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Safety and efficacy of enhanced recovery after surgery among patients undergoing percutaneous nephrolithotomy: protocol for a systematic review and meta-analysis

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ABSTRACT

Introduction Enhanced recovery after surgery is widely used in the perioperative period in the field of urology; however, it lacks comprehensive and systematic evidence supporting its efficacy and safety after percutaneous nephrolithotomy. This meta-analysis aimed to assess the safety and efficacy of enhanced recovery after percutaneous nephrolithotomy.

Methods and analysis Relevant databases, including PubMed, Web of Science, Embase, The Cochrane Library, China Knowledge Resource Integrated Database, Wanfang Database, Chinese Biomedical Document Service System, and Chinese Science and Technology Journal Database, will be searched from their inception to 19 September 2022. Two researchers will independently screen the literature, extract data and evaluate the included studies. The Grading of Recommendations, Assessment, Development, and Evaluation will be used to assess the degree of certainty of the evidence. Based on the Cochrane Handbook V.5.1.0, the risk of bias assessment of the included randomised controlled trials will be assessed. Based on their randomisation method, allocation generation, concealment, blinding and follow-up, we will assess randomised controlled trials. Random-effects and fixed-effects models and subgroup analyses will be used for meta-analysis. RevMan V.5.4.1 will be used for data collection and meta-analysis.

Ethics and dissemination Due to the nature of this systematic review, ethics approval is not required for this study. We will publish the results of this review in a peer-reviewed journal.

PROSPERO registration number CRD42023411520.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ This is the first systematic review specifically designed to investigate the safety and efficacy of enhanced recovery after surgery in percutaneous nephrolithotomy patients.
⇒ This study will present different methods of analysis, such as subgroup analysis and sensitivity analysis.
⇒ The Grading of Recommendations, Assessment, Development, and Evaluation will be used to assess the degree of certainty of the evidence.
⇒ Eight databases will be searched with no language restrictions. Additionally, the reference lists of potentially relevant studies will also be searched to ensure no relevant studies are missed.
⇒ The systematic review may be restricted by the lack of high-quality randomised controlled studies, the heterogeneity of methodological approaches and the small sample size.

INTRODUCTION

The incidence and prevalence (2–20%) of kidney stones have been predicted to increase.[1–4] The recurrence rate of kidney stones is 52% at 10 years.[5] A kidney stone can cause severe renal damage and even kidney loss,[6–8] which poses a heavy burden on the healthcare system and societies in many countries.[2 4 9 10]

Different methods of surgery, such as shockwave lithotripsy, flexible ureteroscopy, conventional/mini-percutaneous nephrolithotomy (PCNL), laparoscopic/robotic surgery and open procedures, are the primary treatments for kidney stones.[11] PCNL has become the primary method of treating kidney stones thanks to the advancement of medical technology.[12] Although PCNL has a high success rate (85~93%), the postoperative complication rate reaches 18%.[13 14] A study from the UK reported that complications of PCNL include bleeding, injury to surrounding organs and infection. Of these, 0.3~7.6% and 9.4% are infection and bleeding, respectively.[15] In the perioperative period, sepsis is the leading cause of mortality.[16 17] Surgical techniques that result in less trauma, faster postoperative rehabilitation and shorter bedrest requirements have received much attention. It has thus become increasingly important to optimise

therapies for patients with major complications after PCNL. Enhanced recovery after surgery (ERAS) was developed by Danish surgeon Kehlet and has been widely used in various types of surgery to achieve rapid rehabilitation following surgery, shorten hospital stays and reduce the incidence of postoperative complications.[18–21] ERAS pathways, also known as fast-track surgery (FTS), have favourable outcomes.[22 23] ERAS is a multimodal perioperative programme including health education, nutrition assessment, nutrition intervention, postoperative fluid management, epidural or local anaesthesia, multimodal analgesia for postoperative pain, early enteral nutrition, early postoperative mobilisation, and early removal of indwelling urinary or drainage catheters. ERAS requires the collaborative efforts of nurses, clinicians, anaesthesiologists and physical therapists.[18 20]

ERAS encourages patients and their families to participate in their care, which includes optimising medical conditions, minimising the burden of patients, reducing perioperative morbidity and mortality, and returning a patient to normal life as soon as possible following surgery. Recently, some ERAS guidelines have been developed to ensure that patients receive the best treatment during surgery.[24] ERAS protocols have been applied to several types of surgery worldwide, including gynaecological tumour surgeries,[25] gastrointestinal tumour surgeries,[26 27] thoracic tumour surgeries[28] and urological cancer surgeries.[29–31] ERAS has also been adopted for the surgical treatment of PCNL.[32 33] However, there is still uncertainty regarding the efficacy and safety of ERAS for perioperative care in PCNL. A comprehensive review of the efficacy and safety of ERAS in PCNL has not been published. The objective of this systematic review is to conduct a meta-analysis of randomised controlled trials (RCTs) assessing the efficacy and safety of ERAS after PCNL.

Objectives

We seek to answer the following questions:

1. Can ERAS improve the postoperative stone clearance rate among patients undergoing PCNL?
2. Does ERAS lessen the indwelling time of the urethral catheter and drainage tube after PCNL, shorten hospital stays and reduce patients' financial burden?
3. Does ERAS reduce the rate of perioperative complications?

METHODS

This study will be reported according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines.[34] This protocol was registered on the PROSPERO database (CRD42023411520).

Inclusion and exclusion criteria

Type of participants

This study will only include RCTs conducted on patients diagnosed with upper urinary tract stones who underwent PCNL and had no mental disorders. Patients will be included regardless of sex, age, nationality or educational background. Studies will be included if data from patients with and without PCNL in the ERAS programme could be separated. Reviews, conference papers, case reports, descriptive studies and non-RCTs will be excluded. At the same time, the examination of day surgery is performed in the outpatient setting, which should be excluded.

Type of intervention

Studies comparing perioperative management before, during and after surgery between the ERAS (intervention) group and the standardised nursing care (control) group will be enrolled. ERAS is widely used in the perioperative period, particularly after discharge. At least one of the outcomes of interest must be reported by the included studies.

Based on guidelines[35] and common clinical measures, ERAS mainly involves preadmission, health education, smoking cessation, nutrition screening, assessment and intervention, preoperative fasting, prevention of hypothermia, minimally invasive surgery, continuous monitoring of vital signs during surgery, postoperative early enteral nutrition, early mobilisation, preventive analgesia, and early removal of indwelling urinary and drainage catheters. RCTs not reporting ERAS outcomes in the preoperative, postoperative or intraoperative period will be excluded.

Type of outcomes

The primary outcomes are the length of postoperative hospital stay and postoperative complication rate. Secondary outcomes include the removal of urethral or drainage catheters, the length of surgery, patient satisfaction, postoperative stone clearance rate and total hospital stay.

Data sources and search strategy

PubMed, Web of Science, Embase, The Cochrane Library, China Knowledge Resource Integrated Database, Wanfang Database, Chinese Biomedical Document Service System, and Chinese Science and Technology Journal Database will be searched from their inception to 19 September 2022. We will also include grey literature, such as bibliographical references. The following keywords will be used for literature search: ('enhanced recovery after surgery' OR 'ERAS' OR 'FTS' OR 'enhanced postsurgical recovery' OR 'postsurgical recoveries, enhanced' OR 'postsurgical recovery, enhanced' OR 'recovery, enhanced postsurgical') and ('nephrolithotomy, percutaneous' OR 'nephrolithotomy, percutaneous' OR 'nephrolithotomies, percutaneous' OR 'percutaneous nephrolithotomies' OR 'percutaneous nephrolithotomy' OR 'PCNL'). The PubMed search strategy is presented in table 1. See online supplemental material 1 for the search strategies of other databases.

Study selection

The inclusion criteria are as follows:

1. Study type: RCTs.

Table 1 PubMed search strategy

Search number	Search detail
#1	enhanced recovery after surgery [MeSH]
#2	ERAS[Title/Abstract]OR FTS[Title/Abstract] OR enhanced postsurgical recovery[Title/Abstract]OR postsurgical recoveries, enhanced[Title/Abstract]OR postsurgical recovery, enhanced [Title/Abstract] OR recovery, enhanced postsurgical [Title/Abstract]
#3	#1 OR #2
#4	nephrolithotomy, percutaneous [MeSH]
#5	nephrolithotomy, percutaneous [Title/Abstract] OR nephrolithotomies, percutaneous [Title/Abstract] OR percutaneous nephrolithotomies [Title/Abstract] OR percutaneous nephrolithotomy [Title/Abstract] OR PCNL [Title/Abstract]
#6	#4 OR #5
#7	#3 AND #6

2. Language: English or Chinese.
3. Research subject: patients diagnosed with upper urinary tract stones who underwent PCNL.

The exclusion criteria are as follows:

1. Studies not measuring the outcomes of interest.
2. Studies not providing specific data or provided data are not easy to extract.

We will export the search results to the EndNote citation manager. The included studies will be independently screened, extracted and assessed for bias by two researchers. The studies will also be audited by these two researchers. In the event of disagreement, two reviewers will discuss the issue or consult with a third reviewer. First, duplicate studies will be removed by EndNote. Then, the title and abstract of each study will be independently reviewed by two reviewers, and the full text of potentially eligible studies will be reviewed.

Data extraction and management

Both reviewers will independently extract and fill out data extraction forms for eligible studies. The following data will be extracted: first author, publication year, sample size, male-to-female ratio, average age, stone diameter, stone location and outcome indicators.

Risk of bias assessment

Based on the Cochrane Handbook V.5.1.0,[36] the quality of included RCTs will be assessed. There are five domains of bias addressed by Cochrane Handbook V.5.1.0: randomisation, deviation from intended interventions, missing outcome data, outcome measurement and selection of reported outcomes.[36] In each domain, one or more signalling questions will be answered, showing that the risk of bias is low, unclear or high. The studies will be assessed independently by two researchers, and the third reviewer will resolve disagreements.

Assessing the certainty of the evidence

The Grading of Recommendations, Assessment, Development, and Evaluation will be used to assess the certainty of evidence. Two steps will be taken: first, the study design will be assessed to measure evidence quality. Then, evidence quality will be downgraded based on five factors, including risk of bias, inconsistency, indirectness, imprecision and publication bias.[37 38] Evidence quality can be classified as high, moderate, low or very low.

Data analysis

Review Manager software (RevMan V.5.4.1) will be used for all statistical analyses. For dichotomous outcomes, intervention effects will be calculated as a risk ratio with 95% CIs. For continuous outcomes, mean difference (MD) with 95% CIs will be calculated in cases where the same outcome was measured using the same method. In cases where the same outcome was evaluated using different methods, we will use the standardised MD with 95% CIs. The I^2 statistic will be used to determine heterogeneity. Heterogeneity is considered low, moderate and high heterogeneity when the value of I^2 is less than 25%, between 25% and 50%, or greater than 50%.[39] A fixed-effects model will be used when the results of trials are homogeneous; otherwise, a random-effects model will be adopted. We will perform subgroup analysis or sensitivity analysis if we observe obvious clinical heterogeneity, or we will perform only descriptive analysis if we observe evident clinical heterogeneity. A funnel plot will be used if we include more than 10 trials for an outcome.

Patient and public involvement

This review does not recruit any patients or members of the public.

DISCUSSION

Recently, ERAS has become widely used in the field of urology and has shown its benefits.[29–31 40 41] So far, no systematic review assessed the efficacy and safety of ERAS in the perioperative care of patients undergoing PCNL. Therefore, in this systematic review, we will assess the safety and efficacy of ERAS among patients undergoing PCNL to provide comprehensive and updated evidence for clinical practice.

ETHICS AND DISSEMINATION

Due to the fact that it is a systematic review, ethics approval is not required for this study. We will publish the results of this review in a peer-reviewed journal.

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Competing interests None declared.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

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