MINIMALLY INVASIVE SURGERY IN UROLOGY

EDITORS

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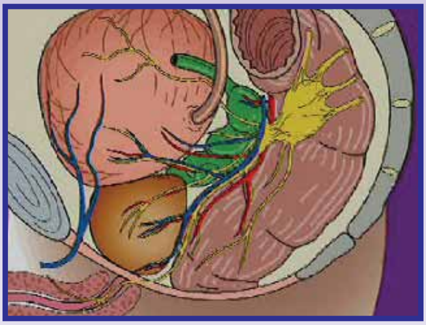

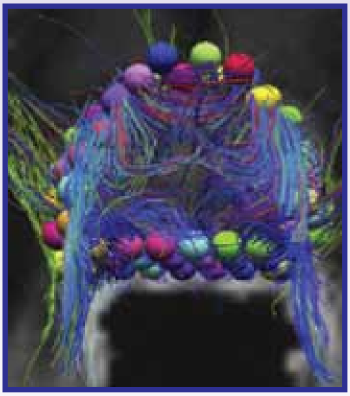

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ICUD
International Consultation on Urological Diseases

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The great tragedy of science :
The slaying of a beautiful hypothesis by an ugly fact
Thomas Huxley (1825-1895)

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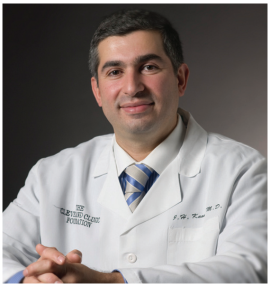

J. Kaouk

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Introduction

Over the past few decades, mini-invasive procedures have been applied more and more in any field of surgery, and particularly in Urology, which has been always at the front of innovation.

The pioneering vision and contributions of many have literally changed the approach to several urological diseases. Unfortunately, novel procedures have often been introduced in clinical practice without a proper evidence-based approach. The ideal process in this sense would have been the IDEAL stepwise structured approach (Innovation, Development, Exploration, Assessment, Long-term study), which was efficiently applied for example in the development of robotic kidney transplantation.

This e-book is the outcome of the commendable effort of a select group of clinicians who, under the input of the European Association of Urology (EAU) in cooperation with International Consultation on Urological Diseases (ICUD), met in Stockholm during the 29th annual meeting of EAU. By means of enthusiastic interactive collaboration, they critically revised the available evidence-based data, using standardised methodology. When evidence was missing, which is not uncommon, their personal experience and expertise filled the gap, providing an updated state-of-the-art overview in various topics related to mini-invasive surgery in urology.

The chapters follow the usual structure of ICUD consultations, with practical recommendations that cannot be intended to replace the conclusions and indications of EAU Guidelines. The aim is to provide an expert synopsis of the present knowledge.

Each section was enriched, whenever available, by a series of video clips showing in practice various operative techniques.

I would like to thank my co-chairs for their full commitment. All chairs and committees members deserve our and reader's appreciation, as they provided a highly informative overview of the present knowledge in the field, and a glimpse about the future.

Special thanks to Saad Khoury who was instrumental in implementing the final lay-out of the book.

This enterprise would have been impossible without the restless effort of the EAU central office, namely of Marian Smink and Loek Keizer.

I wish you an enjoyable journey across the various chapters.

Walter Artibani

Contents

EVIDENCE – BASED MEDICINE OVERVIEW OF THE MAIN STEPS FOR DEVELOPING AND GRADING GUIDELINE RECOMMENDATIONS.

INTRODUCTION

The International Consultation on Urological Diseases (ICUD) is a non-governmental organization registered with the World Health Organisation (WHO). In the last ten years Consultations have been organised on BPH, Prostate Cancer, Urinary Stone Disease, Nosocomial Infections, Erectile Dysfunction and Urinary Incontinence. These consultations have looked at published evidence and produced recommendations at four levels; highly recommended, recommended, optional and not recommended. This method has been useful but the ICUD believes that there should be more explicit statements of the levels of evidence that generate the subsequent grades of recommendations.

The Agency for Health Care Policy and Research (AHCPR) have used specified evidence levels to justify recommendations for the investigation and treatment of a variety of conditions. The Oxford Centre for Evidence Based Medicine have produced a widely accepted adaptation of the work of AHCPR. (June 5th 2001 http://minerva.minervation.com/cebm/docs/levels.html). The ICUD has examined the Oxford guidelines and discussed with the Oxford group their applicability to the Consultations organised by ICUD. It is highly desirable that the recommendations made by the Consultations follow an accepted grading system supported by explicit levels of evidence.

The ICUD proposes that future consultations should use a modified version of the Oxford system which can be directly 'mapped' onto the Oxford system.

1. **1st Step: Define the specific questions or statements that the recommendations are supposed to address.**
2. **2nd Step: Analyse and rate (level of evidence) the relevant papers published in the literature.**

The analysis of the literature is an important step in preparing recommendations and their guarantee of quality.

2.1 What papers should be included in the analysis?

- Papers published, or accepted for publication in the peer reviewed issues of journals.
- The committee should do its best to search for papers accepted for publication by the peer reviewed journals in the relevant field but not yet published.
- Abstracts published in peer review journals should be identified. If of sufficient interest the author(s) should be asked for full details of methodology and results. The relevant committee members can then 'peer review' the data, and if the data confirms the details in the abstract, then that abstract may be included, with an explanatory footnote. This is a complex issue – it may actually increase publication bias as "uninteresting" abstracts commonly do not progress to full publication.
- Papers published in non peer reviewed supplements will not be included.

An exhaustive list should be obtained through:

I. the **major database**s covering the last ten years (e.g. Medline, Embase, Cochrane Library, Biosis, Science Citation Index)

II. the **table of contents** of the major journals of urology and other relevant journals, for the last three months, to take into account the possible delay in the indexation of the published papers in the databases.

It is expected that the highly experienced and expert committee members provide additional assurance that no important study would be missed using this review process.

2.2 How papers are analysed?

Papers published in peer reviewed journals have differing quality and level of evidence.

Each committee will rate the included papers according to levels of evidence (see below).

The level (strength) of evidence provided by an individual study depends on the ability of the study design to minimise the possibility of bias and to maximise attribution.

is influenced by:

• the type of study

The hierarchy of study types are:

- Systematic reviews and meta-analysis of randomised controlled trials
- Randomised controlled trials
- Non-randomised cohort studies
- Case control studies
- Case series
- Expert opinion

• how well the study was designed and carried out

Failure to give due attention to key aspects of study methodology increase the risk of bias or confounding factors, and thus reduces the study's reliability.

The use of **standard check lists** is recommended to insure that all relevant aspects are considered and that a consistent approach is used in the methodological assessment of the evidence.

The objective of the check list is to give a quality rating for individual studies.

• how well the study was reported

The ICUD has adopted the CONSORT statement and its widely accepted check list. The CONSORT statement and the checklist are available at

http: //www.consort-statement.org

2.3 How papers are rated?

Papers are rated following a **«Level of Evidence scale»**.

ICUD has modified the Oxford Center for Evidence-Based Medicine levels of evidence.

The levels of evidence scales vary between types of studies (ie therapy, diagnosis, differential diagnosis/symptom prevalence study).

the Oxford Center for Evidence-Based Medicine Website: http://minerva.minervation.com/cebm/docs/ levels.html

3. 3rd Step: Synthesis of the evidence

After the selection of the papers and the rating of the level of evidence of each study, the next step is to compile a summary of the individual studies and the overall direction of the evidence in an **Evidence Table**.

4. 4th Step: Considered judgment (integration of individual clinical expertise)

Having completed a rigorous and objective synthesis of the evidence base, the committee must then make a judgement as to the grade of the recommendation on the basis of this evidence. This requires the exercise of judgement based on clinical experience as well as knowledge of the evidence and the methods used to generate it. Evidence based medicine requires the integration of individual clinical expertise with best available external clinical evidence from systematic research. Without the former, practice quickly becomes tyrannised by evidence, for even excellent external evidence may be inapplicable to, or inappropriate for, an individual patient: without current bestevidence, practice quickly becomes out of date. Although it is not practical to lay our "rules" for exercising judgement, guideline development groups are asked to consider theevidence in terms of quantity, quality, and consistency; applicability; generalisability; and clinical impact.

5. 5th Step: Final Grading

The grading of the recommendation is intended to strike an appropriate balance between incorporating the complexity of type and quality of the evidence and maintaining clarity for guideline users.

The recommendations for grading follow the Oxford Centre for Evidence-Based Medicine.

The levels of evidence shown below have again been modified in the light of previous consultations. There are now 4 levels of evidence instead of 5.

The grades of recommendation have not been reduced and a "no recommendation possible" grade has been added.

6. Levels of Evidence and Grades of Recommendation Therapeutic Interventions

All interventions should be judged by the body of evidence for their efficacy, tolerability, safety, clinical effectiveness and cost effectiveness. It is accepted that at present little data exists on cost effectiveness for most interventions.

6.1 Levels of Evidence

Firstly, it should be stated that any level of evidence may be positive (the therapy works) or negative (the therapy doesn't work). A level of evidence is given to each individual study.

- **Level 1** evidence (incorporates Oxford 1a, 1b) usually involves meta-anaylsis of trials (RCTs) or a good quality randomised controlled trial, or 'all or none' studies in which no treatment is not an option, for example in vesicovaginal fistula.
- **Level 2** evidence (incorporates Oxford 2a, 2b and 2c) includes "low" quality RCT (e.g. < 80% follow up) or metaanalysis (with homogeneity) of good quality prospective 'cohort studies'. These may include a single group when individuals who develop the condition are compared with others from within the original cohort group. There can be parallel cohorts, where those with the condition in the first group are compared with those in the second group.
- **Level 3** evidence (incorporates Oxford 3a, 3b and 4) includes:

good quality retrospective 'case-control studies' where a group of patients who have a condition are matched appropriately (e.g. for age, sex etc) with control individuals who do not have the condition.

good quality 'case series' where a complete group of patients all, with the same condition/disease/therapeutic intervention, are described, without a comparison control group.

- **Level 4** evidence (incorporates Oxford 4) includes expert opinion were the pinion is based not on evidence but on 'first principles' (e.g. physiological or anatomical) or bench research. The Delphi process can be used to give 'expert opinion' greater authority. In the Delphi process a series of questions are posed to a panel; the answers are collected into a series of 'options'; the options are serially ranked; if a 75% agreement is reached then a Delphi consensus statement can be made.

6.2 Grades of Recommendation

The ICUD will use the four grades from the Oxford system. As with levels of evidence the grades of evidence may apply either positively (do the procedure) or negatively (don't do the procedure). Where there is disparity of evidence, for example if there were three well conducted RCT's indicating that Drug A was superior to placebo, but one RCT whose results show no difference, then there has to be an individual judgement as to the grade of recommendation given and the rationale explained.

- **Grade A** recommendation usually depends on consistent level 1 evidence and often means that the recommendation is effectively mandatory and placed within a clinical care pathway. However, there will be occasions where excellent evidence (level 1) does not lead to a Grade A recommendation, for example, if the therapy is prohibitively expensive, dangerous or unethical. Grade A recommendation can follow from Level 2 evidence. However, a Grade A recommendation needs a greater body of evidence if based on anything except Level 1 evidence
- **Grade B** recommendation usually depends on consistent level 2 and or 3 studies, or 'majority evidence' from RCT's.
- **Grade C** recommendation usually depends on level 4 studies or 'majority evidence' from level 2/3 studies or Dephi processed expert opinion.
- **Grade D** "No recommendation possible" would be used where the evidence is inadequate or conflicting and when expert opinion is delivered without a formal analytical process, such as by Dephi.

7. Levels of Evidence and Grades of Recommendation for Methods of Assessment and Investigation

From initial discussions with the Oxford group it is clear that application of levels of evidence/grades of recommendation for diagnostic techniques is much more complex than for interventions.

The ICUD recommend, that, as a minimum, any test should be subjected to three questions:

1. does the test have good technical performance, for example, do three aliquots of the same urine sample give the same result when subjected to 'stix' testing?
2. Does the test have good diagnostic performance, ideally against a "gold standard" measure?
3. Does the test have good therapeutic performance, that is, does the use of the test alter clinical management, does the use of the test improve outcome?

For the third component (therapeutic performance) the same approach can be used as for section 6.

8. Levels of Evidence and Grades of Recommendation for Basic Science and Epidemiology Studies

The proposed ICUD system does not easily fit into these areas of science. Further research needs to be carried out, in order to develop explicit levels of evidence that can lead to recommendations as to the soundness of data in these important aspects of medicine.

CONCLUSION

The ICUD believes that its consultations should follow the ICUD system of levels of evidence and grades of recommendation, where possible. This system can be mapped to the Oxford system.

There are aspects to the ICUD system that require further research and development, particularly diagnostic performance and cost effectiveness, and also factors such as patient preference.

P. Abrams, S. Khoury, A. Grant 19/1/04

MINIMALLY INVASIVE SURGERY IN UROLOGY

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Minimaly Invasive Radical Prostatectomy

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Minimally Invasive Radical Prostatectomy

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INTRODUCTION

Radical prostatectomy (RP) represents the standard for long-term cure of localised prostate cancer (PCa), with cancer-specific survival approaching 95% at 15 years after radical surgery [1]. Schuessler and colleagues described their initial experience with laparoscopic RP (LRP) and pioneered minimally invasive RP (MIRP) in 1992 [2]. In 1999, Guillonneau and Vallancien operated on a series of 40 patients with their technique of transabdominal descending LRP [3].

Abbou et al. in 2000 [334] and Binder and Kramer in 2001 [4] pioneered robot-assisted RP (RARP). When performed using the Da Vinci Surgical System (Intuitive Surgical, Sunnyvale, CA, USA), RARP has been rapidly accepted as a safe and efficacious treatment option for localised PCa [5]. Over 80% of the RPs performed in the USA in 2011 used robot-assisted surgery [6].

RARP can be performed through a transperitoneal or subperitoneal approach, with more precision and choices for dissection as a result of the 3D vision of the Da Vinci system [6].

Indications for MIRP are the same of those for retropubic RP (RRP). According to the 2007 American Urological Association Guidelines (reviewed and validated in 2011) [7], low-, intermediate- and high-risk patients with localised PCa can undergo RP. The 2013 European Association of Urology (EAU) Guidelines [8] identify four categories of patients who should undergo RP: (1) patients with low- and intermediate-risk localised PCa and life expectancy > 10 years; (2) patients with stage T1a disease and life expectancy > 15 years or Gleason score (GS) 7; (3) selected patients with low-volume, high-risk localised PCa; and (4) highly selected patients with very-high-risk localised PCa (cT3b–T4 N0 or any T N1) in the context of multimodal treatment.

The aims of this issue are to give a comprehensive overview of the anatomical landmarks of MIRP, surgical technique, postoperative management, and short- and long-term outcomes, and then to establish expert guidelines.

METHOD

A detailed search of the major medical databases (e.g., Pubmed and Scopus) was performed to retrieve original articles addressing various aspects of MIRP. Proceedings from the major conferences were also searched in some cases. The evidence was analysed using the Oxford method of assigning levels of evidence, and summary recommendations based on these levels of evidence were graded as advised by the Oxford Centre for Evidence-based Medicine, which are similar to the Grading of Recommendations Assessment, Development and Evaluation working group recommendations [9]. These recommendations are summarised in this issue.

I. PREOPERATIVE CONSIDERATIONS

A. ANATOMICAL ASPECTS OF THE PROSTATE AND SURROUNDING TISSUES

1. SHAPE OF THE PROSTATE (figure 1)

The prostate is an ovoid gland that is normally 3 ´ 4 ´ 2 cm. The prostate gland is traversed by the prostatic urethra. Although ovoid, the prostate is referred to as having anterior, posterior and lateral surfaces, with an inferior narrowed apex and a superior broad base that is contiguous with the base of the bladder [335].

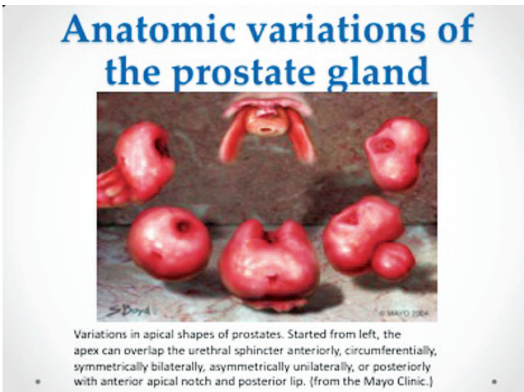


Figure 1. Different aspects of the prostate gland (from the Mayo Clinic)

2. CAPSULE

The structure often termed the “capsule” is the exterior stromal edge of the prostatatic parenchyma, which is formed by the transversely arranged fibromuscular layer of condensed smooth muscle, with relatively few glands in the outermost region of the prostate surface [26]. From a microscopic and pathological point of view, the correct term for this layer would be “condensed smooth muscle” or “outer edge” of the prostate. From a macroscopic and surgical point of view, a clearly defined, distinct outer edge of the prostate, reminiscent of a capsule, is grossly apparent, and it is used as a landmark for proper dissection

3. FASCIAE

The fasciae surrounding the prostate represent an essential anatomical structure for RP, in order to avoid positive surgical margins (PSMs) and preserve erectile function (EF).

Understanding the fasciae around the prostate is key to achieving the right degree of nerve sparing. Anatomical variations and the use of different nomenclature [48] may result in confusion.

The pelvic organs are covered by fasciae [10–12]. According to Terminologia Anatomica, there are essentially four fascial layers surrounding the prostate and neurovascular bundle (NVB). The endopelvic fascia has a parietal (levator ani fascia) and visceral component [13–15]. The parietal component covers the levator ani lateral to the fascial tendinous arch, and the visceral endopelvic fascia sweeps medially to cover the bladder and anterior prostate [10,16,17]. So, the prostatic capsule is covered by an outer endopelvic fascia (levator ani fascia) and inner fascia (prostatic fascia; PF). Posteriorly, Denonvilliers’ fascia surrounds the prostate [48].

All these fasciae are termed the periprostatic fasciae (PPFs) to signify that they are external to the prostatic capsule. The PPF covering the prostate can be divided into three basic elements according to location: anterior, lateral and posterior PPF [10,19,20,23,27,30–34] and seminal vesicular fascia (SVF; Denonvilliers’ fascia) [13,14,21,35–42].

During surgery, access to the lateral prostate may be gained by incision of the endopelvic fascia either medial or lateral to the arcus tendineous fasciae pelvis [12,14,21]. Avoiding incision of the endopelvic fascia might improve early recovery of urinary continence as well as postoperative EF [10,16,22].

4. BLADDER NECK

Surgical anatomy and role in maintaining continence and orgasmic function.

The bladder neck is the junction between the urinary bladder and the prostatic urethra, lying caudal to the apex of the trigone. The detrusor muscle at this level is differentiated into three layers of smooth muscle **(Figure 2)**: inner longitudinal, middle circular, and outer longitudinal [133,134]. In men, the radial fibres of the inner longitudinal layer pass through the internal urethral meatus to become continuous with the smooth muscle of the urethra. The middle layer of circular fibres forms a circular pre-prostatic sphincter that maintains continence at the level of the bladder neck. The verumontanum marks the distal limit of this internal (vesical) sphincter, making it possible to separate the prostate from the internal sphincter by blunt dissection [135]. The outer longitudinal detrusor fibres are thickened posteriorly to support the trigone and pass around the lateral wall of the bladder neck to meet anteriorly, forming a loop around the bladder neck that reinforces the circular pre-prostatic sphincter [133,134]. **(Figure 3)**

Tonic contraction of the bladder neck can maintain continence even if the striated urethral sphincter has been destroyed [133]. Three/four-dimensional multi-slice perineal ultrasonography has shown

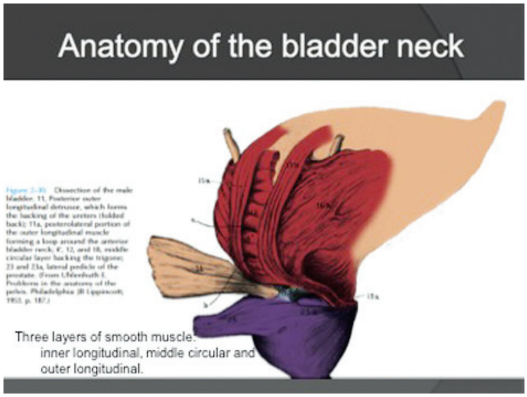


Figure 2. Complexity of the posterior aspect of the bladder neck, 3 main muscular layers are involved playing a role for the continence and the ejaculation mechanism. The injury of the BN leads to “Climaturia”

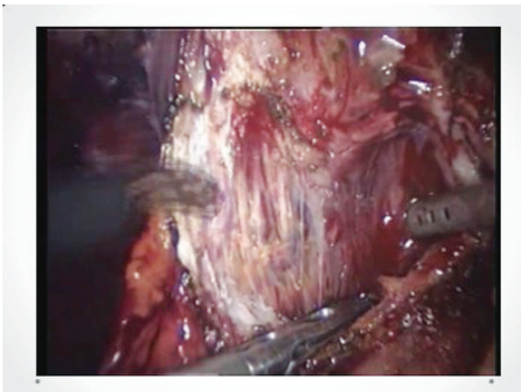


Figure 3. Vision of the posterior layer of the bladder neck muscle after division of the BN

This muscle has been given the name of anterior Denonvilliers fascia or muscle

that, post-prostatectomy, incontinent men differ from continent men mainly in the degree of hypermobility of the proximal urethra and funnelling of the bladder neck [136]. Urethral resistance and length proximal to the external sphincter are postulated to play a role in maintaining continence, and men who are continent after RP have a tubularised bladder neck **(Figure 4)** and functional proximal urethral length similar to the native anatomy [137,138]. The bladder neck is innervated by sympathetic fibres from the anterior portion of the pelvic plexus, causing α-1-mediated contraction of the bladder neck during orgasm.

5. ANATOMY OF THE APICAL REGION OF THE PROSTATE

The shape of the prostatic apex may vary substantially, directly influencing the length of the urethra after emerging from the apex [341]. The apex may overlap the urethral sphincter circumferentially, symmetrically bilaterally, asymmetrically unilaterally, anteriorly only, posteriorly only, or can bluntly end above the sphincter. Significant overlap makes preservation of the long and short urethral sphincters difficult, and should be considered during dissection and appropriate transection of the urethra at the apex. **(Figures 5-6-7-8)**

Furthermore, the position of the apex deep in the small pelvis, as well as its close connection to the dorsal vein complex, rectum and sphincter, makes dissection of the prostatic apex difficult in minimally invasive surgery [225].

The external urethral sphincter is an omega-shaped muscle consisting of an external striated part and an internal smooth muscle layer [48,226,227]. Its fibres surround the urethra, whose length is 1.5–2.4 cm. A considerable part of the urethral sphincter is located intraprostatically between the prostatic apex and the colliculus seminalis [228]. Pelvic magnetic resonance imaging has shown an increased risk of urethral shortening when the prostatic parenchyma covers the urethral muscle

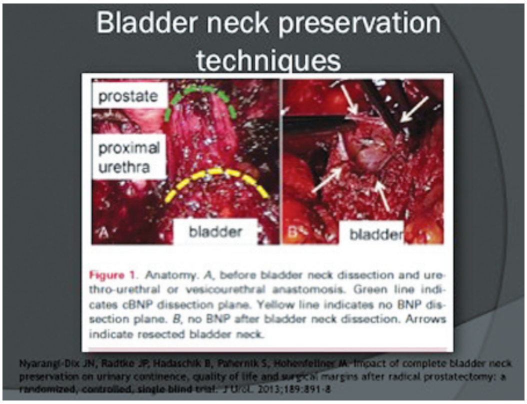


Figure 4. Preservation and non preservation aspect of the bladder neck

Figure 5. Apex of the prostate inside a « sphincter hourglass »

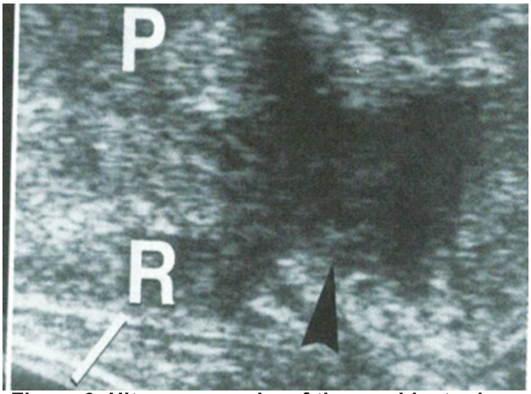


Figure 6. Ultrasonography of the « sphincter hourglass »

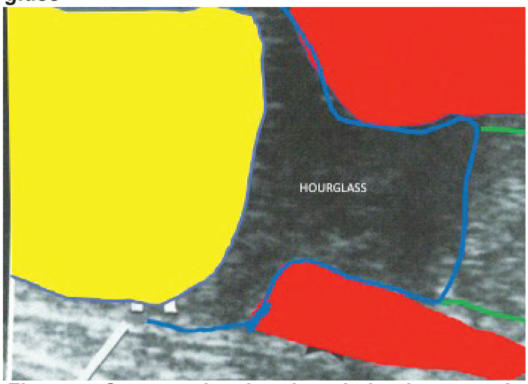


Figure 7. Cartoon showing the relation between the prostate in yellow and the « sphincter hourglass ». Pelvic floor in red.

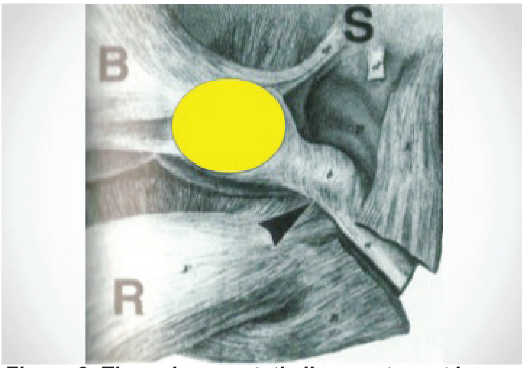


Figure 8. The pubo-prostatic ligament must be preserved to spare the sphincter complex

[229]. This may aggravate preparation of the full-length urethral sphincter during RP.

6. NEUROVASCULAR BUNDLES

a) Introduction

Since the landmark discovery of the cavernous nerves by Walsh and Donker [54], which led to the development of nerve sparing prostatectomy, surgeons have become even more nuanced in their approach to the NVB at the time of RP. Our understanding of the NVB has increased greatly since 2000 with publications from several authors [10,23,55].

The advent of 10 times magnified vision, combined with a dry field in robotic surgery, has allowed urologists to identify the conduit bearing the structures that are called the NVB, including the cavernous nerves, and do as little damage as possible to these structures during the operation.

b) Neuroanatomy

Sympathetic supply (T10–L2) is conveyed to the pelvis via the hypogastric nerves **(Figure 9)**, and the pelvic parasympathetic supply is derived from the pelvic splanchnic nerves (S2–S4). These autonomic fibres converge to form the pelvic plexus (also known as the inferior hypogastric plexus). The pelvic plexus is a fenestrated network of nerves that lies in a sagittal plane in the retroperitoneal space, lateral to the rectum. Caudal fibres of the pelvic plexus join with vessels branching from the inferior vesicle artery to form the NVB [23].

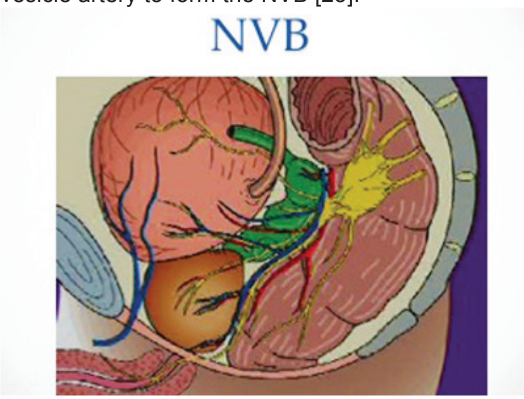


Figure 9. Anatomy of the Hypogastric nerves

1. Cavernous nerves (Figure 10)

The NVB starts at the base of the prostate between 3 and 9 o'clock. It then runs outside the prostatic capsule, inferomedially to the apex. At the apex it projects anteriorly, where it is most likely to be damaged during surgery [23]. This damage can be caused by cutting the NVB, diathermal injury, or inadvertent suturing at this position. There is also concern regarding stretching of the NVB causing neuropraxia. Some surgeons promote a "high anterior release" or "veil of Aphrodite" nerve-sparing technique to prevent damage to anterior parasympathetic fibres [31].

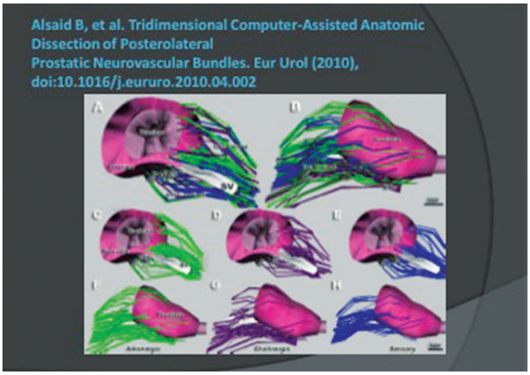


Figure 10. Complexity of the NVB including adrenergic , sensitive and cholinergic nerves.
The nerves surround the postero-lateral aspect of the prostate but some fibres covers the anterior aspect of the gland

We have shown that only a minority of nerves in the anterior periprostatic region are functionally significant parasympathetic nerves [57].

Three fascial spaces functionally compartmentalise the NVB. Rectal neurovascular supply is generally in the posterior and posterolateral sections of the NVB, running within the leaves of Denonvilliers and pararectal fascia. Supply to the levator ani is in the lateral section, within the lateral pelvic fascia. The cavernosal nerves and prostatic neurovascular supply descend along the posterolateral surface of the prostate with the prostatic neurovascular supply most anterior. Functional organisation is not absolute and is less pronounced proximally at the levels of the seminal vesicle and prostatic base. The complexity of the NVB constituents means that the terms NVB and cavernosal nerves are not synonymous [57].

Distally, the cavernosal nerves pierce the urogenital diaphragm and run with the deep artery and vein of the penis to provide parasympathetic supply to the crura [58].

2. Pudendal nerve

The pudendal nerve provides somatic innervation to the external urethral sphincter (rhabdosphincter). It is arises predominantly from the S2–S4 ventral rami, but occasionally receives contributions from S5 [59]. After exiting the pelvis, it runs in the lateral wall of the ischiorectal fossa within Alcock's canal. It then provides rhabdosphincter supply via its infralevator perineal [60,61] or dorsal [10,62] nerve branches.

Takenaka et al. found a mean distance of 5.5 mm from the lowest point of the endopelvic fascia to the point where the sphincteric branch of the pudendal nerve enters the rhabdosphincter [10]. Others have also found branches innervating the rhabdosphincter in close proximity to the prostatic apex [61]. Hence, care must be taken because these branches can potentially be injured during apical dissection of the prostate, or by inadvertent suturing or diathermy deep in this region. Preservation of the levator ani fascia can help protect the levator ani muscle, rhabdosphincter and pudendal nerve branches to the rhabdosphincter [10].

Several studies have suggested that there are intrapelvic pudendal branches to the rhabdosphincter in some men [59,62] and these could be at risk during dissection of the NVB.

c) Vascular anatomy

1. Dorsal vascular complex

The dorsal vascular complex, also known as Santorini's plexus, comprises both veins and small arteries and lies on the ventral surface of the prostate [55]. Ligation of the dorsal vascular complex during radical prostatectomy minimises blood loss. However, since the introduction of laparoscopic and robotic-assisted surgery, some surgeons have advocated division of the dorsal vascular complex without prior ligation, as a means to maximizing urethral length and likelihood of achieving a negative apical margin. This technique is made possible due to the decreased venous blood loss afforded by increased intra-abdominal pressure from CO2 insufflation [63].

2. Accessory pudendal artery

The accessory pudendal arteries are any arteries arising cranial to the pelvic diaphragm, and passing inferior to the pubic bone to enter the penile hilum. These most commonly have an intrapelvic origin but may also come from extrapelvic arteries. Reported prevalence of accessory pudendal arteries varies from 4 to 75% [64], and in some cases they may provide the only erectile arterial supply [65].

Arterial insufficiency post-prostatectomy may affect recovery of EF. Therefore, if possible, these arteries should be preserved during RP [66].

3. Prostatic pedicle

Clegg described the prostatic arterial anatomy in 1955. According to his description, the gland was supplied by the prostatic branch of an artery that he named the prostato-vesical artery, a well-defined trunk of variable origin. Despite the name he gave to this artery, it had only prostatic branches or only small inferior vesical arteries in almost half of the cases. He noted that the prostatic artery had a trajectory obliquely downward, forward, and medially on the anteroinferior surface of the bladder toward the prostate gland, terminating in a division into anterior and posterior branches. Clegg also identified a typical morphology of the prostatic artery capsular branches that he named the "corkscrew pattern" [336–338].

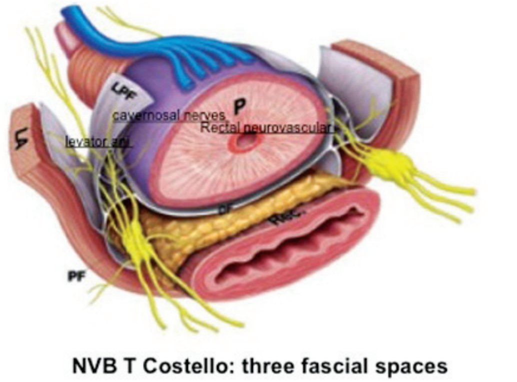


Figure 11. T Costello: The fascias determine three spaces real routes for the NVB

Bouissou and Talazac were the first to describe the presence of two independent prostatic arteries on each pelvic side: one cranial artery they named the vesico-prostatic artery, supplying branches to the bladder base and the inner and cranial prostate gland; and one caudal artery that had a close relationship with the middle rectal artery and mostly supplied the peripheral and caudal gland [339].

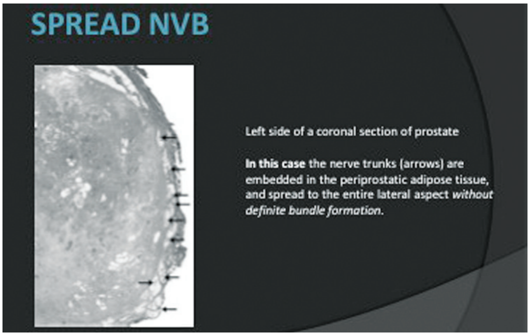
Ambrósio et al. described the variable origin of the prostatic artery: inferior vesical (41.5%), internal pudendal (26.4%), umbilical (15.1%), obturator (5.7%), inferiorgluteal (1.9%), and internal iliac (9.4%) arteries. After reaching the prostatic surface, the arteries penetrate the capsule in two anterolateral and two posterlateral quadrants [340].

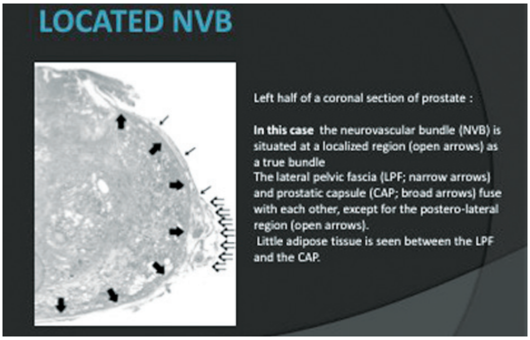
4. Relationship between prostatic fascia and NVB

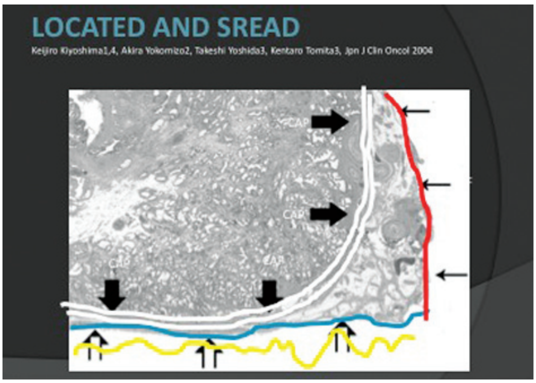
The relationship between the PF and NVB is controversial [32,35,42]. Several authors have stated that the NVB is located strictly between the prostatic capsule and either the visceral endopelvic fascia or posterior PPF/SVF) [19,20,23,43,44]. Kourambas et al. questioned this straightforward view and proposed that, in axial section, the posterior PPF/SVF is part of an H-shaped fascial structure flanking the prostate [32]. These findings were corroborated by others, who described the posterior PPF/SVF as almost merging into the NVB, or splitting at its lateral border into anterior and posterior leaves passing around the NVB **(Figure 11)**, binding it in a triangular fashion with the LAF [14,23,25,45] **(Figure 12,13,14).**

II. SURGICAL STRATEGIES ALLOWED BY NVB ANATOMY

In performing a complete nerve-sparing procedure, surgeons must dissect between the prostatic capsule and prostatic fascia, being the fused endopelvic fascia. As the surgeon comes closer to the prostatic capsule, damage to the NVB is less likely. However, this also allows more opportunity for inadvertent capsular incision or leaving a positive surgical margin. Nerve sparing can be performed antero-inferiorly or in retrograde fashion, or even incrementally with some removal of the NVB tissue but not complete removal.







Three different aspect of the NVB and the fascias

Figure 12. the prostate capsule, prostate fascia and LPF are stuck leaving no space for the NVB

Figure 13. NVB are well gathered in a postero lateral position

Figure 14. NVB are spead and located in a postero lateral position

The multilayered character of the PPF allows the surgeon to vary the dissection between the nerves and prostatic capsule, with the aim of leaving a layer of tissue on the prostate as a safety margin. In cases with a low risk of extraprostatic extension, a closer dissection can be chosen, and in cases with a higher risk of extraprostatic extension, a wider dissection plane can be chosen. This approach is termed incremental nerve sparing [46,47]. The dissection can be intrafascial, interfascial or extrafascial [48] **(Figure 15)**.

1. INTRAFASCIAL DISSECTION

Intrafascial dissection of the NVB follows a plane on the prostatic capsule, remaining medial or internal to the PF at the antero- and posterolateral aspect of the prostate and remaining anterior to the posterior PPF/SVF [24,28,29,49,50]. In antegrade intrafascial dissection starting at the 6 o'clock position, one may find an easier plane of dissection because, at this level, the posterior PPF/SVF is thick and easily recognized as a single-layer structure. During a high lateral approach, the plane of dissection can be difficult to identify, due to the multi-layered appearance of the fasciae, especially at the posterolateral border of the prostate. Intrafascial dissection carries a high risk of inadvertent iatrogenic capsular penetration [18] **(Figure 16)**.

2. INTERFASCIAL DISSECTION

Interfascial dissection of the NVB is performed outside or lateral to the PF at the anterolateral and posterolateral aspects of the prostate, combined with dissection medial to the NVB at the 5 and 7 o'clock or 2 and 10 o'clock positions of the prostate in axial section. This is done by moving the intact NVB off the prostate so that the posterolateral prostate remains covered with fascia. This approach allows a greater tissue buffer to surround the prostate in contrast to intrafascial dissection, presumably resulting in an oncologically safer approach [12,14,24,29,49,50].

Recent studies have suggested subdividing interfascial dissection into closer and wider dissection planes. To define the extent of the prostatic tissue margin, a grading system has been proposed. Tewari et al. proposed four grades of dissection [46]. They also used vascular structures as landmarks for dissection but in their case the veins on the lateral aspect of the prostate are the landmark. Patel *et al.* **(Figure 17, 18)** proposed an inverse five-grade scale of dissection, where grade 5 represents full nerve sparing and grade 1 no nerve sparing. They used the prostatic vasculature as a possible landmark, with the "landmark artery" running on the lateral border of the prostate as either a prostatic or capsular artery [51,52].

Bearing in mind that neural anatomy may vary substantially, different dissection planes aim to achieve an incremental security margin on the prostate, to avoid a positive surgical margin than incremental nerve sparing. Incremental nerve sparing implies that the course and location of erectile nerve fibres can be reliably identified, which is not possible due to their microscopic nature and variable anatomy. The degree of nerve sparing with this technique is due to chance and the degree of nerve fibre preservation cannot reliably be controlled. In contrast, the amount of tissue that is left on the prostate to avoid a positive surgical margin can be controlled to achieve incremental tissue margins to cover the prostatic capsule and PCa if present. For this reason incremental se-

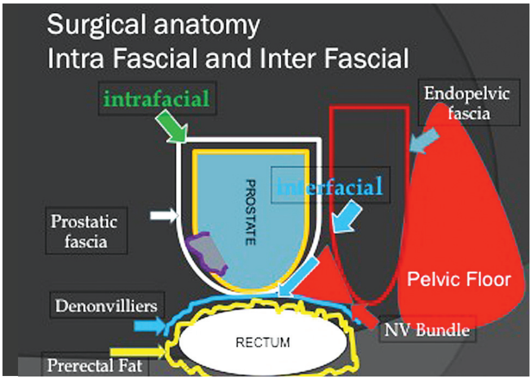


Figure 15. Summary of the different route of the radical prostatectomy (CC Abbou)

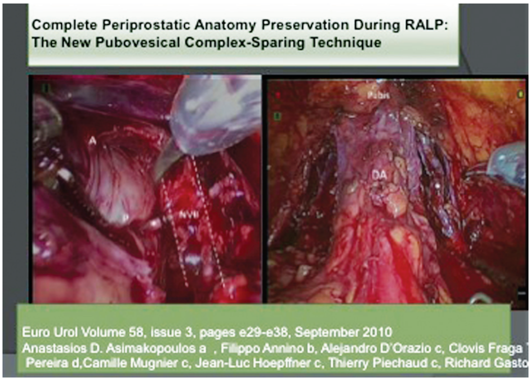


Figure 16. Intrafascial dissection leaving intact the "bladder apron": the prostate is extracted from its cage thought 2 lateral incisions (R Gaston)

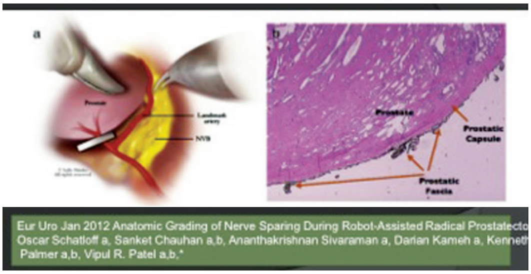


Figure 17. Left figure The Landmark Artery Allows a safe dissection of the prostate leaving a security layer of prostate fascia

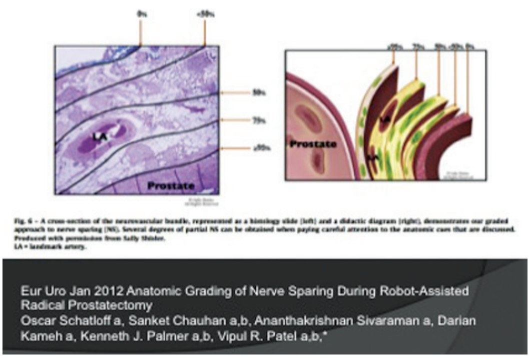


Figure 18. The prostate fascia is an onion like fascia with multiple layers

curity margin rather than incremental nerve sparing better reflects the true prostate anatomy and aim of the proposed technique [53].

3. EXTRAFASCIAL DISSECTION

Extrafascial dissection is performed lateral to the LAF and posterior to the posterior PPF/SVF. The NVB running along the posterolateral aspect of the prostate is completely resected but the LAF, PF and posterior PPF/SVF remain on the prostate. This is the most oncologically safe dissection method, but carries a risk of complete erectile dysfunction (ED) [14,29,50].

III. SURGERY

1. TRANSPERITONEAL APPROACH

The transperitoneal approach is the most widely used for MIRP and gives unparalleled access to perform extended pelvic lymph node dissection (LND) [67].

a) Patient positioning

It is usual to place the patients' legs in stirrups, slightly flexed at the hips, for optimal access to the abdomen and perineum. Some surgeons opt for spreader bars so that the legs are straight, or nearly so, and spread to allow access to the penis, scrotum and perineum, and if necessary, the rectum. Care must be taken with either approach to avoid undue pressure or stretch on the nerves [68,69].

b) Port placement

An appropriate site for insufflation of the pneumoperitoneum for port placement can be safely achieved by placing a Hasson port or Veress needle just underneath the costochondral junction on the left. Once safe entry is achieved, it is important that after the first port is placed, the abdomen should be thoroughly inspected for blood, abnormal insufflation pattern, bowel injury, and other adhesions. Initial laparoscopic lysis of adhesions can safely be achieved if needed.

In general, the camera port site is midline, at or above the navel. This position is sufficiently cephalad to allow comfortable access to the entire pelvis, which is especially important for extended LND.

Most camera/extraction site incisions are vertical; however, many authors have stressed the importance and ease of transverse incision to avoid incisional hernias and improve cosmesis [70,71].

c) Apex of the prostate, dorsal vein complex and anterior prostatic fat

Eichel and associates gave the first detailed description of dissecting the anterior prostatic fat and stapling the dorsal vein to reduce PSMs at the apex [76]. Removing the anterior prostatic fat improves apical landmarks and visualization of the dividing line between the prostate and bladder during anterior bladder neck transection. An unexpected finding is that this fat pad contains lymph nodes in ~15% of cases, and in 1–2% of cases it can be the only site of lymph node metastasis [77, 78].

2. EXTRAPERITONEAL APPROACH

Extraperitoneal RP simulates the gold standard technique of open RP. The entire procedure is performed in the retropubic space of Retzius. The following is a brief description of the technique [104].

a) *Extraperitoneal space creation and trocar configuration* (Figure 19 a,b)

The instruments required to create the potential extraperitoneal space include an OMS-XB2 (Oval) ExtraviewTM balloon dilator trocar (Autosuture, Norwalk, CT, USA) (or a SpacemakerTM), a 0° laparoscope, two S-shaped retractors, and a 15-cm smooth trocar (12 mm 512 XD; Ethicon Endo-Surgery, Cincinnati, OH, USA) (Fig. 5). A separate scope is advised because the robotic camera and scope system are difficult to manoeuvre due to their weight.

Initial access is obtained via a 3-cm left periumbilical skin incision. The subcutaneous tissue is bluntly dissected to expose the anterior rectus sheath. A 1-cm incision is made in the latter and an S-shaped retractor is used to sweep the underlying rectus muscles laterally, to bring the posterior rectus sheath into view. Once the latter is visualised, the balloon dilator is inserted into the space of Retzius, with the scope placed inside the uninflated balloon [104]. The tip of the balloon should be angled upward and toward the midline, to avoid inadvertent injury to the posterior rectus sheath, or access to the peritoneal cavity. There should normally be some resistance from the linea alba until the balloon dilator is passed below the semicircular line of Douglas. With the start of balloon inflation, the space of Retzius and the retropubic fat are dissected, bringing the pubic symphysis into view. The other important landmarks are the inferior epigastric vessels (one artery and two veins), which are visualised on both sides. The balloon dilator is removed after deflation and replaced by a 15-cm smooth trocar, which creates the extra space required for trocar placement cephalad and laterally. CO2 insufflation of the extraperitoneal space is carried out through the same trocar up to a pressure of 15 mm Hg. Under direct vision, the space is enlarged by retracting the scope into the trocar and using the beveled tip of the trocar (insinuated under the inferior epigastric vessels) to sweep the peritoneum posterolaterally on either side. The movements necessary to develop the extraperitoneal space laterally widen the fascial opening, causing leakage of air around the trocar. To lessen air leakage, a Foam Grip Trocad (Covidien), balloon tip trocar, or a Vaseline gauze wrapped around the trocar can also be used for this.

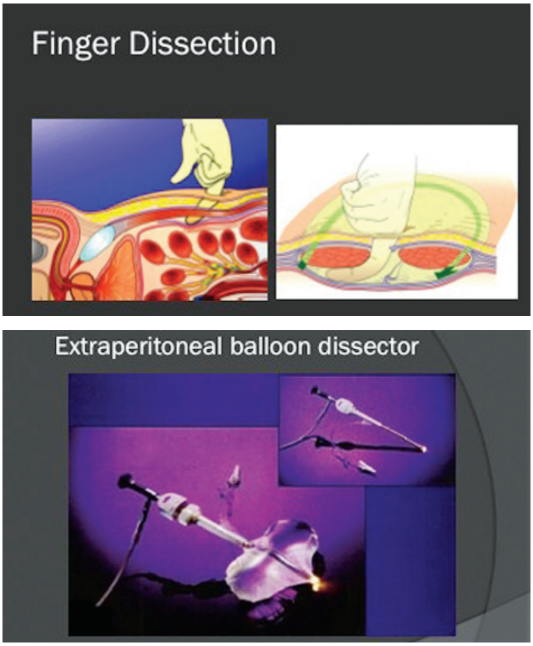


Figure 19 a,b. Creation of the extraperitoneal space using the finger dissection followed by the balloon

Robot-assisted procedures call for particular consideration in trocar placement to avoid robotic arm collision. Ten centimetres between all robotic working arm trocars is advised. Five to six trocars can be used in a "W" configuration during four-arm Da Vinci extraperitoneal robotic prostatectomy. Three 8-mm Da Vinci metal robotic trocars and two disposable assistant trocars (one 12-mm, 150-mm long trocar, and one 5-mm trocar) are used in addition to the 12-mm infraumbilical camera trocar. Once an adequate space is created, and the peritoneum pushed cephalad and laterally, the 12-mm right assistant trocar is introduced 5 cm medial to the anterior superior iliac spine, along a line joining this anatomical landmark to the umbilicus. The assistant trocars can be placed on either side, based on the surgical team's preference.

The trocar for the fourth robotic arm is placed opposite the assistant trocar (5 cm cephalad and medial to the anterior superior iliac spine) and guided toward the pubic symphysis under direct vision. We use a hypodermic needle to guide the site of insertion of the two remaining robotic working trocars on either side. They are generally placed 10 cm caudal and lateral to the umbilicus on either side, forming a triangle with the latter. The trocars for the robotic working arms are placed lateral to the respective epigastric vessels, at a more perpendicular angle to the abdominal wall to avoid robotic arm collision. Trocar tunnelling should be avoided, because it restricts trocar motion. For the remaining 5-mm assistant trocar that is placed 5–8 cm lateral to the umbilicus on the right side, the dissection is performed in a more medial and cephalad direction. The robot is docked once all the trocars are in place.

The subsequent steps of the procedure are similar to those of the transperitoneal approach, regardless of whether robotic assistance is needed.

b) Advantages and disadvantages of the extraperitoneal approach

There are several advantages of the extraperitoneal route. These include the need for less steep Trendelenburg positioning [104,105]. This is helpful in patients with poor pulmonary reserve. Diaphragmatic expansion is less compromised, facilitating ventilation and reducing possible complications. The limited Trendelenburg position also lessens the risk of position-related neuropraxia, which is more likely when body weight is shifted to the shoulders, with possible brachial plexus compression. The extraperitoneal route avoids all potential intraperitoneal adhesions. This approach gives rapid access to the target organ. The bladder takedown step is eliminated. The peritoneum acts as a natural barrier obviating the need for bowel retraction from the operative surgical field. This potentially lessens the incidence of paralytic ileus [105]. In addition, this route allows containment of bleeding or urine leakage in the confined extraperitoneal space.

Disadvantages of the extraperitoneal approach include: unfamiliarity with access and instruments; difficulty in spacing the trocars, especially with the use of the fourth arm; limited working space; and increased risk of lymphocoele formation following pelvic LND. If extended pelvic lymphadenectomy is indicated, the alternative transperitoneal approach may afford better exposure of the cephalad limits of the template of dissection. Tension on the anastomosis is often cited as a potential disadvantage of the extraperitoneal approach, given that the urachal attachments are unaltered. As with open retropubic prostatectomy, which is generally performed extraperitoneally, there is no meaningful tension on the anastomosis once completed. The initial sutures are indeed under some tension, which is quickly redistributed, or relieved with the placement of additional sutures. Approximating the posterior urethra to the posterior bladder neck is helpful in eliminating possible tension, facilitating anastomosis. The pressure in the working space can be decreased to 8 or 10 mm Hg to ease re-approximation of the bladder to the urethra. The application of perineal pressure is also helpful at this stage, lessening the risk of urethral tearing.

3. PELVIC LYMPH NODE DISSECTION

Lymph node status provides staging information that may guide further therapy. More than two positive lymph nodes at prostatectomy significantly affects prostate-cancer-specific survival [83]. LND may be beneficial in some patients [84–86]. A subset of patients may be cured, even with positive lymph node status [87,88]. Performing LND meticulously can reduce time to progression and prostate-cancer-specific mortality [89,90]. Despite these proposed benefits, LND does have significant limitations regarding long operative time and associated risks. Only one randomised single-centre trial has been performed comparing limited/standard to extended pelvic LND, leading to reduced biochemical recurrence in intermediate/high risk men at 74 months [91].

Risks of LND can include vascular, nervous and lymphatic complications [92]. With laparoscopic pelvic LND, incidence of bleeding complications was <1% [93]. Postoperative deep vein thrombosis and pulmonary embolism are associated with LND [94,95]. Obturator nerve injury has not been reported in studies of robotic prostatectomy, however, it remains a constant concern. Ureteral injury is also likely to be encountered during extended LND. The most frequently reported complication of LND is lymphocoele. Lymphocoele occurs in nearly half of the patients, but clinically significant cases are seen in a minority of patients (5–15%), depending on the number of lymph nodes removed [96–98]. The overall number of additional complications of LND is small and a recent systematic review noted that Clavien grade >3 complications occur in <2% of patients.

The major anatomical landmarks for pelvic LND include the internal and external iliac artery and vein, the obturator nerve and vessels, and the iliac bifurcation to the level of the ureter [95]. Some surgeons include super-extended LND to the presacral nodes [99,100]. Obturator only (limited) pelvic LND is not extensive enough to provide accurate staging information because many of the positive nodes are not in this region [99].

Omission of pelvic LND for low-risk PCa is described as safe and is recommended in guidelines [8,101]. The EAU guidelines recommend extended LND if the risk of lymph node involvement is >5% [8].

Thirteen to 20 lymph nodes are recommended as an adequate yield for accurate staging [8,102,103]. Extending LND to include the internal iliac lymph nodes increases nodal yield as well as the ability to detect positive lymph nodes [96,99].

4. SURGICAL DISSECTION OF THE PROSTATE AND SURROUNDING TISSUES USING THE DESCENDING TECHNIQUE

a) Bladder neck preservation, reconstruction and anastomosis

Twelve-month continence rates for open RRP, LRP and RARP vary between 60 and 93%, 66 and 95% and 84 and 97%, respectively [127].

Kojima et al. divided the surgical modifications intended to improve continence into three sub-categories: preservation of anatomical elements, such as bladder neck, NVB and pubovesical complex; reconstruction of the urethral sphincter; and reinforcement of the bladder neck [132]. Resection of the bladder neck during RP contributes to incontinence and disrupts the closure mechanism of the bladder neck during orgasm, possibly leading to orgasm-associated incontinence (climacturia) [139–141].

Technical modifications have been proposed for bladder neck dissection in challenging circumstances: bladder neck reconstruction and Bladder Neck Preservation to hasten the return of continence and lower the incidence of urethrovesical anastomotic strictures, without compromising oncological control of the tumour.

In addition to its possible role in post-prostatectomy continence, bladder neck dissection may affect development of urethrovesical anastomotic leaks [142,143], bladder neck contracture/anastomotic stricture [144,145] and climacturia [139–141]. While bladder neck resection per se is not a predictive factor for anastomotic leakage, a large bladder neck defect may lead to a challenging urethrovesical anastomosis, which in turn is a known risk factor for anastomotic leakage [146]. RARP carried out be experts after a period of learning showed a urine leakage rate of 0.1–6.7% (mean 1.8%) [147]. Anastomotic leakage can precipitate uroperitoneum (especially with transperitoneal LRP/RARP), which if undetected, may cause serious complications [148]. Anastomotic leakage may be a risk factor for development of urethrovesical anastomotic stricture/bladder neck contracture [145,149,150], although a direct causal association is controversial [151]. Similarly, patients with anastomotic leakage may have delayed recovery of continence and even a high incidence of incontinence [145,149].

A difficult urethrovesical anastomosis, potentially resulting from a wide bladder neck defect, may be a risk factor for later bladder neck contracture [144,145]. Breyer et al. found that the incidence of post-prostatectomy bladder neck was 0.48–17.5% with open RRP and 0–3% with LRP/RARP, with weighted mean incidence rates of bladder neck contracture for open RRP, LRP and RARP of 5.1%, 1.1% and 1.4%, respectively [144].

Climacturia is involuntary urine leakage during orgasm [139]. It is a troublesome and under-reported consequence of RP [152], with rates varying between 20 and 93% [139,153–155]. Bladder neck damage and/or injury to sympathetic nerves may prevent closure of the internal sphincter, which when coupled with relaxation of the external sphincter at the time of orgasm, may precipitate urine leakage [141]. Manassero et al. have suggested the role of functional urethral length in addition to loss of bladder neck integrity in post-RP patients complaining of climacturia [140].

Bladder neck dissection in RP can be more challenging in men with enlarged median/lateral prostate lobes [156–160] or prior transurethral resection of the prostate (TURP) for benign prostatic hyperplasia [160–164]. RP in patients with large median lobes can leave a large bladder neck defect, injure the ureteric orifices, and cause ureteric obstruction during subsequent urethrovesical anastomosis. Concern about these factors may lead surgeons to dissect too close to the prostate, creating an inadvertent PSM at the prostate base or bladder neck [157]. Retracting the median lobe anteriorly may facilitate bladder neck dissection. This can be achieved via traction on the Foley catheter [158]; directly via an atraumatic grasper in the fourth robotic arm [160,165]; or passing a “rescue stitch” with a Hem-o-lok clip at the tail end through the enlarged intravesical prostate lobes [159]. Subsequent to posterior bladder neck transection, robot-assisted placement of 6 Fr double pigtail catheters [156] or double J stents [157] into the ureters to identify the ureteric orifices before performing urethrovesical anastomosis has been described in patients with median lobes or cancer protruding into the bladder neck. An enlarged prostate gland or a median lobe can significantly increase blood loss, length of hospital stay, requirement for bladder neck reconstruction, and operative time needed for bladder neck dissection and urethrovesical anastomosis, but there is no significant difference in urine leakage, bladder neck contracture, or continence rates [156–160,166,167]. There is no difference in overall PSM rates after RARP in men with or without median lobes (9.5–10% vs. 11–13.6%, respectively) [158,160]. RARP in men with a large prostate gland is associated with significantly lower PSM rates [166,168].

Men with prior TURP may have wide bladder necks and scar tissue present that can make identification of the ureteric orifices and bladder neck dissection challenging.

Prior TURP can lead to: higher overall PSM rates in men undergoing LRP [169] and RARP [170]; higher bladder neck [170,171] and prostate base margin positivity [160]; anastomotic stricture after LRP [162]; bladder neck contracture after open RRP [145,172]; greater need for bladder neck reconstruction and increased operative time in RARP [164]; and higher rates of anastomotic leak in LRP and open RRP [169,173]. Continence is not affected [162].

b) *Anterior versus posterior approach to the seminal vesicles (only for transperitoneal approach)*

In the initial nine cases of LRP [2], the intention was to reproduce open anatomical Walsh retrograde RP [72]. The bladder was released from the anterior abdominal wall and the prostate was released at the apex. The prostate and nerves were dissected in a retrograde manner and seminal vesicle dissection was the final step in extricating the prostate. Subsequently, Guillonneau and Vallancien introduced the idea of starting the dissection by incising the peritoneum in the pouch of Douglas and accessing and freeing the seminal vesicles [73] **(Figure 20)**. Menon and Tewari [74], describing the Vattikuti Institute RARP, introduced the idea of early transection of the anterior and posterior bladder neck and then releasing the seminal vesicles.

With the posterior approach, dissection begins in the pouch of Douglas, and proponents claim easier identification and dissection of the vas deferens and seminal vesicles and easier transection of the posterior bladder neck. The most potent theoretical reason discouraging the posterior approach is that sympathetic hypogastric nerves in the line of dissection between the lateral borders of the SVs are transected. We know from testicular cancer that injury to the hypogastric plexus can affect bladder neck function and orgasmic sensation [75].

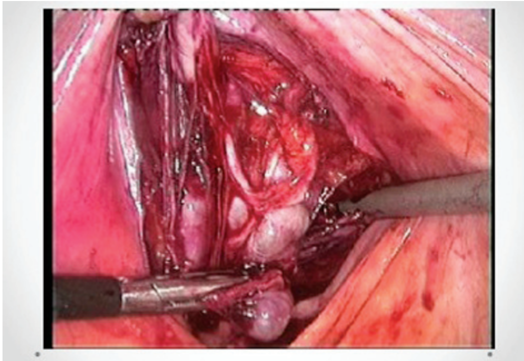


Figure 20. Dissection of the seminal vesicle thought the Douglas pouch

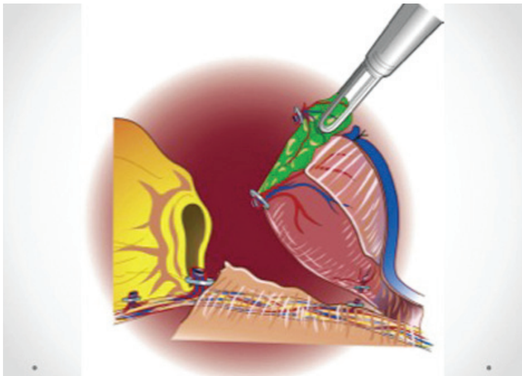


Figure 21. Complete dissection of the posterior aspect of the prostate before apical dissection

c) Anterior bladder/prostate junction and anterior prostatic fat

Removing the anterior prostatic fat can have three advantages: (1) reduce PSM at the apex; (2) improve visualisation of the dividing line between the prostate and bladder during transection of the anterior bladder neck; and (3) remove the lymph nodes on ~15% of occasions. In 1–2% of cases, these lymph nodes can harbour the only site of lymph node metastasis [76–79].

d) Surgical technique for apical dissection

Apical dissection of the prostate is performed after complete mobilisation of the prostate **(Figure 21)**. It may be useful to increase intra-abdominal pressure to 20 mmHg to prevent blood spillage from the dorsal vein complex [230]. Ligature of the dorsal vein complex is beneficial in avoiding blood loss from large vessels [231]. Another option is compression of large vessels with a sponge stick or the use of a bulldog clamp [232].

The prostate is separated from the urethral sphincter by blunt dissection and cut with scissors without cautery for maximal preservation of the NVB.

The tissue covering the prostatic part of the sphincter is gently pushed cranially **(Figure 21)** until the underlying longitudinal smooth muscle becomes visible. The longitudinal smooth muscle fibres are followed intraprostatically by blunt dissection and retraction of the apical tissue.

The anterior part of the urethra is transected until the transurethral catheter becomes visible. The catheter can be lifted toward the symphysis pubis. By external traction applied to the catheter, additional compression of the dorsal vein complex is achieved to minimise blood loss. The dorsal urethra is transected. For better visualisation of the apical region, Tewari et al. described an alternative technique, using a 30° upward-facing lens in combination with retraction of the prostate [233]. By using this technique it was possible to reduce the rate of PSMs from 4.4% to 1.4%.

If the apical region of the prostate is suspicious for a PSM or residual tumour cells remain in the urethra, intraoperative frozen sections should be taken. Biopsies at the apex of the prostate as well as from the urethral resection site are helpful in predicting a positive surgical margin, but there are not many further surgical options in this area, because more aggressive treatment may result in a higher rate of urinary incontinence [234]. In particular, frozen sections can reduce PSM rate for preoperative high-risk tumours and when full functional length urethral sphincter preservation is intended [235].

5. RETROGRADE TECHNIQUE

This approach using the principles of open RRP became known as the Heilbronn technique [122].

a) Control of the dorsal vein complex

Retrograde dissection starts at the apex of the prostate with control of the dorsal vein complex. The bladder is grasped using forceps via port 5 (right lateral port) and retracted cranially. The endopelvic fascia is incised and the apex is dissected bluntly. The puboprostatic ligaments are transected. The dorsal vein complex is secured with double suturing at the apex and bladder neck to provide adequate hemostasis. A 15-cm Vicryl 2/0 with MH needle is used for intracorporal suturing. The dorsal vein complex can be transected proximal to the apical suture. If minor bleeding occurs, it may be controlled with bipolar coagulation.

b) Transection of the urethra

The urethra is incised at the apex of the prostate. The Foley catheter is ligated to avoid deflation of the balloon, and then it is cut at the orifice of the urethra and pulled inside the abdomen to retract the prostate cranially with a grasper. Another 20 Fr Foley catheter is placed in the urethra from outside for better identification of the urethral stump. Finally, the urethra is transected completely.

c) Control of the distal pedicles and sparing of the neurovascular bundles

In case of non-nerve sparing LRP, both NVBs and the distal pedicles of the prostate are dissected. Denonvilliers´ fascia is incised and the dorsal plane of the prostate is separated from the rectum. When preservation of the NVBs is attempted, the space between the urethra and the NVBs is dissected bluntly until Denonvilliers´ fascia can be identified. The rectal balloon is inflated with 40–60 ml of air. The prostatic fascia is incised and the small branches to the NVBs are controlled using 5-mm titanium clips. Hem-o-lock clips are not used near the urethra, to avoid migration into the anastomosis, electric energy sources are not used near the NVBs, to avoid nerve damage.

d) Transection of the bladder neck

The apex of the prostate is pulled ventrally again using the cut Foley catheter as a retractor. The bladder neck is incised, followed by the descending part of the prostatectomy. After incision of the bladder over the blocked balloon of the Foley catheter, the balloon is deflated with a cut into the catheter distal to the ligature. The catheter can be grasped U-shaped and used again as a retractor for the prostate. The ureteral orifices are identified, and the bladder neck is cut completely. The next step is the dissection of the proximal pedicles of the prostate and the transection of the right and left vas deferens.

e) Dissection of seminal vesicles

Retrovesical access to the seminal vesicles is now accomplished, both seminal vesicles are completely exposed, and the seminal vesical arteries are transected after clipping.

6. COMPARISON OF RETROGRADE AND ANTEGRADE TECHNIQUE:

a) Advantages of antegrade technique

Early control of the proximal prostatic pedicle, resulting in reduced bleeding.

Early control of the arteries of the seminal vesicles.

Better working angle for the instruments

b) Disadvantages of antegrade technique

1. Suboptimal exposure of prostatic base during control of prostatic pedicles.
2. Later identification of the NVBs still covered by the levator fascia.

c) Advantages of retrograde technique

1. Early control/haemostasis at dorsal vein complex
2. Earlier identification of NVBs
3. Exposure of NVBs during every step

d) Disadvantages of retrograde technique

1. Late control of the proximal prostatic pedicle
2. Technically more difficult than antegrade technique

7. INGUINAL HERNIAS

An under-reported consequence and/or complication of RARP or LRP is inguinal hernia. The risk of inguinal hernia formation following LRP or RARP is lower than that with open RP and occurs in 5–6.4% of patients following RARP [79,82]. Repair of symptomatic hernias was recently endorsed in the Pasadena consensus [83]. Others have recommended repair of all inguinal hernias due to a low complication rate associated with the new synthetic meshes that do not need re-retroperitonealisation [84], but presently there is no high level of evidence supporting this.

8. SPECIMEN RETRIEVAL AND COMPLETION OF THE PROCEDURE

The fascial opening at the periumbilical camera trocar site is widened just enough to extract the specimen. Only closure of the anterior rectus sheath is necessary. Occasionally, a small opening is required in the posterior rectus sheath and peritoneum to release air trapped in the peritoneum, which should be suspected if tympany is noted with abdominal percussion. No fascial closure is necessary for the other trocar sites given their extraperitoneal location.

IV. POSTOPERATIVE MANAGEMENT

Postoperative management of patients treated with RARP is influenced by several factors related to important differences in terms of national health care systems, personal habits, and cultural background. The aim of this chapter is to help with standardisation of postoperative management of patients treated with RARP.

1. HOSPITAL STAY

Typically, patients treated with RARP have rapid recovery immediately after the surgical procedure. In most studies from high-volume centres, patients were mobilised and allowed to drink clear liquid on the night of surgery [117,271].

The majority of patients are discharged on postoperative day 1 or 2 once they are ambulatory and tolerate food with minimal discomfort, after drain removal [295–297]. After RARP, most patients experience mild/moderate abdominal discomfort, which improves steadily over a few days. In cases of discomfort or pain, oral ketorolac or opiates are the preferred choices. However, there is a rapid decline in the average medication use that corresponds to the subjective improvement in pain symptoms [298].

2. PERIOPERATIVE OUTCOMES AND COMPLICATIONS

RARP can be performed routinely within a short time, with low risk of blood loss and low transfusion rates. The Pasadena systematic review of the literature demonstrated an overall mean operative time of 152 min (range: 90–291 min), mean blood loss of 166 ml (range: 69–534 ml), mean transfusion rate <2% (range: 0.5–5%), mean catheterization time of 6.3 days (range: 5–8.6 days), and mean hospital stay <1.9 days (range: 1–6 days) [Novara, 2012]. Obesity, large prostate volume, prior abdominal surgery, prior surgery for benign prostate hypertrophy, or presence of median lobe may make RARP more challenging, thus increasing operative time, blood loss, or catheterization time. Surgical experience (e.g., number of cases performed, or achieving a fellowship training in RARP) is associated with better perioperative outcomes.

Postoperative complications are uncommon after RARP. The overall mean rate is 9% (range: 3–26%). The mean rates of complications are: grade 1, 4% (range: 2–11.5%); grade 2, 3% (range: 2–9%); grade 3, 2% (range: 0.5–7%); grade 4, 0.4% (range: 0–1.5%); and grade 5, 0.02% (range: 0–0.5%). The most common surgical complications are: lymphocoele or lymphorrhoea (mean: 3.1%; range: 1.2–29%), urinary leakage (mean: 1.8%; range: 0.1–6.7%) and reoperation (mean: 1.6%; range: 0.5–7%) [Novara, 2012].

Several studies have compared perioperative outcomes and complications in RRP, LRP and RARP. With regard to RARP and RRP, Novara's meta-analysis showed significant differences for rates for blood loss [weighted mean difference (WMD): 582.77; 95% confidence interval (CI): 435.25–730.29; P<0.00001] and transfusion rate [odds ratio (OR): 4.85; 95% CI: 2.86–8.22; P<0.00001) in favour of RARP, whereas rates for operative time (WMD: −15.8; 95% CI: −68.65 to 37; P=0.56) and overall complications (OR: 1.1; 95% CI: 0.59–2.04; P=0.76) were similar for RARP and RRP [Novara, 2012]. Previous meta-analysis conclusions were confirmed by two more recent non-randomised comparative studies [Liu, 2013; Alemozaffar, 2014]. Using the National Surgical Quality Improvement Program database, Liu et al. compared 4036 MIRPs and 1283 open RPs. They observed significantly less perioperative blood transfusion (1.3% vs. 21%) and fewer major complications (5% vs. 9%) in the MIRP group in comparison with RRP [Liu, 2013]. Alemozaffar et al. compared 621 RRPs with 282 RARPs and found a significant difference in mean blood loss (852 vs. 207 ml; P<0.001) and transfusion rates (30.3% vs. 4.3%; P<0.001) in favour of RARP [Alemozaffar, 2014].

Conversely, rates for operative time (WMD: 34.78; 95% CI: −1.36 to 70.93; P=0.06), blood loss (WMD: 54.21; 95% CI: −75.17 to 183.59; P=0.41), and overall complications (OR: 1.24; 95% CI: 0.8–1.93; P=0.34) were similar in LRP and RARP. Only the transfusion rate (OR: 2.56; 95% CI: 1.65–3.96; P<0.00001) was significantly lower in RARP patients [Novara, 2012]. The equivalence of perioperative outcomes and complications between RARP and LRP was recently confirmed in a randomised controlled trial (RCT) [Porpiglia, 2013].

RARP can be performed routinely with a low risk of complications [level of evidence (LE) 2-3, grade of recommendation (GR) B]. Surgical experience, patient characteristics, and cancer characteristics may affect the risk of complications. RARP and LRP offer significant advantages in terms of transfusion rate and blood loss in comparison with RRP [LE 2, GR B]. No significant differences between the different approaches were observed in terms of postoperative complications [LE 2, GR B].

3. URETHRAL CATHETER REMOVAL

Postoperative urine drainage after vesicourethral anastomosis during RARP remains an integral part of the operation and has traditionally been maintained using a urethral catheter.

Depending on the surgeon's preference and individual patient considerations, urethral catheter removal takes place between postoperative days 4 and 10 after RARP [271,274,297,299]. In community settings, especially during the learning curve of RARP, a more conservative approach has been reported, with catheter removal around postoperative day 7 [8]. However, in referral centres with a high annual case load, urethral catheter removal is anticipated between postoperative days 2 and 4, without compromising urinary continence recovery or increasing the risk of postoperative complications [300,301]. However, early catheter removal, is associated with a higher rate of urinary retention (5–10%) [302,303].

If a watertight anastomosis has been achieved during RARP, voiding cystography before urethral catheter removal is not routinely recommended, because in most patients, urine leakage is absent [117]. In patients with evident urine leakage, the catheter should be left in place until a subsequent cystogram reveals resolution, typically 1 week later.

Some authors have questioned the need for urethral catheter placement during RARP. Urethral catheterisation may represent a significant source of discomfort following RARP, associated with physical limitations [304]. It has been argued that long-term catheterisation may play a role in enhancing postoperative inflammation, increasing the risk of bladder neck or urethral strictures [305].

Some authors suggest the use of a suprapubic tube to reduce catheter-related discomfort. The suprapubic tube is maintained in place for 5 days after RARP and then clamped. On postoperative day 7, if the residual urine volume is <50 ml per void, the suprapubic tube is removed [306]. However, a recent RCT demonstrated a lack of significant advantages of suprapubic tube placement in terms of pain, catheter-related problems, and treatment satisfaction [301].

4. PELVIC DRAINAGE REMOVAL

The use of a pelvic drain in patients treated with RARP with or without pelvic LND is controversial. The intended role of pelvic drain is the potential collection of urinary extravasation or prevention of symptomatic lymphocoeles when pelvic LND is performed. Most drains play little role in the postoperative course of men undergoing RARP and they are commonly removed within 24 h of patient discharge [16]. However, pelvic drainage is associated with high patient morbidity, infection, prolonged hospital stay, and high costs [307,308]. When the urethrovesical anastomosis is watertight, placement of a pelvic drain may be unnecessary, even if pelvic LND is performed [308,309].

To date, the decision about postoperative drain removal is usually taken at the surgeon's discretion, without the support of specific evidence-based guidelines regarding the ideal time for removal. Typically, the pelvic drain is removed if output is 100 ml/8 h within 24 h of discharge [117,271,308].

5. PENILE REHABILITATION AFTER RARP

Historically, ED after RP was a significant side effect with a negative impact on sexual health of patients treated for PCa. Despite the advantages of the robotic approach, a significant proportion of patients might still experience ED (6–46%) [274].

Management of post-RP ED is mainly by administration of pro-erectile drugs. The final therapeutic goal for postoperative ED is to achieve erections sufficient for satisfactory sexual intercourse. To this end, clinicians have several therapeutic options including phosphodiesterase type-5 (PDE5) inhibitors, intracavernous injection [310-313], urethral microsuppositories [314], vacuum devices, and penile implants [315].

Currently, PDE5 inhibitors represent the first-line therapy in patients undergoing nerve-sparing RARP, either unilateral or bilateral, even if there is no definitive evidence on the best treatment strategy [316,317].

Early penile rehabilitation prevents penile fibrosis development, which ultimately translate to veno-occlusive dysfunction in a time-dependent fashion after surgery [318,319].

In the clinical setting, the concept of penile rehabilitation after RP was pioneered by Montorsi et al. in 1997 [310]. Thirty patients treated with bilateral nerve-sparing (BNS)RP were randomised to receive intracorporeal injections of alprostadil early after surgery or no therapy. The rate of recovery of spontaneous erections in the groups receiving intracavernous injection was significantly higher than in those undergoing observation alone. Advent of PDE5 inhibitors has resulted in a shift toward oral treatment of postoperative ED. Sildenafil, tadalafil and vardenafil provide recovery of EF after open RP ranging from 35 to 75% among patients who undergo nerve-sparing surgery.

Padma-Nathan and colleagues published the first placebo-controlled multicentre RCT assessing the efficacy of daily sildenafil for treatment of post-RP ED in 76 men. However, the recovery of spontaneous erections was limited (27% vs. 4% for sildenafil vs. placebo) due to a high proportion of patients with preoperative EF impairment [320]. Bannowsky et al. evaluated the effect of low-dose sildenafil for rehabilitating EF after nerve-sparing RP. Forty-three sexually active patients were randomised to receive either placebo or sildenafil 25 mg/day at night. In the sildenafil group, 47% achieved and maintained an erection sufficient for vaginal intercourse at 1 year after surgery, compared with 28% in the control group [321].

Montorsi *et al.* evaluated 303 potent men treated with BNSRP and randomised to receive tadalafil 20 mg on demand or placebo. In patients treated with tadalafil, 71% reported an improvement in EF as compared to 24% of those treated with placebo ($P<0.001$). Tadalafil 20 mg achieved a 52% rate of successful intercourse, which was significantly higher than the 26%, obtained with placebo ($P<0.001$) [322]. Despite the encouraging results, to date the optimal treatment regimen after BSRP has still to be clearly defined. Only a few reports have compared the role of on-demand and daily administration of PDE5 inhibitors after BNSRP. Montorsi et al. published a double-blind, double-dummy, multicentre, parallel-group study of 628 patients randomised to receive vardenafil nightly and vardenafil on-demand or placebo. Surprisingly, in contrast to the hypothesised prophylactic use of PDE5 inhibitors for penile rehabilitation, this study demonstrated higher EF recovery rates in patients randomised to the on-demand use of PDE5 inhibitor [323]. Similar results were obtained by Pavlovic et al. in a double-blind RCT of nightly versus on-demand 50 mg sildenafil after nerve-sparing MIRP. Again, the authors failed to demonstrate any significant differences in EF between treatments, after adjusting for potential confounding factors [324].

However, it has been hypothesised that the observed lack of superiority of rehabilitation may be related to the pharmacokinetic profile of the PDE5 inhibitors used in the trials. Sildenafil and vardenafil both have a short half-life, which may limit achievement of a continuous therapeutic dose with single daily administration. Therefore, Montorsi et al. investigated the effect of tadalafil 5 mg/daily and 20 mg on demand versus placebo on the rate of EF recovery after BNSRP in a double-blind, double-dummy, placebo-controlled RCT. Again, this study did not demonstrate superior efficacy of daily tadalafil as compared to on-demand administration [325].

In summary, none of the currently available PDE5 inhibitors showed greater efficacy when given daily as compared to on demand after BNSRP in well-designed, prospective, RCTs. These data suggest that on-demand use of PDE5 inhibitors is warranted for the prevention and treatment of ED in patients undergoing BNSRP, while daily administration is not supported by clinical evidence.

Briganti et al. proposed a group stratification to predict EF recovery in a series of patients who underwent bilateral nerve-sparing RRP [318]. They proposed a classification based on preoperative patients features according to the risk of postoperative ED: low risk [age ≤65 years, IIEF-EF ≥26, and Charlson Comorbidity Index (CCI) ≤1], intermediate risk (age 66–69 years, IIEF-EF 11–25, and CCI ≤1), and high risk (age ≥70 years, IIEF-EF ≤10, and CCI ≥2). Based on this classification, which was subsequently externally validated in a population treated with RARP [326], the same group analysed different treatment schedules according to risk categories. There was a significant improvement in the 3-year EF recovery related to daily therapy with PDE5 inhibitor as compared with on-demand administration, but only in patients with intermediate risk of ED after BNSRP (74% vs. 52%; P=0.02). On the contrary, no differences were noted between on-demand and daily treatment in patients with low or high risk of ED after surgery. It may be that in patients with more favourable preoperative characteristics, the probability of recovering EF is high, regardless of the type of PDE5 inhibitor administered, due to their excellent baseline profile [36]. Similarly, in patients with a high risk of postoperative ED, the potential benefit of rehabilitation is masked by the already compromised EF. Conversely, daily PDE5 inhibitor administration was more effective than on-demand administration in patients with intermediate risk of postoperative ED. The maximal effect of penile rehabilitation is obtained in men with partial impairment of preoperative EF. These results need to be confirmed in large, prospective RCTs [327].

6. PELVIC FLOOR REHABILITATION AFTER RARP

Urinary incontinence in patients treated with RARP ranges from 4 to 31% [129]. In most men, urinary incontinence progressively improves after RARP and spontaneous recovery may take as long as 1–2 years after surgery [269]. Pelvic floor muscle training may provide faster recovery of continence after RP [328-331].

Some authors advocate a potential role for preoperative pelvic floor muscle training, because it is associated with improvement in continence recovery. However, the presence of several biases (significant differences in terms of treatment regimens, continence definitions, and length of follow-up) and the limited number of patients reduced the reproducibility of those results [332].

In general, conservative management is advised as the main approach for urinary incontinence after RP. EAU guidelines state that men undergoing some form of pelvic floor muscle training, before or after RP achieve continence more quickly than untreated men do [333].

V. OUTCOMES OF RARP

In 2012, four systematic reviews and meta-analyses summarised perioperative, oncological and functional (urinary continence and potency recovery) outcomes in case series and comparative studies published until August 2011 [Novara, 2012; Ficarra, 2012; Novara, 2012; Ficarra, 2012]. We performed an update of our previous systematic review to select the most relevant studies reporting RARP outcomes and published until February 2014.

1. ONCOLOGICAL OUTCOMES

Considering the long natural history of PCa and the available follow-up in RARP series, most of oncological data concerning RARP are still represented by surrogate end-points as well as the rate of PSMs and biochemical disease-free survival (bDFS). Data on metastasis-free and cancer-specific survival are immature.

The Pasadena systematic review showed that the mean prevalence of PSMs after RARP was 15% (range: 6.5–32%). According to the pathological extension of primary tumour, the mean PSM rate was 9% (range: 4–23%) in pT2 cancers, 37% (range: 29–50%) in pT3 cancers, and 50% (range: 40–75%) in pT4 cancers. The most prevalent site of PSM after RARP was the apex in 5% (range: 1–7%) of cases, posterolateral surface in 2.6% (range: 2–21%), bladder neck in 1.6% (range: 1–2%), and anterior surface in 0.6% (range: 0.2–2%). Prostate volume, clinical T stage, biopsy Gleason score, presence of perineural invasion, and surgeons' experience were the most relevant predictors of PSMs after RARP [Novara, 2012].

More controversial is the impact of the extent of preservation of NVB dissection on PSM rates. In 2013, Srivastava et al. demonstrated that the use of an appropriate preoperative algorithm for a risk-stratified approach to nerve-sparing surgery does not compromise the oncological safety of the procedure [Srivastava, 2013]. Similarly, cancer control is not influenced by the antegrade or retrograde nerve-sparing technique during RARP. In 2013, Ko et al. published a matched pair analysis comparing 172 cases each that underwent antegrade nerve-sparing or retrograde nerve-sparing surgery. The overall PSM rate was 11.6% after the antegrade approach and 7% after the retrograde approach. A non-significant difference was detected after data stratification according to pathological stage. In pT2 tumours the PSM rates were 7.9% and 4.6% after the antegrade and retrograde approach, respectively.

Meta-analysis of available comparative studies revealed a non-significant difference in overall PSM rates following RRP and RARP [Novara, 2012].

Some studies comparing RARP and RRP were published after the previous meta-analysis [Silberstein, 2013; Pierorazio, 2013; Park, 2014; Thompson, 2014; Alemozoffor, 2014; Sooriakumaran, 2014] (Table 1). Most these studies confirmed the overlapping PSM rates between the open and robot-assisted approaches to RP [Silberstein, 2013; Park, 2014; Alemozaffar, 2014]. However, Pierorazio et al. analysed a large series of patients who underwent RP at Johns Hopkins University, Baltimore, USA. There was a higher overall PSM rate in the 1422 patients who underwent RARP in comparison with the 4950 who underwent RRP (18.1% vs. 13.2%; P<0.001). This difference in favour of open surgery was confirmed by analysing only pT2 cases (8.4% vs. 4.1%; P<0.001) [Pierorazio, 2013]. Conversely, a large multinational, multi-institutional study comparing 22,393 patients who underwent open RP, LRP or RARP showed lower PSM rates after minimally invasive procedures in comparison with open surgery. In detail, the overall PSM rates were 13.8% after RARP, 16.3% after LRP and 22.8% after RRP, respectively. Cox regression with propensity scores for adjustment and covariates confirmed the significant advantages in favour of MIRP in comparison with RRP [Sooriakumaran, 2014]. The potential impact of the learning curve on PSM rates after RARP has been analysed. In a prospective, single-surgeon study of 1552 consecutive cases treated in Australia from 2006 to 2012, Thompson et al. observed that in pT2 tumours, the PSMs after RARP became lower in comparison with RRP after 108 procedures and 55% lower after >860 procedures. Similarly, in pT3/4 cases, PSMs reached a plateau after 200–300 RARPs [Thompson, 2014].

An RCT comparing prevalence of PSMs after 60 RARPs with 60 LRPs showed overlapping results. Overall PSM rates were 20% and 26% after LRP and RARP, respectively. Similarly, PSM rates in pT2 cases were 16% and 13.5%, respectively [Porpiglia, 2013].

With regard to bDFS, only a few studies have reported data with acceptable follow-up. In 2010, Menon et al. reported 1384 patients at a median follow-up of 60 months. The 3-, 5- and 7-year bDFS rates were 90%, 87% and 81%, respectively, with 95.5% cancer-specific survival [Menon, 2010]. Similar results were reported by Sooriakumaran et al. in ~1000 patients evaluated at a median follow-up of 6.3 years [Sooriakumaran, 2012]. More recently, Ficarra et al. analysed bDFS in 183 consecutive patients with a minimum follow-up of 5 years after RARP. The 3-, 5- and 7-year bDFS was 96.3%, 89.6% and 88.3%, respectively [Ficarra, 2013]. In 2014, the Vattikuti Urology Institute published the largest report of oncological outcomes to date, analysing long-term follow-up of 4803 patients who underwent RARP between September 2001 and December 2010 and who were followed up until April 2011. The actuarial 8-year bDFS, metastasis-free survival and cancer-specific survival were 81%, 98.5% and 99.1%, respectively [Sukumar, 2014].

Meta-analysis of comparative studies published in 2012 revealed no significant differences in bDFS between RRP and RARP (hazard ratio: 0.9; 95% CI: 0.7–1.2; P=0.526) or between LRP and RARP (hazard ratio: 0.5; 95% CI: 0.2–1.3; P=0.141) [Novara, 2012]. Three recent studies comparing bDFS in RARP and RRP confirmed these results. [Silberstein, 2013; Park, 2014; Alemozaffar, 2014].

In agreement with the Pasadena consultation and the recent recommendations of the EAU guidelines, we can conclude that RARP offers positive surgical margin rates at least equivalent to those of RRP and LRP [LE 2, GR B]. Preliminary data from large series show that high-volume robotic surgeons can achieve progressively superior results in comparison with traditional open surgery [LE 2, GR B]. Several large case series have shown good long-term prostate-specific antigen (PSA)-free survival of patients treated with RARP [LE 3, GR B]. Some non-randomised comparative studies have confirmed the equivalence between RARP and RRP in terms of bDFS [LE 3, GR B]. However, the median follow-up of these studies is not yet adequate for definitive conclusions. Finally, significant data on metastasis-free survival and cancer-specific mortality are not currently available.

2. URINARY CONTINENCE

The Pasadena systematic review showed that 12-month urinary incontinence rates following RARP ranged from 4% to 31% (mean: 16%) in studies adopting the continence definition of "no pad". In studies using "no pad or safety pad" as the continence definition, 12-mo urinary incontinence rates ranged from 8% to 11% (mean: 9%) [Ficarra, 2012]. Ficarra et al. reported functional outcomes in patients with long-term follow-up. Continence rates were 39% at 1 month, 73% at 3 months, 87% at 6 months and 91% at 12 months. The median time to reach continence was 2 months and no other patients became continent after 12 months [Ficarra, 2013]. Beyond the well-known concerns about study quality and methodological issues due to different definitions and methods used for data collection, some patient characteristics such as age, high body mass index (BMI), large prostate volume, and surgical experience can affect recovery of urinary continence after RARP. Similarly, several surgical aspects can influence continence rates – anterior and posterior anastomosis reconstruction techniques being the most relevant.

A 2013 survey showed that 52% of urologists routinely performed posterior musculofascial plate reconstruction, 20% sometimes, and 28% never [Ficarra, 2013]. The role of posterior reconstruction in early recovery of continence is still controversial. Although two RCTs showed negative results, two meta-analyses showed a small advantage in favour of posterior reconstruction for continence recovery at 1 month after RARP. Conversely, posterior reconstruction showed no advantage for continence at 3 and 6 months after RARP over the standard approach [Ficarra, 2012; Rocco, 2012]. Similarly, total (anterior and posterior) reconstruction was evaluated in a few comparative studies and cumulative analysis showed a small significant difference in favour of total reconstruction at 1 month after RARP (OR: 0.40; 95% CI: 0.16–0.96; P=0.04) [Ficarra, 2012].

Another controversial issue is the role of nerve-sparing procedures in early and late recovery of urinary continence. In fresh cadaveric models, Takenaka et al. observed that the NVB followed a straight proximal-to-distal course along the urethra, but histological analysis revealed that these nerves adopted either a frontal, sagittal or axial course. These nerves either traversed through the connective tissue that is interposed between the rhabdosphincter and levator ani muscle, or travelled ventromedially in the pararectal space. Thick myelinated and thin non-myelinated fibres from nerve bundles originating from the splanchnic nerve were identified. Takenaka et al. believed that these thick myelinated fibres accounted for the motor innervation of the rhabdosphincter, thus supporting the theory that the fibres responsible for continence course along the cavernous nerve. Hence, it is believed that preservation of the cavernous nerve safeguards the adjoining continence fibres (Hollabaugh RS, Steiner MS, 2001) [Takenaka UROLOGY 65: 136–142, 2005] Takenaka Tewari, 2007, J. Urol **Figure 1**) and Hinata N, Murakami G, Urology 2014). Two papers published after the Pasadena meta-analysis analysed this aspect [Srivastava, 2013; Tewari, 2013]. Srivastava et al. analysed the impact of different grades of nerve-sparing techniques on early return of continence in 1417 patients who underwent RARP from December 2008 to October 2011 by a single surgeon. Using no pad as the definition of urinary continence, the authors reported a 3-month urinary continence rate of 71.8% in the grade 1 group, 54.7% in grade 2, 45.7% in grade 3, and 43.5% in grade 4 (P<0.001). The favourable impact of grade of cavernous nerve preservation on early recovery of urinary continence was confirmed in a multivariate analysis [Srivastava, 2013]. The same team published a second case series of 1335 patients who underwent RARP between January 2005 and December 2010 by a single surgeon. Patients included in this retrospective analysis were preoperatively continent and potent and were followed up for ≥1 year. The 1-year continence rates were 98% in grade 1, 93.2% in grade 2, 90.1% in grade 3, and grade 4 in 88.9% (P<0.001). This study confirmed the independent predictive role of nerve-sparing extension on 1-year continence recovery [Tewari, 2013].

In 2014, Hinata et al. investigated the impact of NVB preservation on recovery from sphincter fatigue symptoms following RARP [Hinata 2014]. In a cohort of 11 patients who underwent RARP, overall continence rates of 42.2%, 58.3% and 79.1% were reported at 1, 3 and 6 months, respectively. A significant difference in the continence rates was observed between the patients who underwent bilateral NS, unilateral NS or a non-nerve-sparing procedure at 1 (P=0.0045) and 3 months (P=0.0343), but not at 6 months (P=0.9615). The continence rates at 1 and 3 months were 54.3% and 68.6% for the BNS group, 50.0% and 64.1% for the unilateral NS group, and 28.6% and 47.6% for those who had non-nerve-sparing RARP. Similarly, the frequency of sphincter fatigue symptoms at 1 and 3 months were reported to be 43.8% and 36.4% for the bilateral NS group, 52.2% and 66.7% for the unilateral NS group, and 83.3% and 77.3% for the non-NS group, thus demonstrating a significant difference among the three groups at 1 (P=0.0004) and 3 (P=0.0326) months postoperatively, but not at 6 months (P=0.4316) [Hinata J Urol 2014; 84 (1): 144 – 148].

The Pasadena systematic review retrieved eight studies comparing RARP and RRP and eight comparing RARP and LRP. With regard to RARP and RRP, meta-analysis showed that absolute risk of 12-month urinary incontinence was 11.3% after RRP and 7.5% after RARP. Therefore, the absolute risk reduction was 3.8% in favour of RARP (OR: 1.53; 95% CI: 1.04–2.25; P=0.03). In 2014, Thompson et al. investigated the impact of the learning curve for RARP on recovery of urinary continence in comparison with that for RRP. They showed that early urinary incontinence scores for RARP surpassed RRP after 182 procedures and increased to a mean difference of 8.4 points (95% CI: 2.1–14.7), reaching a plateau at 700–800 cases [Thompson, 2014].

Similarly, with regard to RARP and LRP, the Pasadena systematic review demonstrated significant advantages in 12-month continence rates in favour of RARP (OR: 2.39; 95% CI: 1.29–4.45; P=0.006) [Ficarra, 2012]. These results were recently confirmed by an RCT comparing 60 RARP with 60 LRP procedures performed by a single surgeon with expertise in both techniques. Porpiglia et al. also categorised as continent patients using a safety pad, and reported a 12-mo urinary continence recovery of 95% after RARP and 83% after LRP (P=0.04) [Porpiglia, 2013].

We conclude that RARP offers high rates of early and late continence recovery [LE 3, GR B]. The prevalence of urinary incontinence can be influenced by preoperative patient characteristics, surgeons' experience, surgical technique, and methods used to collect and report data. Posterior musculofascial reconstruction has a slight advantage in terms of 1-month urinary continence recovery [LE 2–3, GR C]. The grade of cavernous nerve preservation correlates with the rate of early and 12-month recovery of urinary continence [LE 3, GR C]. Non-randomised comparative studies showed a significant advantage in favour of RARP in comparison with RRP in terms of 12-month recovery of urinary continence [LE 2–3, GR B]. A recent RCT confirmed that RARP is better than LRP in terms of recovery of urinary continence [LE 2, GR B].

a) Anterior suspension

In a prospective comparative study of 331 patients, Patel et al. found a significant advantage in terms of early recovery of continence at 3 months using a single anterior suspension stitch to the pubic bone (83% vs. 92.9%; P= 0.013) [342].

The aim of this technique is stabilisation of the urethra, thus avoiding urethral retraction and facilitating urethral dissection. Patel et al. used a large needle with a non-braided absorbable suture such as Polyglytone or Caprosyn on a large CT1 needle. The needle is held about two-thirds back at a downward angle and placed in the visible notch between the urethra and dorsal vascular complex. The needle is pushed straight across at 90° and then the wrist is turned to curve around the apex of the prostate. The suture strength needs to be sufficient to allow the needle holders to pull up tight and perform a slip knot, which prevents the suture from loosening as it is tied. A second suture is placed to suspend the urethra to the pubic bone and secondarily ligate the dorsal vascular complex. The dorsal vascular complex is encircled and then stabilised against the pubic bone along with the urethra.

b) Posterior musculofascial plate reconstruction

In 2006, Rocco et al. proposed a technique for restoration of the posterior aspect of the rhabdosphincter, which aimed to shorten the time to continence in patients undergoing RRP [343]. In 2007, Rocco et al. described the posterior reconstruction technique for transperitoneal LRP [344]. In 2008, Coughlin et al. applied posterior reconstruction of the rhabdosphincter to RARP, with some minor technical modifications [345]. The technique was further modified in 2011 [346].

The reconstruction is performed using two 3-0 poliglecaprone sutures (on RB-1 needles) tied together, with each individual length being 12 cm. Ten knots are placed when tying the sutures to provide a bolster. The free edge of the remaining Denonvillier's fascia is identified after prostatectomy and approximated to the posterior aspect of the rhabdosphincter and the posterior median raphe using one arm of the continuous suture. As a rule, four passes are taken from the right to the left and the suture is tied. The second layer of the reconstruction is then performed with the other arm of the suture approximating the posterior lip of the bladder neck (full thickness) and the vesicoprostatic muscle, as described by Walz et al. [347], to the posterior urethral edge and to the already reconstructed median raphe. This suture is then tied to the end of the first suture arm.

One of the key steps for appropriate reconstruction is preservation of Denonvillier's fascia when dissecting the posterior plane between the prostate and the rectal wall. If this dissection is performed at the perirectal fat tissue, Denonvillier's fascia is not adequately spared, precluding posterior reconstruction.

A systematic review in 2012 showed that reconstruction of the posterior musculofascial plate improves early recovery of continence within the first 30–45 days after RP. Furthermore, a trend towards lower leakage rates has been found in patients who underwent posterior reconstruction [348].

3. POTENCY OUTCOMES

a) RALP versus RRP and LRP

NS RALP is increasingly being adopted to improve functional outcomes. In a systematic review by Ficarra et al. [274], cumulative analysis of four prospective studies [127,275-277] comparing RALP and RRP (LE 3) and a further three historical control series [278-280] (LE 4) revealed the prevalence of ED to be 47.8% and 24.2% after RRP and RALP, respectively. This demonstrates significant advantages in terms of 12-month recovery of potency in favour of RALP. The superiority of RALP over LRP in terms of potency was confirmed more recently by Ploussard et al. in a comparison (LE 4) of 1377 extraperitoneal LRPs and 1009 extraperitoneal RARPs. In a systematic review of 31 studies reporting the potency rates after RARP, Ficarra et al. [274] reported that 12- and 24-month potency rates were 54–90% and 63–94%, respectively, following NS RALP. Their report confirmed the lower risk of ED after RALP with bilateral preservation of the cavernous nerves.

4. POTENCY RECOVERY

The Pasadena systematic review showed that potency recovery rates after RARP were 50% (32–68%), 65% (50–86%), 70% (54–90%), and 79% (63–94%) after 3, 6, 12 and 24 months, respectively. Considering only the studies with high methodological quality (according to the Mulhall criteria), the mean 3-, 6-, 12- and 24-month potency rates were 48% (32–68%), 68% (50–86%), 76% (62–90%), and 82% (69–94%), respectively. [Ficarra, 2012]. Similarly to the urinary continence evaluation, the adopted definition of potency and methodological differences can explain the wide variance among the studies. Several predictors can affect potency rates following RARP, including patient age, preoperative potency status, comorbidity, BMI and extent of the nerve-sparing procedure.

Studies including both unilateral and bilateral nerve-sparing procedures showed 3-, 6-, 12-, and 24-month potency rates of 32%, 53%, 69% (62–90%) and 63%, respectively, whereas the same rates for full BNS surgery were 56%, 69% (50–86%), 74% (62–90%), and 82% (69–94%), respectively. Preoperatively potent patients who underwent BNS RARP needed a median 6 months to recover potency. After 12 months, few patients further improved their potency status [Ficarra, 2013].

With regard to the comparison between RARP and RRP, a recent systematic review and meta-analyses demonstrated that the prevalence of ED, according to different definitions, was 47.8% after RRP and 24.2% after RARP, with a significant absolute risk reduction of 23.6% (OR: 2.84; 95% CI: 1.48–5.43; P=0.002). Thompson et al. estimated the number of RARP cases that were needed to achieve sexual results that were better than those with traditional RRP. Using the EPCIC quality of life questionnaire, they calculated that RARP sexual function scores surpassed RRP scores after 99 procedures, and increased to a mean difference of 11.0 points after 861 cases, reaching a plateau at 600–700 RARPs.

Comparative studies have shown that the prevalence of ED was 55.6% after LRP and 39.8% after RARP, with an absolute risk reduction of 14.8% (OR: 1.89; 95% CI: 0.70–5.05; P=0.21) [Ficarra, 2012]. This last meta-analysis included only three poor quality, retrospective comparisons using historical controls and only one RCT. This last study demonstrated a significant advantage in favour of RARP in terms of 12-month recovery of potency. At 1 year after surgery, 32% of patients were potent after LRP and 77% after RARP [Asimakopoulos, 2011]. These data were confirmed by another RCT in 2013. The authors compared 35 patients who received monolateral or bilateral nerve-sparing LRP with 35 who received the same procedure robotically. The 12-month potency rates were 54% in the LRP arm and 80% in the RARP arm (P=0.02).

In conclusion, methodological issues significantly influence the prevalence of potency recovery after RARP. With this limitation, bilateral, cautery-free, retrograde nerve-sparing techniques are associated with a higher percentage of potency recovery than unilateral, cauterising, antegrade techniques [LE 2–3, GR C]. More extended (full) nerve-sparing offers a higher probability of preserving the cavernous nerves and obtaining better functional outcomes [LE 3, GR C]. RARP is associated with significantly better results in comparison with RRP [LE 2–3, GR B] and LRP in terms of potency recovery [LE 2, GR B].

5. TRIFECTA

In 2003, Salomon et al. proposed combining oncological and functional outcomes in a single score [1]. In 2005, Bianco et al. suggested combining bDFS, urinary continence, and sexual potency recovery rates into the trifecta outcome to identify patients who achieved an optimal result after RP [2]. In 2012, Ficarra et al. performed a systematic review to analyse all the studies reporting outcomes as trifecta. Only five studies reported the trifecta for RARP. Trifecta can be reached in 44–83% of evaluated patients. Potency recovery is the most relevant outcome with a negative effect on the trifecta rate. Continence, potency and bDFS rates were 80–98%, 60–97% and 88–96%, respectively [Ficarra, 2012].

In 2013, Ficarra et al. reported combined outcomes of RARP using the Survival, Continence and Potency (SCP) system. In patients who were preoperatively continent and potent, who underwent a nerve-sparing technique and did not require any adjuvant therapy, combined oncological and continence outcomes were attained in 80% of cases. In the subgroup of patients not evaluable for potency recovery, oncological and continence outcomes were reached by 68.7% of cases [Ficarra, 2013].

The SCP system was also used by Porpiglia et al. in a comparison of RARP and LRP. The system allowed us to show that P0 patients overlapped between the two compared techniques, and the main difference concerned the percentage of patients able to reach IIEF-5 score >17 with the use of PDE5 inhibitors [Porpiglia, 2012].

VI. CONCLUSIONS

1. ANATOMY

	Grade of recommendation
The parietal endopelvic fascia covers the medial aspects of the levator ani muscle, and the visceral component of the endopelvic fascia covers the pelvic organs, including prostate, bladder and rectum.	
The periprostatic fascia consists of the anterior, lateral and posterior prostatic fascia and seminal vesicular fascia (Denonvilliers' fascia).	
The structure often termed prostate capsule is not a capsule from an anatomical point of view but the exterior stromal edge of the prostate parenchyma formed by condensed smooth muscle with few glands. From a surgical point of view, a surgical capsule is visible as a clear and distinct outer edge of the prostate, reminiscent of a capsule during RP.	
At the posterolateral aspect of the prostate, the lateral prostatic fascia and Denonvilliers' fascia virtually merge into the NVB to split into several anterior and posterior leaves passing around the bundle to bind it in a triangular fashion with the levator ani fascia.	
Different dissection planes are possible during a nerve-sparing procedure. The amount of tissue that is left on the prostate can be controlled to achieve incremental tissue margins and avoid PSMs. The term incremental security margin instead of incremental nerve sparing does better reflect the true aim of the technical variation.	
Intrafascial dissection of the NVB follows a plane on the prostatic capsule, remaining medial or internal to the PF at the antero- and posterolateral aspect of the prostate and also remaining anterior to the posterior prostatic fascia and seminal vesicles fascia.	
Interfascial dissection of the NVB is performed outside or lateral to the PF at the anterolateral and posterolateral aspects of the prostate, combined with dissection medial to the NVB at the 5 and 7 o'clock or 2 and 10 o'clock positions of the prostate in axial section.	
Extrafascial dissection is carried out lateral to the levator ani fascia and posterior to the posterior prostatic fascia and seminal vesicular fascia. The NVB running along the posterolateral aspect of the prostate is completely resected.	
Surgical principles regarding sparing the NVB at RP relate to understanding its complexity and variability.	
A clear understanding of the neurovascular anatomy and its variations is compulsory for surgeons performing RP.	
There are essentially four fascial layers surrounding the prostate and NVB.	
The endopelvic fascia has a parietal (levator ani fascia) and visceral component. The parietal component covers the levator ani lateral to the fascial tendinous arch, and the visceral endopelvic fascia sweeps medially to cover the bladder and anterior prostate. The prostatic capsule is covered by an outer levator ani fascia and inner prostatic fascia. Posteriorly, Denonvilliers' fascia surrounds the prostate.	
The NVB starts at the base of the prostate between 3 and 9 o'clock. It then travels outside the prostatic capsule, inferomedially to the apex. At the apex it projects anteriorly. Surgeons should understand significant inter-individual variation of NVB anatomy.	
In performing a complete nerve-sparing procedure, surgeons must dissect between the prostatic capsule and the periprostatic fascia, namely, the fused endopelvic fascia.	
The advent of 10× magnified vision with the Da Vinci system allows surgeons to see the neurovascular structures optimally.	
Nerve sparing can be performed antero-inferiorly or in retrograde fashion or even incrementally with some removal of the NVB tissue but not complete removal.	
Anatomical dissection of the NVB shows that the most likely place for damage to the cavernous nerves is at the apex.	

2. TRANSPERITONEAL APPROACH

	Grade of recommendation
The transperitoneal approach is the most widely used for RP and gives unparalleled access to perform extended pelvic LND.	C
Meticulous padding and avoiding hyperextension during patient positioning are essential to prevent neuropathy.	
Obtaining an appropriate site for insufflation of the pneumoperitoneum for port placement can be safely achieved by placing a Hasson port or a Veress needle just underneath the costochondral junction on the left.	
Transverse incisions compared to vertical can lead to reduction of wound complications with fewer hernias, less pain, and superior cosmesis.	B
Posterior approach advantages are: potentially easier to dissect the seminal vesicles, and simplification of posterior transection of the bladder neck.	
Posterior approach disadvantage is the potential partial transection of the hypogastric nerve, which can affect bladder neck function and orgasmic sensation.	
Removal of anterior prostatic fat reduces apical margins, improves visual landmarks during transection of the bladder neck, and identifies and removes metastatic lymph nodes in ~2% of cases.	C
Assessment of risk of nodal involvement is essential to determine necessity and extent of pelvic LND.	
Extended pelvic LND provides important information for prognosis, which cannot be matched by any other current procedure. Studies have recommended that 13–20 nodes are adequate for accurate staging.	C
Inguinal hernia repair is recommended in men when symptomatic and is a consideration in asymptomatic hernias due to low risk and its potential to prevent future need of hernia surgery.	C

3. EXTRAPERITONEAL APPROACH

	Grade of recommendation
Extraperitoneal RP simulates the gold standard open RP technique.	C
Extraperitoneal approach requires less steep Trendelenburg positioning.	C
Extraperitoneal route avoids all potential intraperitoneal adhesions and eliminates the bladder takedown step.	C
Significantly fewer bowel-related complications such as ileus, hernias, and intestinal injury are reported when using the extraperitoneal approach.	C
Avoiding bowel handling lessens the incidence of paralytic ileus, providing relatively faster recovery.	C
Extraperitoneal route allows containment of bleeding or urine leakage.	C
Extraperitoneal approach makes it difficult to space the trocars and provides limited working space, which may be inappropriate if extended lymphadenectomy is indicated.	C
Extraperitoneal approach carries an increased risk of lymphocoele formation following pelvic LND.	C
Fenestration of the peritoneum adjacent to the LND site is recommended to mitigate the incidence of lymphocoele when using the extraperitoneal approach.	C
Anastomotic tension is often cited as a potential disadvantage of the extraperitoneal approach, which may be relieved by posterior musculofascial plate reconstruction.	C
Functional outcomes of extraperitoneal RARP are equivalent to the transperitoneal approach.	C
Extraperitoneal RARP can be performed in patients with obesity, with pelvic kidneys, and kidney transplantation.	C
The only contraindication to the extraperitoneal approach is in patients who have had the extraperitoneal space created during a previous procedure, such as in mesh herniorraphy, especially where bilateral meshes are anchored to the pubic symphysis.	C

4. BLADDER NECK PRESERVATION

	Grade of recommendation
Urethral resistance and urethral length proximal to the external sphincter are postulated to play a role in maintaining continence.	C
Men who are continent after RP have tubularised bladder neck and functional proximal urethral length similar to the native anatomy.	C
A large bladder neck defect may lead to a more challenging urethrovesical anastomosis, which is a known risk factor for anastomotic leakage.	C
A difficult urethrovesical anastomosis, potentially resulting from a wide bladder neck defect, may be a risk factor for later bladder neck contracture.	C
Bladder neck dissection can be more challenging in men with enlarged median/lateral prostate lobes or prior transurethral resection of prostate for benign prostatic hyperplasia.	C
Patients with enlarged median/lateral prostate lobes or prior transurethral resection of prostate are more likely to need bladder neck reconstruction.	C
During RARP, in case of large bladder neck defect, anterior bladder neck plication may be performed; also to shorten time to recovery of continence.	C
During RARP, bladder neck preservation may shorten time to recovery of continence and improve quality of life.	A
Bladder neck preservation does not seem to increase the rate of PSMs.	C
A key concern in bladder neck preservation is the likelihood of leaving residual benign prostate tissue at the bladder neck, which may cause elevated PSA in the post-prostatectomy patient and mimic malignant biochemical recurrence. A negative bladder neck biopsy may not conclusively rule out the absence of benign prostate tissue at the bladder neck.	C

5. APICAL DISSECTION

	Grade of recommendation
The position of the prostate apex deep in the small pelvis as well as the close connection to the dorsal vein complex, rectum, and sphincter makes its dissection a difficult step during minimally invasive surgery.	
Some methods to facilitate apical dissection are: increasing intra-abdominal pressure to 20 mmHg to prevent blood spillage from the dorsal vein complex; ligature of the dorsal vein complex; and compression of larger vessels with a sponge stick or use of a bulldog clamp.	C
Using a 30° upward-facing lens in combination with retraction of the prostate can achieve better visualisation of the apical region. This technique can reduce the rate of PSMs.	C
In preoperative high-risk tumours and when full functional-length urethral sphincter preservation is intended, intraoperative frozen sections of the prostate apex and/or urethral resection can reduce PSM rate.	C
Currently, there is neither standardisation nor a recommendation to perform or omit frozen sections in RP.	C
A PSM can lead to increased biochemical recurrence.	C
Many factors can influence PSM: preoperative high-risk features (PSA >20 ng/ml, Gleason score ≥8, higher clinical stage); high BMI; enlarged prostate or with a narrow pelvic space.	C
Another factor that may influence PSM is the performance of nerve-sparing RP.	C
A high operative volume and surgeons beyond their learning curve can reduce the rate of PSMs significantly.	C
Currently, there are two different treatment options for patients with a PSM: immediate (adjuvant) postoperative external irradiation, or delay of salvage radiotherapy until local recurrence.	B
The best management of a positive surgical margin is striving to avoid it.	

6. RETROGRADE APPROACH

	Grade of recommendation
Minimally invasive RP with a retrograde approach can be performed with a trans- and extraperitoneal approach.	C
Advantages of the retrograde technique include early control of the dorsal vein complex, early identification of NVBs, and exposure of NVBs during every step.	C
The retrograde technique is technically more difficult than the antegrade approach and provides late control of the proximal prostatic pedicle.	C
Retrograde nerve sparing may improve post-prostatectomy potency.	C

7. POTENCY

	Grade of recommendation
RARP offers better 12-month potency rates when compared to RRP.	B
RARP offers better short-term and intermediate-term potency rate when compared to LRP.	B
Nerve-sparing RARP is associated with better potency outcome.	B
Athermal dissection during nerve sparing is supposed to result in better potency outcome.	C
With the limited amount of data available, traction-free nerve sparing during RARP results in early recovery of potency.	C
Intrafascial nerve sparing is associated with improved potency rates when compared to the interfascial nerve-sparing approach, but this can be at the expense of an increased rate of PSMs.	C
Cavernosal nerve preservation is a graded phenomenon and not an "all-or-nothing" concept.	C
Higher degree of nerve sparing is associated with better sexual outcomes.	C
Retrograde nerve sparing is associated with better potency outcome at 3, 6 and 9 months.	C
Nerve sparing during RARP results in better urinary function and continence outcomes.	C
Intrafascial nerve sparing is associated with early return to continence and better short-term continence rates. However, this may be associated with higher rates of PSMs.	C
Better degree of nerve sparing is associated with early return of continence.	C

8. POSTOPERATIVE MANAGEMENT

	Grade of recommendation
In most high-volume centres, patients are mobilised and allowed to drink clear liquid on the night of surgery.	C
Most patients are discharged on postoperative day 1 or 2, after drain removal (if positioned).	C
In case of discomfort or pain, oral ketorolac or opiates are the preferred choice.	C
Catheter removal has been reported between postoperative days 4 and 10.	B
In high-volume centres, catheter removal is anticipated between postoperative days 2 and 4, without compromising recovery of urinary continence or increasing the risk of postoperative complications.	B
If a watertight anastomosis is obtained, voiding cystography before catheter removal is not routinely recommended.	C
In patients with urine leakage, the catheter should be left in place until a subsequent cystogram reveals resolution, typically 1 week later.	C
A suprapubic tube can be used instead of the catheter. However, this does not bring significant advantages in terms of pain, catheter-related bother, and satisfaction when compared with early catheter removal.	A
The role of a pelvic drain to manage potential collection of urine or lymph is controversial. Pelvic drains are associated with higher patient morbidity, infection, prolonged hospital stay, and increased costs. When the urethrovesical anastomosis is watertight, the placement of a pelvic drain may be considered unnecessary, even if LND is performed.	C
Pelvic drain is typically removed if output is 100 ml/8 h within 24 h of discharge.	C
Despite the advantages of the robotic approach, a significant proportion of patients might still experience ED (6–46%), with different degrees of severity.	C
The final goal of treatment of postoperative ED is to achieve erection sufficient for satisfactory sexual intercourse. Therapeutic options include PDE5 inhibitors, intracavernous injections, urethral microsuppositories, vacuum devices, and penile implants.	B

	Grade of recommendation
PDE5 inhibitors represent first-line therapy in patients who undergo nerve-sparing RARP, either unilateral or bilateral.	C
There is evidence for early penile rehabilitation prior to penile fibrosis development.	C
Tadalafil, low-dose sildenafil and vardenafil can be used for penile rehabilitation.	A
The used of a vacuum erection device together with PDE5 inhibitors can have a beneficial effect.	C
Vardenafil on demand shows better recovery rates compared to vardenafil nightly.	A
No significant difference was found between the use of sildenafil nightly or on demand.	A
No significant difference was found between the use of tadalafil 5 mg nightly or 20 mg on demand.	A
In patients with more favourable preoperative characteristics, the probability of recovering EF is high, regardless of the type of PDE5 inhibitor administered.	C
In most men, urinary incontinence shows progressive improvement after RARPand spontaneous recovery may take as long as 1–2 years after surgery.	C
Pelvic floor muscle training can shorten time to continence and improve the severity of incontinence, voiding symptoms and pelvic floor muscle strength 12 months postoperatively.	A
Pre- and postoperative pelvic floor muscle training does not improve continence when compared with postoperative training only.	A

9. OUTCOMES

Oncological outcomes	Grade of recommendation
RARP offers positive surgical margin rates at least equivalent to those of RRP and LRP.	B
Preliminary data from large studies show that high-volume robotic surgeons can achieve progressively superior results in comparison with traditional open surgery.	B
Available large case series have shown good long-term PSA-free survival of patients treated with RARP.	B
Non-randomised comparative studies have confirmed the equivalence between RARP and RRP in terms of bDFS.	B
Significant data on metastasis-free survival and cancer-specific mortality are not currently available.	

Urinary continence outcomes	Grade of recommendation
RARP offers high early and late continence rates.	B
Posterior musculofascial reconstruction seems to offer a slight advantage in terms of 1-month recovery of urinary continence.	C
The grade of cavernous nerves preservation correlates with the percentage of early and 12-month recovery of urinary continence.	C
Non-randomised comparative studies have shown a significant advantage in favour of RARP in comparison with RRP in terms of 12-month recovery of urinary continence.	B
A recent RCT has confirmed that RARP is better than LRP in terms of recovery of urinary continence.	B

Potency recovery	Grade of recommendation
Recovery of potency after RARP is significantly influenced by methodological issues. With this limitation, bilateral, cautery-free, retrograde nerve-sparing techniques are associated with greater recovery of potency.	C
More extended (full) nerve-sparing surgery offers a greater probability of preserving cavernous nerves and achieving better functional outcomes.	B

Perioperative outcomes and complications	Grade of recommendation
RARP can be performed routinely with a relatively small risk of complications.	B
Surgical experience, patient characteristics, and cancer characteristics may affect the risk of complications. RARP and LRP offer significant advantages in terms of transfusion rate and blood loss in comparison with RRP.	B
There are no significant differences in postoperative complications between the different approaches.	B

REFERENCES

1. Patel VR, Coelho RF, Chauhan S, Orvieto MA, Palmer KJ, Rocco B, Sivaraman A, Coughlin G. Continence, potency and oncological outcomes after robotic-assisted radical prostatectomy: early trifecta results of a high-volume surgeon. BJU Int. 2010;106(5):696-702.

2. Schuessler W, Schulam P, Clayman R, Kavoussi L. Laparoscopic radical prostatectomy: Initial short-term experience. Urology 1997; 50:854-857

3. Guillonneau B, Cathelineau X, Baret E, Rozet F, Vallancien G. Laparoscopic radical prostatectomy: Technical and early oncological assessment of 40 operations. Eur Urol 1999;36:14-20

4. Binder J, Kramer W. Robotically-assisted laparoscopic radical prostatectomy. BJU Int. 2001;87(4):408-10.

5. Babbar P, Hemal AK. Robot-assisted urologic surgery in 2010 - Advancements and future outlook. Urol Ann. 2011;3(1):1-7.

6. Piechaud P. State of the art: urologic surgery. J Visc Surg. 2011;148(5 Suppl):e27-9.

7. American Urological Association Guidelines 2007 (reviewed and validity confirmed 2011). Web Site. http://www.auanet.org/content/clinical-practice-guidelines/clinical-guidelines/main-reports/proscan07/content.pdf

8. Heidenreich A, Bastian PJ, Bellmunt J, Bolla M, Joniau S, van der Kwast T, Mason M, Matveev V, Wiegel T, Zattoni F, Mottet N; European Association of Urology. EAU guidelines on prostate cancer. part 1: screening, diagnosis, and local treatment with curative intent-update 2013. Eur Urol. 2014;65(1):124-37.

9. Phillips B BC, Sackett D, Badenoch D, Straus S, Haynes B, Dawes M. Oxford Centre for Evidence-based Medicine — levels of evidence. Centre for Evidence based Medicine Website. http://www.cebm.net/index.aspx?o=1025. 2009.

10. Takenaka A, Hara R, Soga H, Murakami G, Fujisawa M. A novel technique for approaching the endopelvic fascia in retropubic radical prostatectomy, based on an anatomical study of fixed and fresh cadavers. BJU Int. 2005;95(6):766-71.

11. Steiner MS. Continence-preserving anatomic radical retropubic prostatectomy. Urology. 2000;55(3):427-35.

12. Walsh PC, Partin AW. Anatomic radical retropubic prostatectomy. In: Alan J. Wein LRK, Craig A. Peters, Andrew C. Novick, Alan W. Partin, editor. Campbell-Walsh Urology 9th ed: Elsevier Health Sciences; 2006. p. 2956-78.

13. Federative Committee on Anatomical Terminology. Terminologia Anatomica: International Anatomical Terminology. Stuttgart: Thieme; 1998.

14. Myers RP, Villers A. Anatomic considerations in radical prostatectomy. In: Kirby RS PA, Feneley M, Kellogg Parsons J, editor. Prostate Cancer; principles and practice. Abingdon: Taylor and Francis; 2006. p. 701-13.

15. Wimpissinger TF, Tschabitscher M, Feichtinger H, Stackl W. Surgical anatomy of the puboprostatic complex with special reference to radical perineal prostatectomy. BJU Int. 2003;92(7):681-4.

16. Stolzenburg JU, Rabenalt R, Do M, et al. Intrafascial nerve-sparing endoscopic extraperitoneal radical prostatectomy. Eur Urol. 2008;53(5):931-40.

17. Tewari AK, Bigelow K, Rao S, et al. Anatomic restoration technique of continence mechanism and preservation of puboprostatic collar: a novel modification to achieve early urinary continence in men undergoing robotic prostatectomy. Urology. 2007;69(4):726-31.

18. Savera AT, Kaul S, Badani K, Stark AT, Shah NL, Menon M. Robotic radical prostatectomy with the “Veil of Aphrodite” technique: histologic evidence of enhanced nerve sparing. Eur Urol. 2006;49(6):1065-73; discussion 73-4.

19. Kiyoshima K, Yokomizo A, Yoshida T, et al. Anatomical features of periprostatic tissue and its surroundings: a histological analysis of 79 radical retropubic prostatectomy specimens. Jpn J Clin Oncol. 2004;34(8):463-8.

20. Ayala AG, Ro JY, Babaian R, Troncoso P, Grignon DJ. The prostatic capsule: does it exist? Its importance in the staging and treatment of prostatic carcinoma. Am J Surg Pathol. 1989;13(1):21-7.

21. Myers RP. Practical surgical anatomy for radical prostatectomy. Urol Clin North Am. 2001;28(3):473-90.

22. Gillitzer R, Thuroff JW, Neisius A, Wollner J, Hampel C. Robot-assisted ascending-descending laparoscopic nerve-sparing prostatectomy. BJU Int. 2009;104(1):128-53.

23. Costello AJ, Brooks M, Cole OJ. Anatomical studies of the neurovascular bundle and cavernosal nerves. BJU Int. 2004;94(7):1071-6.

24. Stolzenburg JU, Schwalenberg T, Horn LC, Neuhaus J, Constantinides C, Liatsikos EN. Anatomical landmarks of radical prostatecomy. Eur Urol. 2007;51(3):629-39.

25. Tewari A, Peabody JO, Fischer M, et al. An operative and anatomic study to help in nerve sparing during laparoscopic and robotic radical prostatectomy. Eur Urol. 2003;43(5):444-54.

26. Budaus L, Isbarn H, Schlomm T, et al. Current technique of open intrafascial nerve-sparing retropubic prostatectomy. Eur Urol. 2009;56(2):317-24.

27. Graefen M, Walz J, Huland H. Open retropubic nerve-sparing radical prostatectomy. Eur Urol. 2006;49(1):38-48.

28. Menon M, Kaul S, Bhandari A, Shrivastava A, Tewari A, Hemal A. Potency following robotic radical prostatectomy: a questionnaire based analysis of outcomes after conventional nerve sparing and prostatic fascia sparing techniques. J Urol. 2005;174(6):2291-6, discussion 6.

29. Secin FP, Serio A, Bianco FJ, Jr., et al. Preoperative and intraoperative risk factors for side-specific positive surgical margins in laparoscopic radical prostatectomy for prostate cancer. Eur Urol. 2007;51(3):764-71.

30. Nielsen ME, Schaeffer EM, Marschke P, Walsh PC. High anterior release of the levator fascia improves sexual function following open radical retropubic prostatectomy. J Urol. 2008;180(6):2557-64; discussion 64.

31. Menon M, Shrivastava A, Kaul S, et al. Vattikuti Institute prostatectomy: contemporary technique and analysis of results. Eur Urol. 2007;51(3):648-57; discussion 57-8.

32. Kourambas J, Angus DG, Hosking P, Chou ST. A histological study of Denonvilliers’ fascia and its relationship to the neurovascular bundle. Br J Urol. 1998;82(3):408-10.

33. Montorsi F, Salonia A, Suardi N, et al. Improving the preservation of the urethral sphincter and neurovascular bundles during open radical retropubic prostatectomy. Eur Urol. 2005;48(6):938-45.

34. Hong H, Koch MO, Foster RS, et al. Anatomic distribution of periprostatic adipose tissue: a mapping study of 100 radical prostatectomy specimens. Cancer. 2003;97(7):1639-43.

35. Lindsey I, Guy RJ, Warren BF, Mortensen NJ. Anatomy of Denonvilliers’ fascia and pelvic nerves, impotence, and implications for the colorectal surgeon. Br J Surg. 2000;87(10):1288-99.

36. Tobin C, Benjamin J. Anatomical and surgical restudy

of the Denonvilliers' fascia. Surg Gynecol Obstet. 1945;80:373-88.

37. Huland H, Noldus J. An easy and safe approach to separating Denonvilliers' fascia from rectum during radical retropubic prostatectomy. J Urol. 1999;161(5):1533-4.

38. Church JM, Raudkivi PJ, Hill GL. The surgical anatomy of the rectum--a review with particular relevance to the hazards of rectal mobilisation. Int J Colorectal Dis. 1987;2(3):158-66.

39. Silver PH. The role of the peritoneum in the formation of the septum recto-vesicale. J Anat. 1956;90(4):538-46.

40. Villers A, McNeal JE, Freiha FS, Boccon-Gibod L, Stamey TA. Invasion of Denonvilliers' fascia in radical prostatectomy specimens. J Urol. 1993;149(4):793-8.

41. Villers A, Piechaud T. Surgical Anatomy of the Prostate for Radical Prostatectomy. John H W, P, editor. Berlin, Heidelberg: Springer; 2008.

42. van Ophoven A, Roth S. The anatomy and embryological origins of the fascia of Denonvilliers: a medico-historical debate. J Urol. 1997;157(1):3-9.

43. Lepor H, Gregerman M, Crosby R, Mostofi FK, Walsh PC. Precise localization of the autonomic nerves from the pelvic plexus to the corpora cavernosa: a detailed anatomical study of the adult male pelvis. J Urol. 1985;133(2):207-12.

44. McNeal JE. Normal histology of the prostate. Am J Surg Pathol. 1988;12(8):619-33.

45. Kinugasa Y, Murakami G, Uchimoto K, Takenaka A, Yajima T, Sugihara K. Operating behind Denonvilliers' fascia for reliable preservation of urogenital autonomic nerves in total mesorectal excision: a histologic study using cadaveric specimens, including a surgical experiment using fresh cadaveric models. Dis Colon Rectum. 2006;49(7):1024-32.

46. Tewari AK, Srivastava A, Huang MW, et al. Anatomical grades of nerve sparing: a risk-stratified approach to neural-hammock sparing during robot-assisted radical prostatectomy (RARP). BJU Int. 2011;108(6 Pt 2):984-92.

47. Montorsi F, Wilson TG, Rosen RC, et al. Best practices in robot-assisted radical prostatectomy: recommendations of the Pasadena Consensus Panel. Eur Urol. 2012;62(3):368-81.

48. Walz J, Burnett AL, Costello AJ, et al. A critical analysis of the current knowledge of surgical anatomy related to optimization of cancer control and preservation of continence and erection in candidates for radical prostatectomy. Eur Urol. 2010;57(2):179-92.

49. Zorn KC, Gofrit ON, Orvieto MA, Mikhail AA, Zagaja GP, Shalhav AL. Robotic-assisted laparoscopic prostatectomy: functional and pathologic outcomes with interfascial nerve preservation. Eur Urol. 2007;51(3):755-62; discussion 63.

50. Barre C. Open radical retropubic prostatectomy. Eur Urol. 2007;52(1):71-80.

51. Schatloff O, Chauhan S, Sivaraman A, Kameh D, Palmer KJ, Patel VR. Anatomic grading of nerve sparing during robot-assisted radical prostatectomy. Eur Urol. 2012;61(4):796-802.

52. Patel VR, Schatloff O, Chauhan S, et al. The role of the prostatic vasculature as a landmark for nerve sparing during robot-assisted radical prostatectomy. Eur Urol. 2012;61(3):571-6.

53. Walz J, Graefen M, Huland H. Surgical anatomy of the prostate in the era of radical robotic prostatectomy. Curr Opin Urol. 2011;21(3):173-8.

54. Walsh, P.C. & Donker, P.J., 1982. Impotence following radical prostatectomy: insight into etiology and prevention. The Journal of urology, 128(3), pp.492–497.

55. Myers, R.P., 2002. Detrusor apron, associated vascular plexus, and avascular plane: relevance to radical retropubic prostatectomy--anatomic and surgical commentary. Urology, 59(4), pp.472–479.

56. Raychaudhuri, B. & Cahill, D., 2008. Pelvic fasciae in urology. Annals of The Royal College of Surgeons of England, 90(8), pp.633–637.

57. Costello, A.J. et al., 2011. Immunohistochemical study of the cavernous nerves in the periprostatic region. BJU international, 107(8), pp.1210–1215.

58. Paick, J.S., Donatucci, C.F. & Lue, T., 1993. Anatomy of cavernous nerves distal to prostate: microdissection study in adult male cadavers. Urology, 42(2), pp.145–149.

59. Akita, K., Sakamoto, H. & Sato, T., 2003. Origins and courses of the nervous branches to the male urethral sphincter. Surgical and radiologic anatomy : SRA, 25(5-6), pp.387–392.

60. Hollabaugh, R.S., Jr, Dmochowski, R.R. & Steiner, M.S., 1997. Neuroanatomy of the male rhabdosphincter. Urology, 49(3), pp.426–434.

61. Narayan, P. et al., 1995. Neuroanatomy of the External Urethral Sphincter: Implications for Urinary Continence Preservation During Radical Prostate Surgery. The Journal of urology, 153(2), pp.337–341.

62. Song, L.J. et al., 2010. Cadaveric study of nerves supplying the membranous urethra. Neurourology and urodynamics, 29, pp.592–595.

63. Power, N.E. et al., 2011. The dorsal venous complex (DVC): dorsal venous or dorsal vasculature complex? Santorini's plexus revisited. BJU international, 108(6), pp.930–932.

64. Droupy, S. et al., 1999. Assessment of the functional role of accessory pudendal arteries in erection by transrectal color Doppler ultrasound. JURO, 162(6), pp.1987–1991.

65. Breza, J. et al., 1989. Detailed anatomy of penile neurovascular structures: surgical significance. The Journal of urology, 141(2), pp.437–443.

66. Rogers, C.G., Trock, B.P. & Walsh, P.C., 2004. Preservation of accessory pudendal arteries during radical retropubic prostatectomy: surgical technique and results. Urology, 64(1), pp.148–151.

67. Ploussard G, de la Taille A, Moulin M, et al. Comparisons of the perioperative, functional, and oncologic outcomes after robot-assisted versus pure extraperitoneal laparoscopic radical prostatectomy. European urology 2014;65:610-9.

68. Koc G, Tazeh NN, Joudi FN, Winfield HN, Tracy CR, Brown JA. Lower extremity neuropathies after robot-assisted laparoscopic prostatectomy on a split-leg table. Journal of endourology / Endourological Society 2012;26:1026-9.

69. Warner MA, Warner DO, Harper CM, Schroeder DR, Maxson PM. Lower extremity neuropathies associated with lithotomy positions. Anesthesiology 2000;93:938-42.

70. Beck S, Skarecky D, Osann K, Juarez R, Ahlering TE. Transverse versus vertical camera port incision in robotic radical prostatectomy: effect on incisional hernias and cosmesis. Urology 2011;78:586-90.

71. Brown SR, Goodfellow PB. Transverse verses midline incisions for abdominal surgery. The Cochrane database of systematic reviews 2005:CD005199.

72. Walsh PC, Lepor H, Eggleston JC. Radical prostatectomy with preservation of sexual function: anatomical and pathological considerations. The Prostate 1983;4:473-85.

73. Guillonneau B, Vallancien G. Laparoscopic radical prostatectomy: initial experience and preliminary assessment after 65 operations. The Prostate 1999;39:71-5.

74. Tewari A, Menon M. Vattikuti Institute prostatectomy: surgical technique and current results. Current urology reports 2003;4:119-23.

75. Hsiao W, Deveci S, Mulhall JP. Outcomes of the management of post-chemotherapy retroperitoneal lymph node dissection-associated anejaculation. BJU international 2012;110:1196-200.

76. Ahlering TE, Eichel L, Edwards RA, Lee DI, Skarecky DW. Robotic radical prostatectomy: a technique to reduce pT2 positive margins. Urology 2004;64:1224-8.

77. Hansen J, Budaus L, Spethmann J, et al. Assessment of rates of lymph nodes and lymph node metastases in periprostatic fat pads in a consecutive cohort treated with retropubic radical prostatectomy. Urology 2012;80:877-82.

78. Kim IY, Modi PK, Sadimin E, et al. Detailed analysis of patients with metastasis to the prostatic anterior fat pad lymph nodes: a multi-institutional study. The Journal of urology 2013;190:527-34.

79. Finley DS, Deane L, Rodriguez E, et al. Anatomic excision of anterior prostatic fat at radical prostatectomy: implications for pathologic upstaging. Urology 2007;70:1000-3

80. Van Velthoven RF, Ahlering TE, Peltier A, Skarecky DW, Clayman RV. Technique for laparoscopic running urethrovesical anastomosis:the single knot method. Urology 2003;61:699-702.

81. Hu JC, Gu X, Lipsitz SR, et al. Comparative effectiveness of minimally invasive vs open radical prostatectomy. JAMA : the journal of the American Medical Association 2009;302:1557-64.

82. Rocco F, Carmignani L, Acquati P, et al. Restoration of posterior aspect of rhabdosphincter shortens continence time after radical retropubic prostatectomy. The Journal of urology 2006;175:2201-6.

83. Regan TC, Mordkin RM, Constantinople NL, Spence IJ, Dejter SW, Jr. Incidence of inguinal hernias following radical retropubic prostatectomy. Urology 1996;47:536-7.

84. Allaf ME, Palapattu GS, Trock BJ, Carter HB, Walsh PC. Anatomical extent of lymph node dissection: impact on men with clinically localized prostate cancer. The Journal of urology 2004;172:1840-4.

85. Daneshmand S, Quek ML, Stein JP, et al. Prognosis of patients with lymph node positive prostate cancer following radical prostatectomy: long-term results. The Journal of urology 2004;172:2252-5.

86. Messing EM, Manola J, Sarosdy M, Wilding G, Crawford ED, Trump D. Immediate hormonal therapy compared with observation after radical prostatectomy and pelvic lymphadenectomy in men with node-positive prostate cancer. The New England journal of medicine 1999;341:1781-8.

87. Aus G, Nordenskjold K, Robinson D, Rosell J, Varenhorst E. Prognostic factors and survival in node-positive (N1) prostate cancer-a prospective study based on data from a Swedish population-based cohort. European urology 2003;43:627-31.

88. Seiler R, Studer UE, Tschan K, Bader P, Burkhard FC. Removal of Limited Nodal Disease in Patients Undergoing Radical Prostatectomy: Long-Term Results Confirm a Chance for Cure. The Journal of urology 2013.

89. Bader P, Burkhard FC, Markwalder R, Studer UE. Is a limited lymph node dissection an adequate staging procedure for prostate cancer? The Journal of urology 2002;168:514-8; discussion 8.

90. Joslyn SA, Konety BR. Impact of extent of lymphadenectomy on survival after radical prostatectomy for prostate cancer. Urology 2006;68:121-5.

91. Ji J, Yuan H, Wang L, Hou J. Is the impact of the extent of lymphadenectomy in radical prostatectomy related to the disease risk? A single center prospective study. The Journal of surgical research 2012;178:779-84.

92. Yuh B, Artibani W, Heidenreich A, et al. The Role of Robot-assisted Radical Prostatectomy and Pelvic Lymph Node Dissection in the Management of High-risk Prostate Cancer: A Systematic Review. European urology 2014;65:918-27.

93. Musch M, Klevecka V, Roggenbuck U, Kroepfl D. Complications of pelvic lymphadenectomy in 1,380 patients undergoing radical retropubic prostatectomy between 1993 and 2006. The Journal of urology 2008;179:923-8; discussion 8-9.

94. Tollefson MK, Karnes RJ, Rangel L, Carlson R, Boorjian SA. Blood type, lymphadenectomy and blood transfusion predict venous thromboembolic events following radical prostatectomy with pelvic lymphadenectomy. The Journal of urology 2014;191:646-51.

95. Ploussard G, Briganti A, de la Taille A, et al. Pelvic lymph node dissection during robot-assisted radical prostatectomy: efficacy, limitations, and complications-a systematic review of the literature. European urology 2014;65:7-16.

96. Mattei A, Fuechsel FG, Bhatta Dhar N, et al. The template of the primary lymphatic landing sites of the prostate should be revisited: results of a multimodality mapping study. European urology 2008;53:118-25.

97. Capitanio U, Pellucchi F, Gallina A, et al. How can we predict lymphorrhoea and clinically significant lymphocoeles after radical prostatectomy and pelvic lymphadenectomy? Clinical implications. BJU international 2011;107:1095-101.

98. Orvieto MA, Coelho RF, Chauhan S, Palmer KJ, Rocco B, Patel VR. Incidence of lymphoceles after robot-assisted pelvic lymph node dissection. BJU international 2011;108:1185-90.

99. Yuh BE, Ruel NH, Mejia R, Wilson CM, Wilson TG. Robotic extended pelvic lymphadenectomy for intermediate- and high-risk prostate cancer. European urology 2012;61:1004-10.

100. Joniau S, Van den Bergh L, Lerut E, et al. Mapping of Pelvic Lymph Node Metastases in Prostate Cancer. European urology 2012.

101. Bishoff JT, Reyes A, Thompson IM, et al. Pelvic lymphadenectomy can be omitted in selected patients with carcinoma of the prostate: development of a system of patient selection. Urology 1995;45:270-4.

102. Weingartner K, Ramaswamy A, Bittinger A, Gerharz EW, Voge D, Riedmiller H. Anatomical basis for pelvic lymphadenectomy in prostate cancer: results of an autopsy study and implications for the clinic. The Journal of urology 1996;156:1969-71.

103. Sagalovich D, Calaway A, Srivastava A, Sooriakumaran P, Tewari AK. Assessment of required nodal yield in a high risk cohort undergoing extended pelvic lymphadenectomy in robotic-assisted radical prostatectomy and its impact on functional outcomes. BJU international 2012.

104. Joseph JV, Rosenbaum R, Madeb R, et al. Robotic extraperitoneal radical prostatectomy: An alternative approach. J Urol 2006; 175: 945–951.

105. Jacobs BL, Montgomery JS, Weizer AZ, Miller DC, Wood DP, Wolf JS, Zhang Y, Wei JT, Hollenbeck BK, Dunn RL-Comparison of extraperitoneal and intraperitoneal approaches for robotic prostatectomy. Surg Innov 2012; 19:268-74.

106. Mullins JK, Hyndman E, Mettee LZ and Pavlovich CP. Comparison of extraperitoneal and transperitoneal pelvic lymph node dissection during minimally invasive radical prostatectomy. J Endourol 2011; 25: 1883-1887

107. Horstmann M, Vollmer C, Schwab C et al. Single-centre evaluation of the extraperitoneal and transperitoneal approach in robotic-assisted radical prostatectomy. Scand J Urol Nephrol 2012; 46: 117-123.

108. Wyler SF, Sulster T, Seifert HH, Ruszat R, Forster TH, Gasser TC, Bachmann A. Laparoscopic extended pelvic lymph node dissection for high-risk prostate cancer. Urology 2006; 68: 883-887.

109. Stolzenburg J, Wasserscheid J, Rabenalt R, Do M, Schwalenberg T, McNeill A, Constantinides C, Kallidonis P, Ganzer R, Liatsikos E. Reduction in incidence of lymphocele following extraperitoneal radical prostatectomy and pelvic lymph node dissection by bilateral peritoneal fenestration. World J Urol. 2008; 26:581-6

110. Ghazi A, Scosyrev E, Patel H, Messing E, Joseph J. Complications associated with Extraperitoneal robot-assisted radical prostatectomy using the standardized Martin classification. Urology 2013;81:324-333

111. Xylinas E, Durand X, Ploussard G, Campegggi A, Allory Y, Vordos D, Hoznek A, Abbou C, de la Taille A, Salomon L. Evaluation of combined oncologic and functional outcomes after robotic-assisted laparoscopic extraperitoneal radical prostatectomy: Trifecta rate of achieving continence, potency, and cancer control. Urologic Oncology: Seminars and Original Investigations. 2013; 31:99-103

112. Xylinas E, Ploussard G, Durand X, de la taille A. Robot assisted extraperitoneal laparoscopic radical prostatectomy: A review of the current literature. Urologic Oncology: Seminars and Original Investigations. 2013; 31:288-293

113. Boczko J, Madeb R, Golijanin D, Erturk E, Mathe M, Patel HR, Joseph JV. Robot-assisted radical prostatectomy in obese patients. Can J Urol. 2006; 13:3169-73.

114. Boczko J, Joseph JV.Robot-assisted extraperitoneal radical prostatectomy in a patient with a pelvic kidney. Urology. 2006; 68:1122.e3-4.

115. Novara G, De Marco V, Aragona M, et al. Early postoperative complications and 3-monthmortality after radical cystectomyfor transitional cell carcinoma of the bladder. J Urol 2009;182:914–21.

116. Agarwal PK, Sammon J, Bhandari A et al. Safety Profile of Robot-Assisted Radical Prostatectomy: A Standardized Report of Complications in 3317 Patients. Eur Urol 2011; 59: 684 – 698.

117. Coelho RF, Palmer KJ, Rocco B, et al. Early complication rates in a single-surgeon series of 2500 robotic-assisted radical prostatectomies: report applying a standardized grading system. Eur Urol 2010;57:945–52.

118. Stolzenburg J,Rabenalt R, Do M et al. Endoscopic Extraperitoneal Radical Prostatectomy: The University of Leipzig Experience of 2000 Cases. J Endourol 2008;22: 2319–2325.

119. Rabbani F, Yunis LH, Pinochet R, et al. Comprehensive standardized report of complications of retropubic and laparoscopic radical prostatectomy. Eur Urol 2010;57:371–86.

120. Loppenberg B, Noldus J, Holz A, Palisaar RJ. Reporting complications after open radical retropubic prostatectomy using the Martin criteria. J Urol 2010;184:944–8.

121. Constantinides CA, Tyritzis SI, Skolarikos A, Liatsikos E, Zervas A, Deliveliotis C. Short- and long-term complications of open radical prostatectomy according to the Clavien classification system. BJU Int 2008;103:336–40.

122. Rassweiler J, Wagner AA, Moazin M, Goezen AS, Teber D, Frede T, Su L-M. Anatomic nerve-sparing laparoscopic radical prostatectomy: Comparison of retrograde and antegrade techniques. Urology 2006;68:587-592

123. Erdogru T, Teber D, Frede T, Marrero R, Hammady A, Seemann O, Rassweiler J. Comparison of transperitoneal and extreperitoneal laparoscopic radical prostatectomy using match pair analysis. Eur Urol 2004;46:312-320

124. Hruza M, Weiß, HO, Pini G, Goezen AS, Schulze M, Teber D, Rassweiler JJ. Complications in 2200 consecutive laparoscopic radical prostatectomies: Standardized evaluation and analysis of learning curves. Eur Urol 2010;58:733-741

125. Ko YH, Coelho RF, Sivaraman A, Schatloff O, Chauhan S, Abdul-Muhsin HM, Valero Carrion RJ, Palmer KJ, Cheon J, Patel VR. Retrograde versus antegrade nerve sparing during robot-assisted radical prostatectomy: Which is better for achieving early functional recovery? Eur Urol 2013;63:169-177

126. Takenaka A, Tewari AK, Leung RA, Bigelow K, El-Tabey N, Murakami G, Fujisawa M. Preservation of the puboprostatic collar and puboperineoplasty for early recovery of urinary continence after robotic prostatectomy: anatomic basis and preliminary outcomes. Eur Urol 2007;51:433-440

127. Ficarra V, Novara G, Artibani W, Cestari A, Galfano A, Graefen M, et al. Retropubic, laparoscopic, and robot-assisted radical prostatectomy: a systematic review and cumulative analysis of comparative studies. Eur Urol. 2009;55:1037-63.

128. Bauer RM, Bastian PJ, Gozzi C, Stief CG. Postprostatectomy incontinence: all about diagnosis and management. Eur Urol. 2009;55:322-33.

129. Ficarra V, Novara G, Rosen RC, Artibani W, Carroll PR, Costello A, et al. Systematic review and meta-analysis of studies reporting urinary continence recovery after robot-assisted radical prostatectomy. Eur Urol. 2012;62:405-17.

130. Jeong SJ, Yeon JS, Lee JK, Cha WH, Jeong JW, Lee BK, et al. Development and validation of nomograms to predict the recovery of urinary continence after radical prostatectomy: comparisons between immediate, early, and late continence. World J Urol. 2014;32:437-44.

131. Sammon JD, Sharma P, Trinh QD, Ghani KR, Sukumar S, Menon M. Predictors of immediate continence following robot-assisted radical prostatectomy. Journal of Endourology. 2013;27:442-6.

132. Kojima Y, Takahashi N, Haga N, Nomiya M, Yanagida T, Ishibashi K, et al. Urinary incontinence after robot-assisted radical prostatectomy: pathophysiology and intraoperative techniques to improve surgical outcome. Int J Urol. 2013;20:1052-63.

133. Chung BI, Sommer G, Brooks JD. Anatomy of the lower urinary tract and male genitalia. In: Wein AJ, Kavoussi LR, Novick AC, Partin AW, Peters CA, editors. Campbell-Walsh Urology. 10th ed. Philadelphia: Elsevier; 2012. p. 33-70.

134. Piechaud T, Annino F. Bladder neck dissection during robotic-assisted laparoscopic radical prostatectomy. In: John H, Wiklund P, editors. Robotic Urology. 1 ed. Berlin: Springer-Verlag; 2008. p. 51-63.

135. Brunocilla E, Pultrone C, Pernetti R, Schiavina R, Martorana G. Preservation of the smooth muscular internal (vesical) sphincter and of the proximal urethra during retropubic radical prostatectomy: description of the technique. Int J Urol. 2012;19:783-5.

136. Kirschner-Hermanns R, Najjari L, Brehmer B, Blum R, Zeuch V, Maass N, et al. Two- and three-/four dimensional perineal ultrasonography in men with urinary incontinence after radical prostatectomy. BJU Int. 2012;109:46-51.

137. Steiner MS, Burnett AL, Brooks JD, Brendler CB, Stutzman RE, Carter HB. Tubularized neourethra following radical retropubic prostatectomy. J Urol. 1993;150:407-9.

138. Connolly JA, Presti JC, Jr., Carroll PR. Anterior bladder neck tube reconstruction at radical prostatectomy pre-

serves functional urethral length--a comparative urodynamic study. Br J Urol. 1995;75:766-70.

139. Lee J, Hersey K, Lee CT, Fleshner N. Climacturia following radical prostatectomy: prevalence and risk factors. J Urol. 2006;176:2562-5.

140. Manassero F, Di Paola G, Paperini D, Mogorovich A, Pistolesi D, Valent F, et al. Orgasm-associated incontinence (climacturia) after bladder neck-sparing radical prostatectomy: clinical and video-urodynamic evaluation. J Sex Med. 2012;9:2150-6.

141. Frey AU, Sonksen J, Fode M. Neglected side effects after radical prostatectomy: a systematic review. J Sex Med. 2014;11:374-85.

142. Tyritzis SI, Katafigiotis I, Constantinides CA. All you need to know about urethrovesical anastomotic urinary leakage following radical prostatectomy. J Urol. 2012;188:369-76.

143. Kawamoto S, Allaf M, Corl FM, Feng T, Yohannan J, Fishman EK. Anastomotic leak after robot-assisted laparoscopic radical prostatectomy: evaluation with MDCT cystography with multiplanar reformatting and 3D display. AJR Am J Roentgenol. 2012;199:W595-601.

144. Breyer BN, Davis CB, Cowan JE, Kane CJ, Carroll PR. Incidence of bladder neck contracture after robot-assisted laparoscopic and open radical prostatectomy. BJU Int. 2010;106:1734-8.

145. Webb DR, Sethi K, Gee K. An analysis of the causes of bladder neck contracture after open and robot-assisted laparoscopic radical prostatectomy. BJU Int. 2009;103:957-63.

146. Gnanapragasam VJ, Baker P, Naisby GP, Chadwick D. Identification and validation of risk factors for vesicourethral leaks following radical retropubic prostatectomy. Int J Urol. 2005;12:948-52.

147. Novara G, Ficarra V, Rosen RC, Artibani W, Costello A, Eastham JA, et al. Systematic review and meta-analysis of perioperative outcomes and complications after robot-assisted radical prostatectomy. Eur Urol. 2012;62:431-52.

148. Mochtar CA, Kauer PC, Laguna MP, de la Rosette JJ. Urinary leakage after laparoscopic radical prostatectomy: a systematic review. J Endourol. 2007;21:1371-9.

149. Patil N, Krane L, Javed K, Williams T, Bhandari M, Menon M. Evaluating and grading cystographic leakage: correlation with clinical outcomes in patients undergoing robotic prostatectomy. BJU Int. 2009;103:1108-10.

150. Rebuck DA, Haywood S, McDermott K, Perry KT, Nadler RB. What is the long-term relevance of clinically detected postoperative anastomotic urine leakage after robotic-assisted laparoscopic prostatectomy? BJU Int. 2011;108:733-8.

151. Hanson GR, Odom E, Borden LS, Jr., Neil N, Corman JM. Post-operative drain output as a predictor of bladder neck contracture following radical prostatectomy. International Urology & Nephrology. 2008;40:351-4

152. Salonia A, Burnett AL, Graefen M, Hatzimouratidis K, Montorsi F, Mulhall JP, et al. Prevention and management of postprostatectomy sexual dysfunctions part 2: recovery and preservation of erectile function, sexual desire, and orgasmic function. Eur Urol. 2012;62:273-86.

153. Mensink HJ. Orgasm after radical prostatectomy. Br J Urol. 1996;77:861-4.

154. Abouassaly R, Lane BR, Lakin MM, Klein EA, Gill IS. Ejaculatory urine incontinence after radical prostatectomy. Urology. 2006;68:1248-52.

155. Choi JM, Nelson CJ, Stasi J, Mulhall JP. Orgasm associated incontinence (climacturia) following radical pelvic surgery: rates of occurrence and predictors. J Urol. 2007;177:2223-6.

156. El Douaihy Y, Tan GY, Dorsey PJ, Jhaveri JK, Tewari AK. Double-pigtail stenting of the ureters: technique for securing the ureteral orifices during robot-assisted radical prostatectomy for large median lobes. J Endourol. 2009;23:1975-7.

157. Rehman J, Chughtai B, Guru K, Shabsigh R, Samadi DB. Management of an enlarged median lobe with ureteral orifices at the margin of bladder neck during robotic-assisted laparoscopic prostatectomy. Can J Urol. 2009;16:4490-4.

158. Meeks JJ, Zhao L, Greco KA, Macejko A, Nadler RB. Impact of prostate median lobe anatomy on robotic-assisted laparoscopic prostatectomy. Urology. 2009;73:323-7.

159. Abreu AL, Chopra S, Berger AK, Leslie S, Desai MM, Gill IS, et al. Management of large median and lateral intravesical lobes during robot-assisted radical prostatectomy. J Endourol. 2013;27:1389-92.

160. Huang AC, Kowalczyk KJ, Hevelone ND, Lipsitz SR, Yu HY, Plaster BA, et al. The impact of prostate size, median lobe, and prior benign prostatic hyperplasia intervention on robot-assisted laparoscopic prostatectomy: technique and outcomes. Eur Urol. 2011;59:595-603.

161. Albayrak S, Canguven O, Aydemir H, Goktas C, Cetinel C, Akca O. Endoscope-assisted radical perineal prostatectomy. J Endourol. 2010;24:527-30.

162. Menard J, de la Taille A, Hoznek A, Allory Y, Vordos D, Yiou R, et al. Laparoscopic radical prostatectomy after transurethral resection of the prostate: surgical and functional outcomes. Urology. 2008;72:593-7.

163. Martinschek A, Heinzelmann K, Ritter M, Heinrich E, Trojan L. Radical prostatectomy after previous transurethral resection of the prostate: robot-assisted laparoscopic versus open radical prostatectomy in a matched-pair analysis. J Endourol. 2012;26:1136-41.

164. Zugor V, Labanaris AP, Porres D, Witt JH. Surgical, oncologic, and short-term functional outcomes in patients undergoing robot-assisted prostatectomy after previous transurethral resection of the prostate. J Endourol. 2012;26:515-9.

165. Patel SR, Kaplon DM, Jarrard D. A technique for the management of a large median lobe in robot-assisted laparoscopic radical prostatectomy. J Endourol. 2010;24:1899-901.

166. Link BA, Nelson R, Josephson DY, Yoshida JS, Crocitto LE, Kawachi MH, et al. The impact of prostate gland weight in robot assisted laparoscopic radical prostatectomy. J Urol. 2008;180:928-32.

167. Labanaris AP, Zugor V, Witt JH. Robot-assisted radical prostatectomy in patients with a pathologic prostate specimen weight >/=100 grams versus </=50 grams: surgical, oncologic and short-term functional outcomes. Urol Int. 2013;90:24-30.

168. Chan RC, Barocas DA, Chang SS, Herrell SD, Clark PE, Baumgartner R, et al. Effect of a large prostate gland on open and robotically assisted laparoscopic radical prostatectomy. BJU Int. 2008;101:1140-4.

169. Jaffe J, Stakhovsky O, Cathelineau X, Barret E, Vallancien G, Rozet F. Surgical outcomes for men undergoing laparoscopic radical prostatectomy after transurethral resection of the prostate. J Urol. 2007;178:483-7.

170. Hampton L, Nelson RA, Satterthwaite R, Wilson T, Crocitto L. Patients with prior TURP undergoing robot-assisted laparoscopic radical prostatectomy have higher positive surgical margin rates. J Robotic Surg 2008;2:213-6.

171. Gacci M, Simonato A, Lanciotti M, Ennas M, Varca V,

Maffezzini M, et al. The impact of prior TURP on radical prostatectomy surgical margins: a multicenter analysis. Urol Int. 2013;91:62-8.

172. Gillitzer R, Thomas C, Wiesner C, Jones J, Schmidt F, Hampel C, et al. Single center comparison of anastomotic strictures after radical perineal and radical retropubic prostatectomy. Urology. 2010;76:417-22.

173. Mebust WK, Holtgrewe HL, Cockett AT, Peters PC. Transurethral prostatectomy: immediate and postoperative complications. a cooperative study of 13 participating institutions evaluating 3,885 patients. 1989. J Urol. 2002;167:999-1003.

174. Seaman EK, Benson MC. Improved continence with tubularized bladder neck reconstruction following radical retropubic prostatectomy. Urology. 1996;47:532-5.

175. Schoeppler GM, Zaak D, Clevert DA, Schuhmann P, Reich O, Seitz M, et al. The impact of bladder neck mucosal eversion during open radical prostatectomy on bladder neck stricture and urinary extravasation. International Urology & Nephrology. 2012;44:1403-10.

176. Srougi M, Paranhos M, Leite KM, Dall'Oglio M, Nesrallah L. The influence of bladder neck mucosal eversion and early urinary extravasation on patient outcome after radical retropubic prostatectomy: a prospective controlled trial. BJU Int. 2005;95:757-60.

177. Walsh PC, Marschke PL. Intussusception of the reconstructed bladder neck leads to earlier continence after radical prostatectomy. Urology. 2002;59:934-8.

178. Wille S, Varga Z, von Knobloch R, Hofmann R. Intussusception of bladder neck improves early continence after radical prostatectomy: results of a prospective trial. Urology. 2005;65:524-7.

179. Sakai I, Harada K, Hara I, Eto H, Miyake H. Intussusception of the bladder neck does not promote early restoration to urinary continence after non-nerve-sparing radical retropubic prostatectomy. Int J Urol. 2005;12:275-9.

180. Poon M, Ruckle H, Bamshad BR, Tsai C, Webster R, Lui P. Radical retropubic prostatectomy: bladder neck preservation versus reconstruction. J Urol. 2000;163:194-8.

181. Lin VC, Coughlin G, Savamedi S, Palmer KJ, Coelho RF, Patel VR. Modified transverse plication for bladder neck reconstruction during robotic-assisted laparoscopic prostatectomy. BJU Int. 2009;104:878-81.

182. Lee DI, Wedmid A, Mendoza P, Sharma S, Walicki M, Hastings R, et al. Bladder neck plication stitch: a novel technique during robot-assisted radical prostatectomy to improve recovery of urinary continence. J Endourol. 2011;25:1873-7.

183. Malizia AA, Banks DW, Newton NE, Walton GR, Walton KN. Modified radical retropubic prostatectomy: double continence technique [abstract 585]. J Urol. 1989;141:316A.

184. Gomez CA, Soloway MS, Civantos F, Hachiya T. Bladder neck preservation and its impact on positive surgical margins during radical prostatectomy. Urology. 1993;42:689-93; discussion 93-4.

185. Shelfo SW, Obek C, Soloway MS. Update on bladder neck preservation during radical retropubic prostatectomy: impact on pathologic outcome, anastomotic strictures, and continence. Urology. 1998;51:73-8.

186. Selli C, De Antoni P, Moro U, Macchiarella A, Giannarini G, Crisci A. Role of bladder neck preservation in urinary continence following radical retropubic prostatectomy. Scandinavian Journal of Urology & Nephrology. 2004;38:32-7.

187. Nyarangi-Dix JN, Radtke JP, Hadaschik B, Pahernik S, Hohenfellner M. Impact of complete bladder neck preservation on urinary continence, quality of life and surgical margins after radical prostatectomy: a randomized, controlled, single blind trial. J Urol. 2013;189:891-8.

188. Brunocilla E, Schiavina R, Pultrone CV, Borghesi M, Rossi M, Cevenini M, et al. Preservation of the smooth muscular internal (vesical) sphincter and of the proximal urethra for the early recovery of urinary continence after retropubic radical prostatectomy: a prospective case-control study. Int J Urol. 2014;21:157-62.

189. Gaker DL, Steel BL. Radical prostatectomy with preservation of urinary continence: pathology and long-term results. J Urol. 2004;172:2549-52.

190. Deliveliotis C, Protogerou V, Alargof E, Varkarakis J. Radical prostatectomy: bladder neck preservation and puboprostatic ligament sparing--effects on continence and positive margins. Urology. 2002;60:855-8.

191. Grasso M, Torelli F, Lania C, Blanco S. The role of bladder neck preservation during radical prostatectomy: clinical and urodynamic study. Archivio Italiano di Urologia, &rologia. 2012;84:1-6.

192. Chlosta PL, Drewa T, Jaskulski J, Dobruch J, Varkarakis J, Borowka A. Bladder neck preservation during classic laparoscopic radical prostatectomy - point of technique and preliminary results. Wideochir Inne Tech Malo Inwazyjne. 2012;7:89-95.

193. Stolzenburg JU, Kallidonis P, Hicks J, Do M, Dietel A, Sakellaropoulos G, et al. Effect of bladder neck preservation during endoscopic extraperitoneal radical prostatectomy on urinary continence. Urol Int. 2010;85:135-8.

194. Lou J, Jin B, Liu F, Zhang Y, Zhang Q, Zhang D. [Urinary continence in laparoscopic radical prostatectomy with bladder neck preservation]. Zhejiang Da Xue Xue Bao Yi Xue Ban. 2013;42:680-4.

195. Thiel DD, Francis P, Heckman MG, Winfield HN. Prospective evaluation of factors affecting operating time in a residency/fellowship training program incorporating robot-assisted laparoscopic prostatectomy. J Endourol. 2008;22:1331-8.

196. Tewari AK, Rao SR. Anatomical foundations and surgical manoeuvres for precise identification of the prostatovesical junction during robotic radical prostatectomy. BJU Int. 2006;98:833-7.

197. Choi WW, Freire MP, Soukup JR, Yin L, Lipsitz SR, Carvas F, et al. Nerve-sparing technique and urinary control after robot-assisted laparoscopic prostatectomy. World J Urol. 2011;29:21-7.

198. Freire MP, Weinberg AC, Lei Y, Soukup JR, Lipsitz SR, Prasad SM, et al. Anatomic bladder neck preservation during robotic-assisted laparoscopic radical prostatectomy: description of technique and outcomes. Eur Urol. 2009;56:972-80.

199. Lee Z, Sehgal SS, Graves RV, Su YK, Llukani E, Monahan K, et al. Functional and oncologic outcomes of graded bladder neck preservation during robot-assisted radical prostatectomy. J Endourol. 2014;28:48-55.

200. Friedlander DF, Alemozaffar M, Hevelone ND, Lipsitz SR, Hu JC. Stepwise description and outcomes of bladder neck sparing during robot-assisted laparoscopic radical prostatectomy. J Urol. 2012;188:1754-60.

201. Mattei A, Naspro R, Annino F, Burke D, Guida R, Jr., Gaston R. Tension and energy-free robotic-assisted laparoscopic radical prostatectomy with interfascial dissection of the neurovascular bundles. Eur Urol. 2007;52:687-94.

202. Asimakopoulos AD, Mugnier C, Hoepffner JL, Piechaud T, Gaston R. Bladder neck preservation during minimally invasive radical prostatectomy: a standardised technique using a lateral approach. BJU Int. 2012;110:1566-71.

203. Asimakopoulos AD, Annino F, D'Orazio A, Pereira CF,

Mugnier C, Hoepffner JL, et al. Complete periprostatic anatomy preservation during robot-assisted laparoscopic radical prostatectomy (RALP): the new pubovesical complex-sparing technique. Eur Urol. 2010;58:407-17.

204. You YC, Kim TH, Sung GT. Effect of bladder neck preservation and posterior urethral reconstruction during robot-assisted laparoscopic radical prostatectomy for urinary continence. Korean J Urol. 2012;53:29-33.

205. Lowe BA. Comparison of bladder neck preservation to bladder neck resection in maintaining postrostatectomy urinary continence. Urology. 1996;48:889-93.

206. Soloway MS, Neulander E. Bladder-neck preservation during radical retropubic prostatectomy. Semin Urol Oncol. 2000;18:51-6.

207. Braslis KG, Petsch M, Lim A, Civantos F, Soloway MS. Bladder neck preservation following radical prostatectomy: continence and margins. Eur Urol. 1995;28:202-8.

208. Bianco FJ, Grignon DJ, Sakr WA, Shekarriz B, Upadhyay J, Dornelles E, et al. Radical prostatectomy with bladder neck preservation: impact of a positive margin. Eur Urol. 2003;43:461-6.

209. Srougi M, Nesrallah LJ, Kauffmann JR, Nesrallah A, Leite KR. Urinary continence and pathological outcome after bladder neck preservation during radical retropubic prostatectomy: a randomized prospective trial. J Urol. 2001;165:815-8.

210. Marcovich R, Wojno KJ, Wei JT, Rubin MA, Montie JE, Sanda MG. Bladder neck-sparing modification of radical prostatectomy adversely affects surgical margins in pathologic T3a prostate cancer. Urology. 2000;55:904-8.

211. Araki M, Jeong W, Park SY, Lee YH, Nasu Y, Kumon H, et al. Robot-assisted radical prostatectomy: modified ultradissection reduces pT2 positive surgical margins on the bladder neck. Acta Med Okayama. 2014;68:35-41.

212. Meeks JJ, Eastham JA. Radical prostatectomy: positive surgical margins matter. Urol Oncol. 2013;31:974-9.

213. American Joint Commission on Cancer. Urinary bladder. In: Edge SB, Byrd DR, Compton CC, Fritz AG, Greene FL, Trotti A, editors. AJCC Cancer Staging Manual. 7th ed. New York: Springer; 2010. p. 497-505.

214. Pierorazio PM, Epstein JI, Humphreys E, Han M, Walsh PC, Partin AW. The significance of a positive bladder neck margin after radical prostatectomy: the American Joint Committee on Cancer Pathological Stage T4 designation is not warranted. J Urol. 2010;183:151-7.

215. Ploussard G, Rotondo S, Salomon L. The prognostic significance of bladder neck invasion in prostate cancer: is microscopic involvement truly a T4 disease? BJU Int. 2010;105:776-81.

216. Aydin H, Tsuzuki T, Hernandez D, Walsh PC, Partin AW, Epstein JI. Positive proximal (bladder neck) margin at radical prostatectomy confers greater risk of biochemical progression. Urology. 2004;64:551-5.

217. Poulos CK, Koch MO, Eble JN, Daggy JK, Cheng L. Bladder neck invasion is an independent predictor of prostate-specific antigen recurrence. Cancer. 2004;101:1563-8.

218. Zhou M, Reuther AM, Levin HS, Falzarano SM, Kodjoe E, Myles J, et al. Microscopic bladder neck involvement by prostate carcinoma in radical prostatectomy specimens is not a significant independent prognostic factor. Mod Pathol. 2009;22:385-92.

219. Pfitzenmaier J, Pahernik S, Tremmel T, Haferkamp A, Buse S, Hohenfellner M. Positive surgical margins after radical prostatectomy: do they have an impact on biochemical or clinical progression? BJU Int. 2008;102:1413-8.

220. Loeb S, Epstein JI, Ross AE, Schultz L, Humphreys EB, Jarow JP. Benign prostate glands at the bladder neck margin in robotic vs open radical prostatectomy. BJU Int. 2010;105:1446-9.

221. Lepor H, Chan S, Melamed J. The role of bladder neck biopsy in men undergoing radical retropubic prostatectomy with preservation of the bladder neck. J Urol. 1998;160:2435-9.

222. Kohl SK, Balaji KC, Smith LM, Wilson NP, Johansson SL, Sterrett SP, et al. Clinical significance of benign glands at surgical margins in robotic radical prostatectomy specimens. Urology. 2007;69:1112-6.

223. Kernek KM, Koch MO, Daggy JK, Juliar BE, Cheng L. The presence of benign prostatic glandular tissue at surgical margins does not predict PSA recurrence. J Clin Pathol. 2005;58:725-8.

224. Soloway MS, Neulander E. Bladder-neck preservation during radical retropubic prostatectomy. Semin Urol Oncol. 2000;18:51-6.

225. Stolzenburg JU, Rabenalt R, Do M, Horn LC, Liatsikos EN. Modular training for residents with no prior experience with open pelvic surgery in endoscopic extraperitoneal radical prostatectomy. Eur Urol. 2006;49(3):491-8; discussion 9-500. Epub 2005/12/20.

226. Myers RP, Cheville JC, Pawlina W. Making anatomic terminology of the prostate and contiguous structures clinically useful: historical review and suggestions for revision in the 21st century. Clin Anat. 2010;23(1):18-29.

227. Oelrich TM. The urethral sphincter muscle in the male. Am J Anat. 1980;158(2):229-46.

228. Myers RP, Cahill DR, Devine RM, King BF. Anatomy of radical prostatectomy as defined by magnetic resonance imaging. J Urol. 1998;159(6):2148-58.

229. Lee SE, Byun SS, Lee HJ, et al. Impact of variations in prostatic apex shape on early recovery of urinary continence after radical retropubic prostatectomy. Urology. 2006;68(1):137-41.

230. Beyer B, Schlomm T, Tennstedt P, et al. A Feasible and Time-efficient Adaptation of NeuroSAFE for da Vinci Robot-assisted Radical Prostatectomy. Eur Urol. 2013. Epub 2014/01/15.

231. Cristini C, Di Pierro GB, Leonardo C, De Nunzio C, Franco G. Safe digital isolation of the santorini plexus during radical retropubic prostatectomy. BMC urology. 2013;13:13. Epub 2013/03/01.

232. Tufek I, Argun B, Atug F, et al. The use of a laparoscopic bulldog clamp to control the dorsal vein complex during robot-assisted radical prostatectomy: a novel technique. J Endourol. 2013;27(1):29-33. Epub 2012/07/14.

233. Tewari AK, Srivastava A, Mudaliar K, et al. Anatomical retro-apical technique of synchronous (posterior and anterior) urethral transection: a novel approach for ameliorating apical margin positivity during robotic radical prostatectomy. BJU Int. 2010;106(9):1364-73. Epub 2010/04/10.

234. Buckley BS, Lapitan MC, Glazener CM. The effect of urinary incontinence on health utility and health-related quality of life in men following prostate surgery. Neurourol Urodyn. 2012;31(4):465-9. Epub 2012/03/08.

235. Schlomm T, Tennstedt P, Huxhold C, et al. Neurovascular structure-adjacent frozen-section examination (NeuroSAFE) increases nerve-sparing frequency and reduces positive surgical margins in open and robot-assisted laparoscopic radical prostatectomy: experience after 11,069 consecutive patients. European urology. 2012;62(2):333-40.

236. Boorjian SA, Eastham JA, Graefen M, et al. A critical analysis of the long-term impact of radical prostatec-

tomy on cancer control and function outcomes. Eur Urol. 2012;61(4):664-75.

237. Mauermann J, Fradet V, Lacombe L, et al. The impact of solitary and multiple positive surgical margins on hard clinical end points in 1712 adjuvant treatment-naive pT2-4 N0 radical prostatectomy patients. Eur Urol. 2013;64(1):19-25.

238. Wright JL, Dalkin BL, True LD, et al. Positive surgical margins at radical prostatectomy predict prostate cancer specific mortality. J Urol. 2010;183(6):2213-8. Epub 2010/04/20.

239. Hong YM, Hu JC, Paciorek AT, Knight SJ, Carroll PR. Impact of radical prostatectomy positive surgical margins on fear of cancer recurrence: results from CaPSURE. Urol Oncol. 2010;28(3):268-73. Epub 2008/10/14.

240. Barocas DA, Han M, Epstein JI, et al. Does capsular incision at radical retropubic prostatectomy affect disease-free survival in otherwise organ-confined prostate cancer? Urology. 2001;58(5):746-51. Epub 2001/11/17.

241. Chuang AY, Epstein JI. Positive surgical margins in areas of capsular incision in otherwise organ-confined disease at radical prostatectomy: histologic features and pitfalls. Am J Surg Pathol. 2008;32(8):1201-6. Epub 2008/06/27.

242. Secin FP, Savage C, Abbou C, et al. The learning curve for laparoscopic radical prostatectomy: an international multicenter study. J Urol. 2010;184(6):2291-6. Epub 2010/10/19.

243. Sooriakumaran P, John M, Wiklund P, Lee D, Nilsson A, Tewari AK. Learning curve for robotic assisted laparoscopic prostatectomy: a multi-institutional study of 3794 patients. Minerva urologica e nefrologica = The Italian journal of urology and nephrology. 2011;63(3):191-8. Epub 2011/10/14.

244. Zhao HX, Xia CX, Yin HX, Guo N, Zhu Q. The value and limitations of contrast-enhanced transrectal ultrasonography for the detection of prostate cancer. European journal of radiology. 2013;82(11):e641-7. Epub 2013/08/07.

245. de Rooij M, Hamoen EH, Futterer JJ, Barentsz JO, Rovers MM. Accuracy of multiparametric MRI for prostate cancer detection: a meta-analysis. AJR Am J Roentgenol. 2014;202(2):343-51.

246. Mozer P, Roupret M, Le Cossec C, et al. First round of targeted biopsies with magnetic resonance imaging/ultrasound-fusion images compared to conventional ultrasound-guided trans-rectal biopsies for the diagnosis of localised prostate cancer. BJU Int. 2014. Epub 2014/02/21.

247. Preston MA, Harisinghani MG, Mucci L, Witiuk K, Breau RH. Diagnostic tests in urology: magnetic resonance imaging (MRI) for the staging of prostate cancer. BJU Int. 2013;111(3):514-7. Epub 2013/01/17.

248. Behbahani TE, Ellinger J, Caratozzolo DG, Muller SC. Pathological outcomes of men eligible for active surveillance after undergoing radical prostatectomy: are results predictable? Clinical genitourinary cancer. 2012;10(1):32-6. Epub 2011/11/23.

249. Kang DI, Jang TL, Jeong J, et al. Pathological findings following radical prostatectomy in patients who are candidates for active surveillance: impact of varying PSA levels. Asian J Androl. 2011;13(6):838-41. Epub 2011/07/26.

250. Smaldone MC, Cowan JE, Carroll PR, Davies BJ. Eligibility for active surveillance and pathological outcomes for men undergoing radical prostatectomy in a large, community based cohort. J Urol. 2010;183(1):138-43. Epub 2009/11/17.

251. von Bodman C, Brock M, Roghmann F, et al. Intraoperative frozen section of the prostate decreases positive margin rate while ensuring nerve sparing procedure during radical prostatectomy. J Urol. 2013;190(2):515-20.

252. Wong LM, Neal DE, Johnston RB, et al. International multicentre study examining selection criteria for active surveillance in men undergoing radical prostatectomy. British journal of cancer. 2012;107(9):1467-73. Epub 2012/10/06.

253. Ramirez-Backhaus M, Rabenalt R, Jain S, et al. Value of frozen section biopsies during radical prostatectomy: significance of the histological results. World J Urol. 2009;27(2):227-34.

254. Dillenburg W, Poulakis V, Witzsch U, et al. Laparoscopic radical prostatectomy: the value of intraoperative frozen sections. Eur Urol. 2005;48(4):614-21.

255. Kakiuchi Y, Choy B, Gordetsky J, et al. Role of frozen section analysis of surgical margins during robot-assisted laparoscopic radical prostatectomy: a 2608-case experience. Hum Pathol. 2013;44(8):1556-62.

256. Eichelberg C, Erbersdobler A, Haese A, et al. Frozen section for the management of intraoperatively detected palpable tumor lesions during nerve-sparing scheduled radical prostatectomy. Eur Urol. 2006;49(6):1011-6; discussion 6-8.

257. Yossepowitch O, Briganti A, Eastham JA, et al. Positive surgical margins after radical prostatectomy: a systematic review and contemporary update. Eur Urol. 2014;65(2):303-13. Epub 2013/08/13.

258. Bolla M, van Poppel H, Tombal B, et al. Postoperative radiotherapy after radical prostatectomy for high-risk prostate cancer: long-term results of a randomised controlled trial (EORTC trial 22911). Lancet. 2012;380(9858):2018-27. Epub 2012/10/23.

259. Thompson IM, Jr., Tangen CM, Paradelo J, et al. Adjuvant radiotherapy for pathologically advanced prostate cancer: a randomized clinical trial. Jama. 2006;296(19):2329-35.

260. Wiegel T, Bottke D, Steiner U, et al. Phase III postoperative adjuvant radiotherapy after radical prostatectomy compared with radical prostatectomy alone in pT3 prostate cancer with postoperative undetectable prostate-specific antigen: ARO 96-02/AUO AP 09/95. J Clin Oncol. 2009;27(18):2924-30.

261. Wiegel T, Bartkowiak D, Bottke D, et al. Adjuvant Radiotherapy Versus Wait-and-See After Radical Prostatectomy: 10-year Follow-up of the ARO 96-02/AUO AP 09/95 Trial. Eur Urol. 2014. Epub 2014/04/01.

262. Spahn M, Joniau S. Positive surgical margin at radical prostatectomy: futile or surgeon-dependent predictor of prostate cancer death? Eur Urol. 2013;64(1):26-8. Epub 2012/09/25.

263. Eggener SE, Scardino PT, Walsh PC, et al. Predicting 15-year prostate cancer specific mortality after radical prostatectomy. J Urol. 2011;185(3):869-75.

264. Emerson RE, Koch MO, Jones TD, Daggy JK, Juliar BE, Cheng L. The influence of extent of surgical margin positivity on prostate specific antigen recurrence. J Clin Pathol. 2005;58(10):1028-32.

265. Suardi N, Gallina A, Lista G, et al. Impact of adjuvant radiation therapy on urinary continence recovery after radical prostatectomy. Eur Urol. 2014;65(3):546-51. Epub 2013/02/19.

266. Briganti A, Wiegel T, Joniau S, et al. Early salvage radiation therapy does not compromise cancer control in patients with pT3N0 prostate cancer after radical prostatectomy: results of a match-controlled multi-institutional analysis. Eur Urol. 2012;62(3):472-87. Epub 2012/05/29.

267. Stephenson AJ, Scardino PT, Kattan MW, et al. Predicting the outcome of salvage radiation therapy for recurrent prostate cancer after radical prostatectomy. J Clin Oncol. 2007;25(15):2035-41

268. Stanford JL, Feng Z, Hamilton AS, et al. Urinary and sex-

ual function after radical prostatectomy for clinically localized prostate cancer: The prostate cancer outcomes study. JAMA. 2000;283:354-60.

269. Sanda MG, Dunn RL, Michalski J, Sandler HM, Northouse L, Hembroff L, et al. Quality of Life and Satisfaction with Outcome among Prostate-Cancer Survivors. New England Journal of Medicine. 2008;358:1250-61.

270. Magheli A, Burnett AL. Erectile dysfunction following prostatectomy: prevention and treatment. Nature Reviews Urology. 2009;6:415-27.

271. Menon M, Tewari A, Peabody J. Vattikuti Institute prostatectomy: technique. The Journal of urology. 2003;169:2289-92.

272. Tewari A, Takenaka A, Mtui E, Horninger W, Peschel R, Bartsch G, et al. The proximal neurovascular plate and the trizonal neural architecture around the prostate gland: importance in the athermal robotic technique of nerve sparing prostatectomy. BJU international. 2006;98:314-23.

273. Srivastava A, Chopra S, Pham A, Sooriakumaran P, Durand M, Chughtai B, et al. Effect of a risk-stratified grade of nerve-sparing technique on early return of continence after robot-assisted laparoscopic radical prostatectomy. European urology. 2013;63:438-44.

274. Ficarra V, Novara G, Ahlering TE, Costello A, Eastham JA, Graefen M, et al. Systematic review and meta-analysis of studies reporting potency rates after robot-assisted radical prostatectomy. European urology. 2012;62:418-30.

275. Tewari A, Srivasatava A, Menon M. A prospective comparison of radical retropubic and robot.assisted prostatectomy: experience in one institution. BJU international. 2003;92:205-10.

276. Di Pierro GB, Baumeister P, Stucki P, Beatrice J, Danuser H, Mattei A. A prospective trial comparing consecutive series of open retropubic and robot-assisted laparoscopic radical prostatectomy in a centre with a limited caseload. European urology. 2011;59:1-6.

277. Kim SC, Song C, Kim W, Kang T, Park J, Jeong IG, et al. Factors determining functional outcomes after radical prostatectomy: robot-assisted versus retropubic. European urology. 2011;60:413-9.

278. Rocco B, Matei DV, Melegari S, Ospina JC, Mazzoleni F, Errico G, et al. Robotic vs open prostatectomy in a laparoscopically naive centre: a matched-pair analysis. BJU international. 2009;104:991-5.

279. Krambeck AE, DiMarco DS, Rangel LJ, Bergstralh EJ, Myers RP, Blute ML, et al. Radical prostatectomy for prostatic adenocarcinoma: a matched comparison of open retropubic and robot assisted techniques. BJU international. 2009;103:448-53.

280. Ou Y-C, Yang C-R, Wang J, Cheng C-L, Patel VR. Comparison of robotic-assisted versus retropubic radical prostatectomy performed by a single surgeon. Anticancer research. 2009;29:1637-42.

281. Ahlering TE, Rodriguez E, Skarecky DW. Overcoming obstacles: nerve-sparing issues in radical prostatectomy. Journal of Endourology. 2008;22:745-50.

282. Samadi DB, Muntner P, Nabizada-Pace F, Brajtbord JS, Carlucci J, Lavery HJ. Improvements in robot-assisted prostatectomy: the effect of surgeon experience and technical changes on oncologic and functional outcomes. Journal of Endourology. 2010;24:1105-10

283. Kowalczyk KJ, Huang AC, Hevelone ND, Lipsitz SR, Yu H-y, Ulmer WD, et al. Stepwise approach for nerve sparing without countertraction during robot-assisted radical prostatectomy: technique and outcomes. European urology. 2011;60:536-47.

284. Tewari A, Srivastava A, Sooriakumaran P, Grover S, Dorsey P, Leung R. Technique of traction-free nerve-sparing robotic prostatectomy: delicate tissue handling by real-time penile oxygen monitoring. International journal of impotence research. 2012;24:11-9.

285. Shikanov S, Woo J, Al-Ahmadie H, Katz MH, Zagaja GP, Shalhav AL, et al. Extrafascial versus interfascial nerve-sparing technique for robotic-assisted laparoscopic prostatectomy: comparison of functional outcomes and positive surgical margins characteristics. Urology. 2009;74:611-6.

286. Tewari AK, Patel ND, Leung RA, Yadav R, Vaughan ED, El‚ÄêDouaihy Y, et al. Visual cues as a surrogate for tactile feedback during robotic‚Äêassisted laparoscopic prostatectomy: Posterolateral margin rates in 1340 consecutive patients. BJU international. 2010;106:528-36.

287. Srivastava A, Grover S, Sooriakumaran P, Tan G, Takenaka A, Tewari AK. Neuroanatomic basis for traction-free preservation of the neural hammock during athermal robotic radical prostatectomy. Current opinion in urology. 2011;21:49-59.

288. Tewari AK, Ali A, Metgud S, Theckumparampil N, Srivastava A, Khani F, et al. Functional outcomes following robotic prostatectomy using athermal, traction free risk-stratified grades of nerve sparing. World journal of urology. 2013;31:471-80.

289. Moskovic DJ, Alphs H, Nelson CJ, Rabbani F, Eastham J, Touijer K, et al. Subjective characterization of nerve sparing predicts recovery of erectile function after radical prostatectomy: defining the utility of a nerve sparing grading system. The journal of sexual medicine. 2011;8:255-60.

290. Schatloff O, Chauhan S, Kameh D, Valero R, Ko YH, Sivaraman A, et al. Cavernosal nerve preservation during robot-assisted radical prostatectomy is a graded rather than an all-or-none phenomenon: objective demonstration by assessment of residual nerve tissue on surgical specimens. Urology. 2012;79:596-600

291. Coughlin G, Dangle PP, Palmer KJ, Samevedi S, Patel VR. Athermal early retrograde release of the neurovascular bundle during nerve-sparing robotic-assisted laparoscopic radical prostatectomy. Journal of Robotic Surgery. 2009;3:13-7.

292. Kaye DR, Hyndman ME, Segal RL, Mettee LZ, Trock BJ, Feng Z, et al. Urinary Outcomes Are Significantly Affected by Nerve Sparing Quality During Radical Prostatectomy. Urology. 2013;82:1348-54

293. Pick DL, Osann K, Skarecky D, Narula N, Finley DS, Ahlering TE. The impact of cavernosal nerve preservation on continence after robotic radical prostatectomy. BJU international. 2011;108:1492-6.

294. Jeong W, Sood A, Ghani KR, Pucheril D, Sammon JD, Gupta NS, et al. Bimanual Examination Of The Retrieved Specimen And Regional Hypothermia During Robot‚ÄêAssisted Radical Prostatectomy: A Novel Technique For Reducing Positive Surgical Margin And Achieving Pelvic Cooling. BJU international. 2013.

295. Pierorazio PM, Mullins JK, Ross AE, Hyams ES, Partin AW, Han M, Walsh PC, Schaeffer EM, Pavlovich CP, Allaf ME, Bivalacqua TJ. Trends in immediate perioperative morbidity and delay in discharge after open and minimally invasive radical prostatectomy (RP): a 20-year institutional experience. BJU Int. 2013 Jul;112(1):45-53

296. Trinh QD, Sammon J, Sun M, Ravi P, Ghani KR, Bianchi M, Jeong W, Shariat SF, Hansen J, Schmitges J, Jeldres C, Rogers CG, Peabody JO, Montorsi F, Menon M, Karakiewicz PI. Perioperative outcomes of robot-assisted radical prostatectomy compared with open radical prostatectomy: results from the nationwide inpatient sample. Eur Urol. 2012 Apr;61(4):679-85.

297. Bhandari A, McIntire L, Kaul SA, Hemal AK, Peabody

JO, Menon M Perioperative complications of robotic radical prostatectomy after the learning curve.. J Urol. 2005 Sep;174(3):915-8

298. Woldu SL, Weinberg AC, Bergman A, Shapiro EY, Korets R, Motamedinia P, Badani KK.Pain and Analgesic Use After Robot-Assisted Radical Prostatectomy. J Endourol. 2014, in press

299. F, Montorsi F, Mottrie A, Wilson TG. Systematic review and meta-analysis of perioperative outcomes and complications after robot-assisted radical prostatectomy. Eur Urol. 2012 Sep;62(3):431-52

300. Allaparthi SB, Hoang T, Dhanani NN, Tuerk IA. Significance of prostate weight on peri and postoperative outcomes of robot assisted laparoscopic extraperitoneal radical prostatectomy. Can J Urol 2010;17:5383–9.

301. Prasad SM, Large MC, Patel AR, Famakinwa O, Galocy RM, Karrison T, Shalhav AL, Zagaja GP. Randomized controlled trial of early removal of urethral catheter with suprapubic tube drainage versus urethral catheter drainage alone following robot-assisted laparoscopic radical prostatectomy. J Urol. 2014 (in press)

302. Khemees TA, Novak R, Abaza R. Risk and Prevention of Acute Urinary Retention After Robotic Prostatectomy Original Research Article J Urol 2013, 189:1432-1436

303. Prasad SM, Smith ND, Catalona WJ, Sammon J, Menon M. Suprapubic tube after radical prostatectomy. J Urol. 2013 Jun;189(6):2028-30

304. Lepor H, Nieder AM, Fraiman MC. Early removal of urinary catheter after radical retropubic prostatectomy is both feasible and desirable. Urology 2001;58:425–9.

305. Koch MO, Nayee AH, Sloan J, et al. Early catheter removal after radical retropubic prostatectomy: long-term followup. J Urol 2003;169:2170–2.

306. Sammon JD, Trinh QD, Sukumar S, Diaz M, Simone A, Kaul S, Menon M. Long-term follow-up of patients undergoing percutaneous suprapubic tube drainage after robot-assisted radical prostatectomy (RARP). BJU Int. 2012 Aug;110(4):580-5

307. Araki M, Manoharan M, Vyas S, Nieder AM, Soloway MS. A pelvic drain can often be avoided after radical retropubic prostatectomy – an update in 552 cases. Eur Urol 2006; 50: 1241–712

308. Sharma S, Kim HL, Mohler JL. Routine pelvic drainage not required after open or robotic radical prostatectomy. Urology 2007; 69: 330–3

309. Danuser H, Di Pierro GB, Stucki P, Mattei A. Extended pelvic lymphadenectomy and various radical prostatectomy techniques: is pelvic drainage necessary? BJU Int. 2013 May;111(6):963-9

310. Montorsi F, Guazzoni G, Strambi LF, et al. Recovery of spontaneous erectile function after nerve-sparing radical retropubic prostatectomy with and without early intracavernous injections of alprostadil: results of a prospective, randomized trial. J Urol 1997; 158:1408–10.

311. Stephenson RA, Mori M, Hsieh YC, Beer TM, Stanford JL, Gilliland FD, et al. Treatment of erectile dysfunction following therapy for clinically localized prostate cancer: patient reported use and outcomes from the surveillance, epidemiology, and end results prostate cancer outcomes study. J Urol. 2005;174:646–650.

312. Matthew AG, Goldman A, Trachtenberg J, Robinson J, Horsburgh S, Currie K, et al. Sexual dysfunction after radical prostatectomy: prevalence, treatments, restricted use of treatments and distress. J Urol. 2005;174:2105–2110.

313. Giuliano F, Amar E, Chevallier D, Montaigne O, Joubert JM, Chartier-Kastler E. How urologists manage erectile dysfunction after radical prostatectomy: a national survey (REPAIR) by the French urological association. J Sex Med. 2008;5:448-57

314. Raina R, Pahlajani G, Agarwal A, Zippe CD. The early use of transurethral alprostadil after radical prostatectomy potentially facilitates an earlier return of erectile function and successful sexual activity. BJU Int. 2007;100: 1317–1321.

315. Lane BR, Abouassaly R, Angermeier KW, Montague DK. Three-piece inflatable penile prostheses can be safely implanted after radical prostatectomy through a transverse scrotal incision. Urology. 2007;70:539–542.

316. Mulhall JP, Bella AJ, Briganti A, McCullough A, Brock G. Erectile function rehabilitation in the radical prostatectomy patient. J Sex Med 2010;7:1687–98

317. Hatzimouratidis K, Burnett AL, Hatzichristou D, McCullough AR, Montorsi F, Mulhall JP. Phosphodiesterase type 5 inhibitors in postprostatectomy erectile dysfunction: a critical analysis of the basic science rationale and clinical application. Eur Urol 2009;55: 334–47

318. Briganti A, Gallina A, Suardi N, et al. Predicting erectile function recovery after bilateral nerve sparing radical prostatectomy: a proposal of a novel preoperative risk stratification. J Sex Med 2010;7:2521–31.

319. Gallina A, Ferrari M, Suardi N, et al. Erectile function outcome after bilateral nerve sparing radical prostatectomy: which patients may be left untreated? J Sex Med 2012;9:903–8.

320. Padma-Nathan E, McCullough AR, Giuliano F, et al. Postoperative nightly administration of sildenafil citrate significantly improves the return of normal spontaneous erectile function after bilateral nerve-sparing radical prostatectomy. J Urol. 2003;4(Suppl):375

321. Bannowsky A, Schulze H, van der Horst C, Hautmann S, Jünemann KP. Recovery of erectile function after nerve sparing radical prostatectomy: improvement with nightly low-dose sildenafil. BJU Int. 2008;101:1279–1283.

322. Montorsi F, Nathan HP, McCullough A, et al. Tadalafil in the treatment of erectile dysfunction following bilateral nerve sparing radical retropubic prostatectomy: a randomized, double-blind, placebo controlled trial. J Urol. 2004;172:1036–1041

323. Montorsi F, Brock G, Lee J, Shapiro J, Van Poppel H, Graefen M, et al. Effect of nightly versus on-demand vardenafil on recovery of erectile function in men following bilateral nerve-sparing radical prostatectomy. Eur Urol. 2008;54:924–931

324. Pavlovich CP, Levinson AW, Su LM, Mettee LZ, Feng Z, Bivalacqua TJ, Trock BJ. Nightly vs on-demand sildenafil for penile rehabilitation after minimally invasive nerve-sparing radical prostatectomy: results of a randomized double-blind trial with placebo. BJU Int. 2013 Oct;112(6):844-51.

325. Montorsi F, Brock G, Stolzenburg JU, Mulhall J, Moncada I, Patel HR, Chevallier D, Krajka K, Henneges C, Dickson R, Büttner H. Effects of tadalafil treatment on erectile function recovery following bilateral nerve-sparing radical prostatectomy: a randomised placebo-controlled study (REACTT). Eur Urol. 2014 Mar;65(3):587-96

326. Novara G, Ficarra V, D'Elia C, et al. Preoperative criteria to select patients for bilateral nerve-sparing robotic-assisted radical prostatectomy. J Sex Med 2010;7:839–45.

327. Castiglione F, Nini A, Briganti A. Penile Rehabilitation with Phosphodiesterase Type 5 Inhibitors After Nerve-sparing Radical Prostatectomy: Are We Targeting the Right Patients? Eur Urol. 2014 Apr;65(4):673-4

328. Van Kampen M, De Weerdt W, Van Poppel H, De Ridder D, Feys H, Baert L. Effect of pelvic-floor re-education on duration and degree of incontinence after radical prosta-

tectomy: a randomised controlled trial. Lancet. 2000 Jan 8;355(9198):98-102

329. Filocamo MT, Li Marzi V, Del Popolo G, Cecconi F, Marzocco M, Tosto A, Nicita G. Effectiveness of early pelvic floor rehabilitation treatment for post-prostatectomy incontinence. Eur Urol. 2005 Nov;48(5):734-8.

330. Ribeiro LH, Prota C, Gomes CM, de Bessa J Jr, Boldarine MP, Dall'Oglio MF, Bruschini H, Srougi M. Long-term effect of early postoperative pelvic floor biofeedback on continence in men undergoing radical prostatectomy: a prospective, randomized, controlled trial. J Urol. 2010 Sep;184(3):1034-9

331. Conservative management for postprostatectomy urinary incontinence. Campbell SE, Glazener CM, Hunter KF, Cody JD, Moore KN. Cochrane Database Syst Rev. 2012 Jan 18;1:CD001843.

332. Geraerts I, Van Poppel H, Devoogdt N, Joniau S, Van Cleynenbreugel B, De Groef A, Van Kampen M. Influence of preoperative and postoperative pelvic floor muscle training (PFMT) compared with postoperative PFMT on urinary incontinence after radical prostatectomy: a randomized controlled trial. Eur Urol. 2013 Nov;64(5):766-72

333. Lucas MG, Bosch JLHR, Cruz FR, et al. Guidelines on urinary incon-tinence. Arnhem, The Netherlands: European Association of Urolo- gy; 2012. p. 41.

334. Abbou CC, Hoznek A, Salomon L, Lobontiu A, Saint F, Cicco A, Antiphon P, Chopin D. Remote laparoscopic radical prostatectomy carried out with a robot. Report of a case. Prog Urol. 2000;10(4):520-3.

335. Chung BI, Sommer G, Brooks JD. Anatomy of the Lower Urinary Tract and Male Genitalia. In: Campbell-Walsh Urology, 10th edition. Elsevier-Saunders 2012.

336. Clegg EJ: The arterial supply of the human prostate and seminal vesicles. J Anat. 1955;89:209-216.

337. Clegg EJ: The vascular arrangements within the human prostate gland. Brit J Urol. 1956;2 8:428-435.

338. Bilhim T, Tinto HR, Fernandes L, Martins Pisco J. Radiological anatomy of prostatic arteries. Tech Vasc Interv Radiol. 2012;15(4):276-85.

339. Bouissou H, Talazac A. Arterial vascularization of the normal and the pathological prostate. Ann d'Anatom Pathol. 1959;4:63-79.

340. Ambrósio JD, De Almeida JS, De Souza A. Origin of prostatic arteries in man. Rev Paul Med. 1980;96:52-55.

341. Myers RP, Villers A. Anatomic considerations in radical prostatectomy. In: Kirby RS, Partin AW, Feneley M, Parsons JK, eds. Prostate Cancer; Principles and Practice, Vol 1. Abingdon, UK: Taylor & Francis; 2006. p. 701–13.

342. Patel VR, Coelho RF, Palmer KJ, Rocco B. Periurethral suspension stitch during robot-assisted laparoscopic radical prostatectomy: description of the technique and continence outcomes. Eur Urol. 2009;56(3):472-8

343. Rocco F, Carmignani L, Acquati P, Gadda F, Dell'Orto P, Rocco B, Bozzini G, Gazzano G, Morabito A. Restoration of posterior aspect of rhabdosphincter shortens continence time after radical retropubic prostatectomy. J Urol. 2006;175(6):2201-6.

344. Rocco B, Gregori A, Stener S, et al. Posterior reconstruction of the rhabdosphincter allows a rapid recovery of continence after transperitoneal videolaparoscopic radical prostatectomy. Eur Urol. 2007;51(4):996-1003.

345. Coughlin G, Dangle PP, Patil NN, et al. Surgery illustrated – focus on details. Modified posterior reconstruction of the rhabdosphincter: application to robotic-assisted laparoscopic prostatectomy. BJU Int. 2008;102(10):1482-1485.

346. Coelho RF, Chauhan S, Orvieto MA, Sivaraman A, Palmer KJ, Coughlin G, Patel VR.Influence of modified posterior reconstruction of the rhabdosphincter on early recovery of continence and anastomotic leakage rates after robot-assisted radical prostatectomy. Eur Urol. 2011;59(1):72-80.

347. Walz J, Burnett AL, Costello AJ, et al. A critical analysis of the current knowledge of surgical anatomy related to optimization of cancer control and preservation of continence and erection in candidates for radical prostatectomy. Eur Urol 2010;57:179–92.

348. Rocco B, Cozzi G, Spinelli MG, Coelho RF, Patel VR, Tewari A, Wiklund P, Graefen M, Mottrie A, Gaboardi F, Gill IS, Montorsi F, Artibani W, Rocco F. Posterior Musculofascial Reconstruction After Radical Prostatectomy: A Systematic Review of the Literature. Eur Urol. 2012;62(5):779-90.