

Perioperative Management – Rapid Recovery Protocol

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Summary

The perioperative care of the total hip-arthroplasty (THA) patient has undergone a significant evolution similar to advancements in the technical performance of the operative procedure itself. The concept of a rapid recovery protocol is the establishment of aggressive perioperative programmes with the distinct intention to speed recovery, reduce morbidity and complications, and create a programme of efficiency while maintaining the highest level of patient care. The establishment of a focused care plan will align short-term goals of THA with long-term goals which are to relieve pain, increase function, provide stability, and maintain durability.

Introduction

Total hip arthroplasty (THA) has evolved into one of the most successful operative interventions in the field of orthopaedics. The past three decades have witnessed significant technical improvements in the actual surgical procedure. THA consistently provides pain relief and improvement in the quality of life which is sustained into the second and third decades of follow-up [2]. However, THA represents a significant event in a patient's life. It is incumbent upon health-care providers to develop and provide a comprehensive perioperative care plan for the patient and his family. During the past three decades, the authors have developed and refined a rapid recovery protocol for patients undergoing THA. The outline of this protocol is presented in

■ Table 13.1.

■ **Table 13.1.** Fundamentals of the joint implant surgeons rapid road to recovery

1	Comprehensive review of patient's past medical history
2	Preoperative orthopaedic evaluation
3	Preoperative education with educational materials
4	Surgery scheduling
5	Comprehensive medical evaluation
6	Informational videos and surgical consent
7	Preoperative review of entire perioperative protocol with patient and family
8	Preoperative physical therapy evaluation and commencement of rehabilitation
9	Perioperative nutrition and smoking cessation
10	Discharge planning and home requirements
11	Preoperative radiographic planning conference
12	Pre-emptive analgesia
13	Multimodal perioperative analgesia
14	Efficient and accurate surgery
15	Wound-healing adjuncts
16	Clinical pathways focused on early mobilisation
17	Full weight-bearing with crutches or walker for 3 to 4 weeks, then cane as needed
18	Hospital discharge planning for postoperative day 1 or 2
19	Post-discharge nursing contact
20	6 week follow-up clinical evaluation

Preoperative Assessment, Education and Pre-Arthroplasty Rehabilitation

The initial assessment of the patient commences with a comprehensive review of the patients past medical history. Detailed »review-of-systems« forms have been created which can be completed by the patient prior to or at the time of initial consultation. The accuracy and completeness of this information must be documented

by the health-care provider at the time of initial assessment. With the appropriate transfer of information, this assessment can be utilised not only at the time of orthopaedic consultation but also at the time of preoperative medical evaluation as well as admission to the hospital in an effort to avoid the often all too frequent repetition of questioning [20]. The patient should be requested to complete standardised outcome measures. A thorough and complete orthopaedic evaluation must be performed and documented, and a preoperative assessment score calculated.

Once the patient's need for THA has been established, preoperative education should commence. Patient education materials have become readily available and include a multimedia approach. Printed perioperative brochures outline details of the entire operative intervention. These brochures deal with a number of topics ranging from »frequently asked questions« to »intimacy following THA.« Educational videos and interactive computer-based programmes can assist patients in comprehension of both preoperative and postoperative expectations. Videos of the actual surgical procedure can be created for more inquisitive patients who wish to have an in-depth understanding. Frequently, patients will request to see and handle an actual prosthesis, and demonstration models are available in the clinic. Personalised guide books for THA which outline pre- and postoperative exercises, perioperative nutrition, and review what to expect and how to prepare, are extremely beneficial in assisting patients and their families. Additionally, the World Wide Web serves as a source of information for many patients and families. Physicians should direct patients and their families to appropriate online sources. Scheduling for the surgical procedure begins after the pros and cons of the surgical intervention and potential complications have been reviewed with the patient.

A comprehensive medical evaluation should be performed preoperatively. This should include an assessment of co-morbidities and appropriate interventions to optimise the patient's preoperative medical status [11]. While this can be performed by the patient's family or internal medicine practitioner, we have obtained better results by establishing a relationship with a group of internal medicine hospitalists who specialise in the preoperative and perioperative medical management of joint-replacement patients. Upon optimisation of the patient's preoperative medical status, a review of the entire perioperative protocol should be performed with the patient and family. This discussion should include discharge planning and home requirements. A comprehensive physical therapy evaluation should be performed in an effort to establish a baseline and to determine ultimate goals. Patients are instructed before surgery in a preoperative physical therapy conditioning programme and the requisite postoperative exercise regimes.

The benefit of preoperative multi-media education of patients and family and pre-arthroplasty rehabilitation is not only an enhanced comprehension of the entire operative intervention which will concomitantly allay anxiety and facilitate a smoother transition through the entire perioperative period. Liebergall et al. [17] evaluated the effects of preadmission social-work interventions in the form of education, discharge planning and hospital length of stay. Patients who received intense preadmission screening with psychosocial evaluation, discharge planning, coordination of nursing and physical therapy interventions and monitoring of medical testing before elective THA had reduced hospital stays compared with those who did not receive preadmission screening. They concluded that an emphasis on preoperative education and assessments is one method to decrease hospital stay. Crowe and Henderson [5] evaluated the effectiveness of an individually tailored preoperative rehabilitation programme in patients undergoing THA. This preoperative multi-disciplinary rehabilitation and education included information about the hospital stay, early discharge planning, and home preparation. The authors demonstrated that patients who received this focused preoperative rehabilitation rapidly achieved discharge criteria and had shorter hospital stays. In addition to reducing hospital length of stay, Daltroy et al. [6] noted that preoperative education including psychoeducational preparation also reduced pain medication utilisation. It is apparent from the literature that preoperative education focused on informing patients on all aspects of perioperative period combined with perioperative rehabilitation exercises can enhance the patient's ability to progress uneventfully through the perioperative period. Of further note is that reduced hospital stays are obtainable without altering results or complications.

Nutritional Status and Tobacco Utilisation

A number of studies have documented that the patient's nutritional status correlates with perioperative complications following THA. Perioperative malnutrition has been noted to be predictive of delayed or complicated wound healing and has been associated with increased morbidity and increased length of hospitalisation. Del Savio et al. [7] found that patients with low preoperative serum albumin had significant longer hospitalisation than those with normal serum levels. Gherini et al. [10] evaluated nutritional status of patients undergoing THA using serum albumin and serum transferrin levels. Low preoperative transferrin levels were shown to be predictive of delayed wound healing. When combined with bilateral surgery, which causes a higher metabolic demand on the perioperative period, and advancing age, also associated with poor nutrition, serum transferrin levels resulted in predicting delayed

wound healing in 79% of the cases. Similarly, Lavernia et al. [15] found that lower preoperative nutritional parameters such as serum transferrin also were predictive of increased hospital charges, longer surgical and anaesthetic times, and an increased length of stay. These authors along with the current authors suggest that preoperative education regarding nutrition and efforts at supplements or hyperalimentation may help prevent perioperative complications and perhaps improve outcomes.

Multiple studies have noted the adverse effects of cigarette utilisation on the perioperative period. Smoking has been shown to compromise blood supply and decrease both collagen synthesis and osteosynthesis. As a result, multiple studies have documented that smokers are prone to increased cardiopulmonary events, increased intensive care utilisation, higher rate of wound complications, increased surgical times, and longer hospital stays [14, 21, 22]. Smoking cessation protocols have been shown to reduce this increased preoperative morbidity. In a randomised clinical trial, Moller et al. [21] investigated the affects of a smoking-cessation intervention programme on the outcomes of THA and TKA. Sixty patients were randomised into a smoking-intervention group with education, nicotine-replacement therapy and smoking cessation, and compared with 60 patients who were not enrolled in a smoking-intervention programme. The overall complication rate was reduced from 52% in the control group to 18% in the intervention group. Wound related complications dramatically reduced from 31% in the control group to 5% in the intervention group. Furthermore, this six- to eight-week programme reduced the number of secondary surgeries from 15% in the control group to 4% in the intervention group.

Multimodal Perioperative Pain Management

Effective management of perioperative pain is a critical part of the rapid recovery protocol for THA. Pain is a complex conundrum of interactions between the central nervous system, the different pathways and the local site of injury. Peripheral pain like that associated with THA has two sources: neurogenic and inflammatory. Neurogenic pain is a result of the stimulus produced by the surgical trauma and inflammatory pain is a result of the cascade of events involving cytokines, prostaglandins and various chemical mediators [27]. The most significant shortcoming of conventional treatment of surgical pain is that it commences postoperatively. Traditionally, nothing was done to reduce or block the inciting events which cause neurogenic and inflammatory aspects of post surgical pain. These conventional methods have been abandoned and multimodal pain management strategies have been adopted. Multimodal management pain involves pre-emptive analgesia, or pre-treatment of pain prior to the initiat-

ing event that results in central nervous-system excitability and local wound and extremity inflammation [19, 27].

We have been involved and have reported our ongoing efforts at addressing pain management following THA in a multimodal systemic and pre-emptive fashion [18, 19]. The cumulative results of the aforementioned studies suggest that a combined programme of postoperative anti-inflammatory medications, namely non-steroidal anti-inflammatory drugs, regional anaesthetics to include spinal, epidural and blocks [9], anti-emetic medications and local wound soft-tissue infiltration with a cocktail of local anaesthetics, anti-inflammatory agents and narcotics provides safe and effective postoperative pain control [18]. These measures are supplemented with long-acting and short-acting oral narcotics. Several studies have documented that patients undergoing THA can achieve near immediate mobilisation with the establishment of such pain-control management programmes. ■ Table 13.2 outlines the authors' current recommended perioperative pain-control pathway. The incorporation of this pain-control programme has facilitated early mobilisation and early discharge. Patients undergoing THA are mobilised within 24 hours of the operative intervention, with the majority mobilised within six hours. This early mobilisation facilitates early discharge to home within 48 hours of the operative intervention in the majority of patients undergoing THA.

Clinical Pathways for THA Patients

The establishment of specific protocols for the care and treatment of patients undergoing THA can provide efficient and effective service. Commonly referred to as clinical pathways or care maps, these outlines of care provide a framework by which the patient's postoperative care is managed. It is believed that by defining a sequence of events and goals with a map of care, the patient may be able to meet these goals more efficiently and thus experience reduced and uncomplicated hospital stays. THA is a relatively routine procedure when performed on a healthy individual; therefore, clinical pathways can be standardised easily.

Numerous publications have examined the role and effectiveness of these clinical pathways. Kim et al. [13] performed a meta-analysis and identified 11 articles which met the criteria for review. They specifically addressed the reported effectiveness of clinical pathways on perioperative complications, functional rehabilitation, hospital cost and length of stay. As a result of this review, they concluded that implementation of a clinical pathway for elective THA can result in a reduction of the incidence of complications. Furthermore, clinical pathways tended to reduce hospital cost and decrease length of stay without compromise of the clinical result. In a randomised

■ **Table 13.2.** Perioperative pain management pathway

Time Period	Component
Preoperative	Cyclooxygenase-2 inhibiting non-steroidal anti-inflammatory, day before and day of surgery
Intraoperative	Spinal anaesthesia using: <ul style="list-style-type: none"> ■ Bupivacaine 0.75% (7.5 mg to 12 mg based on patient height and weight) ■ Duramorph (200 mcg to 300 mcg based on patient height and weight) Intra-articular soft-tissue injection following closure of fascial muscular periarticular layer using: <ul style="list-style-type: none"> ■ Ropivacaine 0.5% (60 cc) (slightly above recommended dosage due to Epinephrine effect with local anaesthesia) ■ Epinephrine 1:1,000 (0.5cc) ■ Toradol 30 mg
Post-anaesthesia care unit	Dilaudid IV PRN breakthrough pain (dosage based on patient's pain level, height and weight)
Postoperative inpatient unit	
Day of surgery	<ul style="list-style-type: none"> ■ Oxycotin (Oxycodone SR) 20 mg PO q 12 hours x 4 doses (initiate within 2 hours of arrival to unit) OR ■ If >70 years, Oxycotin (Oxycodone SR) 10 mg PO q 12 hours x 4 doses (within 2 hours of arrival to unit) ■ Oxycodone (Roxicodone) 5 mg PO q 4 hours PRN breakthrough pain > 5 on pain scale; may repeat x 1 (notify physician if pain is not relieved after 3rd PRN within 6 hours) ■ If unable to tolerate PO medication within first 24 hours postoperatively, morphine 2 mg IVP q 2 minutes up to a maximum of 10 mg in 1 hour for pain. Notify physician if pain not relieved
Postoperative day 1	Cyclooxygenase-2 inhibiting non-steroidal anti-inflammatory (Celebrex 200 mg PO bid) × 10 days
After 48 hours on unit	After Oxycotin and Oxycodone are discontinued as above, begin: Hydrocodone/APAP (Vicodin) 5/500 mg 2 tabs PO q 4 hours PRN for pain 6–10 on pain scale Hydrocodone/APAP (Vicodin) 5/500 mg 1 tab PO q 4 hours PRN for pain 1–5 on pain scale Give no more than 4000 mg of acetaminophen in 24 hours

prospective study of 163 patients who either entered a clinical pathway or represented a control group, Dowsey et al. [8] demonstrated that clinical pathways resulted in a significant reduction in hospital length of stay, early ambulation, reduction of readmission rate, and more accurate matching of the patient discharge destination as determined by preoperative planning. Clinical pathways should, therefore, be an integral part of the rapid recovery protocol to facilitate the perioperative care of the patient undergoing THA.

Wound-Healing Adjuncts

There is increasing evidence that the use of growth factors in the form of the autologous platelet gel may facilitate wound healing [3, 24]. Autologous platelet gel is a type of tissue adhesive that is derived from the patient's own platelet-rich plasma. This material was originally introduced in the early 1990's and is known to have excellent haemostatic and tissue sealant properties when combined with thrombin and calcium. This byproduct of blood collection techniques has proven to be an excellent source of beneficial cytokines, such as platelet derived growth factor (PDG) and transforming growth factor-beta (TGF-β). By activating the platelets and causing degranulation, the calcium thrombin combination creates a glue-like

substance which promotes osteogenesis, speeds wound healing, promotes haemostasis and may also decrease postoperative pain.

Several manufacturers within the orthopaedic industry have noted these beneficial effects and are currently marketing products to assist in the harvesting of the patient's own platelets from a sample of whole blood (GPS, Biomet Inc., Warsaw, Indiana USA; Symphony, DePuy Inc., Warsaw, Indiana USA). The efficacy of these wound-healing adjuncts is surfacing in arthroplasty. Mooar et al. [23] performed a retrospective evaluation examining the outcome of autologous platelet gel usage. Patients were selected to receive autologous platelet gel applied to the synovium, bony ends and wound prior to closure following TKA. These patients were compared with patients who did not receive the gel. Several distinct differences were noted. The study group experienced significantly less blood loss, had improved range of motion and required significantly less intravenous and oral narcotics than the control group. This study is preliminary and certainly further studies are required to validate the effect of autologous platelet gel. However, no adverse effects currently appear to exist from autologous platelet gel and there is potential benefit in terms of enhanced wound healing, pain relief, diminished blood loss and early hospital discharge. Therefore, the use of wound healing adjuncts should be considered as part of a rapid recovery protocol.

Postoperative Physiotherapy and Rehabilitation

Concomitant with the aggressive and effective multimodal pain management is aggressive physiotherapy and rehabilitation. Despite concerns regarding weight-bearing status following THA, especially with cementless designs, the data would suggest that immediate weight bearing as tolerated with an assistive device has no negative impact on prosthetic stability or osteointegration [25]. Certainly this is not a concern with cemented THA. The benefits of early mobilisation are well-recognized especially with respect to enhancement of pulmonary function [12], facilitation of gastrointestinal motility and prophylaxis against deep venous thrombosis [1]. Several authors have described a multi-modal approach to prophylaxis against deep venous thrombosis in patient undergoing THA which includes early mobilisation [19, 26]. This multimodal approach has been shown to be efficacious and avoids the concomitant perioperative wound complications which are present with chemical prophylaxis.

Results of the Utilization of the Rapid Recovery Protocol in Patients Undergoing THA

Over the past decade, our concept of the road to recovery following THA has evolved into what is now referred to as rapid recovery. Patients are therefore achieving postoperative milestones at significantly earlier times. The average length of stay of 10 days in the early 1990's is now diminished to a little over two days. A retrospective review was performed to examine the perioperative effects of the rapid recovery programme. The control group consists of all primary unilateral THA performed by joint implant surgeons during a six-month period from February 1997 through June 1997. The study group included all primary unilateral THA performed by joint implant surgeons for a consecutive six-month period after implantation of the rapid recovery program (January 2003 to June 2003). Patient demographics, length of hospital stay, discharge disposition and readmission rates were compared between the control and study groups. The control group consisted of 168 THA and the study group was 128 THA. No statistically significant differences were noted between groups for height, weight or age ($p < 0.05$). The length of stay was significantly reduced from 4.0 days in 1997 (range 2–9 days; standard deviation 1.1) to 2.7 days in 2003 (range 1–7 days; standard deviation 0.86; $p > 0.001$). Furthermore, the rate of readmission to the hospital within three months of surgery was significantly lower in the study group (3.9% versus 8.3%; $p = 0.05$).

Conclusion

Total hip arthroplasty (THA) continues to be an evolving science. Numerous debates exist with respect to technique and implants utilised. There is continued controversy regarding issues of cementless versus cemented fixation, appropriate surface finish for cemented implants, and the ideal bearing surface. There is an increasing focus on surgical approaches for THA with is a keen interest in minimally invasive or less invasive surgical procedures. The World Wide Web and lay press are inundated with descriptions of new surgical approaches which facilitate rapid return of function. This chapter has outlined a multifactorial rapid recovery protocol which will enhance the patient's ability to successfully undergo THA. It is our distinct impression that rapid return of function is not limited to the size of the incision but rather to the development of a comprehensive program to guide patients through the perioperative period.

Take Home Messages

- Preoperative assessment, patient education and pre-arthroplasty rehabilitation are essential tools for the implementation of a multifactorial rapid recovery protocol.
- Perioperative malnutrition and smoking are predictive of delayed or complicated wound healing and have been associated with increased morbidity and increased length of hospitalisation.
- Effective management of perioperative pain is a critical part of the rapid recovery protocol for THA. The incorporation of a special pain control programme has facilitated early mobilisation and early discharge.
- Standardised clinical pathways play an important role in the effectiveness of rapid recovery in THA.
- Implementing a multifactorial rapid recovery protocol, the length of stay and the rate of readmission to the hospital within three months of surgery could be significantly reduced.

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