Original Article

Effects of enhanced recovery after surgery on robotic radical prostatectomy: a systematic review and meta-analysis

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Background: Enhanced recovery after surgery (ERAS) has been shown to be an effective, reliable and practical clinical nursing method to support operations on a range of physiological systems, but its effects on robotic radical prostatectomy (RRP) are still unclear. This study assesses the clinical effects of ERAS in RRP.

Methods: Various databases including PubMed, EMBASE, Web of Science and China National Knowledge were searched for relevant studies, in particular full-text articles comparing ERAS groups and conventional groups for RRP. All included articles were subject to a quality assessment, and the data analysis was conducted with Review Manager (5.3). Forest plots, sensitivity analyses, and bias analyses were also prepared based on the included articles.

Results: In total, 8 studies were identified that met the inclusion criteria. The results showed that ERAS groups exhibited significantly reduced time of flatus [mean difference (MD) =−0.58; 95% confidence interval (CI): −0.88, −0.29; P=0.0001], time of catheter removal (MD =−1.65; 95% CI: −2.15, −1.16; P<0.00001), and length of stay (LOS) (MD =−1.49; 95% CI: −2.65, −0.34; P=0.01), and there was no significant difference in terms of postoperative complications between ERAS groups and conventional groups (P=0.07).

Discussion: This study provides further evidence that ERAS improves postoperative recovery in patients undergoing RRP through reduced time of first flatus, time of catheter removal and LOS. Given the limited quality and quantity of the articles included in this study, further work is needed to validate these findings.

Keywords: Enhanced recovery after surgery (ERAS); fast track surgery (FTS); robotic radical prostatectomy (RRP); meta

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Introduction

Prostate cancer is the most commonly occurring tumor in the male genitourinary system, with a high incidence rate worldwide (1). With the development of minimally invasive surgery, robotic radical prostatectomy (RRP) has been widely used in the treatment of prostate cancer, which has had great clinical significance in terms of reducing surgical trauma and promoting postoperative recovery (2-4). The nursing methods after robot radical prostatectomy include routine nursing, intraoperative posture management, robotic nursing and enhanced recovery nursing (3).

Enhanced recovery after surgery (ERAS), also known as fast track surgery (FTS) or early recovery, was first conceived and practiced by Kehlet in 1997. It involves a series of measures in the perioperative period that are intended to reduce or decrease physiological and psychological stress, and to promote the early recovery of patients (5-7). It was first applied in gastrointestinal surgery where it achieved positive results, and since then it had been extended to hepatobiliary surgery, orthopedics and urology (8-10).

Studies have shown that ERAS can significantly shorten the hospital length of stay (LOS) and reduce the costs associated with hospitalization without increasing the incidence of surgical complications (11-13). To date, however, its application in radical prostatectomy, especially robot-assisted radical prostatectomy, has been relatively limited (14,15). Although some studies have explored the safety and efficacy of ERAS for RRP, the results are inconsistent (16,17).

At present, there is a lack of systematic review in the literature on whether ERAS is better than conventional protocols. In order to further evaluate the effectiveness and safety of ERAS, we perform this meta-analysis to compare the clinical effects of different recovery pathways, namely ERAS and conventional, for RRP. We present the following article in accordance with the PRISMA reporting checklist (available at https://dx.doi.org/10.21037/gs-21-699).

Methods

Literature search strategy

A systematic search of academic publication databases (PubMed, EMBASE, Web of Science and China National Knowledge) for relevant studies published between January 2000 and February 2021 was conducted. The following keywords (combined with the Boolean operator "and") were used in the search: enhanced recovery after surgery (ERAS); fast track surgery (FTS); robotic radical prostatectomy (RRP). The literature search was comprehensive, with no limitations on the publishing language. To maximize search sensitivity and identify as many relevant studies as possible, a manual screen of the reference lists of all identified papers was also performed to identify any additional studies of relevance.

Study selection

To be included in this review, studies were required to meet the following inclusion criteria:

(I) Research must contain indicators for assessing and comparing the effectiveness of ERAS and conventional protocols in terms of patient outcomes;
(II) Patients must have undergone RRP;
(III) Full text articles must be available.

Data extraction and quality assessment

Using standardized screening forms, teams of two reviewers independently screened all titles and abstracts that were identified in the literature search. The reviewers obtained full-text articles of all potentially eligible studies, and then evaluated them for eligibility. In performing the evaluation, the following details were recorded: first author's name, type of study, patient's age and gender, country of origin, year of publication, sample size, study duration, and primary outcome. The methodological quality was assessed with the Cochrane bias risk assessment tool.

Statistical analysis

The impact of the results in the selected reports was estimated using the risk of bias tool in Review Manager (version 5.3, Cochrane Collaboration, 2014). Mean difference (MD) and 95% confidence interval (CI) were calculated for continuous results. Heterogeneity across the studies was tested using I^2 statistics, which provide a quantitative degree of inconsistency. In this meta-analysis, I^2 of 25%, 50% and 75% were deemed to represent low, medium and high heterogeneity, respectively. Where $I^2>50\%$, potential sources of heterogeneity were identified by sensitivity analyses. These were conducted by removing one study at a time and evaluating its influence on the overall pooled estimate. Where heterogeneity was observed, a random effect model was used. In addition, potential publication bias was assessed using a funnel plot, and sensitivity analysis was performed to examine the robustness of results.

Results

Search process

Through electronic searching, a total of 554 studies of potential interest were identified. After careful reading, 79 studies meeting the inclusion criteria were identified. Of these, a further 71 articles were excluded due to study design differences or insufficient available data. Ultimately, 8 papers were included in this meta-analysis (18-25). Further details relating to the search process and inclusion and exclusion criteria are presented in *Figure 1*.

Characteristics of included studies

A standard data extraction form was created to collect

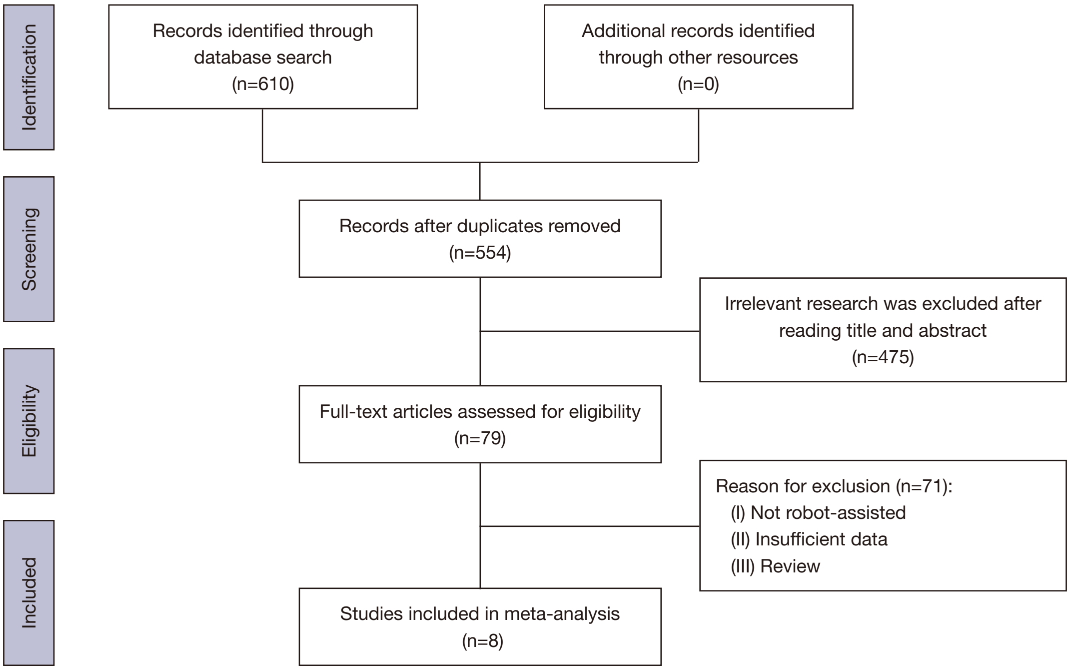

Figure 1 Flow diagram for study selection in the systematic review and meta-analysis.

data from the included studies, including: first author, year of publication, country, age, gender, sample size, recruitment time and primary outcome (*Table 1*). These studies contained 2 randomized controlled trials (RCTs), 2 prospective cohort studies, and 4 retrospective cohort studies. A total of 967 patients were available for the meta-analysis, which included 462 patients subject to ERAS and 505 patients subject to the conventional protocol. All 8 articles were published from 2013 to 2019, and the sample sizes ranged from 29 to 313.

Results of quality assessment

The overall methodological quality was evaluated using the Cochrane bias risk assessment tool. High risk of performance bias and other bias was found in two different studies (*Figure 2*). A summary of all of the kinds of bias found in each study is presented in *Figure 3*.

Results of heterogeneity test

Four of the included studies reported time of first flatus. The forest plot (*Figure 4*) shows that the ERAS group had significantly reduced time of first flatus as compared to the conventional group (MD =−0.58; 95% CI: −0.88, −0.29; P=0.0001; random effect model). The pooled studies were homogeneous (P=0.07; I^2=57%).

Four of the included studies, involving a total of 354 patients, reported time of catheter removal. Meta-analysis showed that compared to the conventional group, the ERAS group exhibited significantly shortened time of catheter removal (MD =−1.65; 95% CI: −2.15, −1.16; P<0.00001; random effect model), and there was significant heterogeneity (P=0.010; I^2=74%) (*Figure 5*). Sensitivity analysis was performed by removing Li 2020's study (20), and the result was not changed (P=0.05; I^2=68%).

Three of the included studies reported postoperative complications. A random effect model was used to evaluate the heterogeneity of postoperative complications. The results showed that there was no significant difference between the ERAS group and the conventional group in evaluation of postoperative complications [risk ratio (RR) =0.49; 95% CI: 0.23, 1.05; P=0.07], with no significant heterogeneity (P=0.06; I^2=64%) (*Figure 6*).

In evaluating hospital LOS between ERAS groups and conventional groups, 8 articles involving 967 patients were included. LOS was analyzed by random effect model. The MD of LOS was −1.49 with 95% CI: −2.65, −0.34 (P=0.01), which indicated that the LOS of the ERAS group was significantly lower than that in conventional group

Table 1 Basic characteristics of included studies

Study	Country	Type of study	No. patients		Age, years		Years of onset	Primary outcome*
			ERAS	Control	ERAS	Control		
Ploussard, 2020	France	Prospective cohort study	156	157	65.9	66.3	From 2014 to 2019	4
Huang, 2018	China	Retrospective cohort study	36	37	62.1±6.9	63.5±7.4	October 2015 to November 2017	1,3,4
Sugi, 2017	Japan	Retrospective cohort study	75	123	68 [49–75]	69 [45–76]	August 2013 and June 2015	3,4
Pan, 2018	China	RCT	50	50	68.75±7.24	69.56±7.67	October 2016 to May 2017	1,2,4
Yaiesh, 2016	Kuwait	Prospective cohort study	17	12	–	–	February 2014 and May 2016	4
Li, 2020	China	Retrospective cohort study	22	20	67.05±8.04	68.90±8.06	July 2017 to April 2019	1,2,4
Graham, 2019	United States	Retrospective cohort study	63	63	–	–	–	2,4
Li, 2021	China	RCT	43	43	65.47±7.26	64.54±7.38	March 2016 to January 2019	1,2,3,4

*, 1: time of first flatus; 2: time of catheter removal; 3: complication; 4: hospital LOS. ERAS, enhanced recovery after surgery; RCT, randomized controlled trial; LOS, length of stay.

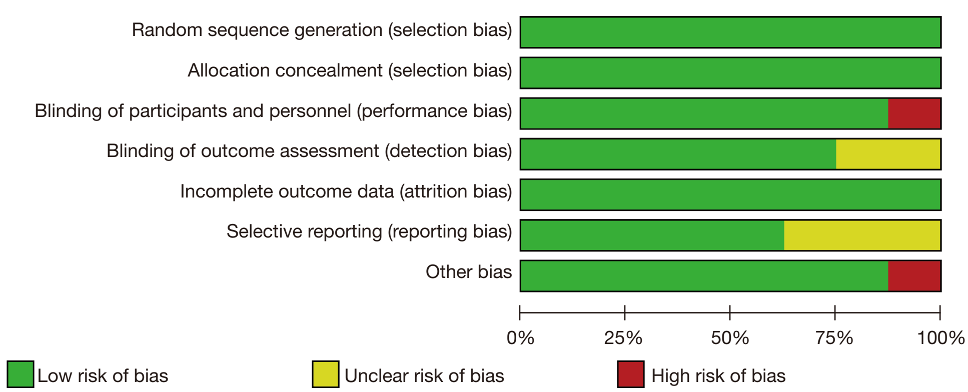

Figure 2 Risk of bias in included studies: low (green color), unclear (yellow color), and high (red color).

(*Figure 7*). The pooled studies were heterogeneous (P<0.00001; I^2=96%). A sensitivity analysis was performed by removing Sugi's study (23), however the result remained unchanged (P<0.00001; I^2=94%).

Publication bias

To identify any evidence of publication bias amongst the included studies, a funnel plot for the time of first flatus was produced. The shape of the resulting funnel plot is symmetrical (*Figure 8*), indicating that no publication bias exists in this meta-analysis.

Discussion

Radical prostatectomy has proven an excellent stage from which to showcase the value of the Da Vinci robot. Because the prostate is located in the depths of the male pelvic cavity, traditional open surgery is characterized by a large incision, significant trauma, increased bleeding, increased postoperative complications, and obvious pain and slow recovery which can easily cause psychological and physiological stress (2,3,26). RRP has become the first choice for the treatment of prostate cancer in recent years (27). Its advantages are minimal trauma, reduced bleeding, rapid recovery, and effective reduction of postoperative complications such as urinary incontinence and positive margins (4,26).

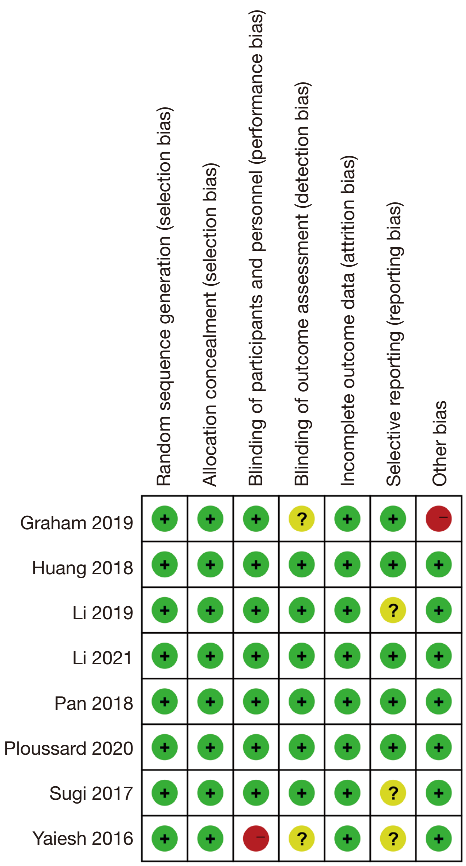

Figure 3 Risk of bias summary of included studies. Low (green color), unclear (yellow color), and high (red color).

ERAS has been shown to be an effective, reliable and practical clinical nursing method, for example, ERAS has shown great effect in patients with gastrointestinal malignancies, obstetric and thoracic surgery (28-30). Some studies have shown that the implementation of ERAS nursing during the perioperative period for patients undergoing RRP can effectively maintain the stability of the patients' internal environment, reduce the stress response caused by surgical trauma, and decrease the clinical complications (31-33).

ERAS involves cooperation between the surgical department, the anesthesia department and the nursing team. As such it is dependent on multi-disciplinary collaborative development, and represents a high standard of medical care (34,35). Laparoscopic surgery combined with ERAS has become an important direction for the development of surgical operation (36,37). It was used in the perioperative surgery of gastrointestinal and abdominal tumors (38,39). Research into the applications of ERAS to urology have primarily focused on radical resection of bladder cancers, which can involve intestinal surgery. Research into applications of ERAS in RRP was limited, but still showed positive significance (17,40).

In this study, a meta-analysis was performed to explore the safety and effectiveness of ERAS in perioperative nursing of patients undergoing RRP. The results showed that ERAS could significantly reduce time of first flatus, time of catheter removal and LOS. Gralla's study (41) reported that FTS could significantly reduce the incidence of complications (P=0.02), but in the meta-analysis presented here no significant difference in postoperative complications was observed. This may be due to the limited research data available for analysis, and additional studies should be carried out to support further investigations into the potential significance of such effects.

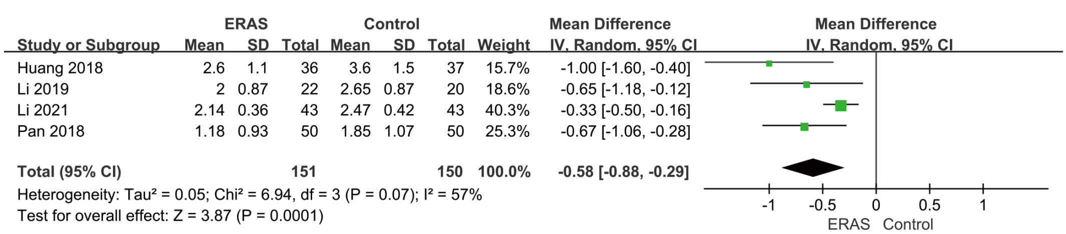

Figure 4 Forest plot: comparison of time of first flatus.

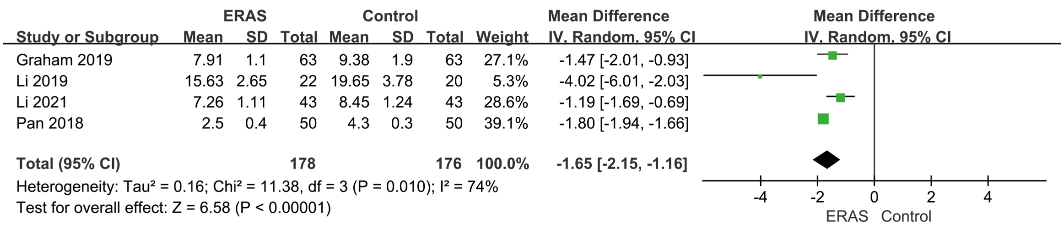

Figure 5 Forest plot: comparison of time of catheter removal.

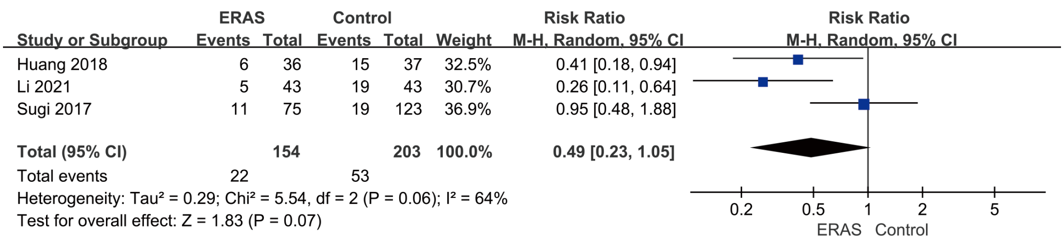

Figure 6 Forest plots: comparison of postoperative complications.

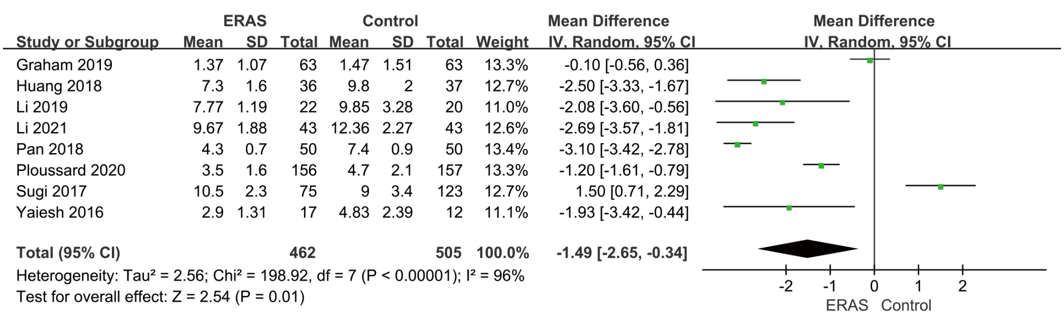

Figure 7 Forest plot: comparison of hospital LOS. LOS, length of stay.

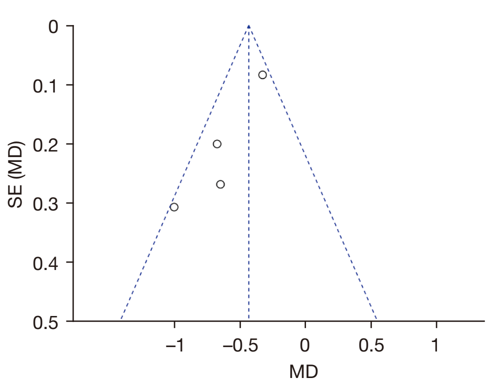

Figure 8 Funnel plot of publication bias.

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Footnote

Reporting Checklist: The authors have completed the PRISMA reporting checklist. Available at https://dx.doi.org/10.21037/gs-21-699

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at https://dx.doi.org/10.21037/gs-21-699). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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