Urinary continence recovery after radical prostatectomy – anatomical/reconstructive and nerve-sparing techniques to improve outcomes

Christian P. Pavlovich*, Bernardo Rocco†, Sasha C. Druskin* and John W. Davis‡

*Brady Urological Institute, Johns Hopkins University School of Medicine, Baltimore, MD, USA, †Ospedale Policlinico e Nuovo Ospedale Civile, S. Agostino Estense, University of Modena and Reggio Emilia, Modena, Italy, and ‡MD Anderson Cancer Center, Houston, TX, USA

In an editorial board-moderated debate format, two experts in prostate cancer surgery are challenged with presenting the key strategies in radical prostatectomy that improve urinary functional outcomes. Dr Bernardo Rocco was tasked with arguing the facts that support the anatomical preservation and reconstruction steps that improve urinary continence. Drs Christian Pavlovich and Sasha Druskin were tasked with arguing the facts supporting neurovascular bundle and high anterior release surgical planes that improve urinary continence. Associate Editor John Davis moderates the debate, and outlines the current status of validated patient questionnaires that can be used to evaluate urinary continence, and recent work that allows measuring what constitutes a ‘clinically significant’ difference that either or both of these surgical techniques could influence. A review of raw data from a publication from Dr Pavlovich’s team demonstrates how clinically relevant differences in patient-reported outcomes can be correlated to technique. A visual atlas is presented from both presenting teams, and Dr Davis demonstrates further reproducibility of technique. A linked video on this concept is available as a supplementary file.

Keywords
radical prostatectomy, robot-assisted prostatectomy, urinary continence, patient-reported outcomes, nerve-sparing prostatectomy, musculofascial plate reconstruction, #PCSM, #ProstateCancer

Introduction
Radical prostatectomy (RP) is a standard option for localised prostate cancer, and may provide the strongest odds of avoiding cancer-specific mortality, metastatic progression, and/or androgen deprivation compared to watchful waiting or radiation therapy [1–5]. From a logistical standpoint, postoperative monitoring with PSA is highly sensitive and convenient, and pathological staging provides robust disease-recurrence prognosis and tissue available for genomic classifiers [6]. Although minimally invasive options are common, the surgery is nevertheless invasive compared to radiation alternatives and the surgical side-effects men fear include urinary incontinence (UI) and sexual dysfunction [7]. One could hypothesise that a durable solution for functional side-effects would have a significant impact on treatment selections and satisfaction. In the present review, we will focus on the urinary continence side-effect with two key points of debate in the literature that propose to improve outcomes: i) anatomical/structural preservation and reconstruction, and ii) nerve preservation planes. Our format will begin with a methodology review by Associate Editor John W. Davis, and then we will proceed with reviews from Team Rocco for the structural arguments and Team Pavlovich for the nerve-sparing (NS) arguments.

Associate Editor John W. Davis’s Review of Baseline UI Data after RP – How we Measure and How Good are we?

Upon initial review of the topic of prostate cancer treatments, patient perception of the risk of UI after RP is likely severe. Many high profile online publications, such as the American Cancer Society [8] and the United States Preventative Services Task Force [9], contain verbiage that could be interpreted as implying that all post-RP patients suffer from UI, and there are often minimal qualifiers as to how long or how severe. This problem is compounded by the observation that physician (surgeon) estimation of urinary continence is too optimistic compared to patient-reported data – especially the risk of ‘minor’ UI [10].

In the late 1990s and onward, outcomes researchers from the University of California Los Angeles (UCLA) and the University of Michigan constructed patient-reported
quality-of-life (QoL) surveys, and validated them in numerous populations with prostate cancer treatments, and used formal test metrics [11,12]. These studies established new standards for QoL studies:

- Urinary, sexual, bowel, and hormonal functions are the key disease-specific domains for prostate cancer QoL.
- Urinary, sexual, bowel, and hormonal bother are separate domains, which address how much a patient’s current function causes them problems. These domains are distinct from function, and reflect long-standing observations that an individual patient may adapt to functional loss and report different levels of bother depending upon their age, expectations, and other factors.
- The UCLA survey and the Michigan updated survey the Expanded Prostate Cancer Index Composite (EPIC) use a series of Likert-like questions with three to five possible answers scaled longitudinally from 0 points for the worse result to 100 points for the best result. Each domain (e.g. urinary function) is a cluster of questions where all of the 0–100 scores are averaged together, with higher numbers representing better outcomes.
- Although cross-sectional data (one measurement per patient, often varying ranges of follow-up averaged together) with ‘normative’ controls have been published, the ideal methodology is for each patient to be surveyed at baseline and then at 3–6 month intervals after treatment for several years [7].
- Post-validation, additional study is required to determine what difference between two treated groups would be considered ‘clinically significant’ as distinct from statistically significant. The former is a fixed delta, whereas the latter is a function of sample size.
- Despite the depth of information built into QoL surveys, patients may be ill-equipped to understand them, and may still request the simple binary result measurement: ‘What is your continence rate?’ Researchers may attempt to accommodate this desire for simplification by taking a single question from an EPIC survey, ‘Which of the following best describes your urinary control during the last 4 weeks’, and reporting the percentage of respondents that answer number 4, for ‘Total control’. Another research may allow answer 3 or 4 (total control or occasional dribbling) and thus the common observation that ‘continence rates depend upon the definition’.

For baseline urinary function, several studies using the EPIC have found mean scores of ~90–93 [7,13–15]. Before considering specific results, Skolarus et al. [16] provided a recent guide to understanding the ‘clinical’ significance question. Using data from the PROSTQA consortium, they used a distribution method, and an ‘anchor-based method’.

These two methods consider standard deviation of baseline and after treatment scores, as well as how domains affect each other. The combined methods generated a ‘Minimally Important Difference’ of 6–9 points for UI (each domain has its own range). Therefore, if the average baseline for UI is 90, then a recovered score of ≥81 would start to meet the definition of ‘no clinically significant difference’.

So how far away are we from declaring UI as a moot point? The ‘gold standard’ study on the topic was published by Sanda et al. [7] on behalf of the PROSTQA study. This funded study grouped 11 academic centres with baseline and follow-up EPIC QoL surveys, and included surgery, radiation, and brachytherapy. The surgery cohort had the typical baseline of 90, and in the 2–3 month postoperative range it dipped to 50, and then recovered quickly to 70 by 6 months, and just under 80 at 12 months. NS cases were slightly better than non-NS, and the curve clearly plateaued from 12 to 24 months postoperatively. Therefore, we can conclude that improvements to urinary control could be measured at the healing time interval, and/or the final ‘healed’ result, which currently appears to be 12 months. Other published studies using EPIC also showed ‘healed’ result scores of 79 from Wei et al. [13], 76–77 from Willis et al. [17], and 74 from Alemozaffar et al. [18].

In summary, the unmet needs for improving urinary control after RP include: i) improve the final healed result into the mid-80s on the EPIC scale, and ii) decrease the length of recovery to <3–6 months. These expectations set the stage for our two teams to argue two different bodies of literature that purport to move us in this direction.

Team Rocco: Urinary Control is Improved from Apical Dissection and Anatomical Reconstruction

Apical Dissection

Dissection of the prostatic apex represents a critical moment in RP, because of the position deep in a narrow portion of the pelvis, and its close connection to the dorsal vein complex (DVC or plexus Santorini), rectum, neurovascular bundles (NVBs), and rhabdosphincter [19]. The external urethral sphincter is an Ω-shaped muscle consisting of an external striated part and an internal smooth muscle layer [20–22]. Its fibres surround the urethra, which length lies in the range of 1.5–2.4 cm. A considerable part of it is located intraprostatically between the apex of the prostate and the colliculus seminalis [23]. In addition, the urethral sphincter is covered by the DVC and ridges of rudimentary striated muscle fibres [24], and the posterolateral aspect by the prostatic apex and neurovascular tissue [22]. This may compromise the full-length urethral sphincter preparation during RP.

According to the technique we imply for robot-assisted RP (RARP), apical dissection is performed after complete
mobilisation of the prostate [25]. We usually ligate the DVC after the endopelvic fascia dissection, and we suspend it to the pubic bone with a second suture according to the technique described by Patel et al. [26]: the aim of this technique is the stabilisation of the urethra avoiding urethral retraction, facilitating the urethral dissection. A ligature of the DVC is beneficial especially for surgeons in their learning curve [27], as it prevents bleeding that may interfere with the apical dissection and division of the urethra under direct vision [25]. Another option is the compression of larger vessels with a sponge stick or the use of a bulldog clamp [28]. Some surgeons prefer to perform an athermal division of the DVC followed by a selective suture ligation. When performing this kind of technique in laparoscopy, it may be useful to increase the intra-abdominal pressure to 20 mmHg to prevent blood spillage from the DVC [29]. In a prospective non-randomised comparative study, Lei et al. [30] reported significantly better 6-month urinary continence rates in patients who underwent DVC division followed by selective suture ligation before anastomosis, in comparison with those receiving suture ligation before bladder neck dissection.

After the division of the DVC, the prostate is separated from the urethral sphincter by a 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 until the underlying longitudinal smooth muscle becomes visible. The longitudinal smooth muscle fibres can be followed intraprostatically by a blunt dissection and retraction of the apical tissue. It was shown by pelvic MRI studies that an increased risk of shortening the urethra is present when the prostatic parenchyma covered the muscular urethra [31].

The anterior part of the urethra is then transected until the transurethral catheter becomes visible. Then the catheter can be retracted and the dorsal urethra is divided. For a better visualisation of the apical region, we use a 30° binocular lens directed downwards. Tewari et al. [32] described an alternative technique, using a 30° upward-facing lens in combination with retraction of the prostate. Using this technique, they reported a reduction in the rate of positive surgical margins (PSMs) from 4.4% to 1.4%. In case the apical region of the prostate is suspicious for a PSM or residual tumour cells are left behind in the urethra, an intraoperative frozen section should be performed. Biopsies at the apex of the prostate, as well as from the urethral resection site, are helpful to predict a PSM, but in fact there are not much further therapeutic surgical options in this area, as more aggressive treatment may result in a higher rate of UI [33]. For clinically high-risk tumours and when full functional-length urethral sphincter preservation is intended, frozen sections in this area could reduce the PSM rate [34].

Posterior Musculofascial Plate Reconstruction Technique

In 2006, Rocco F et al. [35] proposed a technique for reconstruction of the posterior aspect of the rhabdosphincter, which has been suggested to shorten the time to urinary continence in patients undergoing retropubic RP. In 2007, Rocco B et al. [36] described the application of the posterior reconstruction technique to transperitoneal laparoscopic RP (LRP), while, in 2008, Coughlin et al. [37] applied the posterior reconstruction of the rhabdosphincter to RARP with some minor technical modifications. The technique has been further modified in 2011 [38].

The reconstruction is performed using two 3–0 poliglecaprone (Monocryl®, Ethicon, Somerville, NJ, USA) 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 Denonvilliers’ fascia is identified after the RP and approximated to the posterior aspect of the rhabdosphincter and the posterior median raphe using one arm of the continuous suture. Typically, four passes are taken from the right to the left (Fig. 1). 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 vesico-prostatic muscle, as described by Walz et al. [22], to the posterior urethral edge and to the already reconstructed median raphe (Fig. 2). This suture is then tied to the end of the first suture arm.

One of the key steps for an appropriate reconstruction is the preservation of the Denonvilliers’ fascia when dissecting the remaining Denonvilliers’ fascia is approximated to the posterior aspect of the rhabdosphincter reconstruction.

Fig. 1 First layer of posterior reconstruction. The free edge of the remaining Denonvilliers’ fascia is approximated to the posterior aspect of the rhabdosphincter reconstruction.
posterior plane between the prostate and the rectal wall. If this dissection is performed at the perirectal fat tissue, the Denonvilliers’ fascia is not adequately spared, precluding posterior reconstruction.

A systematic review showed that the reconstruction of the posterior musculofascial plate improves early return of urinary continence within the first 30–45 days after RP; in the same study, a trend towards lower anastomotic leakage rates was found in patients who received the posterior reconstruction [39]. Furthermore, the Pasadena Consensus Panel for Best Practices in RARP found unanimous agreement that posterior reconstruction may facilitate performing the urethrovesical anastomosis and reduce bleeding [40]. The results of the European Association of Urology Robotic Urology Section (ERUS) survey of RARP showed that the posterior reconstruction of the musculofascial plate is usually performed by 51.7% of surgeons, and sometimes by 19.8% [41].

Team Pavlovich: The Effects of NS Approaches to RP on the Recovery of Early Urinary Continence

The NS approach to RP was developed in an effort to allow for the recovery of erectile function after surgery. While oncological control is its primary consideration, the preservation of periprostatic tissues, especially posterolaterally (where the NVBs of Walsh are located), has allowed for improved postoperative QoL [42]. It is clear that the major significance of NS relates to the recovery of erectile function; when both nerves are sacrificed, spontaneous potency virtually never returns, while greater degrees of NVB-sparing lead to improved recovery of erectile function [43,44]. But are there reasons to consider that a NS approach to RP might also aid in the recovery of urinary continence? It appears so. Firstly, meticulous anatomical preservation of the NVB generally also preserves the supportive tissues that invest the prostate gland. These tissues in turn ramify toward the prostatic apex and distal urethra, the integrity of which is important for urinary continence. Secondly, an atraumatic approach to NS, including minimising electrocautery and traction injury, should theoretically minimise such damage to structures involved in physiological urinary continence.

Thirdly, the external urethral sphincter is innervated by both autonomic nerve fibres from the pelvic plexus and somatic nerve fibres from the pudendal nerves [45,46], and some nerve fibres along the NVB also innervate the membranous urethra [47]. These nerves, plus autonomic afferents and structures involved in the membranous urethral microcirculation may be compromised by non-NS/wide-excision RP [48,49]. The nerve fibres probably involved in urinary continence recovery after RP, which tend to run more anteromedially, particularly around the prostatic apex, are more likely to be spared with ‘high anterior release’ [50] or ‘veil’ [51] approaches to NS. Despite these arguments for the effects of NS on urinary continence recovery, there are many patients who either have erectile dysfunction (ED) preoperatively and/or who have non-NS surgery who nevertheless regain urinary continence after RP. Therefore, the effects of NS on urinary continence, while potentially real, may be subtle and may at least in part involve supportive structures rather than fully functional nerves.

Here, we review the current data on the association of NS with recovery of urinary continence in men undergoing RP. While there is little level-1 evidence in this area, there are many non-randomised retrospective and prospective cohort studies, as well as a large and recent meta-analysis and review on this topic [52].

Effects of NVB-sparing on Long-term Urinary Continence Outcomes

The vast majority of patients will regain urinary continence within a year or two after RP, after which outcomes plateau [42,43,53–55]. Risk factors for long-term (>1–2 years after RP) UI include increasing patient age, the development of anastomotic stricture, and non-NS surgery, with increasing age appearing to be the most important risk factor [55–57]. Anastomotic strictures are all but disappearing in the robotic era, but the effect of NS on long-term urinary continence outcomes remains controversial. Well-respected groups from various countries have presented conflicting retrospective data – increasing categorical sparing of no, one, or two NVBs has been shown to improve long-term
Urinary continence recovery after radical prostatectomy

Effects of NVB-sparing on Short-term Urinary Continence Outcomes

It is difficult to differentiate between NVB-sparing, and the sparing of the supportive tissues associated with the NVBs. Most surgeons simply state that NS was either performed, or not. However, partial NS surgery has been performed for years, and was indeed discussed at least as far back as 1991 [59]. NS-grading systems have been developed to estimate the extent of NVB preservation, and are currently in use by multiple groups [44,60–62]. Gradations of NS are determined by intraoperative visual inspection, and correlate closely with the recovery of erectile function [44,60,62]. Are gradations of NS relevant to urinary convalescence as well? At least one group has addressed this in a series of men with mixed preoperative erectile function status [63]; at least two groups have looked at this question in preoperatively potent men exclusively [with Sexual Health Inventory for Men (SHIM) or International Index of Erectile Function (IIEF) scores in the top/normal range] [64,65], and at least two groups have looked at this question in men with ED preoperatively (SHIM score <15) [66,67].

Studies of Urinary Continence in Preoperatively Potent Men

Kaye et al. [64] conducted a prospective trial in which 99 preoperatively potent men aged <65 years having LRP or RARP by three surgeons at a single institution had NS graded at the time of surgery using a NS score of 0–4 per side, with 4 being the best (examples of NS depicted in Fig. 3A and B [61,64]). The patients were followed by EPIC questionnaire for their urinary continence outcomes at 0, 1, 3, 6, 9 and 12 months and virtually all had some degree of bilateral NS. In a mixed model analysis accounting for age, body mass index, prostate volume, and time from surgery, patients that had at least one NVB scored as a 4 (‘excellent’ – intact bundle with significant supportive tissue veil/high release, no nerve visualised on specimen) had superior urinary QoL scores and less pad use compared to patients without at least one score 4 NVB, at all postoperative time points. Bilateral ‘excellent’ NS (both score 4) did not confer much in terms of urinary improvements compared to unilateral ‘excellent’ NS (with lesser degrees of NS on the contralateral side). It is important to note that essentially all of these patients would have been recorded simply as having had both nerves spared by most surgeons; a grading system such as the one used here was able to tease out any contribution of sparing the anterior- and lateral-most NVB-investing tissues/structures to improved urinary continence recovery, although these dissections were nevertheless interfascial rather than intrafascial.

Stolzenburg et al. [65] published a larger prospective study of 400 potent, low–intermediate risk men undergoing RARP with bilateral NS performed by multiple surgeons. Half were randomised to bilateral intrafascial NS, the other half to bilateral interfascial NS. Urinary continence was assessed by the International Continence Society questionnaire at 3, 6, and 12 months postoperatively. Urinary continence was defined as 0 pads per day (PPD) or one safety pad. At 3 and 6, but not 12 months postoperatively, intrafascial NS patients had significantly better urinary continence by reported pad usage than patients who had interfascial NS, although no multivariable analysis was done. These data, as well as the data of Kaye et al. [64] above, provide support to the notion that the structures closely adherent to the prostate laterally and anteriorly may aid in the short-term recovery of urinary continence. These structures are spared when an entire NVB is spared, either intrafascially or with a high anterior release/excellent’ NS, but whether the urinary continence improvements are related to actual neurones (e.g. somatic nerve fibres to the rhabdosphincter), membranous urethral vasculature, and/or the structural support that periprostatic tissues provide, remains unclear.
Studies of Urinary Continence in Men with ED Preoperatively

Khoder et al. [66] published a study of 420 men with ED (IIEF score <15) with localised prostate cancer who were treated with bilateral NS RP. In all, 239 received intrafascial RPs for Gleason score ≤6 and a PSA level of ≤10 ng/mL; 181 received interfascial RPs for Gleason score ≤7 and a PSA level of >10 ng/mL. A control group of 77 men undergoing non-NS RP was used. There was no significant difference in UI between each group at 3, 12, and 36 months after surgery; however, there was a non-significant superiority of NS to non-NS for each of the time points for 0 PPD urinary continence, and in men aged >70 years, there was a higher proportion with full urinary continence at 36 months in the NS group (P = 0.052).

Takenaka et al. [67] reported on a subset of men with ED (IIEF score <14) receiving LRP. In this subset, attempted NS was associated with improved urinary continence rates on both uni- and multivariate analyses at the 3- and 6-month postoperative time points.

Meta-analysis of NS vs non-NS on Early Urinary Continence

A systematic review and meta-analysis of whether preservation of the NVB is associated with urinary continence outcomes after RP was recently reported by Reeves et al. [52]. This assessment of the available literature was thorough and comprehensive, although, as with all meta-analyses, it consists of studies with a great heterogeneity of patients and outcome measures—in this case, urinary continence assessment tools. The authors included 27 cohort studies in their review (some prospective, some retrospective, some unclear in design) conducted between 1983 and 2011 that included almost 14 000 patients who had either NS or non-NS RP. They did not include studies only comparing one degree of NS with another (e.g. intrafascial to interfascial) if there was no non-NS ‘control’ group; thus, studies such as those by Kaye et al. [64], Stolzenburg et al. [65], Khoder et al. [66], Takenaka et al. [67], cited previously, were not considered in this meta-analysis. They did analyse bilateral and unilateral NS subgroups when available, but did not take into consideration gradations of NS at any one NVB. Inconsistencies existed in the definitions of NS and urinary continence, as well as in baseline patient characteristics (e.g. preoperative urinary continence; prior TURP) between studies, as expected given the variety of studies reviewed.

Urinary continence was assessed by meta-analysis at multiple postoperative time points: ≤1.5, and 3–4, 6, 12, and 24 months. When comparing any NS to no NS, the rate of urinary continence for those who had NS was higher at the ≤1.5, 3–4 and 6 month time points. By 12 and 24 months, there were no differences between the groups. When comparing bilateral NS to no NS, the relationship was similar. At ≤1.5 months, patients receiving bilateral NS had better urinary continence than those receiving unilateral NS; the two groups were found to be equivalent after that time point. Unilateral NS was also found to have equivalent urinary continence outcomes to no NS for every time point studied. Taken together, these results suggest that bilateral NS, when compared to no NS, may produce higher rates of return of urinary continence in the first 6 months after surgery.

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Table 1 EPIC Urine Summary Score at various time-points before (0) and after (3–12 months) RP.

| Time-point, months | Type of NS | Urine summary score, mean (SD) |
|--------------------|------------|-------------------------------|
| 0                  | BENS       | 91.9 (9.8)                    |
| 0                  | UENS       | 93.8 (6.4)                    |
| 0                  | NS         | 91.6 (8.0)                    |
| 3                  | BENS       | 75.4 (13.6)                   |
| 3                  | UENS       | 72.1 (15.8)                   |
| 3                  | NS         | 63.9 (14.0)                   |
| 6                  | BENS       | 86.8 (10.5)                   |
| 6                  | UENS       | 80.6 (10.6)                   |
| 6                  | NS         | 74.9 (14.5)                   |
| 9                  | BENS       | 89.7 (10.7)                   |
| 9                  | UENS       | 86.3 (8.4)                    |
| 9                  | NS         | 76.8 (12.9)                   |
| 12                 | BENS       | 91.2 (8.5)                    |
| 12                 | UENS       | 89.1 (9.6)                    |
| 12                 | NS         | 79.5 (13.1)                   |

These data are from Kaye et al. [64] (Team Pavlovich). NS is quantified as: BENS, bilateral ‘excellent’ NS; UENS, unilateral ‘excellent’ NS; NS, bilateral but neither side received a score of ‘excellent’; which would involve sparing >90% of the bundle and supportive structures to the apex. The values listed in boldface denote return to within 6–9 points of baseline, or less than the minimally important clinical difference (see Dr Davis’s Introduction).

surgery, but may only outperform unilateral NS for the first 6 weeks; standard unilateral NS may not be better than no NS. However, these results must be interpreted cautiously, given the heterogeneity and missing data in the studies included in the analysis, and the small number of series looking at certain time-points (e.g. only four studies addressed the 6-month time-point). One of the most important pieces of missing data may be the degree to which the NVBs were spared, as NS-scoring systems were generally not used in the studies analysed, with the exception of the study by Srivastava et al. [63], one of the largest series analysed.

Srivastava et al. [63] reported on 1500 preoperatively continent men undergoing NS RARP by a single surgeon, with graded NS quality predicted preoperatively based on risk stratification that included PSA, clinical stage, Gleason score, and multiparametric MRI, and then adjusted intraoperatively as needed. The actual degree of NS, and not the preoperatively planned degree of NS, was recorded, but if each of the two NVBs had different degrees of NS, the patient was recorded as having received the worse of the two degrees of NS. Thus, unilateral vs bilateral NS comparisons were not made. They assessed urinary continence, defined as 0 PPD over the prior 4 weeks, at 6 and 12 weeks postoperatively. They found that rates of urinary continence return at 6–12 weeks postoperatively were significantly better in patients with better qualitative degrees of NS.

Another of the larger series assessed in the meta-analysis was from Ko et al. [68], who prospectively collected data on ~1300 men undergoing RARP with a perirectal suspension suture and modified posterior reconstruction from 2008 to 2010. They collected urinary continence data at 1, 1.5 and 3 months, and every 3–6 months thereafter, using the EPIC questionnaire. Urinary continence was defined as 0 PPD and no reported leakage. Patients were grouped by extent of NS: no NS, complete bilateral NS, or partial NS (everyone not in the other two categories), as determined by the surgeon’s subjective intraoperative assessment of NS. In all, 21 variables were assessed for their association with regaining urinary continence at ≤3 months. They found that ~86% of patients were continent by 3 months and that both partial and bilateral NS were associated with earlier median times to urinary continence when compared to the no NS group.

**Synthesis**

The available literature provides support to the contention that early urinary continence recovery is positively affected by NS, which at its best includes preserving as much of the anatomical cradle of the prostate as possible, its associated investing fasciae, its anterolateral tissues, and of course its posterolateral NVBs. While the effects of such tissue preservation may not have a great deal of impact on long-term urinary continence outcomes, its positive effect on short-term urinary continence outcomes argues for NS and the sparing of periprostatic tissue when it is oncologically acceptable to do so. The increasing use of preoperative multiparametric MRI and targeted biopsy strategies should make it easier to know when it is safe to perform aggressive NS and periprostatic tissue preservation with the intent of improving a patient’s chances of recovering both urinary control and of course erectile function.
In his introduction, Dr Davis asks the important question of whether NS approaches to RP can bring validated urinary continence outcomes back to ‘baseline’ using the EPIC or a comparably validated questionnaire. In other words, is a return to within 6–9 points of preoperative urinary scores, all normalised to 100, possible? We found two published manuscripts that shed partial light on this topic, one from Dr Patel’s group [66] and one from our group [64]. Both datasets assessed NS and early recovery of urinary QoL after RP and used the EPIC questionnaire. The raw data that went into Table 1 of the Kaye et al. [64] paper is presented here for the first time (Table 1), and shows that the EPIC Urine Summary Score is influenced by NS quality, and is in fact statistically ‘back to baseline’ (± 9 points) by 6 months in men who received bilateral ‘excellent’ NS, and by 9 months in men who received unilateral ‘excellent’ NS, but not in men who received lesser qualities of NS. These data suggest that, at least for young (aged <65 years) and preoperatively potent men, meticulous NS and preservation of the periprostatic supportive structures (e.g. ‘excellent’ NS) indeed impacts urinary continence and is a contributor to early ‘back to baseline’ urinary QoL after RP.

**Associate Editor Davis’ Finish**

In the present review, we present multiple aspects of urinary continence post-RP QoL, measuring progress, anatomical concept, and NS concepts. Although presented almost like a
debate, these are not either-or techniques to consider; both may be replicated/validated and put into your repertoire. Figures 4–7 show a series of validation images in which another surgeon (J.W.D.) is replicating the technique and data discussed by team Pavlovich. Figure 7 shows the same concept, replicating/validating the Rocco/posterior reconstruction. With the advances in validated QoL surveys and interpretation, we can improve our ability to quantitate progress and design proper comparisons. Indeed, the next wave of ‘progress’ is now being reported in the form of the ‘Retzius-sparing’ approach [69,70]. In this technique, the entire procedure is performed through the Pouch of Douglas. Although the posterior reconstruction and NS planes can be performed in the same manner, the additional hypothesis proposed is that preserving the complete anterior space of Retzius tissues provides additional bladder support and enhanced recovery of urinary continence. A refreshing future will be the opportunity to have randomised data in this space. Mani Menon (Henry Ford, Detroit, MI, USA) has presented a single centre randomised clinical trial of standard to the Retzius sparing technique and publically reported results indicating advantages for Retzius sparing at 3 months [71] (Clinicaltrials.gov identifier NCT02352103). However, urinary continence at 1 year returned to similar levels. This technique will add to our controversies on ideal technique, training, and learning curves.

In conclusion, urinary continence is a multifactorial process. In this debate-style review, we emphasise two areas highlighted in the literature, whereby a debater considers a question and then aligns literature around that question. In other styles of review, all aspects of a question like continence-sparing technique can be considered. Bessede et al. [72] performed such a review, and with a wide ranging search (urethral sphincter, urethral rhabdosphincter, urinary continence and nerve supply, neuroanatomy and NS), they found 17 articles. Table 2 highlights the sub-topics on urinary continence that they reviewed – a multifactorial contribution of anatomy preservation, reconstruction, and nerve preservation. Their conclusion agrees: ‘it is challenging to delineate the specific impact of periprostatic nerve sparing on urinary continence, but the anatomical data suggest that RP surgeons should steer toward the preservation and protection of these nerves whenever possible’.

**Conflicts of Interest**

Dr. Davis: Consultant, Intuitive Surgical.
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Urinary continence recovery after radical prostatectomy

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Correspondence: John W. Davis, MD Anderson Cancer Center, 1515 Holcombe Blvd, Unit 1303, Houston, TX 77401, USA.
e-mail: JohnDavis@mdanderson.org

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Abbreviations: ED, erectile dysfunction; DVC, dorsal vein complex; EPIC, Expanded Prostate Cancer Index Composite; IIEF, International Index of Erectile Function; NS, nerve sparing; NVB, neurovascular bundle; PPD, pads per day; PSM, positive surgical margin; QoL, quality of life; (L)(RA) RP, (laparoscopic) (robot-assisted) radical prostatectomy; SHIM, Sexual Health Inventory for Men; UCLA, University of California Los Angeles; UI, urinary incontinence.

Supporting Information
Additional Supporting Information may be found in the online version of this article:
Video S1 Dr Davis demonstrates further reproducibility of technique in this supplementary video.