



Fast Track and Outpatient Total Hip and Knee Replacement: A Review

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Abstract

There is a growing trend to have total hip or knee replacement surgery as an outpatient or with short stay. As joint replacements have been extended to younger and healthy patients, the need for inpatient stay has come into question. The movement toward doing total joint replacement in the outpatient setting has come about due to improved and optimized surgical techniques, appropriate anesthesia; and an adaptation of patients, surgeons, and every stakeholder that outpatient total joint replacement is safe and as effective as performing the surgery in an inpatient setting. All the stakeholders for a successful fast-track program including the healthcare team, patients, relatives and caregivers must be aligned in order to optimize efficiency and instill confidence in the patients that they are safe for outpatient discharge. The growing results from the peer-reviewed literature has shown that an outpatient or fast-track total hip or knee replacement program can be as safe and effective as a standard total joint program; in some cases, more effective. Patient selection is important and multifactorial with no absolute contraindications to participation in a fast-track program; each patient should be carefully evaluated to determine their suitability for enrollment in a fast-track total joint program.

Keywords: Total hip and knee; Replacement surgery; Fast-track program; Stakeholder

Abbreviations

LOS: Length of Stay; THA: Total Hip Arthroplasty; TKA: Total Knee Arthroplasty; TJA: Total Joint Arthroplasty; VA: Veterans Health Administration; TNF- α : Tumor Necrosis Factor-Alpha; AE: Adverse Events; DOS: Day of Service; ERAS: Receiving Enhanced Recovery after Surgery; POUR: Postoperative Urinary Retention; POCD: Postoperative Cognitive Dysfunction; UKA: Unicompartmental Knee Arthroplasty

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Introduction

There is a growing trend to have total joint replacement surgery as an outpatient or with short stay (i.e. 1 day). The impetus for this change has come from multiple external forces including those outside the profession in order to reduce the cost of joint replacement for the healthcare system [1,2]. Even within the same health system, outpatient joint replacement is less expensive than inpatient. The payers (government and private insurance) and many surgeons are all aligned to make this commonplace and standard of care. Some surgeons who have not embraced this change to allow medically and psychosocially appropriate patients to recover at home do so out of the reluctance for change and not from a growing number of peer-reviewed publications that show this practice is both safe and effective.

As joint replacements have been extended to younger and healthy patients to maintain a higher level of function, the need for inpatient stay has come into question. During the typical inpatient (overnight) stay following total joint replacement there are a negligible number of tests or interventions that are required; therefore, it is hard to justify that need for healthy patients. Many orthopedic surgeons acknowledge that it may be safer for patients to be discharged home early and to avoid potential iatrogenic problems and hospital borne pathogens.

The movement toward doing total joint replacement in the outpatient setting has come about due to improved and optimized surgical techniques, appropriate anesthesia; and an adaptation of patients, surgeons, and every stakeholder that outpatient total joint replacement is safe and as effective as performing the surgery in an inpatient setting [3,4]. In addition to the cost saving of outpatient total joint replacement, most patients prefer not being admitted to the hospital. Once adopted, most surgeons see the benefits from having patients at home and the efficiency of the

outpatient setting. As more stakeholders adopt this philosophy, it is critical that patient safety is optimized. Current outpatient total joint replacement is being performed at selective centers and there are educational programs that have been established to help new institutions adopt programs and protocols in order to start an outpatient total joint program [5-9]. The purpose of this review is to outline the existing peer-reviewed literature as a basis for centers to consider adaptation of the practice of a Fast-track or outpatient total hip or knee replacement program.

General Considerations

There are many factors that need to be in place to adopt outpatient total joint replacements: Surgeons must be able to skillfully perform the procedures efficiently; longer operative times or increased blood loss make same-day discharge more precarious. The techniques and implants need to allow for early weight-bearing and activity. A team approach with the anesthesiologist is needed to develop appropriate perioperative protocols so anesthesia and pain management are optimized. All team members (surgeon, assistant surgeons, anesthesia, nursing, and physical therapy) must be aligned in order to optimize efficiency and instill confidence in the patients that they are safe for outpatient discharge. To achieve this, there needs to be careful planning with all the stakeholders so that all members collaborate on how best to implement the outpatient total joint surgery program.

Patient Selection

Patient selection for outpatient total joint replacement is a critical factor a motivated patient with good home support and minimal medical comorbidities is needed. For those patients with medical comorbidities, these should be modified, and their conditions optimized prior to surgery. Once an outpatient total joint program is adopted, every healthcare center must monitor outcomes and adverse events, as results may be different at different centers in different locations with different patients.

The question remains if fast track total joint surgery is feasible in all or only well selected patient groups [5]. Husted et al. [10], sought to identify patient characteristics associated with Length of Stay (LOS) and patient satisfaction after total hip and knee replacement surgery. 712 consecutive, unselected patients (440 women) with a mean age of 69 (31-91) years were admitted for hip or knee replacement surgery and placed in a fast-track joint replacement program. 92% of the patients were discharged home within 5 days, and 41% were discharged within 3 days. These authors identified several patient characteristics that influence postoperative outcome, LOS, and patient satisfaction including: Age, sex, marital status, co-morbidity, preoperative use of walking aids, pre- and post-operative hemoglobin levels, the need for blood transfusion, ASA score, and time between surgery and mobilization; highlighting the need for proper patient selection for a successful participation in a fast track program. These authors, however, did not highlight any series of patient characteristics that would preclude a patient from participation in a fast-track total joint program. Holm et al. [6] investigated the role of preoperative pain and functional characteristics in discharge readiness and actual LOS in fast-track Total Hip Arthroplasty (THA) and Total Knee Arthroplasty (TKA). From a review of 153 patients, using univariate linear regression followed by multiple linear regression revealed that age (>86 years) was the only independent predictor of discharge readiness and that they concluded that a reduced length of stay can be achieved for most patients independently of preoperative functional

characteristics.

The issue has been raised that not all countries or health care systems can adopt a fast-track total joint program. Raphael et al. [7] reported on fast-track model of care in order to reduce length of hospital stay following total hip and knee arthroplasty while maintaining patient safety and satisfaction in Canada. Their fast-track program emphasized preoperative patient education, postoperative multimodal analgesia with periarticular injections, early physiotherapy and rehabilitation, and discharge home with an outpatient rehabilitation program. These authors found that their multimodal multidisciplinary fast-track protocol reduced hospital stay and opioid consumption while maintaining a high level of patient safety and was able to be implemented in both in tertiary care and in community hospitals. The ability to translate fast track programs into various patient population and type of medical facilities has also been studied. Yanik et al. [8] evaluated the comprehensive effect of a rapid recovery perioperative Total Joint Arthroplasty (TJA) protocol in the Veterans Health Administration (VA) setting; these authors found implementation of a rapid recovery TJA protocol in the VA setting led to a decreased LOS, decreased cost of perioperative healthcare, and an increase in patients discharged directly home without increased readmission or complication rates.

The clinical pathway and care programs in elective Total Hip and Knee Replacement (THA/TKR) have undergone considerable changes in many countries influenced by the concept of fast-track surgery, resulting in a very short hospital stay [9]. One important factor toward fast-track program for elective THA/TKA is the patient acceptance of the experience. There appear to be three chronological phases in the clinical pathway: preparation, hospital stay for surgery, and recovery. In the preparation phase, patients' experiences and involvement in the planning of the operation are important as they need to know the risks and expectations of recovery and surgical outcome as many patients may be apprehensive with this approach. In the hospital stay for the surgery phase, most patients that have an expectation for fast track discharge after total joint replacement need to have positive experiences regarding admission, early mobilization, and early discharge. Experiences about the recovery phase focused on management of daily life, rehabilitation program, and recovery. Therefore, all stakeholders in the fast track program must have a commitment to a person-centered care approach in order to be a pervasive theme since patient will have doubts regarding unfulfilled expectations. Not only is the patient a stakeholder in a successful fast track program, so is the support of relatives, especially for older patients [11]. It has been reported that by using the theory of maintaining unity (i.e. when each element has a clear visual relationship to one or more other elements, the composition is unified and once unity is achieved a program does not become cluttered or confusing) that the pattern of the patient's relatives behavior through which they resolved the main patient concern of feeling alone, is achieved. The substantive theory of maintaining unity offers a roadmap for relatives who have a strong desire to provide compassionate and loving support for the older patient during their participation in a fast-track treatment programs. The relatives can resolve the patient concern of possible abandonment through three interchangeable behavioral modes: Protecting Mode (by providing loving and respectful support); Substituting Mode (by providing practical and cognitive support); and an Adapting Mode, (by abiding by the patients' and health professionals' requirements). Patient and caregiver anxiety may have a negative impact on patient recovery

after fast-track joint arthroplasty. Most patients report preoperative anxiety fear of not receiving enough attention from a caregiver when undergoing a fast-track knee arthroplasty [12]. It has been found that anxious male caregivers appear to impart their anxiety to male patients but not to female patients; the reason for this is not fully understood. The anxiety of unrelated caregivers is associated with low preoperative anxiety among patients. Preoperative education should not only focus on the patient, but should identify related caregivers, especially male caregivers, to better help them help their related patient cope with anxiety before joint arthroplasty.

Relatives are another stakeholder in a successful fast-track program and should not be overlooked. It has been suggested that health professionals may have problematic relationships with relatives of older patients in fast-track treatment program; these family members may be doubters of their relative to be enrolled in such a program and can be a detriment toward a successful outcome. Berthelsen et al. [13] developed a strategy to resolve this potential problem; the main concern can be resolved by a main strategy: Focusing on Principles, by striving for patients' full compliance during the trajectory, followed by two strategies of social control: Accepting Compliant Motivators, by involving well-informed relatives, and Avoiding Disobedient Doubters, by excluding relatives who do not comply with program principles. By including relatives as stakeholders and proper education, the practice of excluding noncompliant relatives with the fast-track program rules can still have the potential for them of being resources for the patient.

As patient and caregiver factors represent more subjection aspects of a fast track program, there has been a search for objective measure, such as biomarkers, that could conceivably help predict early post-operative pain and function after fast-tracking Total Knee Arthroplasty (TKA). Tumor Necrosis Factor-Alpha (TNF- α) (that helps regulate neuroinflammation and anxiety) has been studied to potentially be such a marker. Zietek et al. [14] found that high levels of pre-operative TNF- α concentrations from synovial fluid could be used as an independent predictor of better knee function (walking, change of pain at rest during six weeks after TKA, greater increases in Knee Society Score (KSS) during six weeks after TKA at six weeks of follow-up). In patients with lower preoperative TNF- α concentration from synovial fluid, post-operative pain management may have to be enhanced in order to improve the early outcome of the operated joint.

Some have considered bilateral simultaneous TKA as a contraindication to patient inclusion in a fast track program. Husted et al. [15] analyzed the outcome of 150 consecutive bilateral simultaneous TKRs compared to 271 unilateral TKRs in a standardized fast-track setting. Results from this study included patients treated from 10 or more years ago (2003 and 2009). The authors reported that the bilateral TKA patients stayed in the hospital longer (mean 4.7 days vs. 3.3 days) and required more blood transfusions than the unilateral UKA cohort. The results did show that the outcome at three months and at two years were similar or better in the bilateral simultaneous TKR group in regard to morbidity, mortality, satisfaction, knee range of movement, pain, the use of a walking aid, and the ability to return to work and to perform activities of daily living. Advantages of simultaneous bilateral TKA (i.e. a single surgery, single anesthetic, single post-operative recovery period) may outweigh the disadvantages of a shorter or outpatient stay in selected patients. High-volume centers that utilize careful patient selection and fast-tracked surgery that perform simultaneous

bilateral total knee arthroplasty have published their results in favor of the procedure. More recently, using risk screening and preoperative optimization have reduced mortality and overall complication rates in patients undergoing bilateral TKA. However, overall procedure-related complications specifically cardiovascular and neurological, remain significantly higher than unilateral TKA and a guarded approach is recommended when enrolling bilateral TKA in a fast-track program [16].

Complications

One of the major concerns with outpatient total joint arthroplasty is a potential risk for increased complications. When adapting a fast-track program, safety and efficacy as compared to a standard total joint program must be maintained. Courtney et al. [17] published a study to determine the complications associated with outpatient Total Joint Arthroplasty (TJA) and to identify high-risk patients who should be excluded from these protocols. These authors queried the American college of surgeons-National Surgical Quality Improvement Program database for all patients who underwent primary TKA or THA from 2011 to 2014. Of the total 169,406 patients who underwent TJA only 1220 (0.7%) were performed as an outpatient. The overall complication rate for both the outpatient and inpatient groups had a complication rate of 8% and 16%, respectively. Patients at higher risk for readmission and complications after THA and TKA (all $P < 0.05$) were aged more than 70 years, had malnutrition, cardiac history, smoking history, or diabetes mellitus. In this study, outpatient TJA alone did not increase the risk of readmission or reoperation and was a negative independent risk factor for complications. The authors concluded that patient selection is critical and outpatient TJA is a safe option, but only in select, healthier patients. Den Hertog et al. [18] investigated fast-track rehabilitation program after TKA to determine the effect on the early recovery after Total Knee Arthroplasty (TKA). This was an open, randomized, prospective clinical study, comparing the fast-track TKA rehabilitation-a pathway-controlled early recovery program (Joint Care[®])- with standard postoperative rehabilitation care. Patients in the fast-track TKA rehabilitation group showed enhanced recovery compared with the standard rehabilitation group with statistically significant higher cumulative AKSS, WOMAC index score, reduced intake of analgesic drugs, reduced LOS and a lower number of adverse events. These results further demonstrate that a fast track program is both safe and effective. Castorina et al. [19] published results from a retrospective observational study comparing the traditional vs. fast track recovery methodologies after total arthroplasty. The parameters of pain and deformity demonstrated the most rapid improvement; different functional test used (Barthel, MRC, VAS) showed that the mean values were significantly greater in Fast Track group when compared to the control. Results from their study further confirm that the application of the fast track protocol after total knee replacement results in rapid post-surgery recovery and is safe and effective. Gulotta et al. [20] reported on their results with a 2-day discharge (fast track) pathway for Total Hip Replacement (THR). These authors prospectively followed the outcomes (i.e. hospital length of stay, intra- and postoperative complications, readmissions, reoperations) of patient in a fast-track compared to a tradition program. At 1 year, there were no differences in complications, readmissions, or reoperations between cohorts; in the fast track group, 58% of patients were discharged home within 2 days; postoperative pain, nausea, and dizziness were the main reasons for not meeting the 2-day discharge goal. These authors noted that a protocol that allows for a 2-day discharge following THR is safe and

effective and the potential for higher success rates in properly selected patients.

In a non-blinded, randomized, controlled clinical study of fast track vs. standard protocol TKA patients, Fransen et al. [21] reported on the functional outcome, clinical outcome, pain, and complications for each day in the first week after surgery and patients were followed up to 5 years after surgery. Patients in the fast track program had significantly lower VAS scores for knee pain, faster Timed-Up and Go test times, and more mobility on functional tests for several days in the first week compared to the standard protocol group and no significant differences were found at 12 weeks and 1, 2 and 5 years after surgery. Not only do these authors note that the fast track program is safe and effective, and it may be advantageous in the early post-operative recovery period over a standard total joint protocol.

Using data from the Swedish Hip and Knee Arthroplasty Registers for patients operated with THR and TKR in 2011-2015, Berg et al. [22] reported on the observational results before-and-after study of 14,148 total joint replacements 2011-2015 in order to determine if fast-track care programs in elective Total Hip and Knee Replacement (THR/TKR) that had been introduced in several countries during the last decade resulted in a significant reduction of hospital stay without any rise in readmissions or early Adverse Events (AE) (Fast-track care programs were introduced at 8 public hospitals from 2012 to 2014). They noted that the total readmission rate <90 days for THR was 7.2% with fast-track compared with 6.7% in the previous program, and for TKR 8.4% in both groups. Since there was no statistically significant difference concerning readmissions or AE when comparing the programs, the authors concluded that implementation of a fast-track care program in routine care of elective hip and knee replacement is effective in reducing hospital stay without increasing the risk of readmissions or adverse events within 90 days after surgery.

In order to address safety concerns still remain regarding complications and readmissions using outpatient Total Hip Arthroplasty (THA) and Total Knee Arthroplasty (TKA), Gromov et al. [23] published their results from a prospective 2-center study on early readmissions with overnight stay and complications following outpatient Total Hip Arthroplasty (THA) and Total Knee Arthroplasty (TKA) compared with a matched patient cohort with at least 1 postoperative night in hospital. Readmissions occurred between postoperative day 2 to 48 and day 4 to 58 in the outpatient and control cohorts, respectively, however the authors found no readmissions within the first 48 h and no readmissions related to the Day of Service (DOS) (i.e. outpatient surgery) discharge. The authors concluded that readmission rates in patients discharged on DOS are like matched patients with at least 1 overnight stay, and emphasized that with the selection criteria used; there was no reduction of patient safety associated with same-day discharge. Zhu et al. [24], reported on enhanced recovery after surgery, fast track surgery, multi-mode analgesia, diet management, or steroid hormones on the postoperative recovery of patients who received Total Hip Arthroplasty (THA) or Total Knee Arthroplasty (TKA). The review included 10 published studies (9,936 cases) or which 4,205 cases receiving Enhanced Recovery After Surgery (ERAS), and 5,731 cases receiving traditional recovery after surgery (non-ERAS). The meta-analysis showed that LOS was significantly lower in the ERAS group than in the control group, and there were fewer incidences of complications in the ERAS group than in the control group; however, there was no significant difference in the 30-day readmission rate. These authors concluded

that ERAS significantly reduces LOS and incidence of complications in joint replacement patients; however, ERAS did not significantly impact 30-day readmission rates.

Postoperative Urinary Retention (POUR) is a common complication after Total Joint Arthroplasty (TJA). Halawi et al. [25] queried their institutional joint registry for patients who underwent primary TJA between January 2016 and November 2017 and developed POUR to determine the incidence and risk factors for POUR in their fast-track TJA program. One hundred eighty-seven Total Hip Arthroplasty (THA) and 191 Total Knee Arthroplasty (TKA) patients were included in the study; 40% of TKA and 36% of THA patients developed POUR requiring bladder catheterization. POUR after THA was significantly associated with age >60 years, intraoperative fluid volume >1350 ml, and intraoperative placement of an indwelling bladder catheter. POUR after TKA was only significantly associated with intraoperative indwelling bladder catheter placement ($P<0.001$). The most significant risk factors for POUR in modern-day fast-track TJA are iatrogenic. These authors concluded that routine intraoperative placement of an indwelling bladder catheter and fluid administration exceeding 1350 ml, especially in patients older than 60 years, are modifiable risk factors that could reduce the risk of POUR. Scholten et al. [26] reported on 381 patients who underwent TJA of the lower limb to determine risk factor for developing POUR. These authors noted that preoperative post void urine retention is a significant predictor of catheterization for postoperative residual urine and spinal anesthesia was correlated with urinary retention; they found no cause-effect relationship between POUR and the perioperative fluid balance. These authors also noted that POUR was a common complication in fast-track lower limb arthroplasty, with spinal anesthesia as a risk factor. They have found that a higher preoperative residual urine volume does lead to higher postoperative residual volume, but not to a higher change in urinary retention. In addition, an increased perioperative fluid administration is not correlated with the incidence of POUR. These authors concluded there is no clear rationale for monitoring residual urine volume both preoperatively and postoperatively and that should not be factored into patient selection for participation in a fast track program.

Krenk et al. [27] noted that Postoperative Cognitive Dysfunction (POCD) can occur after major surgery in as many as 20% of patients (especially elderly patients). These authors evaluated a large uniform cohort of elderly patients in a standardized approach, after major joint replacement surgery (total hip and knee replacement) with a group of patients optimized with perioperative approach (fast track) with multimodal opioid-sparing analgesia, early mobilization, and short length of stay (LOS ≤ 3 days) and discharged to home. 225 patients aged ≥ 60 years undergoing well-defined fast-track total hip or total knee replacement with median LOS of 2 days, noted that there was no statistically significant difference between patients with and without early POCD, regarding pain, opioid use, sleep quality, or C-reactive protein response and the incidence of POCD early after total hip and knee replacement seems to be lower after a fast-track approach than rates previously reported for these procedures.

Lovecchio et al. [28] raised concerns regarding the emerging fiscal climate of value-based decision-making that has driven the concept of outpatient total joint arthroplasty as an attractive alternative provided the incidence of costly complications are similar to "fast-track" inpatient pathways. These authors queried all patients

undergoing total hip arthroplasty or total knee arthroplasty between 2011 and 2013 from the American College of Surgeons-National Surgical Quality Improvement Program database and compared 1,476 fast-track (≤ 2 -day length of stay) inpatients with 492 outpatients. After matching, outpatients had statistically higher rates of medical complications (10.0% vs. 6.7% total incidence; 6.3% vs. 1.1%, after discharge). Most complications were bleeding requiring transfusion, which occurred at similar rates after surgery but at higher rates post discharge in outpatients (7.5% outpatients vs. 5.6% inpatients total incidence (not statistically significant); 4.1% outpatients vs. 0.1% inpatients, after discharge). These authors concluded that outpatient total joint replacement surgery patient can experience higher rates of post-discharge complications; most of these post-discharge medical complications can be prevented by blood management strategies to minimize the risk for transfusion (faster surgical times, tranexamic acid use, and smaller incision surgery).

Pennestri et al. [29] looked to provide information to support blood management strategies in fast-track Total Joint Arthroplasty (TJA) pathways in order to support clinical decision making according to current evidence and best practices, and to identify critical issues which need further research. They identified a number of factors that are important for planning and prediction of the need for blood transfusion such as preoperative anemia detection and treatment, blood anticoagulants, transfusion trigger, anesthetic techniques, local infiltration analgesia, drainage use, clamping and removals, and postoperative multimodal thromboprophylaxis, that should be incorporated into a fast-track pathway, however they did not recommend an optimal strategy; these strategies have to be developed for site specific patient populations.

Postoperative joint stiffness following Total Knee Arthroplasty (TKA) can compromise patient outcomes and require manipulation. There has been concern that in a fast-track setting with the prevalence of joint stiffness and subsequent manipulation may be increased. Husted et al. [30] reported on the up to 1-year follow-up of 3,145 consecutive unselected elective primary unilateral TKA managed in fast-track settings. The prevalence of manipulation was 2.2% which is lower or comparable to that in most published studies following more conventional post-operative pathways. The authors concluded that fast-track TKA does not result in increased risk of manipulation despite a shorter LOS.

Role of Anesthesia

The roles of the type of anesthesia and pain management after joint replacement surgery are another critical factor for patient to be successful in a fast track program. Cáceres-Sánchez et al. [31] compared the efficacy in post-operative pain control of the intraarticular catheter compared to the epidural catheter after primary total knee arthroplasty. Patients were randomized to a control group with intradural anesthesia and an intraoperative epidural catheter (ropivacaine) and an intervention group using the same anesthetic technique and an intra-articular catheter with an elastomeric pump (ropivacaine plus dexketoprofen (a non-steroidal anti-inflammatory drug)). Their results showed a statistically lower incidence and severity on Verbal Rating Scale and a better control of postoperative pain in the intervention group; in addition, the intervention group had better knee flexion and started walking sooner than the control group. These factors help to contribute to a significant 33.3% reduction in hospital stay. Regarding knee replacement surgery, it has been well established that patients undergoing Unicompartmental Knee Arthroplasty

(UKA) have less operative trauma and faster patient recovery than after TKA. After UKA, patients do experience a substantial level of patient-reported pain in the early postsurgical period. There have been other strategies to reduce pain in the post-operative period including the use of a single preoperative dose of systemic methylprednisolone as part of a fast-track UKA program. Rytter et al. [32] reported on the results of a prospective study on 72 patients (35 patients in the treatment group received a single preoperative dose of systemic methylprednisolone 125 mg, whereas the control group (37 patients) did not) in two consecutive series undergoing unilateral UKA. Their results showed that in the first 24 h after surgery, the treatment group had statistically significant less pain at rest and during walking, less consumption of opioids, less knee swelling and better knee extension in comparison to the control group. There were no serious complications associated with the systemic methylprednisolone treatment. The authors concluded that the use of a single preoperative dose of 125 mg of systemic methylprednisolone treatment is a valuable addition to a multimodal analgesic regime. In conclusion, the type of anesthesia and pain management after joint replacement surgery are another critical factor for the patient to be successful in a fast track program and must be specifically tailored to the joint being replaced and the patient needs.

Post-operative Management

The stakeholders for a multidisciplinary approach include surgeons, anesthetists, physician assistant, care manager, nurses, pain specialists and physiotherapists in addition to the patient and their families and caregivers [5]. Level of pain after surgery has been reported to be the most important risk factor for prolonged hospital stay after total joint replacement and as a result multimodal pain management is one of the most important parts of multidisciplinary rapid recovery protocols [5]. The efficacy in perioperative management of pain in patients undergoing total hip replacement surgery and treated with tapentadol or oxycodone/naloxone in combination with ketoprofen in the fast track setting for joint replacement surgery was studied [33]. Results from their single-center retrospective study on patients with moderate-severe pain (106 patients were analyzed in the tapentadol group and compared to 105 patients treated with oxycodone/naloxone), referred to total hip replacement supported the use of tapentadol in combination with ketoprofen for the management of moderate-severe pain in the setting of major orthopedic surgery, given its effectiveness in reducing pain intensity, and its satisfactory tolerance.

Effective rehabilitation is part of a successful fast track program; progressive strength training initiated immediately after TKA is feasible and increases knee-extension strength and functional performance without increasing knee joint effusion or knee pain [34]. A regime of rehabilitation including progressive strength training of the operated leg (leg press and knee-extension), using relative loads of 10 repetition maximum with three training sessions per week for 2 weeks commenced 1 or 2 days after TKA has been shown to be effective. Restoration of strength is an important factor for patient function and to facilitate early discharge following joint replacement surgery. Bandholm et al. [35] reported on knee pain during strength training shortly following fast-track total knee arthroplasty using a cross-sectional study design. Both loading and repetitions performed to contraction failure during knee-extension strength-training, increased post-operative knee pain during strength training implemented shortly following TKA, however, the increase in pain during exercise was very short-lived and there should not

be an impediment toward earlier knee strength after surgery. Pua et al. [36] published a study aimed to develop age- and sex-specific recovery curves of knee flexion range-of-motion, quadriceps strength and fast gait speed post-TKA to assist rehabilitation professionals in interpreting outcomes and quantifying deviations from the expected recovery pattern. These authors found that recovery patterns improved nonlinearly over time and were different regarding both age and sex. Recovery curves of various knee and gait measures were developed so that post-recovery landmarks can be more objectively met during the 1st 8-10 weeks post-surgery and any deviation can be more quickly managed. It has been purported that earlier and more intensive physiotherapy exercise after Total Knee Arthroplasty (TKA) enhances recovery. Zietek et al. [37] performed a randomized, single-blind study to determine whether adding a single, 15 min walk on the day of surgery to a fast-track rehabilitation protocol would reduce knee pain and improve knee function after TKA. The authors found that adding an additional 15 min walk to a fast-track rehabilitation protocol after recovery from spinal anesthesia did not increase pain, but neither did it improve functional recovery. Results from this study again emphasize the need for objective data to support clinical practice that one would intuitively feel would be beneficial. It has been known that knee-extension strength is considerably reduced at discharge after THA in patients from a fast track program, but the early strength reduction does not correlate with changes in thigh or knee circumferences [38]. Because functional performance is reduced at discharge is doesn't appear to be due to reduced knee-extension strength and that other mechanisms such as fear, avoidance of movement, or decreased hip-muscle strength are potential causes.

Joint specific and implant specific issues are also important for success in a fast-track program. Early success with fast-track surgery was reported after Unicompartmental Knee Arthroplasty (UKA) operated with Minimally Invasive Surgery (MIS) [39]. These authors noted that due to less operative trauma for the UKA approach, patients only had slight postoperative knee swelling and had rapid restoration of knee flexion and function. Patients did experience a high level of pain during the first postoperative night and day that fell considerably thereafter and none of the patients needed physiotherapy supervision in the first month after discharge.

There has been a growing trend to not use surgical drains after TKA; however, some providers still use them. As fast track programs are implemented, a surgical drain is another variable that would have to be managed for patients with early discharge. Zhang et al. [40] randomized 101 patients in a fast track program with removal of the drain after 6, 12 and 18 h respectively. The authors concluded that there was no statistical difference in clinical outcomes from all 3 groups and if a surgical drain is used, it can be safely removed within 6 h to 12 h after FT primary TKA so the patient does not need to be discharged with the surgical drain in place.

Conclusion

The growing results from the peer-reviewed literature has shown that an outpatient or fast-track total hip or knee replacement program can be as safe and effective as a standard total joint program; in some cases, more effective. All the stakeholders for a successful fast-track program including the healthcare team (surgeon, assistant surgeons, anesthesia, nursing, and physical therapy), patients, relatives and caregivers must be aligned in order to optimize efficiency and instill confidence in the patients that they are safe for outpatient discharge. Each program should be customized toward their center and patient

population in order to maximize outcomes and each center should monitor their results to ensure safety and efficacy. Patient selection is important and multifactorial with no absolute contraindications to participation in a fast-track program; each patient should be carefully evaluated to determine their suitability for enrollment in a fast-track total joint program.

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