Does Accelerated Physical Therapy After Elective Primary Hip and Knee Arthroplasty Facilitate Early Discharge?

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Abstract

Accelerated physical therapy (PT) protocols are a potential mechanism for achieving early mobilization and safe discharge from hospital after elective primary total hip arthroplasty (THA) or total knee arthroplasty (TKA).

We compared 2 groups of patients who underwent elective unilateral THA or TKA—those who started PT the same day (Day 0) and those who started PT the next day (Non-Day 0).

The difference in mean (SD) hospital length of stay between the Day 0 and Non-Day 0 groups was not statistically significant for THA patients, 2.26 (0.11) days vs 2.50 (0.15) days ($P = .270$), or TKA patients, 2.28 (0.66) days vs 2.35 (0.75) days ($P > .05$). A higher proportion of THA patients in the Day 0 group (16%) vs the Non-Day 0 group (6%) achieved discharge goals on postoperative day 1 ($P = .04$). This effect was not present for TKA patients. Day-of-surgery PT helped THA patients (but not TKA patients) achieve discharge goals on postoperative day 1.

Total hip arthroplasty (THA) and total knee arthroplasty (TKA) are among the most effective surgical procedures in modern medicine. Use of primary THA in the United States is projected to increase by 174% by 2030, to 532,000 cases annually, and the estimate for TKA is even greater.[1] Hospital length of stay (LOS) accounts for a significant portion of the overall cost of these procedures. Reducing LOS to limit costs without compromising patient safety, satisfaction, and outcomes remains the goal at all joint arthroplasty centers. Rapid-recovery or fast-track clinical pathways limiting opioid use and emphasizing patient education and early (day-of-surgery) mobilization have been shown to reduce LOS without compromising patient outcomes.[2-5] Factors correlated with LOS after THA include surgical approach, use of multimodal analgesia, obesity, age, and social situations or living conditions.[4,6-10]

Our institution recently implemented a protocol in which certified physical therapists provide accelerated (day-of-surgery) physical therapy (PT) for all total joint arthroplasty patients. For the study reported here, we hypothesized that, compared with PT started on postoperative day 1 (POD-1), PT started day of surgery (Day 0) would result in shorter LOS for unilateral primary THA and TKA patients. In addition, we wanted to evaluate any predischarge differences in function, as measured by gait distance, between the groups.

Methods

After obtaining Institutional Review Board approval, we retrospectively evaluated use of the new postoperative protocol (Day 0 PT) for primary THA and TKA patients. We reviewed all cases of primary unilateral THA or TKA performed by a single surgeon over the 12-month period immediately following initiation of the protocol. There were 116 THA cases and 126 TKA cases. Charts were reviewed for patient demographics, intraoperative data, in-hospital course, and PT session notes. Patients who had a PT session at any point on day of surgery were designated the Day 0 group, and patients who had PT starting the next day (POD-1) were designated the Non-Day 0 group. Although the medical records showed that Day 0 PT had been ordered in all cases, not all patients

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received PT on the day of their surgery; the most common reason was that they returned from postanesthesia care after the physical therapists' work shift had ended. Another reason was patient noncompliance or unwillingness stemming from the prolonged effects of general anesthesia, diminished mental orientation, excess fatigue, or inadequate pain control. PT sessions after THA and TKA remained consistent over the study period, with twice daily sessions directed at patient mobility, range of motion, and gentle strengthening exercise. PT was performed only with patient consent.

Surgery

A combination of general and spinal anesthesia was used in almost all THA and TKA cases. In <5% of cases, either the patient refused spinal anesthesia, or it was unsuccessful. In addition, tranexamic acid was administered to limit blood loss in all THA and TKA cases. Of the 116 THAs performed over the study period, 3 were excluded (see below). Of the 113 patients included in the study, 88 (77.9%) used a minimally invasive posterolateral approach, 18 (15.9%) a direct anterior approach, and 7 (6.2%) an anterolateral approach. All THAs were performed with conventional instruments and uncemented components. All TKAs were performed with a standard medial parapatellar approach, conventional instruments, and a tourniquet; in each case, the patella was resurfaced, and cemented fixation was used. Drains were not used in any THA or TKA cases. A local anesthetic cocktail (100 mL of 0.25% ropivacaine, 15 mL of 0.5% ropivacaine, and 1 mL of 1:1000 epinephrine) was injected for postoperative analgesia in all THA and TKA cases.

There were 3 important intraoperative findings in the THA Day 0 group: 2 cases of incidental gluteus medius tendon tears requiring repair and 1 case of nondisplaced calcar fracture treated with a cerclage cable. The THA Non-Day 0 group and both TKA groups had no major intraoperative findings.

Physical Therapy

Day-of-surgery PT was ordered for all patients. Patients did not receive formal PT before surgery. The PT protocol consisted of subjective assessment of patient condition, expectations, and goals; lower limb strengthening exercises; and maximum gait training with use of an assistive device as tolerated. Standard hip movement restrictions were ordered for posterolateral approach patients to protect the soft-tissue repair. Continuous passive motion (CPM) was not used during this study period.

Discharge Criteria

Patients were cleared for discharge by a multidisciplinary team using several criteria: no medical condition that would require readmission, intact surgical incision without discharge or concerning erythema, adequate analgesia (oral medications), intact neurovascular examination, and PT goals achieved (independence with bed mobility, transfers, standing balance, and minimum gait distance of 150 feet). Patients who could not be discharged home because of family or occupation issues or because of problems with gait or transfer were referred to skilled nursing or home healthcare. Follow-up for wound assessment and for examination of radiographs and functional range of motion was planned for 2 to 3 weeks after surgery (all patients followed up). Two patients, 1 in the THA Non-Day 0 group and 1 in the TKA Day 0 group, had a mechanical fall 1 day before discharge, but there were no complication-related discharge delays. In addition, there were no readmissions during the first 4 weeks after surgery.

Excluded Patients

Of the 116 THA cases, 113 (63 Day 0, 50 Non-Day 0) were analyzed. To establish homogeneity between groups and remove potential confounding factors, we excluded 4 THA patients (all Non-Day 0) from analysis because of medical complications prolonging LOS. In 1 of these cases, the patient developed respiratory insufficiency and myocardial infarction on POD-3, and critical care support was required (LOS, 16 days). In another case, anticoagulation treatment led to the development of a hip hematoma on POD-9 and to treatment (evacuation) in the operating room (LOS, 14 days). The other 2 cases involved exacerbation of dysphagia from preexisting myasthenia gravis (LOS, 5 days) and Ogilvie syndrome, managed conservatively (LOS, 9 days).

Of the 126 TKA cases, 123 (97 Day 0, 26 Non-Day 0) were analyzed. Three TKA patients were excluded because of prolonged hospitalization for medical reasons: One developed a deep vein thrombosis, 1 acquired *Clostridium difficile* colitis (history of lung transplantation, multiple immunosuppressive drugs), and 1 developed respiratory insufficiency from asthma exacerbation.

Table 1. **Patient Demographics, Perioperative Data, Postoperative Data, and Physical Therapy Data**

	Day 0 PT (n = 159)			Non-Day 0 PT (n = 76)		
	Mean	**SE**	**95% CI**	**Mean**	**SE**	**95% CI**
Age, y	63.7	0.7	62.2-65.2	62.8	1.3	60.2-66.5
Body mass index, kg/m^2	31.9	0.6	30.8-33.1	30.8	0.9	29.0-32.6
Male/female, n		62/97			30/46	
ASA physical status		**n**			**n**	
I		7			2	
II		72			32	
III		78			40	
IV		2			2	
Surgery time, min	46.1	1.9	42.7-49.9	50	3.3	43.4-56.7
Estimated blood loss, mL[a]	150.8	11.2	128.6-173.0	224.6	21.3	182.2-267.2
PT sessions before discharge		**n**			**n**	
1		0			2	
2		18			8	
3		50			35	
4		55			18	
>5		36			13	
Hospital length of stay, d	2.27	0.59	2.15-2.39	2.45	0.11	2.23-2.67
THA patients	2.26	0.11	2.0-2.5	2.50	0.15	2.2-2.8
TKA patients	2.28	0.66	2.15-2.41	2.35	0.75	2.05-2.65

Abbreviations: ASA, American Society of Anesthesiologists; CI, confidence interval; PT, physical therapy (accelerated); SE, standard error; THA, total hip arthroplasty; TKA, total knee arthroplasty.
[a]*P* < .05. All other *P*s > .05.

Statistical Analysis

Power analysis (G*Power) was used to determine an appropriate sample size for comparison.[11] Given a previously published mean LOS after THA of 4 days, the hypothesized mean LOS reducing that by at least 0.5 day to 3.5 days, a significance level set at 5%, a power of test set at 0.95, and an allocation ratio of 1, a minimum of 23 subjects would be needed in each group to attain a statistically significant difference using the nonparametric Mann-Whitney test. The Shapiro-Wilk test was used to assess data normality. Regarding statistical significance, the Mann-Whitney U test was used for non-normally distributed data, the 2-sided Fisher exact test and χ^2 test for qualitative data and contingency, and the 2-tailed, unpaired, independent-samples Student *t* test for normally distributed data. Data were analyzed with SPSS Statistics for Windows Version 20 (IBM).

Results

TKA and THA patients had similar demographic profiles, types of anesthesia, operating room and surgery times, surgical approaches, and total number of PT sessions before discharge. Estimated blood loss, however, was significantly ($P < .05$) higher for Non-Day 0 patients than for Non-Day 0 patients (**Table 1**). Mean LOS was 0.1 day shorter for Day 0 patients than for Non-Day 0 patients, the difference was not statistically significant. These groups had equivalent median LOS (2 days) and interquartile range (1). However, the percentage of THA patients discharged on POD-1 was significantly ($P = .041$) higher for the Day 0 group (16.1%) than for the Non-Day 0 group (6%) (**Figure 1**). The overwhelming majority of patients (146/159 in Day 0 group, 70/75 in Non-Day 0 group) were discharged home.

Mean (SD) distance ambulated during first PT session was 2-fold farther ($P = .014$) for Non-Day 0 patients, 84.1 (10.4) feet, than for Day 0 patients, 42.1 (6.4) feet. On POD-1, mean (SD) gait was significantly ($P = .019$) longer for Day 0 patients, 162.4 (12.9) feet, than for Non-Day 0 patients, 118

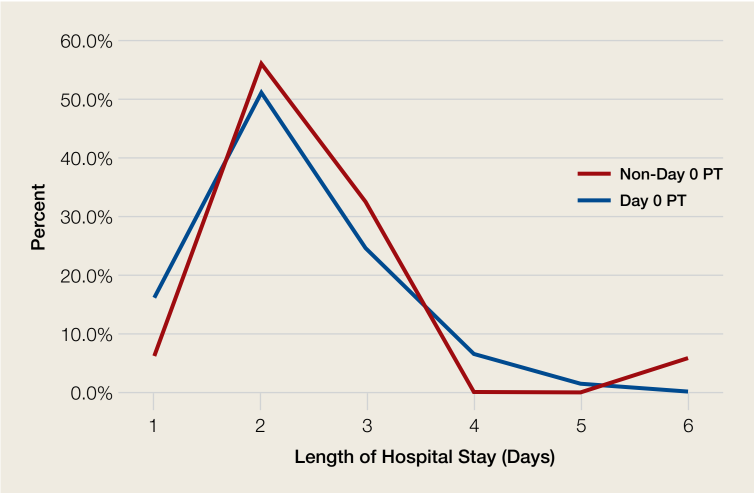

Figure 1. Distribution of percentages of hospital length of stay in total hip arthroplasty patients, with comparison of Day 0 and Non-Day 0 physical therapy (PT) groups.

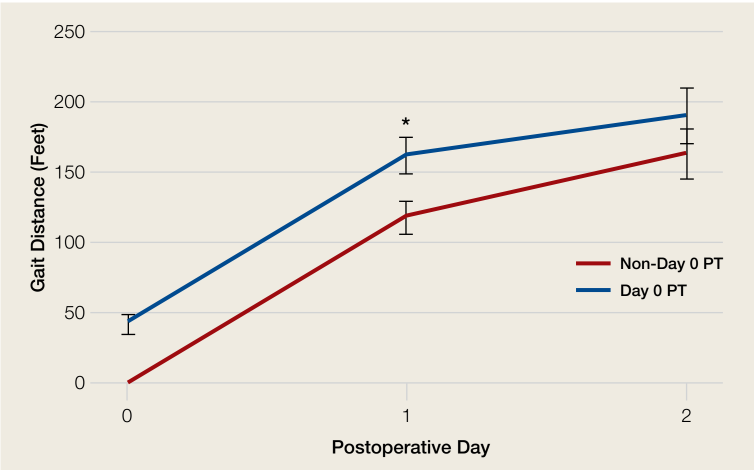

Figure 2. Gait distance as function of postoperative day between Day 0 and Non-Day 0 physical therapy (PT) groups in total hip arthroplasty patients. Error bars represent standard errors; asterisk represents statistical significance (*P* < .05).

(11.7) feet (**Figure 2**). Although mean (SD) gait on POD-2 was longer for Day 0 patients, 189.7 (19.7) feet, than for Non-Day 0 patients, 163 (17.6) feet, the difference was not statistically significant (*P* = .315).

In TKA patients, although mean (SD) distance ambulated tended to be farther for the Day 0 group than for the Non-Day 0 group—114 (12.3) feet on POD-1 and 176 (15.2) feet on POD-2 for Day 0 vs 94 (22.2) feet on POD-1 and 148 (22.1) feet on POD-2 for Non-Day 0—the differences were not statistically significant. In addition, knee arc of motion during first PT session was statistically significantly (*P* = .3) higher for Day 0 patients, 69.1° (18.7°), than for Non-Day 0 patients, 61.7° (18.8°).

Statistical analysis revealed no difference in LOS based on surgical approach to the hip: 2.4 days for posterolateral (2.2 days for Day 0 and 2.6 days for Non-Day 0; *P* = .06); 2.1 days for direct anterior (2.1 days for Day 0 and 2.0 days for Non-Day 0; *P* = .7); and 2.7 days for anterolateral (3.0 days for Day 0 and 2.6 days for Non-Day 0; *P* = .6).

Discussion

Protocols for PT after THA and TKA remain unstandardized and largely dependent on institutions and surgeons. Factors permitting successful implementation of accelerated rehabilitation include patient motivation, adequate analgesia, and adequate support by physical therapists.[12] A potential risk associated with accelerated PT after THA is dislocation, which did not occur in any patient in our Day 0 group. Other risks are increased pain and swelling leading to increased risk of falling and bleeding, which were not observed in our cohort. Although Day 0 PT was ordered in all cases in this study, only 55% of THA patients and 79% of TKA patients received PT the same day as their surgery. The delay can be addressed by making physical therapists' work shifts more flexible for cases that finish later in the day and by providing preoperative education on the importance of day-of-surgery PT. Dr. Incavo and office staff routinely discuss discharge planning with all patients before surgery, but there was no stimulus protocol or communication to discuss or emphasize LOS with patients before surgery, and there was no questionnaire or survey given to assess patient expectations about PT and discharge.

Our finding of no statistically significant reduction in mean LOS after implementation of accelerated PT for THA or TKA differs from findings in multiple other reports.[4,5,13-17] Baseline or control group mean LOS tended to be higher in previous studies[3,5,18-23] (3.4-11.4 days) than in our control group (2.5 days) (**Table 2**). Although we did not find a statistically significant reduction, a higher percentage of THA Day 0 patients were discharged on POD-1, potentially justifying use of accelerated PT for these patients. Another study reported a similar percentage of patients discharged on POD-1 after accelerated rehabilitation.[3] In addition, total number of PT sessions per patient did not differ between groups, limiting the cost-effectiveness of accelerated PT—in contrast to previous reports showing a cost benefit to accelerated PT after THA.[21] Achieving a meaningful change in LOS after THA and TKA needs to be weighed against poten-

Table 2. **Previous Studies on Reduced Hospital LOS After Initiation of PT on Day of Surgery, Compared With Present Study**

	Mean (SD) LOS, d				Sample Size, n			
Study	Control Group	PT Group	*P*	Change in LOS, d	Control Group	PT Group	Study Type	Joint
Isaac et al[18]	6.6 (2.6)	3.6 (1)	<.001	3	80	50	Prospective	Knee
Robbins et al[5]	3.38	2.06	<.05	1.32	400	180	Retrospective	Hip
Labraca et al[19]	8.46 (2.6)	6.37 (1.2)	<.001	1.91	135	138	Prospective, randomized	Knee
Larsen et al[20-22]	7.8 (2.1)	4.9 (2.4)	<.001	2.9	45	45	Prospective, randomized	Hip, knee
den Hartog et al[3]	4.6 (1.2)	2.9 (1.4)	<.001	1.7	384	157	Retrospective	Hip
Wellman et al[23]	3.54 (1.05)	1.65 (0.89)	N/A	1.90	209	218	Retrospective	Hip
Present study	2.45 (0.11)	2.27 (0.06)	.252	0.18	76	159	Retrospective	Hip, knee

Abbreviations: LOS, length of stay; N/A, not applicable; PT, physical therapy (accelerated).

tially compromising patients' safety, outcomes, and satisfaction. We think use of accelerated PT after THA can facilitate achieving PT goals expeditiously and enhance early postoperative function. Achieving PT goals by POD-1 can help restore patient confidence and allow surgeons to sign off on early but safe discharges. Although accelerated PT may provide some benefit (eg, patient satisfaction, confidence) for TKA patients, there was no demonstrable decrease in the important metric of LOS. PT goals may serve as an alternative to LOS alone in determining the effectiveness of accelerated PT. More objective PT parameters (eg, muscle strength testing) may add more validity to this argument, but we did not use them in this study. The retrospective design of this study is considered a weakness, but we should point out that hospital and surgical protocols were applied uniformly to all patients. Furthermore, we expected longer LOS for our Non-Day 0 patients because we thought they would be less willing to have Day 0 PT. To our surprise, LOS did not differ between the Day 0 and Non-Day 0 groups in both THA and TKA. However, it is important to note that more THA Day 0 patients were discharged on POD-1 ($P = .04$). The strengths of this study include its simplicity, adequate statistical power, and lack of a difference in patient demographics between groups. In summary, day-of-surgery PT did not change LOS after elective primary THA or TKA. For elective THA, however, same-day PT helped in achieving POD-1 discharge goals.

Conclusion

These results provide useful information for providers who are managing primary THA and TKA cases and seeking continual improvement in postoperative patient care and better resource allocation. Hospitals, particularly those operating in bundled-care environments, are increasingly coming under scrutiny to control costs. Our study results showed that the costs associated with Day 0 PT are justified for THA but not for TKA.

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