# 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