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**Comparison of functional outcomes in retropubic, laparoscopic and robot-assisted radical prostatectomy: A meta-analysis**

Shi MJ *et al.* Prostate cancer and surgical therapy

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**Abstract**

**AIM**: To assess the 6-mo and 12-mo functional outcomes comparing retropubic, laparoscopic and robot-assisted laparoscopic radical prostatectomy (retropubic radical prostatectomy,RRP, laparoscopic radical prostatectomy,LRP and robot-assisted laparoscopic prostatectomy,RARP).

**METHODS:** A literature search was conducted using the PubMed, EMBASE, The Cochrane Library and the Web of Knowledge databases updated to March, 2014 for relevant published studies. After data extraction and quality assessment *via* the Newcastle-Ottawa Scale or the Cochrane collaboration's tool for assessing risk of bias, meta-analysis was performed using RevMan 5.1, either a random-effects model or a fixed-effects model was used. Potential publication bias was assessed using visual inspection of the funnel plots, and verified with Egger linear regression test.

**RESULTS:** Thirty-seven studies were identified in total: 14 articles comparing LRP with RRP, 12 articles comparing RARP with RRP, and 11 articles comparing RARP with LRP. For urinary continence, a statistically significant advantage was observed in RARP compared with LRP or RRP both at 6-mo [odds ratio (OR), 1.93; *P* < 0.01, OR, 2.23; *P* < 0.05, respectively] and 12-mo (OR, 1.47; *P* < 0.01, OR, 2.93; *P* < 0.01, respectively) postoperatively. While the continence recovery rates after LRP and RRP, with obvious heterogeneity(6-mo: I2 = 74%; 12-mo: I2 = 75%), were equivalent (6-mo: *P* = 0.52; 12-mo: *P* = 0.75). And in terms of potency recovery, for the first time, we dramatically ranked the three surgical approaches into superiority level: RARP > LRP > RRP, with statistically significant difference at 12-mo [RARP *vs* LRP (OR, 1.99; *P* < 0.01); RARP *vs* RRP (OR: 2.66; *P* < 0.01); LRP *vs* RRP (OR, 1.34; *P* < 0.05)], respectively. Meta regression and subgroup analyses according to adjustment of the age, [body mass index](http://suoxie.911cha.com/M25mZQ==.html), prostate volume, gleason score or prostate-specific antigen, did not vary significantly.

**CONCLUSION:** Current evidence suggests that minimally invasive approaches(RARP or LRP) are effective procedures for functional recovery. However, more high-quality randomized control trials investigating the longterm functional outcomes are needed.

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**Key words:** Prostate cancer; Radical prostatectomy; Urinary continence; Potency; Meta-analysis

**Core tip:** This review directly compared the functional outcomes after retropubic, laparoscopic and robot-assisted radical prostatectomy, both at 6-mo and 12-mo follow-up. Compared with the previous meta-analysis which reported a comparable potency recovery of robot-assisted laparoscopic prostatectomy (RARP) *vs* laparoscopic radical prostatectomy (LRP), our review obviously included more studies and ranked the three techniques into a superiority level: RARP > LRP > RRP (retropubic radical prostatectomy). In addition, we performed a quality assessment of the studies, separated evaluation of randomized control trials (RCTs) and non-RCTs, and subgroup analyses or meta-regression as a supplement, thus the risk of methodological bias was reduced considerably.

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**INTRODUCTION**

Prostate cancer (PCa) is now recognized as one of the most important medical problems in the male population. PCa accounted for almost 28% (238590) of all newly diagnosed cancer cases and it is the second cause of male cancer death(the lung cancer first) in the United States, while in Europe, data show an incidence rate of 22.8% and a mortality of 9.5%[1,2]. With combined application of prostate-specific antigen (PSA) test and prostate biopsy, the percentage of early diagnosed PCa cases has increased .

Radical prostatectomy(RP) is one of the recommended standard treatments for clinically localized prostate cancer (cT1–cT2) patients with a life expectancy of more than 10 years[3]. The retropubic radical prostatectomy(RRP), since its first introduction by Walsh *et al*[4] in 1982, soon became the gold standard and the most widely used treatment for patients with localized PCa[5]. And recently, we have witnessed the emergence of laparoscopic radical prostatectomy(LRP) and robot-assisted laparoscopic prostatectomy(RARP). Facing all these surgical options, both patients and surgeons hesitate when a best treatment choice should be made. Although several experts have demonstrated that when compared with RRP, LRP and RARP have obvious advantages such as fewer blood loss, less need for transfusion and shorter hospital-stay[6,7], but the lack of high-quality evidence and randomized control trials available precluded us form proving the superiority of any surgical approaches in terms of postoperative functional outcomes.

The increase in life expectancy in patients with localized PCa has made the post-treatment quality of life a key issue for PCa survivors, but some negative functional outcomes such as urinary incontinence and erectile dysfunction make the health-related quality of life (HRQoL) worse. Relevant comparative studies showed 12-mo urinary continence recovery rate ranging from 47% to 96%, 48% to 97% and 88% to 97% in RRP, LRP and RARP, respectively. And the previously published surgical series showed 12-mo potency recovery rate ranging from 39% to 72%, 41% to 81% and 61% to 87% in RRP, LRP and RARP, respectively. This apparent difference can be attributed to multiple definitions of urinary continence and potency, variations in population baseline, differences among surgical techniques and diverged data collection as well. In comparison with the only two meta-analyses evaluating functional outcomes in different surgical approaches, reported by the same author Ficarra *et al*[8,9] in August 2011, obviously our review included more studies and excluded two studies[10,11] which appeared to be ineligible since the presence of preoperative adjuvant hormonal therapy. Moreover, powerful quality assessment tools were utilized in this initial comparison of three key techniques(RRP, LRP and RARP) both at 6-mo and 12-mo follow-up .

**MATERIALS AND METHODS**

***Literature search***

Search in the following databases was performed: the PubMed, EMBASE, The Cochrane Library and the Web of Knowledge databases up to March, 2014. We used the following limits: humans, gender(male), and no restriction for languages. For each database, the same search terms “radical prostatectomy”, “urinary continence”, “incontinence”, “potency” and “erectile function” were used. Although we also paid attention to two unpublished gray literatures with relevant outcomes reported on the website “Clinical Trials.gov” and tried to contact the experts by e-mail, no response so far, therefore in this review only published papers were included.

***Study selection***

Our study followed the preferred reporting items for meta-analyses of observational studies in epidemiology (MOOSE) statement[12]. The inclusion criteria as follows: (1) Patient characteristics: localized PCa (cT1–cT2); comparable baseline demography; preoperatively potent and continent; no obvious comorbidities; (2) Surgical techniques: only pure RRP/RARP/LRP with or without modification; (3) Methodologically: all studies comparing the postoperative outcomes as RRP/LRP, RRP/RARP or LRP/RARP and including at least one of the functional results; clear definition of urinary continence and potency; (4) Population-based studies, duplicated publications and meeting abstracts were excluded.

***Data extraction***

All eligible records were extracted independently by two reviewers and selected according to the inclusion criteria. We extracted the details of author and publishing date; surgical techniques and number of patients; the study design; the baseline mean age; the BMI value; the prostate volume; the PSA level; the urinary continence and potency definition; and the 6-mo, 12-mo recovery rate of urinary continence and potency. Any uncertainties or discrepancies between the two reviewers were resolved by open discussion or consultation with the third reviewer.

***Methodological quality assessment***

The quality of cohort and case-control studies was assessed using the Newcastle-Ottawa quality scale (NOS) proposed by Wells *et al*[13]. This tool can be used either as a checklist or as a scale. The NOS scales were separately developed for cohort and case-control studies. Briefly, a star system was used for quality assessment of studies , and the NOS ranges from zero up to nine stars; studies were evaluated using items from three broad perspectives: selection of study groups (0-4 stars), comparability between groups (0-2 stars), and ascertainment of either the exposure or the outcome of interest (0-3 stars) for case-control or cohort studies, respectively.

The quality of each randomized control trial (RCT) was assessed using the Cochrane collaboration's tool for assessing risk of bias[14], which utilizes seven aspects: (1) details of randomization method; (2) allocation concealment; (3) blinding of participants and personnel; (4) blinding of outcome assessment; (5) incomplete outcome data; (6) selective outcome reporting; and (7) other sources of bias, to provide a qualification of risk of bias.

***Statistical analysis***

Statistical analyses were performed using the Cochrane Review Manager (RevMan).Version 5.1 software. Odds ratios (ORs) with 95%CIs for dichotomous variables were computed as summary statistics. According to the Higgins’ I2 statistic, a statistical heterogeneity of < 25, 25-50, and > 50% was defined as low, moderate, and high, respectively[15]. If no heterogeneity was found, then a fixed-effects model using the Mantel-Haenszel method would be used[16,17]. If statistically significant heterogeneity was revealed, a random-effects model would be used[18], and the sensitivity analysis was also preformed with two methods: (1) subgroup analysis (2) exclusion of the study accounting for the largest proportion; if no difference was detected then it could be confirmed that the outcomes are stable and reliable. The meta-regression analyses were performed by modeling on binary continence and potency outcomes, adjusting the age, BMI, prostate volume, mean gleason score, PSA level by using the stata SE 12.0. For all statistical analyses, a *P* < 0.05 was set as the level of significance. The publication bias was examined using the funnel plot, the results of which were further verified with Egger's test[19].

**RESULTS**

***Study identification***

Figure 1 showed the flowchart of this review and summarized the number of potential citations (Figure 1). The authors selected seventy three full-text articles after a comprehensive review of 402 potential relevant citations. Among these, fourteen articles compared RRP with LRP, consisting of seven prospective and seven retrospective studies[20-33]; twelve articles compared RRP with RARP, which consisted of six prospective and six retrospective studies[10,11,34-43]; twelve articles compared LRP with RARP, including two RCTs, one prospective and nine retrospective studies[39,44-54].

***Quality of studies***

Totally, there were fourteen prospective studies and twenty one retrospective studies included in this review. According to the NOS scale (case-control studies) used for quality evaluation of the retrospective studies, twelve studies were in the high level (7-9 stars)[29-31,33,41-43,48, 50-52,54], one study was in the low level (0-3 stars)[11], and the remaining eight studies were considered as in the middle level (4-6 stars). As for the quality of the prospective studies, the NOS scale (cohort studies) was used, and twelve studies were in the high level (7-9stars)[20-26,34-36,38,46], one study was in the middle level (4-6 stars)[37], and one study was in the low level (0-3 stars)[10].

The only available two RCTs were considered as high quality by using the Cochrane collaboration's tool for assessing risk of bias.

***Characteristics of included studies and meta-analyses on urinary continence recovery***

Table 1 summarized the results of urinary continence recovery rate comparing LRP and RRP. Among the fourteen studies[20-33], a total of 1427 patients treated with RRP and 1633 patients treated with LRP were included. Most of the selected studies had a very strict urinary continence definition as no pad. Only seven studies[25-27,29-32] provided the 6-mo urinary continence rate. The 12-mo loss to follow-up rate was > 20% in six studies[20-21,26-28,33]. Although Springer *et al*’s[32] report demonstrated a significant better outcome of LRP than ORP (96.8%*vs* 86.4%, *P* < 0.05), we did not include it in because of the preoperatively performed transurethral resection of the prostate (TURP) in that report, which could potentially be an inconsistent factor among the groups. The mean urinary continence recovery rate at 6-mo and 12-mo were 56.6% (42%-70%) and 84.3% (48.0%-96.3%) after LRP; and 64.9% (43.3%-84.1%) and 77.8% (47.0%-95.2%) after RRP, respectively.

**Six-months continence recovery after LRP and RRP**: Statistically high heterogeneity(I2 = 74%, *P* < 0.05) was observed among the eight studies[20-21,25-27,29-31] included. The meta-analysis with a random-effects model showed no significant difference between LRP and RRP(OR, 0.84; 95%CI: 0.50-1.41; *P* = 0.52) (Figure 2).

**Twelve-months continence recovery after LRP and RRP:** Fourteen studies were included in the meta-analysis[20-31,33], and there was a statistical heterogeneity (I2 = 75%, *P* < 0.05). No significant difference was found between LRP and RRP by using a random-effects model (OR, 0.92; 95%CI: 0.57-1.51; *P* = 0.75) (Figure 2).

Table 2 summarized the results of urinary continence recovery rate comparing RARP and RRP. A total of 1942 patients who received RRP and 1882 patients who received RARP were included. Half of the included studies had a very strict urinary continence definition as no pad. Only two studies[37,40] had a high loss to follow-up rate (> 20%) at 12-mo. Tewari *et al*[34] reported that the median urinary continence recovery was significantly better after RARP compared with RRP (44 d *vs* 160 d, *P* < 0.05), and Kim *et al*[10] drew the same conclusion, while Krambeck *et al*[11] presented an opposite result in the comparison of RARP and RRP (91.8% *vs* 93.7%, respectively). However, compared with the previous meta-analysis[8], Kim *et al*’s[10] and Krambeck *et al*’s[11] results were excluded in our review because of their preoperative adjuvant hormonal therapy, which would undoubtedly cause difference.

**Six-months continence recovery after RARP and RRP**: A statistically significant heterogeneity was observed among the eight included studies(I2 = 73%, *P* < 0.05)[36-43], and the meta analysis with a random-effects model showed a significant advantage after RARP than RRP(OR, 2.23; 95%CI: 1.20-4.14; *P* < 0.05)(Figure 3).

**Twelve-months continence recovery after RARP and RRP:** Totally, eight studies were included to compare RARP and RRP[35-38,40-43]. No evidence of statistical heterogeneity was observed (I2 = 49%, *P* = 0.06) and pooled analysis with a fixed-effects model demonstrated a statistically significant advantage in favor of RARP (OR,2.93; 95%CI: 1.99-4.32; *P* < 0.01) (Figure 3).

Table 3 summarized the results of urinary continence recovery rate comparing LRP and RARP. A total of 2195 patients treated with LRP and 1940 patients treated with RARP were included. Both of the only two RCTs (high quality) revealed that the urinary continence recovery rates were significantly higher at 6-mo and 12-mo after RARP, in comparison with those after LRP (*P* < 0.05)[44,45]. The evidence with the largest sample size, reported by Ploussard *et al*[46], was the only prospective study in high quality (7 stars) and showed similar results with the two RCTs. Almost all of the remaining retrospective studies also indicated better outcomes after RARP. Only one study[52] had a high loss to follow-up rate (> 20%) at 12-mo. The most crucial difference between our pooled-analysis and the previous meta-analysis[8] was the point that, the randomized control trials (RCTs) were evaluated separately with non-randomized control trials (NRCTs) in this review, since they were totally different data types.

**Six-months continence recovery after RARP and LRP**: The two RCTs[44,45] showed no heterogeneity (I2 = 0%, *P* = 0.92), and supported the advantage after RARP with a fixed-effects model (OR, 2.66; 95%CI: 1.31-5.40; *P* < 0.01) (Figure 4). In the cumulative analysis of ten NRCTs[39,46-54], no heterogeneity was found (I2 = 38%, *P* = 0.11), so a fixed-effects model was performed. And the result also demonstrated a statistically significant advantage in favor of RARP (OR,1.93; 95%CI: 1.67-2.23; *P* < 0.01) (Figure 4).

**Twelve-months continence recovery after RARP and LRP:** No evidence of statistical heterogeneity was observed in both of the two RCTs (I2 = 0%, *P* = 0.88) or the seven NRCTs (I2 = 0%, *P* = 0.44), and the pooled analyses with a fixed-effects model either for the RCTs or the NRCTs, showed a statistically significant advantage in favor of RARP [(OR, 3.52; 95%CI: 1.36-9.13; *P* < 0.05); (OR, 1.47; 95%CI: 1.25-1.74; *P* < 0.01), respectively] (Figure 4).

***Characteristics of included studies and meta-analyses on potency recovery***

Table 4 summarized the results of potency recovery rate comparing LRP and RRP. Among the ten studies, a total of 907 patients treated with RRP and 1004 patients treated with LRP were included. Eight of them had a very strict potency definition as erection sufficient for intercourse (ESI). The 12-mo loss to follow-up rate was > 20% in three studies[20,26,33]. Springer *et al*’s[32] report was not included in the meta-analysis because of its preoperative surgery. The nerve sparing (NS) procedures were not clearly mentioned in two studies[24,26], the remaining studies either used the bilateral or unilateral nerve sparing measures. The mean potency recovery rates at 6-mo, 12-mo were 30.6% (23.0%-38.1%), 45.8% (32.0%-54.5%) after RRP; and 42.5% (37%-48%), 55% (41%-66%) after LRP, respectively.

**Six-months potency recovery after LRP and LRP**: No statistical heterogeneity was observed (I2 = 0%, *P* = 0.67) in the included four studies[21,26,28,29]. The meta-analysis evaluating potency with a fixed-effects model suggested no statistically significant difference between LRP and RRP (OR, 1.48; 95%CI: 0.94-2.34; *P* = 0.09) (Figure 5).

**Twelve-months potency recovery after LRP and LRP:** Eight studies were included[20-21,23-26,29,33] and no statistical heterogeneity was observed (I2 = 0%, *P* = 0.50). The pooled analysis with a fixed-effects model showed a statistically significant advantage in favor of LRP (OR, 1.34; 95%CI: 1.05-1.70; *P* < 0.05) (Figure 5).

Table 5 summarized the results of potency recovery rate comparing RARP and RRP. A total of 1278 patients treated with RRP and 1309 patients treated with RARP were included. In half of them, the nerve sparing (NS) procedures were not clearly mentioned. Three studies[11,37,40] had a high loss to follow-up rate (> 20%) at 12-mo. Tewari *et al*[34] reported that the median potency recovery was significantly better after RARP than after RRP (180 d *vs* 440 d, *P* < 0.05). The mean 12-mo potency recovery rate ranged from 40% to 50% after RRP and from 54% to 87.5% after RARP, respectively.

**Six-months potency recovery after RARP and RRP**: A statistically significant heterogeneity was observed among the three included studies (I2 = 68%, *P* = 0.05)[37,40,42], and the pooled analysis with a random-effects model suggested a statistically significance in favor of RARP (OR, 2.77; 95%CI: 1.23-6.21; *P* < 0.05) (Figure 6).

**Twelve-months potency recovery after RARP and RRP:** Six studies were included[35-37,40-42] and no statistical heterogeneity was observed (I2 = 0%, *P* = 0.61). The cumulative analysis with a fixed- effects model showed a statistically significant advantage in favor of RARP (OR, 2.66; 95%CI: 1.96-3.60; *P* < 0.01) (Figure 6).

Table 6 summarized the results of potency recovery rate comparing RARP with LRP. Among these eight studies[44-46,49,50,52-54], a total of 1322 patients who received LRP and 1203 patients who received RARP were included, and all these studies performed the nerve sparing (NS) techniques (bilateral or unilateral) except the one by Asimakopoulos *et al*[44]. Most of the studies used a strict potency definition as erection sufficient for intercourse (ESI). In addition, two retrospective studies[52,53] had a high loss to follow-up rate (> 20%) at 12-mo. The randomized control trials (RCTs) were evaluated separately with non-randomized control trials (NRCTs). And for NRCTs, the mean potency recovery rate at 6-mo, 12-mo were 33.8% (20.4%-48.5%), 43.2% (31.6%-65.5%) after LRP; and 55.5% (31.1%-75%), 65.1% (36.5%-80.0%) after RARP, respectively.

**Six-months potency recovery after RARP and LRP**: The two RCTs[44,45] showed a statistical heterogeneity (I2 = 84%, *P* < 0.05), and demonstrated comparable result between RARP and LRP with a random-effects model (OR, 4.75; 95%CI: 0.92-24.54; *P* = 0.06) (Figure 7). In the cumulative analysis of five NRCTs[46,49-50,52,54], no heterogeneity was found (I2 = 0%, *P* = 0.50), so a fixed-effects model was utilized. And the result demonstrated a statistically significant advantage in favor of RARP (OR, 2.56; 95%CI: 2.11-3.10; *P* < 0.01) (Figure 7).

**Twelve-months potency recovery after RARP and LRP:** No evidence of statistical heterogeneity was observed in the two RCTs (I2 = 17%, *P* = 0.27) and the pooled analyses with a fixed-effects model showed a statistically significant advantage in favor of RARP (OR, 5.35; 95%CI: 2.77-10.31; *P* < 0.01) (Figure 7). In the six studies of NRCTs[46,49-50,52-54], a statistical heterogeneity (I2 = 52%, *P* = 0.27) was found, and the cumulative analysis also demonstrated a statistically significant advantage in favor of RARP by using a random-effects model (OR, 1.99; 95%CI: 1.35-2.93; *P* < 0.01) (Figure 7).

***Sensitivity analysis and meta-regression analysis***

Sensitivity analysis was preformed to verify the reliability and stability of the evidence when a statistical heterogeneity existed. The subgroup analyses of the 6-mo or 12-mo urinary continence recovery following LRP and RRP did not vary significantly by source of country (*P* > 0.05), continence definition (*P* > 0.05), study design (*P* > 0.05) and loss of follow-up rate (*P* > 0.05) (Tables 7 and 8). While in the subgroup analyses of 6-mo urinary continence recovery following RARP and RRP, the results were unstable, and western country and strict definition indicated better outcomes in favor of RARP (OR, 2.32; 95%CI: 1.47-3.67; *P* < 0.01 and OR, 3.09; 95%CI: 1.65-5.80; *P* < 0.01, respectively) (Table 9). Table 10 independently evaluated the most important factors (nerve sparing procedures) for 12-mo potency recovery among different techniques. Since all the included studies comparing RARP and LRP had taken unilateral or bilateral nerve sparing procedures, only the subgroups comparing LRP/RRP and RARP/RRP were analyzed. Our results again confirmed that the NS measures were advantageous factors to potency recovery (*P* < 0.05). All of the other remaining outcomes were proved to be stable and reliable by either using model conversion or exclusion of the study with the largest proportion.

Regrettably, in our meta regression analyses, none of the adjustments such as age, BMI, prostate volume, gleason score or PSA, achieved a statistical significance (*P* < 0.05) (Tables 11 and 12), however the l'Abbé graphs showed an overall trend either as a positive correlation or a negative correlation between those potential factors and different surgical techniques. The older age, lower BMI and lower PSA level were associated with lower odds of different technical groups (Figure 8). The prostate volume and Gleason score did not demonstrate any trends between the different methods of surgery (Figure 8).

***Publication bias***

The funnel plots of two comparative results (6-mo potency recovery after LRP/RRP and after RARP/LRP) were asymmetrical (Figure 9), indicating the existence of publication bias; this was also confirmed by Egger linear regression test (*P* = 0.024 and *P* = 0.013, respectively). All the other comparisons demonstrated symmetrical funnel plots and found no statistical significance (*P* > 0.05) by using the Egger's test, indicating no publication bias.

**DISCUSSION**

This meta-analysis was designed in accordance with the MOOSE reporting guidelines[10]. In 2011, Ficarra *et al*[8,9] had performed the meta-analyses which tried to compare the superiority of techniques concerning RARP *vs* RRP and RARP *vs* LRP. However, a deep investigation focusing on the deficiencies of these two studies made them possibly inconvincible: (1) Limited number of studies included; (2) The lack of credible quality assessment tool for the included studies; (3) As for the comparison between RARP and LRP, it did not correspond with the methodological rules of a meta-analysis to integrate the random control trial (RCT) with the non-RCT studies to analyze the outcomes, as they were totally two different level of evidences; (4) In the few included studies, Kim *et al*’s[10] and Krambeck *et al*’s[11] results were not available for the comparison between RARP and RRP; (5) Though all the outcomes of these two studies were apparently heterogenic, the author did not use any sensitivity analysis or subgroup analysis to explain the source of heterogeneity.

In contrast, our meta-analysis directly compared these three surgical approaches for the 6-mo and the 12-mo functional outcomes following radical prostatectomy(RP). In 2009, Ficarra *et al*[6] conducted a meta-analysis including only 6 studies and reported the 12-mo continence recovery following LRP and RRP, whose result was consistent with ours (OR, 0.87; 95%CI: 0.54-1.39; *P* = 0.56 and OR, 0.92; 95%CI: 0.57-1.51; *P* = 0.75, respectively). However, in our meta-analysis, the study by Rassweiler *et al*[55] was excluded because of its preoperative surgery and neo-adjuvant therapy and 13 eligible studies were included, moreover, we evaluated the 6-mo continence recovery (OR, 0.84; 95%CI: 0.50-1.41; *P* = 0.52), so this result would be more convincible and complete. Compared with the previous meta-analysis by Ficarra *et al*[8], whose results for 12-mo urinary continence recovery based on a pooled analysis of 5 studies comparing RARP *vs* RRP, and 5 studies comparing RARP *vs* LRP identified the advantage in favor of RARP (OR, 1.53; 95%CI: 1.04-2.25; *P* < 0.05 and OR, 2.39; 95%CI: 1.29-4.45; *P* < 0.01, respectively), our meta-analyses identified the similar advantage in favor of RARP both at 6-mo and 12-mo follow-up. A critical review by Coelho *et al*[7] also indicated better outcomes after RARP compared with RRP (92% *vs* 80%) or with LRP (92% *vs* 84%). Obviously, except the inclusion of more studies and the exclusion of two studies[10,11], our meta-analyses separated the random control trial(RCT) from the Non-RCT studies to analyze the outcomes, therefore, the result was subjected to fewer confounding and biases of study design.

In terms of potency recovery, for the first time, with 8 studies included, our meta-analysis supported the superiority of LRP than RRP at 12-mo follow-up (OR, 1.34; 95%CI: 1.05-1.70; *P* < 0.05). Compared with the previous meta-analysis by Ficarra *et al*[9], whose results for 12-mo potency recovery based on pooled 6 studies comparing RARP *vs* RRP, and 4 studies comparing RARP *vs* LRP demonstrated a better outcome in favor of RARP against RRP (OR, 2.84; 95%CI: 1.48-5.43; *P* < 0.01) and a non-statistically significant trend between RARP and LRP (OR, 1.89; 95%CI: 0.70-5.05; *P* = 0.21), our meta-analyses showed a statistically significant advantage in favor of RARP *vs* RRP (6-mo: *P* < 0.05 and 12-mo: *P* < 0.01, respectively) and also showed a better result in favor of RARP *vs* LRP (6-mo: *P* < 0.01 and 12-mo: *P* < 0.01, respectively). In addition, there were some potential biases in Ficarra *et al*’s[9] meta-analysis which included only 6 studies, and two of them[10,11] were considered ineligible. While in our meta-analyses, the increased study number and the separation of the random control trial (RCT) and the Non-RCT studies, would be helpful to minimize the confounding of study design. Briefly, we supported a dramatic grading by superiority level for different comparisons of potency: RARP > LRP > RRP.

In this review, a statistically significant heterogeneity was observed for several comparisons. So the subgroup analyses were added according to adjustment for country, continence or potency definition, study design and the nerve sparing procedures. We found that the western country and strict definition indicated better outcomes in favor of RARP against RRP (*P* < 0.01) for 6-mo urinary continence recovery. This difference may be explained by the popularity of robotic technique in the western country. As the classic nerve sparing (NS) technique was repeatedly proved to be a significant predictor of return of potency by Coelho *et al*[7], by Ayyathurai *et al*[56] and by Briganti *et al*[57], this review independently evaluated it for 12-mo potency recovery between different techniques, and we confirmed again that the nerve sparing measures were advantageous factors to potency recovery (*P* < 0.05). Furthermore, the other factors such as age, BMI, prostate volume, gleason score or PSA, could also be a source of heterogeneity. Standford *et al*[58] found that urinary function varied with age and sexual function with age and race. Shikanov *et al*[59] emphasized other factors influencing continence and potency, such as baseline status, surgical technique, extent of nerve sparing and adjuvant therapy. In this review, we performed meta regression analyses to explore the correlation between these factors and different techniques. Though no obviously statistical significance was found, the l'Abbé graphs predicted the trends that better functional outcomes were more easily achieved in patients with a younger age, larger BMI or higher PSA level in RARP group than the other two groups (LRP or RRP), while it was difficult to judge the [superiority](javascript:void(0);) of any techniques in patients with different prostate volume and Gleason score.

Some potential limitations should be noted. Firstly, a moderate heterogeneity was found in several comparisons. Except the potential confounding factors controlled by the inclusion criteria and analyzed with subgroup stratification as described above, surgeon's experience and the means of modification varied from one to another, which could also influence the functional outcomes and were difficult to control. Secondly, contrary to expectation, since few eligible studies were included for each comparison, and the lack of data in available studies, all the meta regression analyses presented non-statistically significant differences, which limited us to reach an exact correlation between those potential factors and the three techniques, this result still needs to be identified by further researches. Thirdly, the quality of eligible studies could potentially be another confounding factor. RCTs are powerful tools, which provide the highest level of evidence; however, because many patients refuse to participate in the randomization and the blinding degree is less, surgical RCTs are difficult to conduct. Only two RCTs were included for the comparison after RARP and LRP, and the remaining studies were all observational comparative studies. In addition, the NOS tool itself has imperfections[60]. Fourthly, publication bias still exists. The failed acquisition of gray literature may contributed to this publication bias.

The superiority of a certain surgical approach in terms of functional outcomes is always a pivotal controversy. These outcomes were influenced by multiple factors including patient characteristics, surgical techniques and methodology used for data collection. In summary, concerning the urinary continence recovery, only RARP showed an advantage when compared with LRP or with RRP, and the result was comparable between LRP and RRP. In terms of potency recovery, for the first time, we dramatically ranked the three surgical approaches into superiority level: RARP > LRP > RRP, which showed a statistical significance advantage both at 6-mo and 12-mo postoperatively. However, the limitation of this meta analysis and potential factors should be taken into consideration and our results also need to be validated by further high quality studies with strict design, large sample size and multi-center randomized controlled trials.

**COMMENTS**

***Background***

Radical prostatectomy (RP) is one of the recommended standard treatments for clinically localized prostate cancer (cT1–cT2) patients. The retropubic radical prostatectomy (RRP) was considered as the gold standard and the most widely used treatment for patients with localized prostate cancer (PCa). And recently, the authors have witnessed the emergence of laparoscopic radical prostatectomy (LRP) and robot-assisted laparoscopic prostatectomy (RARP).

***Research frontiers***

Several experts have demonstrated that when compared with RRP, LRP and RARP have obvious advantages such as fewer blood loss, less need for transfusion and shorter hospital-stay, but the lack of high-quality evidence and randomized control trials available precluded us form proving the superiority of any surgical options in terms of postoperative functional outcomes.

***Innovations and breakthroughs***

In terms of potency recovery, for the first time, we dramatically ranked the three surgical approaches into superiority level: RARP > LRP > RRP, which showed a statistically significant advantage both at 6-mo and 12-mo postoperatively.

***Applications***

Current evidence suggests that minimally invasive approaches (RARP or LRP) are effective procedures for functional recovery. However, more high-quality randomized, controlled trials investigating the long term functional outcomes are required to determine the advantages of RARP.

***Terminology***

RARP means robot-assisted laparoscopic prostatectomy. LRP means laparoscopic radical prostatectomy. RRP means retropubic radical prostatectomy. The principal postoperative functional outcomes for patients with prostatectomy are urinary continence and potency recovery.

***Peer review***

This manuscript compared the functional outcomes among three radical prostatectomy procedures. The project design and analyses of the data are acceptable. The figures and tables well summarize the existing data. Overall the manuscript is well written.

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流程图PS

**Figure 1 Flow diagram of the systematic review.** RRP: Retropubic radical prostatectomy; LRP: Laparoscopic radical prostatectomy; RARP: Robot-assisted radical prostatectomy.

UI LRP-RRP

**Figure 2 Forest plots and meta-analyses of laparoscopic radical prostatectomy and retropubic radical prostatectomy.** A: 6-mo continence recovery; B: 12-mo continence recovery. RRP: Retropubic radical prostatectomy; LRP: Laparoscopic radical prostatectomy.

UI RARP-RRP

**Figure 3 Forest plots and meta-analyses of robot-assisted radical prostatectomy and retropubic radical prostatectomy**. A: 6-mo continence recovery; B: 12-mo continence recovery. RRP: Retropubic radical prostatectomy; RARP: Robot-assisted radical prostatectomy.

UI RARP-LRP

**Figure 4 Forest plots and meta-analyses of robot-assisted radical prostatectomy and laparoscopic radical prostatectomy.** A: 6-mo continence recovery of randomized control trials (RCTs); B: 6-mo continence recovery of non-randomized control trials (NRCTs); C: 12-mo continence recovery of RCTs; D: 12-mo continence recovery of NRCTs. RRP: Retropubic radical prostatectomy; LRP: Laparoscopic radical prostatectomy.

**ED LRP-RRP**

**Figure 5 Forest plots and meta-analyses of laparoscopic radical prostatectomy and retropubic radical prostatectomy.** A: 6-mo potency recovery; B: 12-mo potency recovery. RRP: Retropubic radical prostatectomy; LRP: Laparoscopic radical prostatectomy.

ED RARP-RRP

**Figure 6 Forest plots and meta-analyses of robot-assisted radical prostatectomy and retropubic radical prostatectomy.** A: 6-mo potency recovery; B: 12-mo potency recovery. RRP: Retropubic radical prostatectomy; RARP: Robot-assisted radical prostatectomy.

ED RARP-LRP

**Figure 7 Forest plots and meta-analyses of robot-assisted radical prostatectomy and laparoscopic radical prostatectomy.** A: 6-mo potency recovery of RCTs; B: 6-mo potency recovery of non-randomized control trials (NRCTs); C: 12-mo potency recovery of RCTs; D: 12-mo potency recovery of NRCTs. LRP: Laparoscopic radical prostatectomy; RARP: Robot-assisted radical prostatectomy.

**回归图**

**Figure 8 Representative l’Abbé plots show the overall trend.** A: 12-mo continence of robot-assisted radical prostatectomy (RARP) and Retropubic radical prostatectomy (RRP); B: 12-mo potency of RARP and Laparoscopic radical prostatectomy (LRP); C: 12-mo potency of LRP and RRP; D: 12-mo continence of RARP and RRP; E: 12-mo continence of LRP and RRP.

**6-MO ED LRP-RRP  RARP-LRP NRCTs**

**Figure 9 Funnel plots for 6-mo potency recovery.** A: Comparison of laparoscopic radical prostatectomy (LRP) and retropubic radical prostatectomy (RRP); B: Comparison of robot-assisted radical prostatectomy (RARP) and LRP of non-randomized control trials (NRCTs).

**Table 1 Comparative studies evaluating urinary continence recovery after retropubic radical prostatectomy or laparoscopic radical prostatectomy**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Quality | Case,n | Author, | Country | Age(yr) | BMI | Prostate | Gleason score | PSA | Study | Continence | Data | Loss of follow-up | Urinary continence recovery,%(n) | |
|  |  | Year |  |  | (kg/m2) | Volume(ml,g) | (biopsy) | (ng/ml) | design | definition | collection | (N/Y,%) | 6 mo | 12 mo |
| 3/2/2(H) | RRP,70 | Anastasiadis *et al*, | France | 64.8 ± 6.4 | - | - | 6.1 ± 1.1 | 11.2 ± 9.7 | Prospective | 0 pad | Nonvalidated | Y,>20% | 43.3(16/37) | 77.7(26/33) |
|  | LRP,230 | 2003[20] |  | 64.1 ± 6.4 |  |  | 5.8 ± 1.2 | 10.7 ± 8.8 |  |  | questionnaire |  | 59.2a (67/113) | 89.0(94/106) |
| 2/2/3(H) | RRP,77 | Roumeguere *et al*, | Belgium | 63.9 ± 5.5 | - | 42.0 ± 20.4 | 5.4 ± 1.5 | 10.5 ± 11.5 | Prospective | 0 pad | Interview | Y,>20% | 62.5(40/64) | 83.9(47/56) |
|  | LRP,85 | 2003[21] |  | 62.5 ± 6.0 |  | 37.3 ± 15.6 | 5.4 ± 1.5 | 8.6 ± 5.2 |  |  |  |  | 50.6(37/73) | 80.7(42/52) |
| 3/1/3(H) | RRP,41 | Remzi *et al*, | Austria | 60 ± 14 | - | 44 ± 18 | 4.7 ± 1.5 | 6.9 ± 4.4 | Prospective | 0 pad | Physician | N | - | 80.3(33/41) |
|  | (a)tLRP,39 | 2005[22] |  | 61 ± 11 |  | 37 ± 16 | 5.1 ± 1.2 | 5.5 ± 3.7 |  |  |  |  |  | 84.6(33/39) |
|  | (b)eLRP,41 |  |  | 59 ± 12 |  | 32 ± 14 | 5.5 ± 1.3 | 8.1 ± 6.1 |  |  |  |  |  | 87.8(36/41) |
| 3/2/3(H) | RRP,75 | Wagner *et al*, | United States | 59 ± 6.9 | 29 ± 4.5 | - | - | 8.1 ± 6.27 | Prospective | 0 pad | EPIC | Y,<20% | - | 47.0(31/66) |
|  | LRP,75 | 2007[23] |  | 58 ± 6.9 | 27 ± 3.0 |  |  | 6.2 ± 4.22 |  |  |  |  |  | 64.0a (43/67) |
| 3/2/2(H) | RRP,222 | Touijer *et al*, | United States | 59(54, 64) | - | - | - | 5.3(4.1, 7.3) | Prospective | 0-1 safety | Institutional | N | - | 75.0 a (167/222) |
|  | LRP,193 | 2008[24] |  | 60(55, 65) |  |  |  | 5.3(4.0, 7.5) |  | pad | questionnaire |  |  | 48.0(93/193) |
| 3/2/3(H) | RRP,150 | Greco *et al*, | Italy | 61.5(49-74) | 29(25-33) | - | 5(3-7) | 6.95(3.4-10) | Prospective | 0 pad | Validated | N | 76.0(114/150) | 91.0(137/150) |
|  | LRP,150 | 2009[25] |  | 60.5(45-76) | 32(26-38) |  | 5(3-7) | 6.3(2.4-10) |  |  | questionnaire |  | 89.3(134/150) | 97.0(146/150) |
| 3/2/2(H) | RRP,102 | Dahl *et al*, | United States | 59.9 | - | - | - | - | Prospective | 0 pad | Validated | Y,>20% | 49.0(38/78) | 49.0(35/72) |
|  | LRP,104 | 2009[26] |  | 59.5 |  |  |  |  |  |  | questionnaire |  | 42.0(31/74) | 53.0(41/78) |
| 2/2/2(M) | RRP,49 | Egawa *et al*, | Japan | 67.0 ± 0.7 | - | - | 6.0 ± 0.2 | 8.3 ± 1.4 | Retrospective | 0 pad | Interview | Y,>20% | 84.1 a (37/44) | 92.9 a (39/42) |
|  | LRP,34 | 2003[27] |  | 68.0 ± 0.9 |  |  | 5.0 ± 0.2 | 6.6 ± 0.6 |  |  |  |  | 46.9(15/32) | 60.0(12/20) |
| 3/1/2(M) | RRP,50 | Artibani *et al*, | Italy | 64.28 ± 6.6 | - | - | 5.7 ± 1.2 | 11 ± 9 | Retrospective | 0 pad | Nonvalidated | Y,>20% | - | 64.0(9/14) |
|  | LRP,71 | 2003[28] |  | 63.14 ± 5.8 |  |  | 5.8 ± 1.3 | 15.7 ± 17 |  |  | questionnaire |  |  | 40.0(8/20) |
| 4/2/2(H) | RRP,70 | Ghavamian *et al*, | United States | 57.8 ± 7.3 | 28.1 | 53.2 (19-135) | 6.7 ± 1.3 | 9.9 ± 7.1 | Retrospective | 0 pad | Physician | Y,<20% | 71.4(50/70) | 87.6(57/65) |
|  | LRP,70 | 2006[29] |  | 60.8 ± 6.1 | 27.5 | 40.8 (20-114) | 6.4 ± 0.8 | 7.6 ± 8.0 |  |  |  |  | 70.0(49/70) | 90.0(63/70) |
| 4/2/2(H) | RRP,37 | Takenaka *et al*, | Japan | 67.1 ± 6.0 | 23.5 ± 3.0 | 30.1 ± 26.9 | 6.9 ± 1.0 | 14.7 ± 11.9 | Retrospective | 0 pad | Nonvalidated | N | 77.0(28/37) | 91.0(34/37) |
|  | LRP,109 | 2008[30] |  | 66.1 ± 6.3 | 23.8 ± 2.5 | 32.2 ± 16.5 | 6.6 ± 0.7 | 11.0 ± 8.4 |  |  | questionnaire |  | 65.0(71/109) | 77.0(84/109) |
| 2/2/3(H) | RRP,188 | Simforoosh *et al*, | Iran | 62.1(45-74) | - | - | - | 13,6 | Retrospective | 0 pad | Physician | N | 91.5(172/188) | 95.2(179/188) |
|  | LRP,136 | 2009[31] |  | 62.5(45-76) |  |  |  | 12.7 |  |  |  |  | 89.0(121/136) | 96.3(131/136) |
| 2/1/1(M) | RRP,128 | Springer *et al*, | Germany | 57.2 ± 7.4 | 28.3 ± 2.6 | - | - | 3.1 ± 1.7 | Retrospective | 0 pad | Validated | N | 73.4(94/128) | 86.4(111/128) |
|  | LRP,125 | 2013[32] |  | 56.8 ± 6.7 | 27.7 ± 3.8 |  |  | 3.2 ± 1.4 |  |  | questionnaire |  | 86.4(108/125) a | 96.8 a (121/125) |
| 3/2/2(H) | RRP,168 | Magheli et al, | Germany | 62.6 ± 5.4 | - | 58 ± 22 | - | 10.1 ± 11.9 | Retrospective | 0-1 safety | Validated | Y,>20% | - | 83.2(99/119) |
|  | LRP,171 | 2014[33] |  | 62.3 ± 5.7 |  | 53 ± 20 |  | 9.2 ± 6.9 |  | pad | questionnaire |  |  | 82.8(96/116) |
|  | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |

a*P* < 0.05. RRP: Retropubic radical prostatectomy; LRP: Laparoscopic radical prostatectomy; (a)tLRP: Transperitoneal laparoscopic radical; EPIC: Expanded prostate cancer index composite.

**Table 2 Comparative studies evaluating urinary continence recovery after retropubic radical prostatectomy or robot-assisted radical prostatectomy**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Quality | Case,n | Author, | Country | Age(yr) | BMI | Prostate | Gleason score | PSA | Study | Continence | Data | Loss of follow-up | Urinary continence recovery,%(n) | |
|  |  | Year |  |  | (kg/m2) | Volume(ml,g) | (biopsy) | (ng/ml) | design | definition | collection | (N/Y,%) | 6 mo | 12 mo |
| 3/2/3(H) | RRP,100 | Tewari *et al*, | United States | 63.1(42.8-72) | 27.6(17-41) | 48.4(24.2-70) | - | 7.3(1.9-35) | Prospective | 0-1 safety | Interview | - | Median:160 d | |
|  | RARP,200 | 2003[34] |  | 59.9(40-72) | 27.7(19-38) | 58.8(18-140) |  | 6.4(0.6-41) |  | pad |  |  | Median:44 da | |
| 3/2/2(H) | RRP,105 | Ficarra *et al*, | Italy | 65(61-69) | 26(24-28) | 40(30-47) | - | 6(5-10) | Prospective | 0 pad | ICIQ-UI | N | - | 88.0(92/105) |
|  | RARP,103 | 2008[35] |  | 61(57-67) | 26(24-28) | 37.5(30-48) |  | 6.4(4.6-9) |  |  |  |  |  | 97.0a (100/103) |
| 3/2/3(H) | RRP,110 | Ham *et al*, | South Korea | 66.9 ± 6.0 | 23.6 ± 1.8 | - | - | 55.2 ± 23.7 | Prospective | 0 pad | Validated | N | 75.5(83/110) | 81.8(90/110) |
|  | RARP,188 | 2008[36] |  | 67.3 ± 6.2 | 23.6 ± 2.3 |  |  | 22.3 ± 34.3 |  |  | questionnaire |  | 87.2(164/188) | 92.0a (173/188) |
| 3/1/2(M) | RRP,75 | Di Pierro *et al*, | Switzerland | 64.3(59.1-68.0) | - | - | - | 7.57(5.1-10.4) | Prospective | 0 pad | Institutional | Y,>20% | 83.0(62/75) | 80.0(60/75) |
|  | RARP,75 | 2010[37] |  | 62.8(58.4-67.0) |  |  |  | 7.72(5.6-12.1) |  |  | questionnaire |  | 95.0a (71/75) | 89a (40/45) |
| 1/1/1(L) | RRP, 235 | Kim *et al*, | South Korea | 66.5 ± 5.7 | - | 18.2 ± 23.4 | - | 14.6 ± 22.1 | Prospective | 0 pad | Validated | - | Median: 4.3 mo | |
|  | RARP, 528 | 2011[10] |  | 64.2 ± 7.3 |  | 15.2 ± 20.2 |  | 10.4 ± 16.0 |  |  | questionnaire |  | Median: 3.7 mo | |
| 4/2/3(H) | RRP,109 | Geraerts *et al*, | Belgium | 62.22 ± 6.12 | - | - | - | - | Prospective | 24h pad | Validated | N | 94.0(102/109) | 96.0(105/109) |
|  | RARP,61 | 2013[38] |  | 61.48 ± 6.08 |  |  |  |  |  | test | questionnaire |  | 95.0(58/61) | 97.0(59/61) |
| 2/1/2(M) | RRP,62 | Caballero *et al*, | Spain | 66.5(62-69) | - | 41(30.15-52) | - | 9.66(7-16.6) | Retrospective | 0 pad | Unspecified | Y,<20% | 45.9(28/61) | - |
|  | RARP,60 | 2008[39] |  | 56(56-65.25) |  | 29.5(23-40) |  | 7(5,7-10) |  |  |  |  | 60.0(30/50)a |  |
| 2/0/1(L) | RRP,588 | Krambeck *et al*, | United States | 61.0(41.0-77.0) | - | - | - | 5.0(0.6-39.7) | Retrospective | 0 pad | Institutional | Y,<20% |  | 93.7(446/476) |
|  | RARP,294 | 2008[11] |  | 61.0(38.0-76.0) |  |  |  | 4.9(0.5-33.5) |  |  | questionnaire |  |  | 91.8(224/244) |
| 3/1/2(M) | RRP,240 | Rocco *et al*[40], | Italy | 63(46-77) | - | - | 6(4-10) | 6.7(0.7-22.0) | Retrospective | 0-1 safety | Interview | Y,>20% | 83.0(189/229) | 88.0(191/217) |
|  | RARP,120 | 2009 |  | 63(47-76) |  |  | 6(4-9) | 6.9(0.4-23.0) |  | pad |  |  | 93.0a (102/110) | 97.0a (77/79) |
| 3/1/3(H) | RRP,30 | Ou *et al*[41], | United States | 70.03 ± 6.10 | 24.09 ± 3.28 | 15.89 ± 14.15 | 6.22 ± 1.62 | - | Retrospective | 0-1 safety | Unspecified | N | 83.3(25/30) | 96.6(29/30) |
|  | RARP,30 | 2009 |  | 67.27 ± 6.21 | 24.22 ± 3.16 | 16.45 ± 18.80 | 6.13 ± 0.9 |  |  | pad |  |  | 96.7(29/30) | 100.0(30/30) |
| 3/2/3(H) | RRP,176 | Choo *et al*[42], | South Korea | 67 ± 6.25 | 24 ± 2.73 | 42 ± 18.82 | - | 7.6 ± 19.33 | Retrospective | 0-1 safety | Validated | N | 92.0(162/176) | 96.0(169/176) |
|  | RARP,77 | 2013 |  | 66 ± 7.75 | 24 ± 2.55 | 41 ± 15.77 |  | 7.2 ± 13.19 |  | pad | questionnaire |  | 84.0(65/77) | 94.0(72/77) |
| 3/1/3(H) | RRP, 112 | Son *et al*[43], | South Korea | 65.0 ± 6.1 | 24.3 ± 2.4 | 41.3 ± 30.0 | - | - | Retrospective | 0 pad | Validated | Y,<20% | 51.7(49/94) | 70.7(66/94) |
|  | RARP, 146 | 2013 |  | 65.5 ± 6.7 | 24.5 ± 2.5 | 45.9 ± 16.3 |  |  |  |  | questionnaire |  | 87.5a (107/122) | 94.5a (115/122) |
| a *P* < 0.05. RRP: Retropubic radical prostatectomy; RARP: Robot-assisted radical prostatectomy; ICIQ-UI: International consultation of incontinence questionnaire-urinary incontinence. | | | | | | | | | | | | | | |

**Table 3 Comparative studies evaluating urinary continence recovery after laparoscopic radical prostatectomy or robot-assisted radical prostatectomy**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Quality | Case,n | Author, | Country | Age(yr) | BMI | Prostate | Gleason score | PSA | Study | Continence | Data | Loss of follow-up | Urinary continence recovery,%(n) | |
|  |  | Year |  |  | (kg/m2) | Volume(ml,g) | (biopsy) | (ng/ml) | design | definition | collection | (N/Y,%) | 6 mo | 12 mo |
| High | LRP,60 | Asimakopoulos *et al*, | Italy | 61.1 ± 5.1 | 26.3 ± 2.2 | - | - | 7.37(1.5-9.15) | RCT | 0 pad | ICS-MSF | N | 75.0(45/60) | 83.0(50/60) |
|  | RARP,52 | 2011[44] |  | 59.6 ± 5.4 | 25.8 ± 2.6 |  |  | 8.9(5.8-9.2) |  |  |  |  | 88.0(46/52) | 94.0(49/52) |
| High | LRP,60 | Porpiglia *et al*[45], | Italy | 64.7 ± 5.9 | 26.8 ± 2.9 | 37.7 ± 14.1 | - | 8.3 ± 6.5 | RCT | 0-1 pad | EPIC | N | 73.3(44/60) | 83.3(50/60) |
|  | RARP,60 | 2012 |  | 63.9 ± 6.7 | 26.2 ± 2.5 | 36.2 ± 12.6 |  | 6.9 ± 4.2 |  |  |  |  | 88.3a (53/60) | 95.0a (57/60) |
| 3/1/3(H) | LRP,1377 | Ploussard *et al*[46], | France | 62.7 | 26.6 | - | - | 9.8 | Prospective | 0 pad | Validated | N | 58.9(811/1377) | 68.5(943/1377) |
|  | RARP,1009 | 2012 |  | 62.7 | 26.5 |  |  | 9.2 |  |  | questionnaire |  | 72.0a (726/1009) | 75.4(761/1009) |
| 2/1/2(M) | LRP,50 | Joseph *et al*[47], | United Kingdom | 61.8 ± 1.6 | - | - | 6 ± 0.14 | 6.0 ± 0.83 | Retrospective | 0 pad | Interview | N | 92.0(46/50) | - |
|  | RARP,50 | 2005 |  | 59.6 ± 1.6 |  |  | 6 ± 0.15 | 7.3 ± 1.2 |  |  |  |  | 90.0(45/50) |  |
| 2/1/2(M) | LRP, 70 | Caballero *et al*[39], | Spain | 66.5 (62-69) | - | 41(30.15-52) | - | 9.66 (7-16.6) | Retrospective | 0 pad | Unspecified | Y,<20% | 36.4(24/66) | - |
|  | RARP, 60 | 2008 |  | 56 (56-65.25) |  | 29.5(23-40) |  | 7 (5.7-10) |  |  |  |  | 60.0(30/50) |  |
| 3/1/3(H) | LRP, 31 | Lee *et al*[48], | South Korea | 63.0 ± 8.52 | 25.2 ± 2.59 | 37.4 ± 13.05 | 6.5 ± 1.23 | 11.7 ± 13.72 | Retrospective | 0-1 safety | Institutional | N | 80.6(25/31) | - |
|  | RARP, 21 | 2009 |  | 64.6 ± 6.79 | 25.5 ± 2.64 | 39.9 ± 15.54 | 6.6 ± 0.97 | 8.1 ± 7.01 |  | pad | questionnaire |  | 81.0(17/21) |  |
| 3/1/2(M) | LRP, 60 | Cho *et al*[49], | South Korea | 66.5(57-75) | 23.65(18.1-28.4) | 39.7(19-72) | 6.81(5-9) | 11.04(2.72-36.6) | Retrospective | 0-1 safety | Interview | N | 71.7(43/60) | 100.0(60/60) |
|  | RARP, 60 | 2009 |  | 66.3(50-77) | 24.61(19.9-26.3) | 36.6(22-92.8) | 6.83(5-8) | 9.98(2.91-26.3) |  | pad |  |  | 93.3(56/60) | 100.0(60/60) |
| 4/2/3(H) | LRP,75 | Hakimi *et al*[50], | United States | 59.6(43-72) | - | - | - | 7.5 | Retrospective | 0 pad | IPSS | N | 65.3(49/75) | 89.3(67/75) |
|  | RARP,75 | 2009 |  | 59.8(42-71) |  |  |  | 8.4 |  |  |  |  | 74.7(56/75) | 93.3(70/75) |
| 4/2/2(H) | LRP,45 | Trabulsi *et al*[51], | United States | 58.1(43-74) | - | - | - | 6.2 | Retrospective | 0-1 safety | Validated | N | 71.0(32/45) | 82.0(37/45) |
|  | RARP,205 | 2010 |  | 59.9(42-76) |  |  |  | 6.4 |  | pad | questionnaire |  | 91.0a (187/205) | 94.0a (193/205) |
| 3/2/2(H) | LRP, 161 | Willis *et al*[52], | United States | 58.0 ± 6.7 | 27.0 ± 3.4 | 35.2 ± 10.1 | - | 5.7 ± 2.9 | Retrospective | 0 pad | Validated | Y,>20% | 55.0(64/117) | 72.0(84/116) |
|  | RARP, 121 | 2011 |  | 58.1 ± 6.3 | 26.7 ± 3.3 | 41.5 ± 15.2 |  | 5.0 ± 2.2 |  |  | questionnaire |  | 66.0(50/76) | 75.0(33/44) |
| 3/1/2(M) | LRP,62 | Park J *et al*[53], | South Korea | 65.7(38-77) | 24.6(19.4-31.4) | 30.1(12.0-56.0) | - | 9.14(2.65-30.77) | Retrospective | 0-1 safety | Interview | N | 76.3(47/62) | 95.0(59/62) |
|  | RARP,44 | 2011 |  | 62.7(46-71) | 26.0(19.7-39.4) | 32.9(15.5-66.8) |  | 6.32(1.86-29.5) |  | pad |  |  | 93.5(41/44) | 94.4(42/44) |
| 3/2/3(H) | LRP,144 | Park B *et al*[54], | South Korea | 67(38-77) | 24.2(17.2-31.4) | 28.8(12.0-74.0) | - | 5.84(0.08-41.26) | Retrospective | 0 pad | Interview | N | 65.5(94/144) | 78.1(112/144) |
|  | RARP,183 | 2013 |  | 63(44-75) | 24.7(16.4-39.4) | 30.3(15.5-82.8) |  | 4.98(0.05-51.46) |  |  |  |  | 83.5a (153/183) | 87.4(160/183) |
| a *P* < 0.05. LRP: Laparoscopic radical prostatectomy; RARP: Robot-assisted radical prostatectomy; RCT: Randomized controlled trial; IPSS: International prostate symptom score; EPIC: Expanded prostate cancer index composite; | | | | | | | | | | | | | | |
| ICS-MSF: International continence society-male short form questionnaire. | | | | | | | | | | | | | | |

**Table 4 Comparative studies evaluating potency recovery after retropubic radical prostatectomy or laparoscopic radical prostatectomy**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Quality | Case,n | Author, | Country | Age(yr) | BMI | Prostate | Gleason score | PSA | Study | Potency | Data | Loss of follow-up | Potency recovery(UNS/BNS),%(n) | | Potency recovery(unclear NS),%(n) | |
|  |  | Year |  |  | (kg/m2) | Volume(ml,g) | (biopsy) | (ng/ml) | design | definition | collection | (N/Y,%) | 6 mo | 12 mo | 6 mo | 12 mo |
| 3/2/2(H) | RRP,70 | Anastasiadis *et al*, | France | 64.8 ± 6.4 | - | - | 6.1 ± 1.1 | 11.2 ± 9.7 | Prospective | ESI | Nonvalidated | Y,>20% | - | 71.0(23/33) | - | 30.0(10/33) |
|  | LRP,230 | 2003[20] |  | 64.1 ± 6.4 |  |  | 5.8 ± 1.2 | 10.7 ± 8.8 |  |  | questionnaire |  |  | 98.0(104/106) |  | 41.0(43/106) |
| 2/2/3(H) | RRP,33 | Roumeguere[21] *et al*, | Belgium | 63.9 ± 5.5 | - | 42.0 ± 20.4 | 5.4 ± 1.5 | 10.5 ± 11.5 | Prospective | ESI | IIEF-5 | N | 33.3(11/33) | 54.5(18/33) | - | - |
|  | LRP,26 | 2003 |  | 62.5 ± 6.0 |  | 37.3 ± 15.6 | 5.4 ± 1.5 | 8.6 ± 5.2 |  |  |  |  | 34.6(9/26) | 65.3(17/26) |  |  |
| 3/2/3(H) | RRP,25 | Wagner *et al*[23], | United States | 59 ± 6.9 | 29 ± 4.5 | - | - | 8.1 ± 6.27 | Prospective | ESI | EPIC | N | - | 44.0(11/25) | - | - |
|  | LRP,37 | 2007 |  | 58 ± 6.9 | 27 ± 3.0 |  |  | 6.2 ± 4.22 |  |  |  |  |  | 41.0(15/37) |  |  |
| 3/2/2(H) | RRP,164 | Touijer *et al*[24], | United States | 59(54, 64) | - | - | - | 5.3(4.1, 7.3) | Prospective | ESI | Institutional | N | - | - | - | 58.5(96/164) |
|  | LRP,132 | 2008 |  | 60(55, 65) |  |  |  | 5.3(4.0, 7.5) |  |  | questionnaire |  |  |  |  | 56.2(73/130) |
| 3/2/3(H) | RRP,150 | Greco *et al*[25], | Italy | 61.5(49-74) | 29(25-33) | - | 5(3-7) | 6.95(3.4-10) | Prospective | ESI | IIEF-5 | N | - | 51.0(77/150) | - |  |
|  | LRP,150 | 2009 |  | 60.5(45-76) | 32(26-38) |  | 5(3-7) | 6.3(2.4-10) |  |  |  |  |  | 66.0a (99/150) |  |  |
| 3/2/2(H) | RRP,102 | Dahl *et al*[26], | United States | 59.9 | - | - | - | - | Prospective | ESI | Validated | Y,>20% | - | - | 23.0(18/77) | 32.0(23/73) |
|  | LRP,104 | 2009 |  | 59.5 |  |  |  |  |  |  | questionnaire |  |  |  | 37.0(28/75) | 43.0(33/77) |
| 3/1/2(M) | RRP,50 | Artibani *et al*[28], | Italy | 64.28 ± 6.6 | - | - | 5.7 ± 1.2 | 11 ± 9 | Retrospective | ESI | Nonvalidated | Y,<20% | - | - | 10.0(4/40) | - |
|  | LRP,71 | 2003 |  | 63.14 ± 5.8 |  |  | 5.8 ± 1.3 | 15.7 ± 17 |  |  | questionnaire |  |  |  | 8.8(5/57) |  |
| 4/2/2(H) | RRP,42 | Ghavamian *et al*[29], | United States | 57.8 ± 7.3 | 28.1 | 53.2(19-135) | 6.7 ± 1.3 | 9.9 ± 7.1 | Retrospective | ESI | IIEF-5 | N | 38.1(16/42) | 52.5(21/40) | - | - |
|  | LRP,50 | 2006 |  | 60.8 ± 6.1 | 27.5 | 40.8(20-114) | 6.4 ± 0.8 | 7.6 ± 8.0 |  |  |  |  | 48.0(24/50) | 64.0(32/50) |  |  |
| 2/1/1(M) | RRP,128 | Springer *et al*[32], | Germany | 57.2 ± 7.4 | 28.3 ± 2.6 | - | - | 3.1 ± 1.7 | Retrospective | IIEF-5>22 | IIEF-5 | N | - | 53.1(68/128) | - | - |
|  | LRP,125 | 2013 |  | 56.8 ± 6.7 | 27.7 ± 3.8 |  |  | 3.2 ± 1.4 |  |  |  |  |  | 74.4a (93/125) |  |  |
| 3/2/2(H) | RRP,143 | Magheli *et al*[33], | Germany | 62.6 ± 5.4 | - | 58 ± 22 | - | 10.1 ± 11.9 | Retrospective | IIEF-5>17 | Validated | Y,>20% | - | 29.0(18/62) | - | - |
|  | LRP,79 | 2014 |  | 62.3 ± 5.7 |  | 53 ± 20 |  | 9.2 ± 6.9 |  |  | questionnaire |  |  | 28.0(7/25) |  |  |
| a*P* < 0.05. RRP: Retropubic radical prostatectomy; LRP: Laparoscopic radical prostatectomy; ESI: Erection sufficient for intercourse; IIEF: International index of erectile function; EPIC: Expanded prostate cancer index composite; | | | | | | | | | | | | | | | | |
| UNS: Unilateral nerve sparing; BNS: Bilateral nerve sparing. | | | | | | | | | | | | | | | | |

**Table 5 Comparative studies evaluating potency recovery after retropubic radical prostatectomy or robot-assisted radical prostatectomy**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Quality | Case,n | Author, | Country | Age(y) | BMI | Prostate | Gleason score | PSA | Study | Potency | Data | Loss of follow-up | Potency recovery(UNS/BNS),%(n) | | Potency recovery(unclear NS),%(n) | |
|  |  | Year |  |  | (kg/m2) | Volume(ml,g) | (biopsy) | (ng/ml) | design | definition | collection | (N/Y,%) | 6 mo | 12 mo | 6 mo | 12 mo |
| 3/2/3(H) | RRP,100 | Tewari *et al*[34], | United States | 63.1(42.8-72) | 27.6(17-41) | 48.4(24.2-70) | - | 7.3(1.9-35) | Prospective | Presence of | Interview | - | Median:440 d | | Median:440 d | |
|  | RARP,200 | 2003 |  | 59.9(40-72) | 27.7(19-38) | 58.8(18-140) |  | 6.4(0.6-41) |  | erection |  |  | Median:180 da | | Median:180 da | |
| 3/2/2(H) | RRP,41 | Ficarra *et al*[35], | Italy | 65(61-69) | 26(24-28) | 40(30-47) | - | 6(5-10) | Prospective | IIEF-5>17 | IIEF-5 | N | - | 49.0(20/41) | - | - |
|  | RARP,64 | 2008 |  | 61(57-67) | 26(24-28) | 37.5(30-48) |  | 6.4(4.6-9) |  |  |  |  |  | 81.0a (52/64) |  |  |
| 3/2/3(H) | RRP,81 | Ham *et al*[36], | South Korea | 66.9 ± 6.0 | 23.6 ± 1.8 | - | - | 55.2 ± 23.7 | Prospective | ESI | IIEF-5 | N | - | 40.7(33/81) | - | - |
|  | RARP,164 | 2008 |  | 67.3 ± 6.2 | 23.6 ± 2.3 |  |  | 22.3 ± 34.3 |  |  |  |  |  | 66.5(109/164) |  |  |
| 3/1/2(M) | RRP,49 | Di Pierro *et al*, | Switzerland | 64.3(59.1-68.0) | - | - | - | 7.57(5.1-10.4) | Prospective | ESI | Institutional | Y,>20% | - | - | 25.0(12/49) | 26.0(12/47) |
|  | RARP,37 | 2010[37] |  | 62.8(58.4-67.0) |  |  |  | 7.72(5.6-12.1) |  |  | questionnaire |  |  |  | 68.0(25/37) | 55.0(12/22) |
| 1/1/1(L) | RRP, 122 | Kim *et al*[10], | South Korea | 66.5 ± 5.7 | - | 18.2 ± 23.4 | - | 14.6 ± 22.1 | Prospective | ESI | Validated | N | - | - | 6.7(8/122) | 28.1(34/122) |
|  | RARP, 373 | 2011 |  | 64.2 ± 7.3 |  | 15.2 ± 20.2 |  | 10.4 ± 16.0 |  |  | questionnaire |  |  |  | 33.0(123/373) | 57.1(213/373) |
| 2/0/1(L) | RRP, 588 | Krambeck *et al*, | United States | 61.0(41.0-77.0) | - | - | - | 5.0(0.6-39.7) | Retrospective | ESI | Institutional | Y,>20% | - | - | - | 62.8(262/417) |
|  | RARP, 294 | 2008[11] |  | 61.0(38.0-76.0) |  |  |  | 4.9(0.5-33.5) |  |  | questionnaire |  |  |  |  | 70.0(142/203) |
| 3/1/2(M) | RRP,240 | Rocco *et al*[40], | Italy | 63(46-77) | - | - | 6(4-10) | 6.7(0.7-22.0) | Retrospective | ESI | Interview | Y,>20% | - | - | 31.0(71/229) | 41.0(88/215) |
|  | RARP,120 | 2009 |  | 63(47-76) |  |  | 6(4-9) | 6.9(0.4-23.0) |  |  |  |  |  |  | 43.0(46/107) | 61.0(48/79) |
| 3/1/3(H) | RRP,2 | Ou *et al*[41], | United States | 70.03 ± 6.10 | 24.09 ± 3.28 | 15.89 ± 14.15 | 6.22 ± 1.62 |  | Retrospective | Presence of | Unspecified | N | - | 50.0(1/2) | - | - |
|  | RARP,16 | 2009 |  | 67.27 ± 6.21 | 24.22 ± 3.16 | 16.45 ± 18.80 | 6.13 ± 0.9 |  |  | erection |  |  |  | 87.5.0(14/16) |  |  |
| 3/2/3(H) | RRP,55 | Choo *et al*[42], | South Korea | 67 ± 6.25 | 24 ± 2.73 | 42 ± 18.82 |  | 7.6 ± 19.33 | Retrospective | ESI | IIEF-5 | N | 15.0(8/55) | 40.0(22/55) | - | - |
|  | RARP,41 | 2013 |  | 66 ± 7.75 | 24 ± 2.55 | 41 ± 15.77 |  | 7.2 ± 13.19 |  |  |  |  | 29.0(12/41) | 54.0(22/41) |  |  |
| a*P* < 0.05. RRP: Retropubic radical prostatectomy; RARP: Robot-assisted radical prostatectomy; ESI: Erection sufficient for intercourse; IIEF-5: International index of erectile function; UNS: Unilateral nerve sparing; BNS: Bilateral nerve sparing.. | | | | | | | | | | | | | | | | |

**Table 6 Comparative studies evaluating potency recovery after laparoscopic radical prostatectomy or robot-assisted radical prostatectomy**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Quality | Case,n | Author, | Country | Age(y) | BMI | Prostate | Gleason score | PSA | Study | Potency | Data | Loss of follow-up | Potency recovery(UNS/BNS),%(n) | | Potency recovery(unclear NS),%(n) | |
|  |  | Year |  |  | (kg/m2) | Volume(ml,g) | (biopsy) | (ng/ml) | design | definition | collection | (N/Y,%) | 6 mo | 12 mo | 6 mo | 12 mo |
| High | LRP,60 | Asimakopoulos *et al*, | *al*[44] Italy | 61.1 ± 5.1 | 26.3 ± 2.2 | - | - | 7.37(1.5-9.15) | RCT | ESI | IIEF-6 | N | - | - | 22.0(13/60) | 32.0(19/60) |
|  | RARP,52 | 2011 |  | 59.6 ± 5.4 | 25.8 ± 2.6 |  |  | 8.9(5.8-9.2) |  |  |  |  |  |  | 75.0a (39/52) | 77.0a (40/52) |
| High | LRP,35 | Porpiglia *et al*[45], | Italy | 64.7 ± 5.9 | 26.8 ± 2.9 | 37.7 ± 14.1 | - | 8.3 ± 6.5 | RCT | IIEF-5>17 | IIEF-5 | N | 48.5(17/35) | 54.2(19/35) | - | - |
|  | RARP,35 | 2012 |  | 63.9 ± 6.7 | 26.2 ± 2.5 | 36.2 ± 12.6 |  | 6.9 ± 4.2 |  |  |  |  | 65.7(23/35) | 80.0a (28/35) |  |  |
| 3/1/3(H) | LRP,866 | Ploussard *et al*[46], | France | 62.7 | 26.6 | - | - | 9.8 | Prospective | ESI | IIEF-5 | N | 20.4(177/866) | 31.6(274/866) | - | - |
|  | RARP,711 | 2012 |  | 62.7 | 26.5 |  |  | 9.2 |  |  |  |  | 42.1(299/711) | 57.7(410/711) |  |  |
| 3/1/2(M) | LRP,41 | Cho *et al*[49], | South Korea | 66.5(57-75) | 23.65(18.1-28.4) | 39.7(19-72) | 6.81(5-9) | 11.04(2.72-36.6) | Retrospective | ESI | Interview | N | 46.3(19/41) | 68.3(28/41) | - | - |
|  | RARP,53 | 2009 |  | 66.3(50-77) | 24.61(19.9-26.3) | 36.6(22-92.8) | 6.83(5-8) | 9.98(2.91-26.3) |  |  |  |  | 56.6(30/53) | 69.8(37/53) |  |  |
| 4/2/3(H) | LRP,55 | Hakimi *et al*[50], | United States | 59.6(43-72) | - | - | - | 7.5 | Retrospective | Presence of | IIEF-5 | N | 47.3(26/55) | 65.5(36/55) | - | - |
|  | RARP,58 | 2009 |  | 59.8(42-71) |  |  |  | 8.4 |  | Erection |  |  | 63.8(37/58) | 74.1(43/58) |  |  |
| 3/2/2(H) | LRP, 86 | Willis *et al*[52], | United States | 58.0 ± 6.7 | 27.0 ± 3.4 | 35.2 ± 10.1 | - | 5.7 ± 2.9 | Retrospective | ESI | Validated | Y,>20% | 57.0(34/60) | 67.0(38/57) | - | - |
|  | RARP, 74 | 2011 |  | 58.1 ± 6.3 | 26.7 ± 3.3 | 41.5 ± 15.2 |  | 5.0 ± 2.2 |  |  | questionnaire |  | 73.0(29/40) | 88.0(21/24) |  |  |
| 3/1/2(M) | LRP,35 | Park J *et al*[53], | South Korea | 65.7(38-77) | 24.6(19.4-31.4) | 30.1(12.0-56.0) | - | 9.14(2.65-30.77) | Retrospective | ESI | Interview | Y,>20% | - | 47.6(10/21) | - | - |
|  | RARP,37 | 2011 |  | 62.7(46-71) | 26.0(19.7-39.4) | 32.9(15.5-66.8) |  | 6.32(1.86-29.5) |  |  |  |  |  | 54.5(12/22) |  |  |
| 3/2/3(H) | LRP,144 | Park B *et al*[54], | South Korea | 67(38-77) | 24.2(17.2-31.4) | 28.8(12.0-74.0) | - | 5.84(0.08-41.26) | Retrospective | ESI | Interview | N | 30.8(26/83) | 32.7(27/83) | 10.2(15/144) | 22.9(33/144) |
|  | RARP,183 | 2013 |  | 63(44-75) | 24.7(16.4-39.4) | 30.3(15.5-82.8) |  | 4.98(0.05-51.46) |  |  |  |  | 31.1(49/156) | 36.5(57/156) | 20.1(37/183) | 35.0(64/183) |
| a *P* < 0.05. LRP: Laparoscopic radical prostatectomy; RARP: Robot-assisted radical prostatectomy; RCT: Randomized controlled trial; ESI: Erection sufficient for intercourse; IIEF: International index of erectile function. | | | | | | | | | | | | | | | | |
| EPIC: Expanded prostate cancer index composite; SHIM: Sexual health inventory for men; UNS: Unilateral nerve sparing; BNS: Bilateral nerve sparing. | | | | | | | | | | | | | | | | |

**Table 7 Subgroups analyses of 6-mo urinary continence recovery after laparoscopic radical prostatectomy or retropubic radical prostatectomy**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Subgroup | Study | Sample size | Heterogeneity | *P*-value | Meta-analysis | |
|  |  |  | I2(%) |  | OR | 95% CI |
| Country | Asia | 553 | 63 | 0.06 | 0.45 | 0.20-1.04 |
| America | 346 | 0 | 0.45 | 0.83 | 0.51-1.34 |
| Europe | 763 | 80 | 0.4 | 1.46 | 0.60-3.55 |
| Continence | 0 pad | 1662 | 74 | 0.52 | 0.84 | 0.50-1.41 |
| definition | 0-1 pad | 0 | - | - | - | - |
| Study design | prospective | 968 | 77 | 0.55 | 1.24 | 0.61-2.50 |
| retrospective | 694 | 59 | 0.08 | 0.56 | 0.29-1.07 |
| Loss of follow-up | ≤ 20% | 911 | 71 | 0.87 | 1.06 | 0.53-2.09 |
|  | > 20% | 751 | 78 | 0.32 | 0.66 | 0.29-1.51 |
| RRP: Retropubic radical prostatectomy; LRP: Laparoscopic radical prostatectomy; OR: Odds ratio; CI: Confidence interval. | | | | | | |

**Table 8 Subgroups analyses of 12-mo urinary continence recovery after laparoscopic radical prostatectomy or retropubic radical prostatectomy**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Subgroup | Study | Sample size | Heterogeneity | *P*-value | Meta-analysis | |
|  |  |  | I2(%) |  | OR | 95%CI |
| Country | Asia | 553 | 72 | 0.18 | 0.38 | 0.09-1.54 |
| America | 911 | 89 | 0.91 | 0.95 | 0.35-2.55 |
| Europe | 1343 | 29 | 0.33 | 1.26 | 0.79-2.02 |
| Continence | 0 pad | 908 | 55 | 0.75 | 1.08 | 0.68-1.69 |
| definition | 0-1 pad | 754 | 88 | 0.27 | 0.53 | 0.17-1.63 |
| Study design | prospective | 509 | 83 | 0.51 | 1.26 | 0.63-2.53 |
| retrospective | 1153 | 57 | 0.15 | 0.6 | 0.30-1.20 |
| Loss of follow-up | ≤ 20% | 451 | 82 | 0.82 | 1.09 | 0.51-2.33 |
|  | > 20% | 1211 | 59 | 0.45 | 0.79 | 0.43-1.46 |
| RRP: Retropubic radical prostatectomy; LRP: Laparoscopic radical prostatectomy; OR: Odds ratio; CI: Confidence interval. | | | | | | |

**Table 9 Subgroups analyses of 6-mo urinary continence recovery after robot-assisted radical prostatectomy or retropubic radical prostatectomy**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Subgroup | Study | Sample size | Heterogeneity | *P*-value | Meta-analysis | |
|  |  |  | I2(%) |  | OR | 95%CI |
| Country | Asia | 809 | 92 | 0.35 | 1.93 | 0.48-7.70 |
| Europe/America | 862 | 0 | < 0.01 | 2.32 | 1.47-3.67 |
| Continence | 0 pad | 828 | 63 | < 0.01 | 3.09 | 1.65-5.80 |
| definition | 0-1 pad | 673 | 82 | 0.52 | 1.62 | 0.37-7.06 |
| Study design | prospective | 448 | 0 | < 0.01 | 2.48 | 1.44-4.26 |
| retrospective | 1223 | 80 | 0.1 | 2.07 | 0.87-4.95 |
| Loss of follow-up | ≤ 20% | 1161 | 80 | 0.1 | 2 | 0.88-4.53 |
|  | ≺ 20% | 510 | 0 | < 0.01 | 2.99 | 1.55-5.77 |
|  | | | | | | |

|  |
| --- |
| RRP: Retropubic radical prostatectomy; RARP: Robot-assisted radical prostatectomy.OR:odds ratio;CI:confidence interval. |
| prostatectomy. |

**Table 10 Subgroups analyses of 12-mo potency recovery after nerve sparing procedures**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Techiniques | Subgroup | Sample size | Heterogeneity | *P*-value | Meta-analysis | |
| I2 (%) | OR | 95%CI |
| LRP vs RRP | uni/bilateral NS | 735 | 0 | < 0.05 | 1.52 | 1.09-2.13 |
| unclear NS | 802 | 22 | 0.37 | 1.17 | 0.83-1.65 |
| RARP vs RRP | uni/bilateral NS | 464 | 0 | < 0.01 | 2.83 | 1.90-4.22 |
| unclear NS | 446 | 0 | < 0.01 | 2.43 | 1.52-3.90 |
| RRP: Retropubic radical prostatectomy; LRP: Laparoscopic radical prostatectomy;RARP=robot-assisted radical prostatectomy; | | | | | | |
| OR: Odds ratio; CI: Confidence interval; NS: Nerve sparing. | | | | | | |

**Table 11 Meta-regression of 12-mo continence recovery**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Techiniques | Factors | Sample,n | Coefficient | *P* value | 95%CI | |
|  |  |  |  |  | Lower CI | Upper CI |
| LRP vs RRP | Age | 14 | -0.0422414 | 0.48 | -0.1685084 | 0.0840256 |
| Prostate Volume | 7 | 0.0004602 | 0.976 | -0.0367033 | 0.0376237 |
| Gleason Score | 10 | -0.0002758 | 0.998 | -0.2325786 | 0.2320269 |
| PSA | 11 | 0.0381884 | 0.508 | -0.0871645 | 0.1635414 |
| RARP vs RRP | Age | 8 | -0.0347693 | 0.763 | -0.3038441 | 0.2343054 |
| BMI | 5 | 0.178217 | 0.604 | -0.8030416 | 1.159476 |
| Prostate Volume | 4 | 0.0076432 | 0.912 | -0.2556839 | 0.2709703 |
| PSA | 5 | 0.0028508 | 0.882 | -0.053367 | 0.0590685 |
| RARP vs LRP | Age | 6 | -0.0026949 | 0.968 | -0.1735327 | 0.1789224 |
| BMI | 4 | 0.0709043 | 0.68 | -0.7088789 | 0.5670703 |
| PSA | 6 | 0.0275948 | 0.661 | -0.1898594 | 0.1346698 |
| RRP: Retropubic radical prostatectomy; LRP: Laparoscopic radical prostatectomy;RARP=robot-assisted radical prostatectomy; CI: Confidence interval. | | | | | | |

**Table 12 Meta-regression of 12-mo potency recovery**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Techiniques | Factors | Sample,n | Coefficient | *P* value | 95%CI | |
|  |  |  |  |  | Lower CI | Upper CI |
| LRP vs RRP | Age | 8 | -0.0334222 | 0.682 | -0.156947 | 0.2237914 |
| Gleason Score | 5 | -0.0059256 | 0.732 | -0.5614423 | 0.4429304 |
| PSA | 5 | 0.0509797 | 0.558 | -0.1961242 | 0.2980837 |
| RARP vs RRP | Age | 6 | -0.006352 | 0.939 | -0.2221039 | 0.2093999 |
| PSA | 5 | 0.0018209 | 0.892 | -0.0373331 | 0.0409749 |
| RARP vs LRP | Age | 6 | -0.0437647 | 0.535 | -0.2229024 | 0.1353731 |
| BMI | 5 | 0.1340739 | 0.315 | -0.220684 | 0.4888318 |
| Prostate Volume | 4 | -0.0080152 | 0.894 | -0.2365214 | 0.2204911 |
| PSA | 6 | 0.0350044 | 0.588 | -0.1301063 | 0.200115 |
| RRP: Retropubic radical prostatectomy; LRP: Laparoscopic radical prostatectomy; RARP: Robot-assisted radical prostatectomy; CI: Confidence interval. | | | | | | |