Best Evidence Regarding the Superiority or Inferiority of Robot-Assisted Radical Prostatectomy

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KEYWORDS

• Prostate cancer • Radical prostatectomy • Robotic surgery • Comparative effectiveness

KEY POINTS

- Oncologic outcomes are generally excellent for both robotic-assisted laparoscopic radical prostatectomy (RALP) and radical retropubic prostatectomy (RRP), with no consistent oncologic outcome difference.
- Studies consistently report significantly lesser blood loss with RALP than RRP, and many report lower prolonged duration of stay and bladder neck contracture rates.
- In expert hands, urinary incontinence and potency outcomes are similar between RALP and RRP.
- Ultimately, the skill and experience of the surgeon remain the greatest determinant of surgical outcomes after RALP and RRP.

INTRODUCTION

Since the first robotic-assisted laparoscopic radical prostatectomy (RALP) in 2000, a tectonic shift has occurred in the operative management of prostate cancer.[1] With the rapid diffusion of this innovation, estimates now suggests more than 60% of all radical prostatectomies were performed robotically by the end of the decade and this percentage may increase to greater than 75% in the near future. Proponents of robotic surgery tout the 3-dimensional visualization, wristed instrumentation, and comfortable seated position.[2] When combined with the lower blood loss, robotic systems may allow better visualization of the apex and greater magnification when dissecting surgical planes, both of which may lead to improved surgical outcomes.[3] Detractors note that the widespread adoption was a result of aggressive marketing rather than proven benefits, and that claims for the superiority of the robotic technique remain unproven.[4] Furthermore, the anatomic considerations that allow improved hemostasis and visualization of the prostatic apex were pioneered by Walsh and are common to both open and robotic techniques.[5]

Available evidence regarding outcomes from RALP and RRP arise from retrospective reviews of single-center experience, metaanalyses, and results from administrative datasets. To date, no prospective, randomized trials exist to guide clinical decisions. In addition, given the strong preferences patients harbor coupled with surgeon biases, a randomized trial in the United States would be difficult, if not impossible, to perform in the current health care environment.[6,7] Thus, we

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are faced with existing retrospective data comparing the 2 modalities, which has significant limitations. First, given the impact of the robotic learning curve, outcomes early in the robotic experience are inferior to the mature outcomes achieved after more than 300 cases.[8,9] Second, in centers that have transitioned predominantly to robotic prostatectomy, patients who undergo RRP may be poorer operative candidates,[1,10] biasing statistical analyses of surgical outcomes. Furthermore, continued stage migration between 2000 (when RRP was predominant) and current times (when RALP is more common than RRP) may bias oncologic outcomes in favor of RALP. Administrative datasets traditionally have lacked of a modifier distinguishing RALP from laparoscopic radical prostatectomy (LRP), limiting the ability to compare robotic and open surgery directly. With these limitations in consideration, the objective of the current review is to weigh the available evidence for superiority, inferiority, or equivalence of RALP compared with RRP.

ONCOLOGIC OUTCOMES

Although no randomized, controlled trials comparing oncologic outcomes for RALP and RRP currently exist, observational studies of administrative datasets and retrospective analyses from high-volume centers allow limited comparisons of RALP and RRP. Retrospective analyses of data from single institutions benefit from granular data collection, centralized pathology review, and often from a uniform surgical pathway. However, selection bias and lack of power to detect small differences remain legitimate concerns. Early comparisons of oncologic outcomes between RRP and RALP were based on analyses of single institutions.

Several groups have assessed the risk of positive surgical margin (PSM) between the 2 techniques, with some studies reporting lower PSM after RALP,[11] and others reporting no difference[12,13] or higher PSM rates.[14,15] To reduce potential biases that result from including multiple surgeons who may utilize different surgical techniques, Masterson and colleagues[12] evaluated the experience from a single, high-volume surgeon and a single pathologist to determine whether the robotic technique was associated with decreased surgical margins. The study included 357 men who underwent RRP and 669 who underwent RALP, finding no difference in surgical margin rate after stratifying by TNM stage. No multivariable analysis was included in this study. Of course, the results are limited by potential selection bias in choosing patients for each modality. Magheli and colleagues[14] compared PSM rates after RRP, RALP, or LRP, controlling for selection bias by propensity score matching based on preoperative characteristics. PSM rates were lower in men undergoing RRP (14.4%) and LRP (13.0%) compared with RALP (19.5%) after adjusting based on propensity score (hazard ratio [HR] 1.64 for RALP vs radical prostatectomy [RP] for PSM; *P* = .026). Barocas and colleagues,[16] on the contrary, found a lower PSM rate among men who underwent RALP in their institution (19.9% vs 30.1%; *P*<.01). The authors evaluated 2132 men and found no association between 3-year biochemical recurrence (BCR) and surgical modality after adjusting for pathologic stage, surgical margin status, and pathologic Gleason score, with an HR of 1.01 (*P* = .93).[16] The lack of difference in BCR has been confirmed in other populations.[17]

Single-institution series rely on the experience of 1 or a few surgeons, and the results may not be generalizable. Population studies comparing RALP and RRP have the advantage of diluting the impact of any individual surgeon and allowing an assessment of the collective impact of robotic surgery on oncologic outcomes. Hu and colleagues[18] sought to evaluate oncologic outcomes of RALP and RRP in a propensity-matched analysis of the Surveillance, Epidemiology, and End Results (SEER)-Medicare database. The investigators assessed the rate of PSMs as well as need for additional therapies after surgery in 13,004 men who underwent either RALP or RRP between 2004 and 2010. After propensity matching using data on socioeconomic background, comorbidities, and disease characteristics, the rate of PSM decreased among men who underwent RALP compared with RRP (13.6% vs 18.3%, respectively; HR, 0.70; *P*<.001), particularly in men with intermediate (15.0% vs 21.0%) or high-risk disease (15.1% vs 20.6%). The use of adjuvant therapies was decreased at 6, 12, and 24 months as well (odds ratio [OR], 0.75; *P*<.001) in a multivariable model. The results may have been influenced by differing practice patterns among open and robotic surgeons (eg, propensity for adjuvant therapy utilization), lack of centralized pathology review, and misclassification resulting from unreliable use of the Current Procedural Terminology code for minimally invasive RP (MIRP) during the study period. Unfortunately, SEER does not capture post-prostatectomy prostate-specific antigen (PSA) values, and BCR data were not available. In the Victorian Prostate Cancer Registry, Evans and colleagues[19] found improved oncologic outcomes with RALP. In multivariable models including hospital volume, National Comprehensive Cancer Network risk criteria, hospital type (public vs private), and surgical modality, RALP was significantly less likely than RRP to result in a PSM (OR, 0.69; *P* = .002), and in a separate analysis also including pathologic stage and margin status, RALP was associated with fewer secondary treatments (OR, 0.59; *P* = .010). In a separate population-based comparative effectiveness study of the Health Professionals Follow-up Study, Alemozaffar and colleagues[20] noted no difference in PSM between RALP and RRP (24.4% vs 23.1%; *P* = .51) among the 903 men in the study population. No difference was found in 3- or 5-year BCR rates between RALP and RRP.

Similar conclusions regarding decreased PSM with RALP compared with RRP were reached in a large, multiinstitutional study of 14 high-volume centers in Europe, the United States, and Australia. Sooriakumaran and colleagues[21] compared PSM rates in 22,393 patients, adjusting for differences in age, PSA, Gleason score, pathologic stage, and year of surgery. PSM rates were lowest for RALP (13.8%) compared with LRP (16.3%) and RRP (22.8%), although a greater proportion of men undergoing RRP had high-risk disease and were treated at a significantly earlier time point. After adjustment using either logistic regression analysis or propensity score matching, the HR for PSM was 0.76 when comparing either RALP to RRP or LRP to RRP (*P*<.001 for all analyses). No difference was found between RALP and LRP. It should be noted that surgeon volume could not be controlled for in the analysis and may have contributed to the results. Of note, a similar HR for PSM was seen between the study of Sooriakumaran and colleagues[21] (HR, 0.76) as the PSM rate seen in the analysis of SEER-Medicare data (HR, 0.70).

Early in the robotic experience, it was postulated that RRP would be superior for high-risk prostate cancer (HRCaP) because tactile feedback would allow wider excision in palpably suspicious areas and the open approach would allow wider lymphadenectomy. However, in studies limited to HRCaP, the rates of PSM and BCR are comparable for each modality. Pierorazio and colleagues[22] compared PSM, BCR, and lymphadenectomy data from 913 patients with HRCaP at a single high-volume institution who underwent RRP or MIRP (encompassing both RALP and LRP). PSM rates were similar for RRP and MIRP overall (29.4% vs 31.8%; *P* = .53) and for pT2 disease (1.9% vs 2.9%; *P* = .6). In a multivariable logistic regression controlling for age, PSA, Gleason score, and clinical and pathologic stage, RALP was not associated with BCR (*P* = .359). Of note, a greater number of lymph nodes were removed via the open approach (median of 8 vs 6; *P*<.001). Although the cohort was well matched, the authors acknowledge the possibility of selection bias, given that 92% of patients had only 1 high-risk feature and a greater number of HRCaP in RRP patients was based on Gleason score (40.3% for RRP vs 33.0% for RALP). Other single-institution studies of HRCaP have found no difference in the PSM rate for RRP and RALP.[23,24] Of note, Punnen and colleagues[24] report that 37% of high-risk patients undergoing RALP did not receive pelvic lymphadenectomy, compared with 5% in the RRP cohort, whereas Harty and colleagues[23] report that 44% of RALP patients and 62% of LRP patients with high-risk disease did not undergo lymphadenectomy.

Oncologic outcomes are generally excellent for both RALP and RRP. Single-institution studies, typically from expert RP surgeons, have not consistently demonstrated a clear oncologic outcome difference between RALP and RRP. On the other hand, available data from SEER-Medicare[18] and the Victorian Prostate Cancer Registry[19] have suggested lower rates of PSM and adjuvant therapies among men undergoing RALP than those undergoing RRP. A likely explanation for the lack of consistency is that PSM is surgeon dependent rather than modality dependent. Critical to oncologic and functional outcomes is developing the optimal plane between the neurovascular bundles and prostatic capsule. Err too close to the capsule and PSM will increase; stay too far from the capsule and functional outcomes will suffer. The surgical robot is a tool that can assist a surgeon with exposure and visibility, but the greatest determinants of oncologic and functional outcomes are likely the skill and experience of the surgeon. Some believe that, for young surgeons without extensive experience in either robotic or open surgery, oncologic outcomes for RALP are superior to RRP, as has been reported by Di Pierro and colleagues.[25] The authors report the results of 150 consecutive patients (75 RRP, 75 RALP) who underwent surgery early in the robotic experience at a single institution between 2007 and 2009, finding men who underwent RALP to have lower rate of PSM than those who underwent RRP (16% vs 32%, respectively; *P* = .0016), especially for patients with pT2 disease (8.3% vs 24.1%; *P* = .0107). If other studies reproduce this improvement in the learning curve, it could be the greatest contribution of RALP to surgery for prostate cancer.

LYMPH NODE DISSECTION

In the early RALP experience, robotic pelvic lymphadenectomy (PLND) was limited in its extent[26] and underutilized[27,28] compared with open PLND. Hu and colleagues[28] analyzed SEER-Medicare linked data for men undergoing RP between 2004 and 2006, finding that 87.6% of men undergoing RRP had PLND compared with 38.3% for men undergoing RALP or LRP (*P*<.001). Most studies assessing lymph node yields have documented higher yields from RRP than RALP.[25,29–31] As Silberstein and associates note, the extent of lymph node dissection is at the discretion of the surgeon, and variation in nodal yields likely reflect differences in surgeon preferences and pathologic processing rather than limitations characteristic of the robotic approach.[31] Recent reports from experienced robotic surgeons suggest that the extent of robotic PLND is comparable with open PLND in experienced hands.[32–34]

Complications associated with PLND, such as lymphocele,[35] thromboembolism,[36] or intraoperative complications (eg, obturator nerve injury), are germane to both modalities.[34,37] No study has directly compared complication rates of PLND between modalities, and comparison between the 2 modalities would be difficult because the most common complication of PLND—lymphocele—has been reported in more than 50% of patients undergoing PLND.[35] Thus, differences in rates of lymphocele primarily depend on the willingness of the surgeon to search for them rather than operative technique. One may conclude that complications with PLND are uncommon after both RALP and RRP with little, if any, difference in complication rates between the two.

PERIOPERATIVE OUTCOMES

With the advent of robotic technology, investigators studied whether complication rates decreased after RALP. Single-institution case series, metaanalyses, and population-based studies of administrative datasets have been undertaken to determine how RALP compares with RRP regarding perioperative outcomes. Trinh and colleagues[1] compared the rates of blood transfusions, perioperative complications (based on International Classification of Diseases, 9th edition, diagnostic codes), prolonged length of stay (pLOS), and in-hospital mortality between men undergoing RALP and RRP in the Nationwide Inpatient Sample, which includes hospital discharge data for more than 8 million hospital discharges since 2009. After adjusting for patient characteristics (age, race, Charlson Comorbidity Index, year of surgery, insurance status) and hospital characteristics (volume, academic vs private hospital, location) using propensity score matching, men who underwent RALP had a lower transfusion rate (OR, 0.34; 95% CI, 0.28–0.40), were less likely to experience an intraoperative complication (OR, 0.47; 95% CI, 0.31–0.71), postoperative complication (OR, 0.86; 95% CI, 0.77–0.96), or a pLOS (OR, 0.28; 95% CI, 0.26–0.30) than men undergoing RRP. No difference was seen in in-hospital mortality (OR, 0.21 for RALP vs RRP; *P* = .168) In 2 previous studies of SEER-Medicare data,[38,39] no difference was seen between MIRP and RRP (OR, 0.95; 95% CI, 0.77–1.16), a fact that Trinh and colleagues attribute to the lack of the robotic-assisted modifier code in the former study and the earlier time of the study, before the full maturation of the robotic experience. Recently, an updated analysis of perioperative complications between RALP and RRP in SEER-Medicare data was reported. The authors reported similar rates of overall complications and readmissions for each modality, and similar to Trinh and colleagues, men undergoing RALP had lower transfusion rates and a lesser likelihood of pLOS.[40]

Results from administrative datasets represent accumulated results from multiple practice settings, in which the surgeons are often not experts and the hospitals often not high-volume centers. Conversely, Pierorazio and colleagues[41] compared perioperative complication rate and pLOS, defined as length of stay at the 98th percentile or below, among men treated at a single, high-volume center by expert surgeons over a 20-year period, finding that men who underwent RRP were less likely to experience pLOS than men who underwent RALP (1.20% vs 4.01%; *P*<.001). The majority of men experienced pLOS owing to ileus. Interestingly, in this center, patients who underwent RALP were more likely to develop ileus (*P*<.001), experience a urine leak (*P* = .009), and require blood transfusion (*P* = .01). Surgeon experience (HR, 0.98; *P* = .02), African-American race (HR, 1.92; *P* = .004), and RALP (HR, 2.23; *P*<.001) were significantly associated with pLOS in multivariable analysis. These results, when considered in the context of other single-center studies, demonstrate the importance of surgeon and hospital experience in determining complication rates and length of stay after RP, suggesting that experience may matter more than modality. The importance of institutional experience, which has been demonstrated in SEER-Medicare data as an important contributor to mortality rates after cystectomy,[42] likely also contributed to the low complication rates after RRP at this institution.

In studies from centers specialized in RALP, significantly less blood loss and lower transfusion rates have been seen, although overall complication rates are similar in many centers.[25,43–47] Cumulative analyses of single-institution studies demonstrated significantly lower blood loss and transfusion rates for RARP compared with RRP.[43] Of course, patient characteristics such as body mass index, comorbidities, prostate volume, prior surgery, and age were not considered in the cumulative analysis and may have influenced the results. Fewer bladder neck contractures have been reported with RALP than RRP in multiple studies,[48,49] although some authors have not found a difference.[50] The incidence of bladder neck contracture after RALP (0.2%–1.6%) in reported series is lower than historical series of RRP (often >5%),[51] although these results must be interpreted with caution; more recent studies have noted comparable bladder neck contracture rates between RALP and RRP.[49]

FUNCTIONAL OUTCOMES

Urinary Continence

The majority of publications regarding functional outcomes associated with surgical modality are retrospective reviews of single surgeon's or single center's experience. These studies have considerable limitations.[7] As RALP has become the predominant modality for RP in the United States, patients who undergo RRP are poor RALP candidates owing to prior surgeries, aggressive disease characteristics, or body habitus. As a result, studies in these populations are biased in favor of RALP, and many of these biases (prior surgeries, body habitus) are difficult to quantify in comparative studies. Few of these studies used validated questionnaires to assess postoperative return of continence or potency, and patients may overestimate their functional status in interviews with their surgeons.

A few studies of administrative datasets compare the urinary outcomes of men who undergo RP by surgical modality. Barry and colleagues[10] analyzed a survey sent to Medicare enrollees who underwent RP in 2008. A total of 86% of men answered the questionnaire, which were completed between 343 and 558 days after surgery. A surprisingly high proportion of men had bothersome urinary incontinence (31.1% overall), and after controlling for age, education level, and mental and overall health, men who underwent RALP were more likely to report moderate or big problems with urinary incontinence (P = .007). A major limitation of the study is that no preoperative information was available regarding health status or preoperative incontinence or erectile dysfunction, which in other analyses of the SEER database have been lower in patients undergoing MIRP.[38] Also, all men included in the study were Medicare enrollees, who represent a minority of patients undergoing RP, which likely contributed to the high rate of bothersome urinary incontinence. Rather than using postoperative surveys, Hu and colleagues[38] examined the SEER-Medicare claims file data for a diagnosis of urinary incontinence at least 18 months after surgery for men who underwent RP between 2003 and 2007. These patients underwent RP before the robotic modifier was added to the SEER database, meaning that LRP and RALP were indistinguishable in the analysis and called MIRP. Men who underwent MIRP were more likely to be diagnosed with urinary incontinence 18 months after surgery (based on diagnosis codes) than men who underwent RRP (15.9 vs 12.2 per 100 person-years; OR, 1.3; 95% CI, 1.05–1.61) even after adjusting for baseline urinary incontinence. Importantly, no significant increase in rates of incontinence procedures were seen for men undergoing MIRP, and because it was well documented that men in the MIRP group had an higher socioeconomic status, the higher diagnosis rate may be reflective of closer follow-up in this population.[38]

A number of investigators have compared urinary continence outcomes between RRP and RALP in nonrandomized, single-institution series (**Table 1**). Ahlering and colleagues[13] transitioned from RRP to RALP in 2002 and compared their RALP outcomes (after the learning curve matured by case 45) with the last 60 RRP cases. He reported equivalent urinary continence outcomes for both techniques, finding that 76% of men wore no pads after 3 months with RALP and 75% with RRP. Di Pierro and colleagues[25] reported urinary functional outcomes in patients who underwent RRP and RALP at a smaller center. These authors found improved 3-month continence, defined as "no leakage at all," with RALP compared with RRP (95% vs 83%; P = .003), although no difference was present at 1 year (89% vs 80%; P = .092). Ficarra and colleagues[44] used a validated questionnaire (the International Consultation on Incontinence Modular Questionnaire for Urinary Incontinence [ICIQ-UI]) to assess continence, defining patients who reported "no leak" or leaking "about once a week or less" as continent. The authors found that 69% of men after RALP to be continent at the time of catheter removal, compared with 41% after RRP (P<.001). At 12 months after surgery, 88% of men undergoing RRP were continent, compared with 97% of men undergoing RALP (P = .01). Krambeck and colleagues[7] analyzed the early RALP experience at their institution. The authors included as a comparison group men who underwent RRP during the same time period, matched in a 2:1 ratio of

Table 1
Single-institution studies comparing continence after robotic-assisted laparoscopic radical prostatectomy (RALP) and radical retropubic prostatectomy (RRP)

First Author, Year	N	Continence Definition	Continence Instrument	Urinary Continence Rate (%)	
				3 mo	12 mo
Ahlering et al,[13] 2004	RRP, 60 RALP, 60	0 pads	Nonvalidated questionnaire	75 76	
Di Pierro et al,[25] 2011	RRP, 75 RALP, 75	0 pads	Nonvalidated questionnaire	83 95	80 89
Ficarra et al,[44] 2009	RRP, 105 RALP, 103	Leakage <1 per week	Validated questionnaire	41[a] 69[a]	88 97
Krambeck et al,[7] 2009	RRP, 588 RALP, 294	≤1 pad per day	Nonvalidated questionnaire		93.7 91.8
Geraerts et al,[52] 2013	RRP, 116 RALP, 64	0 g	24-h pad test	78 87	96 97
Tewari et al,[2] 2003	RRP, 100 RALP, 200	0 pads	Third-party interview	160 d[b] 44 d[b]	

[a] Immediately upon catheter removal.
[b] Median time to return of continence.
Data from Refs.[2,7,13,25,44,52]

RRP:RALP based on age, preoperative serum PSA, clinical stage, and biopsy Gleason grade. The authors found no difference in urinary continence at 1 year after surgery, but no earlier time point was available to assess early urinary continence return. Tewari and colleagues[2] also found that men who underwent RALP recovered urinary continence more quickly at a median of 44 days, compared with 160 days for RRP ($P<.05$). Geraerts and colleagues[52] performed a more granular analysis of time to continence in men who underwent RP in a prospective study from a Belgian institution and entered a weekly outpatient pelvic floor muscle-training program. The authors suggest that the early return of continence may be related to surgical technique rather than patient selection, because men undergoing RALP regained continence sooner than those undergoing RRP (16 vs 46 days, respectively; $P = .026$), which remained significant in a multivariable analysis (HR, 1.522; $P = .036$) controlling for D'Amico risk group, nerve-sparing status, surgical margin status, preoperative urinary incontinence, and body mass index. The authors also assessed the difference in continence rates at 1, 3, 6, and 12 months, only finding a significant difference at 1 month. At 1 year, 96% and 97% of men were continent after RRP and RALP, respectively.[52]

In a metaanalysis of single-institution series comparing RALP and RRP, Ficarra and colleagues[53] found that the rate of urinary incontinence was 11.3% after RRP and 7.5% after RALP at 12 months (OR, 1.53; $P = .003$). Of course, these results must be considered in the context of each individual series included in the analysis, each of which has its own definition of continence and postoperative data collection method. Furthermore, many of the studies report the experience at institutions with expert RALP surgeons, with only 1 institution reporting the experience from a center well known for RRP expertise.[7]

Potency

Comparing erectile function outcomes is complicated by lack of consensus for the definition of potency, by a large proportion of patients with suboptimal erectile function preoperatively, and by variation in surgical techniques to preserve potency among open and robotic surgeons. Although potency results in men with perfect preoperative erectile function may be excellent after RALP and RRP, only 28% to 58% of men have perfect preoperative function.[54] The series, which assessed potency outcomes, are largely the same as those that assessed continence outcomes, and thus the limitations germane to the single-institution comparisons for urinary incontinence also apply to potency. The majority of studies found a higher potency rate for men undergoing RALP at 12 months (or faster recovery of potency) than those who underwent RRP (**Table 2**).[2,25,44,55,56] Of note, each of the studies

Table 2
Single-institution studies comparing potency after robotic-assisted laparoscopic radical prostatectomy (RALP) and radical retropubic prostatectomy (RRP)

				Potency Rate (%)	
First Author, Year	**N**	**Potency Definition**	**Potency Instrument**	**3 mo**	**12 mo**
Rocco et al,[55] 2009	RRP, 100 RALP, 200	Sufficient for intercourse	Third-party interview	18 31	41 61
Di Pierro et al,[25] 2011	RRP, 75 RALP, 75	Sufficient for intercourse	Nonvalidated questionnaire	25 68	26 55
Ficarra et al,[44] 2009	RRP, 105 RALP, 103	IIEF-5 > 17	Validated questionnaire		49 81
Krambeck et al,[7] 2009	RRP, 588 RALP, 294	Sufficient for intercourse	Nonvalidated questionnaire		62.8 70.0
Kim et al,[56] 2011	RRP, 235 RALP, 528	Sufficient for intercourse	Interview		28.1 57.1
Tewari et al,[2] 2003	RRP, 100 RALP, 200	Presence of erection	Third-party interview	440 d[a] 180 d[a]	

Abbreviation: IIEF, International Index of Erectile Function.
[a] Median time to return of potency.
Data from Refs.[2,7,25,44,55,56]

included in the analysis only men who were potent preoperatively. Tewari and colleagues[2] found a shorter time to potency recovery after RALP than RRP at their institution (180 vs 440 days, respectively; *P*<.05). In a cumulative analysis of these studies, the 12-month potency was 52.2% after RRP and 75.8% after RALP (OR, 2.84; *P* = .002).[57] When considering these results, one must again consider that the comparison is typically performed at centers with preeminent RALP surgeons but not RRP surgeons. Furthermore, because many studies only include patients with perfect preoperative potency who underwent an ideal, bilateral, nerve-sparing procedure, unbiased comparison with potency rates in historical RRP series (which were typically not limited to these men) becomes difficult. As noted by Eastham, in a comparable series of patients who underwent RRP by a preeminent RRP surgeon, the rate of potency at 12 months was 79%, which is higher than the potency rate after RALP in the majority of reported series.[4,58]

Studies of administrative datasets do not reveal a significant potency advantage to RALP, although methodologic restrictions limit their ability to do so. In the survey of SEER-Medicare patients who underwent RP conducted by Barry and colleagues,[10] there was no difference in the proportion of patients who reported problems with sexual function (89.0% after RRP vs 87.5% after RALP; *P* = .57). Even after adjustment for mental and overall health, age, and education level, no difference in the likelihood of harboring moderate or big problems with sexual function (OR, 0.87; 95% CI, 0.51–1.49). However, in SEER-Medicare data, men treated from 2003 to 2007 were more likely to be diagnosed with erectile dysfunction at least 18 months after surgery if they underwent RALP rather than RRP (26.8 vs 19.2 per 100 person-years, respectively; *P* = .009), although no greater rate of secondary procedures for erectile dysfunction were noted.[38] In the Health Professionals Follow-up Study, 132 men who underwent RALP and 468 who underwent RRP completed the Expanded Prostate Cancer Index Composite (EPIC)-26 questionnaire after surgery.[20] No difference was seen between men undergoing RALP and RRP in patient-reported sexual function outcomes (*P* = .66).

Is there a difference in sexual function outcomes after RALP and RRP? Although single-institution studies from RALP centers suggest that sexual function after RALP is better than after RRP, comparing RALP experts with RRP experts probably yields comparable sexual function outcomes.[4] Results from SEER-Medicare data suggest slightly better outcomes after RRP, although significant methodologic restrictions limit our ability to interpret the data. Furthermore, the dates of treatment from 2003 to 2007 likely represent the early robotic era, and a later analysis may alter the results. In the Health Professionals Follow-up Study, no difference in sexual function was found between the 2 modalities. Thus, one cannot conclude that 1 modality is significantly better than the other, and as has been previously noted,[59] potency outcomes are largely dependent on the expertise of the surgeon.

Although the functional outcomes after RALP are similar to RRP, patients who undergo RALP may expect better results. Schroeck and colleagues[60] surveyed men who had undergone either RRP or RALP at their institution between 2000 and 2007, finding that men who underwent RRP were more satisfied with their functional outcome than those undergoing RALP (OR, 4.45; 95% CI, 1.9–10.4). The study included patients early in the robotic experience, possibly owing to irrational exuberance related to the advertising of RALP by the robotic device manufacturer. Even with the maturation of the robotic experience, long-term functional outcomes after RALP are similar to those of RRP, and patients should be counseled accordingly.

SUMMARY

Are surgical outcomes of RALP superior to those of RRP? Studies consistently report significantly lower blood loss with RALP, and many report a lower pLOS and bladder neck contracture rate. When assessing the trifecta outcomes (urinary incontinence, potency, and oncologic outcomes), the results seem to be highly surgeon dependent. Unfortunately, no prospective, randomized, controlled trials currently exist comparing the 2 modalities directly. However, a well-designed, randomized trial is currently accruing patients in Australia and promises to give some insight on this important question.[61] Yet in the current state, comparative efficacy of these surgical techniques will be limited to data sets as described in this review and subject to the limitations and biases inherent to these studies. In experienced hands, the surgical robot has proven itself to be an effective tool in the performance of RP, although ultimately the skill and experience of the surgeon remain the greatest determinant of surgical outcomes.

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