Original Article

DOI: 10.4274/haseki.galenos.2022.8326
Med Bull Haseki 2022;60:419-424

The Effect of Weekday Preference on Length of Stay in Unilateral Bicompartmental Total Knee Arthroplasty

Kaya Turan, Tugrul Ergun, Osman Gorkem Muratoglu, Haluk Cabuk, Cagatay Ozturk

Istinye University Faculty of Medicine, Department of Orthopedics and Traumatology, Istanbul, Turkey

Presented in: The manuscript was presented at "9. Ortopedi ve Travmatoloji Istanbul Bulusmasi" (PS-26) in 02.04.2022.

Abstract

Aim: There are few studies in the literature evaluating the effect of the day of surgery on length of hospital stay. This study evaluates the effect of the day of surgery on the duration of hospitalization in unilateral primary total knee arthroplasty (TKA) in a group of hospitals providing wide-ranging health services and clarifies the implications for reducing economic burdens.

Methods: Between March 2020 and January 2022, patients treated by TKA with the code P612420 according to the Health Practice Communique were retrospectively scanned in a group of hospitals with different levels. Patients who underwent bilateral TKA on the same day or during hospitalization, underwent any secondary surgical procedures, or developed early complications were excluded from the evaluation.

Results: The data of 743 patients who underwent unilateral TKA were evaluated. The mean hospital stay was 3.32 (2-14) days. It was seen that the shortest hospitalization periods were in the surgeries performed on Saturday (3.15 days), while the longest ones were on Friday (3.62 days). It was found that the patients who underwent surgery on Saturday had significantly shorter hospital stays than on Friday (p=0.006).

Conclusion: While planning TKA, the choice of surgery day is a factor that should be addressed to reduce hospital stays and, therefore, costs.

Keywords: Arthroplasty, replacement, knee, length of stay, financial stress

Introduction

Total knee arthroplasty (TKA) is a widely used surgical procedure for end-stage knee arthrosis. This surgical procedure is cost-effective, but efforts to reduce costs are still ongoing. The length of hospital stay (LOS) is the factor that creates the most financial burden after TKA (1). Recently, LOS has been reduced with the help of clinical guidelines for (2-4). Therefore, a decrease in LOS reduces the economic burden of TKA.

In addition to the cost impact, LOS is associated with the quality of patient care (5). Some studies show higher patient satisfaction with rapid discharge regimens. The effect of patient- and surgery-related factors such as age, gender, comorbidities, type of anesthesia, and blood transfusions on LOS has been the subject of many studies. Still, there are few studies in the literature evaluating the effect of the day of surgery on LOS (6-8). Although studies and results have been reported in multicenter heterogeneous groups in which hip and knee joint replacements were evaluated, studies on patients in a homogeneous group who underwent only unilateral TKA are limited.

This study evaluates the effect of the day of surgery on LOS in unilateral primary TKA in a group of hospitals that provide wide-ranging health services and proposes inferences to reduce economic burdens.

Materials and Methods

Compliance with Ethical Standards

The ethics committee approved the study and the processing of the data to be analyzed before the study

Address for Correspondence: Kaya Turan
Istinye University Faculty of Medicine, Department of Orthopedics and Traumatology, Istanbul, Turkey
Phone: +90 5332937927 E-mail: kaya.turan@istinye.edu.tr ORCID: orcid.org/0000-0002-0547-995X
Received: 11.03.2022 **Accepted:** 23.11.2022

©Copyright 2022 by The Medical Bulletin of Istanbul Haseki Training and Research Hospital
The Medical Bulletin of Haseki published by Galenos Yayinevi.

was started. Generalized informed consent was obtained from all patients according to the law on the processing of personal data, but there was no specific informed consent obtained due to the study's data analysis. Since the data used in the study were obtained from the hospital registration system, an individual informed consent form was not required. The study was approved by the Istinye University Clinical Research Ethic Committee (approval no: 2017-KAEK-120, decision no: 3/2022.K-32).

Study Design

Between March 2020 and January 2022, patients treated by TKA in a group of hospitals with different levels inside, according to the Health Practice Communique, were scanned retrospectively through the Hospital Information Management System (WisdomEra). Patients who underwent bilateral TKA on the same day or during hospitalization, who underwent any secondary surgical procedures such as trigger finger, carpal tunnel syndrome, toe arthrodesis, or interventional arthroscopy in the same session with TKA, or who developed early complications, were excluded from the evaluation. Groups were divided by the day of the surgery, and comparisons were performed by evaluating the patients' age, gender, and LOS.

Data Analysis

WisdomEra's statistics tool, Wanalyzer v1.4.53, is a data analytics platform that uses the SciPy v1.2.3 library (https://www.scipy.org/). SciPy is a Python-based ecosystem of open-source software for mathematics, science, and engineering.

Statistical Analysis

The Statistical Package for the Social Sciences software (version 24 for macOS) (SPSS Inc., Chicago, IL, USA, 2008) was used for the statistical analysis. Qualitative data were represented as numbers and percentages for categorical variables and calculated by computing each variable's mean and standard deviation. The one-sample Kolmogorov-Smirnov test was used to determine normality. Comparisons of numerical variables between the groups were evaluated with the One-Way ANOVA test. The post hoc comparisons were assessed with the Tukey HSD test. Differences were considered statistically significant when the p-value <0.05.

Results

The data of 743 patients who underwent unilateral TKA were evaluated. The mean age of the 648 (87.1%) female and 95 (12.9%) male patients was 67.17 (43-92) years. The mean hospital stay was 3.32 (2-14) days (Figure 1). It was seen that 37.4% of the patients underwent surgical treatment in the winter, followed by summer (23.9%), autumn (20.4%), and spring (18.3%) (Figure 2). The autumn TKAs have a statistically significant higher LOS (p<0.001). In the analysis made according to the days of the week, it was seen that the shortest hospitalization periods were in the surgeries performed on Saturday (3.15 days) and Tuesday (3.18 days), while the longest ones were on Friday (3.62 days) and Wednesday (3.47 days) (Table 1 and Figure 3). In

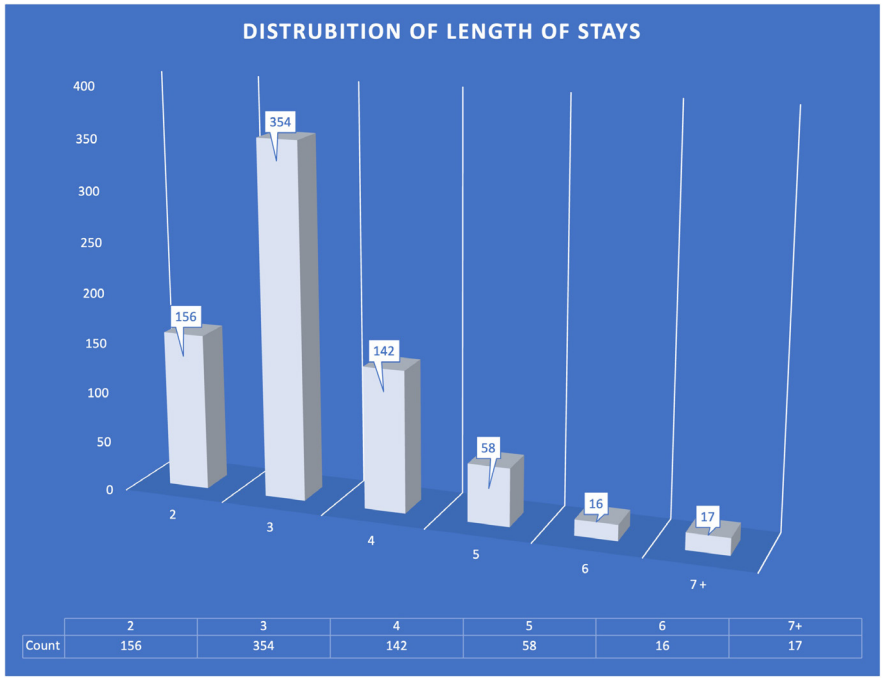

Figure 1. Length of stay chart

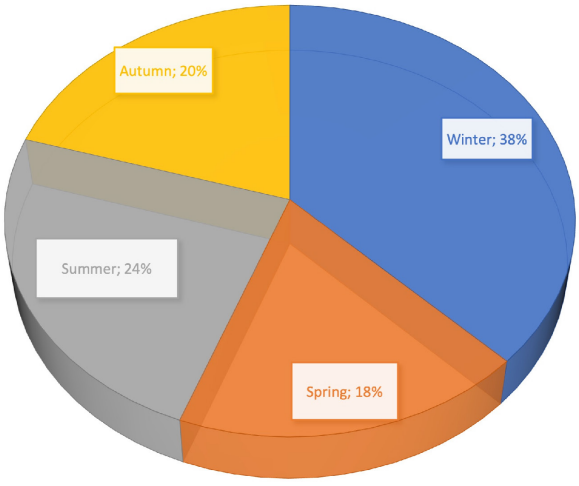

Figure 2. Surgery distribution by seasons

the statistical evaluation, the post hoc analysis between the groups determined that the patients who underwent surgery on Saturday had significantly shorter hospital stays than on Friday (p=0.006) (Table 2). Concurrently, the relationship between age and LOS was statistically significant (p<0.01). There was no association between the daytime of the surgery, gender, and LOS (p=0.320 and p=0.356, respectively).

Discussion

Nowadays, the rising demand for TKA necessitates a reduction in the factors that may cause cost increases (9-11). The most crucial factor in this context is the length of the hospital stay (12,13). Although many studies have evaluated patient- and surgical procedure-related factors influencing LOS (7,14-16), relatively few studies exist on the effect (17,18). In these studies, hip, and knee arthroplasty were evaluated together, and there is no study assessing patients who only underwent unilateral knee arthroplasty. Therefore, we retrospectively determined the effect of the day of surgery on the mean LOS in patients who underwent unilateral, primary, and elective TKA.

Table 1. The mean LOS table by weekdays

Day		N	Subset for alpha=0.05	
			1	2
Tukey HSD[a]	Saturday	127	3.0709	
	Tuesday	176	3.1818	
	Thursday	110	3.2364	3.2364
	Monday	106	3.4151	3.4151
	Wednesday	118	3.4746	3.4746
	Friday	106		3.6226
	Sig.		0.090	0.119

[a]The statistical analysis was performed by the correlation analysis, Tukey HSD test
LOS: Length of hospital stay

In this study, TKA applications performed on Saturday were significantly shorter than those performed on Friday. Muppavarapu et al. (17) retrospectively analyzed 547 patients who underwent total joint replacement and showed that patients who underwent surgery on Monday or Tuesday had significantly less LOS than those on Thursday or Friday. Similarly, Chen (19) reported that patients who underwent TKA on Monday had 9.5% and 6.4% shorter LOS than those treated on Thursday and Friday, respectively. Reversely, Mathijssen et al. (18) showed an increased LOS for surgeries performed on Thursday. They attribute this situation to the small number of personnel, although discharges can be made on the weekends. Although the study by Newman et al. (8) on

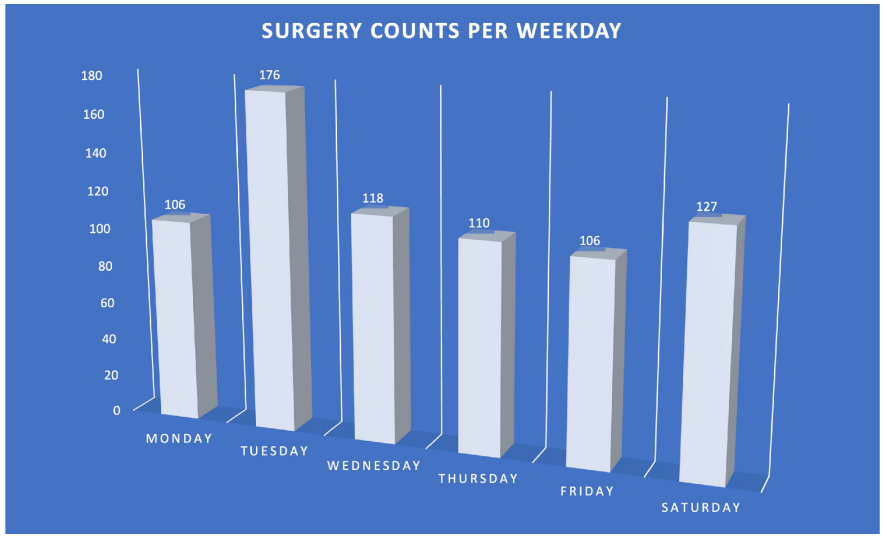

Figure 3. Weekday distribution of the surgeries

Table 2. Tukey comparison of the LOS by weekdays

(I) Day		Mean difference (I-J)	Std. Error	Sig.	95% confidence interval	
					Lower bound	Upper bound
Monday	Tuesday	0.23	0.15	0.599	-0.183	0.650
	Wednesday	-0.06	0.16	0.999	-0.513	0.394
	Thursday	0.18	0.16	0.878	-0.282	0.640
	Friday	-0.21	0.16	0.799	-0.673	0.258
	Saturday	0.34	0.16	0.236	-0.102	0.790
Tuesday	Monday	-0.23	0.15	0.599	-0.650	0.183
	Wednesday	-0.29	0.14	0.302	-0.696	0.110
	Thursday	-0.05	0.14	0.999	-0.466	0.357
	Friday	-0.44	0.15	**0.031**	-0.857	-0.024
	Saturday	0.11	0.14	0.967	-0.284	0.505
Wednesday	Monday	0.06	0.16	0.999	-0.394	0.513
	Tuesday	0.29	0.14	0.302	-0.110	0.696
	Thursday	0.24	0.16	0.654	-0.211	0.687
	Friday	-0.15	0.16	0.938	-0.602	0.305
	Saturday	0.40	0.15	0.084	-0.030	0.837
Thursday	Monday	-0.18	0.16	0.878	-0.640	0.282
	Tuesday	0.05	0.14	0.999	-0.357	0.466
	Wednesday	-0.24	0.16	0.654	-0.687	0.211
	Friday	-0.39	0.16	0.160	-0.847	0.075
	Saturday	0.17	0.15	0.893	-0.276	0.607
Friday	Monday	0.21	0.16	0.799	-0.258	0.673
	Tuesday	0.44	0.15	**0.031**	0.024	0.857
	Wednesday	0.15	0.16	0.938	-0.305	0.602
	Thursday	0.39	0.16	0.160	-0.075	0.847
	Saturday	0.55	0.16	**0.006**	0.106	0.998
Saturday	Monday	-0.34	0.16	0.236	-0.790	0.102
	Tuesday	-0.11	0.14	0.967	-0.505	0.284
	Wednesday	-0.40	0.15	0.084	-0.837	0.030
	Thursday	-0.17	0.15	0.893	-0.607	0.276
	Friday	-0.55	0.16	**0.006**	-0.998	-0.106

LOS: Length of hospital stay

a large patient series showed that surgeries performed in the second half of the week were associated with an increase in costs and LOS compared to those performed in the first half, our results did not support this conclusion. When the week was evaluated as having two or three parts, no statistically significant difference was found between the subdivisions. The reason for our study result may be that active service continues on Saturdays, and only Sundays are holidays in the group of hospitals whose data was analyzed. The average discharge day of patients who were operated on Friday, which coincided with a Sunday, the day before the planned discharge, may cause a delay in their discharge. Performing joint replacement surgeries early or late in the week in hospitals that provide active service on Saturday does not affect the duration of hospitalization.

Our results also confirm the findings of other studies reporting that prolongation of LOS is associated with increasing age. The literature about age's effect on LOS is clear and well-known (20-22). But the effect of gender on LOS is unclear. Some studies have shown that female patients tend to have an increased LOS (7,23). Reversely, we did not find any correlation between LOS and gender, as Tan et al. (24) showed before.

Study Limitations

Our study's first and most obvious limitation is that perioperative patient-specific data could not be evaluated, and the data were obtained retrospectively from the

database. Second, since there are different centers where the applications are made, there may be differences arising from the treatment approaches of different surgical teams. Another limitation is that our inferences may not be valid for hospitals where elective surgical treatment is not performed on Saturdays. The most substantial aspect of our study is our sample size in a relatively brief period, consisting of the hospitals of a single health group and the evaluation of isolated unilateral knee arthroplasty applications by excluding additional surgeries that may affect LOS. The fact that the health group consists of a large academic medical center and multiple satellite hospitals is considered a distinct advantage that will enable us to reflect on our findings in general.

Conclusion

It is crucial to understand and analyze the factors associated with LOS after TKA. Planning unilateral primary TKA surgery on Saturdays or Tuesdays instead of Fridays may reduce costs by shortening hospitalization times. Also, age is an essential risk factor for increased LOS. It is helpful to consider planning before the operation, predicting that LOS may be prolonged in the older age group. Also, the development of programs to standardize the care of TKA and THA patients, including the supervision of discharge procedures, patient management on Sundays, and preoperative discharge planning, may shorten the prolonged LOS.

Ethics

Ethics Committee Approval: The study was approved by the Istinye University Clinical Research Ethic Committee (approval no: 2017-KAEK-120, decision no: 3/2022.K-32).

Informed Consent: Since the data used in the study were obtained from the hospital registration system, an individual informed consent form was not required.

Peer-review: Externally peer-reviewed.

Authorship Contributions

Surgical and Medical Practices: K.T., H.C., C.O., Concept: O.G.M., Design: O.G.M., H.C., Data Collection or Processing: T.E., Analysis or Interpretation: T.E., O.G.M., Literature Search: K.T., Writing: K.T.

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declared that this study received no financial support.

References

1. Johnson RL, Kopp SL. Optimizing perioperative management of total joint arthroplasty. Anesthesiol Clin 2014;32:865-80.
2. Pua YH, Ong PH. Association of early ambulation with length of stay and costs in total knee arthroplasty: retrospective cohort study. Am J Phys Med Rehabil 2014;93:962-70.
3. Halawi MJ, Grant SA, Bolognesi MP. Multimodal Analgesia for Total Joint Arthroplasty. Orthopedics 2015;38:e616-625.
4. Niall P McGoldrick EMO, Connor ND. Cost benefit analysis of the use of tranexamic acid in primary lower limb arthroplasty: A retrospective cohort study. World J Orthop 2015;6:977-82.
5. Thomas JW, Guire KE, Horvat GG. Is patient length of stay related to quality of care? Hosp Health Serv Adm 1997;42:489-507.
6. Rathi P, Coleman S, Durbin-Johnson B, Giordani M, Pereira G, Di Cesare PE. Effect of day of the week of primary total hip arthroplasty on length of stay at a university-based teaching medical center. Am J Orthop (Belle Mead NJ) 2014;43:E299-303.
7. Husted H, Holm G, Jacobsen S. Predictors of length of stay and patient satisfaction after hip and knee replacement surgery: fast-track experience in 712 patients. Acta Orthop 2008;79:168-73.
8. Newman JM, Szubski CR, Barsoum WK, Higuera CA, Molloy RM, Murray TG. Day of Surgery Affects Length of Stay and Charges in Primary Total Hip and Knee Arthroplasty. J Arthroplasty 2017;32:11-5.
9. Bozic KJ, Ward L, Vail TP, Maze M. Bundled payments in total joint arthroplasty: targeting opportunities for quality improvement and cost reduction. Clin Orthop Relat Res 2014;472:188-93.
10. Healy WL, Iorio R, Ko J, Appleby D, Lemos DW. Impact of cost reduction programs on short-term patient outcome and hospital cost of total knee arthroplasty. J Bone Joint Surg Am 2002;84:348-53.
11. Healy WL, Rana AJ, Iorio R. Hospital economics of primary total knee arthroplasty at a teaching hospital. Clin Orthop Relat Res 2011;469:87-94.
12. Lovald ST, Ong KL, Malkani AL, et al. Complications, mortality, and costs for outpatient and short-stay total knee arthroplasty patients in comparison to standard-stay patients. J Arthroplasty 2014;29:510-5.
13. Culler SD, Jevsevar DS, Shea KG, Wright KK, Simon AW. The incremental hospital cost and length-of-stay associated with treating adverse events among Medicare beneficiaries undergoing TKA. J Arthroplasty 2015;30:19-25.
14. Collins TC, Daley J, Henderson WH, Khuri SF. Risk factors for prolonged length of stay after major elective surgery. Ann Surg 1999;230:251-9.
15. Bradley BM, Griffiths SN, Stewart KJ, Higgins GA, Hockings M, Isaac DL. The effect of obesity and increasing age on operative time and length of stay in primary hip and knee arthroplasty. J Arthroplasty 2014;29:1906-10.
16. Brock TM, Baker PN, Rushton S, Bardgett M, Deehan D. Length of stay and its impact upon functional outcomes following lower limb arthroplasty. Knee Surg Sports Traumatol Arthrosc 2017;25:2676-81.

17. Muppavarapu RC, Chaurasia AR, Schwarzkopf R, Matzkin EG, Cassidy CC, Smith EL. Total joint arthroplasty surgery: does day of surgery matter? J Arthroplasty 2014;29:1943-5.

18. Mathijssen NMC, Verburg H, van Leeuwen CCG, Molenaar TL, Hannink G. Factors influencing length of hospital stay after primary total knee arthroplasty in a fast-track setting. Knee Surg Sports Traumatol Arthrosc 2016;24:2692-6.

19. Chen A. Day of Surgery Determines Length of Stay in Total Joint Arthroplasty. ICRJ [Internet]. [cited 2022 Feb 24]. Available from: https://icjr.net/surgeries/day-of-surgery-determines-length-of-stay-in-total-joint-arthroplasty

20. Wu CJ, Ryan SP, Hinton ZW, Charalambous LT, Wellman SS, Bolognesi MP, et al. Short Stay Arthroplasty Is Not Associated with Increased Risk of 90-Day Hospital Returns. J Arthroplasty 2022;37:S819-S822.

21. Klemt C, Tirumala V, Barghi A, Cohen-Levy WB, Robinson MG, Kwon YM. Artificial intelligence algorithms accurately predict prolonged length of stay following revision total knee arthroplasty. Knee Surg Sports Traumatol Arthrosc 2022;30:2556-64.

22. Ahsanuddin S, Snyder DJ, Huang HH, Keswani A, Poeran J, Moucha CS. Surgical Scheduling Impacts Hospital Length of Stay and Associated Healthcare Costs for Patients Undergoing Total Hip and Knee Arthroplasty. HSS J 2022;18:385-92.

23. Vincent HK, Alfano AP, Lee L, Vincent KR. Sex and age effects on outcomes of total hip arthroplasty after inpatient rehabilitation. Arch Phys Med Rehabil 2006;87:461-7.

24. Tan C, Loo G, Pua YH, et al. Predicting discharge outcomes after total knee replacement using the Risk Assessment and Predictor Tool. Physiotherapy 2014;100:176-81.