solid evidence. However, particularly in the US, RARP has become the predominant modality. As in the Duke Prostate Center, RPP was the main procedure until 2003. Between 2003 and 2005, the rates of RRP, RPP, and RARP were 56.7%, 14.9%, and 28.4% respectively. Later, RRP decreased to 55.4%, RPP to 3.5%, while RARP increased to 41.1%. In 2007, RARP rose to 63%, RRP fell to 36%, and <1% were laparoscopic procedures. Up to 2011, over 30,000 robot-assisted prostatectomies were performed worldwide, the US comprising 86% of all procedures. Even though studies did not present an exceptional advantage of RARP, this trend seems to be marketing-driven and causes unsubstantiated high patient expectations [20,21]. Nevertheless, disappointment and regret rates are highest among patients who chose robotic prostatectomy [2, 20, 22, 23, 24].

Several publications brought up the issue of prostate size as a determinant of feasibility for RPP, LRP, and RARP [20]. A volume up to 60 ml was recommended for RPP as passable through the anatomically restricted space [4]. On the other hand, prostate size becomes less of a problem as proven by many surgeons [25]. The author of this paper performed his very first unassisted RPP with prostate volume exceeding 90 ml. Moreover, perineal access is particularly favorable to obese patients in whom the fatty apron impedes transabdominal surgery. Even in such adverse circumstances the prostate may be easily accessed [26]. In all honesty, satisfactory results of RARP were also presented in the obese [27]. RPP is considered a troubleshooting option as the salvage surgery for radiation failure, after TURP, or any previous pelvic surgeries [26].

Lymphadenectomy is also an important topic for debate. Opponents point that the transperineal approach excludes simultaneous lymphadenectomy and a separate procedure must be performed for staging purposes. Such a perspective appears unfounded because prostatectomy, as a curative procedure, ought to be performed in cases with low likelihood of nodal metastases (3% for PSA <10.0 ng/ml, Gleason <6, T2a) [28]. For the above-mentioned parameters, pelvic node dissection is not mandatory [29]. Predictive nomograms can coarsely discriminate between patients at high or low risk of metastases or with insignificant tumors. If irrevocable, concurrent laparoscopic or simultaneous transperineal node sampling can be performed [9]. Indeed, extended lymphadenectomy with curative intention in advanced cases is not possible transperineally, but the benefits of such surgery are still debatable with reference to other treatment options.

Perioperative outcomes

A short duration should not be a surgical priority, but in some measure reflects the method's simplicity and safety. The operative time for RPP is usually short. Experts in perineal surgery complete RPP in 35-120 min [6, 8]. The average time in our institution is 110 minutes (the shortest 55 min.). Amorim cites median time as 114 minutes for perineal and 167 minutes for suprapubic approaches. The mean time for laparoscopic prostatectomy ranges from 238 to 266 minutes (140-480 min.) and 170 minutes for most experienced urologists. For RRP that parameter ranged 110-197 minutes and for RARP 141-160 minutes [13, 30-33].

In morbidly obese patients the duration of RPP ranged 120-203 minutes and for LRP 266-348 minutes [26].

Transfusion rate for all techniques is low and comparable, range 2.2-2.8%. Surveys reported mean blood loss for RALP, RRP, RPP, and LAP at 150, 200, 300, and 450 ml respectively. In our patients mean blood loss was 350 ml (1,500 ml in one severe case). Overall, the estimated mean blood loss for prostatectomy ranges 150-600 ml [8, 12, 13, 20, 28, 31-34].

Intraoperative rectal injury was noticed in all approaches, which was related to surgeon experience or inadvertently occurred in non-standard cases (large prostate, post-RTG, post-TURP) [28, 35].

Studies estimate rectal laceration during LAP at 2.2-3.3% and during RPP at 1-11% [20, 28-31]. The literature did not present any differences in incidence of rectal injuries between RPP and RRP [32]. The vast majority of the above-mentioned lacerations is identified and repaired perioperatively with two-layer sutures without further consequence. Rectal fistulas may develop rarely in 1.5-3.6% of patients [13]. Some trials report transient anal incontinence in 10% after RRP and 15% after RPP although others did not find any differences [32]. Wound infection did not occur often after prostatectomy and was estimated at 5% after RPP, 5-9% after RRP, and 1% after RALP [6, 24, 31].

The length of catheterization in uncomplicated cases depends on the surgeon's practice and varies from four days to a surprising three weeks (with similar effects). Yet it usually takes 7-14 days regardless of the approach [8, 12, 13, 30, 32].

Hospitalization time in uncomplicated cases does not depend on the procedure, but rather on the healthcare system. In the USA, the hospital stay for all approaches is short and similar, lasting for: 1.1 days in RPP, 1.6-2.5 in LAP, 1.1-1.5 in RAP, and 1-2 days in RRP [6, 29, 33, 34]. In Europe, the mean hospitalization is longer due to the tendency to control patients during the catheterization period – 12.1 for RRP, 7.9 for RPP, and 6.8 days for LAP [10, 13, 34].

A complication specific for RPP is transient neurapraxia of the legs due to over-abduction and was noted in 20% of patients, but

this condition usually resolved spontaneously [12, 28]. Patients generally appraise all techniques as definitely favorable in regards to postoperative pain, especially in the case of RPP [12, 34]. Regardless of the approach, the perioperative mortality rate is low (range 0.3-1%) [13, 36].

Intraoperative local cancer control

Meticulous tumor removal is the mainstay of surgery for organ-confined carcinoma. An inadvertent violation of prostate tissue or capsule may impair cancer control, definitively determine operative technique quality, and causes positive surgical margins (PSM) [37]. A substantial portion of PSM is caused by excessive traction of the puboprostatic ligaments during preparation [31]. A positive margin is defined as a focal, multifocal, or massive presence of tumor cells in the inked specimen edge when the cutting line crosses the neoplastic tissue. However, a PSM does not always indicate a remnant of cancer and the question pertaining to the degree to which it affects prognosis is still up for discussion [6, 20, 38]. Surveys yield conflicting results, as one presents no biochemical relapse in 62% of men with PSM during 2-year follow-up, while another reveals relapse in 80% of such patients [12]. Yet, the number of PSM foci correlate with risk of recurrence and prognosis deterioration [20].

PSM and tumor stage are closely linked. In a study on 1,389 patients after prostatectomy (pT1-pT3), PSM was identified in 12.9% of all cases, whereas in 6.8% of pT2 and 23% of pT3 [20]. Interestingly, numerous surveys demonstrate imprecise rates of iatrogenic PSM after all techniques [8, 10, 13, 20, 26, 31, 32, 34]. A series of specimens revealed the overall incidence of PSM as follows: RPP at 16.3-24.7%, LAP at 11-30%, and RRP at 12-25% [6, 12, 20, 26, 28, 31, 34]. A survey from one institution reported overall PSM rates after RPP, RRP, and LAP for organ-confined cancers as 14%, 19%, and 22% respectively [34]. The location of PSM varies and is specific to the approach due to variations in prostate preparation and presentation, although the ease of maintaining wider apical margins is an unquestionable advantage of RPP [25]. The distribution of PSM sites is as follows: LAP – 50% apical, 30% posterolateral, and 20% at prostate base; RRP – 48-58% apex, 19-40% posterior aspect, and 19% prostate base; and RPP – 25% anterior, 16% posterolateral, and 7% apical location [8, 29, 34].

Data for PSM rate stratified to tumor stage are also comparable for all techniques: RALP 9.4-15.1% for pT2 and 32.7-52.1% for pT3; RRP 24.1% for pT2 and 60% for pT3; and LAP 10-14.6% for pT2 and 26-56% for pT3 [20, 33].

Again, at the Duke Prostate Center, the PSM rates for RRP, RPP, and RALP in pT2 stage were 24.0%, 28.2%, and 27.3% and in pT3, 50.6%, 59.2%, and 54.7%, respectively. Overall PSM rates for RPP and RRP performed by the same surgeon did not differ statistically [28].

Late surgical complications

The most troublesome surgical complications of prostatectomy are after-effects of rectal injury and urethral/anastomotic strictures. Inadvertent intraoperative rectal injury occurs in 1.5-11% regardless of the type of prostatectomy [39, 40]. If secured perioperatively with two-layer sutures, it usually resolves without further consequences. Overall, rectal fistula may develop rarely in 1.5-3.6% [4]. Rectal laceration is more often a complication of RPP rather than other techniques. Despite perfect exposure, it usually occurs secondary to excessive downward traction of the rectal wall with retractors or is caused by careless blunt creation of the ischiorectal fossa [39].

The overall risk of urethral stricture after radical prostatectomy techniques varies from 1% to 15% [36, 41, 42]. This complication is usually resolved by dilation, urethrotomy, or resection. In an RPP series, anastomotic strictures develop less frequently (1-3.8%) [6, 20, 28, 29]. The incidence of anastomotic stricture after RRP is slightly more common as it has been reported in large series at 5.5%. The LAP series revealed an incidence of strictures at 0.6-4.1%, but even up to 22% for novice surgeons [31]. In centers of excellence, anastomotic stricture frequency is extremely low (0.2%) [13]. An anastomotic stricture after RALP was reported in up to 4% [20]. The most recent studies cite overall stricture rate at 4.8% due to technique improvements [12, 28, 35, 43].

Mild, transient bowel malfunctions (fecal urgency, stress flatus) occur after all techniques. A previous study suggesting its prevalence in post-RPP patients has not yet been confirmed [44, 45]. Postoperative fecal incontinence has been reported in patients after RPP and RRP at a similar rate of 5-6%. Moreover, surveys have revealed rectal urgency or fecal leakage in a significant subset of elderly men before surgery (19.2% and 11.5% respectively) [45]. Purely new post-RPP fecal incontinence occurred in 2.9%, while fecal urgency and stress-related flatus were reported in 2-4% [6, 28].

Late oncological outcomes

Postoperative PSA level is recognized as a sensitive predictor of oncological outcomes since it is more likely to identify the presence of remnant or rebound cancer [46]. Biochemical failure, to a large extent, depends on the pathological stage and grade and precedes clinical progression by years [47]. Therefore, surveys analyzed the possible relation of different surgical approaches with biochemical recurrence rate. In a series of patients four years after RPP without evidence of PSA relapse were 94.5-96.3% organ-confined, 79.4% specimen-confined, and 69.4% PSM [6, 28]. A large study on patients seven years after RPP with pT2 shows biochemical recurrence in only 13.8% cases [28]. Analysis on biochemical outcome for the RPP series stratified to tumor stage shows upward trend of PSA failure along with an increasing stage (4.4% in pT2, 20.3% in pT3 with NSM, 32.9% in pT3 with PSM, and 65.5% in pT3 with seminal vesicles invasion) [28]. A survey on a small, preliminary set of pT2 patients after LAP revealed a 20% rate of biochemical failure during the first year [31]. High volume centers report much better outcomes: PSA-freedom rate at 88-92% for pT2, 80.3% for pT3a, and 72.4% for pT3b during 3-years follow-up [13]. In a group of 2,766 pT2 patients 5-years after RALP, PSA-freedom rate approached 84% [33]. The probability of PSA-recurrence following RRP is comparably low: for patients with pT2, studies show PSA-free survival in 91-95% during 5-year follow-up [34, 48]. Finally, the data clearly demonstrate that all prostatectomy techniques are equivalent options with regards to late oncological outcomes [26, 49].

Functional outcomes

Numerous surveys have been dedicated to functional post-prostatectomy outcomes and satisfaction with the chosen treatment. Both parameters are closely related because continence and sexual status mold the patient's quality of life. The point at issue is the ambiguity of applied definitions for post-prostatectomy continence and potency in different surveys and its relationship with many factors (patient's age, preoperative status, and surgeon's experience) [8, 36]. On that note, anatomical factors may favor perineal access: perfect exposure of apex, posterolateral prostate with adjacent neurovascular bundles and a long segment of urethra, and its meticulous preparation with further watertight re-anastomosis [12, 35]. Again, this study did not reveal any significant differences in these outcomes after all approaches [8, 11, 22, 34]. A detailed review by the author is presented in a separate paper.

Comprehensive reports on continence one year after RPP have revealed its return (defined as "up to one pad" or "occasional drib-

bling") in 81-96%, after RRP in 61-97.1%, after LAP in 80.7-91.9%, and after RALP in 86.3-91.8% of cases [6, 12, 43, 50-55].

Reports on return of potency (only nerve sparing procedures assessed) are far less favorable and difficult to compare considering the vague non-uniform definitions used as endpoints (e.g. 'return of any erections', 'adequate enough for penetration', and 'any potency'). Regardless, the reported rates one year postoperatively for a consecutive series are as follows: post-RPP 41-80%, post-RRP 50-55%, post-RALP 53-81%, and post-LAP 52.5-65% [6, 52, 56-59].

Satisfaction with the chosen treatment is highly rated for all procedures: for RPP 94.8%, for RRP 87.1-89.2%, for LAP 98%, and for RALP 80.1% [23, 56, 60, 61]. Surprisingly, patients after RALP are the most discontented due to the buildup of unduly high expectations [2, 3, 4].

Costs comparison

Costs are an important, but sensitive issue in the assessment of treatment methods. They determine the usefulness and availability of a given method. The comparison of costs in different countries is hampered by dissimilar healthcare systems, different methods of calculation (e.g. hospitalization time, fees, surgeon, anesthesia, operation theater, disposables, and approach to postoperative complications).

The following statistics have been collected from the publications of a number of different countries and centers. The accounting methods were not clearly disclosed hence data must be regarded as crude and approximate. Also, billing charges for the same procedure in regards to the method of payment (health-insurance or cash-paying patients) may differ substantially, as in the case of centers of excellence versus community hospitals [28, 29]. For example, in the USA the estimated cost for the same technique (RRP) ranged from $15,000 to $21,000 [33]. Additionally, billing for "minimally-invasive procedures" adds the expense of equipment, its maintenance, and indispensable disposables (e.g. for robot-assisted prostatectomy: $1.6 million, $100,000-200,000, and $2,000-3,000 per case, respectively) [36]. In the USA, the reported average charges for cash-payers for RPP, RRP, and RLAP were $11,600, $34,000, and $42,000 respectively. For equipment expenses, profits for institution are dissimilar while treatment effectiveness is equivalent. A financial report from one US community hospital presents profits by RPP, RRP, and RALP per case as $1,560, $1,060, and $92 respectively [28, 29]. Conversely, European (France) analyses revealed the mean costs for LAP to be $1,237 lower than for RRP due shorter hospital stay [37].

In 2000, the overall costs of perineal prostatectomy in the USA were low ($4,889) for minimal blood loss, no costs of disposable instruments, and faster recovery [6, 26, 30, 32]. Numerous studies confirmed that RPP costs are 40% lower than for RRP [29]. The mean direct costs (Texas Southwestern Medical Center data) associated with RALP, LRP, and RRP were $6,283-7,369, $4,941-5905, and $3,989-5,141 per patient respectively, while added additional surgical supply costs were RALP: $2,015, LRP: $725, and RRP: $185. Operating theater costs also contributed: RALP - $2,798, LRP - $2,453, and RRP - $1,611. Moreover, RALP raised costs with $2,698 per case for robot purchase and maintenance [62]. At a first glance, estimates for the four types of prostatectomy are high. In reality, expenditures for radiotherapy, long-term pharmacotherapy, and active surveillance among others, are far greater [34, 36].

CONCLUSIONS

At present, the debate whether any prostatectomy technique possesses superiority over the other remains rhetorical [20, 63], because the answer is that neither is superior to another. Some authors have deemed the minimally-invasive approaches as 'golden' means. However, no clinical trials have validated these expectations. All the techniques have yielded equivalent effectiveness rates of functional, oncological, and surgical outcomes [25]. Moreover, numerous recent studies have indeed shown RPP as a minimally-invasive procedure that was found to be the most cost-effective [20, 22, 28, 37]. Also, a clear answer to whether robotization is fully justified is ranked as one of the top priorities by the U.S. Institute of Medicine [36]. It is the high price of robotic surgery that seems to be called into question [21, 22]. At the moment "...there is no reason that a surgeon obtaining excellent functional and oncologic results with RPP should change to a different approach". Furthermore, "the robot will not transform a bad surgeon into a good one" [11, 20, 63]. Generally, RPP is considered very efficacious and the most cost-efficient method of surgical treatment of PCa with similar effectiveness [22, 28]. All its advantages are recapped by a prominent urologist: "There is no doubt that as far as pain, complications, transfusion rate, continence, positive margins, and cosmesis go, radical perineal prostatectomy meets every goal of minimally-invasive surgery" [37].

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