Arthroplasty Today xxx (2017) 1–5

Contents lists available at ScienceDirect

Arthroplasty Today

journal homepage: http://www.arthroplastytoday.org/

Original research

Decreased risk of knee buckling with adductor canal block versus femoral nerve block in total knee arthroplasty: a retrospective cohort study

Ryan R. Thacher, BA [a], Thomas R. Hickernell, MD [a], Matthew J. Grosso, MD [a], Roshan Shah, MD [a], Herbert J. Cooper, MD [a], Robert Maniker, MD [b], Anthony Robin Brown, MD [b], Jeffrey Geller, MD [a,] *

[a] *Center for Hip and Knee Replacement, Department of Orthopedics, Columbia University Medical Center, NewYork-Presbyterian Hospital, New York, NY, USA*
[b] *Department of Anesthesiology, Columbia University Medical Center, NewYork-Presbyterian Hospital, New York, NY, USA*

ARTICLE INFO

Article history:
Received 27 January 2017
Received in revised form 24 February 2017
Accepted 27 February 2017
Available online xxx

Keywords:
Primary total knee arthroplasty
Adductor canal block
Femoral nerve block
Buckle
Fall

ABSTRACT

Background: Femoral nerve (FNB) and adductor canal blocks (ACB) are used in the setting of total knee arthroplasty (TKA), but neither has been demonstrated to be clearly superior. Although dynamometer studies have shown ACBs spare perioperative quadriceps function when compared to FNBs, ACBs have been widely adopted in orthopaedic surgery without significant evidence that they decrease the risk of perioperative falls.

Methods: All patients who received single-shot FNB (129 patients) or ACB (150 patients) at our institution for unilateral primary TKA from April 2014 to September 2015 were retrospectively reviewed for perioperative falls or near-falls during physical therapy and inpatient care.

Results: There were significantly more “near-falls” with documented episodes of knee buckling in the FNB group (17 vs 3, $P = .0004$). These patients’ first buckling episode occurred at an average of 21.1 hours postoperatively (standard deviation 5.83, range 13.83-41.15). There were no significant differences in pain scores between the 2 groups at any of the time periods measured; however, patients in the FNB group consumed significantly fewer opioids on postoperative day 1 than the ACB group (59 morphine equivalents vs 73, $P = .004$).

Conclusions: A significantly higher rate of near-falls with knee buckling during in-hospital physical therapy was discovered in the FNB group. With increasing numbers of TKAs being performed on a “fast-track” discharge model, these results must be seriously considered, particularly in patients planning to go home the same day, to reduce the risk of postoperative falls. These data support the recent clinical data trend favoring ACB over FNB in orthopaedic surgery.

Introduction

Preoperative peripheral nerve blocks are frequently utilized as part of multimodal pain regimens in total knee arthroplasty (TKA) to provide relief and limit the use of opioid analgesics with their potential side effects and complications [1,2]. Studies suggest, however, that nerve blocks, specifically a femoral nerve block (FNB), can result in marked quadriceps weakness [3-10]. This muscle weakness can interfere with early ambulation and is thought to lead to an increased risk of falling in the postoperative setting.

Recent literature has discussed the potential of the adductor canal block (ACB) as a safer and equally effective alternative to the FNB. In contrast to the FNB, the ACB is primarily a sensory block and is thought to spare much of the quadriceps muscle due to the more distal injection site. A number of studies have shown that an ACB does in fact preserve quadriceps strength to a greater degree than an FNB [3-10], while providing effective pain relief [4,6-9,11-15].

One or more of the authors of this paper have disclosed potential or pertinent conflicts of interest, which may include receipt of payment, either direct or indirect, institutional support, or association with an entity in the biomedical field which may be perceived to have potential conflict of interest with this work. For full disclosure statements refer to http://dx.doi.org/10.1016/j.artd.2017.02.008.

* Corresponding author. 622 West 168th Street, PH 1147, New York, NY 10032, USA. Tel.: +1 212 305 8193.
E-mail address: jeffreygeller@aol.com

http://dx.doi.org/10.1016/j.artd.2017.02.008
2352-3441/

In this investigation, we specifically sought to quantify the risk of falling by retrospectively comparing the incidence of recorded falls or "near-falls" during postoperative ambulation in a group of patients who received an ACB for pain relief following unilateral, primary TKA with a separate cohort of patients who received an FNB for the same procedure. For this study, we used knee buckling events as a proxy for measuring the incidence of near-falls. A knee buckle was defined as a sudden and involuntary loss of postural strength and balance as witnessed by our physical therapy (PT) staff, which may or may not have required the patient to brace herself to keep from falling. Our hypothesis was that there would be fewer falls or knee buckles in the ACB group compared to the FNB group. Secondary aims of the study included evaluation of the patient's pain level, pain medication requirements measured in morphine equivalent levels, and ability to ambulate in the immediate postoperative period.

Material and methods

After receiving Institutional Review Board approval, we queried hospital anesthesia records to retrospectively identify all patients who received either an FNB or an ACB for postoperative pain control between April 2014 and September 2015. From that list, we generated a comparative cohort of all patients who received either a single-shot FNB or ACB for unilateral, primary TKA. The decision to administer FNB vs ACB was made by both the Anesthesia and Orthopaedic provider preference at the time of surgery. Of an initial 515 patients identified as having received FNBs, 386 patients were ultimately excluded for the following reasons: 89 fractures of the hip, femur, patella, tibia, ankle, and foot; 68 anterior cruciate ligament reconstructions, 67 continuous pain catheters, 41 unicondylar knee replacements, 36 hip arthroplasties, 34 bilateral or revision TKAs, 16 quadriceps or patellar tendon repairs, and 18 miscellaneous procedures. The final 17 were excluded due to having inaccessible or incomplete charts or for pre-existing conditions such as chronic opioid use, neuropathies, or nonambulatory status, leaving a total of 129 patients who met inclusion criteria. With respect to the ACB, of an initial list of 434 patients, 284 were ultimately excluded for the following reasons: 70 femur, patella, tibia, ankle, and foot fractures, 62 unicondylar knee replacements, 39 anterior cruciate ligaments, 36 bilateral or revision TKAs, 26 continuous pain catheters, and 26 other procedures. As was the case with the FNB group, the final 25 patients were excluded because of inaccessible or insufficient records as well as for pre-existing conditions, leaving 150 patients who met study criteria.

Patient charts were reviewed to determine demographics data such as patient age, sex, body mass index (BMI), and comorbidities, including the incidence of dementia, cardiovascular disease, neurological and pulmonary disorders, and diabetes. Notes from the first 4 sessions of PT, which were conducted twice daily starting on the morning of postoperative day 1 (POD1) as was protocol during the study period, were evaluated for any recorded falls or objective episodes of knee buckling as witnessed by the therapists. We did not include any instances of subjective buckles reported by patients to avoid inconsistencies in reporting. Nursing and physician records were scanned for notes capturing any falls that did not occur or were not documented during PT. Physical activity was measured by total distance walked (feet) and total stairs ascended at each PT session within the first 2 PODs. Pain scores before and after therapy session were also noted.

Medication dosing charts were consulted for the total consumption of opioids per patient by POD. Multimodal pain regimens included acetaminophen, ketorolac, and gabapentin in addition to opioid medications. Postoperative opioid pain medication was administered by means of a combination of patient-controlled analgesia (PCA) pumps, nurse-controlled intravenous infusions, and oral tablets. Opioids consumed included hydromorphone, oxycodone, hydrocodone, and morphine sulfate. For ease of analysis, opioid doses were all converted to morphine equivalents using established conversion factors [16].

Operative room records were examined to determine operative time, and discharge notes were reviewed to determine length of stay. All patients in both groups were operated on by one of the 3 attending orthopaedic arthroplasty surgeons at our institution. Surgical approaches were consistent with each surgeon utilizing a midline medial parapatellar approach with eversion of the patella. Additionally, the same team of anesthesiologists performed the blocks using ultrasound guidance for both study groups. All patients in both groups received injections of 0.5% ropivacaine and all blocks were documented as being successful.

The same inpatient PT staff worked with all patients in both study groups and PT protocols had remained constant throughout the data collection period. They consisted of one PT session in the morning and one in the afternoon on POD1 and 2, provided the patients were healthy enough to participate. All patients had been allowed to weight bear as tolerated beginning at the first PT session. Pain ratings on a scale from 0 to 10 which had been collected before the start of each session were recorded. PT sessions generally consisted of a series of mobility and strength exercises both in and out of bed, including gait training that involved walking and climbing stairs as tolerated. All exercises and ambulation were performed under close supervision and contact guard assistance from the therapists as needed. Patients utilized rolling walkers or canes for balance and support. Pain ratings were again collected from the end of each session.

Statistical analysis of all categorical data of event frequencies including comorbidities and knee buckling incidents was performed using Fisher's exact test (where the event frequency was <5) or chi-square test. Two-sampled, 2-tailed Student's *t*-tests were conducted to compare all continuous data which included age, BMI, physical activity, and opioids consumed. A *P*-value <.05 was considered to be statistically significant.

Results

Final analysis included 129 FNBs and 150 ACBs for patients treated with unilateral, primary TKA between April 2014 and September 2015. The 2 cohorts were similar with respect to age (FNB = 69.4, ACB = 69.2, *P* = .87), sex (both 21% male), and BMI (FNB = 32.4, ACB = 30.8, *P* = .06) (Table 1). There were no significant differences in the presence of any of the 5 comorbidities measured between the 2 groups, including no differences in the rates of pre-existing neurological disorders (Table 1). The total operative time in both groups was 1 hour 51 minutes (*P* = .87) and there was no statistically significant difference in length of stay between each group (Table 2).

Table 1
Demographic data for ACB and FNB cohorts

Demographics	FNB	ACB	*P* value
Age, y (range)	69.4 (49-88)	69.2 (47-89)	.87
Male, *n* (%)	27 (21)	32 (21)	.82
BMI (range)	32.4 (17.3-55.6)	30.8 (18.7-51.9)	.06
Dementia, *n* (%)[a]	1 (1)	3 (2)	.63
CVD, *n* (%)	24 (19)	30 (20)	.79
Neurological, *n* (%)[a]	4 (3)	5 (3)	1
Respiratory, *n* (%)	18 (14)	16 (11)	.41
DM, *n* (%)	23 (18)	33 (22)	.45

Values are generated with Fischer's exact test.
CVD, cardiovascular disease; DM, diabetes mellitus.
[a] *P* < .05 is significant.

Please cite this article in press as: R.R. Thacher, et al., Decreased risk of knee buckling with adductor canal block versus femoral nerve block in total knee arthroplasty: a retrospective cohort study, Arthroplasty Today (2017), http://dx.doi.org/10.1016/j.artd.2017.02.008