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Original research

The effect of a preoperative education class on the rate of manipulation under anesthesia after total knee arthroplasty in a veterans population

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ABSTRACT

Background: Arthrofibrosis after total knee arthroplasty (TKA) is a common complication, potentially occurring in up to 25% of patients, and may be treated during the early recovery period by manipulation under anesthesia (MUA). The majority of preoperative factors that predispose patients to postoperative stiffness are patient specific and not modifiable. The United States Veteran Affairs is a particularly challenging group given a higher baseline rate of medical comorbidities and opioid dependence than the general population. Patient education about postoperative expectations and complications has been shown to improve outcomes in certain orthopedic procedures. This retrospective study aims to determine if preoperative counseling for veterans undergoing primary TKA reduces the rate of postoperative stiffness, and consequently MUA, in this subset of patients.

Methods: We evaluated the medical records of 244 veterans at a single veteran affairs hospital who underwent 278 TKAs during a 6-year period under one surgeon. Patients were separated into groups based on attendance in the preoperative counseling session. Effects of various factors, including age, sex, body mass index, preoperative knee range of motion, and history of previous knee surgery, were compared between these 2 cohorts.

Results: Attendance in the preoperative course did not have a statistically significant impact on the rate of manipulation (odds ratio [OR], 1.07). Female gender and prior manipulation had an increased OR of knee manipulation, whereas age > 65 years had a decreased OR that did not reach significance.

Conclusions: Our results show that preoperative counseling did not have a benefit in terms of postoperative MUA rates in veterans. Preoperative education may be helpful for setting appropriate expectations of pain, recovery, and function after total joint arthroplasty and may be useful in an online or video format in small practices in which cost may be prohibitive. Further studies are needed to determine whether they provide any benefit in postoperative arthrofibrosis rates.

Introduction

It is estimated that nearly 700,000 total knee arthroplasty (TKA) surgeries were performed in the United States in 2010 [1]. Though long-term patient survival and patient satisfaction are typically high after TKAs, studies have estimated that 20%-25% of patients may suffer from postoperative stiffness [2]. Arthrofibrosis can have significant implications for functional outcomes after knee replacement, as patients require over 90 degrees of flexion to descend stairs and stand from a seated position [3]. Many factors contribute to postoperative stiffness, including previous knee surgery and diabetes, but preoperative stiffness is the most significant correlating factor [4]. Previous trauma, obesity, and hypertrophic scar formation may also play roles [5]. Intraoperative factors thought to contribute to stiffness include component malalignment, poor sagittal plane gap balancing, and inadequate osteophyte

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resection [6]. Pain control, patient compliance, and heterotopic ossification are postoperative risk factors contributing to stiffness [7,8].

Typical first-line therapy is physical therapy to break down fibrous tissue, which may result from tissue hypoxia or reaction oxygen species in the soft tissue near the surgical site [9]. More invasive approaches include arthroscopic or open arthrolysis and revision surgery [10], but management after failed physical therapy typically starts with manipulation under anesthesia (MUA), defined as the closed forced flexion of the knee under general anesthesia to gain an increased range of motion. This procedure has been shown to have better outcomes when performed within 12 weeks of the index surgery [10].

Multiple studies have confirmed that patients undergoing MUA have good clinical outcomes in terms of patients recovering the range of motion required for activities of daily living and performing similar to TKA patients not needing MUA [2,11,12]. This procedure, however, is not without its own risks, including exposure to anesthetic agents and possible extensor mechanism rupture or periprosthetic fractures [13]. Patients requiring MUA may also have an increased risk of early revision TKA [14]. Studies have shown that preoperative counseling may help to improve postoperative outcomes after orthopedic surgery [4]. Preoperative counseling that increases patient knowledge regarding pain science, multimodal pain management, and coping strategies may be beneficial in reducing postoperative pain in TKA patients [15]. Similarly, preoperative expectations, which can be significantly influenced through education and counseling, have been shown to impact outcomes in rotator cuff repairs [16].

The Veterans' Affairs (VA) health-care system deals with a particularly challenging population undergoing TKA, often with an increased baseline burden of comorbid illnesses. These patients often have chronic pain issues and opioid use, psychological disorders, and a high rate of preoperative use of nonnarcotic medications such as muscle relaxers and benzodiazepines. Hadlandsmyth et al. [17] showed an increased risk of prolonged opioid use in veterans after TKA and also found that patients at the VA were more likely to have chronic preoperative opioid use than the general population. The authors suggested the use of cognitive behavioral therapy in the VA population, who they also found to have a higher rate of psychological disorders than the general population undergoing TKA. The veteran population also has a higher rate of homelessness than the general population. Bennett et al. [18], however, found that with the proper counseling and resources, TKA could be performed successfully and achieved good outcomes even in homeless VA patients. These studies show that with the appropriate resources, education and counseling can be used to effectively improve outcomes in TKA in the veteran population.

Kiskaddon et al. [19] described a program designed to facilitate early discharge after total joint arthroplasty. Part of their protocol included a preoperative counseling class that they postulated, which may have contributed to reduced visits to the emergency department postoperatively as a result of improved patient education and expectations. Gayed et al. [20] reported a joint-replacement program that made use of the Lean Six Sigma process-improvement methods to increase total joint volume at the VA while reducing costs and complications. The implementation of a preoperative class for all patients undergoing total joint arthroplasty was also included in their protocol. They felt that this class helped to set postoperative expectations, perform baseline physical therapy and functional status evaluations, and determine potential discharge needs. The aforementioned studies show that with proper education, veterans undergoing TKA can have improved outcomes despite their higher rate of comorbidities and risk factors for complications than the general population.

The purpose of this study was to determine if the initiation of mandatory preoperative counseling for primary TKA would lead to a decrease in the rates of MUA after the procedure. We also aimed to evaluate the effects of medical comorbidities, knee-specific factors, and demographics as risk factors for MUA.

Material and methods

Study design

Between 2010 and 2016, 244 patients underwent 278 primary TKAs at the Veterans Administration Hospital in West Haven, Connecticut. In March of 2013, the West Haven Veterans Administration instituted a mandatory preoperative total joint education course that provided patients with general information regarding total joint replacement and details of the operation but focused primarily on the expected postoperative course. The course is administered by a multidisciplinary team consisting of an orthopedic physician assistant, physical therapist, and surgical case manager. During the class, the importance of active participation in physical therapy to ensure progression toward a functional range of motion is emphasized. In addition, the necessity of compliance with deep vein thrombosis prophylaxis and discharge to home vs a short-term rehabilitation center are discussed.

After Institutional Review Board approval, a chart review of these 244 patients was conducted. The inclusion criterion was primary TKA performed by surgeon L.W. Exclusion criteria included revision knee arthroplasty, conversion of unicondylar knee arthroplasty to TKA, postoperative follow-up of less than 3 months, and ligamentous instability requiring more constrained components.

Surgical technique

All TKAs were performed by a single surgeon (L.W.) using a cemented Zimmer NexGen Legacy Posterior Stabilized Knee through a medial parapatellar arthrotomy for exposure. The surgical technique remained the same throughout the duration of this study. Tourniquets were used for cementation and as necessary for the approach. A deep Hemovac drain was placed at the end of surgery in all cases. Patients were placed in a knee immobilizer postoperatively, which was discontinued when they were able to achieve a straight leg raise against gravity. This was performed as it has been shown to reduce falls in patients who received femoral nerve blocks preoperatively [21]. Drains were discontinued on postoperative day 2. All patients underwent our standard rehabilitation protocol that included ambulation and initiation of physical therapy on postoperative day 1. Enoxaparin was used for venous thromboembolism prophylaxis for 6 weeks, unless the patient was previously on anticoagulation.

Follow-up

All patients were seen at 2, 6, and 12 weeks postoperatively with a range of motion assessments. Patients who failed to achieve 90 degrees of flexion beginning at their 6-week appointment were counseled about MUA and seen at 8 weeks postoperatively to determine if they were candidates for MUA. Failure to achieve 90 degrees of flexion by 12 weeks was considered an absolute indication for MUA.

Statistical analysis

Patient and procedure characteristics were tabulated, and differences between the groups were assessed using t-statistics for

continuous measures and χ^2-statistics for categorical measures. A multiple logistic regression analysis was performed to assess the effect of preoperative counseling while controlling for patient factors. All patient factors collected were included in the multiple regression analysis based on a priori determination of known risk factors for postoperative stiffness. All calculations were performed using Stata 13.1 (StataCorp, College Station, TX), and the threshold for significance was a type I error rate of 0.05.

Results

Patient characteristics

There were 278 primary TKA procedures performed in 244 patients at our institution from 2010 to 2016. Fourteen cases were excluded from the data analysis. Nine were performed by alternate surgeons, and 5 did not meet the full 3-month follow-up required. Groups were separated based on attendance in the preoperative arthroplasty class for the purpose of this investigation. One patient did not attend the preoperative class within the mandatory time frame and was analyzed with the control group. There were 12 manipulations in the group without the preoperative class and 13 in the group with the preoperative counseling. There were 2 patients who had bilateral knee manipulations performed at different time points. In both the patients, manipulations in one knee were performed before the preoperative counseling and in the other after having attended the course.

The overall study population was predominantly male (96% in the group without counseling and 97% in the group with counseling). The 2 groups had similar age, gender, body mass index (BMI), preoperative flexion scores, and history of prior TKA (Table 1). Preoperative knee extension was lower on average in the preoperative counseling group by 2 degrees, a difference which approached statistical significance ($P = .051$; Table 1). The manipulation group comprised a younger patient population and had significantly more females (Table 2). However, we were unable to reproduce this in our regression analysis as the differences were representative of confounding variables.

Risk-factor analysis

A multiple regression analysis was performed to evaluate the separate data points as independent risk factors for manipulation. Presence of the preoperative course did not have a statistically significant impact on the rate of manipulation (odds ratio [OR], 1.10; Table 3). Female gender, prior manipulation, and age greater than 65 years did not reach statistical significance (OR, 2.75 [$P = .20$]; OR, 4.45 [$P = .141$]; OR, 0.44 [$P = .11$], respectively). Other preoperative risk factors, including preoperative range of motion, history of prior surgery, diabetes, and preoperative course, did not increase the risk of knee manipulation postoperatively.

Table 1
Patient demographic characteristics and procedure data.

Characteristics	No counseling group	Preoperative counseling group	*P* value
Number of knees	131	133	
Age (y)[a]	65 (26-86)	65 (27-87)	.71
Gender (M/F) (% male)	126/5 (96)	129/4 (97)	.72
Average BMI[b]	31.6	31.3	.67
Normal (BMI < 25) (no. [%] of patients)	12 (9)	10 (9)	
Overweight (BMI: 25-30) (no. [%] of patients)	38 (29)	45 (34)	
Obese (BMI > 30) (no. [%] of patients)	81 (62)	78 (59)	
Average preoperative flexion (degrees)	109	112	.16
Average preoperative extension (degrees)	2	4	.051
Prior surgery to knee (no. [%] of patients)	51 (39)	49 (37)	.73
Diabetes (no. [%] of patient)	22 (17)	25 (19)	.67
Number of manipulations	12	13	.86

[a] The values are given as the average with the range in parentheses.
[b] BMI = weight (in kilograms)/height^2 (in meters).

Table 2
Patient demographic characteristics in groups with and without manipulation.

Characteristics	MUA	No MUA	*P* value
Number of knees	25	239	
Age (y)[a]	60 (44-71)	66 (26-87)	.0026
Gender (M/F) (% male)	22/3 (88)	233/6 (97)	.0130
Average BMI[b]	30.3	31.6	.1859
Normal (BMI < 25) (no. [%] of patients)	3 (12)	20 (8)	
Overweight (BMI: 25-30) (no. [%] of patients)	7 (28)	75 (31)	
Obese (BMI > 30) (no. [%] of patients)	15 (60)	144 (60)	
Average preoperative flexion (degrees)	109	111	.6562
Average preoperative extension (degrees)	3.8	3.2	.6414
Prior surgery to knee (no. [%] of patients)	12 (48)	88 (37)	.470
Diabetes (no. [%] of patient)	2 (8)	45 (19)	.176
Preoperative course	13 (52)	120 (50)	.865

[a] The values are given as the average with the range in parentheses.
[b] BMI = weight (in kilograms)/height^2 (in meters).

Discussion

Previous data have shown that preoperative education independently decreases the risk of MUA after TKA [15]. We implemented mandatory preoperative education for all total joint arthroplasty patients at our local VA hospital in March 2013. This multidisciplinary education session was attended by all preoperative total joint patients and is administered by the same orthopedic physician assistant, physical therapists, and surgical case manager.

There are multiple postulated benefits for total joint centers to host a mandatory preoperative class, including description of the perioperative events, answering patients' questions at one time (thus decreasing the time spent in clinic answering questions), and explanation of postoperative exercises/restrictions. In addition, preoperative education may be helpful for setting appropriate expectations of pain, recovery, and function after total joint arthroplasty. Classes have been shown to reduce preoperative pain and anxiety in patients undergoing arthroplasty surgery [17]. However, there are potential drawbacks to mandatory preoperative education. Patients may be delayed in receiving their joint arthroplasty to find time to attend the preoperative education. If patients are traveling long distances (as can often happen in our regional VA orthopedic referral center), the logistics of attending the course can also place an unnecessary burden on them. There are also potential

Table 3
Regression analysis of risk factors for manipulation.

Risk factor	OR	*P* value
Preoperative course	1.10	.839
Female	2.75	.200
Age > 65	0.44	.113
BMI		
Normal	Reference	
Overweight	0.52	.415
Obese	0.58	.460
Prior surgery	1.49	.409
Diabetes mellitus	0.51	.383
Prior manipulation	4.45	.141
Preoperative flexion	1.00	.904
Preoperative extension	1.01	.734

costs to the independent surgeons or hospitals for providing the team and location to perform this preoperative education.

Our findings show that mandatory preoperative counseling does not significantly affect the rate of knee MUA after TKA in our veteran population. The greatest effect on the risk of manipulation was a patient history of prior manipulation, although this did not reach statistical significance. In addition, we had 2 patients who had TKAs performed both before and after the implementation of the preoperative education. Both these patients required manipulations for each knee, suggesting internal causes for arthrofibrosis rather than modifiable external effects.

The results of this study may have implications for practitioners in small practices for whom implementing preoperative education would be cost prohibitive. Although our results do not show a significant improvement in the rate of manipulations with preoperative education, there are potential benefits as mentioned previously. One way to provide accessible preoperative education for patients to perform on their own time would be through online or in-office videos. This has been shown effective to decrease anxiety scores in preoperative total joint arthroplasty patients [16].

The strengths of this study are that it was a single-surgeon study with no other changes in preoperative evaluation, operative technique, implants, or postoperative care other than the implementation of mandatory preoperative counseling. There were very few patients lost to follow-up during the collection period. The baseline characteristics of the groups were very similar, with a minimal difference in preoperative extension between the groups.

This study had several limitations. First, the results may not be generalizable to a more typical knee arthroplasty population. We have very few women in our study group, largely due to the prevalence of older male patients in our single urban VA institution. This may have led to a sampling bias and overestimation of the risk of female gender for manipulation. Second, because of our limited numbers, we potentially could have falsely accepted our null hypothesis and failed to detect a small difference in the rate of manipulations after implementing the mandatory preoperative education. In addition, this was a single-surgeon study with a single implant, and the single-surgeon surgical technique and one single method of establishing the flexion gap may be a confounding variable in this study.

Conclusions

Our results demonstrate that mandatory preoperative education may not impart a significant difference in the rate of MUA among veterans undergoing TKA. Women and prior knee manipulation patients had an increased risk of MUA, but these factors did not meet statistical significance. Further studies with larger sample sizes and/or multi-institutional cohorts are needed to determine whether these classes can provide specific benefit in reducing the rate of MUA in this subset of patients.

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