Preoperative Patient Education Reduces In-hospital Falls After Total Knee Arthroplasty

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Abstract

Background Inpatient hospital falls after orthopaedic surgery represent a major problem, with rates of about one to three falls per 1000 patient days. These falls result in substantial morbidity for the patient and liability for the institution.

Questions/purposes We determined whether preoperative patient education reduced the rate of in-hospital falls after primary TKA and documented the circumstances and the injuries resulting from the falls.

Patients and Methods We reviewed data from all 244 patients who underwent primary TKA at a single institution between March and November 2009. Seventy-two patients of one surgeon were enrolled in a preoperative nurse-led education program. This group was compared with a control group of 172 patients who concurrently underwent TKA at the same institution but did not receive preoperative education.

Results More control patients had in-hospital falls than those in the education group: seven (one of whom had two falls) of 172 (4%) versus none of 72 (0%), respectively. Three of the eight falls resulted in a serious injury,

including one wound dehiscence and one wound hematoma that both required repeat surgery and one clavicle fracture.

Conclusions Inpatient falls after TKA may be associated with major complications. Our preoperative patient education reduced these falls and is now mandatory for patients undergoing TKA at our institution.

Level of Evidence Level III, therapeutic study. See Guidelines for Authors for a complete description of levels of evidence.

Introduction

Inpatient hospital falls after orthopaedic surgery represent a major problem, with rates of about one to three falls per 1000 patient days [1, 4, 12]. These postoperative falls represent a major source of potential morbidity for the patient, as well as regulatory and financial liability for the institution; therefore, substantial resources have been expended to understand which patients are at risk for falling and when these falls occur [2, 4, 10, 12, 15, 16]. Numerous factors associated with falls have been identified, some of which are intrinsic to the patient, such as age and cognitive impairment, while other factors are related to the procedures and treatments that they undergo, such as medication side effects and muscle weakness from peripheral nerve blocks [3, 9, 10, 13, 17]. External factors may also play a role, including room design, bed height, and staff-to-patient ratios [19, 20]. Indeed, in most patients, multiple factors are likely involved [2, 10, 12, 15, 16]. In a recent study of falls in an orthopaedic unit, the type of surgery was also important, with TKA representing a particular risk [1]. Based on the results of these investigations, various clinical tools have been developed that help to identify patients who are at risk for falling and thereby

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Each author certifies that his or her institution approved the human protocol for this investigation, that all investigations were conducted in conformity with ethical principles of research, and that informed consent for participation in the study was obtained.

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reduce the likelihood that a fall will occur through implementation of fall reduction measures [2, 4, 10, 15, 16]. While considerable work has been reported to understand why patients fall, fewer studies [5–8, 11, 18, 21] have determined whether particular strategies reduce falls. Although these studies suggest falls may be reduced by approximately 20% to 60%, fall reduction programs have frequently incorporated multimodal strategies rather than a single intervention [5, 6, 18, 21]; common elements in these studies have included use of interdisciplinary teams consisting of therapists, nurses, and physicians; comprehensive patient assessment and identification of patients at risk; staff and patient education; and focused rehabilitation [5, 6, 18, 21]. Consequently, little is known about the value of patient education as an independent tool for reducing falls in patients after surgery, despite acknowledgment of the theoretical potential of this intervention [7, 8, 11]. TKA represents a good model for evaluating the effect of patient education on reducing postoperative inpatient falls because it is an elective operation associated with substantial preoperative lead time and has been associated with an increased fall risk compared with other orthopaedic surgeries [1].

We therefore (1) determined whether a nurse-led preoperative patient education program reduced the rate of inpatient hospital falls after primary TKA; (2) defined the circumstances in which falls occur after TKA; and (3) identified the type and severity of the injuries resulting from these inpatient falls.

Patients and Methods

We retrospectively reviewed data from all 244 patients who underwent primary TKA with six surgeons at our institution between March and November 2009. Beginning in March 2009, all patients undergoing TKA with one surgeon (HDC) were enrolled in a preoperative education program run by one of two trained nurse educators that was solely designed to address fall prevention after surgery as part of a quality assurance project at our institution. Seventy-two patients (46 women, 26 men; mean age, 70.2 years) underwent surgery with a single surgeon (HDC) and completed the education program (educated group). In addition, there were an additional 19 patients who underwent surgery with the same surgeon who did not participate in the program either because a nurse educator was not available at the time of the patient's preoperative appointment or because the patient failed to report as scheduled. These 19 patients were included in the control group with 153 additional patients who underwent TKA with one of five other surgeons. Therefore, in total, the control group consisted of 172 patients (96 women,

76 men; mean age, 70.3 years). The two cohorts were not matched. The age and sex of the patients in the two groups were compared. Data from one patient in the education group was lost and therefore analysis was performed on 243 of the 244 patients. We found no differences in the percentage of male patients or mean age of the patients between the two groups (Table 1). No patients were recalled specifically for this study; all data were obtained from a prospective institutional quality assurance database and from medical records. This retrospective, cohort study was approved by our Institutional Review Board.

The education program consisted of a one-on-one education session performed in the outpatient setting at the time of the patient's routine preoperative visit with the surgical team within 14 days of surgery. This education session lasted approximately 15 to 30 minutes depending on individual patient questions. Factors that may contribute to falls, such as the weakness associated with the use of peripheral nerve blocks, as well as instructions about how to prevent falls, such as always summoning help before getting out of bed and using the walker with two hands, were reviewed. A patient education sheet was provided for subsequent reminders and an oral test was administered at the end of the session. During this test, the patients were asked to recall three ways that they could help prevent themselves from becoming a fall victim.

Perioperative management was similar for the patients in both groups and was based on established departmental guidelines. Peripheral nerve blocks, with supplemental oral and intravenous narcotics, were used for postoperative pain management. Data about the use of blocks were not retrievable for one patient in the education group. Two hundred forty-two of the 243 patients for whom data were available received a femoral block performed with an indwelling catheter and removed at 6 AM on the morning of Postoperative Day (POD) 2. Sciatic blocks were performed in some patients as either a single shot or with an indwelling catheter that was removed at 6 AM on POD 1. Sixty-nine of 71 patients (97%) in the education group received a sciatic block, while 123 of 172 patients (72%) in the control group received a sciatic block. The use of sciatic blocks was higher ($p < 0.001$; 95% confidence interval: 0.17–0.33) in the education group.

Patients were mobilized in physical therapy with weightbearing as tolerated and a walker twice daily

Table 1. Patient demographics

Variable	Education group (n = 71)	Control group (n = 172)	95% confidence interval
Mean age (years)	70.2 (SD, 9.2)	70.3 (SD, 9.3)	–2.5 to 2.7
Males	25 (35%)	76 (44%)	–0.22 to 0.04

beginning on POD 1. Knee immobilizers were not routinely used. Transfusions were given according to departmental guidelines to patients with a hemoglobin level of less than 8 g/dL during the postoperative period; patients with prior cardiac disease if the hemoglobin level was less than 10 g/dL; any patient where substantial hypotension, dizziness, or loss of consciousness was refractory to fluid resuscitation; and any patient for whom consulting medical services recommended transfusions even though the above specific criteria were not met. Patients were also treated with a postoperative urinary catheter for 24 hours.

For each patient who fell, we gathered basic demographic information, use of peripheral nerve blocks, details of the fall (including patient activity and time of day), and injuries resulting from the fall. Furthermore, at our institution, every patient is evaluated with the Hendrich II Fall Risk Score [10] during each 12-hour nursing shift. This tool, which has been validated for identifying hospitalized patients at risk of a fall, was derived from a retrospective review of 600 possible risk factors studied in 1232 patients; of these 600 possible risk factors, eight variables, each weighted differently, were identified and incorporated into the Hendrich Fall Risk Score [10]. Elements of this score include confusion (4 points), depression (2 points), altered elimination (1 point), subjective dizziness (1 point), male gender (1 point), and use of antiepileptics (2 points) or benzodiazepines (1 point) [10]. In addition, the patients are evaluated on ability to rise from a chair as follows: able to rise in a single movement (0 points), pushes up and successful in one attempt (1 point), multiple attempts but successful (3 points), and unable (4 points) [10]. The resulting scores range from 1 to 16 for male patients and range from 0 to 15 for female patients; any patient with a score of 5 or more points is considered at high risk for an inpatient fall [10]. We reviewed the fall score that had been recorded prospectively for each patient at some point during the 12-hour shift before their fall.

We defined a major injury as a fracture or any injury requiring reoperation and a minor injury as superficial contusions, abrasions, or other wound complications not requiring repeat surgery.

Age was compared using a two-sample t test. All other demographic and descriptive variables were compared using a chi square test. SAS® statistical software (Version 9.1; SAS Institute Inc, Cary, NC) was used for the analysis. We used a likelihood ratio chi square test to compare the fall rates between the two groups. This analysis was performed at a different time from the descriptive statistics and was performed with JMP® statistical software (Version 8; SAS Institute Inc).

Results

More control patients ($p = 0.03$) had in-hospital falls than those in the education group: seven (one of whom had two falls) of 172 versus none of 72, respectively.

Of the seven patients who fell, six were female and one was male. The mean age of these seven patients at the time of surgery was 73 years (range, 64–88 years). Five of the falls occurred on POD 1, two on POD 2, and one on POD 4 (Table 2). Only two of the patients had a Hendrich II Fall Risk Score of 5 or greater on their last evaluation (within 12 hours before the fall), which classified them at high risk for a fall; the other five patients did not. Femoral blocks (performed with an indwelling catheter and removed at 6 AM on POD 2) were still in effect to varying degrees in six of seven patients at the time of their falls and may have directly contributed to the falls; in the other patient, the femoral nerve catheter had been removed 48 hours before the fall and was unlikely to have been a contributing factor. In addition to the use of femoral blocks in all of the patients who fell, sciatic blocks had also been used in some patients. Two of the patients who fell did not receive a sciatic block of any kind. Two patients who had received a one-shot sciatic block fell on POD 2 and 4, respectively; as

Table 2. Falls after TKA

Patient	POD of fall	Time of day	Fall score	Femoral block	Block in effect	Sciatic block	Block in effect
1	1	8:00	4	2-day catheter	Yes	No	NA
2	2	9:55	4	2-day catheter	Residual	1 shot	Residual
3A	1	13:55	4	2-day catheter	Yes	1-day catheter	Residual
3B	1	14:20	4	2-day catheter	Yes	1-day catheter	Residual
4	1	18:00	3	2-day catheter	Yes	1-day catheter	Residual
5	1	12:20	5	2-day catheter	Yes	1-day catheter	Residual
6	2	3:55	5	2-day catheter	Yes	No	NA
7	4	12:45	3	2-day catheter	No	1 shot	No

POD = postoperative day; NA = not applicable.

these blocks had been performed more than 36 hours previously, it is unlikely any effect can be attributed to these blocks. Three additional patients who sustained four falls all fell during the afternoon of POD 1, after a sciatic catheter had been removed at 6 AM on the same day. In these patients, it is possible some persistent weakness resulted from the blocks at the time of the falls. The use of nerve blocks in the entire study population was reviewed. Information about nerve blocks was lost for one patient; therefore, information is presented about the remaining 243 patients. The use of femoral blocks could not be analyzed as an independent risk factor for falls as 242 of 243 patients in the study had received one. In contrast, the use of sciatic blocks was less consistent (192 of 243; 79%) and was analyzed as a risk factor for falls. The rate of falls was similar ($p = 0.64$; 95% confidence interval: -0.07 to 0.04) in patients who had sciatic blocks (five of 192; 3%) and those who did not have sciatic blocks (two of 51; 4%). The activities at the time of the falls were associated with toileting or personal hygiene in four patients (Table 3). Two patients (three falls) slipped to the floor while attempting to get up from or reposition on a chair; one patient fell while ambulating with her walker about 1 hour before discharge home after she had been cleared by physical therapy for independent ambulation.

Three major or minor injuries occurred as a result of three falls in two patients. In the one patient who sustained two falls, these occurred within 30 minutes of each other and it was impossible to attribute specific injuries to the first and second falls as a physician evaluation was not performed until after the second fall. Therefore, three of eight falls (37.5%) resulted in a serious injury (Table 3). These injuries included one clavicle fracture, one wound hematoma requiring débridement and subsequent revision

TKA, and one superficial wound dehiscence requiring resuturing of the incision. In addition, two of eight falls (25%) resulted in a minor injury.

Discussion

In-hospital fall rates after orthopaedic surgery are reportedly about one to three per 1000 patient days with rates as high as 16 per 1000 patient days in geriatric patients treated for hip fractures [1, 4, 12, 18]. Consequences of these falls include morbidity for the patient and regulatory and financial liability for the institution. For all these reasons, fall reduction has become a high priority for hospitals throughout the United States and numerous studies have been conducted to understand when and why these falls occur [2, 4, 10, 12, 15, 16]. While several studies [5–8, 18, 21] have evaluated the effectiveness of particular strategies to reduce falls, the fall reduction programs that reduce falls among inpatients have frequently incorporated multimodal intervention strategies, rather than focusing on one specific variable. These programs have demonstrated reductions in fall rates of approximately 20% to 60% through the use of patient identification, multidisciplinary patient assessment and management, staff and patient education, and specialized therapy [5, 6, 18, 21]. Patient education as an independent strategy for fall reduction in patients after surgery has received little attention but has proven beneficial in general acute hospital inpatients and subacute care center patients [7, 8, 11]. We therefore (1) evaluated the effectiveness of a nurse-led preoperative patient education program in reducing the rate of inpatient hospital falls after primary TKA; (2) defined the circumstances in which

Table 3. Activity at time of fall and injuries sustained by each patient who fell after TKA

Patient	Activity at time of fall	Alone or with staff	Injury
1	Standing at sink	Alone	None
2	Up to bathroom	Alone	Superficial dehiscence midportion of incision, requiring suture closure
3A	Getting out of chair	Witnessed but not assisted during fall	Clavicle fracture; wound hematoma requiring open débridement $\times$ 2; delayed revision for instability
3B	Getting out of chair	Witnessed but not assisted during fall	
4	Transfer to bedside commode	Alone	Small amount of wound bleeding; forearm abrasion
5	Slid off chair attempting to reach dropped pen	Alone	None
6	Transfer to bedside commode	With staff nurse who assisted patient to floor	Contralateral thigh abrasion
7	Walking with walker (1 hour before discharge)	Alone (previously cleared by physical therapy for discharge home)	None

falls occur after TKA; and (3) identified the type and severity of the injuries resulting from these inpatient falls.

Major limitations of the study exist. First and most importantly, the patients were not randomized into the experimental and control groups. Rather, the control group represented a contemporaneous group of patients who underwent TKA at our institution but did not receive the preoperative education. Therefore, underlying differences in the two groups may account for the observed differences in outcomes. Specifically, we did not evaluate other variables, such as comorbidities, the use of benzodiazepines or antiepileptics, or a history of falls before hospitalization, which are risk factors for falls in hospitalized patients [2, 10, 15, 16], nor did we evaluate the effects of postoperative hemoglobin, which conceptually could be associated with falls, although this variable has not been identified as a risk factor in major fall risk assessment studies [2, 10, 15, 16]. Second, while perioperative care for the patients was similar, based on standardized treatment algorithms and practice standards for all patients undergoing TKA at our institution, regardless of operating surgeon, the care was not identical; therefore, again other confounding unstudied variables may account for the differences in the fall rates between the two groups.

Our primary goal was to evaluate the effect of implementing a preoperative patient education program on fall rates in patients undergoing elective TKA. We found a reduction in postoperative falls in patients who participated in a one-on-one, nurse-led preoperative education program. Interestingly, in our study, the rate of sciatic nerve block use was higher in the education group and all patients received a femoral block, yet no falls occurred in this cohort. Therefore, patient education alone appears to negate the risks that may be associated with the use of peripheral blocks. However, while this education program has proven effective, it is relatively time-consuming and therefore costly. In a center performing 500 TKAs a year, the resources required to administer this program would be equivalent to approximately 0.1 full-time nursing position (15 to 30 minutes multiplied by 500 patients = 125 to 250 person/hours with an average work year of 2000 person/hours). Other initiatives may also be successful at reducing falls, such as the use of an immobilizer while peripheral nerve blocks are in effect, and may be associated with lower costs [17]. In addition, it is unknown whether fall reduction education may be delivered in a group setting or by a video, which would be more cost-effective and yet maintain the proven benefits. Further trials are required to investigate these questions and to determine whether the effects of education and other interventions are complimentary.

Our second goal was to identify the circumstances of the falls. The majority occurred during hygiene and toileting

activities when the patient was alone. No detailed analysis was performed that attempted to find differences between the patients who fell and those who did not. It is interesting to note, based on the Hendrich II Fall Risk Assessment Score, which is a widely used fall risk predictor for hospitalized patients, only two of seven patients achieved a score of 5 that placed them into the high-risk group for falls [10]. Importantly, this score was developed and validated in a group of 1135 general patients in an acute-care hospital based on logistic regression analysis of more than 600 variables for each patient [10]. Sensitivity of 75% and specificity of 74% have been reported with the use of this score for predicting falls in hospitalized patients [10]; however, this has been challenged recently [14]. In our study, the Hendrich score was a poor predictor of falls; this finding may have been due to the high use of peripheral nerve blocks and the clustering of falls during the first 48 hours when the blocks may have produced motor block. Alternatively, inaccurate assessments by the evaluating nurse or too long a time interval between assessments may have contributed to this finding (verbal communication, Ann L. Hendrich, MSN, RN, 2010). Based on these findings, more detailed investigation of the value of this score in patients undergoing TKA should be conducted.

Our third goal was to detail the type and severity of the injuries resulting from falls after TKA. We found three of the eight falls resulted in a major injury and two additional falls resulted in a minor injury. In distinction, in a recent study of 6912 mostly elective postoperative admissions to a 50-bed specialty orthopaedic patient care unit, moderate or serious injury occurred in only 10% of patients who fell, while a further 9% sustained a minor injury [1]. In another report characterizing falls among all types of inpatients at a 1300-bed academic hospital, an injury occurred in 42% of the patients who fell; however, only 8% of the patients who fell sustained moderate to severe injuries [12]. The higher rate of more severe injuries in our patients may have been due to the nature of the operation performed, with patients after TKA at potentially increased risk of complications to the surgical site itself. Certainly, compared to nonsurgical patients, where a fall may result in a knee laceration, in patients after TKA, a fall of similar magnitude and mechanism may result in wound dehiscence that would be graded as a more serious injury due to the potential need for reoperation and major infection complications. Therefore, not only may patients undergoing TKA be at higher risk of fall compared with other orthopaedic procedures but the types of injuries sustained may be more severe [1].

Despite the limitations, this study has demonstrated serious injuries result at a high rate in patients who fall after TKA and a nurse-led preoperative education program is statistically and clinically effective in reducing these falls. Based on these findings, a decision was made to

incorporate fall reduction education into the preoperative program that all patients undergo at our institution before TKA. Further studies would be beneficial to identify whether this approach could also be used in other types of elective surgery and also to evaluate whether the benefits of preoperative education continue to reduce falls after discharge from the hospital.

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