

# Rapid Recovery™ Program

WHITE PAPER 2021

*An evidence-based program that  
combines fast-track surgery,  
process optimization and  
patient engagement*

# WHITEPAPER

# RAPID RECOVERY™ PROGRAM

# INDEX

## Introduction

---

## Rapid Recovery™ Program benefits

---

## Needs and challenges

---

## Optimal clinical approaches evidence-based consensus

### Consensus context

#### Preoperative

Preoperative optimization  
Patient information and apps  
Thromboembolic prophylaxis

#### Perioperativ

Perioperative pain management  
Anesthesia protocol  
Local infiltration analgesia  
Surgical factors  
Tourniquets  
Blood management  
Drains  
Wound management  
The role of implant

#### Postoperativ

Postoperative process redesign, clinical enhancement and patient management

---

## Making it happen with Biomet Zimmer



# RAPID RECOVERY PROGRAM WITH ZIMMER BIOMET



**Rapid Recovery aims to optimize all aspects of patient care. Over the past 20 years, the program has delivered impactful and sustainable change across Europe, through multidisciplinary collaboration and clearly defined standards.**

At Zimmer Biomet our mission is to alleviate pain and improve the quality of life for people around the world. As healthcare providers, our main goal is to facilitate the best available treatment.

We focus on enabling healthcare teams to address patient and staff needs – before, during and after hospital stays. This is why Zimmer Biomet developed Rapid Recovery, an established evidence-based pathway optimization program for total joint arthroplasty (TJA), empowered by a clinician advisory board with outstanding expertise in fast-track surgery.

This White Paper is designed to support Rapid Recovery implementations. It covers the most important features of fast-track total hip arthroplasty (THA) and total knee arthroplasty (TKA) processes and clinical approaches. It aims to provide an overview on where to focus, which clinical enhancements to implement, and what the barriers to improvement are.

The evidence-based clinical summary content has been written, reviewed and validated as a consensus statement by the Zimmer Biomet Rapid Recovery Advisory Board members. The other parts of the document have been written by the Zimmer Biomet Connect team. The list of references is by no means exhaustive. It represents the major contributions to the various aspects as judged by the authors.

#### **Zimmer Biomet Rapid Recovery Advisory Board members**

Prof Michael Clarius  
Prof Kirill Gromov  
Prof Henrik Kehlet  
Prof Oliver Pearce  
Prof Emmanuel Thienpont  
Dr Stephan Vehmeijer

#### **Moderator**

Prof Sebastien Parratte,  
*Chief Medical Advisor Zimmer Biomet EMEA*



**“ To me, the Rapid Recovery Program is a revolutionary approach to the package of care that our patients receive. Lengths of stay are down, patient satisfaction has improved significantly, and staff engagement is high.**

Mr Ian Holloway,  
*Consultant Orthopaedic Surgeon*

**”**



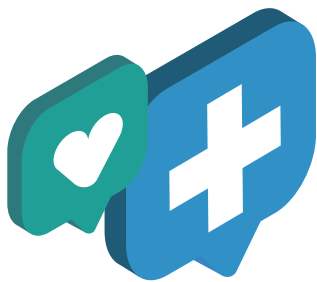
# RAPID RECOVERY: TOGETHER WE CAN ACHIEVE MORE



The Rapid Recovery Program has empowered our staff to focus on the best care for our patients. By doing so our patients have a consistently better experience, resulting in a quicker and more comfortable recovery.

This in turn has considerably reduced our patients' length of stay, enabling a 40% increase in throughput while utilising the same number of beds.

*Mr Andrew T Johnston  
Consultant in Trauma and Orthopaedics  
Clinical Lead, Elective Orthopaedic Surgery  
Woodend Hospital, Aberdeen UK*



Healthcare costs are rising globally – including a greater demand for joint replacements due to increasing life expectancies<sup>1</sup>. Healthcare professionals (HCPs) are expected to achieve more with less. **Fast-track protocol implementation is a cost-effective strategy for patients undergoing joint replacement, associated with substantial quality-adjusted life years improvements and reduced costs<sup>1</sup>.**

Hospitals already aim to provide affordable and efficient access to treatment while maintaining quality of orthopedic care and improving clinical outcomes. But new approaches are needed to truly optimize efficiency and productivity without neglecting the quality of clinical results.

Hospitals in Europe that follow an intensive recovery program for their patients, like the

Rapid Recovery Program, achieve **statistically significant savings of around 20% in costs per procedure**, compared with a standard clinical pathway<sup>2,3</sup>. Furthermore, patients who follow the pathway and accelerated processes experience a notable **increase in satisfaction and quality of life** after discharge versus standard care<sup>2,3</sup>.

Zimmer Biomet offers hospitals a proposal for savings, both financially and in the use of resources, while at the same time, the team of caregivers/multidisciplinary team sees **improved results<sup>4,5</sup> and the patient experiences the benefits of early rehabilitation<sup>6</sup>**. We offer evidence-based programs that add value to organizations through medical and business process redesign to get better and more predictable outcomes<sup>2</sup>.

1. Jansen JA, Kruidenier J, Spek B, Snoeker BAM. A cost-effectiveness analysis after implementation of a fast-track protocol for total knee arthroplasty. *Knee* 2020; 27: 451-458.
2. Büttner M, Maye AM, Büchler B, Betz U, Drees P, Susanne S. Economic analyses of fast track total hip and knee arthroplasty: a systematic review. *European Journal of Orthopaedic Surgery & Traumatology* 2020; 30: 67-74.
3. Larsen K, Hansen TB, Thomsen PB, Christiansen T, Søballe K. Cost-effectiveness of accelerated perioperative care and rehabilitation after total hip and knee arthroplasty. *J Bone Joint Surg Am* 2009; 91: 761-772.
4. Khan SK, Malviya A, Muller SD et al. Reduced short-term complications and mortality following Enhanced Recovery primary hip and knee arthroplasty: results from 6,000 consecutive procedures. *Acta Orthop* 2014; 85: 26-31.
5. Houlihan-Burne DG, Akhtar KSN. Optimization of the Patient Undergoing Total Knee Arthroplasty - The Rapid Recovery Programme. The UK, Hillingdon hospital & Mount Vernon hospital. *Journal of Clinical Rheumatology & Musculoskeletal Medicine* 2010; 1: 2.
6. Specht K, Kjaersgaard-Andersen P, Kehlet H, Wedderkopp N, Pedersen BD. High patient satisfaction in 445 patients who underwent fast-track hip or knee replacement. *Acta Orthop* 2015; 86: 702-707.

# ACHIEVE MORE WITH RAPID RECOVERY

A LEGACY OF

**20**  
YEARS



**REDUCED**  
re-admission rates  
and complications



a team of 22 dedicated consultants with  
over 145 years of combined experience

implementations in 18+ countries  
across europe and the middle east

**REDUCED**  
length of  
hospital stay



**IMPROVED PATIENT SATISFACTION**



**IMPROVED PATIENT OUTCOME**



**REDUCED COSTS**

# RAPID RECOVERY: NEEDS AND CHALLENGES IN THA AND TKA

**Outcomes of TJA are traditionally measured in:**

Length of hospital stay (LoS)

Safety aspects in the form of morbidity/mortality rates

Patient satisfaction

Complication and readmission rates

And – as a secondary factor – economic savings

A change of mind-set and a patient-centric approach are needed. Rapid Recovery is a fast-track program that combines evidence-based, clinical features with organizational optimization – including revised traditions. The program provides a streamlined TJA pathway from admission to discharge – and beyond.

However, the success of a treatment should not only be measured in terms of the effect of isolated procedures and/or general outcomes. Instead, the assessment should primarily be based on the value for the individual patient, while keeping the goal of optimum patient satisfaction affordable.

Most countries with developed economies are nearing the limit of what they can afford to spend on healthcare. But demand is increasing as new treatments become available and the burden of ageing populations continues to rise. So, the focus of providers and payers is shifting to achieving better value for the money spent. The concept of value-based healthcare, put forward by Harvard's Michael E Porter more than a decade ago<sup>1</sup>, is attracting growing attention. Porter defined value in healthcare as follows:

$$\text{Patient value} = \frac{\text{Patient outcomes}}{\text{Costs to achieve these outcomes}}$$

Patient value can be increased by either improving patient-relevant outcomes or getting the same outcomes but reducing the cost of patient care, through better use of resources. But today's healthcare system is not designed to adopt a value-based approach.

A patient-centric approach will be key to understanding value. This means defining and using more patient-reported outcome measures (PROMs) to capture relevant data and quantify outcomes.





## Further evolving the Rapid Recovery Program to continuously improve the patient's journey is needed, but First Better – Then Faster.

Across Europe, we still see:

- Variations in treatment protocols within countries and even within hospitals; fast-track has not become the gold standard in many countries yet
- Healthcare systems facing increasing economic pressures
- A high variation in LOS for the same procedure
- An increasing interest from patients, organizations and government in outpatient surgery for THA and TKA
- Hospitals and HCPs often stuck in traditions: continuous improvement is not embedded everywhere
- An aging patient population and rising patient demand and expectations
- A lack of data at the post-discharge activity level



### **Need and Challenge 1** **Fast-track as a gold standard; further improvement of analgesia and anesthesia protocols to reach the goal of a pain and risk-free operation.**

The Rapid Recovery approach has led to major progress, especially in the last decade. But it has not yet succeeded in reaching the final goal of the “pain and risk-free” THA and TKA as introduced by Kehlet<sup>2</sup>. Therefore, a key challenge is to further understand the pathophysiological mechanisms of morbidity and recovery, and to optimize post-discharge functional outcomes – to prevent sub-acute problems turning into chronic problems. Continuous clinical improvement is needed and the question, “Why is the patient still in hospital?” needs to be asked directly after surgery, and repeated frequently.

The main reasons for being hospitalized after THA and TKA surgery are<sup>3</sup>:

- Dizziness and general weakness
- Nausea
- Vomiting

Confusion and sedation have minimal impact on discharge time<sup>3</sup>.

Future efforts to enhance recovery after THA and TKA should focus on analgesia, orthostatic intolerance and muscle function. With clear goals:

- Achieving early mobilization
- Optimizing analgesia and anesthetic protocols
- Reducing complications
- Answering the question: why is your patient still in hospital now?



## Need and Challenge 2 Variation of LOS days in European countries and the interest in out- patient surgery for TJA

Rapid Recovery has evolved during the past 20 years. The program has proven to reduce LOS, morbidity and convalescence time, without an increase in readmission rates or compromising patient safety<sup>4,5,6,7,8</sup>. Despite the scientific evidence for Rapid Recovery and fast-track surgery for THA and TKA, widespread implementation is still lagging in Europe. LOS is still around 4–6 days in many places, with outliers exceeding 10 days<sup>9</sup> after THA and TKA. This is compared with 2–3 days or less in large epidemiological studies<sup>5,6,8</sup>.

For the hospitals who have reached a LOS of less than 3 days, by using the question: Why is the patient still in hospital?, a percentage of patients can be safely and effectively discharged on the day of surgery<sup>10</sup>.

This means that the next step in Rapid Recovery is Rapid Recovery Outpatient, where based on the existing Rapid Recovery protocols, organizational and clinical protocols will be adapted to achieve day of surgery discharge, while maintaining the same or better outcomes as for patients who are hospitalized for more than 1 day.

---

## Need and Challenge 3 Variation of LOS days in European countries and the interest in out- patient surgery for TJA

As Rapid Recovery is a multidisciplinary team effort, representatives from each group of staff and specialty involved should form the team of decision-makers. Dedicated leaders should be front-runners. The staff involved in fast-track surgery should have a uniform approach to giving evidence-based care to patients<sup>11</sup>. In reorganizing the patient pathway processes, team members can improve knowledge and understanding. They can gain insight into each other's fields and thus plan the best possible flow for their patients.

Alongside clinical improvements, organizational optimization is key to the success of Rapid Recovery. Husted and Kristensen discussed the importance of "breaking traditions" in their 2012 white paper<sup>12</sup>. In the past decade many of those topics have been researched and discussed, and best practice changed or improved. These improvements have become the new normal in Rapid Recovery hospitals. However, there is a danger of the new normal becoming the new traditions, with no further improvement as the evidence develops.

Therefore, **a continuous improvement process (CIP) – looking at every part of the patient pathway – is an integrated part of Rapid Recovery**. CIP is the ongoing effort to improve products, services or processes. The Rapid Recovery Program needs to be constantly evaluated and improved in the light of its efficiency, effectiveness and flexibility – keeping value-based healthcare<sup>1</sup> as an anchor, and supported by data collection and analysis.

1. The core principle of CIP is the (self) reflection of processes. (Feedback)
2. The purpose of CIP is to identify, reduce and eliminate suboptimal processes. (Efficiency)
3. The emphasis of CIP is on incremental, continuous steps rather than giant leaps. (Evolution)

A future organizational challenge lies in expanding the scope of Rapid Recovery. There is a need to expand the horizon to an end-to-end care continuum – from pre-referral to post-discharge.

One example is a hospital where the surgeons have set up shop once a week at the GP's surgery (family practice) to see patients. By doing this, patient selection, education and expectations have improved. Simultaneously, as many hospitals have now implemented Rapid Recovery for some years<sup>13</sup>, the CIP should also start taking "deep dives" into particular areas that need attention. Is the planning of new patients on the surgery list done in an efficient way? Is there a need for staggered day of surgery admission? Are the theaters running efficiently? What is the discharge destination of the patients?

## Need and Challenge 4 Data on post-discharge activity level

Another challenge lies in the integration of technology into Rapid Recovery. In the ever-changing healthcare environment, demand is growing at a faster rate than the capacity available. [Technology can help to transfer parts of the end-to-end patient continuum to patients' homes via telemedicine, and therefore reduce the number of visits needed to the hospital.](#)

Telemedicine is one of the healthcare sectors that has developed the most in recent years. Today, it's a way to bridge the accessibility gap, compensating for the lack of medical centers in rural zones and the increase in the older population. Yet most telemedicine systems remain experimental and have never been used on a large scale. It's difficult to imagine the technical developments that will take place in the next 5 years, though one thing is clear: [telemedicine and telerehabilitation interventions can optimize the delivery of the total care continuum.](#)

As modern healthcare is more and more focused on patient involvement, the use of telemedicine and digital aids such as smartphones and wearables (e.g. smart watches) have proven to be effective in educating patients and engaging them in their treatment<sup>14</sup>. Telerehabilitation interventions can optimize the delivery of care and will enable post-discharge follow-up and data collection by using available technology.

Currently available technology like the mymobility® app can help in:

- Improving patient information and managing patient expectations
- Getting patients better prepared for surgery, physically and mentally
- Following up on patients throughout the end-to-end patient continuum
- Reducing the number of hospital visits needed

*Needs and challenges authors : Rutger Martens, Mireia Dasi, Iris Hafner*

1. Porter ME. PhD: Redefining Health Care. 2006.
2. Kehlet H, Jørgensen CC. Advancing surgical outcomes research and quality improvement within an enhanced recovery program framework. *Ann Surg* 2016; 264: 237-238.
3. Husted H, Lunn TH, Troelsen A et al. Why still in hospital after fast-track hip and knee arthroplasty? *Acta Orthop* 2011; 82: 679-684.
4. Kehlet H. Fast-track hip and knee arthroplasty. *Lancet* 2013; 381: 1600-1602.
5. Khan SK, Malviya A, Muller SD et al. Reduced short-term complications and mortality following Enhanced Recovery primary hip and knee arthroplasty: results from 6,000 consecutive procedures. *Acta Orthop* 2014; 85: 26-31.
6. Berg U, Bulow E, Sundberg M, Rolfson O. No increase in readmissions or adverse events after implementation of fast-track program in total hip and knee replacement at 8 Swedish hospitals: an observational before-and-after study of 14,148 total joint replacements 2011–2015. *Acta Orthop* 2018; 89: 522-527.
7. Pamilo KJ, Torkki P, Peltola M et al. Fast-tracking for total knee replacement reduces use of institutional care without compromising quality. *Acta Orthop* 2018; 89: 184-189.
8. Petersen PB, Kehlet H, Jørgensen CC. Myocardial infarction following fast-track total hip and knee arthroplasty—incidence, time course and risk factors: a prospective cohort study of 24,862 procedures. *Acta Orthop* 2018a; 89: 603-609.
9. Lorenzoni L, Marino A. OECD Health Working Papers No 94: Understanding variations in hospital length of stay. 2017. [https://www.oecd-ilibrary.org/social-issues-migration-health/understanding-variations-in-hospital-length-of-stay-and-cost\\_ae3a5ce9-en](https://www.oecd-ilibrary.org/social-issues-migration-health/understanding-variations-in-hospital-length-of-stay-and-cost_ae3a5ce9-en).
10. Vehmeijer S, Husted H, Kehlet H. Outpatient total hip and knee arthroplasty. *Acta Orthop* 2018; 89: 141-144.
11. Husted H. Fast-track hip and knee arthroplasty: clinical and organizational aspects. *Acta Orthop* 2012; 83: sup346: 1-39.
12. Husted H, Kristensen BB. Fast-track THA and TKA, state of the art. 2012.
13. Wainwright K. Fast-track hip and knee arthroplasty – have we reached the goal? *Acta Orthop* 2019; 90: 3-5.
14. Timmers J, van der Zwaard P, van Oostveen K et al. Assessing the efficacy of an educational smartphone or tablet app with subdivided and interactive content to increase patients' medical knowledge: A randomized controlled trial. *JMIR Mhealth Uhealth*. 2018; 6: e10742.

**“ Rapid Recovery promotes interdisciplinary exchange immensely. The project strengthens an open communication culture in which suggestions for improvement or problems are discussed and can be tackled.**

Carola Keller and Laura Golther,  
*Project Managers at Vulpius Klinik  
Bad Rappenau, Germany*

**”**

# OPTIMAL CLINICAL APPROACHES EVIDENCE-BASED CONSENSUS INDEX

## Consensus context

---

### Preoperative

- Preoperative optimization
- Patient information and apps
- Thromboembolic prophylaxis

---

### Perioperative

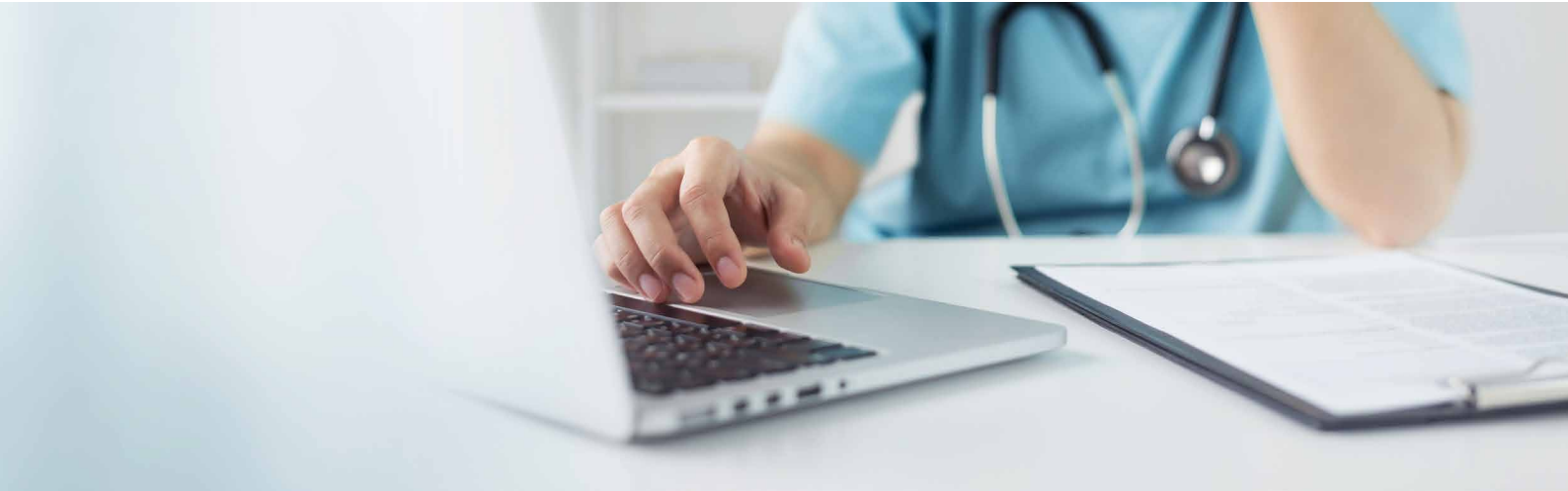
- Perioperative pain management
- Anesthesia protocol
- Local infiltration analgesia
- Surgical factors
- Tourniquets
- Blood management
- Drains
- Wound management
- The implant

---

### Postoperative



# OPTIMAL CLINICAL APPROACHES EVIDENCE-BASED CONSENSUS CONSENSUS CONTEXT



## Zimmer Biomet Rapid Recovery

Advisory Board members

Prof Michael Clarius

Prof Henrik Kehlet

Prof Emmanuel Thienpont

Prof Kirill Gromov

Prof Oliver Pearce

Dr Stephan Vehmeijer

## Moderator

Prof Sebastien Parratte,

Chief Medical Advisor

Zimmer Biomet EMEA

## The evidence behind Rapid Recovery

This section is an up-to-date evidence-based clinical summary, reviewed and validated as a consensus statement by the Zimmer Biomet Rapid Recovery Advisory Board members. It covers relevant topics on each phase of patient treatment and summarizes “the state of the art” based on the most recent and important papers published in the literature.

Rapid Recovery or “fast-track” or “enhanced recovery” programs were introduced in the 1990s. This led to an explosion of publications across surgical specialties in the following decades, including on hip and knee arthroplasty<sup>1</sup>.

In a laudable effort, the Enhanced Recovery After Surgery (ERAS) Society published its care guidelines for hip and knee replacement in 2020. However, recommendations are often difficult to make due to the many publications with different designs and often including studies without a fully implemented evidence-based care program<sup>1,2,3</sup>.

Consequently, [these Rapid Recovery recommendations should be carefully interpreted and implemented in relation to current national guidelines, healthcare conditions and the rapidly evolving progress in the topic.](#)

1. Wainwright TW, Gill M, McDonald DA et al. Consensus statement for perioperative care in total hip replacement and total knee replacement surgery: Enhanced Recovery After Surgery (ERAS) Society recommendations. *Acta Orthop* 2020; 91: 3-19.
2. Kehlet H, Memtsoudis SG. ERAS guidelines for hip and knee replacement - need for reanalysis of evidence and recommendations? *Acta Orthop* 2020; 91: 243-245.
3. Kehlet H, Memtsoudis SG. Perioperative care guidelines: conflicts and controversies. *Br J Surg* 2020; 107: 1243-1244.

# OPTIMAL CLINICAL APPROACHES EVIDENCE-BASED CONSENSUS PREOPERATIVE

## Preoperative process redesign, clinical enhancement and patient management



### Preoperative optimization

Patients with risk factors are associated with higher morbidity, higher mortality, an increased complication rate and a longer LOS. In elective hip and knee arthroplasty it is therefore necessary to identify these patients, develop an individual risk stratification and optimize their preoperative status if possible<sup>1</sup>.

Malnutrition, obesity, smoking, alcohol abuse, uncontrolled diabetes and poor dental health are possible modifiable risk factors. It is very likely that patients profit from a preoperative optimization<sup>1</sup>. However, more clinical studies are needed to show the beneficial effect in a fast-track setup.

Patients with psychiatric diseases, depression or anxiety disorders remain a challenge for arthroplasty surgeons. Psychiatric diseases are associated with a longer LoS and higher readmission and complication rates.

There is a correlation between emotional disorders (like depression and anxiety) and postoperative pain and clinical results after arthroplasty<sup>2</sup>. Although not specific for fast-track protocols, a careful patient evaluation and selection, multidisciplinary approach and preoperative treatment might improve the outcome after surgery.

Preoperative anemia is diagnosed in 10–15% of patients planned for hip or knee replacement surgery and is associated with a higher risk of a transfusion, longer LOS, infection, morbidity and a higher rate of readmissions<sup>3</sup>. The cause of anemia needs to be investigated and treated – anemia is often caused by iron deficiency and can therefore be optimized. A routine preoperative anemia screening and a so-called patient blood management program is vital.

*Prof Michael Clarius, Prof Henrik Kehlet*

# OPTIMAL CLINICAL APPROACHES EVIDENCE-BASED CONSENSUS PREOPERATIVE

## Patient information and apps



Comprehensive patient information and counseling about diagnosis and treatment are key for a trusting relationship between patient and surgeon. Carefully timed documentation is necessary, not only legally, but also to allow the patient to review what has been discussed and planned.

Rapid Recovery protocols have used interdisciplinary patient seminars to explain the disease, operation, pain management, early mobilization and each step of the program. These protocols include the role of a friend or relative as a “coach” during the whole process of treatment and rehabilitation. The coach supports and encourages the patient on their journey.

There is strong evidence that such patient information reduces preoperative anxiety; however, it has not so far been shown to affect postoperative outcomes – such as acce-

lerating the achievement of discharge criteria, pain or functional outcome<sup>3</sup>.

Patient information apps have been developed to provide additional information, practical tips and instructional videos for patients to enhance recovery. Studies have shown that app users have a better early functional outcome and less pain<sup>4,5,6,7</sup>.

Patient information apps enable surgeons to stay in contact with the patient, remind them of necessary control examinations and collect PROMS to measure the benefit of the functional outcome and demonstrate the clinical result.

Newer apps allow communication between surgeon and patient via videocall and can track preoperative and postoperative activity levels. This will help to further understand the whole rehabilitation process after arthroplasty and to improve recovery.

1. Rackwitz L, Reyle-Hahn SM, Noth U. Preoperative management and patient education in fast-track arthroplasty. *Orthopade* 2020; 49: 299-305.
2. Hassett AL, Marshall E, Bailey AM et al. Changes in Anxiety and Depression Are Mediated by Changes in Pain Severity in Patients Undergoing Lower-Extremity Total Joint Arthroplasty. *Reg Anesth Pain Med* 2018; 43: 14-18.
3. Wainwright TW, Gill M, McDonald DA et al. Consensus statement for perioperative care in total hip replacement and total knee replacement surgery: Enhanced Recovery After Surgery (ERAS®) Society recommendations. *Acta Orthop* 2020; 91: 3-19.
4. Hardt S, Schulz MRG, Pfitzner T et al. Improved early outcome after TKA through an app-based active muscle training programme-a randomized-controlled trial. *Knee Surg Sports Traumatol Arthrosc* 2018; 26: 3429-3437.
5. Pronk Y, Peters M, Sheombar A et al. Effectiveness of a Mobile eHealth App in Guiding Patients in Pain Control and Opiate Use After Total Knee Replacement: Randomized Controlled Trial. *JMIR Mhealth Uhealth* 8; 2020: e16415.
6. Timmers T, Janssen L, Kool RB et al. Educating Patients by Providing Timely Information Using Smartphone and Tablet Apps: Systematic Review. *J Med Internet Res* 2020; 22: e17342.
7. Timmers T, Janssen L, Van Der Weegen W et al. The Effect of an App for Day-to-Day Postoperative Care Education on Patients With Total Knee Replacement: Randomized Controlled Trial. *JMIR Mhealth Uhealth* 2019; 7: e15323.



# OPTIMAL CLINICAL APPROACHES EVIDENCE-BASED CONSENSUS PREOPERATIVE

## Thromboembolic prophylaxis



Hip and knee arthroplasty provide one of the classical surgical models used in thromboembolic prophylaxis studies – previously indicating the need for prolonged postoperative treatment. However, the introduction of Rapid Recovery Programs has shown that improved care, including early mobilization, may reduce the risk of thromboembolism and therefore the need for prolonged thromboembolic prophylaxis<sup>1</sup>.

This has been well demonstrated in fully implemented Rapid Recovery Programs (with no use of long-term prophylaxis if LoS less than 5 days). However, there is a need for confirmatory studies and international agreement on the optimal use of thromboembolic prophylaxis in THA/TKA. Until then, national guidelines must be followed for legal reasons<sup>2</sup>.

1. Petersen PB, Kehlet H, Jørgensen CC. Safety of In-Hospital Only Thromboprophylaxis after Fast-Track Total Hip and Knee Arthroplasty: A Prospective Follow-Up Study in 17,582 Procedures. *Thromb Haemost* 2018; 118: 2152-2161.
2. Jørgensen CC, Petersen PB, Reed M, Kehlet H. Recommendations on thromboprophylaxis in major joint arthroplasty - many guidelines, little consensus? *J Thromb Haemost* 2019; 17: 250-253.

# OPTIMAL CLINICAL APPROACHES EVIDENCE-BASED CONSENSUS PERIOPERATIVE

## Perioperative process redesign, clinical enhancement and patient management



### Perioperative pain management

Sufficient pain management, allowing early mobilization, is a prerequisite for Rapid Recovery Programs. Unfortunately, despite the vast literature on THA and TKA, the optimal treatment is still debatable – especially concerning more invasive analgesic techniques.

The recent ERAS guidelines recommend basic treatment with paracetamol and an NSAID/COX-2 inhibitor starting preoperatively, with local infiltration analgesia in TKA but not in THA<sup>1,2</sup>. Meanwhile the use of nerve block techniques is controversial: although they provide improved analgesia, they may not be needed in a fully implemented optimized Rapid Recovery Program for outpatient THA and TKA.

Preoperative high-dose glucocorticoid is recommended, while other systemic analgesics like gabapentinoids and ketamine are not<sup>3</sup>. The analgesic planning for “high-risk” patients (such as pain catastrophizers and preoperative opioid users) requires more specific studies. The optimal duration of postoperative analgesic treatment has not been determined, but is probably around 2–3 weeks – depending on the recovery and the role of continuous pain<sup>4</sup>.

In summary, several research challenges lie ahead to provide final recommendations.

*Prof Henrik Kehlet, Prof Emmanuel Thienpont,  
Prof Oliver Pearce, Prof Kirill Gromov*

1. Wainwright TW, Gill M, McDonald DA et al. Consensus statement for perioperative care in total hip replacement and total knee replacement surgery: Enhanced Recovery After Surgery (ERAS) Society recommendations. *Acta Orthop* 2020; 91: 3-19.
2. Kehlet H, Lindberg-Larsen V. High-dose glucocorticoid before hip and knee arthroplasty: To use or not to use—that's the question. *Acta Orthop* 2018; 89: 477-479.
3. Soffin EM, Gibbons MM, Ko CY et al. Evidence Review Conducted for the Agency for Healthcare Research and Quality Safety Program for Improving Surgical Care and Recovery: Focus on Anesthesiology for Total Hip Arthroplasty. *Anesth Analg* 2019; 128: 454-465.
4. Wainwright TW, Kehlet H. Fast-track hip and knee arthroplasty - have we reached the goal? *Acta Orthop* 2019; 90: 3-5.

# OPTIMAL CLINICAL APPROACHES EVIDENCE-BASED CONSENSUS PERIOPERATIVE

## Anesthesia protocol

### General anesthesia (GA)

Carries potential risks relating to airways – such as dental or oral soft tissue damage, vocal cord trauma, barotrauma, aspiration – and to the circulatory system, such as negative inotropic and chronotropic effects<sup>1,2,3</sup>.

### Spinal anesthesia

Carries potential risks such as hypotension (vasodilation), spinal hematoma (rare)<sup>4,5,6</sup>. Quoted advantages are reduced blood loss (and transfusion rate), reduced postoperative pain and reduced venous thromboembolism (VTE) rate, derived from studies predating widespread use of multimodal pain pathways and pre-emptive analgesia.

### Nerve blocks

Provide excellent analgesia postoperatively in combination with GA. But they are not conducive to mobilization on the same day as surgery, have a finite incidence of prolonged motor blockade and are associated with an increase in falls risk for 6 weeks post surgery<sup>7</sup>. There may be a role for blocks in the difficult pain patient where analgesia can be very difficult to achieve.

Broadly speaking there are two types of anesthesia for hip and knee arthroplasty. From the patient's perspective, general anesthesia means not being aware of surgery as it happens. And spinal anesthesia means being completely numb during and for a period after surgery, but (even combined with sedation) with the possibility of hearing the surgery taking place. The advantage of spinal anesthesia to the patient is not being in pain immediately postoperatively.

Spinal anesthesia has been preferred across numerous studies for safety, patient experience and reduced complications.

Opioids should be avoided to reduce postoperative urinary retention incidence<sup>8</sup>. Catheterization rates for retention can safely be reduced by having an 800 ml threshold on bladder scan before catheterizing<sup>9</sup>.

**Knowledge gap** - There is still a need for well-powered comparative studies to compare with modern GA techniques such as total intravenous anesthesia in the context of a well-executed Rapid Recovery Program<sup>10</sup>.

**Knowledge gap** - GA versus spinal anesthesia: more high-level trials are needed to definitively answer which is best for patient experience as well as safety.

1. Memtsoudis SG, Rasul R, Suzuki Set al. Does the impact of the type of anesthesia on outcomes differ by patient age and comorbidity burden? *Reg Anesth Pain Med* 2014; 39: 112-119.
2. Opperer M, Danninger T, Stundner O et al. Perioperative outcomes and type of anesthesia in hip surgical patients: An evidence based review. *World J Orthop.* 2014; 5: 336-343.
3. Basques BA, Toy JO, Bohl DD et al. General compared with spinal anesthesia for total hip arthroplasty. *J Bone Joint Surg Am* 2015; 97: 455-461.
4. Pitkänen MT, Aromaa U, Cozanitis DA et al. Serious complications associated with spinal and epidural anaesthesia in Finland from 2000 to 2009. *Acta Anaesthesiol Scand* 2013; 57: 553-564.
5. Pumberger M, Memtsoudis SG, Stundner O et al. An analysis of the safety of epidural and spinal neuraxial anesthesia in more than 100,000 consecutive major lower extremity joint replacements. *Reg Anesth Pain Med* 2013; 38: 515-519.
6. Rosencher N, Llau JV, Mueck W et al. Incidence of neuraxial haematoma after total hip or knee surgery: RECORD programme (rivaroxaban vs. enoxaparin). *Acta Anaesthesiol Scand* 2013; 57: 565-572.
7. Sharma S, Iorio R, Specht L, Davies-Lepie S, Healy W. Complications of Femoral Nerve Block for Total Knee Arthroplasty. *Clin Orthop Relat Res* 2010; 468: 135-140.
8. Essving P, Axelsson K, Åberg E et al. Local infiltration analgesia versus intrathecal morphine for postoperative pain management after total knee arthroplasty: a randomized controlled trial. *Anesth Analg* 2011; 113: 926-933.
9. Bjerregaard LS, Hornum U, Trolldborg C et al. Postoperative Urinary Catheterization Thresholds of 500 versus 800 ml after Fast-track Total Hip and Knee Arthroplasty: A Randomized, Open-label, Controlled Trial. *Anesthesiology* 2016; 124: 1256-1264.
10. Kaye AD, Urman RD, Cornett EM et al. Enhanced recovery pathways in orthopedic surgery. *J Anaesthesiol Clin Pharmacol* 2019; 35(Suppl 1): S35-S39.

# OPTIMAL CLINICAL APPROACHES EVIDENCE-BASED CONSENSUS PERIOPERATIVE

## Local infiltration analgesia

Local infiltration analgesia (LIA) has been proven effective in knee arthroplasty, but not in hip arthroplasty. A significant difference between the two may be the easy accessibility of the femoral periosteum and posterior capsule of the knee. The main genicular branches for joint innervation of the knee capsule are close to the periosteum and can therefore be found by using bony landmarks. At the articular level these branches are purely sensitive and therefore their blockade doesn't lead to motor dysfunction<sup>1</sup>.

Despite peer-reviewed publications on the outcome of LIA, no standardized technique has been recognized among surgeons<sup>2</sup>. Many infiltrate the soft tissues at the end of surgery and inject different areas depending on personal choice. A standardized technique has been proposed by Thienpont and Kehlet – available on video for easy E-learning purposes. The principle of this LIA technique is to infiltrate different anatomic areas of the knee in turn, often before tissue damage is created, and therefore optimize the reduction of peripheral sensitization.

The proposed technique starts with an adductor canal blockade with proximal infiltra-

tion of the saphenous nerve. The next step after opening of the knee joint is infiltration of the periosteum at the medial side and the anterior part of the femur. During this step the superior medial genicular nerve is injected in front of the adductor tubercle at the posterior 1/3 level of the femur. After the distal cut of the femur and proximal tibia, the anterolateral and lateral area of the femur can be infiltrated. The superior lateral genicular nerve is found at the upper edge of the lateral condyle. After performing the 4 in 1 cuts of the femur, the posterior medial and lateral capsule can be infiltrated. Before final preparation of the tibia, the inferomedial genicular nerve can be injected at the tibial metaphysis (transition shaft to medial condyle), beneath the deep medial collateral ligament in the middle of the tibial level in the sagittal plane.

With this type of LIA, very low visual analog scale scores can be obtained for the first 24 hours after surgery, allowing early mobilization and full-weight bearing because no motor function impairment is obtained. An opioid-sparing effect and enhanced recovery have been observed.

1. Fonkoue L, Behets C, Kouassi J-EK et al. Distribution of sensory nerves supplying the knee joint capsule and implications for genicular blockade and radiofrequency ablation: an anatomical study. *Surg Radiol Anat* 2019; 41: 1461-1471.
2. Seangleulur A, Vanasbodeekul P, Prapaitrakool S et al. The efficacy of local infiltration analgesia in the early postoperative period after total knee arthroplasty: a systematic review and meta-analysis. *Eur J Anaesthesiol* 2016; 33: 816-831.

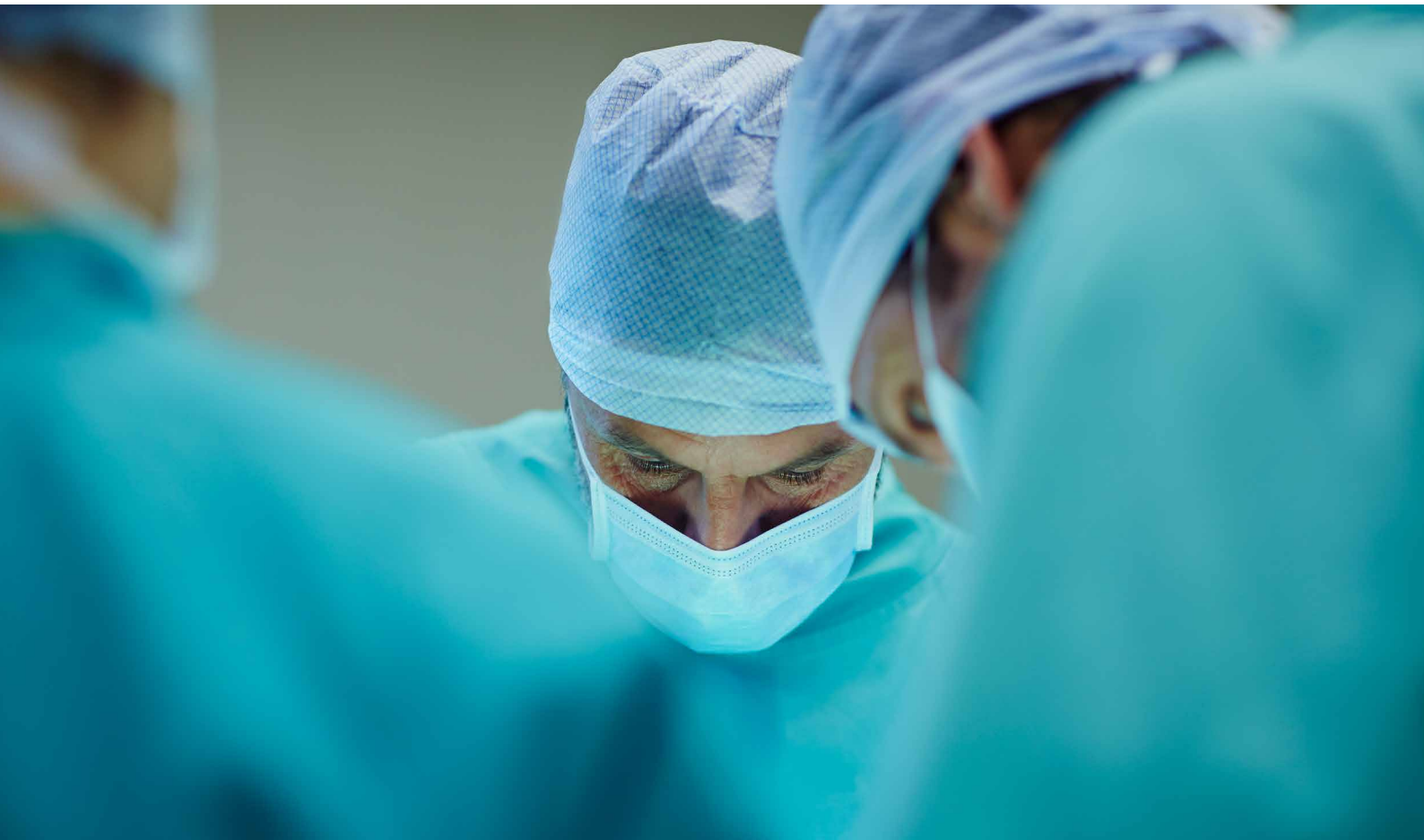
# OPTIMAL CLINICAL APPROACHES EVIDENCE-BASED CONSENSUS PERIOPERATIVE

## Surgical factors

Needless to say, a well-performed hip or knee arthroplasty is mandatory as a baseline in the context of recovery post operatively: this means minimum soft tissue damage and optimized balancing of the hip or knee. Blood loss relating to surgical technique and use of tranexamic acid (TXA) is discussed below.

No single surgical approach has been conclusively shown to offer an advantage in hip or knee arthroplasty in the context of a well-executed Rapid Recovery Program.

Posterior, anterolateral and direct anterior approaches have all been used successfully with few complications, good patient outcomes and short LOS. The same goes for medial parapatellar and subvastus techniques in the knee.



# OPTIMAL CLINICAL APPROACHES EVIDENCE-BASED CONSENSUS PERIOPERATIVE

## Tourniquets

Tourniquet use in TKA is the source of long-standing debate: the methodological quality of studies has been criticized. There is no consensus on a standardized method for use of tourniquets in the studies (such as inflation pressure, method for exsanguination, position and calibration to patient limb occlusion pressure)<sup>1,2</sup>.

Multiple meta analyses have been performed. It is agreed that with a tourniquet, intraoperative blood loss, calculated blood loss and operative time are all reduced (the latter is 10 minutes less on average with tourniquets), while surgical view of operative structures is improved. But total blood loss and postoperative blood loss are often found to be the same. There may be an increase in deep vein thrombosis (DVT) incidence in tourniquet use.

Thigh pain exists in groups with and without tourniquets<sup>1,2</sup>, but is often attributed to the tourniquet when it has been used. Eversion of the patella and forcible flexion of the knee during arthroplasty is another mechanism for postoperative quad pain that is forgotten in many reviews.

There is no high quality evidence to influence the decision on whether or not to use tourniquets in TKA. Both methods are acceptable in the context of a working Rapid Recovery Program.

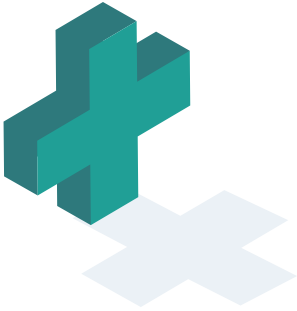
**Knowledge gap** - The literature does not specify tourniquet pressure. New studies are needed on the use of low pressure tourniquets and Rapid Recovery Program techniques to see if VTE rate is affected.

1. Papalia R, Zampogna B, Franceschi F et al. Tourniquet in knee surgery. *BR Med Bull* 2014; 111: 63-76.
2. Cai DF, Fan QH, Zhong HH, Peng S, Song H. The effects of tourniquet use on blood loss in primary total knee arthroplasty for patients with osteoarthritis: a meta-analysis. *J Orthop Surg Res* 2019; 14: article number: 348.



# OPTIMAL CLINICAL APPROACHES EVIDENCE-BASED CONSENSUS PERIOPERATIVE

## Blood management



Patients undergoing knee arthroplasty might be exposed to substantial bleeding by opening the medullary canals<sup>1</sup> – cutting the bony surfaces of femur and tibia. Many patients have inflammatory disease leading to hypervascularization of the tissues and many are taking anti-coagulant medication for associated comorbidities.

In the past, TKA was accompanied by important blood loss and need for transfusion. The resulting shift in fluid volumes led to increased comorbidity. Transfusion is also known to cause immunomodulation, so an increased risk of peri-prosthetic joint infection was discussed in the orthopedic literature. Blood loss within the joint can create pain and stiffness. However, with the development of multi-modal blood management, both visible and hidden blood loss could be reduced during and after surgery, leading to rare indications for blood transfusion.

### In multi-modal blood management:

- Use TXA, which is a fibrinolysis inhibitor that works by competition for a lysine receptor, preventing fibrin from binding to plasmin and its activator. Meta-analysis and systematic review articles have confirmed its efficacy both in an intravenous and a local administration formula<sup>2,3</sup>. It leads to less blood loss and less transfusion without increasing DVT and pulmonary emboli.
- Improve surgical hemostasis by using electrocautery at well-known anatomic areas of the knee. Typically, coagulation is advised for the medial genicular arteries during the surgical approach, small vessels in Hoffa's fat pad, the femoral in-

sertion of the posterior cruciate ligament and the lateral genicular artery after lateral meniscectomy. Chemical hemostasis can be applied by using an appropriate LIA technique. Despite ropivacaine already having an adrenergic effect, it can be improved when adrenaline is added. Quick injection at the end of the procedure reduces the adrenaline advantage and if LIA is used subcutaneously, might increase the risk of skin necrosis.

- Plug the femoral drill hole when an intramedullary technique is used in combination with a femoral implant with an open box. This step isn't necessary if navigation, patient-specific instrumentation or robotics are used<sup>4</sup>.
- Ensure meticulous watertight closure to avoid the risk of drainage of blood and oozing. Closing the capsule well and positioning the knee in flexion during the hours immediately after surgery will substantially reduce the risk of blood loss in patients at high risk for bleeding.
- Use compression bandaging to avoid swelling and hematoma by reducing the expansion volume of the articular space and surrounding soft tissues.
- Consider choice of implant: partial knee arthroplasty will reduce the risk of bleeding<sup>1</sup>.

Modern blood management and an evidence-based trigger for transfusion can significantly reduce the need for blood transfusion after knee arthroplasty<sup>5</sup>. Thanks to this program, aspirin doesn't have to be discontinued in arthroplasty patients.





1. Schwab P-E, Lavand'homme P, Cyr Yombi J, Thienpont E. Lower blood loss after unicompartmental than after total knee arthroplasty. *Knee Surg Sports Traumatol Arthrosc* 2015; 23: 3494-3500.
2. Fillingham YA, Ramkumar DB, Jevsevar DS et al. The efficacy of tranexamic acid in total knee arthroplasty: a network meta-analysis. *J Arthroplasty* 2018; 33: 3090-3098.
3. Xiong H, Liu Y, Zeng Y, Wu Y, Shen B. The efficacy and safety of combined administration of intravenous and topical tranexamic acid in primary total knee arthroplasty: a meta-analysis of randomized controlled trials. *BMC Musculoskelet Disord* 2018; 19: 321.
4. Thienpont E, Schwab P-E, Fenneken P. Efficacy of patient-specific instrument in total knee arthroplasty: A systematic review and meta-analysis. *J Bone Joint Surg Am* 2017; 9: 521-530.
5. Schwab P-E, Lavand'homme P, Cyr Yombi J, Thienpont E. Aspirin mono-therapy continuation does not result in more bleeding after knee arthroplasty. *Knee Surg Sports Traumatol Arthrosc* 2017; 25: 2586-2593.

# OPTIMAL CLINICAL APPROACHES EVIDENCE-BASED CONSENSUS PERIOPERATIVE

## Drains

The use of a closed suction drain after total hip and knee arthroplasty has been a popular topic of studies over the years. These studies have typically only included small numbers of patients. The general consensus is that there is either no difference in blood loss and transfusion rate when a drain is used, or more blood loss and transfusion rate with the use of the drain (suction and loss of tamponade effect in drain use).

Some studies with no drain use showed an increase in ecchymosis and dressing change. There is no improvement in manipulation under anesthesia rate with use of the drain. There is also no demonstrated change in surgical site infection with or without drain use<sup>1,2,3,4</sup>. There is therefore no evidence base for the need for a closed suction drain in THA and TKA.

1. Parker MJ, Roberts CP, Hay D. Closed suction drainage for hip and knee arthroplasty. A meta-analysis. *J Bone Joint Surg Am* 2004; 86-A: 1146-1152.
2. Quinn M, Bowe A, Galvin R, Dawson P, O'Byrne J. The use of postoperative suction drainage in total knee arthroplasty: a systematic review. *Int Orthop* 2015; 39: 653-658.
3. Zhang Q, Liu L, Sun W et al. Are closed suction drains necessary for primary total knee arthroplasty? A systematic review and meta-analysis. *Medicine (Baltimore)* 2018; 97: e11290.
4. Wainwright TW, Gill M, McDonald DA et al. Consensus statement for perioperative care in total hip replacement and total knee replacement surgery: Enhanced Recovery After Surgery (ERAS®) Society recommendations. *Acta Orthop* 2020; 91: 3-19.



# OPTIMAL CLINICAL APPROACHES EVIDENCE-BASED CONSENSUS PERIOPERATIVE

## Wound Management

A lot of wound management can take place before getting as far as the operating theater, particularly in the context of preventing surgical site infection (SSI) with evidence-based interventions. For example, cessation of smoking more than 4 weeks preoperatively reduces infection and wound breakdown<sup>1</sup>.

Use of antibiotic prophylaxis reduces SSI by 8%<sup>2</sup>. It is important to ensure that it is given at least 20 minutes before onset of surgery and, if using a tourniquet, well before inflation of the tourniquet.

MSSA (methicillin-sensitive *Staphylococcus aureus*) screening and treatment before admission reduces SSI. The treatment is a body wash and nasal gel containing chlorhexidine or octenisan<sup>3</sup>. Use of 2% chlorhexidine skin preparation during preparation and draping for THA or TKA reduces SSI. The evidence for this across different surgical specialties is strong (in orthopedics the key papers are in foot and ankle surgery and shoulder surgery)<sup>4</sup>.

Glycemic control optimization in diabetics is associated with reduced SSI (compared with poor diabetic control) and must be achieved before admission for arthroplasty. The recommendation is hemoglobin A1c preoperatively less than 7%. But equally important is the glycemic control on the day of surgery, and the recommendation is to keep this between 110 and 180 mg/dl<sup>5,6</sup>.

Obesity is associated with increased wound problems and SSI when body mass index reaches the super-obese level of more than 40. This predisposes to longer operating

times, increased dissection and soft tissue trauma<sup>7,8</sup>. The Advisory Board recommends deferring arthroplasty surgery until BMI is less than 40, as this is a modifiable risk factor. Avoiding aggressive anticoagulation reduces the incidence of postoperative hematoma formation, which is itself a recognized increased risk of SSI<sup>9,10</sup>. National guidelines permitting, the evidence for aspirin chemoprophylaxis is strong<sup>9,10,11</sup>.

All of these interventions take place before the operation itself. There are evidence-based wound management recommendations for the intraoperative period too.

Reducing operating room traffic has been shown to reduce risk of infection. There is good evidence for a correlation between microbial load and movement/number of theater personnel<sup>12</sup>. It is good theater practice to keep personnel numbers to a minimum and close the doors to traffic during the procedure. Use of dilute povidone-iodine wash in the operative wound before closure is proven to reduce SSI<sup>13</sup>. Use of triclosan-coated sutures for closure of the layers post implantation is proven to reduce SSI, when compared with standard braided suture materials<sup>14</sup>.

Whatever closure method is used, the most important element to keep in mind is the watertight seal achieved, and the resulting incidence of dressing changes needed. Repeated dressing changes are associated with increased SSI risk. So, while there is no consensus on what method, or combination of methods, are best, the operating surgeon must monitor his or her dressing change rate and address the issue objectively.

1. Lindström D, Azodi OS, Wladis A et al. Effects of a Perioperative Smoking Cessation Intervention on Postoperative Complications: A Randomized Trial. *Ann Surg* 2008; 248: 739-745.
2. Wainwright TW, Gill M, McDonald DA et al. Consensus statement for perioperative care in total hip replacement and total knee replacement surgery: Enhanced Recovery After Surgery (ERAS®) Society recommendations. *Acta Orthop* 2020; 91: 3-19.
3. Jeans E, Holleyman R, Tate D, Reed M, Malviya A. Methicillin sensitive staphylococcus aureus screening and decolonisation in elective hip and knee arthroplasty. *J Infect* 2018; 77: 405-409.
4. Saltzman MD, Nuber GW, Gryzlo SM, Marecek GS, Koh JL. Efficacy of surgical preparation solutions in shoulder surgery. *J Bone Joint Surg Am* 2009; 91: 1949-1953.
5. Lorio R, Williams KM, Marcantonio AJ et al. Diabetes mellitus, hemoglobin A1C, and the incidence of total joint arthroplasty infection. *J Arthroplasty* 2012; 27: 726-729.e1.
6. Chrastil J, Anderson MB, Stevens V et al. Is hemoglobin A1c or perioperative hyperglycemia predictive of periprosthetic joint infection or death following primary total joint arthroplasty? *J Arthroplasty* 2015; 30: 1197-1202.
7. Ponnusamy KE, Marsh JD, Somerville LE, McCalden RW, Vasarhelyi EM. Ninety-Day Costs, Reoperations, and Readmissions for Primary Total Hip Arthroplasty Patients of Varying Body Mass Index Levels. *J Arthroplasty* 2019; 34: 433-438.
8. Ponnusamy KE, Marsh JD, Somerville LE, McCalden RW, Vasarhelyi EM. Ninety-Day Costs, Reoperations, and Readmissions for Primary Total Knee Arthroplasty Patients With Varying Body Mass Index Levels. *J Arthroplasty* 2018; 33(7S): S157-S161.
9. Huang RC, Parvizi J, Hozack WJ, Chen AF, Austin MS. Aspirin is as effective as and safer than warfarin for patients at higher risk of venous thromboembolism undergoing total joint arthroplasty. *J Arthroplasty* 2016; 31(Suppl): 83-86.
10. Parvizi J, Huang R, Restrepo C et al. Low-dose aspirin is effective chemoprophylaxis against clinically important venous thromboembolism following total joint arthroplasty: a preliminary analysis. *J Bone Joint Surg Am* 2017; 99: 91-98.
11. An VV, Phan K, Levy YD, Bruce WJ. Aspirin as thromboprophylaxis in hip and knee arthroplasty: a systematic review and meta-analysis. *J Arthroplasty* 2016; 31: 2608-2616.
12. Taaffe K, Lee B, Ferrand Y et al. The influence of traffic, area location, and other factors on operating room microbial load. *Infect Control Hosp Epidemiol* 2018; 39: 391-397.
13. Brown NM, Cipriano CA, Moric M, Sporer SM, Della Valle CJ. Dilute betadine lavage before closure for the prevention of acute postoperative deep periprosthetic joint infection. *J Arthroplasty* 2012; 27: 27-30.
14. Ahmed I, Boulton AJ, Rizvi S et al. The use of triclosan-coated sutures to prevent surgical site infections: a systematic review and meta-analysis of the literature. *BMJ Open* 2019; 9: e029727.



# OPTIMAL CLINICAL APPROACHES EVIDENCE-BASED CONSENSUS PERIOPERATIVE

## The role of the implant

Recently published National Institute for Health and Care Excellence (NICE) guidelines support use of medial unicompartmental knee arthroplasty (UKA) for eligible patients with isolated anteromedial osteoarthritis<sup>1</sup>. Studies have shown that UKA is cost-effective<sup>2</sup> compared with TKA, offering shorter LOS, faster recovery and improved patient-reported outcomes<sup>3</sup>, but with a potential drawback of an increased revision rate<sup>4</sup>. Studies have shown UKA to be a suitable procedure for outpatient arthroplasty with a high rate of discharge on the day of surgery<sup>5,6</sup> and a recent study has shown that centers with high use of UKA are more likely to discharge patients on the day of surgery<sup>7</sup>.

UKA should therefore be considered for eligible patients with isolated anteromedial osteoarthritis in a Rapid Recovery pathway as it allows for a quicker recovery and shorter LOS.

For THA, use of cemented femoral fixation should be considered in older patients with poor bone quality, as use of cementless fixation in these patients is associated with increased risk for periprosthetic femoral fractures<sup>8</sup>. Besides use of cemented femoral fixation in older patients, there is no evidence suggesting superiority of one type of implant over another for THA or TKA.

1. NICE guidelines on joint replacement (primary): hip, knee and shoulder. <https://www.nice.org.uk/guidance/NG157/>.
2. Burn E, Liddle AD, Hamilton TW et al. Cost-effectiveness of unicompartmental compared with total knee replacement: A population-based study using data from the National Joint Registry for England and Wales. *BMJ Open* 2018; 8(4).
3. Wilson HA, Middleton R, Abram SGF et al. Patient-relevant outcomes of unicompartmental versus total knee replacement: systematic review and meta-analysis. *BMJ* 2019; 364: l352.
4. Liddle AD, Judge A, Pandit H, Murray DW. Adverse outcomes after total and unicompartmental knee replacement in 101330 matched patients: A study of data from the National Joint Registry for England and Wales. *Lancet* 2014; 384: 1437-1445.
5. Nakasone CK, Combs D, Buchner B, Andrews S. Day of surgery discharge success after implementation of a rapid discharge protocol following unilateral unicompartmental knee arthroplasty. *Knee* 2020; 27(3): 1043-1048.
6. Gruskay J, Richardson S, Schairer W et al. Incidence and safety profile of outpatient unicompartmental knee arthroplasty. *Knee* 2019; 26: 708-713.
7. Gromov K, Petersen PB, Jørgensen CC, Troelsen A, Kehlet H. Unicompartmental knee arthroplasty undertaken using a fast-track protocol. *Bone Joint J* 2020; 102-B: 1167-1175.
8. Carli AV, Negus JJ, Haddad FS. Periprosthetic femoral fractures and trying to avoid them. *Bone Joint J* 2017; 99-B(1\_Supple\_A): 50-59.

**“ In our hospital we have the highest standards of medical care for our patients. However we decided to introduce the Rapid Recovery Program not only to enhance faster recovery but also to prevent rare complications and to make patient outcomes measurable. Within a short time we implemented the standardized and patientoriented care concept and improved our clinical outcome and achieved a higher patient satisfaction.**

Prof Dr Med Michael Clarius  
*Head of Department of Orthopaedics*

**”**



# OPTIMAL CLINICAL APPROACHES EVIDENCE-BASED CONSENSUS POSTOPERATIVE

## Postoperative process redesign, clinical enhancement and patient management



### Postoperative delirium

Modern Rapid Recovery protocols with early mobilization and multimodal opioid-sparing anesthesia have virtually eliminated postoperative delirium (PD) and postoperative cognitive dysfunction following elective TKA and THA. Latest studies show less than 0.01% of patients having PD following TKA and THA in a fast-track setup<sup>1</sup>, compared with 5–14% of patients with PD in more conventional pathways<sup>2</sup>.

*Dr Stephan Vehmeijer, Prof Kirill Gromov*

### Knowledge gap around sleep disturbances

Sleep disturbances, likely caused by a combination of inflammatory responses and postoperative pain, often occur in the weeks following surgery in THA and TKA<sup>3</sup>. While little is known about sleep disturbances following arthroplasty performed in a modern Rapid Recovery setup, several interventions should be considered to minimize the impact of the surgery on postoperative sleep.

Early mobilization and early discharge to the comfort of a patient's own home can minimize stress and allow them to return to normal sleep patterns. Also, while high-dose steroids may have the potential side effect of sleep disturbance, the benefits of reduced pain, opioid use and neuro-inflammation<sup>4</sup> outweigh the potential drawbacks and should be included in perioperative patient treatment.

### Postoperative nausea and vomiting management

Postoperative nausea and vomiting (PONV) is one of the most common reasons for delay-

ed mobilization and prolonged hospitalization<sup>5,6</sup> and is present in up to 40% of patients undergoing primary THA<sup>7</sup>. Risk factors such as female gender, previous history of motion sickness or PONV and being a non-smoker have been identified<sup>8</sup>, but are based on old literature and are not specific enough to allow for targeted prevention.

Use of postoperative morphine should be minimized and use of spinal opioids is not recommended due to unwanted side effects<sup>9</sup>. High-dose steroids have a well-documented anti-nausea and vomiting effect and should be included in perioperative patient treatment<sup>4</sup>. However, it should be noted that high dose methylprednisolone has not been shown to have an effect on orthostatic intolerance in primary THA patients<sup>10</sup>. Several medications have been proposed to reduce PONV – such as dopamine antagonists, serotonin antagonists and alpha-1 agonists – and these can be considered in patients where mobilization is complicated by PONV. Early elevation of the head rest and minimizing bed stay as a non-pharmacological prevention of PONV have also been proposed<sup>11</sup>.

### Oral fluid and nutritional status

Regular fasting guidelines for elective surgery apply to the Rapid Recovery pathway, with patient intake of clear oral fluids until 2 hours before surgery and solid food fasting for 6 hours before surgery being recommended. Preoperative carbohydrate loading has been proposed<sup>12</sup> but no procedure-specific studies have been done, and it is not used routinely in most outpatient and short-stay Rapid Recovery pathways<sup>13,14</sup>.



## Restrictions

Early mobilization is a central aspect of Rapid Recovery and should be applied to all patients, irrespective of comorbidities and procedure.

While postoperative restrictions following THA have traditionally been used in an attempt to minimize the risk for dislocation,

recent literature has shown no effect of such precautions or restrictions in respect to risk of dislocation, irrespective of the surgical approach<sup>15</sup>. Furthermore, postoperative restrictions may have a negative effect on both mental and physical early recovery, and as such, postoperative restrictions following primary THA are being abandoned in many Rapid Recovery pathways<sup>16</sup>.

1. Petersen PB, Jørgensen CC, Kehlet H et al. Delirium after fast-track hip and knee arthroplasty – a cohort study of 6331 elderly patients. *Acta Anaesthesiol Scand Blackwell Munksgaard* 2017; 61: 767-72.
2. Bin Abd Razak HR, Yung WYA. Postoperative Delirium in Patients Undergoing Total Joint Arthroplasty: A Systematic Review. *J Arthroplasty* 2015: 1414-1417.
3. Krenk L, Jennum P, Kehlet H. Sleep disturbances after fast-track hip and knee arthroplasty. *Br J Anaesth* 2012; 109: 769-775.
4. Kehlet H, Lindberg-Larsen V. High-dose glucocorticoid before hip and knee arthroplasty: To use or not to use—that's the question. *Acta Orthop* 2018; 89: 477-479.
5. Husted H, Lunn TH, Troelsen A et al. Why still in hospital after fast-track hip and knee arthroplasty? *Acta Orthop* 2011; 82: 679-684.
6. Jensen CB, Troelsen A, Nielsen CS et al. Why are patients still in hospital after fast-track, unilateral unicompartmental knee arthroplasty. *Acta Orthop* 2020; 91: 433-438.
7. Jans Ø, Bundgaard-Nielsen M, Solgaard S, Johansson PI, Kehlet H. Orthostatic intolerance during early mobilization after fast-track hip arthroplasty. *Br J Anaesth* 2012; 108: 436-443.
8. Apfel CC, Läärä E, Koivuranta M, Greim CA, Roewer N. A simplified risk score for predicting postoperative nausea and vomiting: Conclusions from cross-validations between two centers. *Anesthesiology* 1999; 91: 693-700.
9. Wainwright TW, Gill M, McDonald DA et al. Consensus statement for perioperative care in total hip replacement and total knee replacement surgery: Enhanced Recovery After Surgery (ERAS®) Society recommendations. *Acta Orthop* 2020; 91: 3-19.
10. Lindberg-Larsen V, Petersen PB, Jans Ø, Beck T, Kehlet H. Effect of pre-operative methylprednisolone on orthostatic hypotension during early mobilization after total hip arthroplasty. *Acta Anaesthesiol Scand* 2018; 62: 882-892.
11. Husted C, Gromov K, Hansen HK et al. Outpatient total hip or knee arthroplasty in ambulatory surgery center versus arthroplasty ward: a randomized controlled trial. *Acta Orthop* 2020; 91: 42-47.
12. Harsten A, Hjartarson H, Toksvig-Larsen S. Total hip arthroplasty and perioperative oral carbohydrate treatment: A randomised, double-blind, controlled trial. *Eur J Anaesthesiol* 2012; 29: 271-274.
13. Kehlet H. Fast-track hip and knee arthroplasty. *Lancet* 2013; 381: 1600-1602.
14. Gromov K, Kjærsgaard-Andersen P, Revald P, Kehlet H, Husted H. Feasibility of outpatient total hip and knee arthroplasty in unselected patients: A prospective 2-center study. *Acta Orthop* 2017; 88: 516-521.
15. van der Weegen W, Kornuijt A, Das D. Do lifestyle restrictions and precautions prevent dislocation after total hip arthroplasty? A systematic review and meta-analysis of the literature. *Clin Rehabil* 2015; 30: 329-339.
16. Gromov K, Troelsen A, Modaddes M et al. Varying but reduced use of postoperative mobilization restrictions after primary total hip arthroplasty in Nordic countries: a questionnaire-based study. *Acta Orthop* 2019; 90: 143-147.



# RAPID RECOVERY ENABLES YOU TO ADDRESS TODAY'S HEALTHCARE CHALLENGES

Zimmer Biomet's team plays a critical part in successfully implementing and continuously improving the Rapid Recovery Program. We don't just help you to improve the efficiency of your day-to-day logistics – **your department will have access to our European network of key opinion leaders for their expertise as well as the opportunity to visit our Centres of Reference and our European and local symposia.**

We'll come and see what you're doing well... and work with you to help you achieve even more.

Learn more with our implementation case studies, at <https://www.rapidrecovery.eu/healthcare-executive/case-study.html>

The Rapid Recovery Program enables healthcare teams to optimize all aspects of a patient's orthopedic journey – from preoperative assessment to discharge and beyond – with evidence-based clinical protocols. The program is designed to improve outcomes, quality of treatment and economic performance – minimizing complications and delivering patient-centered care. Standardizing and minimizing variance is an important part of the process leading to more predictable outcomes. But Zimmer Biomet recognizes that process and clinical practice change on this scale can be daunting.

Zimmer Biomet's change management experts partner with hospitals to support executives in the delivery of high-level patient care, improving staff satisfaction, surgical outcomes and financial performance. Staff at all levels are engaged to establish and develop a multidisciplinary team approach. This creates efficient pathways that provide the highest levels of patient care with enhanced patient reported outcome measures – PROMs – and patient satisfaction – patient reported experience measures.

Proven performance and outcomes for you and your patients:

## Improved clinical outcomes

- ✓ Increased health-related quality of life<sup>1</sup>
- ✓ No increase of readmissions in elective hip and knee arthroplasty patients<sup>2</sup>
- ✓ Improved function and outcome scores, such as WOMAC and AKSS<sup>3</sup>

## Improved patient satisfaction

- ✓ Patients significantly more satisfied across all measures related to their hospital stay<sup>4</sup>
- ✓ Positive correlation of higher patient satisfaction with shorter length of stay<sup>5</sup>

## Improved team dynamics and staff satisfaction

- ✓ Considerably increased satisfaction of all involved healthcare professionals, despite a perceived moderate increase in workload<sup>6</sup>

## Reduced length of stay

- ✓ Significantly reduced duration of hospital stay<sup>3,7</sup>
- ✓ Slightly reduced period of rehabilitation<sup>3</sup>

## Improved financial performance and efficiency of care

- ✓ Significantly lower treatment cost coinciding with increased health-related quality of life<sup>1</sup>





1. Larsen K, Hansen TB, Thomsen PB, Christiansen T, Søballe K. Cost-effectiveness of accelerated perioperative care and rehabilitation after total hip and knee arthroplasty. *J Bone Joint Surg Am* 2009; 91: 761-772.
2. Husted H, Stahl Otte K, Kristensen BB, Orsnes T, Kehlet H. Readmissions after fast-track hip and knee arthroplasty. *Arch Orthop Trauma Surg* 2010; 130: 1185-1191.
3. Den Hertog A, Gliesche K, Timm J, Mühlbauer B, Zebrowski S. Pathway-controlled fast-track rehabilitation after total knee arthroplasty: a randomized prospective clinical study evaluating the recovery pattern, drug consumption, and length of stay. *Arch Orthop Trauma Surg* 2012; 132: 1153-1163.
4. Akhtar KSN, Houlihan-Burne D. Optimization of the Patient Undergoing Total Knee Arthroplasty – The Rapid Recovery Program. *J Clin Rheumatol Musc Med* 2010; 1: 1-4.
5. Husted H, Holm G, Jacobsen S. Predictors of length of stay and patient satisfaction after hip and knee replacement surgery. *Acta Orthopaedica* 2008; 79: 168-173.
6. Jonsson G, Bergh Lundgren S. Rapid Recovery – improves the work satisfaction of the staff. Presented at the 3rd European Rapid Recovery Symposium, London, 2012.
7. Gordon D, Malhas A, Goubran A et al. Implementing the Rapid Recovery Program in primary hip and knee arthroplasty in a UK state run hospital. *Eur J Orthop Traumatol* 2011; 21: 151-158.

