Rapid Recovery Protocol for Peri-Operative Care of Total Hip and Total Knee Arthroplasty Patients

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ABSTRACT

Total hip arthroplasty (THA) and total knee arthroplasty (TKA) are among the most successful procedures performed in terms of quality-of-life years gained. The long-term goals of arthroplasty, to relieve pain, increase function, provide stability, and obtain durability, are accomplished in the vast majority of cases. The short-term goals, however, have become the target of aggressive peri-operative programs that aim to speed recovery, reduce morbidity and complications, and create a program of efficiency while maintaining the highest level of patient care. The concept of rapid recovery is built upon the burgeoning interest in less-invasive and small-incision surgeries for (THA and TKA). However, the incision size does not appear to be the most critical aspect of the program. This article outlines the specific elements of the rapid-recovery program for lower-extremity arthroplasty patients, including pre-operative patient education, peri-opera-

tive nutrition, vitamin and herbal medication supplementation, preemptive analgesia, and post-operative rehabilitation. A holistic peri-operative, rapid-recovery program has lead to a significantly decreased hospital length of stay and significantly lower hospital readmission rates in patients who undergo primary THAs and TKAs. Combining these results with minimally invasive techniques and instrumentation should make recovery even faster.

INTRODUCTION

The overwhelmingly favorable results of modern total hip and total knee arthroplasty (THA and TKA) are undisputed. From the original descriptions of Sir John Charnley to today, THA and TKA are among the most effective surgical or medical interventions that consistently provide quality of life and pain relief.[1-3] This relief of pain and improvement in quality of life appears to be long-standing and THA and TKA are being reported as successful into the second and even third decades of follow up.[4-12]

The long-term goals of arthroplasty, which include relieving pain, improving function, providing stability, and obtaining durability are achieved and maintained in the majority of cases. Therefore, recent focus has centered upon obtaining similar successes in the peri-operative period. Reducing peri-operative complications, increasing the speed of recovery, and reducing the length of hospital stay appear to be the next set of goals in care of the hip and knee arthroplasty patient. As noted by Del Savio et al., a longer than necessary hospital stay cannot be dismissed as insignificant, as hospital stay is among the more costly aspects of total joint arthroplasty.[13] The concept of rapid recovery is built upon the burgeoning interest in less-invasive and small-incision surgeries for hip and knee arthroplasty. Implant manufacturers and the medical industry are concentrating efforts on these concepts. However, minimally invasive techniques and small incision surgery are not the keystone to a rapid recovery. Instead, a holistic approach concentrating on education, information, and peri-operative management is likely to affect an even more significant change. A complete Rapid Recovery Program has become available recently for use (Biomet Inc., Warsaw, IN, USA). The short- and long-term outcomes of these concepts have been validated individually, but the holistic, combined approach has not heretofore been described.

This Chapter reviews the current knowledge of pre-operative patient education, peri-operative nutrition, vitamin and herbal medication supplementation, preemptive analgesia, post-operative rehabilitation, and the possible beneficial effects these have on peri-operative recovery. We further present our early experience with a holistic peri-operative rapid recovery program.

PRE-OPERATIVE EDUCATION AND PRE-ARTHROPLASTY REHABILITATION

One of the easiest and safest ways to increase the efficiency by which an arthroplasty patient flows through the peri-operative period appears to be by providing a high level of education for the patient and family. Crowe and Henderson evaluated the effectiveness of an individually tailored, pre-operative rehabilitation program in patients who undergo THA and TKA. This pre-operative multidisciplinary rehabilitation and education included information about the hospital stay, early discharge planning, and focused preparation for the patient's discharge home. The authors demonstrated that patients who received this focused pre-operative rehabilitation achieved discharge criteria significantly earlier (5.4 days compared with 8 days) and had shorter (6.5 days versus 10.5 days) hospital stays.[14] A similar study was performed to examine the effects of pre-admission social work interventions in the form of education and discharge planning on hospital length of stay. Patients who received intense pre-admission screening with psychosocial evaluation, discharge planning, coordination of nursing and physical therapy interventions, and monitoring of medical testing before elective THA and TKA had reduced hospital stays compared with

Figure 1. Soft-tissue and intra-articular injection of bupivacaine, epinephrine, and narcotic was determined to be beneficial in reducing blood loss and improving immediate post-operative pain levels, and increasing ROM following TKA.

those who did not receive the pre-admission screening. The authors concluded that thorough case management, with an emphasis on pre-operative education and assessments, is one way to decrease length of stay.[15] Interestingly, Daltroy et al. added that pre-operative education, including psychoeducational preparation, not only reduced hospital stay but also reduced pain-medication usage in their study.[16] By informing patients of what to expect and educating them pre-operatively on the required rehabilitation exercises and activities, patients can be better prepared to face the stresses of surgery and recovery. Thus, reduced hospital stays are obtainable without altering results or increasing complications.

CLINICAL PATHWAYS FOR THA AND TKA PATIENTS

In a classic Americanized society, the industrial model, concept of factory work, and assembly-line mentality are believed to be ones of efficiency. If a company does one thing or makes only one product, that company may be more efficient and more effective at doing one thing and doing it well. That concept has permeated into TKA and THA in the form of clinical pathways. Also known as care maps, these outlines of care provide a scaffold by which the patients' peri-operative period is managed. The belief is 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 hospital stay. THA and TKA are ideal proving grounds for such clinical pathways as the care of these patients is relatively standard, procedures are routine, and patients are typically healthy. In addition, the magnitude of the cost of THA and TKA makes these procedures targets for increasing efficiency with potential financial savings.[17] Multiple articles have been published that examine the role and effectiveness of these clinical pathways on various aspects of the peri-operative period for THA and TKA patients. Kim et al. published a review article that encompasses the results of 11 articles identified by strict meta-analysis criteria.[17] In their review, they specifically addressed the reported effectiveness of clinical pathways on length of stay, hospital costs, complications, and functional status. They concluded that implementation of a clinical pathway for elective THA and TKA can result in diminished length of stay with accompanying decreases in cost. Furthermore, clinical pathways either reduced the incidence of complications or, at the least, did not increase these events. Lastly, no decreases in patient-reported outcomes were reported.[17]

One specific study, referenced by Kim et al., warrants particular attention, as it was a randomized, prospective, controlled design.[17] Dowsey et al. randomized 163 patients into a clinical pathway group and control group. Thus, valid comparisons should be able to be drawn from this study design. They concluded that these clinical pathways resulted in significant reductions in hospital length of stay, earlier ambulating ability, reduction in the readmission rate, and importantly, more accurate matching of the patient discharge destinations as determined by pre-operative education.[18]

With the exception of Mauerhan et al., who reported an increased rate of manipulation in their care-mapped patients, all published series thus far have shown similar good results.[19] It appears that the use of care pathways can safely be added to the rapid-recovery concept for the peri-operative care of the THA and TKA patient.

PREEMPTIVE ANALGESIA

Any surgery, and especially TKA, is associated with some level of pain. The simple definition of pain, outlined by the International Association for the Study of Pain (IASP) *is an unpleasant sensory and emotional experience associated with actual or potential tissue damage.* The adequacy of relief from pain after TKA and THA can affect not only short-term outcomes, but overall satisfaction with the surgical intervention. Peripheral pain, such as that from THA and TKA, has two sources: neurogenic and inflammatory.[20,21] Neurogenic pain is that of the stimuli of the surgical event, and inflammatory pain is secondary to a cascade of events that involve cytokines, prostaglandins, and a number of other chemical mediators.[21,22] Conventional treatment of surgical pain begins post-operatively, and does not effectively reduce or block the inciting events that cause the neurogenic and inflammatory aspects of post-surgical pain. The painful stimulus has already occurred, namely "surgical trauma."

Multimodal management of peri-operative pain involves preemptive analgesia, or pre-treatment of pain before the inciting event that results in central nervous system excitability and local wound and extremity inflammation. The current authors have reported on our on-going efforts at addressing THA and TKA pain management in a multi-modal, systematic, and pre-emptive program.[23-25]

The cumulative results of the aforementioned studies suggest that a combined program of pre-operative and post-operative anti-inflammatory medication, regional anesthetic, antiemetic medication, and local wound soft-tissue and intraarticular anesthetic medication and narcotic injections provide safe and effective post-operative pain control.

The current authors investigated the role of cyclooxygenase-2-inhibiting nonsteroidal medications (COX-2) in patients who underwent THA and TKA with either spinal or epidural anesthesia.[24] Several important conclusions were noted. Patients who had epidural anesthetic for the surgery removed in the recovery room, combined with COX-2, had significantly less post-operative pain-control issues than those who had epidural without COX-2 and those with spinal and COX-2. Additionally, epidural and COX-2 patients demonstrated less post-operative confusion and less post-operative nausea than those without COX-2. Epidural and COX-2 also resulted in less post-operative ileus. The patients in the epidural and COX-2 group had slightly higher pain levels on the day of surgery, but significantly lower pain levels than the spinal and COX-2 patients on post-operative days 1 and 2. Lastly, the epidural and COX-2 group had the shortest average hospital stay of the groups—a difference that was statistically significant.

Our studies did, despite significant positive results, identify a window of inadequate pain control in the immediate post-operative period in patients who had epidural anesthesia for surgery, removed in the recovery room. Continuous, prolonged epidural can obviate this window of increased pain, and has been reported to allow earlier obtainment of functional goals than general anesthesia alone, but also is associated with increased complexity of care and maintenance, and requires close post-operative observation.[26] These observations prompted the third study that investigated the role of intra-operative soft-tissue injection with local anesthetic, and intra-articular injection with local anesthetic and long-acting narcotic, for adequate pain control in the early post-operative period (Fig. 1).[25] Patients who received intra-operative soft-tissue injections with 0.25% bupivacaine with epinephrine and intraarticular injection of 0.25% bupivacaine with epinephrine and long-acting narcotic (Astramorph 10 mg) were compared with those who did not receive supplemental injections. Otherwise, the peri-operative pain-management protocols were identical between the two groups. This study included two weeks of pre-operative and ten days of post-operative COX-2 inhibitors, general anesthetic, patient-controlled on-demand intravenous narcotic administration for 24 hours post-operatively, and initiation of scheduled long-acting oral narcotics, and as-needed breakthrough oral narcotics on post-operative day 1.

A significantly reduced need for breakthrough narcotic in the study group on the day of surgery was noted, as well as a deceased need for rescue doses of narcotic reversal in the study group (Figs. 2 & 3). Significantly less confusion was observed in the study group, likely a result of less narcotic sedation. Greater average range of motion (ROM) was achieved in the study group compared with the controls, and whereas the difference did not reach significance, a decreased need for manipulation in the study group was noted.[25]

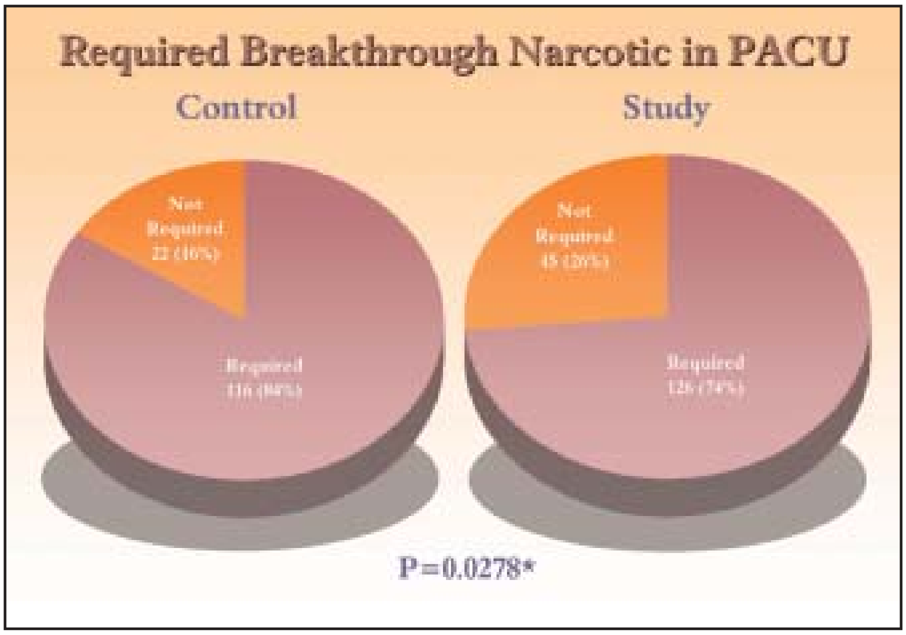

Figure 2. Soft-tissue and intra-articular injection of bupivacaine, epinephrine, and narcotic resulted in a reduced need for breakthrough narcotic in the post-anesthesia care unit compared with a control group following TKA.

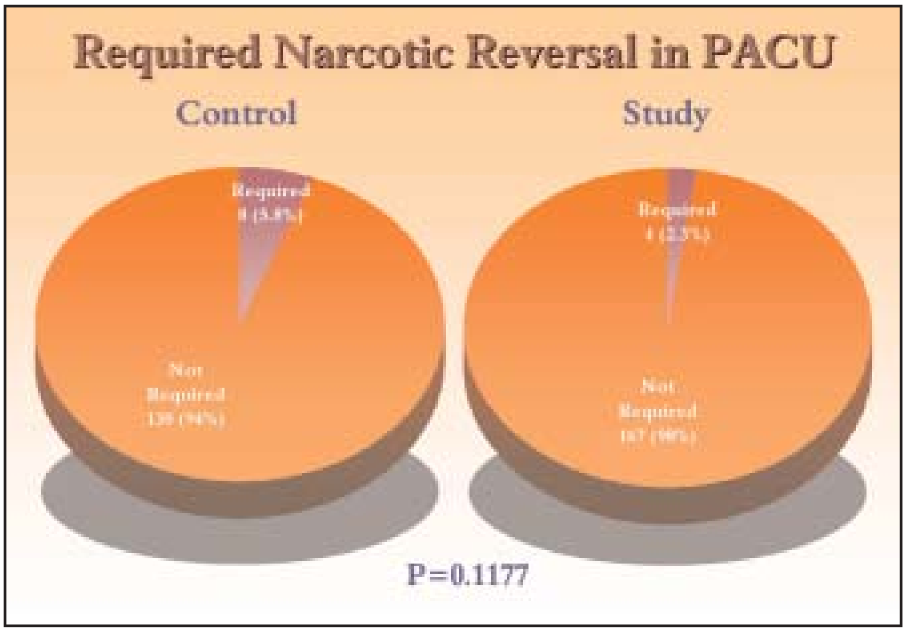

Figure 3. Concomitant with the reduced need for breakthrough narcotic, the study group that received soft-tissue and intra-articular injection had a reduced requirement for administration of narcotic reversal agents in the post-anesthesia care unit.

In the same study, those patients who received the local anesthetic injection also had significantly lower bleeding indices. Furthermore, the study patients had significantly lower intra-operative blood loss, likely as a direct result of the epinephrine injection. It appears the use of intra-operative local anesthetic injection with epinephrine and a long-acting narcotic has an overall beneficial effect on the recovery from TKA.[25]

Similar beneficial effects from the pre-operative and post-operative use of COX-2 drugs in management of pain following TKA have been reported by Buvanendran et al.[27] In a placebo-controlled investigation, the authors reported significantly less epidural infusion and in-hospital narcotic usage in the study patients. Additionally, the group that received COX-2 medications had lower median pain scores, less post-operative vomiting, and a decrease in sleep disturbances than the placebo group. Better knee flexion was observed in the COX-2 group compared with the placebo group upon discharge home. The COX-2 group also was more satisfied, in general, with their analgesia.[27]

The authors' current bias is toward the increased use of regional anesthesia, including regional neural blockade, as reported by Luber et al. and others. The use of a lumbar plexus and sciatic nerve regional block provided adequate pain relief for an average of 13 hours before supplemental narcotic was requested by the patient. In addition, 92% patient satisfaction was reported using this technique for TKA.[28] The so-called 3-in-1 block, which combines a sciatic block with femoral nerve block, has been reported by multiple authors to provide improved pain control over general and spinal anesthetic for both knee and hip surgery.[28-32] These blocks appear to be effective in providing long-acting relief from pain while allowing for rapid and aggressive rehabilitation. They can be combined safely with local anesthetic injection with epinephrine (in doses below 1 mg/kg of anesthetic) and COX-2 inhibitors, and may obviate the need for intravenous narcotics.

NUTRITION AND SMOKING

Nutrition, or perhaps more precisely, a patient's state of nourishment, can have a critical role in the peri-operative complications following THA and TKA. Multiple authors have investigated the predictive value of pre-operative nutritional evaluation with laboratory measures. It appears that pre-operative malnutrition is not only predictive of delayed or complicated wound healing, but also can be predictive of increased morbidity and increased length of hospital stay.[13] Patients with low pre-operative albumin had significantly longer hospital stays than those with normal serum levels. In addition, albumin was the only serum marker reported to be predictive in the study by Del Savio et al.[13]

Gherini et al. evaluated the nutritional status of patients who underwent 103 THAs performed at our institution using serum albumin and serum transferrin. Low pre-operative transferrin levels were shown to be predictive of delayed wound healing.[33] When combined with bilateral surgery, which causes a higher metabolic demand during the peri-operative period, and advancing age, also associated with worsening nutrition, serum transferrin levels resulted in a correct prediction of delayed wound healing in 79% of cases.[33] Interestingly, Lavernia et al. reported that lower pre-operative nutritional parameters, such as serum albumin and transferrin, also were predictive of higher hospital charges, longer surgical and anesthetic times, along with a longer length of hospital stay.[34]

The current authors believe pre-operative education regarding proper nutrition and efforts at supplementation or hyperalimentation may help prevent peri-operative complications and perhaps improve outcomes.[33-34] Dr. Steven Brown of Phoenix, Arizona has developed a pre-operative formula for nutritional supplementation that may prove beneficial (personal communication). The formula is built first upon the availability and end-organ delivery of oxygen. Erythropoietin may be a beneficial agent for combating pre-operative anemia. L-arginine, an amino acid, may be helpful in enhancing oxygen transfer to tissues. This amino acid appears to affect nitric-oxide production that results in vasodilatation. Organic germanium is a safe and non-toxic supplement that facilitates the release of oxygen from hemoglobin, thus increasing the end-organ oxygen tension.

The next building block in Dr. Brown's formula is vitamins and minerals. Starting with a good-quality multivitamin, supplemental vitamins C and E should be added. In addition, zinc, an essential element for protein synthesis, should be taken. This had been shown to promote healing of burns, and may help wound healing while boosting the immune response. L-glutamine is included in the formula. As a non-essential amino acid, this chemical is produced mostly during stress and exercise. The stress of surgery depletes our natural stores of this chemical, which proves to be critical for immune function. L-glutamine supplementation can enhance healing, promote immune function, and stabilize the gastrointestinal tract. An alternative to L-glutamine, omithine alpha-ketoglutarate, provides the needed levels of glutamine without ammonia production and also stimulates growth hormone and insulin production. Lastly, beta-1, 3-1, 6-glycan, a polysaccharide present in certain mushrooms, has been noted to enhance the immune response by way of macrophage stimulation. This chemical may help prevent or combat post-operative infection while also lowering the cholesterol and triglyceride levels. These are recommendations based upon one surgeon's experience and research, and should be considered as such (personal communication: Dr. Steven Brown). Not all supplements are beneficial; in fact, some herbal medications can have a negative effect on peri-operative outcome. One such chemical is omega-3-fatty acids, which can increase bleeding when taken in moderate amounts.

In multiple studies, the most harmful and dangerous habit is cigarette usage. Patients who smoke have been shown to have significantly increased rates of peri-operative complications including cardiopulmonary problems, increased intensive care stays, and a much higher rate of wound complications.[35] Smokers who undergo total joint arthroplasty also tend to be younger than their non-smoking counterparts, have a higher comorbidity index, indicating they are sicker at baseline. These factors, combined with the effect that smoking has on blood supply, collagen synthesis, and osteosynthesis, result in the increased surgical times, delayed wound healing, and longer hospital stays observed in multiple studies.[35-37]

Counseling and a protocol for smoking cessation can be amazingly effective in reducing this increased peri-operative morbidity seen in smokers. In a randomized clinical trial, Moller et al. investigated the effects of a smoking-intervention program on the outcomes of THA and TKA. Sixty patients were randomized into a smoking-intervention group with education, nicotine-replacement therapy, and smoking cessation (or a 50% reduction in smoking) and compared with 60 patients who were not enrolled in a smoking-intervention program. The overall complication rate dropped from 52% in the control group to 18% in the intervention group. Wound-related complications, and cardiovascular issues resulted in the most dramatic drop with the program. This 6- to 8-week program even reduced the number of secondary surgeries performed from 15% in the control group to 4% in the intervention group.[37] Thus, any pre-operative, rapid-recovery educational program should include nutritional evaluation, diet and nutritional supplementation, and a smoking-cessation program.

WOUND-HEALING ADJUNCTS

As discussed previously, many variables are involved in the healing of the operative site following THA and TKA. Smoking, nutritional status, and obesity are among the patient-related factors that can cause delayed wound healing. Surgical technique also may be an important variable, with meticulous soft-tissue handling and hemostasis being aspects under the surgeon's immediate control. Mounting evidence exists that the use of exogenously applied growth factors, in the form of autologous platelet gel, may help to facilitate wound healing, among other benefits.

Autologous platelet gel is a type of tissue adhesive derived from the patient's own platelet-rich plasma. This material was introduced originally in the early 1990s, and was noted to have excellent hemostatic and tissue sealant properties when combined with thrombin and calcium.[38,39] Since that time, this byproduct of blood-collection techniques has proven to be an excellent source of beneficial cytokines, such as platelet-derived growth factor (PDGF) and transforming growth factor-beta (TGF-ß). By activating the patelets and causing degranulation, the calcium and thrombin combination creates a glue-like substance that promotes osteogenesis, speeds wound healing, promotes hemostasis, and, interestingly, decreases post-operative pain.[40-42] Multiple orthopaedic implant manufacturers have noted these beneficial effects and are currently marketing products that allow easy harvesting of the patient's own platelets from a small sample of whole blood (GPS, Biomet, Inc., Warsaw, IN, USA; Symphony, DePuy, Inc., Warsaw, IN, USA). Alternatively, many hospital perfusionists are able to obtain platelet concentrate and platelet-rich plasma using existing blood-salvage equipment. Whereas this process requires a trained perfusionist and advanced machinery, the potential advantage is that larger volumes of platelet-rich plasma can be obtained and the red blood cells returned to the patient.

The efficacy of this material in THA and TKA is just beginning to be proven in clinical practice. Mooar et al. performed a retrospective evaluation that examined the outcome of autologous platelet gel usage. A group of patients received autologous platelet gel applied to the synovium, bony cut surfaces, and wound lining before closure following TKA. These were compared with patients who had not received the gel. As one might predict, the group that received the gel experienced statistically significant less blood loss than the controls, along with a significantly shorter hospital stay. The study group also had improved ROM over controls at discharge from the hospital. Interestingly, the study group required significantly less intravenous and oral narcotic than the controls. These differences also were significant.[42]

Further studies are required to validate the local tissue effects of autologous platelet gel. However, at this time it appears little negative effect exists, and the potential benefit in terms of wound healing, pain relief, blood loss, and hospital discharge warrant more widespread use.

POST-OPERATIVE MANAGEMENT

Aggressive post-operative physical therapy has a positive overall benefit. Concerns have been raised as to weight-bearing status following THA and TKA, especially with cementless designs. The data suggest, however, that immediate

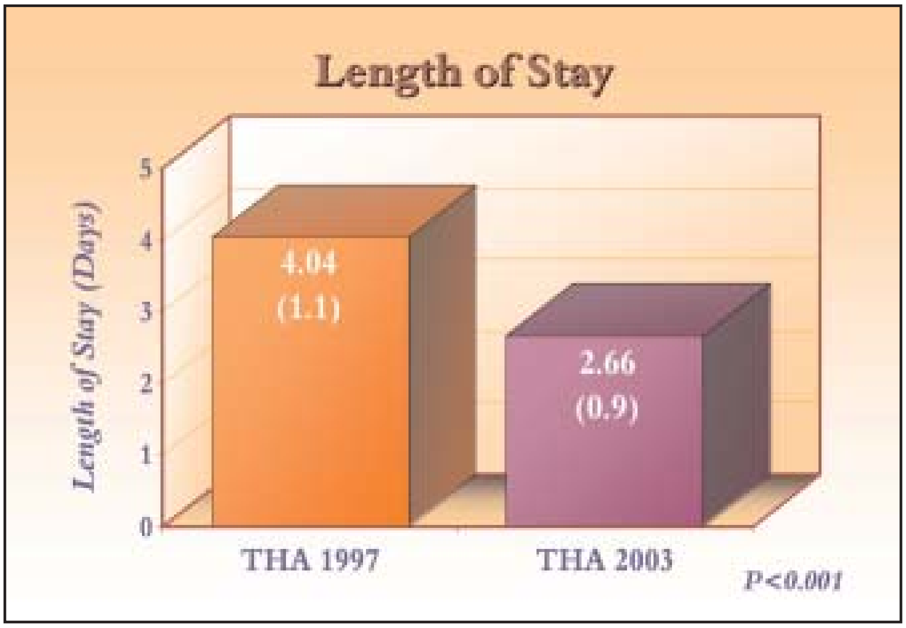

Figure 4. Implementation of a rapid-recovery protocol has resulted in a significantly reduced length of hospital stay for patients who undergo TKA.

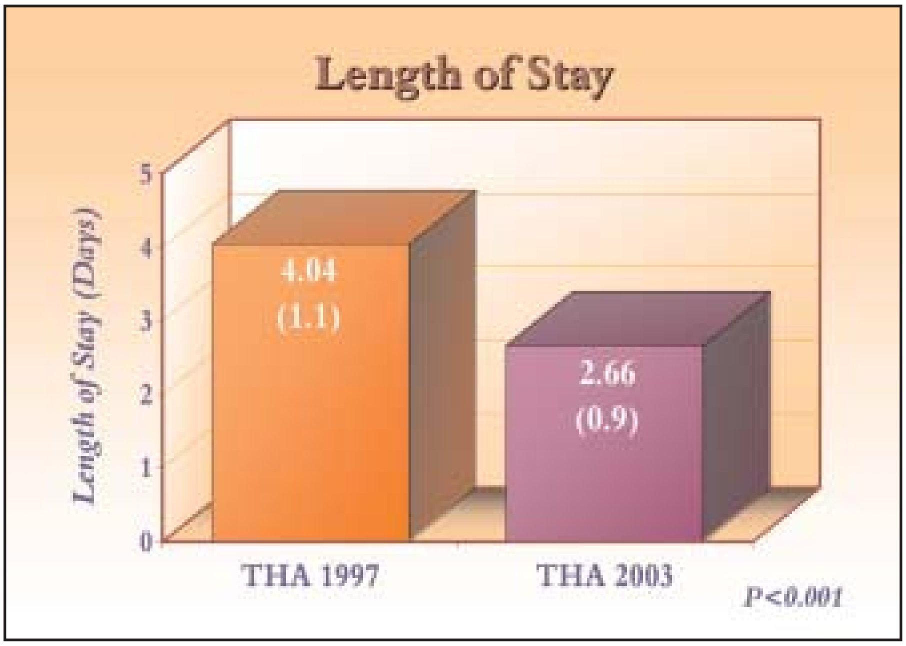

Figure 5. Patients managed using the rapid recovery protocol had a significantly reduced rate of hospital readmission during the three-month period following TKA.

weight bearing as tolerated with an assistive device has no negative impact on prosthetic stability or osteointegration.[43] In a prospective study, no differences were noted in terms of porous ingrowth or prosthetic stability between patients allowed full weight bearing versus protected weight bearing. However, a significantly longer hospital stay was required in the group with protected weight bearing, as well as a significantly protracted rehabilitation.[43] Woolson and Alder compared full weight bearing with partial weight bearing using the AML prosthesis (DePuy, Inc., Warsaw, IN, USA) and concluded that weight bearing, or protection thereof, has no effect on the bony ingrowth of an extensively porous coated implant.[44] Using the Mallory-Head primary porous stem (Biomet Inc, Warsaw, IN, USA), we have previously reported 97.5% survivorship at a minimum 10-year follow up (average follow up: 12.2 years) with unrestricted progression to full-weight bearing as tolerated in all patients.[45]

With TKA, ROM is perhaps the most highly debated topic in the acute post-operative period. Ritter et al. recently demonstrated, in a large study of more than 4700 TKAs, that pre-operative ROM is the most predictive variable that affects post-operative motion. In addition, adequate removal of posterior osteophytes and adequate medial release was associated with better motion in varus arthritis.[46] Other factors associated with decreased final passive motion have been reported to include tightness of the posterior cruciate ligament in cruciate retaining designs, elevation of the prosthetic joint line, under-resection of the patella or over-stuffing the patellofemoral space, and unbalanced flexion and extension space gaps. In addition, previous surgery and obesity also have been shown to be associated with lower-than-average knee flexion. Manipulation under anesthesia can be effective in improving motion in the stiff TKA if performed within 12 weeks of surgery.[47]

The use of a continuous passive motion (CPM) device also has been much debated. The reported results in the literature are conflicting. In well-designed, prospective studies by Lau and Chui, Beaupre et al., MacDonald et al., and Chen et al. CPM was not shown to offer any significant clinical benefit.[48-51] This is in contrast to a meta-analysis of the literature in which the results of CPM appear to be better than those without CPM in some measures such as decreased length of hospital stay, increased active knee flexion, and a decreased need for manipulation. CPM did not, however, improve passive flexion, or active or passive knee extension.[52]

RESULTS OF IMPLEMENTATION OF RAPID-RECOVERY CONCEPT TO TKA AND THA

Over the past year, we have implemented many of the above outlined components of the rapid-recovery program in the care of our TKA and THA patients. In a retrospective review, we examined the perioperative effects of the rapid-recovery program. The control group consisted of all primary unilateral THA, performed by our practice, during a six-month period before implementation of the rapid-recovery program (January 1997 through June 1997). The study group included all primary unilateral THA, performed by our practice, during a consecutive six-month period after implementation (January 2003 through June 2003).

Patient demographics, length of hospital stay, hospital discharge disposition, and readmission rates were compared between the control and study groups. The control group consisted of 168 THA and the control 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 reduced significantly in the study group from 4.04 days in 1997 (range: 2-9 days; SD: 1.1 days) to 2.66 days in 2003 (range: 1-7 days; SD: 0.86; $p<0.0001$) (Fig. 4). Furthermore, the rate of readmission to the hospital for any reason within three months of surgery was significantly lower in the study group (3.9% versus 8.3%) (Fig. 5). This difference was significant at $p=0.05$.

Authors have argued that early discharge from the acute-care setting simply shifts the burden of care to the rehabilitation setting.[53-55] In our study we did not determine this to be true. In the control group, 20.5% of patients were discharged to a skilled unit or rehabilitation setting, whereas in 2003, 23% were discharged to a skilled facility or rehabilitation unit. Furthermore, of the 79.5% of patients discharged to home in the control group, 24% received in-house home health therapy. In the study group, only 15% of the 77% of patients discharged to home required home health therapy services (Fig. 6).

In patients who underwent TKA during the same time periods, the length of hospital stay was reduced sig-

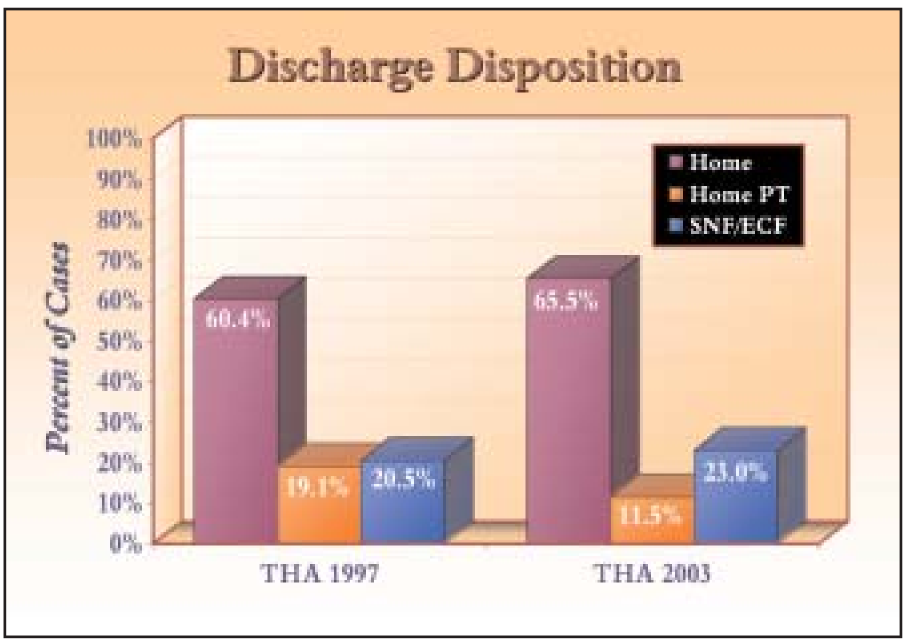

Figure 6. While length of hospital stay and readmission rate were lower for patients managed with the rapid-recovery protocol, discharge disposition was not changed significantly, which suggests the rapid-recovery results were genuine and not merely a shift in burden of care to extended care and rehabilitation facilities.

nificantly in the study group of 195 TKA compared with the control group of 185 TKA. In the study group, the hospital length of stay averaged 2.8 days (range: 1-7 days; SD: 0.92) compared with an average length of stay of 3.9 days in the control group (range: 2-19 days; SD: 1.8; $p<0.0001$). Again the hospital discharge disposition did not change significantly from the control group to the study group. Of specific note, early discharge did not correlate with readmission or transfer to a rehabilitation or skilled facility. Instead, those patients with longer hospital stays tended to be sent to further inpatient settings.

The majority of patients in the above-mentioned study group did not have minimally invasive surgery. Only 10% of primary THA and no TKA, at that time, were minimally invasive. It would, therefore, be assumed that the decreases in hospital stay and reduced readmission rates seen with the implementation of this program are a distinct finding, not related to less-invasive techniques. Combining minimally invasive techniques with a holistic peri-operative program should yield an even more rapid recovery to a functional level of activities.

CONCLUSION

The use of a holistic peri-operative rapid-recovery program has lead to a significantly decreased hospital length of stay in patients who underwent primary THA and TKA. Our data suggest no transfer of burden to other inpatient facilities results from this aggressive approach. Furthermore, by combining a multi-modal approach of pre-operative and post-operative education with early and aggressive rehabilitation, rapid recovery is possible. With this rapid recovery and early discharge from the hospital, no increase in readmission has been observed.

In primary THA and TKA, significant improvements in implant fixation, bearing surface longevity, and component life-span have mostly reached a plateau. The majority of total joint arthroplasty procedures are successful in providing pain relief, improved function, and improvements in the quality of life by 8 to 12 weeks post-operatively. So why should we examine and concentrate on a more rapid recovery? Patients demand it, the lay press touts many of the concepts of rapid recovery such as minimally invasive surgery, and our limited resources require surgeons to examine ways to be more efficient. If similar excellent long-term survivorship of THA and TKA can be achieved by way of less-invasive surgery, shorter hospital stays, and more rapid return to work or play, we all benefit. STI

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