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Original Article

Effect of Total Joint Arthroplasty Surgical Day of the Week on Length of Stay and Readmissions: A Clinical Pathway Approach

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ABSTRACT

Background: The demand for total joint arthroplasty (TJA) is increasing at the same time that alternative payment models place increased scrutiny on the cost of these procedures. Using a clinical pathway model, this study aimed to examine the effect of day of surgery on length of stay (LOS).
Methods: A retrospective electronic chart review was conducted on 2968 cases over 20 months at a single hospital. Least square means analysis of the effect of surgical day of the week on LOS was conducted using Statistical Analysis Software 9.3, followed by Tukey's multiple comparison test. Logistic regression assessed the effect of surgical day of week on readmission.
Results: Within the primary TJA group, there was no significant difference in mean LOS for each day of the week (1.17, 1.32, 1.29, 1.27, and 1.27 for Monday through Friday, respectively). Of all days, mean LOS for revision TJA (1.51, 1.57, 1.57, 2.49, and 2.03) only differed significantly for Thursday ($P < .0001$), although in adjusted analysis with age and American Society of Anesthesiologist, this difference was no longer significant ($P = .3954$). Readmission was likewise not significantly affected by surgical day of week (chi sq = 1.426, $P = .8396$) in the sample.
Conclusion: As the volume of joint arthroplasties increases and alternative payment models are implemented, programs that promote decreased LOS regardless of operative day of the week are critical. Practices can use clinical pathway models to reduce costs related to LOS while maintaining a high level of patient care.

According to the Triple Aim, improving the health care system in the United States depends on addressing 3 simultaneous priorities: improving the experience of care, improving the health of populations, and reducing health care costs [1]. Innovative approaches are being implemented in orthopedic surgery to address these priorities, with a specific focus on procedures that are in the highest demand with the highest costs, including total joint arthroplasty (TJA). With the advent of alternative payment models, increased scrutiny has been placed on the cost of TJA. Most of these alternative payment models provide an opportunity to share the risk of penalties dependent on the cost and quality delivered during the episode of care. The Bundled Payment for Care Improvement (BPCI) initiative is based on a 90-day postoperative episode of care [2]. Most TJA costs occur during the index procedure (51%) and the post-acute recovery phase (33%) [3]. Implementation of a clinical pathway for TJA has shown decreased hospital length of stay (LOS), improved clinical outcomes, and decreased number of all post-operative complications including deep venous thrombosis, pulmonary embolism, manipulation, and superficial and deep infections [4-9].

Decreasing the LOS and discharging patients to home rather than an extended care facility are two important factors that can be improved in a coordinated clinical care pathway for TJA. Recent studies have shown efficient clinical pathways maintain a low LOS while simultaneously decreasing readmissions [10]. These factors can contribute to a substantial reduction in health care costs [11-14].

Several studies have reported increased LOS for joint arthroplasty patients whose surgeries were completed later in the week [15,16]. This “weekend effect” phenomenon has shown increases in LOS up to 15% (mean LOS = 4.2 days) compared with LOS for patients who had surgery on a Monday (mean LOS = 3.7 days) [17]. A Cleveland Clinic study reported that the mean LOS for late-week

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arthroplasty was 4.01 compared with early-week arthroplasty LOS mean of 3.61 [16]. The difference in LOS translated to a difference in total charges between the 2 groups. However, other studies report no change in LOS depending on the surgical day of the week [18].

The purpose of this study was to retrospectively analyze the effect of TJA surgical day of the week and LOS for clinical pathway patients. We hypothesized that the use of a highly organized clinical pathway would reduce LOS regardless of the day of the week that surgery occurs. The researchers aimed to demonstrate that there is no significant difference in LOS depending on surgery day of the week.

Material and Methods

After obtaining approval from the institutional review board, a retrospective review of all TJA cases—diagnosis-related group codes 469 and 470—was performed between January 1, 2012 and September 30, 2014. All patients included in this study participated in the highly organized Joint Academy clinical pathway program. This multidisciplinary preoperative education program includes preoperative patient education, hospitalist coverage, advanced practice nurse (APN) inhospital care, physical therapy, and oversight by a joint coordinator, including weekend coverage for all those roles. All decisions for discharge were made by the attending physician and executed by the APN on service through the electronic medical record. Details of the clinical pathway have been previously published [10]. The following data were obtained from patient medical records: age, gender, American Society of Anesthesiologist (ASA), operative site, procedure, day of week surgery performed, LOS, readmission status, and location to which patient was discharged. Analysis for significant differences in the data collected for each arm was performed using least square means procedure in SAS 9.3, followed by Tukey's multiple comparison procedure. An adjusted analysis was also performed controlling for age and ASA in the least square means model, as these variables have been known to contribute to LOS in other studies [19]. Logistic regression analysis was used to assess the effect of surgical day of week on readmission status as a dichotomous outcome variable.

Results

The study cohort was comprised of 2531 TJAs, including 1868 primary and 663 revision cases. Surgeries were categorized by surgical day of the week (Monday, Tuesday, Wednesday, Thursday, and Friday). Each category had 1148, 685, 263, 287, and 148 patients, respectively (Table 1). Table 2 includes mean LOS for the groups analyzed. Within the primary TJA group, there was no significant difference in mean LOS for each day of the week (1.17, 1.32, 1.29, 1.27, and 1.27). Of all days, mean LOS for revision TJA (1.51, 1.57, 1.57, 2.49, and 2.03 for Monday through Friday, respectively) only differed significantly for Thursday ($P < .0001$). In the adjusted model that included day of week, age, and ASA, however, day of week was not a significant contributor to the effect on LOS ($P = .3954$) (Table 3). Logistic regression analysis concluded that surgical days of week were not significant predictors of readmissions in the sample ($P = .8396$).

Discussion

To achieve the Triple Aim, models of care delivery that propose to reduce health care costs while improving the patient experience and population health must be carefully planned and tested. Clinical pathways and other standardized care delivery models have been used and tested in orthopedic practices over the last 20 years, and the cost benefit of using these highly structured and managed approaches has been realized.

Hospitals must execute innovative strategies that deliver efficient throughput and enhance revenue, while still preserving high-quality services. One promising strategy is improving utilization of current hospital resources (ie, operating block time and hospital bed management) rather than increasing capital expenditure (ie, expanding operating room capacity and beds) to accommodate increased patient volume. Aligning hospital bed supply to bed demand will maximize throughput, improve patient flow, and better use current resources. Optimal surgical schedules aligned with bed resources reduce hospital and patient costs, reduce patient waiting times, and increase utilization of the operating rooms. Reducing inpatient hospital LOS and readmissions for both elective and nonelective joint arthroplasty is critical to the success of this strategy.

Patient volume, operating room, and bed utilization for elective orthopedic surgery often drop precipitously late in the week. This decrease is widely thought to be a result of a lack of a coordinated care team to assist in managing these patients

Table 1
Demographics.

Characteristic (n = 2531)	n (%)
Age	
<40	65 (2.6)
41-49	174 (6.9)
50-59	548 (21.7)
60-69	815 (32.2)
70-79	672 (26.6)
80+	257 (10.2)
Total	2531 (100)
Race	
African-American	379 (15.0)
Hispanic	2 (.1)
White	2102 (83.1)
Other	20 (.7)
Unknown	28 (1.1)
Total	2531 (100)
ASA	
1	47 (1.9)
2	1335 (52.7)
3	1100 (43.5)
4	42 (1.7)
Missing values	7 (.3)
Total	2531 (100)
Day of week	
Monday	1148 (45.4)
Tuesday	685 (27.1)
Wednesday	263 (10.4)
Thursday	287 (11.3)
Friday	148 (5.8)
Total	2531 (100)

ASA, American Society of Anesthesiologist Status Score.

Table 2
Mean Length of Stay (LOS) for the Total Joint Arthroplasty (TJA) Primary and TJA Revision Groups.

Day of Week	TJA Primary		TJA Revision		% Readmitted	Readmission *P* Values
	LOS (N)	SD	LOS (N)	SD		
Monday	1.17 (860)	1.22	1.51 (288)	2.13	7.3	.2279
Tuesday	1.32 (501)	0.61	1.57 (184)	1.20	7.3	.2844
Wednesday	1.29 (182)	0.95	1.57 (81)	2.03	7.6	REF
Thursday	1.27 (206)	1.59	2.49 (81)	1.63	11.8	.0259
Friday	1.27 (119)	0.80	2.03 (29)	1.39	8.8	.8518
	F 4, 1868 = 1.79		F 4, 663 = 7.46		DF 4, chi-square = 1.4262	
	P = .1289		*P* < .0001		*P* = .8396	

SD, standard deviation.