The Journal of Arthroplasty 30 (2015) 885–890

Contents lists available at ScienceDirect

The Journal of Arthroplasty

journal homepage: www.arthroplastyjournal.org

Outpatient Rehabilitation Care Process Factors and Clinical Outcomes Among Patients Discharged Home Following Unilateral Total Knee Arthroplasty

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ARTICLE INFO

Article history:
Received 14 August 2014
Accepted 9 December 2014

Keywords:
total knee arthroplasty
physical therapy
rehabilitation
quality improvement
care pathway

ABSTRACT

Research examining care process variables and their relationship to clinical outcomes after total knee arthroplasty has focused primarily on inpatient variables. Care process factors related to outpatient rehabilitation have not been adequately examined. We conducted a retrospective review of 321 patients evaluating outpatient care process variables including use of continuous passive motion, home health physical therapy, number of days from inpatient discharge to beginning outpatient physical therapy, and aspects of outpatient physical therapy (number of visits, length of stay) as possible predictors of pain and disability outcomes of outpatient physical therapy. Only the number of days between inpatient discharge and outpatient physical therapy predicted better outcomes, suggesting that this may be a target for improving outcomes after total knee arthroplasty for patients discharged directly home.

Total knee arthroplasty (TKA) surgery is a common and generally effective procedure to restore mobility and reduce pain in individuals with osteoarthritis or other degenerative conditions of the knee [1–3]. In the United States, the projected growth in demand between 2005 and 2030 for a primary TKA is 673%, which equates to 3.48 million procedures per year [3]. Currently, patients over age 65 account for the majority of TKA procedures performed in the United States, however current trends indicate that TKAs are increasing being performed in younger individuals. Projections indicate that patients under age 65 will constitute a majority of TKA recipients in the United States by the year 2030 [4]. This demographic shift indicates the need for research evaluating the process of care and outcomes specific to a younger population.

Although outcomes following TKA are generally favorable, studies observe a high degree of variability in outcome with a considerable number of patients failing to recover a satisfactory level of physical activity [5–7]. A recent systematic review reported 20% of patients continue to report persistent pain that limits function at assessments at least 6 months post-surgery [8].

Suboptimal outcomes cannot be solely attributed to advanced age. Although there is an increased incidence of TKA between the ages 75–79, there is no evidence that older age itself is a predictor of functional outcome. Many studies report no relation between age and functional outcomes [9–11]. Other studies suggest that levels of satisfaction with the outcomes of TKA are lower among younger individuals, possibly due to higher levels of expectation in this age group [12,13]. These findings further support the need to examine outcomes specific to a younger population of patients receiving TKA.

Reducing unwarranted variations in the process of care for patients undergoing TKA may provide an opportunity to improve clinical outcomes [14]. Studies in the United States indicate a high degree of variation in several care process decisions for patients following TKA such as length of the inpatient stay, the timing and amount of physical therapy during the inpatient stay, and the use of extended inpatient care in rehabilitation or skilled nursing facilities [3,15]. Some research has been conducted on the implications of these inpatient care process issues for clinical outcomes as well as costs [16–20]. Care process decisions made during the outpatient phase of rehabilitation following TKA, however, have not been adequately studied [5,21]. Key decisions including the use of home health physical therapy, home use of continuous passive motion (CPM) devices, and the use and timing of outpatient, clinic-based, physical therapy likely influence outcomes, but their impact has not been adequately researched. Most patients receive

No author associated with this paper has disclosed any potential or pertinent conflicts which may be perceived to have impending conflict with this work. For full disclosure statements refer to http://dx.doi.org/10.1016/j.arth.2014.12.013.

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http://dx.doi.org/10.1016/j.arth.2014.12.013
0883-5403/

physical therapy following a TKA, but care process decisions related to recovery are highly variable and their effect on outcomes after TKA is uncertain [3,22]. Considering that younger patients are more likely to be discharged directly home following TKA and forego extended inpatient care [23], an improved understanding of how outpatient rehabilitation care process decisions relate to clinical outcomes for patients following TKA is needed.

The primary purpose of this project was to explore predictors of clinical outcomes at the completion of outpatient rehabilitation in a cohort of younger, privately-insured patients who were discharged directly home following a primary, unilateral TKA surgery. Specifically, we examined associations between outpatient rehabilitation care process factors on clinical outcomes after controlling for patient demographic and clinical factors.

Methods

Patients

Patients included in this study were those who received outpatient physical therapy after a primary unilateral TKA surgery performed between January 1, 2008 and December 31, 2010 in an outpatient physical therapy clinic operated by Intermountain Health Care, a private, nonprofit, integrated health care system located in Utah and Idaho. Additional inclusion requirements were primary insurance coverage through SelectHealth, a private, nonprofit, health insurance company and integrated subsidiary of Intermountain Health Care, and discharge directly home following the TKA inpatient stay. We excluded patients who were discharged to a skilled nursing or inpatient rehabilitation facility following TKA, those undergoing a revision or bilateral TKA, or those receiving a contra-lateral TKA within 6 months. We excluded patients whose TKA was not due to degenerative osteoarthritis (e.g., inflammatory arthritis, bone tumor, etc.), and those who died within 1 year after TKA. The Intermountain Health Care Institutional Review Board approved an expedited review and waiver of authorization of consent for this study.

Data Sources and Variables

We initially identified potentially eligible patients using claims data from SelectHealth based on the presence of a CPT code 27447 (total knee arthroplasty) occurring within the study time frame. The date on which the TKA occurred was defined as the index surgical date. Additional eligibility criteria were continuous enrollment with SelectHealth for one year preceding and following the index surgical date and no 27447 CPT code for the contra-lateral knee occurring within 6 months before or after the index date. We extracted all claims data billed for a 1-year period from the index surgical date in order to determine aspects of management during the outpatient rehabilitation period. Patients discharged directly home following surgery who did not receive outpatient physical therapy within 90 days of discharge were excluded. We recorded the occurrence of a hospital readmission for any reason within 30 days after discharge and excluded these patients. For remaining patients we recorded the length of the inpatient hospital stay and the following post-discharge outpatient rehabilitation care process factors from the claims data; use of a CPM device in the patient's home prior to outpatient physical therapy [yes or no], the use of home health physical therapy post-discharge but prior outpatient physical therapy [yes or no], and the number of days from inpatient hospital discharge to the initial outpatient, clinic-based, physical therapy session.

We next linked eligible patients extracted from the claims data with the Rehabilitation Outcomes Management System (ROMS), a Web-based clinical outcomes electronic database maintained by Intermoutain Health Care physical therapy clinics. It is standard procedure within Intermountain outpatient physical therapy clinics to collect a patient-reported disability score and numeric pain rating at each visit and enter the scores into ROMS. The Knee Outcome Survey Score of Activities of Daily Living [KOS] [24] is the self-reported disability measure used for patients following TKA. The KOS consists of 14 questions pertaining to a patient's ability to perform activities of daily living. The score is expressed as a percentage with higher scores representing a higher degree of perceived functional ability. The KOS has been shown to have high reliability and validity with good responsiveness to change in patients with various knee pathologies including post-TKA rehabilitation with a minimum clinically important difference of 8 points for patients with knee osteoarthritis [25–27]. A 0–10 numeric pain rating scale [NPRS] [28] is used to capture each patient's current pain level. The minimum clinically important difference for the NPRS among patients with chronic musculoskeletal conditions including knee osteoarthritis is 2 points [29]. We extracted the initial and final KOS and NPRS scores from ROMS for included patients. If scores were not entered for the initial or final visit we extracted scores for the nearest available date. Additional variables extracted from ROMS were the number of outpatient physical therapy visits and the length of stay [LOS] based on the initial and final visit dates. The LOS was considered complete if a gap of 45 days or more occurred between visits. We computed the time to completion of outpatient rehabilitation as the number of days from inpatient hospital discharge to completion of the outpatient physical therapy LOS.

The Intermountain Health Care electronic medical record (EMR) was used to obtain additional information on included patients including sex and BMI at the index surgical date. The EMR was used to generate the Charlson co-morbidity index (CCI), a validated, weighted index of co-morbid medical conditions [30]. Intermountain Health Care generates the CCI using validated procedures adapted for use with administrative databases [31]. We examined each patient's health history associated with the index surgical date and the medical problem list in the EMR as well as examining ICD-9 codes associated with the claims data to identify specific co-morbidities known to influence outcomes after TKA beyond the CCI score including mental health diagnoses (anxiety and depression) [10], low back pain [32], and osteoporosis [33]. These conditions were identified from the EMR or based on the following ICD-9 codes in claims data: osteoporosis (733.xx), mental health condition including anxiety (300.xx) or depression, (296.xx, 298.0, 311.xx), and low back pain (721.3, 722.xx, 724.xx, 738.4, 738.5, 739.3, 756.11, 846.xx, 847.2). From the EMR we recorded if a contra-lateral TKA had been performed at least 6 months prior to the index surgical date.

Statistical Analysis

Descriptive statistics were calculated for patient demographic [age, sex, BMI] and clinical characteristics (CCI, specific co-morbidities, history of prior contra-lateral TKA at least 6 months prior to index surgery date) and post-discharge outpatient rehabilitation care process factors (home use of CPM, use of home health physical therapy, days from inpatient discharge to outpatient, clinic-based, physical therapy, number of visits and LOS in outpatient physical therapy). Descriptive statistics were calculated for the clinical outcome variables (initial and final KOS and NPRS scores) from the outpatient physical therapy episode of care. Univariate associations between patient demographics, clinical characteristics and care process factors with clinical outcomes were examined using correlation coefficients.

We evaluated the influence of outpatient rehabilitation care process factors on clinical outcomes using multivariate generalized linear mixed models to avoid assumptions of independence in the independent variables based on clustering effects. We constructed a baseline model with final KOS score as the dependent variable and patient demographic and clinical variables entered as fixed effects. We entered the surgeon nested within the hospital in which the index surgery occurred; and the physical therapist nested within the outpatient physical therapy clinic as random effects with a scaled identity covariance structure to account for the effects of individual providers nested within treatment settings on clinical outcome. We also entered the initial KOS score in