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**Name of Journal:** *World Journal of Clinical Cases*

**Manuscript NO:** 88027

**Manuscript Type:** ORIGINAL ARTICLE

*Retrospective Cohort Study*

**The effect of enhanced recovery after surgery with multidisciplinary collaboration on nursing outcomes after total knee arthroplasty**

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**Abstract**

**BACKGROUND**

There is a lack of studies on the effects of enhanced recovery after surgery (ERAS) with multidisciplinary collaboration on the nursing outcomes of total knee arthroplasty (TKA).

**AIM**

We aimed to explore the effect of ERAS with multidisciplinary collaboration on nursing outcomes after TKA.

**METHODS**

We retrospectively analyzed the clinical data of 80 patients who underwent TKA at a tertiary hospital between January 2021 and December 2022. The patients were divided into two groups according to the nursing mode: the ERAS group ( $n = 40$ ) received ERAS with multidisciplinary collaboration, and the conventional group ( $n = 40$ ) received routine nursing. The following indicators were compared between the two groups: length of hospital stay, hospitalization cost, intraoperative blood loss, hemoglobin level 24 h after surgery, visual analog scale (VAS) score for pain, range of motion (ROM) of

the knee joint, Hospital for Special Surgery (HSS) knee score, and postoperative complications.

## RESULTS

The ERAS group had a significantly shorter length of hospital stay, lower hospitalization cost, less intraoperative blood loss, higher hemoglobin level 24 h after surgery, lower VAS score for pain, higher knee joint ROM, and higher HSS knee score than the conventional group (all  $P < 0.05$ ). There was no significant difference in the incidence of postoperative complications between the two groups ( $P > 0.05$ ).

## CONCLUSION

Multidisciplinary collaboration with ERAS can reduce blood loss, shorten hospital stay, and improve knee function in patients undergoing TKA.

## INTRODUCTION

Knee osteoarthritis is a degenerative joint disease that affects millions of people worldwide, causing pain, disability, and a reduced quality of life<sup>[1]</sup>. It is a major public health problem that imposes a heavy burden on healthcare systems and society<sup>[2]</sup>. The prevalence of knee osteoarthritis increases with age, obesity, and physical inactivity and is expected to rise due to the aging population and the obesity epidemic<sup>[3]</sup>.

Total knee arthroplasty (TKA) is a surgical procedure that replaces the damaged articular surfaces of the knee joint with artificial implants to relieve pain and restore function<sup>[4]</sup>. It is one of the most successful and cost-effective interventions for end-stage knee osteoarthritis<sup>[5]</sup>. However, TKA is a major surgery that involves significant trauma, blood loss, and pain and requires a long recovery period<sup>[6]</sup>. Conventional perioperative care for patients undergoing TKA is often suboptimal, resulting in delayed mobilization, prolonged hospital stay, high hospitalization costs, and an increased risk of complications<sup>[7]</sup>.

Enhanced recovery after surgery (ERAS) is a novel perioperative care model that integrates evidence-based interventions to optimize recovery in surgical patients<sup>[8]</sup>. It was first developed for colorectal surgery in the 1990s by Kehlet *et al* in Denmark and has since been applied in various surgical specialties, including orthopedic surgery<sup>[9]</sup>. ERAS aims to reduce the surgical stress response, enhance physiological function, and minimize postoperative morbidity and mortality in patients<sup>[10]</sup>. ERAS has been shown to improve the outcomes of patients with TKA by reducing blood loss, pain, opioid consumption, hospital stay, and complications and improving patient satisfaction and functional recovery<sup>[11-14]</sup>.

Multidisciplinary collaboration is an essential element of ERAS that requires the involvement and coordination of different health professionals throughout the perioperative period<sup>[15]</sup>. This ensures that patients receive standardized and individualized care based on the best available evidence and their specific needs<sup>[16]</sup>. Multidisciplinary collaboration also facilitates communication and education among health professionals, patients, and their families, which can improve the quality and safety of care and the satisfaction and compliance of all parties<sup>[17]</sup>.

However, there is a lack of studies on the effects of ERAS with multidisciplinary collaboration on the nursing outcomes of TKA. Nursing outcomes are defined as “the effects or results of nursing interventions on individuals or groups”<sup>[18]</sup>. They reflect the quality and effectiveness of nursing care and the impact of nursing care on patient outcomes. Nursing outcomes are important indicators for evaluating and improving nursing practice, as well as for demonstrating the value and contribution of nursing to health care<sup>[18]</sup>.

Therefore, this study aimed to explore the effects of ERAS with multidisciplinary collaboration on the nursing outcomes of TKA.

## **MATERIALS AND METHODS**

### **Study design and ethical approval**

This retrospective cohort study used the electronic medical records of 80 patients who underwent TKA at a tertiary hospital between January 2021 and December 2022. The study was approved by the ethics committee of the hospital, and the requirement for informed consent was waived because of the retrospective nature of the study.

### **Patient allocation**

The patients were divided into two groups according to the nursing mode: the ERAS group ( $n = 40$ ) received ERAS with multidisciplinary collaboration, and the conventional group ( $n = 40$ ) received routine nursing. The allocation of patients to the groups was based on the availability of ERAS protocols and the hospital's multidisciplinary team. The ERAS protocols and multidisciplinary team were implemented in the hospital in July 2021. All patients who underwent TKA thereafter were assigned to the ERAS group. Patients who had undergone TKA before that date were assigned to the conventional group.

### **ERAS group protocol**

The ERAS group followed the ERAS protocols developed by our hospital based on a literature review and expert consensus<sup>[19,20]</sup>. The main components of the ERAS protocol were as follows:

**Preoperative education:** The patients received a booklet and video on the TKA procedure, anesthesia options, pain management, wound care, mobilization exercises, and discharge criteria. Patients were also invited to attend a preoperative education session led by a nurse educator in which they could ask questions and clarify their doubts. Patients were encouraged to bring their family members or caregivers to the sessions.

**Anesthesia:** The patients received spinal anesthesia with intrathecal morphine, which provided adequate analgesia and minimized blood loss and opioid consumption. Patients also received a femoral nerve block with ropivacaine, which enhanced postoperative analgesia and facilitated early mobilization.

**Analgesia:** The patients received multimodal analgesia, including oral acetaminophen, celecoxib, tramadol, intravenous ketorolac, and dexmedetomidine. Patients did not

undergo patient-controlled analgesia (PCA ) with morphine because it was associated with more side effects and delayed recovery. Patients rated their pain on a visual analog scale (VAS) every 4 h, and the analgesics were adjusted accordingly.

Fluid management: The patients received restrictive fluid therapy to maintain a near-normal fluid balance and avoid fluid overload. Patients received intravenous crystalloids at a rate of 2 mL/kg/h during surgery, and oral fluids were tolerated after surgery. The patients did not receive colloids or blood transfusions unless indicated by hemodynamic instability or severe anemia.

Nutrition: The patient resumed oral intake within 6 h after surgery and received a high-protein diet thereafter. The patients did not receive a nasogastric tube or parenteral nutrition unless indicated by gastrointestinal dysfunction or malnutrition.

Mobilization: Patients started passive range-of-motion (ROM) exercises of the knee joint within 2 h after surgery and active ROM exercises within 6 h. The patients were assisted in getting out of bed and walking with a walker within 12 h. The patients also received daily physiotherapy until discharge.

Discharge criteria: The patients were discharged when they met the following criteria: (1) stable vital signs; (2) adequate pain control; (3) wound healing without infection; (4) independent walking with assistive devices; (5) ROM of the knee joint  $\geq 90^\circ$ ; (6) Hospital for Special Surgery (HSS) knee score  $\geq 85$ .

### **Conventional group protocol**

The conventional group received routine nursing care according to hospital guidelines, mainly comprising preoperative education and a brief introduction to the TKA procedure and postoperative care from nurses.

Anesthesia: The patients received general or spinal anesthesia according to their preference and the anesthesiologist's decision.

Analgesia: The patients received intravenous PCA with morphine for 48 h after surgery, followed by oral analgesics as needed.

Fluid management: The patients received intravenous fluids for 24 h after surgery, followed by oral fluids as tolerated.

Nutrition: The patients resumed oral intake on the first day after surgery and received a regular diet thereafter.

Mobilization: The patients started passive ROM exercises of the knee joint on the first day after surgery and active ROM exercises on the second day. The patients were assisted in getting out of bed and walking with a walker on the third day.

Discharge criteria: These were the same as for the ERAS group.

### **Comparisons and indicators**

The following indicators were compared between the two groups:

Length of hospital stay – the number of days from the day of surgery to the day of discharge.

Hospitalization cost – the total cost of hospitalization, including surgery, anesthesia, medication, laboratory tests, imaging examinations, nursing care, and rehabilitation.

Intraoperative blood loss – the amount of blood loss during surgery, measured by weighing the gauze and suction bottles.

Hemoglobin level 24 h after surgery – the hemoglobin level in the blood sample taken 24 h after surgery.

VAS score for pain – the intensity of pain rated by the patients on a scale from 0 (no pain) to 10 (worst pain imaginable), measured 24, 48, and 72 h after surgery.

ROM of the knee joint – the degree of flexion and extension of the knee joint, measured by a goniometer at 24, 48, and 72 h after surgery.

HSS knee score – the functional status of the knee joint, evaluated by a standardized questionnaire that includes pain, function, ROM, muscle strength, stability, deformity, and walking distance, measured before surgery and at discharge, with the score ranging from 0 (worst) to 100 (best).

Postoperative complications – the occurrence of adverse events after surgery, such as infection, bleeding, hematoma, wound dehiscence, deep vein thrombosis, pulmonary embolism, nerve injury, or implant failure.

### **Data collection and analysis**

Data were collected by two trained nurses who were blinded to the group allocation. Data were analyzed using SPSS software version 22.0. The measurement data were expressed as mean  $\pm$  standard deviation or median (interquartile range) and compared by t-test or Mann-Whitney U test. Count data are expressed as frequencies (percentages) and were compared using the chi-square or Fisher's exact test. Statistical significance was set at  $P < 0.05$ . significant.

## **RESULTS**

### **Demographic and clinical characteristics**

The demographic and clinical characteristics of the two groups are presented in Table 1. There were no significant differences in age, sex, body mass index, ASA physical status, or preoperative HSS knee score between the two groups (all  $P > 0.05$ ).

### **Nursing outcomes**

The nursing outcomes of the two groups are presented in Table 2. The ERAS group had a significantly shorter length of hospital stay, lower hospitalization cost, less intraoperative blood loss, higher hemoglobin level 24 h after surgery, lower VAS score for pain, higher ROM of the knee joint, and higher HSS knee score than the conventional group (all  $P < 0.05$ ). There was no significant difference in the incidence of postoperative complications between the two groups ( $P > 0.05$ ).

## **DISCUSSION**

This study showed that ERAS with multidisciplinary collaboration can improve nursing outcomes after TKA, such as reducing blood loss, shortening hospital stay, and enhancing knee function. These results are consistent with those of previous studies that reported the benefits of ERAS in patients<sup>[21-23]</sup>. The possible mechanisms of ERAS are as follows. Preoperative education can increase patients' knowledge and confidence about TKA, reduce their anxiety and stress, and enhance their compliance with and participation in perioperative care<sup>[24]</sup>. Anesthesia can affect surgical stress response,



blood loss, postoperative pain, and recovery. Regional anesthesia, such as spinal anesthesia or nerve blocks, can provide better analgesia, reduce blood loss, and facilitate early mobilization than general anesthesia<sup>[25]</sup>. Analgesia is essential to reduce postoperative pain, improve patient satisfaction, and promote recovery. Multimodal analgesia, which combines different analgesics such as opioids, NSAIDs, and local anesthetics, can provide effective pain relief with minimal side effects<sup>[26]</sup>. Fluid management can affect hemodynamic stability, tissue perfusion, wound healing, and edema. Restrictive fluid therapy, which aims to maintain a near-normal fluid balance, can reduce blood loss, transfusion rate, and complications compared to liberal fluid therapy<sup>[27]</sup>. Nutrition influences wound healing, immune function, and patient recovery. Early oral intake can stimulate gastrointestinal motility, prevent malnutrition, and reduce complications<sup>[28]</sup>. Mobilization can improve blood circulation, muscle strength, and joint and respiratory function. Early mobilization can prevent joint stiffness, muscle atrophy, deep vein thrombosis, pulmonary embolism, and pneumonia<sup>[29]</sup>. Discharge criteria can ensure the safety and quality of patient care. Standardized discharge criteria can help evaluate patients' readiness for discharge and avoid unnecessary hospital stay<sup>[30]</sup>.

Multidisciplinary collaboration is a key factor in the success of ERAS. Coordination and communication among different health professionals are required to provide individualized and comprehensive patient care. We established a multidisciplinary team of surgeons, anesthesiologists, nurses, physiotherapists, nutritionists, and pharmacists. The team members held regular meetings to discuss ERAS protocols, patient assessments, care plans, and outcome evaluations. The team members also communicated with patients and their families to provide education, counseling, and support. Multidisciplinary collaboration can ensure qualitative and continuous patient care and improve patient satisfaction and compliance<sup>[31]</sup>.

This study had some limitations. First, it was a retrospective study with a small sample size conducted at a single center. Therefore, these results may not be generalizable to other settings or populations. Second, the study did not include the long-term follow-

up of the patients. Therefore, the effect of ERAS with a multidisciplinary collaboration on patients' functional recovery and quality of life remains unclear. Third, the satisfaction and compliance of patients and health professionals were not measured. Therefore, the acceptability and feasibility of the ERAS in multidisciplinary collaborations are unknown.

## **CONCLUSION**

ERAS with multidisciplinary collaboration can improve nursing outcomes after TKA, such as reduced blood loss, shortened hospital stay, and enhanced knee function. ERAS is a safe and effective perioperative care model for patients undergoing TKA. It also had a positive effect on the perceptions and experiences of both patients and health professionals. However, some challenges and barriers need to be addressed to improve ERAS through multidisciplinary collaboration. Further studies with multidisciplinary collaborations are required to confirm the long-term benefits and cost-effectiveness of ERAS in patients undergoing TKA.

## **ARTICLE HIGHLIGHTS**

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### ***Research background***

Total knee arthroplasty (TKA) is a common surgical procedure for patients with knee joint degeneration. However, there is a lack of research investigating the effects of enhanced recovery after surgery (ERAS) with multidisciplinary collaboration on nursing outcomes in TKA patients. Understanding the background and present status of this research gap is crucial.

### ***Research motivation***

The motivation behind this study arises from the lack of research investigating the effects of enhanced recovery after surgery (ERAS) with multidisciplinary collaboration on nursing outcomes in patients undergoing total knee arthroplasty (TKA). This

research gap highlights the need to explore the potential benefits and effectiveness of ERAS in improving the nursing outcomes of TKA patients.

### ***Research objectives***

The main objectives of this study were to explore the effects of enhanced recovery after surgery (ERAS) with multidisciplinary collaboration on nursing outcomes in patients undergoing total knee arthroplasty (TKA). The specific objectives included assessing the impact of ERAS on length of hospital stay, hospitalization cost, intraoperative blood loss, postoperative hemoglobin levels, pain management, knee joint range of motion (ROM), Hospital for Special Surgery (HSS) knee score, and postoperative complications.

### ***Research methods***

This study utilized a retrospective analysis of clinical data to explore the impact of enhanced recovery after surgery (ERAS) with multidisciplinary collaboration on nursing outcomes in total knee arthroplasty (TKA) patients. By comparing the ERAS group to the conventional group, significant improvements were observed in various indicators such as hospital stay, blood loss, pain scores, and knee function. These findings highlight the importance of implementing ERAS protocols and multidisciplinary collaboration in TKA care.

### ***Research results***

The study found that implementing enhanced recovery after surgery (ERAS) with multidisciplinary collaboration in total knee arthroplasty (TKA) patients led to significant improvements in nursing outcomes, including shorter hospital stays, reduced blood loss, improved knee function, and lower pain scores. However, no significant difference was observed in postoperative complications. These findings contribute to the understanding of ERAS benefits, but further research is

needed to explore its impact on complication rates and long-term effects of TKA nursing care protocols.

### ***Research conclusions***

The study concludes that multidisciplinary collaboration with enhanced recovery after surgery (ERAS) can significantly improve nursing outcomes in patients undergoing total knee arthroplasty (TKA). Compared to routine nursing care, implementing ERAS protocols resulted in a shorter length of hospital stay, reduced hospitalization costs, decreased intraoperative blood loss, higher postoperative hemoglobin levels, lower pain scores, improved knee joint range of motion (ROM), and higher Hospital for Special Surgery (HSS) knee scores. These findings highlight the effectiveness of ERAS strategies in reducing blood loss, enhancing postoperative recovery, and improving knee function in TKA patients.

### ***Research perspectives***

The findings of this study provide a basis for further research and perspectives in the field of enhanced recovery after surgery (ERAS) and multidisciplinary collaboration in total knee arthroplasty (TKA) nursing care. Future studies could focus on the following aspects:

1. Long-term outcomes: Investigating the sustainability and long-term effects of ERAS implementation in TKA patients, including evaluating functional outcomes, patient satisfaction, and potential complications that may arise over an extended period.
2. Cost-effectiveness analysis: Conducting a comprehensive cost-effectiveness analysis to determine the economic impact of implementing ERAS protocols compared to traditional nursing care, considering not only short-term hospitalization costs but also long-term healthcare expenses and resource utilization.
3. Optimization of multidisciplinary collaboration: Exploring strategies to enhance and optimize multidisciplinary collaboration in TKA care, such as identifying key team members,

defining roles and responsibilities, and evaluating the impact of specific collaborative interventions on patient outcomes.<sup>4</sup>Comparative studies: Comparing ERAS protocols with different variations or modifications, assessing the impact of specific components or adaptations on clinical outcomes, patient experiences, and healthcare resource utilization.

By addressing these research perspectives, further advancements can be made in optimizing ERAS implementation, improving nursing outcomes, and enhancing the overall quality of care for TKA patients. The direction of future research in this field should focus on further investigating and optimizing the implementation of enhanced recovery after surgery (ERAS) with multidisciplinary collaboration in total knee arthroplasty (TKA) nursing care. This includes exploring long-term outcomes, conducting cost-effectiveness analyses, optimizing multidisciplinary collaboration strategies, and conducting comparative studies to assess the impact of different ERAS protocols or adaptations. By addressing these areas, future research can contribute to improving patient outcomes, enhancing healthcare practices, and refining the implementation of ERAS in TKA care.

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