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Optimising Recovery after Primary Total Knee Replacement: A Multidisciplinary, Evidence-Based Approach

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Abstract

Total Knee Arthroplasty (TKA) is a major elective orthopaedic procedure frequently associated with significant blood loss and a resulting high rate of allogeneic blood transfusion, potentially ranging from 20% to 40% of patients in some centers. The high economic burden and associated complications of TKA necessitate safe and efficient recovery pathways. The current standard of care is the implementation of Enhanced Recovery After Surgery (ERAS) protocols, which are evidence-based, scientific protocols aimed at ameliorating the surgical stress response. Key strategies span the perioperative period. Preoperative optimization must address anemia, a strong predictor of transfusion, often recommending intravenous iron supplementation to correct iron deficiency. For sarcopenic older individuals, prehabilitation and dietary supplementation, such as Essential Amino Acids (EAAs), are crucial for enhancing functional reserve and accelerating functional recovery. Intraoperatively, the routine use of Tranexamic Acid (TXA) is strongly recommended to reduce perioperative blood loss. Studies show TXA significantly reduces total perioperative blood loss (median 800 mL to 375 mL) and lowers transfusion rates (45.83% to 10.42%). The routine use of a tourniquet is not recommended in TKA due to its associations with increased hidden blood loss (HBL) and decreased knee range of motion (ROM), without providing significant benefits to total blood loss or transfusion rate when TXA is used. Postoperatively, appropriate VTE prophylaxis is paramount; aspirin thromboprophylaxis is independently associated with a lower rate of early Periprosthetic Joint Infection (PJI) (0.3% versus 0.8%) compared with non-aspirin agents. ERAS consistently reduces the length of hospital stay (LOS), complications, and improves patient satisfaction.

Keywords: Total Knee Arthroplasty (TKA), Enhanced Recovery After Surgery (ERAS) protocols, Tranexamic Acid (TXA)

Introduction

Knee osteoarthritis is a degenerative disorder affecting older adults, causing debilitating pain and impairment of mobility. Tka is the most common elective orthopedic surgical procedure and effectively improves joint functionality and quality of life [1]. However, this extensive intervention often leads to significant blood volume loss, which may result in hemodynamic instability, organ ischemia, and may necessitate allogeneic blood transfusion. Allogeneic blood transfusions carry risks including infection, fluid overload, increased los, and mortality.

The objective of optimizing recovery is to mitigate these physiological stressors and accelerate rehabilitation. This is achieved through the eras approach, which involves a multifaceted, multidisciplinary framework integrating surgeons, anesthetists, nurses, and other healthcare professionals [2, 3]. The synergy among these team members is critical for achieving optimal patient outcomes and reducing hospital stays. This review synthesizes evidence regarding key interventions across the perioperative continuum to guide best practices for optimizing recovery after primary tkr.

Method

This article synthesizes current evidence regarding interventions utilized in enhanced recovery after surgery

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(eras) protocols for primary tka. The synthesis draws on reports concerning antibiotic prophylaxis practices, perioperative blood management strategies, the use of txa and tourniquets, eras implementation and multidisciplinary coordination, vte prophylaxis and associated infection rates, preoperative optimization of sarcopenia and nutrition, and the management of wound drainage [2, 4]. Data extracted address pre-, intra-, and postoperative factors, focusing on effectiveness, safety, and cost-efficiency. The resulting recommendations are based on high-quality evidence, where available, addressing areas of strong consensus as well as persistent controversy in tka care.

Discussion

Optimal recovery relies on the successful and consistent execution of eras protocols.

1. Preoperative optimization: maximizing surgical resilience

Preoperative optimization aims to correct modifiable risk factors and enhance the patient's capacity to withstand surgical stress.

Anemia management: preoperative anemia is a major factor associated with high transfusion rates [5]. While oral iron supplementation has produced mixed results regarding transfusion reduction, intravenous iron is a safe and effective method to correct preoperative anemia [6]. Iv iron significantly reduced allogeneic blood transfusion rates (8.9% vs 30.1%) and shortened hospitalization periods (8.4 days vs 10.7 days).

Sarcopenia and prehabilitation: age-related sarcopenia is linked to adverse outcomes and makes enduring surgery significantly harder [7]. Prehabilitation (including strength, resistance, balance, and flexibility training) is a crucial preliminary step to empower surgical resilience and accelerate functional recovery [4, 8].

Nutritional supplementation: supplementation with essential amino acids (eaas) (e.g., 20 g twice daily for one week pre- and two weeks post-surgery) has been shown to attenuate quadriceps muscle atrophy and accelerate the return of functional mobility in older adults following tka [7, 9, 10]. Other nutraceuticals like iron, vitamin D, and glucosamine sulphate are also suggested. Additionally, smoking and alcohol cessation (for 4 weeks or more) are strongly recommended before tka [4].

2. Intraoperative standards: minimizing blood loss and infection

Antibiotic prophylaxis: the prophylactic use of antibiotics in primary tjr is the acknowledged standard of practice [11]. Most canadian surgeons favor a first-generation cephalosporin, typically using a 1 g dose, although some literature supports a larger 2 g iv dose. The optimum timing for the pre-operative antibiotic dose should be administered within less than 1 hour of skin incision.

Tranexamic acid (txa): high quality evidence favors the routine use of txa in tka [12,13,14]. Txa administered intravenously in a double-dose regimen significantly reduced total perioperative blood loss (median 800 ml to 375 ml). This led to a substantial reduction in the percentage of patients needing transfusion (45.83% in the control group vs 10.42% in the txa group) [12].

Txa and recovery: the effectiveness of txa in reducing bleeding translates to an indirect positive impact on postoperative functional recovery. Patients receiving txa stood (verticalization) and ambulated significantly earlier postoperatively [15].

Tourniquet use: the routine use of a tourniquet is not recommended [16]. While using a tourniquet with txa decreases intra-operative blood loss and shortens surgery duration, it is associated with more hidden blood loss and less knee rom compared to the txa-only group. Crucially, when txa is used, there were no significant differences in total blood loss, decrease in hemoglobin, or transfusion rates between the tourniquet and non-tourniquet groups.

Analgesia: multimodal analgesia, including local infiltration analgesia (lia), is a core component of eras, promoting early mobilization [3].

3. Postoperative care: mobilization and complication prevention

Vte prophylaxis and pji risk: aspirin is a suitable vte prophylaxis agent given its cost, ease of administration, and predictable pharmacokinetics [17]. In a large retrospective review of primary tka patients, the use of aspirin thromboprophylaxis was independently associated with a lower rate of early pji [17]. The pji rate was 0.3% in the aspirin group compared to 0.8% in the non-aspirin group [18]. Non-aspirin thromboprophylaxis was associated with a 2.5 times higher risk of early pji. This protection is likely due to the decreased risk of persistent wound drainage and hematoma associated with aspirin, thereby reducing the chance of retrograde contamination [18].

Wound drainage management: persistent wound drainage (pwd) (fluid extrusion beyond 72 hours) is a key risk factor for pji [19]. The use of potent agents like low molecular weight heparin (lmwh) results in significantly longer wound discharge compared to aspirin. If pwd occurs, pharmacological vte prophylaxis must be reassessed and sometimes temporarily ceased, initiating mechanical prophylaxis instead. If pwd persists after 5 to 7 days, immediate surgical exploration, washout, and exchange of modular components are required [19]. Routine use of surgical drains is not recommended in

primary uncomplicated tka [20].

Early mobilization and discharge: early mobilization should be encouraged. This practice reduces the length of stay (los) [3]. Restrictive transfusion strategies (hb level 7--8 g/dl) are recommended, though a more liberal approach (hb > 8 g/dl) is suggested for patients with acute or chronic cardiovascular disease.

Conclusion

Optimising recovery after primary tka is effectively achieved through the systematic application of eras protocols, guided by multidisciplinary coordination [2, 3]. Key evidence supports intensive preoperative preparation (addressing anemia and sarcopenia), mandatory intraoperative blood loss control using txa, avoidance of routine tourniquet use, and aggressive postoperative management focused on complication mitigation and acceleration of function [4, 15]. The strong association between aspirin thromboprophylaxis and reduced pji rates suggests it should be the gold standard vte agent when medically appropriate [17, 18]. Adherence to these evidence-based protocols ensures enhanced patient recovery and reduced los.

Declaration of patient consent: The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given his consent for his images and other clinical information to be reported in the Journal. The patient understands that his name and initials will not be published, and due efforts will be made to conceal his identity, but anonymity cannot be guaranteed.

Conflict of Interest: NIL; **Source of Support:** NIL

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