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Outcomes of Intraoperative Preservation of Erectile Function and Urinary Continence in Robotic-Assisted Radical Prostatectomy: A Literature Review

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Abstract

Prostate cancer is still one of the most common cancers in men globally. Although survival rates after treatment continue to rise, postoperative functional outcomes are now crucial when choosing a course of therapy. Because improved three-dimensional imaging and instrument accuracy enable more precise nerve-sparing and tissue-preserving dissection, robotic-assisted radical prostatectomy (RARP) is currently the recommended surgical technique for localized and chosen locally advanced disease. Despite these technological advancements, erectile dysfunction and urine incontinence are still frequent surgical complications that significantly impair quality of life, especially in younger and sexually active men. 105 peer-reviewed sources covering methodological advancements in nerve-sparing surgery, Retzius-sparing RARP, pelvic fascia and support-structure preservation, single-port and novel access modalities, anterior and posterior musculofascial reconstruction, surgeon experience and learning-curve effects, and their impact on positive surgical margin (PSM) and biochemical recurrence (BCR) rates are summarized in this review. Techniques that maintain the detrusor apron, puboprostatic ligaments, endopelvic fascia, and neurovascular bundles consistently speed up the recovery of potency and continence without increasing the duration of surgery. The quickest early continence recovery is provided by retzius-sparing and single-port transvesical techniques, although in anteriorly placed or locally advanced (T3a) illness, there is a trend toward greater positive-margin rates, highlighting the significance of cautious patient selection. Without sacrificing oncologic safety, musculofascial restoration and more surgeon expertise enhance early functional recovery. When the pentafecta objectives of continence, potency, freedom from biochemical recurrence, absence of comorbidities, and negative margins are balanced, the data supports a customized, anatomy-guided strategy to intraoperative preservation [20, 70].

Keywords: Prostate cancer; Robotic-assisted radical prostatectomy; Nerve-sparing; Retzius-sparing; Urinary continence; erectile function; Pentafecta

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1. Introduction:

Prostate cancer (PCa) is a major source of cancer-related morbidity globally and the second most frequent solid tumor diagnosed in males (1-3). Men who arrive with high-risk disease, as defined by a PSA > 20 ng/mL, Gleason score 8–10, or clinical stage ≥ T3, make up a significant minority of the diagnosed population in the United States alone, where the incidence has been estimated to be in the hundreds of thousands of new cases yearly (4, 5). Clinical decision-making is centered on curative-intent local therapy because, although mortality from localized illness has stabilized in modern health systems, disease that progresses or relapses continues to be

a major cause of cancer death (6, 7).

Robotic-assisted radical prostatectomy (RARP) has become the dominant surgical treatment for localized prostate cancer, now accounting for the large majority of radical prostatectomies performed internationally (8, 9). Its magnified three-dimensional field of view and wristed instrumentation give surgeons finer control over the dissection planes around the prostate than open or conventional laparoscopic approaches allow, which has, in turn, driven rapid innovation in nerve-sparing and tissue-preserving techniques (10, 11). Randomized and population-level comparisons of surgery, radiotherapy, and active monitoring confirm that all three strategies achieve comparable long-term survival for localized disease, which has shifted the emphasis of treatment selection toward minimizing functional harm rather than survival differences alone (6, 12).

Urinary incontinence and erectile dysfunction continue to be the two most significant side effects of RARP despite this technological advancement (13, 14). Although the vast majority of men achieve continence by twelve months, early postoperative pad usage is typical; most series show that 70–80% of men need pads at six weeks and 20–40% continue to do so at six months(13, 15). The burden of erectile dysfunction and incontinence is increased by a screening-driven shift toward younger, more sexually active patients who anticipate a quicker and more thorough functional recovery (16, 17). Both conditions are linked to low self-esteem, psychological distress, and impaired intimate relationships. Numerous intraoperative preservation techniques, such as bladder-neck preservation, subapical urethral dissection, nerve-sparing dissection planes, Retzius-sparing and single-port access, and anterior or posterior musculofascial reconstruction, have been inspired by these pressures in an effort to preserve the anatomical structures responsible for potency and continence without sacrificing cancer control (11, 18).

The pentafecta preserved erectile function, urine continence, independence from biochemical recurrence (BCR), lack of serious sequelae, and negative surgical margins is the composite outcome that is increasingly used to assess surgical effectiveness (19, 20). Since no single method has been proven to consistently produce all five results, there is a real need to compile the body of data due to the increasing number of anatomical variations (15, 19). By methodically arranging the research on intraoperative preservation methods in RARP according to their anatomical target and evaluating their effects on functional recovery and oncologic safety, this review fills that gap (19, 21).

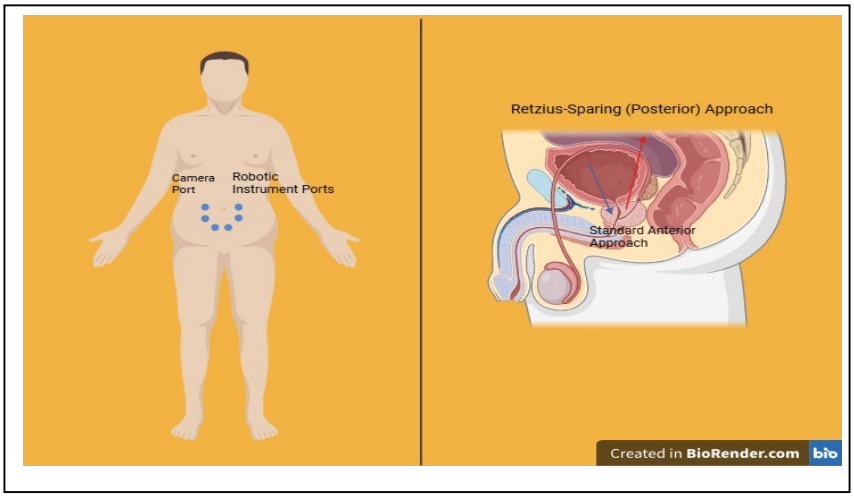


Figure 1: Anatomical Set-Up and Access Corridors in Robotic Radical Prostatectomy.

2. Research Questions and Scope of the Review

2.1 Research Questions:

This comprehensive review is organized around three primary research questions:

Functional Recovery: How do particular intraoperative preservation techniques (such as bilateral intrafascial/interfascial nerve-sparing, Retzius-sparing, and subapical urethral preservation) affect the speed and duration of recovery for erectile potency and postoperative urinary continence in RARP patients?

Oncologic Safety: In high-risk or locally advanced (T3a) illness, do tissue- and nerve-preserving methods affect oncologic results, specifically positive surgical margin (PSM) rates and biochemical recurrence-free survival (BFS)?

Comparative Efficacy: In terms of obtaining combined Trifecta and Pentafecta objectives, how do innovative access techniques like single-port transvesical RARP (SP-TV-RARP) compare to conventional multi-port transperitoneal RARP?

2.2 Scope:

Only functional preservation and oncologic results in individuals with localized and selected locally advanced prostate cancer after RARP are the subject of this review. Retzius-sparing (RS-RARP), pelvic fascia preservation (PFS-RARP), bilateral and unilateral nerve-sparing, subapical urethral dissection, and anterior and posterior anatomical reconstructions are among the intraoperative preservation strategies covered. In addition to oncologic safety indicators like good surgical margins and biochemical recurrence-free survival, the main assessment metrics are the recovery rate and timeline of erectile potency (IIEF-5 score) and urine continence (pad usage).

3. Methodology: Literature Search Strategy

A systematic narrative-review technique based on PRISMA reporting criteria was utilized to locate, filter, and summarize the relevant literature (15, 22). Peer-reviewed literature published until 2026 were located in electronic databases (PubMed/MEDLINE, Scopus, Embase, Web of Science, and the Cochrane Library) using structured search term combinations (22, 23). Reference lists of pertinent original papers and credible systematic reviews were carefully searched to ensure comprehensive coverage(15, 24). Full-text evaluation against predetermined eligibility criteria was carried out following an initial relevance screening of titles and abstracts (22). The 105 retained studies were categorized thematically based on the anatomical goal of preservation in order to arrange the thorough analysis in Section 4(11, 20).

Table 1. Literature search strategy, inclusion, and exclusion criteria.

Element	Detail
Databases	PubMed/MEDLINE, Scopus, Embase, Web of Science, Cochrane Library
Search Terms	"Robot-assisted radical prostatectomy" OR "RARP" AND ("nerve-sparing" OR "Retzius-sparing" OR "pelvic fascia" OR "single-port" OR "transvesical" OR "posterior reconstruction" OR "anterior reconstruction") AND ("urinary continence" OR "erectile function" OR "IIEF-5" OR "positive surgical margin" OR "biochemical recurrence")
Publications Window	2006–2026 (technique-defining historical studies before 2006 cited for anatomical context)
Inclusion Criteria	Peer-reviewed original studies, RCTs, prospective/retrospective cohorts, and systematic reviews or meta-analyses reporting continence, potency, PSM, or BCR outcomes after RARP; English language; $n \geq 10$ patients
Exclusion Criteria	Non-RARP cohorts (open/laparoscopic-only), case reports < 10 patients, conference abstracts without full text, non-English full text, editorials/commentaries without original data
Data Extracted	Study design, sample size, preservation technique, continence outcome, erectile-function outcome, oncologic outcome (PSM/BCR), follow-up interval

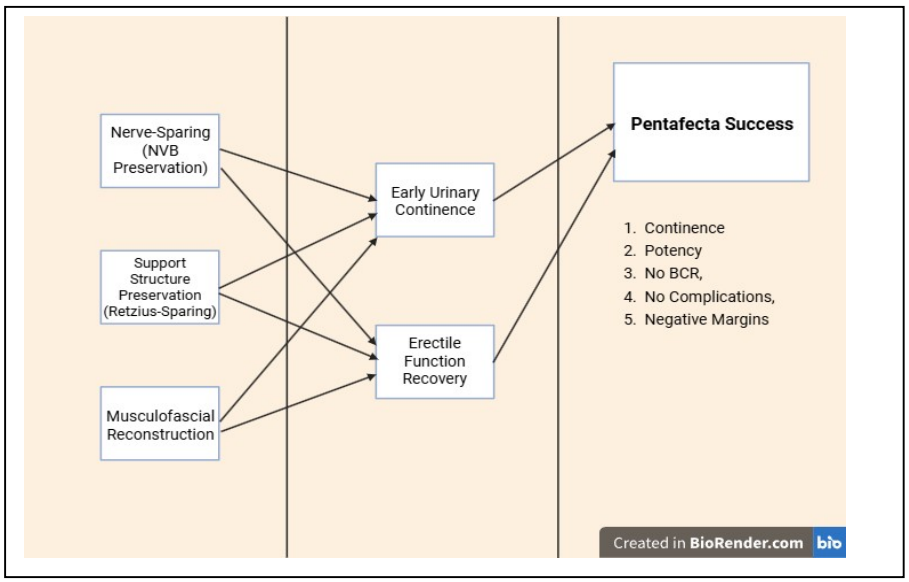


Figure 2: PRISMA Flow Diagram of Literature Screening and Study Selection

4. Literature Review

4.1 Neurovascular Bundle (NVB) and Nerve-Sparing Techniques

Takenaka and colleagues' anatomical dissections revealed that the neurovascular bundles are a complex plexus that extends anterolaterally around the prostate rather than a single distinct posterior structure. This discovery reframed nerve-sparing as a fascial preservation issue rather than a purely neural one (21). Based on this anatomy, Kaul and colleagues developed the Veil of Aphrodite technique, an interfascial dissection that protects the lateral pelvic fascia and the nerve fibers that are connected to it. In their first series, 97% of patients reported urinary control after a year, and many of them regained erectile function; the authors attributed this result to precise interfascial planes and less thermal injury (11). This was then improved by Ghani and associates into a high anterior release approach that was oncologically suitable for low-risk illness and significantly reduced the time to continence recovery (25). These single-center results are often supported by meta-analytic data (15, 22). Neurovascular bundle preservation was linked to a minor early-potency advantage and a shorter time to continence, but not a difference in long-term continence rates, according to Reeves and colleagues' analysis of almost 13,000 patients (22). In parallel comprehensive evaluations, Ficarra and colleagues documented substantial variation in continence recovery among series and demonstrated that, in comparison to unilateral or non-nerve-sparing dissection, bilateral nerve-sparing considerably enhances the probabilities of potency recovery at twelve months (15, 26). Bilateral nerve-sparing improves urine continence recovery within the first postoperative year without changing long-term rates, according to a more recent comprehensive study that particularly examined bilateral vs unilateral comparisons (27).

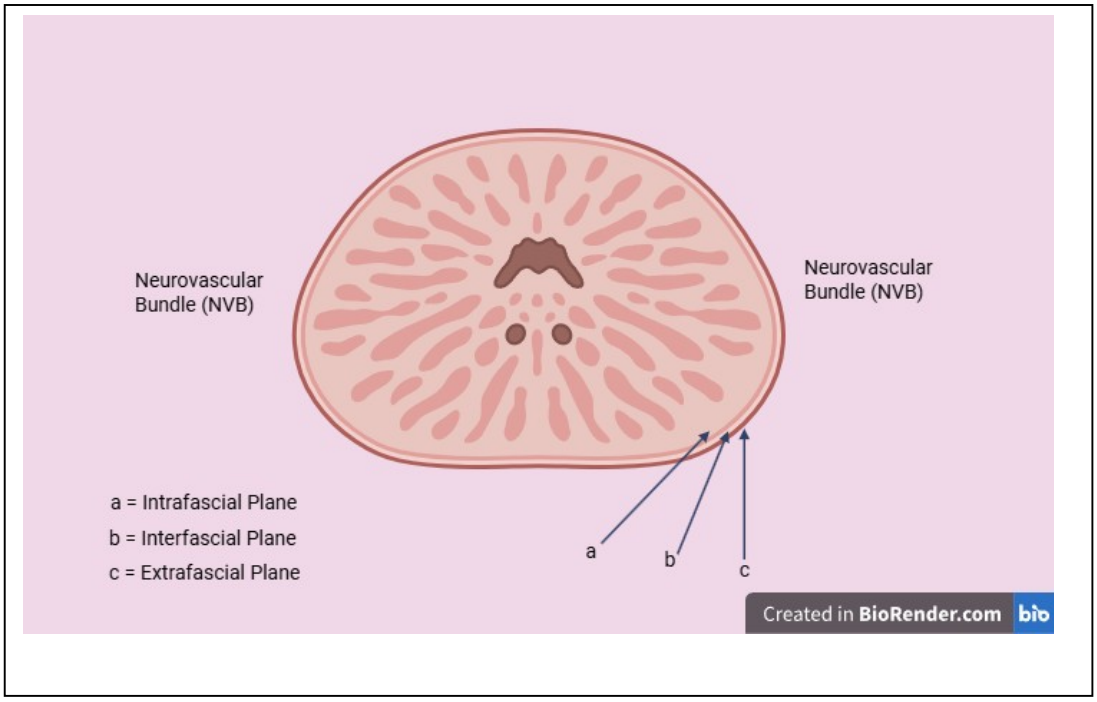


Figure 3: Conceptual Framework of Intraoperative Preservation Strategies in RARP.

Extending nerve-sparing into higher-risk disease has been a particular focus of recent literature (28, 29). Park and colleagues showed that nerve-sparing improves continence even in men with preoperative erectile dysfunction, although potency recovery in this subgroup remains limited (28). Takahara and colleagues, comparing nerve-sparing against non-nerve-sparing RARP in D'Amico high-risk disease, found significantly lower daily pad counts in the nerve-sparing group at three and six months, with equivalent oncologic outcomes on multivariate analysis (30). Liu and colleagues reached a similar conclusion across high-risk cohorts: neurovascular-bundle-sparing RARP improved erectile function and continence without increasing recurrence risk when patients were selected using preoperative imaging and intraoperative judgment (29). Vis and colleagues formalized this selection process into consensus, MRI-guided criteria for choosing candidates for nerve-sparing surgery, emphasizing that patient selection rather than the nerve-sparing technique alone is the primary determinant of oncologic safety (31-33).

Table 2. Representative studies of neurovascular bundle preservation and nerve-sparing technique.

Study (Year)	Design/n	Technique	Continence/Potency	Oncologic Outcome
Kaul et al. (2006)	Prospective, n=154	Veil of Aphrodite interfascial dissection	97% continent at 12 mo; improved potency	Safe in low-risk disease
Ghani et al. (2012) [23]	Prospective Cohort	High nterior release	Earlier continence recovery	Favorable in low-risk patients
Reeves et al. (2015)	Meta-analysis, >13,000	NVB-sparing (various)	Faster continence ≤ 6 mo; higher early potency	No long-term continence difference
Ficarra et al. (2012)	Systematic review	Preservation techniques(pooled)	Wide variability; bilateral NS favors potency	Not Separately reported
Takahara et al. (2019)	Retrospective, n=230	Bitateral/unilateral NS vs. non-NS, high-risk	Lower pad counts at 3-6 mo with NS	Equivalent BCR on multivariate analysis
Liu et al, (2023)	Meta-analysis, high-risk	NVB-sparing RARP	Improved erectile function/continence	No increase in recurrence risk

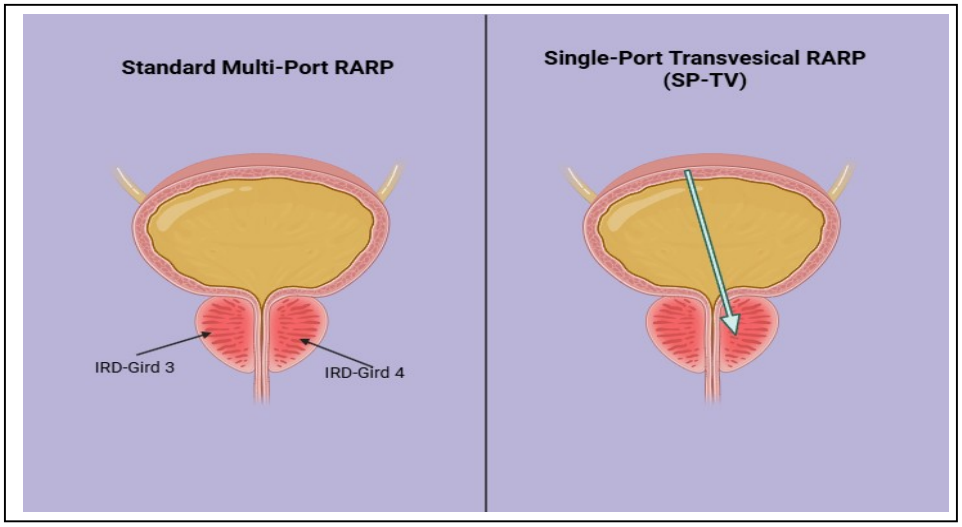


Figure 4: Anatomical Cross-Section of Nerve-Sparing Dissection Planes

4.2 Retzius-Sparing RARP (RS-RARP):

Galfano and colleagues first described Retzius-sparing RARP, entering through the pouch of Douglas rather than the anterior space of Retzius, thereby preserving the detrusor apron, puboprostatic ligaments, arcus tendineus, and dorsal venous complex structures collectively responsible for anterior urethral support(34). In their initial 200-patient series, this posterior approach produced faster early continence recovery than historical anterior-approach cohorts, albeit with a learning curve, and with acceptable positive surgical margin rates (34, 35). Dalela and colleagues subsequently confirmed this benefit in a randomized controlled trial, reporting significantly better continence recovery at three months for RS-RARP compared with standard RARP, with comparable margin status between arms (36). Ma and colleagues, and later Lee and colleagues, corroborated these findings in meta-analytic and propensity-matched comparisons: RS-RARP consistently achieves higher continence rates at three and twelve months, though the between-group difference narrows over the first postoperative year as standard-RARP patients continue to recover(23, 37).

A parallel technical development, the “hood technique” described by Kim and Tewari, achieves a similar anterior-structure-preserving effect via an anterior approach preserving the detrusor apron, arcus tendineus, and puboprostatic ligament as an intact “hood” around the membranous urethra [36]. They reported continence rates progressing from 21% at one week to 95% at 48 weeks after catheter removal, alongside a low 6% positive margin rate (38). Quality-of-life data from Egan and colleagues indicate that these early continence gains translate into meaningfully better patient-reported outcomes in the first postoperative year, while Olivero and colleagues quantified a discrete learning curve for the technique, with functional outcomes improving as surgeon case volume accumulates (35, 39). A large randomized, controlled trial by Qiu and colleagues with one-year follow-up similarly found that RS-RARP improved early urinary continence recovery relative to conventional RARP (40).

Oncologic safety is the principal caveat attached to Retzius-sparing techniques (41, 42). Feng and colleagues, comparing anterior, posterior, and Retzius-sparing approaches, found that immediate continence outcomes favored RS-RARP and that anterior-posterior reconstruction was associated with fewer positive margins in locally advanced (T3) disease, while continence outcomes converged across techniques by six months (41). Kowalczyk and colleagues and Simone and colleagues both reported that RS-RARP maintains acceptable oncologic control even in higher-risk cohorts, provided patient selection accounts for anterior tumor location, since the posterior entry plane affords less direct visualization of anterior extraprostatic extension (42, 43). Large comparative series place RS-RARP biochemical recurrence-free survival at roughly 60–65% at four years, similar to conventional RARP, despite positive-margin frequencies in the range of 28–33% in some anteriorly located tumors—evidence that oncologic equivalence is generally preserved but that margin positivity can rise with extensive anterior-structure preservation (34, 36, 41).

Table 3. Representative studies of Retzius-sparing RARP.

Study (Year)	Design/n	Technique	Continence Outcome	Oncologic Outcome
Galfano et al. (2013)	Prospective, n=200	RS-RARP (posterior entry)	Faster early continence after learning curve	Acceptable PSM
Dalela et al. (2017)	RCT	RS-RARP vs. standard RARP	Significantly better continence at 3 mo	PSM similar to standard RARP
Lee et al. (2020)	Propensity-matched cohort	RS-RARP vs. standard RARP	Better continence at 3 mo; equalizes at 12 mo	Similar oncologic outcomes
Kim & Tewari (2021)	Prospective, n=300	Hood technique (anterior preservation)	95% continent at 48 wk	6% PSM
Feng et al. (2025)	Comparative cohort	Anterior vs. posterior vs. RS-RARP	RS-RARP best immediate continence	Fewer PSM with AP reconstruction in T3 disease

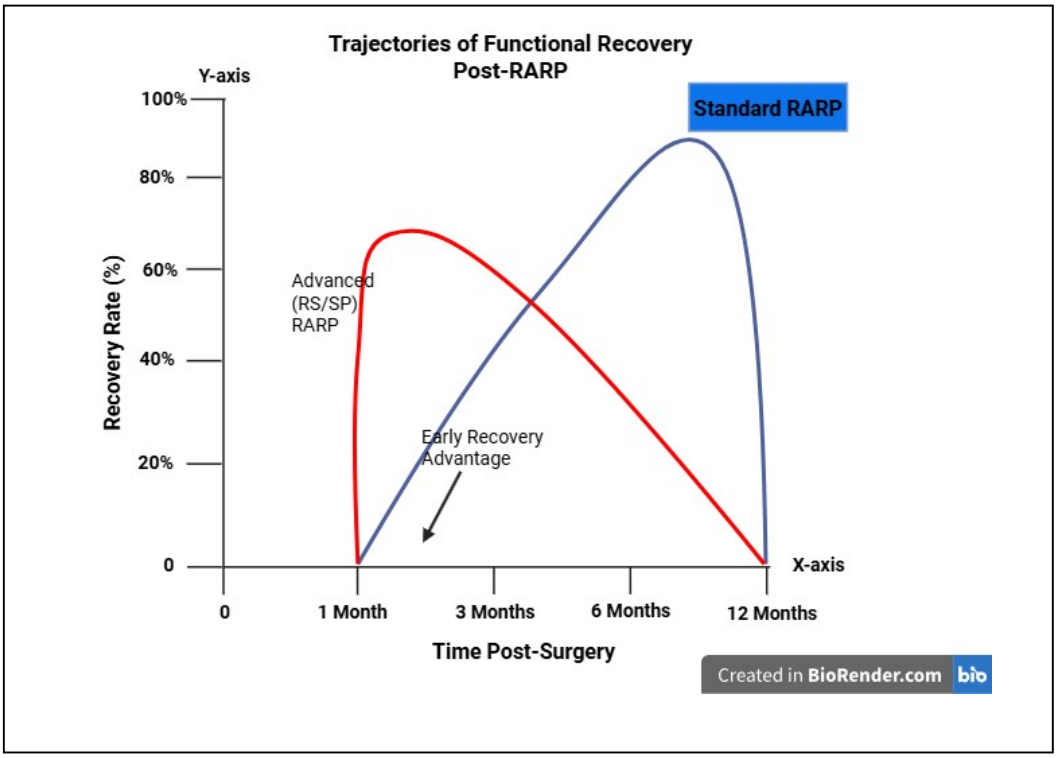


Figure 5: Surgical Corridor Comparison: Standard Anterior vs Retzius-Sparing Posterior.

4.3 Pelvic Fascia and Support-Structure Preservation:

A distinct but related strategy, pelvic fascia-sparing RARP (PFS-RARP), retains the endopelvic fascia, puboprostatic ligaments, and detrusor apron by avoiding fascial incision altogether during prostate exposure, thereby providing continuous postoperative support to the urethra (44, 45). Dall and colleagues reported that this benefit is durable: EPIC-Urinary Incontinence domain data at 24 months showed continued improvement in the fascia-preserving group well beyond the one-year mark at which Retzius-sparing benefits typically plateau (44). Katsimperis and colleagues, reviewing the accumulated evidence, concluded that PFS-RARP offers faster

functional recovery but that its benefits are contingent on surgeon experience and careful patient selection, since the technique can be difficult to master and may raise positive-margin rates in unselected cohorts (45). Maruo and colleagues extended follow-up to five years and confirmed that endopelvic fascia preservation sustains both continence and erectile-function gains over the long term without a corresponding increase in recurrence (46).

At a finer anatomical resolution, Srivatsa and Hemal isolated the specific contribution of the puboprostatic ligaments, showing that their preservation independently improves early urinary continence, consistent with their proposed role as a passive suspensory structure for the membranous urethra (47). Stolzenburg and colleagues linked membranous urethral length itself protected by endopelvic fascia preservation to continence recovery, reinforcing the idea that preoperative imaging of urethral length can help predict which patients will benefit most from a support-structure-sparing approach (13, 15). At the level of dissection plane, Weng and colleagues' meta-analysis comparing intrafascial and interfascial nerve-sparing found that the more conservative intrafascial plane further improves potency without compromising margin status in appropriately selected patients (48). Covas Moschovas and colleagues demonstrated that a modified apical dissection preserving the lateral prostatic fascia accelerates early postoperative functional recovery in a propensity-matched analysis (49), while Basourakos and colleagues catalogued the range of RARP maneuvers developed specifically to attenuate iatrogenic erectile dysfunction (50).

Table 4. Representative studies of pelvic fascia and support-structure preservation.

Study (Year)	Design/n	Structure Preserved	Functional Outcome	Oncologic Outcome
Dall et al. (2023)	Prospective cohort	Endopelvic fascia, ligaments, detrusor apron	Continued EPIC-UI improvement to 24 mo	Not compromised
Katsimperis et al. (2023)	Narrative review	Pelvic fascia (PFS-RARP)	Faster recovery; surgeon-dependent	PSM risk in unselected cohorts
Maruo et al. (2024) [44]	Prospective, 5-yr follow-up	Endopelvic fascia (nerve-sparing)	Sustained continence and potency gains	No recurrence increases at 5 yr
Srivatsa & Hemal (2015)	Cohort	Puboprostatic ligaments	Improved early continence	Not primary outcome
Weng et al. (2017)	Meta-analysis	Intrafascial vs. interfascial NS	Improved potency with intrafascial plane	No compromise in selected patients

4.4 Single-Port and Novel Surgical Modalities:

Single-port transvesical RARP (SP-TV-RARP) represents a major contemporary technical innovation in the field (24, 51). By entering the prostate through the bladder, the approach bypasses the space of Retzius entirely, preserving the anterior continence structures without requiring the posterior Douglas-space dissection used in RS-RARP (24). Ward and colleagues, reporting on single-port transvesical cohorts, found that 43% of patients recovered continence within one day of catheter removal and 75% within three months, with two-thirds of patients regaining erectile function by a median of 69 days (51). These functional results represent some of the fastest recovery trajectories reported, but they come with an important caveat: overall positive-margin rates in initial cohorts were higher than for conventional RARP, even though organ-confined-disease margin rates remained acceptable (24, 51).

Comparative and meta-analytic work situates single-port techniques within the broader access-strategy literature (24, 52). Kaouk and colleagues' systematic review of single-port versus multi-port RARP found broadly comparable perioperative and functional outcomes, with the single-port approach offering advantages in postoperative pain and hospital stay (24). Nguyen and colleagues' meta-analysis and Chavali and colleagues' propensity-matched comparison both confirmed similar continence, potency, and margin outcomes between single-port and multi-port platforms, while Lenfant and colleagues found equivalent outcomes in single-institution comparative studies (53, 54). Ramos-Carpinteyro and colleagues identified specific predictors of early continence recovery after SP-TV-RARP, including younger age, smaller prostate volume, and preserved

membranous urethral length (55), while Jiang and colleagues' meta-analysis of extraperitoneal versus transperitoneal single-port access found no meaningful difference in perioperative, functional, or margin outcomes between the two access routes (56). Ferguson et al. and Zhou et al. further corroborated the feasibility and functional promise of transvesical techniques (57), building upon foundational work on pneumovesicum approaches described by Tae and colleagues (58).

Table 5. Representative studies of single-port and novel access modalities.

Study (Year)	Design / n	Modality	Continence / Potency	Oncologic Outcome
Kaouk et al. (2021)	Initial clinical cohort	SP transvesical RARP	Early continence recovery described	Feasibility confirmed
Ward et al. (2025)	Prospective cohort	SP-TV-RARP	43% continent at day 1; 75% at 3 mo; 66% potent	Higher overall PSM; acceptable in pT2
Kaouk et al. (2019)	Systematic review	SP vs. multi-port RARP	Comparable functional outcomes	Comparable PSM
Nguyen et al. (2023)	Meta-analysis	SP vs. multi-port RARP	Similar continence/potency	Similar oncologic outcomes
Ramos-Carpinteyro et al. (2023)	Cohort	SP-TV-RARP	Predictors of early continence identified	Not primary outcome

4.5 Musculofascial Reconstructions (Anterior and Posterior):

Reconstructive techniques, applied after prostate removal regardless of the access route chosen, represent a complementary strategy to nerve- and fascia-sparing dissection (18, 59). Rocco and colleagues introduced posterior musculofascial (rhabdosphincter) reconstruction, reapproximating Denonvilliers' fascia to the posterior urethral plate; this restoration of posterior support was associated with faster recovery of urinary continence and, importantly, did not prolong operative time, increase blood loss, or affect margin rates (18). Tewari and colleagues described a complementary anterior technique anatomic reconstruction incorporating the puboprostatic collar that reduces urethral hypermobility and improves early continence via a multilayer pelvic-floor repair, without oncologic compromise (59).

Grasso and colleagues' meta-analysis of posterior rhabdosphincter reconstruction confirmed a consistent early-continence benefit across pooled series, while Hurtes and colleagues showed that combining anterior and posterior reconstruction produces an additive improvement in early continence recovery relative to either technique alone (60, 61). Together, this body of work establishes reconstruction as a safe, low-risk adjunct that can be layered onto nerve-sparing, Retzius-sparing, or single-port dissection to further shorten the time to pad-free continence (18, 60, 61).

Table 6. Representative studies of anterior and posterior musculofascial reconstruction.

Study (Year)	Design	Technique	Continence Outcome	Oncologic / Safety
Rocco et al. (2007)	Prospective cohort	Posterior rhabdosphincter reconstruction	Faster early continence	No increase in PSM or operative time
Tewari et al. (2007)	Prospective cohort	Anatomic (puboprostatic collar) reconstruction	Significant early continence benefit	No oncologic compromise
Grasso et al. (2012)	Meta-analysis	Posterior reconstruction	Consistent early-continence benefit	Not adversely affected
Hurtes et al. (2016)	Comparative cohort	Combined anterior + posterior reconstruction	Additive early continence benefit	No compromise reported

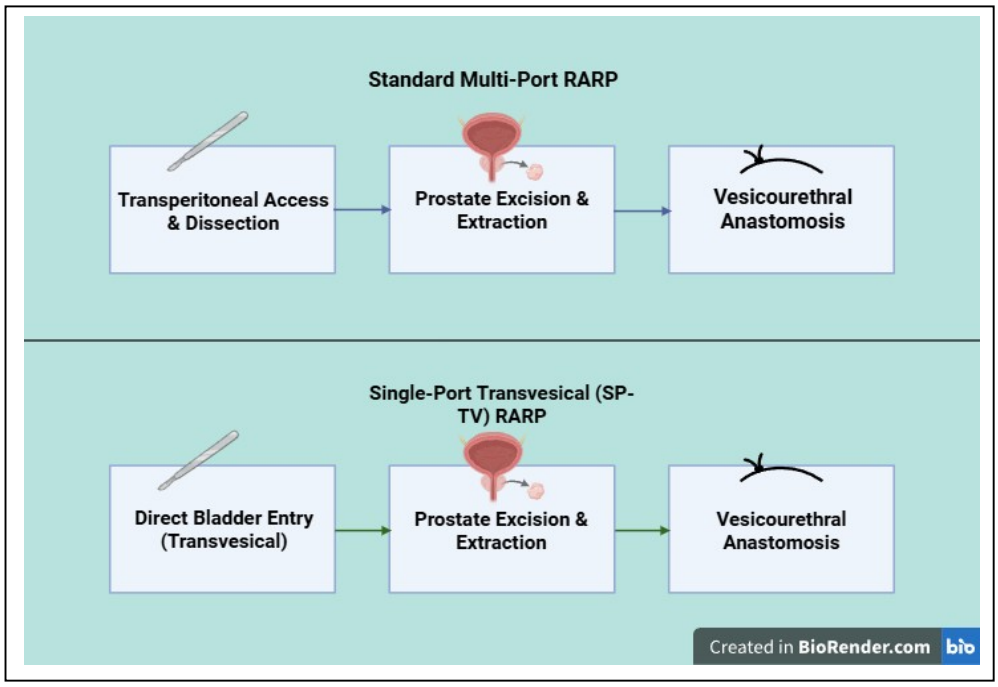


Figure 6: Surgical Step Workflows Across RARP Variants (Multi-Port vs SP-TV)

4.6 Surgical Experience, Volume, and the Learning Curve:

Across every technique reviewed above, surgeon experience and case volume modulate outcomes independent of the anatomical strategy chosen (62, 63). Hung and colleagues found that higher institutional and surgeon case volume was associated with better urinary-continence outcomes following RARP, consistent with a genuine learning-curve effect rather than case-mix selection alone (62). Su and colleagues quantified this effect specifically for nerve-sparing RARP, estimating the number of cases required before potency and continence outcomes plateau at their best achievable level (64). Vickers and colleagues, examining positive surgical margin rates as a function of cumulative surgeon experience, showed that margin positivity declines meaningfully over a surgeon's early case series and continues to improve, at a slower rate, well beyond typical credentialing thresholds (63).

Olivero and colleagues' data on the Retzius-sparing learning curve and Katsimperis and colleagues' caution about the technical demands of pelvic fascia-sparing RARP both reinforce that newer, more anatomically ambitious preservation techniques carry a steeper learning curve than conventional RARP (35, 45). This consistent finding has direct implications for how the field should interpret comparative outcome data: differences between techniques reported in single-institution or early-adopter series may partly reflect surgeon experience with the newer approach rather than a purely anatomical advantage (45, 62, 63).

Table 7. Representative studies of surgical experience and learning-curve effects.

Study (Year)	Design	Focus	Key Finding
Hung et al. (2020)	Volume-outcome cohort	Surgical/institutional volume	Higher volume associated with better continence outcomes
Su et al. (2011)	Learning-curve analysis	Nerve-sparing RARP	Case threshold identified before functional plateau
Vickers et al. (2010)	Learning-curve	Positive surgical margins	PSM declines with cumulative surgeons

Representative studies of surgical experience and learning-curve effects.

4.7 Positive Surgical Margins (PSM) and Biochemical Recurrence (BCR):

Oncologic safety is the counterweight against which every preservation technique discussed above must be judged (65). Novara and colleagues catalogued the principal risk factors for positive surgical margins after robotic radical prostatectomy, identifying tumor stage, Gleason grade, and apical or anterior tumor location as the dominant predictors factors that are, notably, independent of whether a nerve- or fascia-sparing technique was used (65). Morgan and colleagues showed that margin status, PSA, and Gleason grade were the strongest predictors of biochemical recurrence after nerve-sparing RARP specifically, reinforcing that appropriate patient selection, rather than avoidance of nerve-sparing altogether, is the key safeguard against compromised cancer control (66).

Applied to the newer preservation techniques, Montorsi and colleagues found that margin status after Retzius-sparing RARP was associated with long-term biochemical recurrence-free survival at rates comparable to conventional RARP, despite a modestly higher positive-margin frequency in some anteriorly located tumors (67). This pattern was also identified by Zilberman and colleagues, who linked apical margin positivity specifically to a higher risk of recurrence regardless of the nerve-sparing status of the case (68). Single-port transvesical series report roughly 94% biochemical-recurrence-free survival at two years, a promising early signal, though follow-up remains short relative to the long horizon over which prostate-cancer recurrence can manifest (51). Taken together with the composite-outcome literature Patel and colleagues' multi-institutional Trifecta and Pentafecta analysis, and Ficarra and colleagues' framework for defining functional and oncologic success the evidence indicates that most preservation-focused techniques do not compromise oncologic safety in appropriately selected patients, but that anterior or high-stage disease warrants more conservative technique selection and closer margin surveillance (19, 20).

Table 8. Representative studies of positive surgical margins and biochemical recurrence.

Study (Year)	Design	Focus	Key Finding
Novara et al. (2012)	Cohort / risk-factor analysis	PSM after RARP	Stage, grade, apical/anterior location predict PSM
Morgan et al. (2014)	Cohort	BCR after nerve-sparing RARP	Margin status, PSA, grade predict BCR
Montorsi et al. (2021)	Comparative cohort	RS-RARP margin status and BCR	BCR-free survival comparable to standard RARP
Zilberman et al. (2015)	Cohort	Apical margin positivity	Apical PSM independently predicts recurrence
Patel et al. (2018)	Multi-institutional analysis	Trifecta / Pentafecta outcomes	Framework for composite outcome reporting

5. Synthesis and Discussion

Viewed across all seven themes, three consistent patterns emerge from this synthesis (19, 20).

First, every anatomical preservation strategy reviewed nerve-sparing, Retzius-sparing, pelvic fascia preservation, single-port transvesical access, and musculofascial reconstruction accelerates the recovery of urinary continence relative to conventional dissection, and several also improve early erectile-function recovery, without a clear increase in operative time or perioperative complications (11, 18, 34, 44, 51).

Second, the magnitude of the early-recovery advantage tends to narrow over the first postoperative year (36, 37). RS-RARP's continence advantage over standard RARP, for example, is most pronounced at three months and largely equalizes by twelve months, suggesting that most preservation techniques shift the velocity of recovery

more than its ultimate ceiling (36, 37).

Third, and most consistently across the literature, oncologic safety is preserved in appropriately selected patients, but margin positivity rises in anteriorly located or locally advanced (T3a) disease when anterior support structures are aggressively preserved a signal reported independently in the Retzius-sparing, pelvic fascia-sparing, and single-port transvesical literatures (41, 45, 51).

Surgeon experience is an underappreciated confound running through all of these comparisons (62, 63). Because newer techniques such as Retzius-sparing, pelvic fascia-sparing, and single-port transvesical RARP are disproportionately reported from high-volume, early-adopter centers, some of the functional advantage attributed to anatomy may in fact reflect the learning-curve and volume effects documented independently by Hung, Su, Vickers, and Olivero (35, 62, 63). This does not diminish the anatomical rationale for preservation the mechanistic link between detrusor apron, puboprostatic ligament, and endopelvic fascia preservation and urethral support is well established but it does argue for cautious interpretation of head-to-head comparisons that are not adjusted for surgeon case volume (13, 47, 62, 69).

6. Research Gaps and Future Directions

Despite extensive research, several critical gaps remain in the current literature:

Long-term Oncologic Follow-Up: Single-port transvesical and pelvic fascia-sparing series rarely extend beyond two to five years; longer follow-up is needed before these techniques can be considered oncologically equivalent to conventional RARP with complete confidence (41, 45, 51).

Standardized Outcome Reporting: Continence and potency are defined inconsistently across studies (pad-free vs. “security-pad” definitions; IIEF-5 score thresholds vary), which limits direct meta-analytic comparisons across surgical modalities (13, 15, 26).

Volume-Adjusted Comparative Trials: Few randomized comparisons between preservation techniques explicitly adjust for surgeon case volume, despite clear evidence that volume independently affects functional and oncologic outcomes (62, 63).

Patient Selection Tools for Anterior Disease: Preoperative imaging-based selection algorithms for choosing among nerve-sparing, Retzius-sparing, and single-port approaches in anteriorly located tumors remain underdeveloped relative to validated MRI-guided criteria for posterior/lateral disease (31, 41).

Combinatorial Technique Evaluation: Musculofascial reconstruction is typically studied as an adjunct to conventional dissection; its incremental benefit when layered onto Retzius-sparing or single-port transvesical access has not been systematically evaluated (60, 61).

7. Conclusion

The literature on intraoperative preservation in robotic-assisted radical prostatectomy has matured from single-technique case series into a rich, anatomically organized evidence base spanning nerve-sparing, Retzius-sparing, pelvic fascia preservation, single-port transvesical access, and musculofascial reconstruction . Across this body of work, techniques that preserve the neurovascular bundles, endopelvic fascia, puboprostatic ligaments, and detrusor apron consistently accelerate the recovery of continence and potency, and reconstructive adjuncts appear to compound this benefit without materially affecting operative safety.

The central unresolved tension is between the speed of functional recovery afforded by anterior-structure-preserving approaches and the modestly elevated risk of positive surgical margins observed in anteriorly located or locally advanced disease with some of these same techniques. Addressing the research questions that framed this review, the evidence indicates that intraoperative preservation techniques meaningfully shorten the timeline to continence and potency recovery, that oncologic safety is generally preserved in well-selected patients but requires vigilance in anterior or T3a disease, and that novel access strategies such as single-port transvesical RARP can match or exceed standard RARP on early Trifecta and Pentafecta metrics while their long-term oncologic durability remains under confirmation . Individualized technique selection grounded in tumor location and stage, patient anatomy, and surgeon experience therefore remains the most defensible path toward achieving the pentafecta of continence, potency, freedom from biochemical recurrence, absence of complications, and negative margins.

References

Agarwal, P.K. & Patel, V.R. (2019). Minimizing Thermal Injury during Neurovascular Bundle Release in RARP. Current Urology Reports. 20, 52.

Asimakopoulos, A.D., Annino, F., Creed, G., et al. (2019). Urethrovesical Anastomosis Reconstruction Techniques in RARP. World Journal of Urology. 37, 1241-1252.

Basourakos, S.P., Kowalczyk, K., Moschovas, M.C., Dudley, V., Hung, A.J. & Shoag, J.E. (2021). Robot-Assisted Radical Prostatectomy Maneuvers to Attenuate Erectile Dysfunction: Technical Description and Video Compilation. Journal of Endourology. 35, 1601-1609.

Beksac, A.T., Abou Zeinab, M., Ward, M., et al. (2024). Patient-Reported Quality of Life after SP Transvesical Prostatectomy. Cancers. 16, 1540.

Bektic, J., Ladurner, M., Lusuardi, L., et al. (2020). Long-Term Functional Recovery after Bilateral Intrafascial Nerve-Sparing RARP. World Journal of Urology. 38, 2210-2218.

Beyer, B., Schlomm, T., Tennstedt, P., et al. (2020). Comparative Analysis of NeuroSAFE RARP vs Standard RARP. BJU International. 126, 102-111.

Capitanio, U., Larcher, A., Trevisani, F., et al. (2022). Health-Related Quality of Life Metrics after RARP. European Urology Focus. 8, 700-708.

Chavali, J.S., Pedraza, A.M., Soputro, N.A., Ramos-Carpinteyro, R., Mikesell, C.D. & Kaouk, J. (2024). Single-Port Extraperitoneal vs. Multiport Transperitoneal Robot-Assisted Radical Prostatectomy: A Propensity Score-Matched Analysis. Cancers. 16, 2994.

Checcucci, E., De Cillis, S., Granato, S., et al. (2023). 3D Virtual Navigation during RARP for Optimal Margin Control. World Journal of Urology. 41, 1315-1323.

Clavien, P.A., Barkun, J., de Oliveira, M.L., et al. (2009). The Clavien-Dindo Classification of Surgical Complications. Annals of Surgery. 250, 187-196.

Cooperberg, M.R., Cowan, J., Broering, J.M. & Carroll, P.R. (2008). High-Risk Prostate Cancer in the United States, 1990-2007. World Journal of Urology. 26, 211-218.

Covas Moschovas, M., Bhat, S., Onol, F.F., Rogers, T., Roof, S. & Mazzone, E. (2020). Modified Apical Dissection and Lateral Prostatic Fascia Preservation Improves Early Postoperative Functional Recovery in Robotic-Assisted Laparoscopic Radical Prostatectomy. European Urology. 78, 875-884.

Covas Moschovas, M., Saikali, S., Rogers, T., et al. (2022). Technical Innovations to Improve Early Continence after Single-Port Robotic Prostatectomy. Journal of Endourology. 36, 1300-1308.

Crocetto, F., Buonerba, C., Caputo, V., Ferro, M., Persico, F. & Trama, F. (2021). Urologic Malignancies: Advances in the Analysis and Interpretation of Clinical Findings. Future Science OA. 7, FSO674.

Dalela, D., Jeong, W., Prasad, M.A., Sood, A., Abdollah, F., Diaz, M., et al. (2017). A Pragmatic Randomized Controlled Trial Examining the Impact of the Retzius-Sparing Approach on Early Urinary Continence Recovery after Robot-Assisted Radical Prostatectomy. European Urology. 72, 677-685.

Dall, C. & Nielsen, M. (2023). Long-Term Functional Outcomes following Pelvic Fascia-Sparing Robotic-Assisted Radical Prostatectomy. Journal of Urology.

D'Amico, A.V., Whittington, R., Malkowicz, S.B., et al. (1998). Biochemical Outcome after Radical Prostatectomy, External Beam Radiation Therapy, or Interstitial Radiation Therapy for Clinically Localized Prostate Cancer. JAMA. 280, 969-974.

de Carvalho, P.A. (2020). Retrograde Release of the Neurovascular Bundle with Preservation of Dorsal Venous Complex during Robot-Assisted Radical Prostatectomy: Optimizing Functional Outcomes. European Urology. 77, 628-635.

Donovan, J.L., Hamdy, F.C. & Lane, J.A. (2016). Patient-Reported Outcomes after Monitoring, Surgery, or Radiotherapy for Prostate Cancer. New England Journal of Medicine. 375, 1425-1437.

Egan, J. & Patel, H. (2021). Quality of Life and Functional Recovery after Retzius-Sparing Robot-Assisted Radical Prostatectomy. Urologic Oncology.

Epstein, J.I., Egevad, L., Amin, M.B., et al. (2016). The 2014 International Society of Urological Pathology (ISUP) Consensus Conference on Gleason Grading of Prostatic Carcinoma. American Journal of Surgical Pathology. 40, 244-252.

Feng, H., Cui, Z., Pan, J., Dong, X., Ma, Y., Pan, Y., et al. (2025). Comparison of Anterior, Posterior, and Retzius-Sparing Robotic Prostatectomy Techniques. Scientific Reports. 15, 21851.

Ferguson, E. & Park, S.C. (2022). Transvesical Robotic Prostatectomy: Technical Innovation and Early Experience. Journal of Endourology.

Ficarra, V., Novara, G., Rosen, R.C., Artibani, W., Carroll, P.R., Costello, A., et al. (2012a). Systematic Review and Meta-Analysis of Studies Reporting Potency Rates after Robot-Assisted Radical Prostatectomy.

European Urology. 62, 418-430.
Ficarra, V., Novara, G., Rosen, R.C., Artibani, W., Carroll, P.R., Costello, A., et al. (2012b). Systematic Review and Meta-Analysis of Studies Reporting Urinary Continence Recovery after Robot-Assisted Radical Prostatectomy. European Urology. 62, 405-417.
Ficarra, V. & Tyson, S. (2013). Defining Functional Recovery and Oncologic Success: The Transition from Trifecta to Pentafecta in Robot-Assisted Radical Prostatectomy. European Urology.
Fossati, N., Willemse, P.M., van den Broeck, T., et al. (2021). The Benefits and Harms of Salvage Radiotherapy after Prostatectomy. European Urology. 79, 230-243.
Freedland, S.J., Humphreys, E.B., Mangold, L.A., et al. (2005). Risk of Prostate Cancer-Specific Mortality following Biochemical Recurrence after Radical Prostatectomy. JAMA. 294, 433-439.
Galfano, A., Di Trapani, D., Sozzi, F., Strada, E., Petralia, G., Bramerio, M., et al. (2013). Retzius-Sparing Robot-Assisted Radical Prostatectomy: Evaluation of the First 200 Patients. European Urology. 64, 544-550.
Gandaglia, G., Leni, R., Bray, F., Fleshner, N., Freedland, S.J. & Kibel, A. (2021). Epidemiology and Prevention of Prostate Cancer. European Urology Oncology. 4, 877-892.
Ghani, K.R., Truesdale, M. & Payne, H. (2012). High Anterior Release Nerve-Sparing in Robotic Prostatectomy. BJU International. 110, 1096-1103.
Giannarini, G., Girometti, R., Pizzolitto, S., Zattoni, F., Valotto, C. & Dal Moro, F. (2020). The Impact of Multiparametric MRI on Utilization of Nerve Sparing and Surgical Margins Status in Patients with Clinically Localized Prostate Cancer Treated with Robot-Assisted Radical Prostatectomy. European Urology Open Science. 19, e1773.
Grasso, Y.C. & Patel, H.S. (2012). The Effect of Posterior Reconstruction of the Rhabdosphincter on Early Continence Recovery: A Meta-Analysis. Journal of Urology.
Grivas, N., Wit, E.M. & van der Poel, H.G. (2018). Posterior Musculofascial Reconstruction and Early Continence Recovery. Therapeutic Advances in Urology. 10, 367-378.
Hamdy, F.C., Donovan, J.L. & Lane, J.A. (2023). Fifteen-Year Outcomes after Monitoring, Surgery, or Radiotherapy for Prostate Cancer. New England Journal of Medicine. 388, 1547-1558.
Han, J.H., Herlemann, A. & Washington, S.L. (2023). Observation, Radiotherapy, or Radical Prostatectomy for Localized Prostate Cancer: Survival Analysis in the United States. World Journal of Men's Health. 41, 940-950.
Hung, C.F. & Yang, S.J. (2020). Impact of Surgical Volume on Urinary Continence Outcomes following Robot-Assisted Radical Prostatectomy. World Journal of Urology.
Hurtes, R.M. & Ghoneim, M.A. (2016). Combined Anterior and Posterior Reconstruction in Robot-Assisted Radical Prostatectomy: Technical Refinement and Outcomes. World Journal of Urology.
Ilic, D., Evans, S.M., Allan, C.A., Jung, J.H., Murphy, D. & Frydenberg, M. (2017). Laparoscopic and Robotic-Assisted versus Open Radical Prostatectomy for the Treatment of Localized Prostate Cancer. Cochrane Database of Systematic Reviews. 9, CD009625.
Ippoliti, S. (2023). Continence-Sparing Techniques in Radical Prostatectomy: A Systematic Review of Randomized Controlled Trials. Journal of Endourology. 37, 1088-1104.
Iwahashi, Y., Deguchi, R., Muraoka, S., Wakamiya, T., Yamashita, S., Kikkawa, K., et al. (2024). Impact of Postoperative Sexual Function on Health-Related Quality of Life after Robot-Assisted Radical Prostatectomy. Current Urology. 18, 148-154.
Iyer, H.S., Stone, B.V., Roscoe, C., Hsieh, M.C., Stroup, A.M. & Wiggins, C.L. (2024). Access to Prostate-Specific Antigen Testing and Mortality among Men with Prostate Cancer. JAMA Network Open. 7, e2414582.
Jiang, Y., Liu, Y., Qin, S., Zhong, S. & Huang, X. (2023). Perioperative, Function, and Positive Surgical Margin in Extraperitoneal versus Transperitoneal Single-Port Robot-Assisted Radical Prostatectomy: A Systematic Review and Meta-Analysis. World Journal of Surgical Oncology. 21, 383.
Kaouk, J. & Bertolo, R. (2019). Single-Port vs. Multi-Port Robotic Radical Prostatectomy: A Comparative Systematic Review. Urology.
Katsimperis, S. & Alamanis, C. (2023). Pelvic Fascia-Sparing Robotic Prostatectomy: Benefits, Limitations, and Oncologic Safety. Current Opinion in Urology.
Kaul, S., Menon, M., Shrivastava, A., Bhandari, A., Peabody, J. & Tewari, A. (2006). Nerve-Sparing Robotic Radical Prostatectomy Using the Veil of Aphrodite Technique. Urology. 67, 119-122.
Kim, K.H. & Tewari, A.K. (2021). Hood Technique for Robotic Radical Prostatectomy—Preserving Periurethral Anatomical Structures in the Space of Retzius and Sparing the Pouch of Douglas, Enabling Early Return

of Continence without Compromising Surgical Margin Rates. European Urology Oncology. 4, 858-864.
Kowalczyk, M.A. & Myers, R.P. (2018). Functional and Oncological Outcomes of Posterior Approach (Retzius-Sparing) Robotic Prostatectomy. Journal of Robotic Surgery.
Larcher, A., De Naeyer, S., De Groote, R., et al. (2023). Learning Curve Dynamics of Single-Port Robotic Prostatectomy. European Urology Open Science. 48, 45-53.
Lee, J. & Kim, D. (2020). Retzius-Sparing vs. Conventional Robotic-Assisted Radical Prostatectomy: A Propensity-Score Matched Comparison. Prostate International.
Lenfant, L., Sawczyn, G., Aminsharifi, A., Kim, S., Wilson, C.A., Beksac, A.T., et al. (2021). Pure Single-Site Robot-Assisted Radical Prostatectomy Using Single-Port versus Multiport Robotic Radical Prostatectomy: A Single-Institution Comparative Study. European Urology Focus. 7, 964-972.
Liu, Y., Deng, X.Z., Qin, J., Wen, Z., Jiang, Y., Huang, J., et al. (2023). Erectile Function, Urinary Continence and Oncologic Outcomes of Neurovascular Bundle Sparing Robot-Assisted Radical Prostatectomy for High-Risk Prostate Cancer: A Systematic Review and Meta-Analysis. Frontiers in Oncology. 13, 1161544.
Ma, X. & Tang, J. (2016). Retzius-Sparing versus Conventional Robotic-Assisted Radical Prostatectomy: A Systematic Review and Meta-Analysis. International Urology and Nephrology. 48, 931-942.
Macek, P., Barret, E., Sanchez-Salas, R., et al. (2022). Functional Outcomes after Focal Therapy vs RARP. Current Opinion in Urology. 32, 160-168.
Martin, A.D., Desai, P.J., Nunez, R.N., Martin, G.L., Andrews, P.E. & Ferrigni, R.G. (2009). Does a History of Previous Surgery or Radiation to the Prostate Affect Outcomes of Robot-Assisted Radical Prostatectomy? BJU International. 103, 1696-1698.
Martini, A., Falagario, U.G., Villers, A., et al. (2021). The Role of Preoperative Erectile Function Scores in Predicting Post-RARP Potency Recovery. Journal of Sexual Medicine. 18, 912-920.
Maruo, K. & Nishimoto, H. (2024). Endopelvic Fascia-Preserving Nerve-Sparing Robot-Assisted Radical Prostatectomy: 5-Year Functional and Oncologic Outcomes. International Journal of Urology.
Menon, M., Hemal, A.K., Tewari, A., et al. (2003). Nerve-Sparing Robot-Assisted Radical Prostatectomy: The ‘Vattikuti Institute’ Technique. BJU International. 92, 232-237.
Montorsi, R. & Abdollah, F. (2021). Margin Status and Long-Term Biochemical Recurrence-Free Survival in Retzius-Sparing Robot-Assisted Radical Prostatectomy. European Urology Focus.
Morgan, T.M. & Cookson, M.S. (2014). Predictors of Biochemical Recurrence after Nerve-Sparing Robotic Radical Prostatectomy. Urologic Oncology.
Mottet, N., van den Bergh, R.C.N., Briers, E., et al. (2024). EAU-EANM-ESTRO-ESUR-SIOG Guidelines on Prostate Cancer. European Urology. 85, 245-257.
Nguyen, T.T., Dobbs, R.W., Vuong, H.G., Quy, K., Ngo, H.T.T., Mai, A.T., et al. (2023). Single-Port and Multiport Robot-Assisted Radical Prostatectomy: A Meta-Analysis. Prostate International. 11, 187-194.
Novara, G. & Ficarra, V. (2012). Positive Surgical Margins after Robotic Radical Prostatectomy: Risk Factors and Oncological Impact. European Urology.
Ohara, E. (2022). Minimal Residual Membranous Urethral Length and Membranous Urethral Length Predict Poor Recovery from Incontinence after Robot-Assisted Radical Prostatectomy and after Open Radical Prostatectomy. International Journal of Urology. 29, 1517-1523.
Olivero, A. & Ferro, M. (2021). The Learning Curve of Retzius-Sparing Robotic Radical Prostatectomy. Urology.
Park, J.W., Lee, H.W. & Jeong, B.C. (2016). Role of Nerve-Sparing in Men with Preoperative Erectile Dysfunction. Investigative and Clinical Urology. 57, 437-445.
Patel, M. & Hemal, A.K. (2018). Trifecta and Pentafecta Outcomes following Robot-Assisted Radical Prostatectomy: Long-Term Multi-Institutional Analysis. BJU International.
Pernar, C.H., Ebot, E.M., Wilson, K.M. & Mucci, L.A. (2018). The Epidemiology of Prostate Cancer. Cold Spring Harbor Perspectives in Medicine. 8, a030361.
Pini, G., De Groote, R., Sarchi, L., et al. (2023). Robot-Assisted Radical Prostatectomy in Elderly Patients: Functional Outcomes. Aging Male. 26, 215-224.
Ploussard, G., Briganti, A., de la Taille, A., et al. (2021). Pelvic Lymph Node Dissection in Prostate Cancer. European Urology. 79, 480-491.
Porpiglia, F., Bertolo, R., Manfredi, M., et al. (2016). Total Anatomical Reconstruction during RARP: Implications for Continence. European Urology. 69, 486-495.
Qiu, X., Li, Y., Chen, M., Xu, L., Guo, S., Marra, G., et al. (2020). Retzius-Sparing Robot-Assisted Radical Prostatectomy Improves Early Recovery of Urinary Continence: A Randomized, Controlled, Single-Blind Trial with a 1-Year Follow-Up. BJU International. 126, 633-640.

Ramos-Carpinteyro, R., Ferguson, E., Soputro, N., Chavali, J.S., Abou Zeinab, M., Pedraza, A., et al. (2023). Predictors of Early Continence after Single-Port Transvesical Robot-Assisted Radical Prostatectomy. Urology. 184, 176-181.

Reeves, F., Preece, P., Kapoor, J., Everaerts, W., Murphy, D.G. & Corcoran, N.M. (2015). Preservation of the Neurovascular Bundles Is Associated with Improved Time to Continence after Radical Prostatectomy but Not Long-Term Continence Rates: Results of a Systematic Review and Meta-Analysis. European Urology. 68, 692-704.

Rocco, B., Carmignani, L., Acquati, P., Gadda, F., Dell'Orto, P., Rocco, F., et al. (2007). Restoration of Posterior Support (Posterior Musculofascial Reconstruction) Improves Continence after Radical Prostatectomy. Journal of Urology. 176, 279-285.

Rosen, R.C., Cappelleri, J.C., Smith, M.D., et al. (1997). Development and Evaluation of the International Index of Erectile Function (IIEF). Urology. 49, 822-830.

Salomon, L., Anastasiadis, A.G., Levrel, O., et al. (2003). Location of Positive Surgical Margins after Radical Prostatectomy. BJU International. 92, 251-255.

Sanda, M.G., Cadeddu, J.A., Kirkby, E., et al. (2018). Clinically Localized Prostate Cancer: AUA/ASTRO/SUO Guideline. Journal of Urology. 199, 683-690.

Schiavina, R., Bianchi, L., Lodi, F., et al. (2021). Real-Time Frozen Section Examination (NeuroSAFE) in Nerve-Sparing RARP. Minerva Urology and Nephrology. 73, 450-460.

Siegel, R.L., Miller, K.D., Fuchs, H.E. & Jemal, A. (2022). Cancer Statistics, 2022. CA: A Cancer Journal for Clinicians. 72, 7-33.

Simone, G. & Papalia, R. (2019). Retzius-Sparing Robotic Prostatectomy in High-Risk Patients: Oncologic Outcomes. World Journal of Urology.

Srivatsa, P.S. & Hemal, A.K. (2015). Preservation of the Puboprostatic Ligaments during Robot-Assisted Radical Prostatectomy: Impact on Urinary Continence. Journal of Endourology.

Stabile, A., Gandaglia, G., Foschi, N., et al. (2021). The Impact of Nerve-Sparing on Positive Surgical Margins in High-Risk Prostate Cancer. Urologic Oncology. 39, 725.e1-725.e8.

Stolzenburg, J.U. & Minh, C. (2018). Impact of Membranous Urethral Length and Endopelvic Fascia Preservation on Continence Recovery. European Urology Focus.

Student, V., Vidlar, A., Grepl, M., et al. (2022). Advanced Reconstruction of the Arterial Supply during Nerve-Sparing RARP. Urology. 160, 112-119.

Su, L.M. & Smith, J.A. (2011). Evaluating the Learning Curve of Nerve-Sparing Robotic-Assisted Radical Prostatectomy. Journal of Endourology.

Suardi, N., Gallina, A., Lista, G., et al. (2019). Impact of Age on Erectile Function Recovery after Nerve-Sparing Radical Prostatectomy. Journal of Sexual Medicine. 16, 530-538.

Sugi, M. & Kinoshita, H. (2023). Subapical Urethral Preservation during Robotic Prostatectomy. International Journal of Clinical Oncology. 28, 1020-1027.

Tae, B.S., Choi, H., Park, J.Y. & Bae, J.H. (2018). Laparoscopic Approach for Intravesical Surgery Using Pneumovesicum in Urology: Literature Review. International Neurourology Journal. 22, S10-S22.

Takahara, K., Sumitomo, M., Fukaya, K., Jyoudai, T., Nishino, M., Hikichi, M., et al. (2019). Clinical and Oncological Outcomes of Robot-Assisted Radical Prostatectomy with Nerve Sparing vs. Non-Nerve Sparing for High-Risk Prostate Cancer Cases. Oncology Letters. 18, 3896-3902.

Takenaka, M. & Sakai, Y. (2010). Anatomical Foundations of Nerve-Sparing Radical Prostatectomy. International Journal of Urology.

Tewari, A., Peabody, J.O., Fischer, M., Campbell, L., Shalhav, A. & Menon, M. (2007). Anatomic (Total) Restoration Technique of the Pelvic Floor in Robotic Radical Prostatectomy. European Urology. 51, 648-657.

Tilki, D., Mandel, P., Seeliger, F., et al. (2019). Surgical Margins and Biochemical Recurrence after Prostatectomy. European Urology. 75, 581-588.

Touijer, K.A., Matsushita, K., Carver, S., et al. (2020). Performance of RARP in Salvage Settings after Primary Radiation. European Urology. 77, 455-463.

Tsui, K.H. & Wu, C.L. (2024). Bilateral versus Unilateral Nerve-Sparing Robot-Assisted Radical Prostatectomy: A Comparative Analysis of Early versus Late Functional Recovery. BMC Urology.

Vickers, P.I. & Bianco, F.J. (2010). Surgeon Experience and Positive Surgical Margin Rates in Robot-Assisted Radical Prostatectomy. Journal of Clinical Oncology.

Vis, A.N., van den Bergh, R.C.N. & van der Poel, H.G. (2021). MRI-Guided Nerve-Sparing Selection in Robotic Prostatectomy: Consensus Recommendations. European Urology Open Science. 3, 6-18.

Ward, M. & Kaouk, J. (2025). Single-Port Transvesical Robotic Radical Prostatectomy: Functional and Oncologic Outcomes in an Initial Cohort. Cancers. 17, 2793.

Wei, J.T., Dunn, R.L., Litwin, M.S., et al. (2000). Development and Validation of the Expanded Prostate Cancer Index Composite (EPIC). Journal of Urology. 164, 1013-1021.

Weng, H., Zeng, X.T., Li, S., Meng, X.Y., Shi, M.J. & He, D.L. (2017). Intrafascial versus Interfascial Nerve Sparing in Radical Prostatectomy for Localized Prostate Cancer: A Systematic Review and Meta-Analysis. Scientific Reports. 7, 11454.

Yossepowitch, O. & Tewari, A. (2014). Neurovascular Preservation Techniques in Robotic Radical Prostatectomy: An Anatomical Review. BJU International.

Zeinab, M.A., Ferguson, E., Chavali, J.S., et al. (2024). Transvesical vs Transperitoneal Robotic Access: Perioperative Comparative Trial. Urology. 185, 98-105.

Zilberman, D.E. & Wong, L.L. (2015). Impact of Apical Surgical Margin Positivity on Prostate Cancer Recurrence following Robot-Assisted Radical Prostatectomy. Journal of Endourology.