e-ISSN: 0976-822X, p-ISSN:2961-6042

Available online on http://www.ijcpr.com/

International Journal of Current Pharmaceutical Review and Research 2026; 18(7); 727-732

Original Research Article

Fast-Track Enhanced Recovery After Surgery (ERAS) Protocols in Total Knee Replacement: Impact on Length of Stay and Readmission Rates

Gaurav Singh[1], Vishnu Pratap Singh[2], Saurabh Singh[3], Ravi Pratap Singh[4]

[1]Assistant Professor, Dept. of Orthopedics, T.S Misra Medical College and Hospital, Lucknow
[2]Assistant Professor, Dept. of Orthopedics, T.S Misra Medical College and Hospital, Lucknow
[3]Associate Professor, Dept. of Orthopedics, T.S Misra Medical College and Hospital, Lucknow
[4]Assistant Professor, Dept. of Orthopedics, T.S Misra Medical College and Hospital, Lucknow

Received: 16-05-2026 / Revised: 15-06-2026 / Accepted: 18-07-2026
Corresponding Author: Dr. Saurabh Singh
Conflict of interest: Nil

Abstract:

Background: Total knee replacement (TKR) is one of the most commonly performed orthopedic procedures for managing end-stage knee osteoarthritis. Enhanced Recovery After Surgery (ERAS) protocols have been developed to optimize perioperative care, reduce surgical stress, facilitate early mobilization, and improve postoperative recovery. Although ERAS pathways have demonstrated promising outcomes, further evaluation is required to determine their effectiveness in reducing hospital length of stay without increasing readmission rates.

Objectives: To evaluate the impact of Fast-Track Enhanced Recovery After Surgery (ERAS) protocols on hospital length of stay and 30-day readmission rates among patients undergoing primary total knee replacement.

Methods: A prospective comparative study was conducted on 60 patients aged 40 years and above undergoing elective primary total knee replacement at a tertiary care teaching hospital. Patients were equally allocated into two groups: 30 patients managed using a standardized Fast-Track ERAS protocol (ERAS group) and 30 patients receiving conventional perioperative care (Conventional group). Baseline demographic characteristics, operative details, postoperative pain scores, time to first ambulation, length of hospital stay, postoperative complications, and 30-day readmission rates were compared between the two groups. Statistical analysis was performed using the independent Student's *t*-test and Chi-square test, with a p-value <0.05 considered statistically significant.

Results: The mean age of the study population was 63.4 ± 8.2 years (range 42–82 years). There were 36 females (60.0%) and 24 males (40.0%). The ERAS group demonstrated a significantly shorter mean hospital stay (2.6 ± 0.8 days) compared with the conventional care group (5.4 ± 1.2 days, p<0.001). Early ambulation was achieved significantly earlier in the ERAS group (7.3 ± 2.1 hours) than in the conventional group (24.5 ± 4.8 hours, p<0.001). The 30-day readmission rate was comparable between the ERAS group (2 patients; 6.7%) and the conventional group (3 patients; 10.0%) (p=0.64). Postoperative pain scores, opioid consumption, and complication rates were significantly lower in the ERAS group.

Conclusion: Fast-Track ERAS protocols significantly reduce hospital length of stay and enhance postoperative recovery following total knee replacement without increasing 30-day readmission rates. The implementation of standardized ERAS pathways may improve patient outcomes, optimize hospital resource utilization, and reduce healthcare costs.

Keywords: Enhanced Recovery After Surgery, ERAS, Total Knee Arthroplasty, Fast-track Surgery, Length of Stay, Readmission, Orthopedics.

DOI: 10.25258/ijcpr.18.7.114

Introduction

Total knee replacement (TKR), also known as total knee arthroplasty (TKA), is one of the most successful orthopedic procedures for relieving pain, correcting deformity, and restoring function in patients with advanced knee osteoarthritis. The incidence of TKR has increased substantially over the past two decades owing to the aging population, increasing prevalence of obesity, and improved surgical techniques. Consequently, optimizing perioperative care has become an important priority to improve patient outcomes while reducing healthcare costs. [1]

Traditionally, patients undergoing TKR experienced prolonged hospital stays due to postoperative pain, delayed mobilization, extensive use of opioid analgesics, and concerns regarding complications. Conventional perioperative management often involved prolonged fasting, delayed initiation of oral feeding, liberal intravenous fluid administration, and

immobilization after surgery, all of which could delay functional recovery and increase healthcare resource utilization. [2]

Enhanced Recovery After Surgery (ERAS) is a multidisciplinary, evidence-based perioperative care pathway developed to reduce the physiological stress associated with surgery and accelerate postoperative recovery. Initially introduced in colorectal surgery, ERAS has now been successfully adopted across various surgical specialties, including orthopedic surgery. The ERAS approach integrates multiple interventions throughout the preoperative, intraoperative, and postoperative periods to improve clinical outcomes and facilitate earlier discharge. [3]

In total knee replacement, ERAS protocols include comprehensive patient education, optimization of medical comorbidities, shortened preoperative fasting, carbohydrate loading where appropriate, regional anesthesia, multimodal opioid-sparing analgesia, blood conservation strategies, maintenance of normothermia, early oral nutrition, thromboprophylaxis, and early postoperative mobilization. These interventions collectively reduce surgical stress, improve pain control, promote faster rehabilitation, and shorten hospital stay. [4-7]

One of the principal objectives of fast-track ERAS programs is to enable patients to regain functional independence as early as possible without compromising safety. Early mobilization, often within a few hours after surgery, has been shown to reduce postoperative complications such as venous thromboembolism, pulmonary complications, muscle weakness, and joint stiffness while improving patient satisfaction and functional recovery. [8]

Hospital length of stay has become an important indicator of healthcare quality and efficiency. Prolonged hospitalization increases the risk of hospital-acquired infections, delays rehabilitation, and contributes significantly to healthcare expenditure. Several studies have demonstrated that implementation of ERAS pathways can reduce the average hospital stay following total knee replacement from several days to approximately two to three days without adversely affecting patient outcomes. [9-11]

Despite these benefits, concerns remain regarding the possibility that accelerated discharge may increase postoperative complications and hospital readmissions. Thirty-day readmission rate is therefore considered an important quality indicator for evaluating the safety of fast-track protocols. Current evidence suggests that when ERAS pathways are implemented using standardized discharge criteria and multidisciplinary postoperative follow-up, shorter hospital stays do not result in increased readmission rates or major postoperative complications. [12-14]

Although ERAS has become increasingly accepted in orthopedic practice, variations in protocol implementation and institutional practices continue to exist. Further clinical evaluation is required to assess its effectiveness in different healthcare settings and patient populations. Therefore, the present study was undertaken to evaluate the impact of Fast-Track ERAS protocols on hospital length of stay and 30-day readmission rates among 60 patients undergoing primary total knee replacement, while also assessing postoperative recovery and perioperative outcomes. [15]

Aim: To evaluate the impact of fast-track Enhanced Recovery After Surgery (ERAS) protocols on hospital length of stay and readmission rates in patients undergoing primary total knee replacement.

Objectives

1. To compare hospital length of stay between ERAS and conventional perioperative care.
2. To compare 30-day readmission rates between both groups.
3. To evaluate postoperative complications associated with ERAS implementation.
4. To assess early postoperative pain and functional recovery.
5. To determine the effectiveness of multidisciplinary ERAS pathways in improving perioperative outcomes.

Materials and Methods

Study Design: This prospective comparative observational study was conducted to evaluate the effectiveness of Fast-Track Enhanced Recovery After Surgery (ERAS) protocols in reducing hospital length of stay and readmission rates among patients undergoing primary total knee replacement (TKR). The study compared perioperative outcomes between patients managed with a standardized ERAS pathway and those receiving conventional perioperative care.

Study Setting: The study was carried out in the Department of Orthopaedics at a tertiary care teaching hospital, over a period of 12 months from January 2025 to December 2025.

Study Population: A total of 60 consecutive patients undergoing elective primary total knee replacement were enrolled in the study after obtaining written informed consent. Patients were allocated into two equal groups:

- **Group A (ERAS Group):** 30 patients managed according to a standardized Fast-Track Enhanced Recovery After Surgery (ERAS) protocol.

- **Group B (Conventional Group):** 30 patients managed according to the hospital's conventional perioperative care protocol.

The study included patients aged 40 years and above with radiologically confirmed advanced knee osteoarthritis requiring primary unilateral total knee replacement.

Sample Size: The study comprised a total sample of 60 patients, with 30 patients in each group. Consecutive eligible patients presenting during the study period and fulfilling the selection criteria were included until the required sample size was achieved.

Inclusion Criteria

Patients fulfilling all of the following criteria were included:

1. Age 40 years or older.
2. Patients diagnosed with primary osteoarthritis of the knee requiring elective primary total knee replacement.
3. Patients willing to participate in the study and provide written informed consent.
4. American Society of Anesthesiologists (ASA) physical status Grade I–III.
5. Patients able to participate in postoperative physiotherapy and rehabilitation.

Exclusion Criteria

Patients with any of the following conditions were excluded:

1. Revision total knee arthroplasty.
2. Bilateral simultaneous total knee replacement.
3. Inflammatory arthritis (rheumatoid arthritis, ankylosing spondylitis, psoriatic arthritis).
4. Active local or systemic infection.
5. Severe hepatic, renal, or cardiac failure (ASA Grade IV or V).
6. Neurological disorders affecting lower limb function.
7. Cognitive impairment or inability to comply with ERAS protocols.
8. Patients refusing consent.

ERAS Protocol: Patients in the ERAS group were managed using a standardized Fast-Track Enhanced Recovery After Surgery (ERAS) protocol that incorporated evidence-based interventions during the preoperative, intraoperative, and postoperative phases. In the preoperative phase, all patients received detailed education regarding the surgical procedure, expected postoperative recovery, pain management strategies, and rehabilitation goals. Nutritional status was assessed and optimized where necessary. Patients were screened for anemia, and appropriate corrective measures were undertaken when indicated. Medical comorbidities, including diabetes mellitus and hypertension, were optimized before surgery. Patients who smoked or consumed alcohol were counseled regarding cessation. A structured prehabilitation program, including physiotherapy and quadriceps strengthening exercises, was implemented. In accordance with the American Society of Anesthesiologists (ASA) fasting guidelines, prolonged fasting was avoided, and carbohydrate-rich clear fluids were permitted up to two hours before surgery whenever appropriate.

During the intraoperative phase, regional (spinal) anesthesia was preferred whenever feasible. Prophylactic antibiotics were administered within one hour before the skin incision to reduce the risk of surgical site infection. Intravenous tranexamic acid was used for blood conservation, and normothermia was maintained throughout the procedure. Goal-directed fluid therapy was employed to optimize intravascular volume and minimize fluid overload. Local infiltration analgesia was administered, and multimodal opioid-sparing analgesic techniques were adopted to provide effective postoperative pain control. Routine urinary catheterization and the use of surgical drains were avoided whenever clinically appropriate.

In the postoperative phase, oral fluids were initiated within 4–6 hours after surgery, followed by early oral feeding on the day of surgery as tolerated. Pain management was achieved using a multimodal analgesic regimen consisting of acetaminophen, non-steroidal anti-inflammatory drugs (NSAIDs), regional analgesia, and minimal opioid administration. Appropriate venous thromboembolism prophylaxis was provided according to institutional guidelines. Physiotherapy was commenced within 6–8 hours after surgery, and patients were encouraged to bear weight as tolerated on the day of surgery. Discharge was based on standardized criteria, including independent ambulation with walking aids, adequate pain control using oral analgesics, stable vital signs, satisfactory oral intake, and an uncomplicated surgical wound.

Conventional Care Protocol: Patients assigned to the conventional care group received the institution's routine perioperative management. This included overnight fasting before surgery and administration of either spinal or general anesthesia according to the anesthesiologist's preference. Postoperative pain management primarily relied on opioid-based analgesia. Intravenous fluids were continued for 24–48 hours after surgery, and oral feeding was initiated only after satisfactory recovery from anesthesia. Physiotherapy was generally started on the first or second postoperative day, and mobilization was progressed according to the surgeon's discretion. Patients were discharged following routine clinical assessment without the use of standardized fast-track discharge criteria.

Outcome Measures: The **primary outcome measures** of the study were the length of hospital stay, measured in days from the date of surgery until discharge, and the 30-day hospital readmission rate following discharge. These outcomes were selected to assess the effectiveness and safety of the Fast-Track ERAS protocol.

The secondary outcome measures included the time to first ambulation, measured in hours after surgery, postoperative pain intensity assessed using the Visual Analogue Scale (VAS), postoperative complications, requirement for opioid analgesics, functional recovery, time to independent walking with or without assistive devices, and overall patient satisfaction with perioperative care.

Data Collection: Baseline demographic and clinical information was collected for all participants using a standardized data collection form. The variables recorded included age, gender, body mass index (BMI), side of surgery, American Society of Anesthesiologists (ASA) physical status, presence of diabetes mellitus, hypertension, duration of surgery, length of hospital stay, time to first ambulation, postoperative pain scores, postoperative complications, and readmission within 30 days after discharge.

Clinical assessments were performed throughout the hospital stay by the treating orthopedic team and physiotherapists. Following discharge, all patients were monitored for a period of 30 days through scheduled outpatient follow-up visits and telephone interviews to identify any postoperative complications, emergency department visits, or hospital readmissions.

Statistical Analysis: Data were entered into Microsoft Excel and analyzed using IBM SPSS Statistics version 26.0. Continuous variables were expressed as mean ± standard deviation (SD), while categorical variables were presented as frequency and percentage. The independent Student's t-test was used to compare continuous variables between the two groups. The Chi-square test or Fisher's exact test was used for categorical variables as appropriate. A p-value <0.05 was considered statistically significant.

Results

Table 1: Baseline demographic and clinical characteristics of the study participants

Variable	ERAS Group (n=30)	Conventional Group (n=30)	p-value
Age (years), Mean ± SD	62.8 ± 7.9	64.1 ± 8.4	0.53
Male, n (%)	12 (40.0)	12 (40.0)	1.000
Female, n (%)	18 (60.0)	18 (60.0)	1.000
BMI (kg/m²), Mean ± SD	28.1 ± 3.4	28.7 ± 3.6	0.49
Diabetes mellitus, n (%)	10 (33.3)	11 (36.7)	0.78
Hypertension, n (%)	14 (46.7)	15 (50.0)	0.79
ASA Grade I/II/III, n	6/18/6	5/19/6	0.95

Interpretation: There were no statistically significant differences in baseline demographic or clinical characteristics between the two groups ($p>0.05$).

Table 2: Comparison of perioperative characteristics

Variable	ERAS Group (n=30)	Conventional Group (n=30)	p-value
Duration of surgery (minutes)	96.4 ± 12.5	98.7 ± 13.2	0.49
Time to first ambulation (hours)	7.3 ± 2.1	24.5 ± 4.8	<0.001*
VAS pain score at 24 hours	3.4 ± 0.9	5.8 ± 1.1	<0.001*
Opioid requirement (Yes), n (%)	8 (26.7)	20 (66.7)	0.002*

Interpretation: Patients managed with the ERAS protocol achieved significantly earlier ambulation, experienced lower postoperative pain scores, and required fewer opioid analgesics than those receiving conventional care.

Table 3: Comparison of postoperative outcomes

Outcome	ERAS Group (n=30)	Conventional Group (n=30)	p-value
Length of hospital stay (days)	2.6 ± 0.8	5.4 ± 1.2	<0.001*
Independent walking (days)	1.5 ± 0.5	3.1 ± 0.8	<0.001*
Patient satisfaction (VAS 0–10)	9.2 ± 0.7	7.6 ± 1.0	<0.001*

Interpretation: ERAS significantly reduced hospital stay and accelerated functional recovery while improving patient satisfaction.

Table 4: Comparison of postoperative complications

Complication	ERAS (n=30)	Conventional (n=30)	p-value
Nausea/Vomiting	2 (6.7%)	7 (23.3%)	0.07
Wound complication	1 (3.3%)	2 (6.7%)	0.55
Deep vein thrombosis	0 (0.0%)	1 (3.3%)	0.31
Urinary retention	1 (3.3%)	4 (13.3%)	0.16
Surgical site infection	0 (0.0%)	1 (3.3%)	0.31
Total patients with any complication	4 (13.3%)	15 (50.0%)	0.002*

Interpretation: The overall postoperative complication rate was significantly lower in the ERAS group compared with the conventional care group.

Table 5: Comparison of hospital readmission within 30 days

Outcome	ERAS Group (n=30)	Conventional Group (n=30)	p-value
Readmission	2 (6.7%)	3 (10.0%)	0.64
No readmission	28 (93.3%)	27 (90.0%)	

Reasons for readmission

Cause	ERAS	Conventional
Persistent pain	1	1
Wound-related problem	1	1
Knee stiffness	0	1

Interpretation: Although the ERAS protocol significantly shortened hospital stay, there was no statistically significant difference in the 30-day readmission rate between the two groups (p=0.64).

Discussion

The present prospective comparative study evaluated the effectiveness of Fast-Track Enhanced Recovery After Surgery (ERAS) protocols in 60 patients undergoing primary total knee replacement. The findings demonstrated that patients managed with the ERAS pathway experienced a significantly shorter hospital stay, earlier postoperative mobilization, lower pain scores, reduced opioid consumption, and higher patient satisfaction compared with those receiving conventional perioperative care. Importantly, these improvements were achieved without a significant increase in the 30-day hospital readmission rate.

One of the major findings of the present study was the significant reduction in the mean length of hospital stay in the ERAS group (2.6 ± 0.8 days) compared with the conventional care group (5.4 ± 1.2 days). Early mobilization, multimodal analgesia, optimized anesthesia, and standardized discharge criteria were the principal contributors to accelerated recovery. Similar findings have been reported by Wainwright et al., who demonstrated that ERAS protocols significantly shorten hospitalization while maintaining patient safety following total knee arthroplasty. [16] Likewise, Auyong et al. observed that implementation of an updated ERAS pathway resulted in earlier discharge and improved postoperative recovery without increasing complications. [17]

The present study also found that postoperative pain scores and opioid requirements were significantly lower in the ERAS group. Effective multimodal analgesia and regional anesthesia facilitated earlier ambulation and functional recovery. These findings are consistent with those reported by Soffin and YaDeau, who emphasized that opioid-sparing analgesic strategies are fundamental components of ERAS pathways and contribute to improved postoperative outcomes in total joint arthroplasty. [18]

Another important observation was that the 30-day readmission rate did not differ significantly between the two groups, indicating that early discharge under ERAS protocols did not compromise patient safety. This finding supports previous studies by Khan et al., who reported that enhanced recovery programs reduce hospital stay without increasing readmission or postoperative complications. [19] Similarly, Zhu et al., in their systematic review and meta-analysis, concluded that ERAS protocols improve recovery, reduce hospitalization, and do not increase adverse events or readmission following total joint arthroplasty. [20]

Overall, the findings of the present study support the growing evidence that Fast-Track ERAS protocols are safe and effective for patients undergoing total knee replacement. Their implementation can enhance postoperative recovery, optimize hospital resource utilization, improve patient satisfaction, and reduce healthcare costs without adversely affecting clinical outcomes.

Conclusion

Fast-Track Enhanced Recovery After Surgery (ERAS) protocols significantly reduced the length of hospital stay and improved early postoperative recovery in patients undergoing primary total knee replacement. The ERAS pathway facilitated earlier mobilization, better pain control, and reduced opioid requirements without increasing the 30-day readmission rate. These findings support the implementation of standardized ERAS protocols to enhance patient outcomes and optimize healthcare resource utilization in total knee arthroplasty.

References

1. Wainwright TW, Gill M, McDonald DA, Middleton RG, Reed M, Sahota O, et al. Consensus statement for perioperative care in total hip replacement and total knee replacement surgery: Enhanced Recovery After Surgery (ERAS®) Society recommendations. Acta Orthop. 2020;91(1):3–19.
2. Kehlet H, Wilmore DW. Evidence-based surgical care and the evolution of fast-track surgery. Ann Surg.2008;248(2):189–98.
3. Kehlet H. Fast-track hip and knee arthroplasty. Lancet. 2013;381(9878):1600–2.
4. Ljungqvist O, Scott M, Fearon KC. Enhanced Recovery After Surgery: A review. JAMA Surg. 2017;152(3):292–8.
5. Kehlet H, Dahl JB. Anaesthesia, surgery, and challenges in postoperative recovery. Lancet. 2003;362(9399):1921–8.
6. Soffin EM, YaDeau JT. Enhanced Recovery After Surgery for primary hip and knee arthroplasty: A review of the evidence. Br J Anaesth. 2016;117(Suppl 3):iii62–72.
7. Husted H, Holm G, Jacobsen S. Predictors of length of stay and patient satisfaction after hip and knee replacement surgery: Fast-track experience in 712 patients. Acta Orthop. 2008;79(2):168–73.
8. Husted H. Fast-track hip and knee arthroplasty: Clinical and organizational aspects. Acta Orthop Suppl.2012;83(346):1–39.
9. Malviya A, Martin K, Harper I, Muller SD, Emmerson KP, Partington PF, et al. Enhanced recovery program for hip and knee replacement reduces death rate. Acta Orthop. 2011;82(5):577–81.
10. Khan SK, Malviya A, Muller SD, Carluke I, Partington PF, Emmerson KP, et al. Reduced short-term complications and mortality following enhanced recovery primary hip and knee arthroplasty. Acta Orthop. 2014;85(1):26–31.
11. Auyong DB, Allen CJ, Pahang JA, Clabeaux JJ, MacDonald KM, Hanson NA. Reduced length of hospitalization in primary total knee arthroplasty patients using an updated Enhanced Recovery After Orthopedic Surgery (ERAS) pathway. J Arthroplasty. 2015;30(10):1705–9.
12. Zhu S, Qian W, Jiang C, Ye C, Chen X. Enhanced Recovery After Surgery for total joint arthroplasty: A systematic review and meta-analysis. Postgrad Med J. 2017;93(1106):736–42.
13. Sutton JC III, Antoniou J. Enhanced Recovery After Surgery pathways in hip and knee arthroplasty. Orthop Clin North Am. 2017;48(4):617–25.
14. Sibia US, Turcotte JJ, MacDonald JH, King PJ. The impact of Enhanced Recovery pathways on length of stay and complications in total joint arthroplasty: A systematic review. J Arthroplasty. 2017;32(12):3819–26.
15. den Hertog A, Gliesche K, Timm J, Mühlbauer B, Zebrowski S. Pathway-controlled fast-track rehabilitation after total knee arthroplasty: A randomized prospective clinical study evaluating the recovery pattern, drug consumption, and length of stay. Arch Orthop Trauma Surg. 2012;132(8):1153–63.
16. Wainwright TW, Gill M, McDonald DA, Middleton RG, Reed M, Sahota O, et al. Consensus statement for perioperative care in total hip replacement and total knee replacement surgery: Enhanced Recovery After Surgery (ERAS®) Society recommendations. Acta Orthop. 2020;91(1):3–19.
17. Auyong DB, Allen CJ, Pahang JA, Clabeaux JJ, MacDonald KM, Hanson NA. Reduced length of hospitalization in primary total knee arthroplasty patients using an updated Enhanced Recovery After Orthopedic Surgery (ERAS) pathway. J Arthroplasty. 2015;30(10):1705–9.
18. Soffin EM, YaDeau JT. Enhanced Recovery After Surgery for primary hip and knee arthroplasty: A review of the evidence. Br J Anaesth. 2016;117(Suppl 3):iii62–72.
19. Khan SK, Malviya A, Muller SD, Carluke I, Partington PF, Emmerson KP, et al. Reduced short-term complications and mortality following enhanced recovery primary hip and knee arthroplasty. Acta Orthop. 2014;85(1):26–31.
20. Zhu S, Qian W, Jiang C, Ye C, Chen X. Enhanced Recovery After Surgery for total joint arthroplasty: A systematic review and meta-analysis. Postgrad Med J. 2017;93(1106):736–42.