Arthroplasty Today xxx (2016) 1–5

Contents lists available at ScienceDirect

Arthroplasty Today

journal homepage: http://www.arthroplastytoday.org/

Original research

Improving value in primary total joint arthroplasty care pathways: changes in inpatient physical therapy staffing

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ARTICLE INFO

Article history:
Received 9 December 2015
Received in revised form
11 February 2016
Accepted 16 February 2016
Available online xxx

Keywords:
Value-driven outcomes
Total joint arthroplasty
Physical therapy
Early ambulation and value

ABSTRACT

Background: An early physical therapy (PT) care pathway was implemented to provide same-day ambulation after total joint arthroplasty by changing PT staffing hours.
Methods: After receiving an exemption from our institutional review board, we performed a secondary data analysis on a cohort of patients that underwent primary TJA of the hip or knee 6 months before and 12 months after implementation of the change. Data on same-day ambulation rates, length of stay (LOS), and in-hospital costs were reviewed.
Results: Early evaluation and mobilization of patients by PT improved on postoperative day (POD) 0 from 64% to 85% after the change ($P \leq .001$). The median LOS before the change was 3.27 days compared to 3.23 days after the change ($P = .014$). Patients with higher American Society of Anesthesiologists scores were less likely to ambulate on POD 0 ($P = .038$) and had longer hospital stays ($P < .001$). Early mobilization in the entire cohort was associated with a greater cost savings ($P < .001$).
Conclusions: A relatively simple change to staffing hours, using resources currently available to us, and little additional financial or institutional investment resulted in a significant improvement in the number of patients ambulating on POD 0, with a modest reduction in both LOS and inpatient costs.

Introduction

As health care and reimbursement reform progresses, the value equation (value = quality + service/costs) is becoming increasingly prominent. Total joint arthroplasty (TJA), well known to be one of the most quality-of-life–restoring and cost-effective procedures in medicine, is under increasing pressure to provide improved value given the ever-increasing utilization of this intervention [1,2]. One method for improving value has been increasing the early mobility of patients undergoing TJA. Early mobility has many potential advantages to the postoperative recovery process of patients undergoing TJA. Prior studies have indicated that early mobilization can decrease complications such as venous thromboembolic events, decrease length of stay (LOS), decrease hospital-acquired conditions, decrease hospital costs, and improve functional outcomes [3-15]. As a result, efforts to improve early mobilization may indirectly improve value by improving quality and decreasing costs. Thus, further refinement of the postoperative care pathway may be needed and has previously been recommended [16].

Multimodal approaches to the improvement of perioperative care of joint replacement patients have become increasingly popular. These so-called “rapid recovery” care pathways typically use several strategies including, but not limited to, preoperative patient education and expectation management, preoperative multimodal pain medication, enhanced anesthesia practices, minimally invasive surgical techniques, antiemetic therapies, postoperative multimodal pain medication control with narcotic minimization, early mobilization, accelerated discharge and disposition, and case

One or more of the authors of this paper have disclosed potential or pertinent conflicts of interest, which may include receipt of payment, either direct or indirect, institutional support, or association with an entity in the biomedical field which may be perceived to have potential conflict of interest with this work. For full disclosure statements refer to http://dx.doi.org/10.1016/j.artd.2016.02.003.

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http://dx.doi.org/10.1016/j.artd.2016.02.003
2352-3441/

management [5,17]. Widespread adoption of the many necessary pieces of these protocols may be challenging given potential institutional and administrative barriers as well as financial, personnel, or other similar resource limitations. Attempts to identify opportunities for improvement using existing resources may aid in efforts to overcome these barriers.

Based on the findings of these prior studies and pathways, as well as an increased focus on value at our institution along with a newly available cost-and-quality—tracking tool known as Value Driven Outcomes (VDO), we assembled a multidisciplinary team of surgeons, nurses, therapists, case managers, and value engineers with a goal of identifying opportunities for improvement in our joint replacement care pathways using currently available resources. We hypothesized that changing the inpatient physical therapists' scheduled work hours to include a swing shift to be able to evaluate all patients on the day of surgery (postoperative day 0, POD 0), with the goal of ambulation on POD 0, would lead to improvements in quality and decreases in cost. To test this hypothesis, we sought to answer the following research questions:

1. Did the change in physical therapy (PT) staffing result in increased early ambulation on POD 0?
2. Was LOS shorter after the PT staffing change?
3. Was there a cost benefit associated with early ambulation?

Material and methods

In the fall of 2012, a multidisciplinary team was assembled at our institution to identify potential areas for improvement as part of a joint replacement care pathway improvement project. During this process, we identified early ambulation as a target for improvement. After receiving an exemption from our institutional review board, we performed secondary data analysis on a cohort of patients that underwent TJA of the hip or knee. Data from the 6 months prior (n = 259) to implementation of the change in April 2013 were reviewed and compared to data for the 12 months after (n = 489) the change using an institutional cost and quality dashboard tool, known as VDO. Of the 748 primary joint replacements, 461 underwent primary total knee arthroplasty (TKA) and 287 had undergone primary total hip arthroplasty (THA). This time frame was chosen to minimize the potential impact of other care pathway improvement initiatives that were ongoing both before and after that 18-month window, during which time the primary focus and only major change to the care pathway was the early ambulation initiative.

Under the guidance of the department manager and lead inpatient orthopaedic physical therapist (MF), inpatient PT staffing hours were adjusted. Previous staffing of 3-6 full-time physical therapists and physical therapy assistants (PTAs) with a work schedule of 8 AM-5 PM was modified to a new schedule to provide 3-4 full-time physical therapists and PTAs during the regular daytime shift and adding a swing shift from 11 AM to 8 PM with 1-2 physical therapists and PTAs. The goal of the intervention was to increase the rate of evaluating and attempting to assist all postoperative primary TJA patients with ambulation on the day of surgery.

The primary outcome comprised of the number of patients who were evaluated and ambulated on the day of surgery (POD 0), as documented by PT in the electronic medical record. The difference in overall cost before and after the implementation of the swing shifts with the PT staff was compared. The VDO tool provided cost data for each patient in terms of percentage cost savings as compared to the mean overall historical cost from the prior year, and therefore, our cost data are presented as such.

Patient characteristics are reported as mean (range) for age and body mass index (BMI) and compared using an independent-samples *t* test. American Society of Anesthesiologists physical status classification (ASA scores) are presented as median (interquartile range [IQR]) and analyzed using the Wilcoxon rank sum test. A chi-square analysis was used to compare the proportion of males and females between the groups.

Our primary outcome, early ambulation on POD 0, was analyzed using multivariable logistic regression. The main predictor was before or after implementation of the PT staffing change, and potential covariates included age, sex, BMI, ASA score (classified as 1, 2, $\geq$3), anesthesia type (general or spinal), and procedure (THA vs TKA). Given the inherent skewness of LOS, it was analyzed using these same predictors in several regression models: linear regression, linear regression with a log transformation of LOS, gamma regression, and Cox proportional hazards regression [18]. The results were consistent across all models with and without the outliers, and thus, we present results from the multivariable linear regression model for ease of interpretation. Cost savings also had a skewed distribution, but negative values precluded the LOS models. Thus, cost savings results are presented from a multivariable linear regression, where the statistical significance of results was verified using bootstrapping. In the cost saving model, the primary predictor was early ambulation and covariates included those previously described. The presence of collinearity in the regression models was assessed with the variance inflation factor diagnostic [19]. When the variance inflation factor was >10, the variables included in the model were chosen by clinical significance. To further assess the cost savings related to the intervention, a simple linear regression analysis was performed to identify the difference in cost savings between groups with 95% confidence intervals. The outcome was generated as 14% of the overall cost savings, which was directly attributable to facility utilization as explained in the following. Analyses were conducted in Stata version 13.1 (College Station, TX), and statistical significance was assessed at the 0.05 level.

Results

There was no difference in age, BMI, ASA score, or sex between patients who underwent TJA before and after the PT staffing change (Table 1, all $P > .500$). Patients who underwent TKA were older ($P < .001$) with a mean age of 63 years (range, 20-92), whereas patients who underwent THA had a mean age of 59 years (range, 12-95). The BMI was greater in the TKA patients ($P < .001$) with a mean BMI of 32.8 kg/m^2 (range, 15.4-61.6) compared to a mean BMI of 30.5 kg/m^2 (range, 15.3-59.7).

Early evaluation and mobilization of patients by the PT staff improved significantly on POD 0 from 64% in the 6 months prior to 85% after the change in PT staffing (Table 2, $P < .001$). Of those patients who were unable to ambulate on POD 0 after the change,

Table 1
Comparison of patient characteristics before and after the change in the PT schedule.

Characteristic	Before change, n = 259	After change, n = 489	*P* value
Age, y, mean (range)	61 (14-95)	62 (12-88)	.761
BMI, kg/m^2; mean (range)	31.7 (15.4-57.1)	32.0 (15.3-61.6)	.604
ASA score, median (IQR)	2 (2-3)	2 (2-3)	.760
Sex, n (%)			
Female	156 (60)	293 (60)	.934
Male	103 (40)	196 (40)	
Procedure			
TKA	161 (62)	300 (61)	.828
THA	98 (38)	189 (39)	