REVIEW ARTICLE

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Application and prospect of enhanced recovery after surgery in patients with arthroplasty in China

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INTRODUCTION

Enhanced recovery after surgery (ERAS) was first proposed by Danish scholar Henrik kehlet in 1997[1]. In the actual promotion process, researchers have found and verified that ERAS can not only accelerate the recovery of patients and reduce the incidence of complications but also reduce medical costs, shorten the length of hospital stay, and increase patient satisfaction[2-4].

In 2007, ERAS was introduced into China by Professor Li Jieshou[5], and its application scope gradually expanded from abdominal surgery to orthopedics, urology, and other fields. In 2016, a Chinese expert consensus about hip and knee arthroplasty[6-8] pointed out that a key of ERAS in hip and knee arthroplasty is to improve the operation technology and optimize the perioperative management. Compared with the traditional hip and knee arthroplasty perioperative management strategy, ERAS has made great progress not only in concept but also in the actual development process. Specific projects have also been clearly subdivided.

METHODS

Search strategy

A literature search using PubMed, MEDLINE, China National Knowledge Infrastructure (CNKI), and the Wanfang databases on November 20, 2020, was performed using the Medical Subject Headings terms and the following search words in combination with Boolean "AND" and "OR" phrases: "enhanced recovery after surgery," "enhanced recovery pathways," "ERAS," "fast-track surgery," "arthroplasty," and "joint replacement." A total of 48 articles were retrieved, including 19 randomized controlled trials and a total of 19 retrospective studies. A total of 1741 cases outcomes were summarized.

Inclusion criteria

Inclusion criteria were as follows: (1) population — undergoing hip joint replacement, knee joint replacement, and spinal surgery for general osteoarthritis; (2) intervention — ERAS vs. conventional care; (3) outcomes — primary outcomes (e.g., mortality rate, transfusion rate, range of motion [ROM]) and secondary outcomes (e.g., 30-day readmission rate, complication rate, length of stay [LOS]).

Exclusion criteria

Case reports, review articles, or other works without original data and studies investigating only multimodal analgesia or comparing the efficacy of various analgesic medications were excluded.

Data extraction

We reviewed abstracts and titles, read the full text carefully according to prespecified inclusion criteria, and extracted relevant clinical, study, and other information, including authors, year of publication, sample size, age and gender of subjects, ERAS-specific recovery measures, surgical site, postoperative complications, LOS, and readmission rates after 30 days for patients in the group and non-ERAS groups.

Definition of outcome events

The primary outcome events were mortality, transfusion rate, and ROM. Secondary events were postoperative LOS, 30-day readmission rates, and overall complication rates and other reported outcomes.

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RESULTS

Review of enhanced recovery after surgery program

Preoperative education and counseling

Most patients with arthroplasty have anxiety and fear before an operation. Positive communication with patients, preoperative psychological education, and intervention is very important.

One study found that explicit pre-anesthesia education can significantly relieve anxiety and emotional stress before hip or knee replacement[9]. Preoperative education helps improve patients' confidence, satisfaction, early rehabilitation, and discharge[10]. Louw and other scholars reported that preoperative patients with more knowledge of pain science and preoperative education courses may be more effective in controlling postoperative pain[11].

Preoperative evaluation

Anemia is a common complication in hip and knee replacement patients[12], which can lead to adverse clinical outcomes, such as stroke, periprosthetic inflammation, and postoperative mortality. In China, prior to joint replacement, the patients are suggested to have screening for anemia.

Diabetes is very common in patients with hip and knee arthroplasty and may have adverse effects on the outcome of hip and knee replacement[13]. Literature on diabetic patients with arthroplasty and its relationship with prognosis shows that diabetes increases the risk of postoperative death[14, 15]. Therefore, based on the ERAS concept, patients with diabetes should be screened and identified before joint replacement, and the endocrine pathway should be optimized to improve the clinical outcomes.

Multimodal analgesia

Pain is the main complication after hip and knee replacement. Beswick and other scholars found that 7–23% of total hip arthroplasty (THA) patients and 10–34% of total knee arthroplasty patients have persistent pain after surgery[16]. In China, the multimodal, opioid-sparing techniques are advocated as the basis for postoperative pain control. Multimodal analgesia is an effective way to manage arthroplasty pain. It has a good analgesic effect by combining different drugs with different mechanisms[17]. In addition, ice can also reduce inflammation and swelling, thereby reducing the incidence of pain[18].

Selection of intraoperative anesthesia techniques

The choice of anesthesia mode for patients with arthroplasty is of great significance to the safety and rapid recovery of patients[19]. There is a physiological view that regional anesthesia is the optimal ERAS technique for hip and knee arthroplasty. Axonal anesthesia is adequate for surgery. It provides sympathetic block, inhibits the release of stress hormones, and attenuates the release of insulin after nerve conduction[20, 21]. A lot of evidence demonstrates a lower incidence of postoperative complications when hip or knee arthroplasty is performed under normal/regional compared general with anesthesia. Pulmonary embolus, pulmonary compromise, renal injury, infection, need for transfusion, and LOS are all significantly lower after neuraxial anesthesia[22, 23]. A recent meta-analysis of 29 studies (including 10,488 patients) found that axial anesthesia reduced hospital stay by nearly half a day compared with the general anesthesia group[24]. A multi-institution retrospective study found that the use of general anesthesia increased the risk of moderate-to-severe postoperative pain by 8.5 times and the risk of persistent pain after hip surgery by 2.5 times[25, 26].

In addition, the combined sevoflurane inhalation anesthesia and lumbosacral plexus block under the guidance of Gas Man software can provide relatively accurate anesthesia management for elderly patients undergoing hip arthroplasty and promote rapid postoperative recovery. For elderly patients with poor tolerance, intraspinal anesthesia is also a better choice. Zheng Quan et al. found that the cognitive impairment of patients after spinal anesthesia was reduced, and the visual analog scale (VAS) score was decreased 48 h after operation[27]. Thus, spinal anesthesia is a better choice for joint replacement, which can promote faster recovery of patients.

Prevention and treatment of postoperative nausea and vomiting

Postoperative nausea and vomiting (PONV) may be more distressing than pain[28]. The risk factors of PONV included female, non-smoking status, exercise history, or previous history of PONV[29]. The treatment of PONV may be avoiding general anesthesia and minimizing opioids.

Early mobilization

Early mobilization is a key component of ERAS. Adverse physiological effects of long-term bed rest include increased insulin resistance, myopathy, decreased pulmonary function, impaired tissue oxygenation, and thromboembolism[30]. Safe and effective analgesia is a prerequisite for encouraging postoperative activities. A recent meta-analysis showed that ambulation within 24 h after surgery reduced hospital stay (by 1.8 days)[31]. The early activity of knee replacement was also related to the

improvement of functional recovery[32]. Early joint activity plays a positive role in improving prognosis. Despite these benefits, it is unclear whether early mobilization is associated with other complications.

Current obstacles of enhanced recovery after surgery in China

There are many obstacles in the process of ERAS promotion, which mainly focus on policy support, team building, evaluation process, scheme formulation, insufficient effect evaluation, and so on[33]. A meta-analysis published in 2017 that included seven randomized controlled or clinically controlled studies involving a total of 8346 patients undergoing total hip replacement or total knee replacement showed that arthroplasty ERAS significantly reduced the length of hospital stay by 1.44 days compared to controls. However, the ERAS-related departments did no close cooperation in China, each link is not to achieve optimization, and early experience accumulation stage, basic-level hospital looking forward and developed, and the system of specific measures in accordance with the arthroplasty characteristics is not clear; thus, further practice and exploration efforts were needed. In addition, among the patients who have carried out ERAS (including all and part of ERAS), some patients expressed dissatisfaction with the current situation. The dissatisfaction mainly focused on PONV, application of tourniquet, and optimization of analgesia scheme.

DISCUSSION

In foreign countries, one of the reasons for the limited clinical development of ERAS is the difficulty of some of the contents of expert consensus. Some experts believe that the lack of team human resources will also hinder the development of ERAS. At present, in our country, the design and implementation of the specific composition, operation management, collaboration mode, and diagnosis and treatment process of ERAS are still in the exploratory stage. Enhanced recovery requires multidisciplinary optimization and cooperation, which is the optimal management of the perioperative "process."

It is required that the medical staff of various disciplines participating in ERAS pay attention to the perioperative management of patients, do a good job in the optimization measures of this discipline, and strengthen the cooperation and communication with relevant departments of ERAS[34]. In the application of the concept of fast-track surgery in the perioperative management of hip and knee arthroplasty, we should strictly implement the fast-track measures, reduce the surgical stress and complications, shorten the length of hospital stay and reduce the cost of hospitalization, and pay more attention to the rehabilitation effect and follow-up work after discharge. Based on the above two points, we should strengthen the research on the process and clinical pathway of ERAS and innovate and construct the organization and management[35]. Based on the optimization strategy of ERAS, at the level of diagnosis and treatment team, we should establish a multidisciplinary ERAS diagnosis and treatment team, including surgery, anesthesiology, operating room, nutrition, and rehabilitation, and clarify the responsibilities and rights between disciplines; the objectives are to establish a follow-up system for discharged patients with ERAS, understand the rehabilitation of patients after discharge, provide necessary feedback for the mechanism research of the ERAS, and promote the development of ERAS concept in orthopedic hip and knee arthroplasty. In short, with the strengthening of the application of ERAS in orthopedic theory and practice, the concept of rapid rehabilitation will benefit patients better. This will make ERAS better and more reasonable localization promotion, more standardized and more effective implementation, promote the promotion and application of ERAS in China, and provide high-level and high-quality medical services for patients.

CONCLUSION

We need to proceed from our own reality, hold the attitude of seeking truth from facts, carry out more and more reliable clinical exploration, and obtain more and more feasible solutions in the process of promotion. All this will make ERAS better and more reasonable localized promotion, more standardized and more effective implementation, and provide high-level, high-quality medical services for patients.

AVAILABILITY OF DATA AND MATERIALS

All data generated or analyzed during this study are included in this article.

The data that support the findings of this study are available from the corresponding author upon reasonable request.

ETHICS APPROVAL

This study was conducted in accordance with the Declaration of Helsinki and was approved by the Ethics Committee of our hospital.

AUTHORS' CONTRIBUTIONS

YF: Conceptualization, Data curation, Formal Analysis, Funding acquisition, Validation, Visualization, Writing – original draft, Writing – review & editing. **XL:** Investigation, Methodology, Project administration, Resources, Software, Supervision, Writing – original draft, Writing – review & editing. All authors wrote and gave final approval of the manuscript.

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