A Resource for Healthcare Providers

Clinical Pathway for Inpatient and Outpatient Hip and Knee Arthroplasty

Enhanced Recovery Canada:

A Collaborative to Improve Surgical Care

Enhanced RECOVERY Canada™

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Total Hip and Knee Arthroplasty Pathway

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References are organized in sections according to their topics.
You can find specific references using the section letter.

I P A S NF M

This material also available online through the Enhanced Recovery Canada website:
enhancedrecoverycanada.ca

About ERC Pathways

Scope and Purpose

The purpose of this clinical pathway is to provide practitioners in Canada with evidence-based strategies to improve surgical outcomes in hip and knee arthroplasty patients. Applying these principles will also help to reduce hospital length of stay. Based on patient's personal and medical conditions they may be candidates for an outpatient surgery (discharged home on the same calendar day as the surgery) or a day surgery (discharge <24 h after surgery).

All patients should be managed by applying six core principles that emerge from Enhanced Recovery After Surgery (ERAS), including: patient and family engagement, surgical best practices, multimodal opioid-sparing pain management, mobility and physical activity, as well as fluid and nutrition management.

This clinical pathway is organized in a stepwise approach according to the patient's continuum of care. The goals of the pathway include to:

- increase patient engagement
- reduce pain while minimizing opioid use
- avoid patient sedation
- improve patient's early function and mobilization
- minimize postoperative anemia
- decrease wound complication
- reduce deep vein thrombosis (DVT) risk
- reduce hospital length of stay and hospital-acquired infections
- increase patient satisfaction

There are also clear benefits for the institution and society, including:

- improved efficiency by reducing frequent patient complications
- increased bed availability
- minimal postoperative outpatient care
- reduced costs

About ERC Pathways

Target Population[1-6]

All adult patients who require total hip arthroplasty (THA) or total knee arthroplasty (TKA) or unicompartmental knee arthroplasty (UKA) should be considered for ERAS management using the recommendations provided in this clinical pathway regardless of the planned hospital length of stay (outpatient or hospitalized).

Inclusion criteria:

- Patient ability to give informed consent
- Patient comprehension of the protocol

Exclusion criteria for an ERAS outpatient procedure:

- Elderly patients who are frail with possible malnutrition; advanced age itself is not a contraindication
- Significant coagulation disorder
- Systemic disease involvement necessitating special perioperative care (intensive care, multiple transfusions, dialysis, etc.)
- Psychiatric disease limiting participation; cognitive impairment or communication problem
- Significant mobility problem, other than the joint to be replaced, imposing functional limitations that prevent movement without technical or physical assistance
- Transportation barriers to and from hospital
- Lack of caregiver support (physically, mentally) during the first postoperative days during home recovery, especially the first night after discharge
- Absence of medical service located near the patient's residence. Home services by the local community service centre in the area should be available if felt to be necessary.

Patient characteristics that merit caution and individual evaluation before attempting an ERAS outpatient procedure with the present pathway:

- Significant comorbidities (i.e. known history of heart failure or coronary artery diseases, moderate to severe chronic obstructive pulmonary disease [COPD], moderate to severe kidney failure or chronic kidney disease)
- Major complications during previous THA or TKA surgery (e.g. delirium, infection)
- Pulmonary embolism or DVT in the past year
- Body mass index (BMI) > 35 or 40 kg/m2
- Allergies or sensitivities to medications specified in the protocol
- Previous need for long-term urinary Foley catheter postop
- Current or in the past year: systemic corticotherapy (unless confirmation of a cortrosyn test prior to surgery)

About ERC Pathways

Target Audience[17]

Surgeons, anesthetists, physiotherapists, occupational therapists, nurses, pharmacists, dietitians, and other providers involved in the delivery of care of patients undergoing THA and TKA, and health care leaders. Please note, “The success of implementing fast-track depends on dynamic harmony amongst the various participants than on reaching an optimum level of excellence at each separate organization level.”

Stakeholder Involvement

This clinical pathway was developed by a multidisciplinary group of clinicians from across the country experienced in THA and TKA surgery. Patients were included in the pathway work to ensure the patient perspective was integrated and prioritized.

Development[18]

This clinical pathway work was guided by Dr. Pascal-André Vendittoli, MD, MSc, Orthopedic Surgeon at Hôpital Maisonneuve-Rosemont in Montreal Quebec. The pathway includes common approaches to incorporate evidence-based practices into your own clinical pathway. For the protocol that Dr. Vendittoli uses at Hôpital Maisonneuve-Rosemont, see Appendix C. For a comprehensive summary of the literature, please refer to the ERAS Society consensus guidelines for perioperative care in THA and TKA. A framework for evaluating the impact of the pathway on the quality of care is presented in Appendix D and Appendix E. A physician order set template in presented in Appendix F.

Note: Drugs and dosages are provided throughout the pathway, where appropriate, as examples; only non-proprietary (generic) names are provided. Please consult with a pharmacist when developing your clinical pathway. All medications have side effects that should be taken into consideration on an individual patient basis prior to administration.

Editorial Independence

All working group members signed a member agreement form indicating that they had no conflicts of interest in relation to the project.

About ERC Pathways

Disclaimer

The recommendations made in this document are a synthesis of currently accepted approaches based on a review of relevant scientific literature. HEC has no obligation to update such information or advise on further developments concerning topics mentioned in this document. Clinicians using this resource should, in consultation with the patient, use independent medical judgment in the context of individual clinical circumstances to direct care. The views expressed in this document are those of the authors and do not necessarily represent the views of HEC or Health Canada. This information is provided "AS IS" without any representations, warranties, or conditions of any kind, express or implied, including without limitation implied warranties or conditions of fitness for a particular purpose or use or non-infringement.

Key Messages

Patient and Family Engagement

The inclusion of patients in their care implies that care teams include patients along with families, caregivers and/or advocates at the outset, and that they are involved with collaborative decision-making and receive optimum communication and information before, during and after surgery.

- Health care providers should use plain language to optimize communication of patient-centred information throughout the perioperative trajectory. Prior to engaging patients in their care, patients and families must first be able to understand the information that is provided.
- Avoid providing verbal information exclusively. Written and other media should be made available.
- For more information on what patient and families, providers and leaders can do to increase patient engagement see Engaging Patients in Patient Safety – a Canadian Guide.
- Create a non-judgmental environment where patients and families are encouraged to ask questions and feel comfortable voicing concerns. Use the teach-back method to reinforce learnings and optimize understanding.
- Strategies to increase patient engagement throughout the perioperative process should be known and utilized by all multidisciplinary team members.
- Health care providers should understand the concept of health literacy and its effect on understanding, engagement, and its impact on health outcomes.

Patient Optimization

- Clinicians should discuss pain management expectations with patients preoperatively to help guide treatment decisions, and to help shape realistic patient expectations about pain.
- Drugs and doses used by patients should be documented before surgery to help identify opioid-tolerant patients and manage appropriately.
- Screen for anxiety and depression to identify patients who may require additional counselling/psychological services to prevent symptoms from worsening.
- Use an evidence-based approach to preoperative assessment to identify which patients are suitable for an outpatient procedure, and to optimize and treat relevant comorbidities.
- Patients should plan their return home in advance because they will need help with transportation, meals, washing, other personal tasks, and mobility.
- Patients should receive education about the negative impact of prolonged bed rest and the importance of early and progressive mobilization after surgery.
- While current evidence does not support preoperative physiotherapy as an essential intervention, patients should be encouraged to stay as active as they can within the limitations of their pain.

Key Messages

Analgesia

- Anesthesia technique should aim to reduce postoperative pain, avoid patient sedation, minimize the risk of orthostatic hypotension or urinary retention and limit motor function loss during and after surgery. A multimodal approach is ideal to achieve these goals.
- The number/combination of components that should be selected to optimize pain management, reduce opioid burden, and avoid the side effects of all analgesics used is unknown.
- Local infiltration analgesia (LIA) is recommended for THA and TKA.
- Multimodal analgesics prescriptions can be suggested to the surgical team when the patient is ready to be discharged. Non-opioid therapies should be encouraged as primary treatment.

Surgical Best Practices

- All adult patient who require THA and TKA should be considered for ERAS management.
- Prevent surgical site infections (SSIs) by routinely implementing infection prevention strategies.
- A systematic approach to antiemetic prophylaxis that includes limited preoperative fasting, aprepitant or ondansetron, scopolamine and dexamethasone is recommended.
- Tranexamic acid should be used to reduce blood loss.
- Surgical approach is left to surgeon preference. The surgical technique should minimize soft tissue dissection, minimize surgery time, reduce blood loss, maximize joint stability to permit unrestricted postoperative range of motion and weight-bearing.
- For TKA, the routine use of a tourniquet is not recommended.
- Wound closure should aim to prevent wound discharge, spontaneous evacuation of hematomas, patient concern (perception of hemorrhage), minimize dressing changes, and minimize nursing care.
- Patients should be informed about the risk of transient bacteremia and the potential need for prophylactic antibiotics for future procedures.
- Patients should receive detailed information about how to identify and address potential adverse events

Key Messages

Fluid Management

- Patients should be encouraged to arrive to surgery adequately hydrated, which means that routine prolonged preoperative fasting (nothing by mouth [NPO] after midnight) should be abandoned.
- Intake of solids until 6 h prior to the induction of anesthesia, and unrestricted clear fluids until 2 h prior to induction of anesthesia is recommended for most patients.
- For the purposes of patient well-being and metabolism, patients may be offered a carbohydrate drink within ≥2 h before surgery (non-pulp fruit juice, black coffee with sugar, sport drink).
- Balanced IV solutions such as Plasmalyte or Ringer's Lactate solution are recommended over normal saline.
- Tailor the amount of IV fluids to intraoperative blood losses.
- Routine discontinuation of IV maintenance fluid is recommended as soon as the patient is consuming fluids by mouth.

Nutrition

- Patients should be encouraged to eat a balanced diet according to Canada's Food Guide.
- Patients should be screened as early as possible for nutritional risk at the preoperative assessment clinic. If there is clinical concern for nutrition risk, refer to a dietitian for optimization.
- Unless patients experience nausea or vomiting, an early return to normal diet is recommended and should be promoted.

Key Messages

Mobility and Physical Activity

- There should be no range of motion restrictions on the operated hip or knee unless specified by the operating surgeon.
- An appropriately trained health care provider (e.g. nurse, physiotherapist) should be responsible for the initial assessment prior to the first mobilization attempt.
- Patients should be mobilized as early as they are able to facilitate early achievement of discharge criteria.
- Ideally, the physiotherapy exercise interventions after THA and TKA should be simple, using few and well-chosen exercises that are described in detail, adhering to basic exercise physiology principles
- Patients should be informed of the return to work plan after THA and TKA, including time to return to work, and to either full or modified duties.
- According to the standard of care in the area, a physiotherapist should conduct a home visit or patients should attend an outpatient clinic, where the physiotherapist will assess patients and teach them how to progress prescribed hip and knee exercises.

Overarching Recommendations

1

Local champions should be identified from each discipline (surgery, anesthesiology, nursing) to lead implementation and address discipline specific issues, and concerns. It is also critical to identify a champion in hospital administration to get institutional buy-in and help to secure resources for the pathway.[9]

2

Pre-set orders should be used as part of ERAS pathways.

3

Implementation success requires assessment of adherence to ERAS processes, through ongoing process and outcome measurement. This may require utilizing a database, and risk adjustment for various procedures and patient populations.

4

Patients and caregivers/families are engaged as active partners in their care. As such, a pre-admission discussion of milestones, discharge criteria and the patient's role in the recovery process should take place with the patient and/or family prior to surgery. This discussion should begin in the surgeon's office and continue in the pre-admission unit by a trained health practitioner (e.g. nurse, physiotherapist) or an anesthesiologist, depending on patient factors and the complexity of the proposed surgery.

5

Patient and family education should be presented using a variety of formats and delivery styles, including:

- Printed material (booklets, pictograms);
- Individual and group counselling;
- Webinars; and/or videos
- Apps/software (tablet, phone, or computer)

6

All health care providers involved in the care of THA and TKA patients should be familiar with the ERC clinical pathway for THA and TKA.

ERC Clinical Pathway for Inpatient and Outpatient Hip and Knee Arthroplasty

Phase 1. Patient and Family Engagement

Phase 2. Patient Optimization

Phase 3. Preoperative

Phase 4. Intraoperative

Phase 5. Postoperative

Phase 6. Discharge

1 Patient and Family Engagement

Engaging Patients in their Care[P1-11]

Recommendations

To help your organization improve the patient and family experience in the ERAS program we recommend the following:

- Avoid giving verbal information to patients as the only form of communication. Between 40 to 80% of what health care providers say to patients and families is immediately forgotten, and half of what is remembered is recalled incorrectly. Patients and caregivers/families should receive preoperative information, ideally both written and verbal. Include detailed information about the surgical procedure and components of the clinical pathway in which patients and caregivers/families are expected to participate, including:
    - reduced fasting
    - early ambulation
    - perioperative exercises
    - safe oral medication administration, avoiding or minimizing opioids, and
    - discharge planning
- Inform patients and caregivers/families of any changes to patient medication regimens in preparation for and after surgery.
- Be aware of the health literacy level within Canada. Consider testing for health literacy levels, if appropriate.
- Use plain language (i.e. avoid medical jargon and acronyms) when conversing with patients and their caregivers/families.
- Include pictures in the design of health education materials to increase the effectiveness of health communications.
- Slow down and listen.
- Avoid interruptions.
- Avoid asking questions such as “Do you understand?” or “Do you have any questions?” Instead use the teach-back method to ensure comprehension. The teach-back method is a strategy used to reinforce learning and optimize understanding.
- Practice a universal approach when communicating with patients and their caregivers/families. In general, patients and their caregivers/families prefer to receive health information in a simple way.
- Address people in the same way irrelevant of their education level.
- Refer patients and their caregivers/families to reliable websites. Many patients and their caregivers/families refer to the internet for health information.
- Highlight the ERC Patient Guide and online videos to the patient and their caregivers/families.
- Help your organization improve the patient and family experience in an ERAS program.

1 Patient and Family Engagement

Engaging Patients in their Care[P1-11]

Tools and Equipment

- Patient Optimization Booklet for Hip and Knee
- Animated Precare Hip and Precare Knee Arthroplasty Guide

Additional Information

- Sixty percent of Canadian adults and 88% of older adults have low health literacy.
- Health literacy program for adults
- Health literacy measurement tools
- Health literacy how-to tips
- Health information and the internet: The 5 Cs website evaluation tool
- Meaningful and effective patient engagement: What matters most to stakeholders
- Patients as Partners in Enhanced Recovery After Surgery: A Qualitative Patient-Led Study
- What is teach-back?
- Writing health information for patients and families

Data Collection

Pre-admission counselling and education

1 Patient and Family Engagement

Analgesia[A1-2]

Recommendations

- Patients should understand that ERAS approaches to analgesia are opioid-sparing, and the goal of pain control is to restore function.
- Perioperative pain management options should be explained and discussed with patients before their surgery.
- Clinicians should discuss pain management expectations with patients to help guide treatment decisions, and to help shape realistic patient expectations about pain.
- Discuss the risks and benefits of opioid therapy with patients.
- Patients should be taught how to effectively assess their pain.
- Careful consideration should be given to educating opioid-dependent patients about the potential for increased postoperative pain and effective pain management strategies.

Tools and Equipment

- Pain assessment scale
- Patient Optimization Booklet
- Animated Precare Hip and Precare Knee Arthroplasty Guide

Additional Information

Patient education about the process to achieve optimal analgesia for functional recovery needs to continue into the post anesthesia care unit (PACU) and postoperative ward.

1 Patient and Family Engagement

Surgical Best Practice[S1-2]

Recommendations

- Patients should receive a detailed overview of their surgery day, including what's going to happen, when, why, and by which member of the health care team.
- Patients selected for outpatient surgery should understand the benefits and risks of an expedited discharge, and their role in a positive outpatient experience.
- Models or actual prosthetics that patients can look at are recommended to help patients know what their new joint will look and feel like.
- Patient concerns and questions about scarring should be addressed.
- Patients should be advised that they may need to modify or discontinue the use of their medications before surgery.
- By the day of surgery, patients should be prepared as much as possible to minimize stress on the surgical day, feel confident in their care team, and know how they are expected to participate in their own care.
- Smokers and high-risk drinkers should be advised and supported to stop smoking and drinking for at least 4 weeks before surgery.

Tools and Equipment

- Models or actual prosthetics
- Patient Optimization Booklet
- Animated Precare Hip and Precare Knee Arthroplasty Guide

1 Patient and Family Engagement

Nutrition and Fluid Management[NF1]

Recommendations

- Patients should be encouraged to eat a balanced diet according to Canada's Food Guide.
- Specific guidance on fasting should be provided, including the importance of staying hydrated. The traditional NPO after midnight recommendation should be abandoned. Instead, if hungry and awake, patients can eat solid food until 6 h before surgery and should be encouraged to drink clear fluids up until 2 h before surgery time.

Tools and Equipment

- Patient Optimization Booklet
- Animated Precare Hip and Precare Knee Arthroplasty Guide
- Canada's Food Guide

1 Patient and Family Engagement

Mobility and Physical Activity[M1-3]

Recommendations

- Patients should plan their return home in advance because they will need help with transportation, meals, washing, other personal tasks, and mobility.
- Patients should receive education about the negative impact of prolonged bed rest and the importance of early and progressive mobilization after surgery.
- Patients should consult with their health care team before deciding to use an app designed to guide mobility and exercises post-surgery.

Implementation Approaches

- Education and instruction about early mobilization should be delivered by a physiotherapist. The format of education can range from one-on-one verbal communication and patient group sessions [separate outpatients and inpatients] to booklets or videos. Ideally, patients should receive information in both written and oral formats. Education and instruction should include:
  - An explanation of exercises in the pre- and postoperative periods.
  - An explanation of the required at-home technical aids and equipment in the postoperative period.
  - Review of the discharge criteria (see Appendix B).
- When considered appropriate by the professional, patients should purchase recommended special equipment (e.g. gripper/grabber/reacher, hand-held shower head, non-slip bathroom mat, etc.).
- Education about early mobilization should be reinforced throughout the hospital stay.
- Caregivers/family members should be educated about how they can facilitate and encourage early mobilization.

Tools and Equipment

- Patient Optimization Booklet
- Animated Precare Hip and Precare Knee Arthroplasty Guide

2 Patient Optimization

Analgesia

• Identify Opioid Tolerance[A3-7]

Recommendations

- Drugs and doses used by patients should be documented to help identify opioid-tolerant patients and to modify the pain management plan accordingly.
- Opioid-tolerant patients may require closer follow-up and referral to clinicians specializing in pain management after surgery. Opioid reduction or cessation is recommended in the preoperative period.
- Preoperative recreational and medical cannabis use should also be documented. General and regional anesthesia should be avoided for at least 72 h from last exposure.

Additional Information

- Chronic opioid use is a preoperative risk factor associated with poor postoperative outcomes.
- High lipid solubility of cannabinoids favours build-up in fatty tissue, which delays elimination and drug interaction up to 5 days after exposure.

2 Patient Optimization

Analgesia

Psychological Screening[A8-18]

Recommendations

- Depression and anxiety can have a significant impact on perioperative care. Different scales and tools to assess the severity of the problem may be used.
- Use of a validated screening tool can identify patients with high levels of anxiety and/or depression. These patients may require a complete assessment and individualized care before surgery to improve symptoms.

Tools and Equipment

Use a validated screening tool like the Hospital Anxiety and Depression Scale (HADS) or Patient-Reported Outcomes Measurement Information System (PROMIS) Depression and PROMIS anxiety.

Additional Information

- The prevalence of anxiety in THA and TKA patients has been reported to be around 28%.
- Low preoperative mental health, pain catastrophizing, and unrealistic patient expectations might influence outcomes after THA and TKA.
- Current literature does not support routine psychological interventions for THA and TKA. However, the literature for psychological interventions in conjunction with THA and TKA is in early stages of development.

2 Patient Optimization

Surgical Best Practices

Preoperative Assessment Clinic

Recommendations

- All patients should receive a preoperative assessment several weeks before surgery to establish rapport with the patient and their caregiver/family and to identify co-morbidities that may lead to complications.
- Factors that should be used to guide the timing of the preoperative assessment relative to the surgery date include: patient demographics and clinical conditions, availability of resources, and flexibility of the surgery date. Assessments undertaken too close to the date of surgery provide less time for optimization.

Risk Assessment/Management[S3-6]

Recommendations

- Patients should undergo a thorough, evidence-informed preoperative risk assessment prior to THA and TKA.
- All pre-existing medical conditions should be optimized before surgery, including:
  - Obesity
  - Malnutrition
  - Diabetes
  - Chronic kidney disease
  - Hepatic diseases (e.g. hepatitis, liver cirrhosis)
  - Depression
  - Cardiovascular disease
  - Lung disease (e.g. COPD)
  - Anemia (hemoglobin <130 g/L for men and women)
  - Neurologic (e.g. myasthenia gravis)
- Consult with a medical specialist if needed.
- Patients selected for outpatient management should be scheduled for surgery early in the morning to facilitate early discharge.

Tools and Equipment

- The Outpatient Arthroplasty Risk Assessment score
- The Readmission Risk Assessment Tool

Data Collection

Preoperative risk assessment

2 Patient Optimization

Surgical Best Practices

Infection Prevention[S3, S7]

Recommendations

- In addition to taking a thorough history and performing a physical examination, all patients with a high index of suspicion for infection should be considered for further workup.
- THA and TKA is contraindicated in patients with ongoing infection, until the infection is resolved.
- In endemic areas, methicillin-resistant S. aureus (MRSA) screening and treatment might be performed on all patients prior to surgery. Consult with a local microbiologist.

Additional Information

- Modifiable risk factors for infection prevention include: smoking, excessive alcohol consumption, IV drug use, coagulopathy, malnourishment, preoperative anemia and postoperative transfusions, diabetes mellitus, peripheral vascular disease, skin ulcers, and obesity.
- A small number of patients will not respond to S. aureus treatment and will remain chronic carriers. Although the patient's risk will remain elevated for periprosthetic joint infections (PJIs), continued colonization is a relative contraindication.

Urinary Problem Prevention[S8]

Recommendations

- Although routine urinalysis is no longer recommended, patients with symptoms of acute or chronic urinary infection should be screened and treated appropriately preoperatively.
- Men with prostatitis symptoms should be identified preoperatively to avoid postoperative urinary retention. At-risk patients should be given a prescription for oral tamsulosin (0.4 mg qhs x 10 days) starting 3 nights before admission to the hospital.

Tools and Equipment

- 7-question International Prostate Symptoms Score (IPSS) has been used as a screening tool to quantify the severity of lower urinary tract symptoms in males.

2 Patient Optimization

Surgical Best Practices

Medication Discontinuation[S9-11]

Recommendations

- Many drugs used to treat pre-existing conditions need to be continued prior to surgery to ensure patient stability. Discontinuation and resumption of these drugs should be determined by a person with specialized knowledge of these conditions (e.g. anesthesiologist, internal medicine, or general practitioner).
- Patients using the following medications will be advised to discontinue them before surgery:
  - Hormonal therapy: 1 month before surgery.
  - Anti-inflammatory drugs: 7 days before surgery if patients can tolerate early discontinuation (e.g. ibuprofen, naproxen, diclofenac).
  - Antiplatelets and anticoagulants: according to medical recommendations.
  - Antirheumatic medications: according to the American College of Rheumatology/ American Association of Hip and Knee Surgeons guidelines.
  - Natural products: 2 weeks before surgery.
- Patients should not receive an intra-articular injection in the 3-6 months before surgery (steroids or hyaluronic acid).
- Patients experiencing pain a week before the operation may take acetaminophen and/or COX-2 nonsteroidal anti-inflammatory drugs (NSAIDs).

Tools and Equipment

- Patient Optimization Booklet
- Animated Precare Hip and Precare Knee Arthroplasty Guide

Additional Information

If pain is intolerable, and to avoid opioid use, patients can use COX-2 NSAIDs up to the date of surgery for symptomatic relief.

2 Patient Optimization

Surgical Best Practices

Smoking and Alcohol Use[S3, S12-15]

Recommendations

- Identify current smokers and high-risk drinkers by self-report.
- 4 weeks or more of abstinence from smoking is recommended.
- Patients with high alcohol intake should receive an alcohol cessation intervention to remain abstinent for 4 weeks or more.

Tools and Equipment

Discuss products and aids to help smokers quit. Offer all smokers and high-risk drinkers access to an intervention program.

Additional Information

- Current smokers includes daily and occasional smokers.
- The impact of electronic cigarettes on patients undergoing orthopedic surgery is still unclear; use may increase local and systemic complications through impaired healing, cytotoxicity, inflammation, and impaired immune response.
- High-risk drinking is defined as: more than10 drinks a week for women with more than 2 drinks a day most days, and more than 15 drinks a week for men, with more than 3 drinks a day most days.

Skin Preparation[S16-17]

Recommendations

All patients should be advised to clean their skin with chlorhexidine the night before and the morning of their surgery.

2 Patient Optimization

Nutrition

• Nutrition Screening[NF2]

Recommendations

Patients should be screened as early as possible for nutritional risk at the preoperative assessment clinic. If there is clinical concern for nutrition risk, refer to a dietitian for optimization.

Tools and Equipment

Use a screening tool like the Canadian Nutrition Screening Tool (CNST). The CNST asks two questions:

1. Have you lost weight in the past 6 months without trying to lose this weight?
2. Have you been eating less than usual for more than a week?

Additional Information

Malnutrition in the orthopedic population is reported to be 9-39%.

Data Collection

Malnutrition screening

2 Patient Optimization

Mobility and Physical Activity

• Mobility and Physical Activity[M4-5]

Recommendations

- While current evidence does not support preoperative physiotherapy as an essential intervention, patients should be encouraged to stay as active as they can within the limitations of their pain.
- For patients with high levels of pain, consider low-impact exercises (e.g. biking, swimming) or upper body activities (e.g. arm circles, seated bicep curls) to stay active before surgery.

3 Preoperative

Patient and Family Engagement

• Engaging Patients in their care

Recommendations

- Utilize adult education principles. Stimulate patient's interest in their surgical experience and answer from the start: "What's in it for me?" and the impact on their health outcomes.
- Include patient's caregiver/family in conversation.
- Let patient speak about their last hospitalization experience.
- Ensure patients and their caregiver/families receive consistent information from all members of the preoperative team.
- Encourage the patient and their caregiver/families to bring back booklet on day of surgery and to refer to it during hospital stay.
- Offer different teaching methods depending on patient preference and their caregiver/family's preference.
- Refer to reliable internet sites (see Health On the Net)

3 Preoperative

Nutrition and Fluid Management

Reduced Fasting[NF1]

Recommendations

- Patients should be encouraged to arrive to surgery adequately hydrated, which means prolonged preoperative fasting (NPO after midnight) should be abandoned.
- Intake of solids until 6 h prior to the induction of anesthesia, and unrestricted clear fluids until 2 h prior to induction of anesthesia is recommended, unless a patient has documented delayed gastric emptying or other contraindications.
- Patients with an increased risk of pulmonary aspiration and with fluid restrictions should be considered on a case by case basis. Preoperative diet restrictions may need to be extended.

Additional Information

- Clear fluid is a liquid that you can see through. Examples include: water, electrolyte-containing sports drinks, non-pulp fruit juices and coffee/tea without milk/cream.
- Risk factors for aspiration include:
  - Documented gastroparesis
  - Metoclopramide, domperidone and/or cisapride used to treat gastroparesis
  - Documented gastric outlet or bowel obstruction
  - Achalasia
  - Dysphagia
- Examples of patients with fluid restrictions include dialysis and congestive heart failure.

Data Collection

Reduced fasting protocol

Complex Carbohydrate Loading[NF1, NF3]

Recommendations

For the purposes of patient well-being and metabolism, patients may be offered a carbohydrate drink within greater than or equal to 2 h before surgery (non-pulp fruit juice, black coffee with sugar, sport drink). Specific and expensive complex carbohydrate drinks have not been shown to accelerate the achievement of discharge criteria or to reduce complications.

3 Preoperative

Analgesia

• Anxiety

Recommendations

Routine administration of sedatives to reduce anxiety preoperatively is not recommended. Generally, patient anxiety can be managed by explaining the planned interventions, listening to the patient, answering questions, and being reassuring.

Additional Information

Sedative premedication delays immediate postoperative recovery by impairing mobility and oral intake.

• Pre-emptive Multimodal analgesia[A19-24]

Recommendations

- Routine oral administration of pre-emptive multimodal drugs to reduce the level of postoperative pain should be given within 2 h before surgery.
  - Acetaminophen 1 g PO
  - Celecoxib 400mg PO
  - Long-acting opioids (e.g. oxycodone-CR or OxyNEO 10mg PO, hydromorphone-CR or hydromorph contin 3 mg PO or morphine (12 h release formula) 15 mg PO may be considered as a one-time preoperative dose in opioid-naïve patients. By giving a single preoperative dose we may prevent or reduce the postoperative need for opioids.
  - Routine use of gabapentinoids is controversial.
- Dexamethasone 4-8 mg IV in the operating room, 0-1 h before incision, infused over 15 mins.
- For opioid-dependent patients, continuation of preoperative opioid regimens (same doses) should occur on the day of surgery and in the postoperative period. Adding more long-acting opioids as recommended above is not endorsed in opioid-dependent patients.

Additional Information

- NSAIDs should be used with caution in patients with peptic ulcer disease, NSAID induced bronchospasm, hypertension or in presence of reduced renal function.
  If patient has a sulfa allergy, celecoxib should be replaced by an equivalent drug with no effect on platelet function. (Continue to next page)

3 Preoperative

Analgesia

- **Pre-emptive Multimodal analgesia**[A19-24]

Additional Information

- Exposure to gabapentinoids at any dose on the day of THA or TKA has been associated with increased odds of postoperative pulmonary complications in a dose-response fashion, with minimal effects on perioperative opioid consumption.
- In opioid-dependent patients, an adequate opioid dose needs to be maintained to prevent opioid withdrawal.

Data Collection

Use of pre-emptive medication

3 Preoperative

Surgical Best Practices

Antiemetic Prophylaxis[S18-19]

Recommendations

- Postoperative nausea and vomiting (PONV) are prevalent after THA and TKA and negatively impacts patient recovery. Thus, the working group recommends a systematic approach to prevention, including:
  - Limited preoperative fasting
  - Aprepitant 125 mg PO, or ondansetron 4 mg PO 1-2 h preoperatively or intraoperatively
  - Transdermal scopolamine (1.5 mg) patch application behind ear, 1-2 h preoperatively. Avoid use in patients with glaucoma, more than 70 years of age and at risk of confusion or delirium.
  - Dexamethasone 4-8 mg IV in the operating room, 0-1 h before incision, infused over 15 mins.

Additional Information

- There is currently no standard approach for the management of PONV.
- Aprepitant is non-sedative and has a half-life of 9-13 h. Aprepitant is a strong substrate inhibitor of CYP3A4. Potential significant interactions may occur. Patients should be advised not to drink or eat grapefruit and pomelo 3 days before surgery, if aprepitant is planned to be used as antiemetic prophylaxis.
- Transdermal delivery of scopolamine provides a continuous slow release over 72 h of patch application. The patch can be worn for 24-72 h.
- If propofol is being used, wait for patient sedation before administering dexamethasone.
- Anticholinergic drugs like haloperidol should be avoided because of the increased risk for falls due to somnolence, orthostatic hypotension, and motor or sensory instability.
- Consult with pharmacist for patients taking medication metabolized or interfering with CYP3A4, CrCl less than 30 cc/min to ensure correct drug dosage of tranexamic acid, Xarelto and COX-2 inhibitors for examples. CrCl less than 30 cc/min is also linked to platelet dysfunction and increased bleeding risks.

3 Preoperative

Surgical Best Practices

• Antimicrobial Prophylaxis[S20-22]

Recommendations

- A first- or second-generation cephalosporin (i.e. cefazolin or cefuroxime) administered intravenously within 30 to 60 mins before incision as a single and weight-adjusted dose is recommended.
- The nature of a previous patient-reported allergic reaction to penicillin should be probed to aid in determining if the patient has a true allergy.

  a. If patient's history review rules out an IgE-mediated reaction: maculopapular or morbilliform rash, isolated pruritis, gastrointestinal side effects, headache, delayed >1 h reaction, cephalosporins can be administered without prior penicillin allergy testing.

  b. In patients with a high index of suspicion of a true allergy, and lacking a formal diagnosis, preoperative allergy testing should be considered (see decision algorithm, p. 645 in Vorobeichik, Weber, and Tarshis, 2018).
- Patients with a documented true allergy to penicillin can be given a single, weight-adjusted dose of vancomycin (15 mg/kg/dose to maximum 2 g/dose) started 2 h before incision time.
- Antibiotic redosing is recommended in cases of prolonged procedures (i.e. when the procedure exceeds the half-life of the antimicrobial agent or is longer than 3 to 4 h) and in patients with major blood loss (approx. more than 1500 ml discuss with anesthetist). Redosing should also occur at intervals of 1 to 2 times the prophylactic antimicrobial agent half-life, starting at the beginning of the preoperative dose.

Additional Information

- Approximately 10% of patients report an allergy to penicillin, but 90% of these individuals do not present a true allergy.
- Cephalosporin is more effective than vancomycin as a prophylactic agent for patients undergoing orthopedic procedures.
- If treatment with vancomycin is necessary, consider administering it in combination with other antibiotics to increase therapeutic efficacy.

4 Intraoperative

Analgesia

The impact of anesthesia approach on perioperative outcomes is controversial. ERAS orthopedic surgery has the specific challenge to promote patient's early return of function and mobilization. ERAS anesthesia technique for hip and knee arthroplasty should aim to reduce postoperative pain, avoid patient sedation, minimize the risk of orthostatic hypotension or urinary retention and limit motor function loss during and after surgery. A multimodal approach is ideal to achieve these goals.

Additional Information

- The principle of multimodal pain management is to use interventions that target several different steps of the pain pathway, which allows for more effective pain control with fewer side effects.
- The number/combination of components that should be selected to optimize pain management, reduce opioid burden, and avoid the side effects of all analgesics is unknown.
- Reducing the use of intraoperative opioids decreases postoperative pain and nausea and opioid consumption by reducing what is known as opioid-induced hyperalgesia caused by high doses of opioids.

4 Intraoperative

Analgesia

- **Anesthesia**[A20, A25-38]

Recommendations

Although no consensus has been made on the ideal technique each of them has associated benefits and downsides:

- **Spinal anesthesia**
  - Simple and well-known method
  - Should be opioid free: IV opioids or spinal morphine are not recommended
  - Motor block is unavoidable, and duration should be minimized using short acting agents, tailored for requested surgical time. Refer to the study published by Mahan, Jildeh, Tenbrunsel, and Davis (2018) comparing mepivacaine to bupivacaine.
  - Bladder dysfunction may be present postoperative
  - Associated with orthostatic hypotension
- **Combined lumbar epidural and propofol sedation, titrated to achieve the desired clinical effect**
  - Should be opioid-free
  - Maintains some degree of lower limb motor function
  - Promotes hemodynamic stability
  - Prevents the increase of cortisol and adrenocorticotrophic hormone (ACTH) levels
  - Reduces postoperative opioid use
  - Requires careful monitoring and a learning curve

  Technique description: Epidural injection with 10-20 ml lidocaine 2% without epinephrine. Catheter is left in place during surgery in case additional injection is needed. Catheter is removed at the end of the procedure. Propofol infusion is titrated (25-150 mcg/kg/min) to obtain a deep sedation with spontaneous breathing at the time of skin incision. Vasopressor perfusion may be needed to maintain blood pressure. Refer to Vendittoli et al. (2019) and Sağllik, Yazıcıoğlu, Çiçekler, and Gümüş (2015).
- **General anesthesia**
  - Readily available and straightforward
  - More rapid mobilization versus spinal
  - Potential risks related to airway management and respiration
  - Narcotics and benzodiazepine should be introduced only if clinically unavoidable
  - Total IV anesthesia (TIVA) with propofol is favoured for its desirable pharmacokinetic and side effect profile
  - Refer to Harsten, Kehlet, and Toksvig-Larsen (2013) for more information about using target-controlled infusion of propofol and remifentanil

4 Intraoperative

Analgesia

- **Anesthesia**[A20, A25-38]

Additional Information

Based on expert opinion and retrospective studies, ERAS THA and TKA pathways support neuraxial techniques over general anesthesia, which is supported by expert consensus regarding anesthetic practice in THA/TKA surgery and a recent large retrospective study comparing general and spinal anesthesia.

Data Collection

Approach to anesthesia minimizes opioids, sedatives, and motor function loss

4 Intraoperative

Analgesia

• Local Infiltration Analgesia (LIA)[A20, A25, A34, A39-47]

Recommendations

- LIA is recommended for THA and for TKA.
- Several combinations of drugs and dosages have been proposed but there is limited evidence to confirm superiority of a specific recipe. Drug combinations include: ropivacaine or bupivacaine, epinephrine and adjuvants like NSAIDs, corticosteroid or opioids.
- There is so far no real advantage demonstrated in using extended release of local anesthetics as LIA. Moreover, these drug formulations are not available in Canada yet.

Additional Information

- We do not recommend adding opioids to LIA because there is no clear benefit of doing so, and because ERAS protocols aim to minimize the use of opioids.
- Since larger doses of ropivacaine in comparison to bupivacaine can be used safely, ropivacaine should be favoured.
- The following LIA recipe demonstrated effectiveness in improving pain control, maintaining quadriceps function and allowing outpatient procedures
  - Solution for deep tissues of 110 ml: 10 ml of ropivacaine (10 mg/ml): 30 mg of ketorolac and 0.5 ml of adrenaline (1:1000) with 100 ml of ropivacaine 2 mg/ml (total of 300 mg of ropivacaine). This solution is injected into the deep tissues around the joint (periosteum, capsule, ligaments, tendon, etc.).
  - Solution for superficial tissues of 50 to 100 ml of ropivacaine 2 mg/ml (100-200 mg of ropivacaine). This solution is injected into the subcutaneous (SC) tissues.
- No epinephrine is used for the SC tissues to minimize the risk of blister formation.
- Ketorolac used as a single dose presents minimal risk but should be used with caution in patients with renal impairment or history of kidney disease. Dosage adjustment may be required in patients with moderate elevation in serum creatinine.

4 Intraoperative

Analgesia

Regional Nerve Block for TKA[A44, A48-51]

Recommendations

- Adductor canal block (ACB) with LIA is recommended over femoral nerve block (FNB) for most patients because ACB is associated with better ability to ambulate and improved quadricep strength.
- Continuous ACB added to LIA has no additional benefits on pain and ambulation on postoperative day (POD) 1 and POD 2 compared with LIA alone.
- Data is still emerging on the efficacy of interspace between the IPACK (infiltration between the popliteal artery and capsule of the knee) blocks and is therefore not recommended at this time.

Additional Information

- Continuous injection adductor canal block may be considered for patients staying in the hospital for more than 24 h.
- FNB has been associated with reduced quadricep function affecting early mobilization after surgery.

Data Collection

Use of LIA/regional nerve block

4 Intraoperative

Surgical Best Practices

Skin Preparation[S3, S23-24]

Recommendations

Preoperative chlorhexidine-alcohol based skin preparation is recommended to reduce SSIs.

Additional Information

- Based on multiple studies demonstrating superior efficacy of chlorohexidine-alcohol at decreasing bacterial pathogen load, as well as leading to reductions in SSIs, povidone-iodine is no longer considered the standard-of-care antiseptic skin preparation.
- Plastic adhesive drape use to reduce SSIs is controversial. Therefore, its use is left to surgeon preference.

Prevention of Blood Loss[S25-27]

Recommendations

- Administration of IV, topical, or oral tranexamic acid, as well as combinations of individual formulations of tranexamic acid are all effective strategies for reducing blood loss.
- All methods of administration effectively demonstrate equivalent efficacy at reducing blood loss.
- It is unclear if there is a difference in blood loss when tranexamic acid is used with different administration methods (oral, IV, topical) and with a single or multiple dose.

Additional Information

- Recommended administration method, dose, and timing:
  - IV: 10-15 mg/kg before incision
  - Topical: 1 g/50 ml of normal saline applied into the wound at the end of the procedure
  - Oral: 2 g approximately 2 h before desired effect of medication
- Oral dose tranexamic acid is a cost-effective alternative to IV tranexamic acid.
- Tranexamic acid administration to high-risk THA and TKA patients is not associated with a statistically significant difference in adverse outcomes.

Data Collection

Use of tranexamic acid

4 Intraoperative

Surgical Best Practices

Surgical Approach[S12]

Recommendations

- Surgical approach is left to surgeon preference. There is no conclusive evidence to recommend one surgical technique over another, including type of approach, use of a minimally invasive technique, prosthesis choice, or use of computer navigation or robot.
- The surgical approach chosen should minimize soft tissue dissection, minimize surgery time, reduce blood loss, and maximize joint stability to permit unrestricted postoperative range of motion.

Use of Tourniquets [S12, S28]

Recommendations

For TKA, the routine use of a tourniquet is not recommended. If used (e.g. cement application), reduce the application time to a minimum, minimize cuff pressure, and release before wound closure to perform optimal cauterization/hemostasis.

Data Collection

Use of tourniquet

Use of Drains[S12, S29-33]

Recommendations

- The routine use of surgical drains is not recommended for THA and TKA because they have no positive effect on wound infection, hematomas, and healing complication. Moreover, they increase postoperative nursing care and complicate ambulation.
- An option to reduce the risk of intraarticular hematoma formation is to use a flexion pillow (knee flexed at 60-80°) for the first 3-4 h after surgery.

Additional Information

The flexion pillow should be placed after wound closure in the operating room before patient transfer to the recovery unit. Flexion pillow use has been shown to significantly reduce calculated and hidden blood loss and improved range of motion (ROM) in the early postoperative period, which may contribute to early rehabilitation.

4 Intraoperative

Surgical Best Practices

Local Antimicrobials[S34]

Recommendations

- Routine use of antibiotic-loaded cement in primary THA or TKA is not generally recommended to reduce the risk of subsequent surgical site infections (SSIs)/PJIs.
- Antibiotic-impregnated cement may be used to reduce the risk of SSIs//PJIs, particularly in THAs. The benefits of antibiotic-impregnated cement versus its cost and other potential adverse effects may be most justified in patients at high risk of infection (e.g. diabetics).

Maintaining Normothermia[S35-36]

Recommendations

- Active patient warming, control of the operating room ambient temperature, and other methods, should be used to target a central core temperature of 36-37°C.
- Each facility should have a formal protocol to follow to maintain perioperative normothermia.

Tools and Equipment

- CAS Guidelines to the Practice of Anesthesia – Perioperative Temperature Management
- German guidelines – Preventing Inadvertent Perioperative Hypothermia
- NICE – Hypothermia: Prevention and Management in Adults having Surgery

Additional Information

Intraoperative and postoperative hypothermia are common in patients who have undergone orthopedic surgery. Intraoperative hypothermia, lower preoperative temperature, female sex, lower BMI, and older age are all reported risk factors for postoperative hypothermia.

4 Intraoperative

Surgical Best Practices

Wound Closure[S37-52]

Recommendations

- Wound closure should aim to prevent wound discharge, spontaneous evacuation of hematomas, patient concern (perception of hemorrhage), minimize dressing changes, and minimize nursing care.
- A watertight closure of the fascia in THA, and the joint capsule in TKA, might be favourable. One optimized method of sealing the skin can be accomplished by:
  - Subcuticular skin closure with barbed sutures or knotless tissue control device
  - Use skin glue to seal the incision and prevent wound discharge or retrograde contamination, and
  - Apply a light dressing once the glue is dry.

Additional Information

- Wound discharge is a major factor of distress for patients, especially when in outpatient surgery, and is a common reason for emergency consultation when hematoma discharge occurs at home.
- Eliminating/reducing dressing changes and staple removal helps to facilitate patient home care.
- Sealing the wound allow patients to resume personal activities of daily living like showering. It also improves patient satisfaction.
- If staples are used, special attention is required to application (i.e. staple placement) and removal time to prevent superficial infections.

Data Collection

Optimized wound closure

4 Intraoperative

Nutrition and Fluid Management

- **Fluid Management**[NF1, NF4-5]

Recommendations

- Judicious use of IV fluids is recommended.
- Balanced IV solutions such as Plasma-Lyte or Ringer's Lactate solution are recommended over normal saline.
- With less restrictive preoperative fasting instructions (see Fluid Management section for reduced fasting recommendations) and the absence of third space volume loss, the amount of IV fluid should be tailored with the intraoperative blood losses.

Additional Information

- There are limited studies published about intraoperative fluid techniques such as goal-directed fluid therapy in THA and TKA.
- Acute kidney injury is most often due to pre-existing kidney disease and postoperative hypotension, calling for increased focus on perioperative fluid management and patient optimization in individuals with pre-existing kidney disease.

5 Postoperative

Patient and Family Engagement

Involving Patients in their Care[P9-10]

Recommendations

- Use communication tools (e.g. whiteboards) to provide a constant reference point to help health care providers, patients and families know what's going on with patient care.
- Remind patients and their caregivers/families to refer to their Patient Optimization Booklet for Hip and Knee for goals of each postoperative day. Knowing recovery goals and schedule of the day is important to know for hospitalized patients.
- Improved nursing hand-offs at shift change.
- Consider involving patients and caregivers/families in the end of shift report.

5 Postoperative

Analgesia

• Pain Assessment

Recommendations

- Patients should be counselled to expect some pain after surgery, which should improve day-by-day.
- Opioids should only be prescribed to manage severe pain and should be discontinued as soon as pain is tolerable (i.e. not when the patient is pain free).
- Suboptimal analgesia should be assessed promptly by staff members trained in acute pain management.
- Measurement of analgesia and the side effects of analgesics, as well as measurement of anxiety should occur through a system that accounts for patient experience, function, and quality of life.

Tools and Equipment

Assess pain using the visual analogue scale, and ask the question,
“Is your pain tolerable?”.

5 Postoperative

Analgesia

• Multimodal Opioid-Sparing Pain Management[A20, A52]

Recommendations

- Opioids may be inevitable in pain management, but are a significant public health and patient safety issue when used inappropriately. Physicians must exercise caution in prescribing opioids.
- ERAS programs seek to minimize the use of opioids. However, opioids may be necessary to provide adequate pain relief when included as part of a multimodal approach.
- Avoid IV or SC analgesia in favor of a stepwise protocol starting with oral medication.
- Recommended pain control using a multimodal analgesia protocol:

  Regular medication
  - Acetaminophen 1000 mg TID PO until discharge, up to 1000 mg QID (max of 4 g/day) if pain is not relieved. Adjust dose to 500 mg/dose for hepatic impairment.
  - Celecoxib 100 mg BID PO

  If insufficient, a stepwise approach like the following example may be used:
  - Step 1: Tramadol 50-100 mg PO q 4-6 h as needed (PRN); maximum 400 mg/day
    - If CrCl is less than or equal to 30 ml/min, 50-100 mg PO q 12 h PRN; maximum 200 mg/day
  - Step 2: If tramadol is insufficient, add oxycodone 5-7.5 mg PO q 3 h PRN
  - Step 3: If tramadol and oxycodone are insufficient, replace oxycodone with hydromorphone 1-2 mg PO or 0.5-1 mg SC q 4 h PRN if the oral route isn't feasible.

Additional Information

- The duration of use of this combination is also unclear to achieve the best effect. Nevertheless, it is recommended to use regular multimodal analgesia based on NSAIDs and acetaminophen +/- PRN opioids and local anesthesia for the entire duration of pain levels above 4/10 (Numeric Rating Scale [NRS])
- Celecoxib is not recommended in patients who have allergies to sulfonamides, gastritis, cardiovascular disease, or severe renal insufficiency.
- Opioid and other analgesics dose selection should be tailored according to patient characteristics (e.g. weight, age, prior use).

Data Collection

Use of multimodal pain management

5 Postoperative

Surgical Best Practices

Urinary Retention Prevention[S12, S53-58]

Recommendations

- Routine use of urinary catheters is not recommended. If used, urinary catheters should be removed as soon as possible, ideally within 24 h after surgery.
- Patients who do not void in the first few hours after surgery should have a bladder scan. A volume greater than 600 cc requires catheterization.
- As a measure of safety, outpatients should void before discharge.

Additional Information

Various patient characteristics have been associated with urinary retention following arthroplasty, including advanced age and male sex related to prostatism.

Venous Thromboembolism (VTE) Prophylaxis[S12, S18, S59-64]

Recommendations

- Patients should be mobilized as soon as possible post-surgery.
- Patients should receive pharmacological anti-thrombotic prophylaxis treatment in accordance with local policy. For outpatient cases, oral drugs are favored to simplify home care and avoid injection teaching.
- Patients on anticoagulants preoperatively for another disease should have them restarted as soon as the clinical team deems it safe.

Additional Information

- Most DVTs occurs in the first 24 h after the start of anesthesia.
- Pharmacological intervention is recommended for 14 days for TKA, 28 days for THA and up to 35 days for patients with risk factors.
- Options to simplify postoperative care and to reduce cost, include:
  - Acetylsalicylic acid (ASA) 80 mg
  - Oral rivaroxaban (10 mg) once a day until POD 5 and then switch to aspirin (80 mg daily) for an additional 9 days after TKA or for 30 days after THA
  - Results of EPCATIII are anticipated to determine if aspirin alone is non-inferior to rivaroxaban and aspirin in the prevention of VTE (ClinicalTrials.gov)
- While there is unclear evidence to support the additional benefit of mechanical prophylaxis with pharmacological prophylaxis, they have been used effectively together in an outpatient protocol (i.e. no DVT formation in the first 12 h).

5 Postoperative

Surgical Best Practices

Venous Thromboembolism (VTE) Prophylaxis[S12, S18, S59-64]

Data Collection

Chemical VTE prophylaxis prescribed

Antimicrobial Prophylaxis[S20, S65]

Recommendations

Although there is no clear evidence to support the benefit of postoperative prophylactic antibiotic doses in primary THA and TKA, it is common practice that 1-3 doses maximum for a period of 24 h can be administered after surgery. If additional doses are required, the same oral equivalent of antibiotic used preoperatively can be given orally to outpatient cases so as not to delay discharge.

Additional Information

Guidelines from the Centers for Disease Control and Prevention (CDC) advocate for a single dose of perioperative antibiotics citing studies that are underpowered and primarily outside of orthopedics. From the limited evidence available, a single pre-incisional dose of antibiotics, compared to multiple doses, does not appear to increase rates of subsequent SSIs/PJIs.

Hip and Knee Precautions[S66-69]

Recommendations

Range of motion restrictions should be avoided to facilitate early mobilization and reduce patient anxiety. However, this decision should be left to the operating surgeon.

Additional Information

- There is no good evidence to support whether hip precautions with or without the addition of equipment and functional restrictions are effective in preventing dislocation and improving outcomes after THA.
- Depending on surgical training, volume, and approach, a few studies suggest standard hip precautions may be relaxed.

5 Postoperative

Nutrition and Fluid Management

Nutrition and Fluid Management[NF1, NF6]

Recommendations

- Unless patients experience nausea or vomiting, an early return to normal diet is recommended and should be promoted. Encourage patients to eat and drink as soon as they feel able.
- Routine discontinuation of IV maintenance fluid is recommended as soon as the patient is consuming fluid by mouth.
- In patients not tolerating oral fluid intake, a maintenance infusion of 1.5 ml/kg/h of IV fluids should be started.

Additional Information

No published study has examined the association of early feeding or nutritional supplementation with the accelerated achievement of discharge criteria. However, return to normal food intake is considered an essential component of ERAS protocols.

5 Postoperative

Mobility and Physical Activity

Patient Assessment Prior to Early Mobilization

Recommendations

- An appropriately trained health care provider (e.g. nurse, physiotherapist) should be responsible for the initial assessment prior to the first mobilization attempt.
- The initial evaluation and instructional session should occur within the first hours after surgery, according to lower limb motor function and patient ability to stand.
- There should be no range of motion restrictions on the operated hip or knee unless specified by the operating surgeon.

Additional Information

- Shift schedules for physiotherapists may need to be adjusted to facilitate implementation of these recommendations.
- For TKA, if in place, the flexion pillow should be removed 3-4 h after surgery.

In-Hospital Mobilization[M5-M12]

Recommendations

- Patients should be mobilized as early as they are able to facilitate early achievement of discharge criteria.
- Ideally, the physiotherapy exercise interventions after THA and TKA should be simple, using few and well-chosen exercises that are described in detail, adhering to basic exercise physiology principles.
- An appropriately trained health care provider (e.g. nurse, physiotherapist), should assist the first mobilization attempt.
- Throughout the hospital stay, patients should be encouraged to mobilize independently when considered safe or with assistance from a health care provider, family and/or friends.
- Cryotherapy may be useful for pain relief, and it can be used in combination with compression devices.
- Splints are not recommended for TKA.

5 Postoperative

Mobility and Physical Activity

In-Hospital Mobilization[M5-M12]

Implementation Approaches

- Patients should perform exercises to help with their circulatory and respiratory system in the immediate postoperative periods, including:
  - Foot and ankle pumping (10 times every h).
  - Inspirometer exercises (10 times every 1 h, holding for 2 secs. each time)
- On POD 0 all patients should be encouraged to mobilize out of bed (transfer from bed to chair, stand to sit, perform bathroom transfers) and walk regularly.
- For TKA, swelling of the knee is common if activity is increased too abruptly. Patients should allow sufficient time to rest and elevate their leg for the first 4 to 5 days post-surgery.
- From POD 1, patients should be encouraged to mobilize out of bed as much as possible according to their tolerance. Out of bed activities may include, but are not limited to, walking in the corridor and climbing stairs.

Tools and equipment

A walker, crutches or cane can be used to support walking for as long as 3-4 weeks. Patients should be encouraged to progressively discontinue using these devices as they regain their strength and balance.

Additional Information

The paucity and heterogeneity of existing studies that examine early supervised exercise therapy following THA and TKA surgery makes it challenging for clinicians to deliver high-quality evidence-based exercise programs in the early postoperative period.

Data Collection

First postoperative mobilization

6 Discharge

Patient and Family Engagement

• Engaging Patients in their Care

Recommendations

- Providers should address or answer any questions that patients and their caregivers/families may have related to the patient's condition or concerns with their discharge and follow-up.
- Encourage patients and their caregivers/families to review the "At home" section of their Patient Optimization Booklet for Hip and Knee prior to discharge.
- Encourage patients and their caregivers/families to ask questions as needed and/or use the teach-back method, as required.
- Ensure relevant members of the health care team are available to respond to questions or concerns patients or family members may have about the discharge plan.
- Educate patients and caregivers/families on the safe use and disposal of opioids.

Additional Information

More specific patient and family insights to support discharge are outlined below, in the Analgesia, Nutrition and Mobility sections.

6 Discharge

Analgesia

• Multimodal Opioid-Sparing Pain Management[A20, A53-56]

Recommendations

- Patients should continue taking celecoxib (100 mg BID) for a total of 30 days, and acetaminophen (1000 mg TID; 500 mg for hepatic insufficiency) for a total of 30-60 days.
- Non-pharmacologic therapies should be encouraged (e.g. ice, elevation, physical therapy).
- Do not prescribe opioids with other sedative medications (e.g. benzodiazepines) unless patients were already using them.
- Opioids can be prescribed for longer periods but specify on the prescription the quantity to be dispensed to cover the first weeks after surgery based on patient need.
- Educate patients on tapering of opioids as surgical pain resolves.
- Educate patients about the safe use of opioids, potential side effects, overdose risks, and developing dependence or addiction.
- Refer and provide resources for patients who have or are suspected to have a substance use disorder after surgery.
- If in place, patients should remove the scopolamine patch 3 full days after application.

Additional Information

- Celecoxib is not recommended in patients who have allergies to sulfonamides, gastritis, cardiovascular disease, or severe renal insufficiency.
- Clinicians should be aware that the risks for chronic opioid use increase with each additional day supplied.

6 Discharge

Surgical Best Practices

Patient Education[S70-72]

Recommendations

- Patients should be informed about the risk of transient bacteremia and the potential need for prophylactic antibiotics for future procedures like cystoscopy, transurethral prostatectomy, colonoscopy or upper gastrointestinal endoscopy.
- Routine antibiotic prophylaxis is not indicated for dental patients who have undergone THA or TKA.
- Patients should receive detailed information about how to identify and address potential adverse events, including signs of infection (draining of wounds, redness, fever, abnormal pain), signs of DVT (calf pain, limb swelling, shortness of breath, chest pain), and decreased range of motion (knee flexion below 90° after 4 to 6 weeks).

Surveillance

Recommendations

- For outpatient cases, if available in the area, a home visit in the first few days after surgery by a nurse to check the wound/dressing and vital signs may be performed.
- Follow-up visits according to the standard of care in the area should occur as needed in the first weeks after surgery.

6 Discharge

Mobility and Physical Activity

• Patient Education Prior to Discharge

Recommendations

- Before hospital discharge, all patients should receive education about the negative impact of sedentary behavior and the importance of physical activity for health.
- Patients should be informed of the return to work plan after THA and TKA, including time to return to work, and to either full or modified duties.

Implementation Approaches

- Education about post-discharge physical activity should be completed before discharge, if not done previously.
- Family members should be educated about how they can facilitate and encourage post-discharge physical activity.

6 Discharge

Mobility and Physical Activity

• Post-Discharge Physical Activity[M13-15]

Recommendations

- According to the standard of care in the area, physiotherapists should conduct a home visit or patients should attend an outpatient clinic, where the physiotherapists will assess patients and teach them teach how to progress prescribed hip and knee exercises.
- Tele-rehabilitation may also replace in person care if available.
- Patients should be encouraged not to stay in bed and resume activities of daily living (such as housework and running errands) progressively after hospital discharge.
- Patients should initially avoid strenuous physical effort. Low impact exercises such as swimming, cycling, and walking are encouraged (at low intensity levels) in the early weeks post-surgery once the wound is healed, swelling is controlled, and as the patient feels comfortable.
- Higher impact activities may start at 3 months post-surgery according to the surgeon's recommendations.

Implementation Approaches

Patients should be encouraged to follow recommendations on physical activity for health as outlined by the World Health Organization (WHO), as soon as it is safely possible

Data Collection

Outcome Measures:

- Outpatient surgery failure
- Acute length of stay
- Complication rate
- Visits to emergency department within 30 days after discharge
- Readmission within 30 days after discharge
- Return to work

Introduction

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Nutrition and Fluid Management

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Abbreviations

ACB, adductor canal block
ACTH, adrenocorticotrophic hormone
ASA, acetylsalicylic acid
BID, twice a day
BMI, body mass index
CDC, Centers for Disease Control and Prevention
COPD, chronic obstructive pulmonary disease
CNST, Canadian Nutrition Screening Tool
CPSI, Canadian Patient Safety institute
DVT, deep vein thrombosis
ERC, Enhanced Recovery Canada
ERAS, Enhanced Recovery After Surgery
FNB, femoral nerve block
HADS, Hospital Anxiety and Depression Scale
HMR, Hôpital Maisonneuve Rosemont
IPACK, infiltration between the popliteal artery and capsule of the knee
IPSS, International Prostate Symptoms Score (IPSS)
IV, intravenous
LIA, local infiltration analgesia
MUHC, McGill University Hospital Centre
MRSA, methicillin-resistant S. aureus
NPO, nothing by mouth
NRS, numeric rating scale
NSAID, nonsteroidal anti-inflammatory drug
PACU, post anesthesia care unit
PJI, periprosthetic joint infection
PO, by mouth
POD, postoperative day
PONV, postoperative nausea and vomiting
PRN, as needed
PROMIS, Patient-Reported Outcomes Measurement Information System
QHS, every bedtime
QID, four times a day
SC, subcutaneous
SSI, surgical site infection
THA, total hip arthroplasty
TKA, total knee arthroplasty
TID, three times a day
TIVA, total intravenous anesthesia
UKA, unicompartmental knee arthroplasty
WHO, World Health Organization

Discharge Criteria

It is necessary to have fixed discharge criteria, known to both patients and staff, for both parties to know when discharge should occur[1]. Numerous discharge criteria are used for THA and TKA patients. Based on the recommendations within this clinical pathway, we consider the criteria for postoperative discharge are met when:

- Blood pressure and pulse are stable and within the normal range.
- Oxygen saturation level on room air is 95% unless history of pulmonary problems.
- Nausea is mild or absent when at rest (seated or lying down).
- Pain is mild or absent: score 0-4/10 (NRS). Patient feels that the pain is at an acceptable level and managed with oral medication.
- Bleeding is considered to be minimal and there is no need to change the dressing.
- The patient is alert and oriented to person, place and time.
- On neurological assessment, the patient exhibits the following myotome movements: extension of the big toe, normal dorsiflexion eversion and plantar flexion, bilaterally, with equal movement on both sides. Additionally, the below knee dermatomes are normal.
- There are no signs to suggest the patient is at risk for a circulatory problem: pedal and tibial pulses are palpable and capillary refill of the big toe is present (important to compare with preoperative state).
- The patient has resumed an oral diet.
- Patient was able to void spontaneously.
- The physiotherapist or appropriately trained healthcare provider has assessed mobility and recommends discharge.
  - Gait is steady when using an assistive device (walker, crutches) and there is no dizziness.
  - The patient has functional joint range of mobility in the operated lower extremity, thus allowing for movement in and out of bed.
  - The patient can safely and independently maneuver stairs with a cane or crutches if necessary.
- The patient and patient's support person have received the necessary instructions about postoperative pain management.
- The patient has been issued the discharge prescriptions and received a follow-up outpatient clinic appointment.

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ERAS Outpatient Hip and Knee Arthroplasty Example from Hôpital Maisonneuve-Rosemont (HMR), Montreal QC

ERAS implies a multimodal approach where the combination of the different interventions will lead to a specific clinical result. To help the different teams implement their own protocol, we are providing an example with published clinical results. The detailed protocol results are publicly available[1]. This ERAS short-stay protocol resulted not only in improved patient care, but also in reduced direct health care costs and hospital length of stay (LOS). It was efficient at reducing the frequency of patient complications, including: pain, nausea, vomiting, dizziness, headache, constipation, hypotension, anemia, edema, gait impairment, and urinary retention ($p<0.001$-0.04). The detailed HMR protocol results are publicly available[1]. While the pathway below has demonstrated effectiveness, a number of other Canadian centers have established care pathways that have divergent features based on peer reviewed evidence. A copy of these protocols can be obtained by communicating directly with one the participating authors.

To be effective, ERAS protocols should be applied systematically and include the patient and family, supported through the efforts of the multidisciplinary team. In most cases, it involves important practice modifications. Willingness to modify the practices is the most important factor of success.

Patient selection

Inclusion criteria:

- Patient ability to give informed consent;
- Patient comprehension of the protocol.

Absolute exclusion criteria for an ERAS outpatient procedure:

- Coagulation disorder;
- Systemic disease involvement necessitating special perioperative care (intensive care, multiple transfusions, dialysis, etc.);
- Psychiatric disease limiting participation/cognitive impairment or communication problems;
- Significant locomotor problem, other than the joint to be replaced, imposing functional limitations that prevent movement without technical or physical assistance;
- Transportation barriers;
- Lack of assistance (physically, mentally) during the first postoperative week during home recovery, especially the first night after discharge;
- Absence of home services by the local community service centre in the area, if felt to be necessary.

Patient characteristics that merit caution and individual evaluation before attempting an ERAS outpatient procedure:

- Pulmonary embolism or DVT in the past year.
- BMI > 35 or 40 kg/m2
- Allergies/sensitivities to medications specified in the protocol.
- CrCl < 30 ml/min (Cockcroft-Gault formula)
- Previous need for long-term urinary Foley catheter in the postoperative period.

ERAS Outpatient Hip and Knee Arthroplasty Example from Hôpital Maisonneuve-Rosemont (HMR), Montreal QC

Pre-surgery evaluation and investigation

In addition to the standard of care for each institution, the following aspects should be added:

Nurse intervention
- Review selection and exclusion criteria
- Evaluate patient's level of anxiety and willingness to collaborate
- Confirm the presence of the presence of a caregiver postoperatively
- Provide patient and caregiver education on the ERAS program
- Describe the course of the ambulatory day
- Explain drugs administered in the protocol and side effects
- Answer all patient and caregiver questions

Internal medicine
- Evaluate and treat modifiable surgical risk factors and comorbidities
- Optimize and target a hemoglobin >130 g/l

Anesthesiologist
- Determine if the patient is a candidate for the specific medications and anesthesia included in the protocol.

Physiotherapist
- Physical assessment
- Teaching pre- and postoperative exercises and use of technical aids.

****Patients are encouraged to visit www.precare.ca for animated information about their surgery.***

Preparing for day surgery

Preparing for day surgery

- Patients should stop taking certain medications including: Hormone therapy (1 month); Anti-inflammatory (7 days); antiplatelet and anticoagulant: Coumadin, Pradax, Xarelto, aspirin (according to medical recommendations); and other over-the-counter products (2 weeks).
- The day before surgery the patient is directed to take a shower with chlorhexidine soap.

ERAS Outpatient Hip and Knee Arthroplasty Example from Hôpital Maisonneuve-Rosemont (HMR), Montreal QC

Day of surgery

- Solid food is allowed until midnight and clear fluids until 2 h before surgery.

Preoperative medication within 2 h before surgery:
- Acetaminophen 1 g PO,
- Oxycontin 10 mg PO,
- Celebrex 400 mg PO,
- Lyrica 150 mg PO,
- Aprepitant 125 mg PO,
- Scopolamine patch 1.5 mg applied behind the ear (remove after 72 h)

IV medications preoperatively
- Selected prophylactic antibiotic given within 30 min of surgery
- Dexamethasone 6-8 mg IV
- Tranexamic acid 1g IV (max 15 mg/kg) before skin incision

Anesthetic protocol
- Epidural anesthesia + propofol sedation
  Technique description: Epidural injection with 10-15 ml lidocaine 2% without epinephrine. Catheter is left in place during surgery in case additional injection is needed. Catheter is removed at the end of the procedure. Propofol perfusion is titrated (25-150 mcg/kg/min) to obtain a deep sedation with spontaneous breathing at the time of skin incision. Noradrenaline perfusion may be required to maintain blood pressure goals.
  Refer to Vendittoli et al. (2019) and Sağllik, Yazıcıoğlu, Çiçekler, and Gümüş (2015).[1-2]
- Avoid narcotics, sedatives, spinal anesthesia, and peripheral nerve blocks.

ERAS Outpatient Hip and Knee Arthroplasty Example from Hôpital Maisonneuve-Rosemont (HMR), Montreal QC

Day of surgery

Surgery

- Apply intermittent compression device for legs to the contralateral lower extremity
- Surgical approach
- TKA: avoid the use of the tourniquet (permitted if cementing)
- THA: large diameter (> 36mm) bearing is used to maximize joint stability (for posterolateral approach)
- Periarticular infiltration according to the following recipe.[1.3-4]
    - Solution for deep tissues of 110 ml: 10 ml of ropivacaine (10 mg/ml), 30 mg of ketorolac and 0.5 ml of adrenaline (1:1000) with 100 ml of ropivacaine 2 mg/ml (total of 300 mg of ropivacaine). This solution is injected into the deep tissues around the joint (periosteum, capsule, ligaments, tendon, etc.).
    - Solution for superficial tissues of 50 to 100 ml of ropivacaine 2 mg/ml (100-200 mg of ropivacaine).
- Close the fascia with barbed suture 1.0
- 1g IV tranexamic acid (max 15 mg/kg) prior to closing the surgical site
- Close the skin with subcuticular suture 3.0
- Seal wound with the cyanoacrylate glue closing system.
- Apply intermittent compression device for legs to the surgical lower extremity
- TKA: keep the knee bent at 60-70 degrees with positioning cushion

Recovery room

- Pain control by a multimodal analgesia protocol (avoid SC or IV drugs and opioids)
- Patient transfer to the outpatient unit when vital signs stable, controlled pain and nausea, alert, and coherent.

ERAS Outpatient Hip and Knee Arthroplasty Example from Hôpital Maisonneuve-Rosemont (HMR), Montreal QC

Outpatient unit

- Vital signs q 30 min x 2, 2 x q1h, q 4 h and neurovascular q 2 h until discharge
- Breathing exercises
- Pain control medication if needed
  - Step 1: Tramadol 50-100 mg PO q 4-6 h PRN (max. 400 mg/d, max. 200 mg/d if CrCl ≤30 ml/min)
  - Step 2: If insufficient, replace Tramadol with oxycodone 5-7.5 mg PO q 3 h PRN
  - Step 3: If insufficient, replace oxycodone with hydromorphone 1-2 mg PO q 4 h PRN or 0.5-1 mg SC if not tolerating PO
- IV fluid according to requirements Ringer Lactate solution, to end as soon as possible
  - Promote oral dietary intake as early as wanted
- Apply ice for 20 min as needed every 2 h until the next meeting with the physiotherapist or physiotherapy assistant or nurse
- Discontinue IV if stable vital signs (3-5 h post op)
- 3-4 h for TKA remove bending cushion
- Patient can sit in bed if comfortable
- No range of motion restriction of the operated joint
- First physiotherapist session
  - First attempt to stand and walk
  - Evaluate safety and autonomy during walking and transfers
  - TKA: apply cryo-compression device if available for 30 min every 2 h

Home medication and instruction

- Xarelto 10 mg PO to begin the day after surgery for 5 days for both TKA and THA, followed by 80 mg Aspirin PO for 9 days for TKA and 30 days for THA
- Tramadol 50 mg PO 1-2 tabs q 6 h PRN. If ineffective: oxycodone 5 mg PO 1-2 tabs q 4-6 h PRN
- Tylenol 1000 mg PO TID regular for 30-60 days
- Celecoxib 100 mg PO regular BID for 30 days
- Lyrica 75 mg QHS x 30 days only for TKA
- Book follow-up with orthopedic care provider as usual (4-8 weeks)
- Provide patient and their caregiver with summary sheet
- Provide emergency contact number
- Ensure patient leaves the hospital with caregiver

ERAS Outpatient Hip and Knee Arthroplasty Example from Hôpital Maisonneuve-Rosemont (HMR), Montreal QC

Home medication and instruction

Home care

- Nurse home visits by local health center, if available, or phone call or virtual care assessment.
  - Assess wound / dressing and vital signs
  - Further visit as needed or according to the local procedures
- Physiotherapist home visit if available or tele-rehabilitation
  - Teach and supervise exercise protocol
  - Further visit according to local protocol
- Standard outpatient clinic visits per standard care pathways (4-8 weeks postoperative)

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Data Collection and Measurement

Summary

This resource will guide clinicians through data collection and measurement to support the implementation of the *Enhanced Recovery Canada (ERC)* total hip and knee replacement surgery pathway. It includes information about how to identify your study population, how to calculate the appropriate sample size, as well as identifies what specific data points to be collected on each patient.

Study Population

It is helpful for teams to collect data on patients undergoing the same total hip and knee replacement surgeries to allow for data aggregation and comparisons. This is possible because each Canadian acute care institution reviews patient's charts after discharge and classifies their surgeries based on a universal coding system.

The World Health Organization created an international coding system of medical classifications; the International Statistical Classification of Diseases and Related Health Problems (ICD), version 10. Within *ERC*, we will use this coding system to describe the total hip and knee replacement surgeries which should be included in your patient population. By providing your Health Care Information Management and Technology Department with the following list of ICD-10 codes they should be able to provide data on the number of total hip and knee replacement surgeries performed monthly and details about the acute care stay of the patients who endured these procedures.

ICD-10 Code	Description of Procedure
0SR9019	Replacement of Right Hip Joint with Metal Synthetic Substitute, Cemented, Open Approach
0SR901A	Replacement of Right Hip Joint with Metal Synthetic Substitute, Uncemented, Open Approach
0SR901Z	Replacement of Right Hip Joint with Metal Synthetic Substitute, Open Approach
0SR9029	Replacement of Right Hip Joint with Metal on Polyethylene Synthetic Substitute, Cemented, Open Approach
0SR902A	Replacement of Right Hip Joint with Metal on Polyethylene Synthetic Substitute, Uncemented, Open Approach
0SR902Z	Replacement of Right Hip Joint with Metal on Polyethylene Synthetic Substitute, Open Approach
0SR9039	Replacement of Right Hip Joint with Ceramic Synthetic Substitute, Cemented, Open Approach
0SR903A	Replacement of Right Hip Joint with Ceramic Synthetic Substitute, Uncemented, Open Approach
0SR903Z	Replacement of Right Hip Joint with Ceramic Synthetic Substitute, Open Approach

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ICD-10 Code	Description of Procedure
0SR9049	Replacement of Right Hip Joint with Ceramic on Polyethylene Synthetic Substitute, Cemented, Open Approach
0SR904A	Replacement of Right Hip Joint with Ceramic on Polyethylene Synthetic Substitute, Uncemented, Open Approach
0SR904Z	Replacement of Right Hip Joint with Ceramic on Polyethylene Synthetic Substitute, Open Approach
0SR9069	Replacement of Right Hip Joint with Oxidized Zirconium on Polyethylene Synthetic Substitute, Cemented, Open Approach
0SR906A	Replacement of Right Hip Joint with Oxidized Zirconium on Polyethylene Synthetic Substitute, Uncemented, Open Approach
0SR906Z	Replacement of Right Hip Joint with Oxidized Zirconium on Polyethylene Synthetic Substitute, Open Approach
0SR90J9	Replacement of Right Hip Joint with Synthetic Substitute, Cemented, Open Approach
0SR90JA	Replacement of Right Hip Joint with Synthetic Substitute, Uncemented, Open Approach
0SR90JZ	Replacement of Right Hip Joint with Synthetic Substitute, Open Approach
0SRB019	Replacement of Left Hip Joint with Metal Synthetic Substitute, Cemented, Open Approach
0SRB01A	Replacement of Left Hip Joint with Metal Synthetic Substitute, Uncemented, Open Approach
0SRB01Z	Replacement of Left Hip Joint with Metal Synthetic Substitute, Open Approach
0SRB029	Replacement of Left Hip Joint with Metal on Polyethylene Synthetic Substitute, Cemented, Open Approach
0SRB02A	Replacement of Left Hip Joint with Metal on Polyethylene Synthetic Substitute, Uncemented, Open Approach
0SRB02Z	Replacement of Left Hip Joint with Metal on Polyethylene Synthetic Substitute, Open Approach
0SRB039	Replacement of Left Hip Joint with Ceramic Synthetic Substitute, Cemented, Open Approach
0SRB03A	Replacement of Left Hip Joint with Ceramic Synthetic Substitute, Uncemented, Open Approach
0SRB03Z	Replacement of Left Hip Joint with Ceramic Synthetic Substitute, Open Approach
0SRB049	Replacement of Left Hip Joint with Ceramic on Polyethylene Synthetic Substitute, Cemented, Open Approach
0SRB04A	Replacement of Left Hip Joint with Ceramic on Polyethylene Synthetic Substitute, Uncemented, Open Approach
0SRB04Z	Replacement of Left Hip Joint with Ceramic on Polyethylene Synthetic Substitute, Open Approach
0SRB069	Replacement of Left Hip Joint with Oxidized Zirconium on Polyethylene Synthetic Substitute, Cemented, Open Approach
0SRB06A	Replacement of Left Hip Joint with Oxidized Zirconium on Polyethylene Synthetic Substitute, Uncemented, Open Approach
0SRB06Z	Replacement of Left Hip Joint with Oxidized Zirconium on Polyethylene Synthetic Substitute, Open Approach
0SRB0J9	Replacement of Left Hip Joint with Synthetic Substitute, Cemented, Open Approach
0SRB0JA	Replacement of Left Hip Joint with Synthetic Substitute, Uncemented, Open Approach

Data Collection and Measurement

ICD-10 Code	Description of Procedure
0SRB0JZ	Replacement of Left Hip Joint with Synthetic Substitute, Open Approach
0SRC069	Replacement of Right Knee Joint with Oxidized Zirconium on Polyethylene Synthetic Substitute, Cemented, Open Approach
0SRC06A	Replacement of Right Knee Joint with Oxidized Zirconium on Polyethylene Synthetic Substitute, Uncemented, Open Approach
0SRC06Z	Replacement of Right Knee Joint with Oxidized Zirconium on Polyethylene Synthetic Substitute, Open Approach
0SRC0J9	Replacement of Right Knee Joint with Synthetic Substitute, Cemented, Open Approach
0SRC0JA	Replacement of Right Knee Joint with Synthetic Substitute, Uncemented, Open Approach
0SRC0JZ	Replacement of Right Knee Joint with Synthetic Substitute, Open Approach
0SRC0L9	Replacement of Right Knee Joint with Medial Unicondylar Synthetic Substitute, Cemented, Open Approach
0SRC0LA	Replacement of Right Knee Joint with Medial Unicondylar Synthetic Substitute, Uncemented, Open Approach
0SRC0LZ	Replacement of Right Knee Joint with Medial Unicondylar Synthetic Substitute, Open Approach
0SRC0M9	Replacement of Right Knee Joint with Lateral Unicondylar Synthetic Substitute, Cemented, Open Approach
0SRC0MA	Replacement of Right Knee Joint with Lateral Unicondylar Synthetic Substitute, Uncemented, Open Approach
0SRC0MZ	Replacement of Right Knee Joint with Lateral Unicondylar Synthetic Substitute, Open Approach
0SRC0N9	Replacement of Right Knee Joint with Patellofemoral Synthetic Substitute, Cemented, Open Approach
0SRC0NA	Replacement of Right Knee Joint with Patellofemoral Synthetic Substitute, Uncemented, Open Approach
0SRC0NZ	Replacement of Right Knee Joint with Patellofemoral Synthetic Substitute, Open Approach
0SRD069	Replacement of Left Knee Joint with Oxidized Zirconium on Polyethylene Synthetic Substitute, Cemented, Open Approach
0SRD06A	Replacement of Left Knee Joint with Oxidized Zirconium on Polyethylene Synthetic Substitute, Uncemented, Open Approach
0SRD06Z	Replacement of Left Knee Joint with Oxidized Zirconium on Polyethylene Synthetic Substitute, Open Approach
0SRD0J9	Replacement of Left Knee Joint with Synthetic Substitute, Cemented, Open Approach
0SRD0JA	Replacement of Left Knee Joint with Synthetic Substitute, Uncemented, Open Approach
0SRD0JZ	Replacement of Left Knee Joint with Synthetic Substitute, Open Approach
0SRD0KZ	Replacement of Left Knee Joint with Nonautologous Tissue Substitute, Open Approach
0SRD0L9	Replacement of Left Knee Joint with Medial Unicondylar Synthetic Substitute, Cemented, Open Approach
0SRD0LA	Replacement of Left Knee Joint with Medial Unicondylar Synthetic Substitute, Uncemented, Open Approach

Data Collection and Measurement

ICD-10 Code	Description of Procedure
0SRD0LZ	Replacement of Left Knee Joint with Medial Unicondylar Synthetic Substitute, Open Approach
0SRD0M9	Replacement of Left Knee Joint with Lateral Unicondylar Synthetic Substitute, Cemented, Open Approach
0SRD0MA	Replacement of Left Knee Joint with Lateral Unicondylar Synthetic Substitute, Uncemented, Open Approach
0SRD0MZ	Replacement of Left Knee Joint with Lateral Unicondylar Synthetic Substitute, Open Approach
0SRD0N9	Replacement of Left Knee Joint with Patellofemoral Synthetic Substitute, Cemented, Open Approach
0SRD0NA	Replacement of Left Knee Joint with Patellofemoral Synthetic Substitute, Uncemented, Open Approach
0SRD0NZ	Replacement of Left Knee Joint with Patellofemoral Synthetic Substitute, Open Approach

Sampling

A suggested sampling calculation is provided below.[1] This calculation recommends how many patient charts should be reviewed during the baseline period selected and the ongoing data collection through the implementation phase. This sampling is based on the number of total hip and knee replacement surgeries performed monthly.

Average Monthly Population Size "N"	*Minimum required sample "n"*
<20	No sampling; 100% of population required
20 - 100	20
> 100	15-20% of population size

Data Collection and Measurement

Collection Strategy

Before implementing the pathway, specific data points must be identified for collection which will demonstrate the process changes (process variables) or the impact of these changes (outcome variables). These data points must be obtained before any changes are made, then at scheduled time periods throughout the implementation to reflect progress.

Baseline data collection should occur over a 3-month period to ensure an accurate reflection of the surgical care provided. Monthly data collection and reporting is recommended to reflect the process changes and improvements in postoperative patient outcomes. Data should continue to be collected monthly until the team has determined that a level of sustainability has been reach.

It is recommended to collect both process and outcome variables

1. Perla RJ, Provost LP, Murray SK. Sampling considerations for health care improvement. *Qual Manag Health Care*. Oct.-déc. 2014;23(4):268-79. doi: 10.1097/QMH.0000000000000042

Process Variables

Enhanced Recovery programs are the implementation of evidence-based recommendation in the preoperative, intraoperative and postoperative phases. Thus, there are various process variables to be collected along the surgical continuum to ensure compliance to these recommendations. A process variable evaluates whether the recommended intervention is being followed. For example, if an organization is trying to reduce the need for blood transfusion in patients it may measure the process of administering tranexamic acid.

It is anticipated that process variables will be found via manual chart review, whether your organization document on paper or electronically. The recommended process variables are listed below, with a full description found in *Appendix D*.

Surgical Phase	Process Variables
Preoperative	• Pre-admission counselling and education • Preoperative risk assessment • Reduced fasting protocol • Use of pre-emptive medication

Data Collection and Measurement

Intraoperative	• Use of tranexamic acid • Approach to anesthesia minimizes opioids, sedatives, and motor function loss • Use of tourniquet • Use of LIA/regional nerve block • Optimized wound closure
Postoperative	• Use of multimodal pain management • Chemical VTE prophylaxis prescribed • First postoperative mobilization

Outcome Variables

An outcome variable determines if a specific intervention is having the desired effect on a clinical measure, such as reducing postoperative infection rates.

Recommended outcome variables are listed below, with full description found in *Appendix D*.

- Outpatient surgery failure
- Acute length of stay
- Complication rate
- Visits to Emergency Department within 30 days after discharge
- Readmission within 30 days after discharge
- Return to work

As previously mentioned, patient charts are reviewed and coded on discharge. This information is entered into the Discharge Abstract Database (DAD), including postoperative complications, acute care length of stay and readmissions to hospital. It is suggested to liaise with your organization's Health Care Information Management and Technology Department to extract this data, as it would significantly reduce data collection time and ensure consistency in collection methods between sites. By providing the Health Care Information Management and Technology Department with the list of ICD-10 codes used to define the hip and knee arthroplasty population, they can provide the number of hip and knee arthroplasties and the patient outcomes from information which has already been collected in your organization.

Process Variables

Preoperative Phase

• Pre-admission counselling and education

Intent of Variable	To capture whether or not the patient received counselling before admission describing expectations and detailing the postoperative care plan.
Definition	Preoperative counselling refers to the provision of written information prior to admission which details expectations specific to enabling patients to be active participants in their care.
Criteria	Describe if patient was provided with specific written instructions detailing expectation and responsibilities before surgery and after surgery. • Yes: Patient provide with specific written instruction. • No: Patient not provided with specific written instruction.
Options	• Yes • No
Scenarios to Clarify (Assign Variable)	• N/A
Scenarios to Clarify (Do NOT Assign Variable)	• N/A
Notes	Hospitals can meet these criteria by providing the ERC Patient Optimization Guide, precare.ca hip surgery and knee surgery videos, or having their own similar instructions which address elements such as preoperative skin preparation and limited fasting, as well as postoperative pain control and mobilization/exercise.

Process Variables

Preoperative Phase

• Preoperative risk assessment

Intent of Variable	To capture whether or not the patient received a preoperative risk assessment prior to surgery.
Definition	A preoperative risk assessment identifies comorbidities that may affect surgery and/or require additional preoperative workup and optimization.
Criteria	A preoperative risk assessment prior to surgery includes the most common pre-existing medical conditions: • Allergies to drugs listed in the pathway • Obesity • Malnutrition • Diabetes • Chronic kidney disease • Hepatic diseases (e.g. hepatitis, liver cirrhosis) • Depression • Cardiovascular disease • Lung disease (e.g. COPD) • Anemia (hemoglobin <130 g/L for men and women) • Neurologic (e.g. myasthenia gravis) And other modifiable risk factors: • Excessive alcohol consumption • Tobacco use • Specific drugs to be discontinued before surgery • Prostatic symptoms (males) • Urinary infection symptoms • MRSA carrier
Options	• Yes • No
Scenarios to Clarify (Assign Variable)	• N/A
Scenarios to Clarify (Do NOT Assign Variable)	• N/A
Notes	

Process Variables

Preoperative Phase

• Reduced fasting protocol

Intent of Variable	To capture whether or not the patient was instructed to follow a reduced fasting protocol.
Definition	Preoperative fasting is defined as a prescribed period of time before surgery when patients are not allowed the oral intake of liquids or solids. A reduced fasting protocol allows clear fluids up to 2 h and solid food 6 h prior to anesthesia.
Criteria	Patient was instructed that intake of solids until 6 h prior to the induction of anesthesia, and unrestricted clear fluids until 2 h prior to induction of anesthesia was permitted, unless a patient has documented delayed gastric emptying or other contraindications
Options	• Yes, patient was instructed about the reduced fasting protocol • No, patient had stricter preoperative diet restrictions
Scenarios to Clarify (Assign Variable)	• N/A
Scenarios to Clarify (Do NOT Assign Variable)	• N/A
Notes	Patients with an increased risk of pulmonary aspiration and with fluid restrictions should be considered on a case by case basis. Preoperative diet restrictions may need to be extended.

Process Variables

Preoperative Phase

- **Use of pre-emptive medication**

Intent of Variable	To capture what pre-emptive medications the patient received.
Definition	Pre-emptive medication is administered prior to anesthesia for surgery to prevent nausea and vomiting and to reduce postoperative pain. Pre-emptive medications include: • Acetaminophen • NSAID • Long-acting opioids • Dexamethasone • Antiemetics
Criteria	• Yes, patient received all 5 pre-emptive medications listed above • Yes, patient received 3-4 pre-emptive medications from the list above. Contraindications were documented (e.g. allergy, intolerance, risk factors) • No, patient received < 3 pre-emptive medications listed above without a documented reason
Options	• Yes, all 5 pre-emptive medications • Yes,3-4 pre-emptive medications • No, < 3 pre-emptive medications
Scenarios to Clarify (Assign Variable)	
Scenarios to Clarify (Do NOT Assign Variable)	
Notes	

Process Variables

Intraoperative Phase

- **Use of tranexamic acid**

Intent of Variable	To capture whether a patient received tranexamic acid in the perioperative period.
Definition	Administration of tranexamic acid to minimize intraoperative/ postoperative blood loss.
Criteria	Indicate whether or not tranexamic acid was administered perioperatively.
Options	• Yes, oral • Yes, IV • Yes, topic • Yes, combination • No
Scenarios to Clarify (Assign Variable)	• N/A
Scenarios to Clarify (Do NOT Assign Variable)	• N/A
Notes	It is unclear if there is a difference in blood loss when tranexamic acid is used with different administration methods (oral, IV, topical) and with a single or multiple dose.

Process Variables

Intraoperative Phase

- **Approach to anesthesia minimizes opioids, sedatives, and motor function loss**

Intent of Variable	To capture whether an approach to anesthesia that avoids prolonged motor function loss, opioids and sedatives was employed in the preoperative holding area, operating room, PACU, or recovery area.
Definition	Anesthesia includes lumbar epidural plus propofol, spinal (intrathecal) injection, and general anesthesia.
Criteria	Indicate whether a form of regional anesthesia was employed • Yes, lumbar epidural plus propofol sedation was performed. • Yes, a spinal (intrathecal) injection for anesthesia was performed using short-acting anesthetics without intrathecal opioids or using very short-acting ones. • Yes, general anesthesia favoring propofol-based total IV anesthesia was used • No, none of the above regional anesthesia methods were employed
Options	• Yes, lumbar epidural • Yes, spinal (intrathecal) injection • Yes, general anesthesia • No, none of the above were employed
Scenarios to Clarify (Assign Variable)	• N/A
Scenarios to Clarify (Do NOT Assign Variable)	• N/A
Notes	

Process Variables

Intraoperative Phase

• Use of tourniquet

Intent of Variable	To capture whether a tourniquet was used for knee arthroplasty.
Definition	Use of a tourniquet to provide a bloodless field of view for surgery, to help reduce intraoperative blood loss and to improve cement penetration. If used, tourniquet pressure and time period should be minimized.
Criteria	Indicate whether or not a tourniquet was used during knee arthroplasty.
Options	• Yes, for the whole procedure • Yes, for cementation only • No
Scenarios to Clarify (Assign Variable)	• N/A
Scenarios to Clarify (Do NOT Assign Variable)	• N/A
Notes	Use of a tourniquet may increase postoperative pain and blood loss, as well as reduce patient quadricep function.

Process Variables

Intraoperative Phase

• Use of LIA/regional nerve block

Intent of Variable	To capture whether LIA is used for both THA and TKA, and whether a regional nerve block is used for TKA.
Definition	LIA infiltrates a large volume of local anesthetic agent throughout the wound at the time of surgery. The anesthetic is: • Diluted • Long-acting • Often with adjuvants Several combinations of drugs and dosages have been proposed for LIA. Drug combinations include: • Ropivacaine or bupivacaine • Epinephrine • Adjuvants like NSAIDs, corticosteroid or opioids. A regional nerve block is injected near a specific nerve or bundle of nerves to block sensations of pain from a specific area of the body.
Criteria	Indicate whether some form of LIA was used for THA and TKA, and whether a regional nerve block was used for THA.
Options	For THA patients: • Yes, LIA was used • No, LIA was not used For TKA patients: • Yes, both LIA and a regional nerve block were used • No, LIA or a regional nerve block were not used together
Scenarios to Clarify (Assign Variable)	• N/A
Scenarios to Clarify (Do NOT Assign Variable)	• N/A
Notes	Several combinations of drugs and dosages have been proposed for LIA but there is limited evidence to confirm superiority of a specific recipe. We do not recommend adding opioids to LIA because there is no clear benefit of doing so, and because ERAS protocols aim to minimize the use of opioids. ACB with LIA is recommended over FNB for most patients because ACB is associated with better ability to ambulate and improved quadricep strength.

Process Variables

Intraoperative Phase

- **Optimized wound closure**

Intent of Variable	To capture whether an optimized approach to wound closure was used.
Definition	An optimized wound closure method aims to minimize/avoid postoperative wound discharge, dressing changes and nursing care. The dressing should be lightweight (not circumferential) to support joint mobilization and permit early return to activities of daily living (e.g. showering). Patient preference is an important factor to consider.
Criteria	Indicate whether or not an optimized wound closure method was used.
Options	• Yes, with subcuticular suture and skin glue sealing • Yes, with skin staples and optimized dressing • No, optimized wound closure not used
Scenarios to Clarify (Assign Variable)	• N/A
Scenarios to Clarify (Do NOT Assign Variable)	Staples with a large John's dressing and a splint
Notes	

Process Variables

Postoperative Phase

- **Use of multimodal pain management**

Intent of Variable	To capture whether multimodal approaches to pain management were utilized postoperatively.
Definition	Multimodal pain management is defined as use of ≥2 drugs and/or interventions, NOT including systemic opioid, that act by different mechanisms to provide analgesia. These drugs and/or interventions can be administered via the same route or different routes. Opioids may be administered for pain relief when indicated but will not count towards this measure. Strategies or medications that would qualify include ≥2 of the following: • NSAIDs (including ibuprofen, ketorolac, COX-2 inhibitors) • Acetaminophen • Regional anesthesia • Cryotherapy
Criteria	Indicate whether a multimodal approach to pain management was used in the postoperative period. • Yes, ≥2 of the above analgesics were administered (concurrently) in the postoperative period within 12 h of surgery finish time. • Yes: If a patient was discharged within the 12 h of surgery end time but has any 2 of the above medications listed as outpatient prescriptions for pain management or instructions to take any two of the above medications for pain management on discharge instructions. • No: ≥2 of the above analgesics were not administered simultaneously in the postoperative period within the 12 h of surgery finished time
Options	• Yes • No
Scenarios to Clarify (Assign Variable)	• N/A
Scenarios to Clarify (Do NOT Assign Variable)	• PRN orders for pain medication alone would not qualify
Notes	• Combination opioid medications which include acetaminophen, do not count as a dose of acetaminophen.

Process Variables

Postoperative Phase

• Chemical VTE prophylaxis prescribed

Intent of Variable	To capture the prescription of prophylactic measures/ therapeutic medication to prevent DVT or pulmonary embolism after orthopedic surgery (14 days for TKA, 28 days for THA and up to 35 days for patients with risk factors).
Definition	Pulmonary embolism is the lodging of a blood clot in the pulmonary artery with subsequent obstruction of blood supply to the lung parenchyma. DVT are blood clots that usually form in the deep veins of the lower limbs or the pelvic venous system.
Criteria	The patient is prescribed one of the modalities listed below for any reason, including as prophylactic treatment or therapeutic management through 14 (TKA), 28 (THA), and up to 35 days (patients with risk factors) from the date of operation. Should capture new prescriptions for prophylaxis or if patient was on prophylaxis prior to surgery, and continues the medication through 14, 28, and up to 35 days post-op.
Options	• Yes • No
Scenarios to Clarify (Assign Variable)	• Aspirin combined wtih other anti-coagulant • Aspirin alone • Low molecular weight heparin • Unfractionated heparin • Warfarin • Fondaparinux sodium • Oral factor 10A inhibitor • Direct thrombin inhibitor
Scenarios to Clarify (Do NOT Assign Variable)	• Clopidogrel, ticagrelor, ticlopidine, cilostazol, abciximab, eptifibatide, tirofiban, dipyridamole • Mechanical device only • Do not assign if there is no clear evidence of prophylaxis • Therapy not continued for 14 (TKA), 28 (THA), or up to 35 (high risk patients) days
Notes	• If uncertain, please ask surgeon or surgeon champion. • If unknown, default answer is “No.”

Process Variables

Postoperative Phase

• First postoperative mobilization

Intent of Variable	To capture the date and time when a patient is first mobilized following surgery.
Definition	Mobilization is defined as ambulation, with weight-bearing as tolerated, including with the assistance of a walking aid. A patient has been mobilized if they perform either of the following: • Ambulation over a distance of ≥10 m • Ambulate for a duration of ≥5 mins
Criteria	Specify the first documented date and time of patient ambulation following surgery. • Day of Surgery • POD 1 • POD 2 • ≥ POD 3 • N/A: Patient discharged prior to mobilization or documentation of first mobilization not available
Options	• Day of Surgery • POD 1 • POD 2 • ≥ POD 3 • N/A: Patient discharged prior to mobilization or documentation of first mobilization not available
Scenarios to Clarify (Assign Variable)	• N/A
Scenarios to Clarify (Do NOT Assign Variable)	• Standing at bedside • Up to chair
Notes	

Outcome Variables

Please note that definitions with (*) were provided through Canadian Coding Standards and apply to all data sets submitted to the Discharge Abstract Database (DAD).

Outcome Variable	Definition
Outpatient Surgery Failure	Failure to be discharged on the day of surgery when an outpatient procedure was planned.
Acute Length of Stay*	For inpatient cases. Acute Length of Stay (LOS) is the Calculated Length of Stay minus the number of Alternative Level of Care (ALC) days. The ALC designation identifies a patient is occupying a bed in a facility and does not require the intensity of resources/services provided in that care setting.
Complication Rate*	Complication: a post-intervention condition or symptom that is not attributable to another cause arises during an uninterrupted, continuous episode of care within 30 days following the intervention, or a cause/effect relationship is documented, regardless of timeline. List of frequent complications to be recorded: • Pain control problem • Nausea • Vomiting • Bladder retention • Hypotension • Dizziness • Headache • Pruritus • Constipation • Edema • Hematoma • Wound discharge >3 days • Fall • Orthostatic hypotension • DVT • Anemia • Transfusion • SSI (superficial wound) • SSI (deep) • Pulmonary embolism • Urinary tract infection • Unplanned return to operating room • Readmission • Mortality • Other, describe: _____

Outcome Variables

Please note that definitions with (*) were provided through Canadian Coding Standards and apply to all data sets submitted to the Discharge Abstract Database (DAD).

Outcome Variable	Definition
Complication Rate*	Note: the 30-day timeline does not apply when a patient has been discharged. This is considered an interruption in care. To clarify, postoperative complications occurring after discharge are not recorded. Complication rate is caused by: Number of patients who experience a complication --- Total number of patients who underwent surgery
Visits to Emergency Department within 30 Days after Discharge*	Patients who were discharged from an acute care institution after surgery but were readmitted to an acute care institution within 30 days after the discharge. Note: there may be limitations to accessing information of patients who are readmitted outside the regional health authority.
Readmission within 30 Days after Discharge*	Patients who were discharged from an acute care institution after surgery but were readmitted to an acute care institution within 30 days after the discharge. Note: there may be limitations to accessing information of patients who are readmitted outside the regional health authority.

Return to Work	For patients who were employed before surgery:
	• Return to work date
	  ○ Date: DD/MM/YY
	  ○ Unknown
	• Return to work situation
	  ○ Normal duties
	  ○ Modified duties

Template for Physician Order Set - Preoperative

Enhanced Recovery After Hip and Knee Arthroplasty

Patient Name	
Health Care Number	
Date of Birth	

Weight:____kg Height:____cm Allergy(s):_____ Intolerance(s):_____

TYPE OF INTERVENTION

√ Evaluate if patient has contraindications to an enhanced recovery mode: see exclusion criteria and cautions outlined in clinical pathway

- ☐ Total hip arthroplasty (THA) **or** ☐ Unicompartimental knee arthroplasty (UKA) **or** ☐ Total knee arthroplasty (TKA)
- ☐ Inpatient **or** ☐ Outpatient

PREOPERATIVE EVALUATIONS

√ Evidence-informed preoperative assessment

√ Optimize all pre-existing medical conditions and risk factors, including:

- ☐ Obesity
- ☐ Chronic kidney disease
- ☐ Depression
- ☐ Lung disease
- ☐ Neurologic disorder
- ☐ Prostatitis symptoms
- ☐ Substance abuse (smoking, alcohol, drugs)
- ☐ MRSA screening if endemic
- ☐ Diabetes
- ☐ Hepatic disease
- ☐ Cardiovascular disease
- ☐ Anemia (hemoglobin <130 g/L for men and women)
- ☐ Malnutrition

Anxiety and depression

CONSULTATIONS

√ Internal medicine

√ Physiotherapy

√ Other(s):

PATIENT AND FAMILY EDUCATION

√ Provide patient with information to participate effectively in their health care (patient booklets, Precare videos)

√ Changes to patient medication regimens

√ Instructions for preoperative fasting

√ Instructions for cleaning skin with chlorhexidine the night before and the morning of surgery

Template for Physician Order Set - Preoperative

Enhanced Recovery After Hip and Knee Arthroplasty

Patient Name	
Health Care Number	
Date of Birth	

PREOPERATIVE PREPARATIONS

√ Solid foods until 6 h before surgery and clear fluids until 2 h before surgery
Extended diet restrictions (e.g. gastroparesis, dialysis)

√ Chlorhexidine skin cleaning night before and morning of surgery

√ Samples: - FSC control, cross-match

PHARMACOTHERAPY

- **1-2 h preoperative**

√ Analgesia

☐ Acetaminophen 1 g PO x 1 dose

☐ Celecoxib 400 mg PO x 1 dose (do not give if allergic to sulfas or severe heart disease)

☐ Long-acting opioid x 1 dose:

☐ Oxycodone-CR or OxyNEO 10 mg PO **or**

☐ Hydromorphone-CR or hydromorph contin 3 mg PO **or**

☐ Morphine (12-h release formula) 15 mg PO **or**

☐ Other: _____

√ Antiemetic

☐ Aprepitant 125 mg PO x 1 dose or ondansetron 4 mg PO x 1 dose

☐ Transdermal scopolamine 1.5 mg patch (unless glaucoma, >70 years old, risk of confusion or delirium)

Template for Physician Order Set - Intraoperative

Enhanced Recovery After Hip and Knee Arthroplasty

Patient Name	
Health Care Number	
Date of Birth	

Weight:____kg Height:____cm Allergy(s):_____ Intolerance(s):_____

Operating Room

√ Administer IV antibiotic (administration timing depends on selected antibiotic)

- ☐ Dexamethasone 4-8 mg IV, 0-6 mins. before incision, infused over 15 mins.
- ☐ Tranexamic acid
  - ☐ 10-15 mg/kg IV before incision **or**
  - ☐ 1 g/50 ml of normal saline applied into wound at end of the procedure **or**
  - ☐ 2 g PO approximately 2 h before desired effect of medication
  - ☐ Additional dose(s): _____

Anesthesia, general guidelines:

√ Balanced IV solutions tailored to the intraoperative blood losses

√ Avoid benzodiazepines

√ Avoid opioids

√ Minimize motor function loss and duration

√ Regional nerve block (for TKA)

Local anesthetic infiltration protocol administered by surgeon

Ropivacaine 400 mg in 200 cc

100 cc for deep infiltration add 30 mg of ketorolac and 0.5 ml of adrenaline (1:1000)

Wound closure, general guidelines:

√ Aim to prevent wound discharge, spontaneous evacuation of hematomas, patient concern (perception of hemorrhage), minimize dressing changes, and minimize nursing care

TYPE OF INTERVENTION

☐ THA or ☐ UKA or TKA Date: ____/____/____

Template for Physician Order Set - Intraoperative

Enhanced Recovery After Hip and Knee Arthroplasty

Patient Name	
Health Care Number	
Date of Birth	

CARE AND SURVEILLANCE

- Vital signs: q 30 min. x 2, q 1 hx 2, q 4 hx 24 h
- Neurovascular signs: q 2 h for 8 h or ad departure
- Inspirometer exercises: 10 times q 1 h hold 2 sec.
- Food and ankle pumping: 10 times q 1 h
- Monitor urination:
  - If patient does not void in the first few hours after surgery order bladder scan. If more than 600 cc perform bladder catheterization
  - Outpatients should void before discharge
- Consider intermittent pneumatic compression device on opposite leg when in bed
- For TKA: flexion pillow under knee, keep 3 to 4 h
- Mobilization as soon as possible on POD 0: first get up by appropriately trained health care provider
- No range of motion restrictions or ☐ _____
- Cryotherapy according to physiotherapy

FLUID AND ELECTROLYTE REPLENISHMENT

- Balanced IV solution of 1.5 ml/kg/h
- Discontinue as soon as patient consuming fluids by mouth

FOOD

- Return to normal food intake as soon as possible

Template for Physician Order Set - In-Hospital Postoperative Prescriptions

Enhanced Recovery After Hip and Knee Arthroplasty Preoperative

Patient Name	
Health Care Number	
Date of Birth	

Weight:____kg Height:____cm Allergy(s):_____ Intolerance(s):_____

PHARMACOTHERAPY

ANALGESIA/COANALGESIA (from the recovery room on departure)

- ☐ Acetaminophen 1000 mg PO TID until discharge, up to 1000 mg QID (maximum of 4 g/day) if pain not relieved. Adjust dose to 500 mg/dose for hepatic impairment
- ☐ Celecoxib 100 mg PO BID (contraindicated if allergic to sulfas, gastritis or severe cardiovascular disease)
- ☐ If non-opioid medications insufficient, administer oral opioids using a stepwise approach
- ☐ Other: _____

Antiemetics

√ Keep scopolamine 1.5 mg patch in place for 3 full days after application

Prophylactic Anticoagulotherapy

- ☐ Rivaroxaban 10 mg PO once a day until POD 5 and then continue with
  Aspirin 80 mg PO once a day from POD 6 to POD 30 or 35 (THA) or from POD 6 to 14 days (TKA)
- ☐ Other: _____

Template for Physician Order Set - Discharge Prescriptions

Enhanced Recovery After Hip and Knee Arthroplasty

Patient Name	
Health Care Number	
Date of Birth	

TYPE OF INTERVENTION

☐ THA or ☐ UKA or TKA Date: ____/____/____

LEAVE AND CONTINUITY OF CARE

- As soon as patient meets criteria for returning home: see clinical pathway (appendix B)
- Follow-up appointment with Dr Date: ____/____/____
- Control X-ray

ANALGESIA

√ 1000 mg TID from POD 0 to POD 30-POD 60 (or 500 mg for hepatic insufficiency)

√ Celecoxib 100 mg BID from POD 0 to POD 30 (contraindicated if allergic to sulfas, gastritis or severe cardiovascular disease)

☐ Other(s): _____

General guidelines:

- Do not prescribe opioids with other sedative medications unless patients were already using them
- Opioids can be prescribed for longer periods but specify on prescription quantity to be dispensed to cover first weeks after surgery based on patient need

ANTIEMETICS

√ Remove scopolamine 1,5 mg patch 3 full days after application

ANTICOAGULATION

Rivaroxaban 10 mg PO once a day from POD 0 to POD 5 and then continue with Aspirin 80 mg PO once a day from POD 6 to POD 35 (TKA) or 30 from POD 6 to POD 14 days (THA)

☐ Other: _____

SURVEILLANCE, general guidelines:

- For outpatient cases, if available in area, home visit in first few days after surgery by nurse to check wound/dressing and vital signs may be performed
- Follow-up visits according to standard of care in area should occur as needed in first weeks after surgery

PHYSCIAL ACTIVITY, general guidelines:

- According to standard of care in area, physiotherapists should conduct home visit or patients should attend outpatient clinic, where physiotherapists will assess patients and teach them teach how to progress prescribed hip and knee exercises
- Tele-rehabilitation may replace in person care if available

Enhanced RECOVERY Canada™