

Research Article

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A meta-analysis of robot assisted laparoscopic radical prostatectomy versus laparoscopic radical prostatectomy

<https://doi.org/10.1515/med-2019-0052>

received August 25, 2018; accepted October 13, 2018

Abstract: Objective: To evaluate the efficacy and safety of robot-assisted laparoscopic radical prostatectomy (RALP) and laparoscopic radical prostatectomy (LRP) for the treatment of localized prostate cancer. Methods: Meta-analysis was applied using Review Manager V5.3 software and the retrieved clinical trials comparing RALP with LRP for the treatment of localized prostate cancer published from 2000 to 2018 in PubMed, Ovid, ScienceDirect, and EMBASE datasets were analyzed. Results: This meta-analysis included 16 articles, totaling 7952 patients, with 5170 RALP patients and 2782 LRP patients. Meta-analysis showed that RALP postoperative complications were fewer ($P=0.0007$), and the postoperative urinary continence rate was better at 1 year after surgery ($P<0.00001$). There was no statistical significance between RALP and LRP with regards to the positive incidence of surgical margin ($P = 0.18$). Conclusion: As an emerging technology, RALP is superior to LRP for localized prostate cancer treatment in terms of postoperative complications, and postoperative urinary continence rate.

Keywords: Prostate cancer; Robot-assisted laparoscopic; Laparoscopy; Meta-analysis

1 Introduction

Prostate cancer is one of the most common malignant tumors in older men [1]. At present, the main surgical

treatment methods include open surgery, retro-pubic laparoscopic radical prostatectomy, and robotic-assisted laparoscopic radical prostatectomy [2]. With the rapid development of minimally invasive techniques, laparoscopic techniques have been increasingly applied to urological surgery [3], and the most important minimally invasive procedures include retropubic laparoscopic radical prostatectomy (LRP) and robotic assisted laparoscopic prostate (RALP), both of which have the advantages of small surgical incisions, less trauma, less bleeding, fewer postoperative complications, faster recovery, shorter hospital stay, etc.. However, which technique is better is still controversial. For this reason, this study used the meta analysis method to provide an evidence-based medical basis for treatment decisions regarding clinical prostate cancer.

2 Methods

2.1 Searching method

We conducted a search of PubMed, Ovid, ScineceDirect, and EMBASE from 2005 to 2018. We developed a search strategy as outlined by the Cochrane Collaboration Workbook. The medical subject heading terms and keywords included “prostate cancer prostatectomy”, “radical prostatectomy laparoscopy”, “assisted-laparoscopic”. We excluded duplicate articles and unpublished studies from international conferences.

2.2 Inclusion criteria

(1) The patients that were diagnosed with localized prostate cancer treated for the first time, and all had indications for treatment by radical prostatectomy. (2) The literature compared the difference in efficacy between RALP and LRP. (3) The study was designed as a prospective controlled study or a retrospective case-control study. (4)

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The literature involved at least one of the following seven indicators: operation time, intraoperative blood loss, blood transfusion rate, surgical margin positive rate and hospitalization time, postoperative urinary function and postoperative complications, and follow-up time more than 1 year.

2.3 Exclusion criteria

The following criteria were used to exclude literature: non-clinical controlled trials, non-prostate cancer studies, other surgical treatments or data descriptions were unclear.

2.4 Data extraction

The literature was selected according to the inclusion/exclusion criteria, and the parallel extraction method was used, which was completed by two researchers and cross-examined. When the opinions were inconsistent, decisions to include or exclude literature were resolved through discussion. Any lack of information was supplemented by contact with the author, which included basic information about the subject, including patient numbers, characteristics, interventions, and outcome measures. Literature quality evaluation: The methodological quality of the randomized controlled trial literature included in the study was based on the Jadad quality scoring method, including randomization, blinding, etc.

2.5 Statistical analysis

Meta analysis was performed using RevMan 5.3 software recommended by the Cochrane Collaboration. If the two categorical variables were used, the odds ratios and their 95% confidence intervals were used to describe the results. $P < 0.05$ was considered statistically significant. If it was a continuous variable, the weighted mean difference (WMD) was used to describe the results. The included studies were simultaneously tested for homogeneity. If the study data was not heterogeneous, a fixed effect model is used; if heterogeneity exists, the sensitivity analysis is used to filter heterogeneous study heterogeneity. If there was clinical consistency, a random effect model was used, and vice versa, descriptive analysis is used.

3 Results

3.1 Literature searches and characteristics of eligible studies

Figure 1 shows the flow diagram of the study selection process. After further screening, we obtained 22 studies. Table 1 summarizes the detailed characteristics of the 22 eligible studies.

Table 1: Baseline characteristics of included studies

References	Group	NO. of patients	Mean age (years)
Coelho 2010 [9]	RALP	250	60.4
	LRP	250	62.9
Drouin 2009 [10]	RALP	71	60.4
	LRP	85	61.8
Ficarra 2007 [11]	RALP	40	62.8
	LRP	40	63.1
Finkelstein 2010 [12]	RALP	2841	61.3
	LRP	168	63.6
Hakimi 2009 [13]	RALP	75	59.8
	LRP	75	59.6
Hu 2006 [14]	RALP	322	63.7
	LRP	358	62.1
Joseph 2005 [15]	RALP	50	59.6
	LRP	50	61.8
Magheli 2011 [16]	RALP	522	58.3
	LRP	522	58.4
Menon 2002 [17]	RALP	40	60.7
	LRP	40	62.8
Papachristos 2015 [18]	RALP	100	60.5
	LRP	100	62.5
Park 2013 [19]	RALP	183	63
	LRP	144	67
Porpiglia 2013 [20]	RALP	60	63.9
	LRP	60	64.7
Rozet 2007 [21]	RALP	133	62
	LRP	133	62.5
Tozawa 2014 [22]	RALP	157	67
	LRP	551	67.4
Trabulsi 2011 [23]	RALP	205	59.9
	LRP	45	58.1
Willis 2012 [24]	RALP	121	58.1
	LRP	161	58

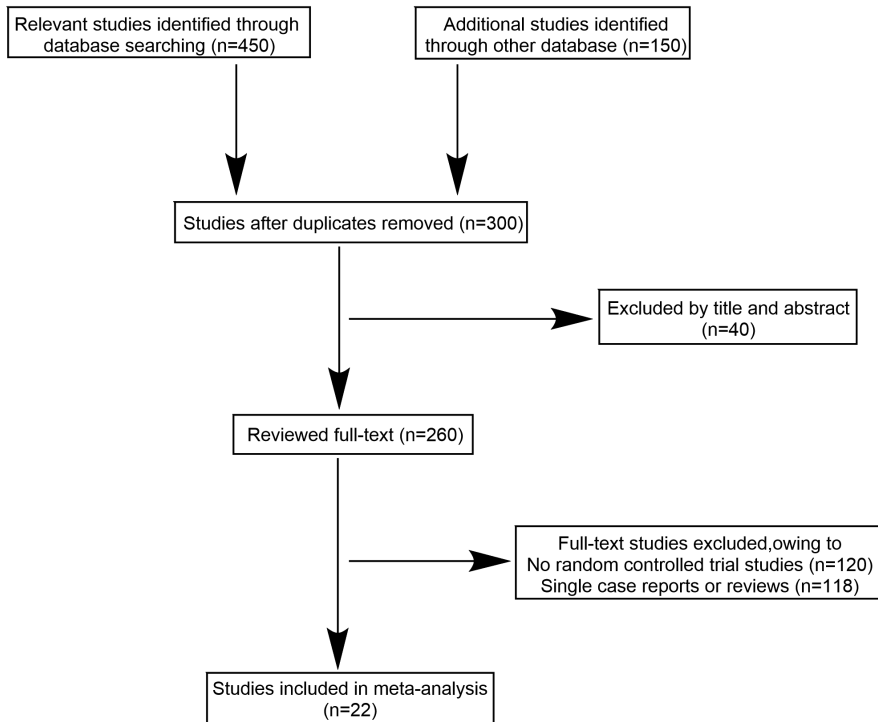


Figure 1: The study selection process

3.2 Meta-analysis of surgical blood loss of RALP and LRP

Surgical blood loss was reported in nine studies (Figure 2). Compared with LRP, RALP was associated with a 0.38 reduction in blood loss (95% CI, [-0.84, 0.08]). Significant heterogeneity was found among these studies ($I^2=95\%$, $P < 0.00001$). Due to significant heterogeneity of the data, we used a random effect model. According to our analysis, the difference between RALP and LRP was not significant.

3.3 Meta-analysis of the postoperative complications of RALP and LRP

The number of postoperative complications was reported in eight studies (Figure 3). Data from these 8 studies was analyzed in a fixed effect model and the pooled OR was 0.57 (95% CI, [0.46, 0.70]). The I^2 estimate of the variance between the studies is 35% and $P = 0.16$, which showed low heterogeneity. According to our analysis, the postoperative complications between RALP and LRP was significant. ($P < 0.00001$).

3.4 Meta-analysis of the postoperative urinary continence rate 1 year after RALP and LRP

The postoperative urinary continence rate 1 year after surgery was reported in eight studies (Figure 4). The fixed effects model was used. The meta-analysis demonstrated that patients with RALP had significantly lower postoperative urinary continence rates 1 year after surgery compared with LRP (OR=2.09; 95% CI, [1.61, 2.73]). The I^2 estimate of the variance between these studies is 0% and $P = 0.73$, which showed no significant heterogeneity. According to our analysis, the postoperative urinary continence rate 1 year after RALP was lower than LRP ($P < 0.00001$).

3.5 Meta-analysis of the rate of positive surgical margins of RALP and LRP

The rate of positive surgical margins was reported in twelve studies (Figure 5). The fixed effects model was used. The meta-analysis shows that the rate of positive surgical margins of RALP and LRP was not significant ($P = 0.82$) and the pooled OR was 0.97 (95% CI, [0.76, 1.24]). The I^2 is 43% and $P = 0.06$, which indicate low heterogeneity. According to our analysis, the rate of positive surgical margins of RALP and LRP was not significant ($P = 0.82$).

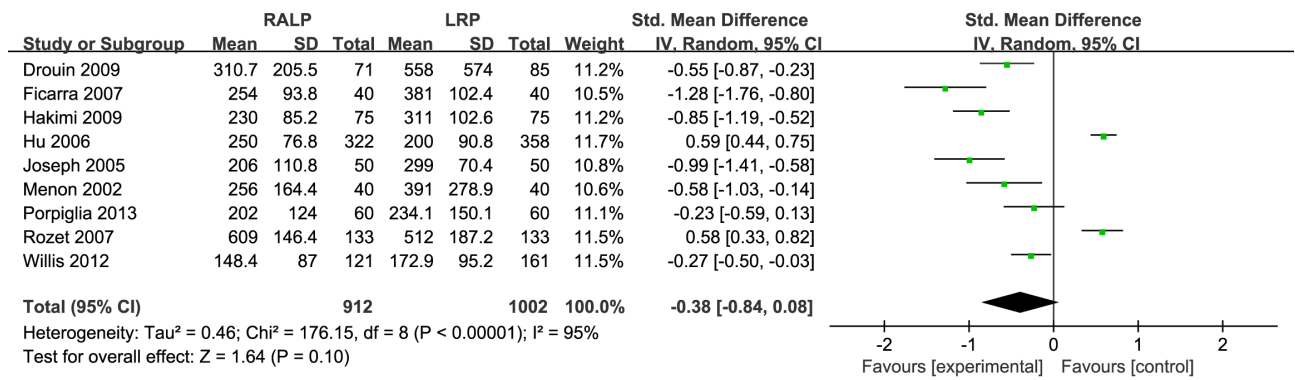


Figure 2: The forest plot for surgical blood loss of RALP and LRP groups

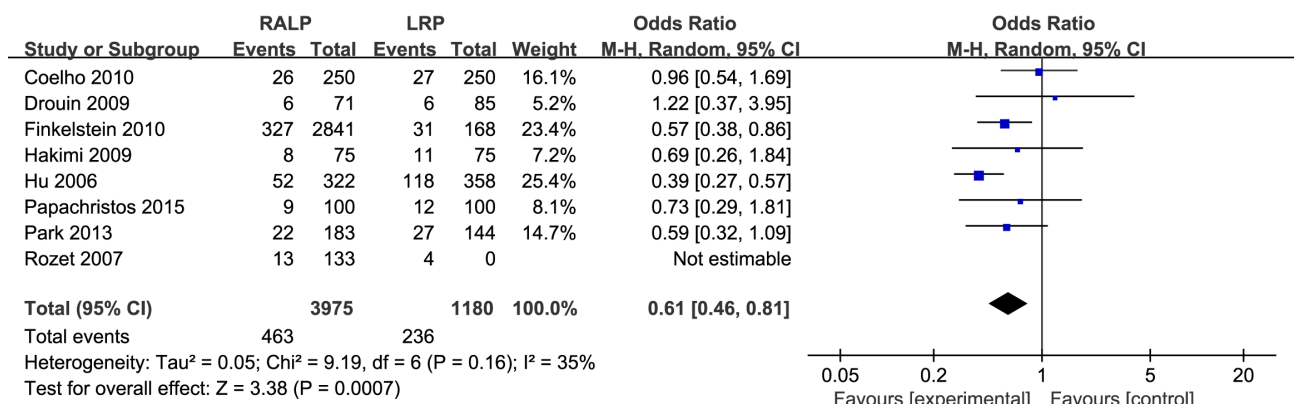


Figure 3: The forest plot for postoperative complications of RALP and LRP groups

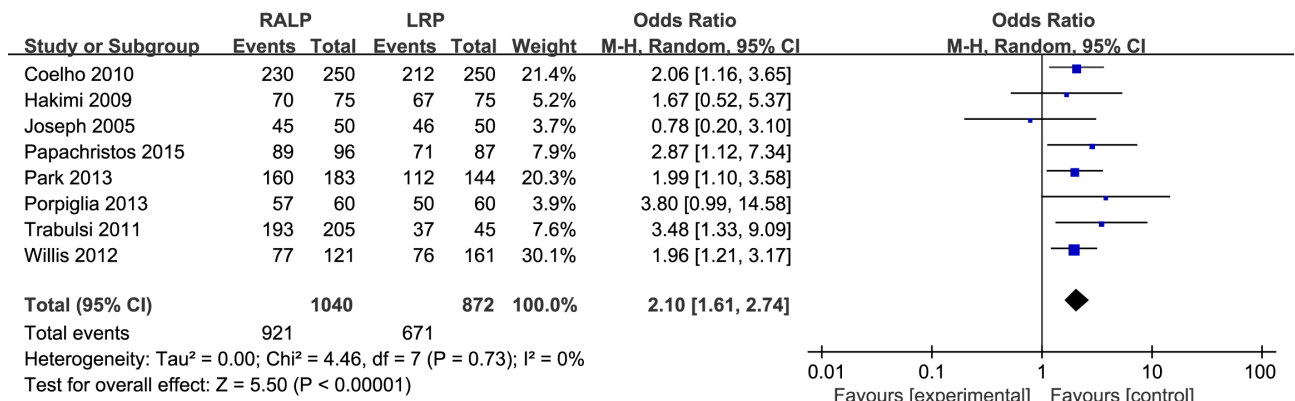


Figure 4: The forest plot for the postoperative urinary continence rate 1 year after RALP and LRP

4 Discussion

Because patients and their family members have the right to self-selection (taking into account economic and local medical conditions, etc.) [4], it is unrealistic to find completely randomized controlled studies. Therefore, most of the literature we have included are prospective and

non-random controlled trials or retrospective controlled studies.

There are many complications after radical prostatectomy, including anastomotic leakage, anastomotic stenosis, rectal injury, urinary incontinence, and erectile dysfunction [5]. Due to the limited number of published studies and data values, this study analyzed the incidence

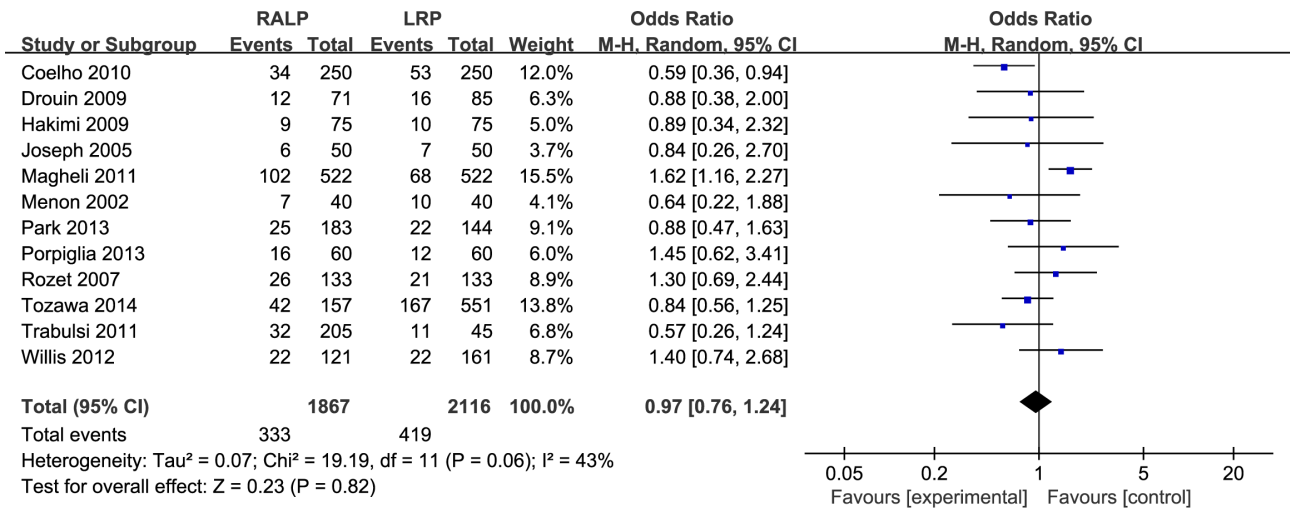


Figure 5: The forest plot for the rate of positive surgical margins of RALP and LRP

of postoperative complications in general, and the results showed that robot-assisted laparoscopy was lower.

The main advantage of robot-assisted laparoscopic surgery is to simulate the standard steps of traditional laparoscopic surgery [6]. In the narrow pelvic space, the flexible robotic arm makes the anatomical operation finer than the human hand, and it is easier to preserve the integrity of the nerve [7]. The urinary structure is maintained in tumor resection and sexual function and complete urinary control is retained. However, its main disadvantages are high cost (including cost, maintenance and consumables). The cost problem has limited the widespread promotion of robot-assisted laparoscopy in the clinic [8], but we believe that it may be reduced in the future through improvement.

Limitations of this paper and future research directions: Due to the limitation of the number and quality of the included literature, and the lack of grey literature, these factors may cause deviation of the analysis results; therefore, it is necessary to further study the long-term follow-up effects of the two procedures. This should provide more strong evidence for clinical practice and research work.

In summary, robot-assisted laparoscopic surgery is safer and more effective than laparoscopic radical prostatectomy, but more prospective randomized controlled trials are needed for further validation. Looking to the future, robotic assistive technology will be more widely used in the clinical treatment of prostate cancer.

Conflict of interest: Authors state no conflict of interest.

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