

# Updates in Enhanced Recovery Pathways for Total Knee Arthroplasty

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## KEYWORDS

- Enhanced recovery pathway • Enhanced recovery after surgery
- Total knee arthroplasty • Anesthetic technique

## KEY POINTS

- Multidisciplinary team work and coordination is required to develop an enhanced recovery pathway after surgery (ERAS) for patients receiving total knee arthroplasty.
- Not all aspects of other ERAS pathways are applicable in total knee arthroplasty.
- The pathway must be tailored to a specific institution and patient population.
- Looking well ahead of admission until well after discharge provides the biggest opportunity for patient-centric gains.

More than 700,000 primary and revision total knee arthroplasty (TKA) procedures are performed annually in the United States, accounting for more than \$10 billion in health related costs.<sup>1</sup> These numbers will continue to grow as obesity and osteoarthritis become more prevalent, and as our population demographics shift to a more aged cohort that is active and desires to maintain their functionality. As such, total joint arthroplasty has become a focus for efforts to develop enhanced recovery after surgery (ERAS) protocols with the aim of improving patient outcomes and reducing health care costs. Originally developed for colorectal surgery, ERAS protocols have now been adopted by a variety of other surgical service lines.

Unlike other surgical procedures, patients undergoing joint replacement typically present with pain and decreased mobility. ERAS pathways for joint replacement focus on reducing pain and accelerating the return to functional recovery, goals that are

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aligned with the purpose of the surgery itself. As shown with other surgeries, ERAS pathways for TKA have resulted in decreased hospital length of stay (LOS), readmission rates, and health care costs.<sup>2,3</sup> Additionally, standardized clinical pathways have been shown to decrease the incidence of perioperative complications, morbidity, and mortality.<sup>4</sup> This review aims to describe common interventions of an ERAS pathway for TKA patients and to examine the evidence supporting these interventions.

## PREOPERATIVE OPTIMIZATION

A key principle of ERAS programs is the identification and optimization of patient-related factors that are known to increase perioperative risk of adverse events. One such patient factor is anemia. Patients with preoperative anemia (defined as hemoglobin <12 g/dL in women and <13 g/dL in men in most studies) appear to be at higher risk for transfusion and postoperative morbidity and mortality.<sup>5,6</sup> In one prospective cohort study of more than 7000 noncardiac, elective surgical patients, preoperative anemia was associated with a twofold increase in the risk of death within the first 14 days, an effect that persisted 90 days after surgery.<sup>5</sup> Another prospective observational database study with more than 5000 patients with total hip arthroplasty and TKA found that preoperative anemia was associated with a fourfold higher rate of transfusion during admission, exposing them to transfusion-related complications, as well as a significantly increased readmission rate within 90 days of surgery.<sup>6</sup> Anemia in this cohort was also associated with increased the risk for a prolonged (>5 days) hospital LOS after adjustment for preoperative patient-related risk factors. Preoperative anemia also has been associated with higher risk of periprosthetic joint infection, with the incidence of infection being up to twice as high in anemic patients in a cohort of 15,000 patients.<sup>7</sup>

When anemia is identified preoperatively (commonly defined as hemoglobin <12 g/dL in women and <13 g/dL in men), hemoglobin should be optimized, and corrected if possible to these minimum concentrations (**Fig. 1**). Given enough lead time (several weeks) this can be done with oral iron therapy alone. Those who cannot tolerate oral iron and those who are scheduled for surgery within 21 days should receive intravenous iron therapy. If indicated (eg, severe anemia or anemia unresponsive to iron therapy), erythropoietin supplementation is periodically used for total joint patients.<sup>8</sup> These therapies require time (typically 3–4 weeks to raise the hemoglobin by 1–2 mg/dL in most patients), highlighting the need for early assessment and implementation of therapy. However, when implemented correctly, these anemia corrective pathways have been shown to decrease allogeneic blood transfusion rates and reduce overall costs.<sup>9,10</sup>

Nutritional status is another patient factor that should be assessed and optimized. Preoperative malnutrition (ie, low albumin and transferrin levels) has been linked with delayed wound healing, increased morbidity, and increased hospital LOS.<sup>11</sup> In a recent retrospective review of 4500 revision TKAs, patients with low serum albumin (<3.5 mg/dL) were more likely to develop deep surgical site infections, pneumonia, sepsis, and major perioperative complications, such as unplanned intubation, transfusion, and acute kidney injury.<sup>12</sup> Preoperative nutrition screening tools can be used to assess body mass index, recent weight loss, recent reduction in oral intake, and low serum albumin.<sup>13</sup> If the patient is at high risk, from a nutritional standpoint, a nutrition consult is recommended and a least 7 days of oral nutrition supplementation should be provided.

Cigarette smoking is another known risk factor for poor outcomes, including increased rates of infection, inadequate pain control, pulmonary complications,

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