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

**Manuscript NO:** 90330

**Manuscript Type:** EDITORIAL

**Multidisciplinary approach toward enhanced recovery after surgery for total knee arthroplasty improves outcomes**

Nag DS *et al*. Multidisciplinary approach for ERAS in TKA

Deb Sanjay Nag, Amlan Swain, Seelora Sahu, Ayaskant Sahoo, Gunjan Wadhwa

**Deb Sanjay Nag, Amlan Swain, Seelora Sahu, Gunjan Wadhwa,** Department of Anaesthesiology, Tata Main Hospital, Jamshedpur 831001, India

**Ayaskant Sahoo,** Department of Anaesthesiology, Manipal Tata Medical College, Jamshedpur 831001, India

**Author contributions:** Nag DS, Swain A, Sahu S, Sahoo A, Wadhwa G contributed to this paper; Nag DS and Swain A designed the overall concept and outline of the manuscript; Sahu S, Sahoo A and Wadhwa G contributed to the discussion and design of the manuscript; Nag DS, Swain A, Sahu S, Sahoo A and Wadhwa G contributed to the writing, and editing the manuscript and review of literature.

**Corresponding author: Deb Sanjay Nag, MBBS, MD, Doctor,** Department of Anaesthesiology, Tata Main Hospital, C Road West, Northern Town, Bistupur, Jamshedpur 831001, India. ds.nag@tatasteel.com

**Received:** November 30, 2023

**Revised:** January 26, 2024

**Accepted:** February 28, 2024

**Published online:**

**Abstract**

Knee osteoarthritis is a degenerative disorder of the knee, which leads to joint pain, stiffness, and inactivity and significantly affects the quality of life. With an increased prevalence of obesity and greater life expectancies, total knee arthroplasty (TKA) is now one of the major arthroplasty surgeries performed for knee osteoarthritis. When enhanced recovery after surgery (ERAS) was introduced in TKA, clinical outcomes were enhanced and the economic burden on the healthcare system was reduced. ERAS is an evidence-based scientific protocol aimed at ameliorating the surgical stress response. ERAS aims to enhance the recovery phase, which encompasses multidisciplinary strategies at every step of perioperative care, including the rehabilitation phase. Implementation of ERAS in TKA aids in reducing the length of hospital stay, improving pain management, reducing perioperative complications, and enhancing patient satisfaction. Multidisciplinary collaboration, integrating the expertise of anesthesiologists, orthopedic surgeons, nursing personnel, and other healthcare professionals, is the cornerstone of ERAS in patients undergoing TKA.

**Key Words:** Arthroplasty; Replacement; Knee; Recovery of function; Anesthesia; Care; Nursing

Nag DS, Swain A, Sahu S, Sahoo A, Wadhwa G. Multidisciplinary approach toward enhanced recovery after surgery for total knee arthroplasty improves outcomes. *World J Clin Cases* 2024; In press

**Core Tip:** Current evidence shows that a protocolized approach toward enhanced recovery after surgery with multidisciplinary collaboration improves outcomes following total knee arthroplasty (TKA). As healthcare professionals continue to refine and evolve enhanced recovery after surgery (ERAS) protocols in patients undergoing TKA, the integration of multidisciplinary teams in ERAS implementation is critical to achieving optimal patient outcomes.

**INTRODUCTION**

Knee osteoarthritis is a degenerative disease affecting older adults with a significant effect on quality of life[1]. There is progressive articular cartilage loss that leads to debilitating pain with impairment of mobility. Increasing rates of obesity and longevity have indicated that knee osteoarthritis has resulted in public health crisis proportions[2].

Total knee arthroplasty (TKA) is a major surgical intervention that is effective in treating knee osteoarthritis and enhancing the quality of life for individuals with debilitating knee joint disorders[3]. Increased life expectancies and a rapidly growing geriatric population have indicated that a high number of people undergoing TKA have a strong need for an early return to daily activities[4].

The concept of enhanced recovery after surgery (ERAS) protocols was first proposed by Kehlet *et al*[5] in 1997 in colorectal surgery. The surgical stress response, which caused a multitude of systemic effects and resulted in increased convalescence time was targeted to enhance outcomes using this approach. The ERAS approach, with its significant advantages on health economics and improved patient outcomes, has been adopted and shown to be useful in diverse groups of surgical patient populations[6].

The ERAS approach necessitated a multidisciplinary (anesthetists, surgeons, nurses, and physiotherapists) collaboration to achieve early autonomy in the postoperative recovery period, resulting in a lower length of stay[7]. Multidisciplinary collaboration is the main goal of ERAS, integrating the expertise of surgeons, anesthetists, nurses, and various other healthcare professionals. This collaborative effort is crucial for evidence-based practice implementation and patient care optimization throughout the perioperative period. The synergy among team members contributes to a comprehensive and patient-centered approach, which aligns with ERAS principles[8,9].

The increased propagation of the ERAS approach has also included patients posted for orthopedic joint (hip and knee) replacements. The reasons for the increased use of ERAS in patients undergoing TKA are diverse-ranging from the increasing number of elderly people requiring knee surgery to the increased benefits of shorter hospital stays in such patients[10].

**ERAS IN TKA PATIENTS**

Similar to other surgical specialties, ERAS protocols for the TKA patient must be targeted to decrease the surgical stress response, which can be broadly divided into preoperative, intraoperative, and postoperative periods[11,12]. Various components during the perioperative period of implementation of ERAS protocols in patients undergoing TKA exist, which have been now summarized in recent consensus statements by the ERAS Society (Tables 1 and 2)[13,14].

Certain pertinent points of ERAS implementation in patients with TKA, which is specific to these patients, are as follows: (1) Preoperative education and physical therapy decrease anxiety and the cost of treatment[15,16]; (2) Anesthesia techniques must aim to use neuraxial/peripheral nerve block/local anesthesia infiltration techniques with the use of multimodal opioid-sparing regimens and hypobaric intrathecal solutions to promote early mobilization with adequate pain control[17-21]; (3) Urinary catheter placement and postoperative urinary retention: Spinal anesthesia and prostatism are contributory factors. Opioid-sparing spinal anesthetic is regarded to be the best choice[22,23]; (4) Use of tranexamic acid in the intraoperative period reduces blood loss and blood component therapy[24]; (5) Early mobilization should be encouraged[25]; and (6) Orthostatic intolerance is a notorious cause of failure of ERAS protocols in patients undergoing TKA and is frequently multifactorial[26].

**ADVANTAGES OF ERAS IN TKA**

***Reduced length of hospital stay***

Studies have consistently demonstrated that the implementation of ERAS protocols in TKA results in a significant reduction in the length of hospital stays. The study by Khan *et al*[27] highlighted the impact of ERAS on patient outcomes, indicating a shorter duration of hospitalization, which not only reduces healthcare costs but also facilitates a quicker return to normal activities.

***Improved pain management***

Effective pain management is a fundamental component of ERAS, and its impact on nursing outcomes is shown by Urban *et al*[28] and Wei *et al*[29]. These authors validated the importance of multimodal analgesia and patient engagement in pain control strategies, resulting in improved postoperative pain management and enhanced patient comfort during the recovery phase.

***Enhanced patient satisfaction***

The patient experience is a vital aspect of healthcare, and ERAS, through its patient-centric approach, significantly influences patient satisfaction. Research by Aasvang *et al*[30] demonstrated that informed patients actively participating in their care decisions and early mobilization contribute to higher levels of satisfaction and overall positive experiences.

***Early mobilization and functional recovery***

Nurses play a pivotal role in encouraging early mobilization, which is a key component of ERAS associated with faster functional recovery. Riga *et al*[31] emphasized the importance of nursing interventions in facilitating early ambulation, resulting in improved joint function and overall recovery.

***Reduced complications***

ERAS implementation has been associated with a reduction in postoperative complications. Artz *et al*[32] highlighted the impact of ERAS concerning physiotherapy and exercise on minimizing complications and better functional outcomes. Nursing vigilance and prompt intervention play a crucial role in the identification and management of potential issues.

**CONCLUSION**

ERAS protocols are currently based on scientific evidence of a combination of multidisciplinary protocols to enhance outcomes, hasten recovery, and reduce costs during the perioperative period[33]. Even though ERAS has now scientifically established itself as the standard of care, future studies that focus on compliance with ERAS protocols would validate its utility and relationship with outcomes[34]. ERAS protocols continue to evolve as our learning in identifying therapeutic interventions targeting “modifiable risk factors” by modulating surgical stressors and ensuring perioperative homeostasis ensures improved outcomes[35].

Although ERAS protocols have been shown to decrease mortality, need for blood and blood component transfusion, complication rate, and length of stay, studies have identified at least 17 specific elements, and optimizing their usage in clinical scenarios would be guided by future studies[36]. These elements comprise preoperative components of (1) “preoperative information, education and counseling”; (2) “preoperative optimization of smoking, alcohol consumption and anemia”; and (3) optimum preoperative fasting[36]. The intraoperative components include: (1) a standardized anesthesia protocol; (2) local anesthetic infiltration and specific nerve blocks; (3) prevention of postoperative nausea and vomiting; (4) reducing perioperative blood loss with use of tranexamic acid; (5) perioperative analgesia including use of paracetamol; (6) ensuring normothermia; (7) optimum antibiotic prophylaxis; (8) perioperative fluid management; and (9) modulating surgical factors[36]. The postoperative interventions include: (1) thromboprophylaxis; (2) postoperative nutrition; (3) early mobilization; (4) criteria-based discharge; and (5) continuous audit and improvement[36]. Recent studies also reveal the importance of a multidisciplinary approach in enhancing nursing outcomes[9].

The evidence from these studies highlights the positive impact of ERAS with multidisciplinary collaboration on overall outcomes following TKA. As healthcare professionals continue to refine and implement ERAS protocols in patients undergoing TKA, the integration of multidisciplinary expertise in ERAS implementation remains central to achieving optimal outcomes and ensuring a smoother recovery for these patients.

**REFERENCES**

1 **Farr Ii J**, Miller LE, Block JE. Quality of life in patients with knee osteoarthritis: a commentary on nonsurgical and surgical treatments. *Open Orthop J* 2013; **7**: 619-623 [PMID: 24285987 DOI: 10.2174/1874325001307010619]

2 **White PH**, Waterman M. Making osteoarthritis a public health priority. *Am J Nurs* 2012; **112**: S20-S25 [PMID: 22373742 DOI: 10.1097/01.NAJ.0000412647.18173.62]

3 **Palazzuolo M**, Antoniadis A, Mahlouly J, Wegrzyn J. Total knee arthroplasty improves the quality-adjusted life years in patients who exceeded their estimated life expectancy. *Int Orthop* 2021; **45**: 635-641 [PMID: 33447874 DOI: 10.1007/s00264-020-04917-y]

4 **Sloan M**, Premkumar A, Sheth NP. Projected Volume of Primary Total Joint Arthroplasty in the U.S., 2014 to 2030. *J Bone Joint Surg Am* 2018; **100**: 1455-1460 [PMID: 30180053 DOI: 10.2106/JBJS.17.01617]

5 **Kehlet H**. Multimodal approach to control postoperative pathophysiology and rehabilitation. *Br J Anaesth* 1997; **78**: 606-617 [PMID: 9175983 DOI: 10.1093/bja/78.5.606]

6 **Altman AD**, Helpman L, McGee J, Samouëlian V, Auclair MH, Brar H, Nelson GS; Society of Gynecologic Oncology of Canada’s Communities of Practice in ERAS and Venous Thromboembolism. Enhanced recovery after surgery: implementing a new standard of surgical care. *CMAJ* 2019; **191**: E469-E475 [PMID: 31036609 DOI: 10.1503/cmaj.180635]

7 **Kehlet H**, Dahl JB. Anaesthesia, surgery, and challenges in postoperative recovery. *Lancet* 2003; **362**: 1921-1928 [PMID: 14667752 DOI: 10.1016/S0140-6736(03)14966-5]

8 **Ljungqvist O**, Scott M, Fearon KC. Enhanced Recovery After Surgery: A Review. *JAMA Surg* 2017; **152**: 292-298 [PMID: 28097305 DOI: 10.1001/jamasurg.2016.4952]

9 **Liu J**, Zheng QQ, Wu YT. Effect of enhanced recovery after surgery with multidisciplinary collaboration on nursing outcomes after total knee arthroplasty. *World J Clin Cases* 2023; **11**: 7745-7752 [PMID: 38073701 DOI: 10.12998/wjcc.v11.i32.7745]

10 **Kehlet H**. Fast-track hip and knee arthroplasty. *Lancet* 2013; **381**: 1600-1602 [PMID: 23663938 DOI: 10.1016/S0140-6736(13)61003-X]

11 **Roth JA**, Ajani JA, Rich TA. Multidisciplinary therapy for esophageal cancer. *Adv Surg* 1990; **23**: 239-260 [PMID: 2403459 DOI: 10.1016/S0968-0160(13)70006-1]

12 **Jenny JY**, Courtin C, Boisrenoult P, Chouteau J, Henky P, Schwartz C, de Ladoucette A; Société Française de Chirurgie Orthopédique et Traumatologique (SOFCOT). Fast-track procedures after primary total knee arthroplasty reduce hospital stay by unselected patients: a prospective national multi-centre study. *Int Orthop* 2021; **45**: 133-138 [PMID: 32601722 DOI: 10.1007/s00264-020-04680-0]

13 **Wainwright TW**, Gill M, McDonald DA, Middleton RG, Reed M, Sahota O, Yates P, Ljungqvist O. 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**: 3-19 [PMID: 31663402 DOI: 10.1080/17453674.2019.1683790]

14 **Guyatt GH**, Oxman AD, Vist GE, Kunz R, Falck-Ytter Y, Alonso-Coello P, Schünemann HJ; GRADE Working Group. GRADE: an emerging consensus on rating quality of evidence and strength of recommendations. *BMJ* 2008; **336**: 924-926 [PMID: 18436948 DOI: 10.1136/bmj.39489.470347.AD]

15 **McDonald S**, Page MJ, Beringer K, Wasiak J, Sprowson A. Preoperative education for hip or knee replacement. *Cochrane Database Syst Rev* 2014; **2014**: CD003526 [PMID: 24820247 DOI: 10.1002/14651858.CD003526.pub3]

16 **Snow R**, Granata J, Ruhil AV, Vogel K, McShane M, Wasielewski R. Associations between preoperative physical therapy and post-acute care utilization patterns and cost in total joint replacement. *J Bone Joint Surg Am* 2014; **96**: e165 [PMID: 25274793 DOI: 10.2106/JBJS.M.01285]

17 **Johnson RL**, Kopp SL, Burkle CM, Duncan CM, Jacob AK, Erwin PJ, Murad MH, Mantilla CB. Neuraxial vs general anaesthesia for total hip and total knee arthroplasty: a systematic review of comparative-effectiveness research. *Br J Anaesth* 2016; **116**: 163-176 [PMID: 26787787 DOI: 10.1093/bja/aev455]

18 **Kopp SL**, Børglum J, Buvanendran A, Horlocker TT, Ilfeld BM, Memtsoudis SG, Neal JM, Rawal N, Wegener JT. Anesthesia and Analgesia Practice Pathway Options for Total Knee Arthroplasty: An Evidence-Based Review by the American and European Societies of Regional Anesthesia and Pain Medicine. *Reg Anesth Pain Med* 2017; **42**: 683-697 [PMID: 29053504 DOI: 10.1097/AAP.0000000000000673]

19 **Memtsoudis SG**, Poeran J, Cozowicz C, Zubizarreta N, Ozbek U, Mazumdar M. The impact of peripheral nerve blocks on perioperative outcome in hip and knee arthroplasty-a population-based study. *Pain* 2016; **157**: 2341-2349 [PMID: 27643835 DOI: 10.1097/j.pain.0000000000000654]

20 **Frassanito L**, Vergari A, Zanghi F, Messina A, Bitondo M, Antonelli M. Post-operative analgesia following total knee arthroplasty: comparison of low-dose intrathecal morphine and single-shot ultrasound-guided femoral nerve block: a randomized, single blinded, controlled study. *Eur Rev Med Pharmacol Sci* 2010; **14**: 589-596 [PMID: 20707248]

21 **Frassanito L**, Vergari A, Nestorini R, Cerulli G, Placella G, Pace V, Rossi M. Enhanced recovery after surgery (ERAS) in hip and knee replacement surgery: description of a multidisciplinary program to improve management of the patients undergoing major orthopedic surgery. *Musculoskelet Surg* 2020; **104**: 87-92 [PMID: 31054080 DOI: 10.1007/s12306-019-00603-4]

22 **Bjerregaard LS**, Bogø S, Raaschou S, Troldborg C, Hornum U, Poulsen AM, Bagi P, Kehlet H. Incidence of and risk factors for postoperative urinary retention in fast-track hip and knee arthroplasty. *Acta Orthop* 2015; **86**: 183-188 [PMID: 25301436 DOI: 10.3109/17453674.2014.972262]

23 **Tischler EH**, Restrepo C, Oh J, Matthews CN, Chen AF, Parvizi J. Urinary Retention is Rare After Total Joint Arthroplasty When Using Opioid-Free Regional Anesthesia. *J Arthroplasty* 2016; **31**: 480-483 [PMID: 26453530 DOI: 10.1016/j.arth.2015.09.007]

24 **Eachempati KK**, Gurava Reddy AV, Apsingi S, Sankineani SR, Shaheed J, Dannana C. A comparative analysis of the role of Tranexamic acid as an independent variable in reducing intraoperative blood loss in patients undergoing conventional total knee arthroplasty versus computer-assisted total knee arthroplasty. *Musculoskelet Surg* 2017; **101**: 255-259 [PMID: 28470576 DOI: 10.1007/s12306-017-0477-9]

25 **Guerra ML**, Singh PJ, Taylor NF. Early mobilization of patients who have had a hip or knee joint replacement reduces length of stay in hospital: a systematic review. *Clin Rehabil* 2015; **29**: 844-854 [PMID: 25452634 DOI: 10.1177/0269215514558641]

26 **Jans Ø**, Kehlet H. Postoperative orthostatic intolerance: a common perioperative problem with few available solutions. *Can J Anaesth* 2017; **64**: 10-15 [PMID: 27638295 DOI: 10.1007/s12630-016-0734-7]

27 **Khan SK**, Malviya A, Muller SD, Carluke I, Partington PF, Emmerson KP, Reed MR. Reduced short-term complications and mortality following Enhanced Recovery primary hip and knee arthroplasty: results from 6,000 consecutive procedures. *Acta Orthop* 2014; **85**: 26-31 [PMID: 24359028 DOI: 10.3109/17453674.2013.874925]

28 **Urban JA**, Dolesh K, Martin E. A Multimodal Pain Management Protocol Including Preoperative Cryoneurolysis for Total Knee Arthroplasty to Reduce Pain, Opioid Consumption, and Length of Stay. *Arthroplast Today* 2021; **10**: 87-92 [PMID: 34286056 DOI: 10.1016/j.artd.2021.06.008]

29 **Wei B**, Tang C, Li X, Lin R, Han L, Zheng S, Xu Y, Yao Q, Wang L. Enhanced recovery after surgery protocols in total knee arthroplasty via midvastus approach: a randomized controlled trial. *BMC Musculoskelet Disord* 2021; **22**: 856 [PMID: 34625057 DOI: 10.1186/s12891-021-04731-6]

30 **Aasvang EK**, Luna IE, Kehlet H. Challenges in postdischarge function and recovery: the case of fast-track hip and knee arthroplasty. *Br J Anaesth* 2015; **115**: 861-866 [PMID: 26209853 DOI: 10.1093/bja/aev257]

31 **Riga M**, Altsitzioglou P, Saranteas T, Mavrogenis AF. Enhanced recovery after surgery (ERAS) protocols for total joint replacement surgery. *SICOT J* 2023; **9**: E1 [PMID: 37819173 DOI: 10.1051/sicotj/2023030]

32 **Artz N**, Elvers KT, Lowe CM, Sackley C, Jepson P, Beswick AD. Effectiveness of physiotherapy exercise following total knee replacement: systematic review and meta-analysis. *BMC Musculoskelet Disord* 2015; **16**: 15 [PMID: 25886975 DOI: 10.1186/s12891-015-0469-6]

33 **Melnyk M**, Casey RG, Black P, Koupparis AJ. Enhanced recovery after surgery (ERAS) protocols: Time to change practice? *Can Urol Assoc J* 2011; **5**: 342-348 [PMID: 22031616 DOI: 10.5489/cuaj.11002]

34 **Park IJ**. Future direction of Enhanced Recovery After Surgery (ERAS) program in colorectal surgery. *Ann Coloproctol* 2022; **38**: 1-2 [PMID: 35247946 DOI: 10.3393/ac.2022.00094.0013]

35 **Brown JK**, Singh K, Dumitru R, Chan E, Kim MP. The Benefits of Enhanced Recovery After Surgery Programs and Their Application in Cardiothoracic Surgery. *Methodist Debakey Cardiovasc J* 2018; **14**: 77-88 [PMID: 29977464 DOI: 10.14797/mdcj-14-2-77]

36 **Changjun C**, Xin Z, Yue L, Liyile C, Pengde K. Key Elements of Enhanced Recovery after Total Joint Arthroplasty: A Reanalysis of the Enhanced Recovery after Surgery Guidelines. *Orthop Surg* 2023; **15**: 671-678 [PMID: 36597677 DOI: 10.1111/os.13623]

**Footnotes**

**Conflict-of-interest statement:** The authors declare no conflict of interest.

**Open-Access:** This article is an open-access article that was selected by an in-house editor and fully peer-reviewed by external reviewers. It is distributed in accordance with the Creative Commons Attribution NonCommercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited and the use is non-commercial. See: https://creativecommons.org/Licenses/by-nc/4.0/

**Provenance and peer review:** Invited article; Externally peer reviewed.

**Peer-review model:** Single blind

**Corresponding Author's Membership in Professional Societies:** Indian Society of Anaesthesiology, S2863.

**Peer-review started:** November 30, 2023

**First decision:** January 17, 2024

**Article in press:**

**Specialty type:** Anesthesiology

**Country/Territory of origin:** India

**Peer-review report’s scientific quality classification**

Grade A (Excellent): 0

Grade B (Very good): 0

Grade C (Good): C

Grade D (Fair): 0

Grade E (Poor): 0

**P-Reviewer:** Pace V, Italy **S-Editor:** Gong ZM **L-Editor:** A **P-Editor:**

**Table 1 GRADE system for rating strength of recommendations and rating quality of evidence (Guyatt *et al*[15], 2008)**

|  |  |
| --- | --- |
| **Recommendation strength** | **Definition** |
| Strong  | desirable effects of intervention clearly outweigh the undesirable effects, or clearly do not |
| Weak  | When trade-offs are less certain—either because of low-quality evidence or because evidence suggests desirable and undesirable effects are closely balanced |
| Evidence level  | Definition |
| High quality  | Further research unlikely to change confidence in estimate of effect |
| Moderate quality | Further research likely to have important impact on confidence in estimate of effect and may change the estimate |
| Low quality | Further research very likely to have important impact on confidence in estimate of effect and likely to change the estimate |
| Very low quality  | Any estimate of effect is very uncertain |

**Table 2 Summary of recommended interventions for the perioperative care of knee replacement**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | **Recommendation** | **Recommendation grade** | **Level of evidence** |
| Preoperative  | Preoperative information, education and counselling | Preoperative patient education recommended | Strong  | Low |
| Preadmission patient optimization | Smoking  | Smoking cessation for 4 wk or more recommended before surgery | Strong | High |
| Alcohol | Alcohol cessation recommended before surgery | Strong  | Low  |
| Anemia | Anemia shouldbe identified, investigated, and corrected prior to surgery | Strong | High |
| Preoperative physiotherapy | Not recommended as an essential intervention | Strong  | Moderate (for not recommending) |
| Perioperative | Preoperative fasting | Intake of clear fluids until 2 h before the induction of anesthesia, and a 6-h fast for solid food is recommended | Strong  | Moderate |
| Preoperative carbohydrate treatment | Not currently recommended as an essential routineIntervention | Strong  | Moderate (for not recommending) |
| Pre-anesthetic medication | routine administration of sedatives to reduce anxiety preoperatively is not recommended | Strong | Low |
| Standardized anesthetic protocol | General versus central neuraxial anesthesia | Both may be used as part of multimodal anesthetic regimes | Strong  | Moderate (for both) |
| Spinal (intrathecal) opioids | Not recommendedfor routine use | Strong | Moderate |
| Epidurals | Not recommended for routine use | Strong  | High (analgesic efficacy), moderate (negative safety and side-effect profile) |
| Use of local anesthetics for nerve blocks and infiltrationanalgesia | LIA recommendedfor knee replacementNerve blocks are therefore not recommended as anessential ERAS component | Strong | High (LIA in knee replacement) |
| Postoperative  | Nausea and vomiting | screening for and multimodal PONV prophylaxis andtreatment | Strong | Moderate |
| Prevention of perioperative blood loss-tranexamic acid | Recommended to reduce perioperative blood loss | Strong | High |
| Multimodal analgesia | Paracetamol | Recommended for routine use | Strong | Moderate |
| Non-steroidal anti-inflammatory drugs (NSAIDs) | Routine use of NSAIDS recommended for patients without contraindications | Strong | High |
| Gabapentinoids | Not recommended currently  | Strong  | Moderate (for not recommending) |
| Supplemental opioid analgesia | ERAS programs seek to minimize the use of opioids. However, opioids such as oxycodone may be used when required as part of a multimodalapproach | Strong | High |
| Perioperative factors | Maintaining normothermia | Normal body temperature should be maintained peri- and postoperatively through pre-warming and the active warming of patients intraoperatively | Strong | High |
| Antimicrobial prophylaxis | Systemic antimicrobial prophylaxis recommended in accordance with local policy and availability | Strong | Moderate |
| Antithrombotic prophylaxis treatment | Patients should be mobilized as soon as possible post-surgery and receive antithrombotic prophylaxis treatment in accordance with local policy | Strong | Moderate |
| Perioperative surgical factors | Surgical technique | No recommendation on surgical technique | Strong  | High |
| Use of tourniquet | Routine use not recommended | Strong | Moderate |
| Surgical Drain | Routine use not recommended | Strong | Moderate |
| Fluid management | Intravenous fluids – judicious use  | Strong | Moderate |
| Postoperative intravenous fluids – discouraged in favor of early oral intake |
| Urinary catheter | Routine use – not recommended | Strong | Moderate |
| When used – should be removed as soon as the patient is able to void, ideally within 24 h of surgery |
| Recommended catheterization threshold – 800 mL |
| Nutritional care | Early return to normaldiet recommended | Strong | Low |
| Early mobilization | Patients should be mobilized as early as they are able to in order in order to facilitate early achievement of discharge criteria | Strong | Strong |
| Criteria-based discharge | Objective discharge criteria should be used to facilitate patient discharge directly to their home | Strong | Low |
| Continuous improvement and audit |  | Routine internal and/or external audit of process measures, clinical outcomes, cost effectiveness, patient satisfaction/experience, and changes to the pathway is recommended | Strong | Low |