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SCIENTIFIC ARTICLE

Femoral nerve block: assessment of postoperative analgesia in arthroscopic anterior cruciate ligament reconstruction☆

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Adverse event

Abstract
Background and objectives: Knee anterior cruciate ligament reconstruction (ACLR) may be painful in the postoperative period. The primary objective of this study was to evaluate whether the use of femoral nerve block (FNB) associated with spinal anesthesia would improve the postoperative pain treatment in ACLR and the secondary objectives were to evaluate tramadol request and adverse events.
Method: 53 patients were randomly divided into two groups: GA (n =26) received spinal anesthesia and GB (n = 27) received spinal anesthesia and FNB. All patients received multimodal analgesia and rescue analgesics could be requested anytime. Assessments were performed at 6, 12 and 24 hours.
Results: There was no difference between both groups regarding demographic and clinical-surgical variables. There was no difference between groups regarding pain intensity. Mean pain scores were higher at 12 hours in GA and there was no change in GB; 55.6% of patients reported moderate pain in GA and 53.8% mild pain in GB. There was no difference regarding tramadol request. There were no serious adverse events: 80.8% of patients in GB had motor block of the thigh and two fell.
Conclusions: Analgesia was more effective with the combination of spinal and FNB, which allowed better control of postoperative pain, assessed 12 hours after anesthesia. There was no difference in tramadol request. Patients in this study had no serious adverse events; however, one must be attentive to motor paralysis and the possibility of falling when FNB is performed.

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Introduction

The postoperative period of knee anterior cruciate ligament reconstruction (ACLR) may be painful if techniques for pain control are not used properly.[1,2]

Potent analgesics such as opioids may be administered for postoperative pain treatment in ACLR, however, they may increase the incidence of respiratory depression, excessive sedation, nausea and vomiting, leading to increased length of stay and hospital costs.[2,3-6] Femoral nerve block (FNB) has been successfully used for treating postoperative pain, helps reduce the administration of opioids, but often presents with temporary motor paralysis of the thigh flexor muscles, especially the quadriceps, which my cause a patient fall in the postoperative period.[1-4,7,8]

Several techniques for postoperative pain control in ACLR have been tested and there is no consensus in current literature about the most appropriate technique.[9] Techniques such as multimodal analgesia,[10] intra-articular injection of morphine and local anesthetic,[9,11] FNB,[1,2,12,13] sciatic nerve blockade associated with FNB,[14] and continuous FNB,[15] have been described, among others. Among the analgesic techniques used for postoperative pain control, FNB is an interesting option because it is easy to perform, inexpensive, and may be done in combination with general or spinal anesthesia.[16,17]

Several authors found positive results in pain treatment with the use of FNB for knee operations, such as arthroscopy, total knee arthroplasty, and ACLR.[1,4,6,14,18-21] However, some authors found no evidence for routine use of FNB [2,13] and that it could even be related to complications such as infection, hematoma, and motor paralysis of the thigh flexor muscles.[22-24]

The primary objective of this prospective randomized study was to evaluate postoperative pain in patients undergoing ACLR with spinal anesthesia, alone or combined with FNB, and assess whether any of the techniques would have a better control of postoperative pain. The secondary objectives were to assess whether rescue analgesics request was needed in the postoperative period, adverse events related to the techniques, and medications used.

Patients and methods

Prospective study started after approval by the Human Research Ethics Committee of the Health Department of Paraná and registered under the number 141/2009. All patients signed the informed.

We invited patients of both sexes, with anterior cruciate ligament (ACL) injury, who would undergo ACLR between March 2010 and March 2011, with arthroscopic assistance and with or without concomitant operation of the meniscus and chondral cartilage. Inclusion criteria were age between 18 and 65 years, ASA physical status I or II, height 150 to 190 cm, weight 50 to 110 kg, and body mass index (BMI) between 18.5 and 40 $kg.m^{-2}$. Exclusion criteria were patients with contraindications to medications or techniques used, illiterate or cognitive impairment, current or previous history of abuse of legal or illegal drugs, pregnant women, and emergency surgery or ACL reoperation.

Anesthetic techniques	Groups	
	Group A	Group B
Spinal	15 mg of isobaric bupivacaine 0.5% (3 mL)	15 mg of 0.5% isobaric bupivacaine (3 mL)
Femoral nerve block		100 mg of 0.5% bupivacaine without vasoconstrictor (20 mL)

Figure 1 Anesthetic techniques used in the study groups. mg, milligram; mL, milliliter.

The study subjects were monitored with pulse oximetry, cardioscopy and noninvasive blood pressure; venous access was obtained with 20-22 G catheter in upper limb and venous midazolam was administered at the maximum dose of 0.1 $mg.kg^{-1}$ until response to verbal command corresponded to a score of 3 according to Ramsay's classification.

Patients were randomly assigned to groups A and B in a manner previously determined without their knowledge (Fig. 1).

Spinal anesthesia was performed in all patients in groups A and B, in the sitting position after skin antisepsis with chlorhexidine, sterile surgical field placement, infiltration of 2% lidocaine with 13 x 4.5 and 25 x 7 mm needles, in the skin and into the intervertebral space selected (L3-L4, L4-L5 or L5-S1). Disposable Quincke-type cutting needle (27 G) was used. The subarachnoid space was identified by spontaneous reflux of CSF, followed by 15 mg of 0.5% isobaric bupivacaine. Patients were immediately placed in the supine position without tilting the operating table. Anesthesia was considered satisfactory when there was loss of cold sensitivity from lower limbs to the umbilicus, tested with an alcohol swab.

FNB was performed only in GB patients, using the paravascular puncture technique of the femoral nerve in the lower limb to be operated. After antisepsis with chlorhexidine and sterile surgical field placement, the needle was inserted at the midpoint of the line joining the anterior superior iliac spine to the pubic tubercle, lateral to the pulse of the femoral artery, below the inguinal ligament and at the inguinal crease level. Appropriate neurostimulator needle (Stimuplex® A, 22G x 2", 0.7 x 50 mm, B Braun, Melsungen, Germany) was used, which was connected to the electrical neurostimulator (Stimuplex®, DIG RC, B Braun, Melsungen, Germany), initially programmed with 2 Hz frequency and 1.0 mA electric current to cause contraction of the femoral quadriceps muscle central portion, evidenced by patella elevation. After identifying the correct needle placement, determined by the persistence of muscle contraction by reducing the stimulation between 0.6 and 0.2 mA, 0.5% bupivacaine (100 mg) was administered without vasoconstrictor.

All patients received dipyrone (1 g), ketoprofen (100 mg), cefazolin (1 g), and ondansetron (4 mg) through the venous access. Oxygen (5 $L \bullet m^{-1}$) was administered via face mask while patients remained sedated and they were covered

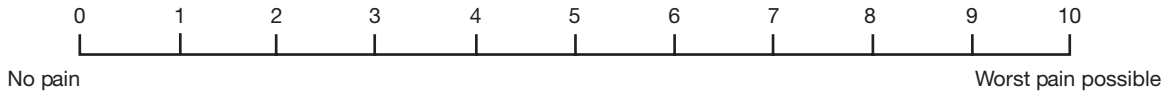

Figure 2 Verbal Numeric Scale.

with a sheet and blanket. Hypotension was defined as 30% decrease from baseline blood pressure, and corrected with bolus dose of ephedrinea (5 mg) as needed.

ACLR were performed by the same team that harvested the graft from the same knee with ACL injury, which could be the central third of the patellar tendon or tendons of the flexor semitendinosus and gracilis, according to tendons condition of each patient. The surgical technique was similar, regardless of the graft chosen.

At discharge to the ward, all patients received a card with the Verbal Numerical Scale (VNE) (Fig. 2). All patients were told that if the pain score was equal to or greater than 4, they could request the analgesic tramadol or the "painkiller" at any time.

Postoperative prescription was standardized for all patients in both groups with general diet and water ad libitum, intravenous cefazolin (1 g/every 8 hours), diluted dipyrone (1 g/every 6 hours), ketoprofen (100 mg/every 12 hours at 30 minutes), tramadol (100 mg) or "painkiller" diluted in 100 mL 0.9% saline at 30 minutes, only if requested by the patient, and metoclopramide (10 mg) in case of nausea or vomiting.

Pain intensity assessments were made according to VNS in which "0" means no pain and "10" the worst pain possible,[27-30] at three times:

- Time 1 (T1): 6 hours after spinal anesthesia. At this time, the patient should be able to extend the thigh and flex the knee of the non-operated limb and define the end of the spinal anesthesia effects. After making sure the patient understood the pain scale, the VNS score choice was requested without interference from the evaluator. Patient was reminded that he could request tramadol or "painkiller" if the VNS score was equal to or greater than 4. The success of FNB was evaluated in GB patients with thermal sensitivity test (gauze soaked with 70% alcohol solution) and technique was considered successful if there was absence of thermal sensitivity in the anterior region of the operated thigh and presence of sensation in contralateral thigh.
- Time 2 (T2): 12 hours after spinal anesthesia. Patients chose the VNS score and were reminded that they could request tramadol or "painkiller" if pain score was equal to or greater than 4.
- Time 3 (T3): 24 hours after spinal anesthesia. Patients chose the VNS score, and complaints, adverse events or complications were recorded, as well as whether or not tramadol was requested and, if requested, how many hours after spinal analgesia it was requested.

Data were collected prospectively, using a data collection instrument, and entered into a spreadsheet, checked and exported to the Statistica® software. For comparison of A and B groups regarding quantitative variables, Mann-Whitney test and Student's *t*-test were used for independent samples, and chi-square and Fisher's exact tests for qualitative variables. For pain score evaluation between groups, nonparametric Mann-Whitney and Friedman tests were used, and Friedman post hoc used for multiple comparisons. A p-value of less than 0.05 (or 5%) was considered statistically significant. According to a previous statistical study, the sample size of 30 patients in each group would be required to identify a significant difference of two cores in VNS between A and B groups, with a probability of type-I error equal to 0.05 and 84% power.

Results

In total, 53 patients were evaluated and randomly divided into Group A (GA = control) and Group B (GB = intervention). In GA, initially with 30 patients, there were three exclusions: two due to intraoperative change (arthroscopy without ACLR) in surgical plan and one due to hospital discharge before the first 24 hours postoperatively, with lost to follow-up; therefore, 27 patients were evaluated. In GB, initially with 30 patients, there were two refusals to participate and two exclusions due to hospital discharge before the first 24 hours postoperatively, with lost to follow-up; therefore, 27 patients were evaluated. There was no failure of any FNB.

Groups were homogeneous in terms of gender, age, weight, height, and BMI (Table 1) and there was no difference regarding ASA status, operated side, graft used in ACLR, and concomitant operation on meniscus or chondral cartilage (Table 2).

Regarding postoperative pain intensity, patients in groups A and B were compared between the evaluated times (T1, T2, and T3), and this comparison between each time showed no statistically significant difference between groups (Table 3).

The mean pain scores found in T1 and T3 was below 3 in both groups, but the scores at T2 exceeded that value. In order to evaluate whether the increased scores were significant, times were compared within each group. In GA (Table 4), the highest mean pain scores at T2 (3.9 ± 2.5) was different and statistically significant compared to T1 and T3, p = 0.001 (Table 5). In GB, the increased pain scores at T2 (3.2 ± 2.5) showed no difference compared to T1 and T3. GA patients had maximum pain 12 hours after spinal anesthesia and GB patients had no maximum pain (Table 6). Postoperative median scores are shown in Fig. 3.

In order to assess T2, during which patients assigned higher scores of pain, we stratified pain scores as absent

Table 1 Demographic characteristics.

Data	Group A (n = 27)	Group B (n = 26)	p
Gender			
Male	22 (81.5%)	20 (76.9%)	0.685[a]
Female	5 (18.5%)	6 (23.1%)	
Age (years)			
min-max	18-58	18-57	0.209[b]
Mean ± SD	31.3 ± 10.9	33.7 ± 9.8	
Weight (kg)			
min-max	59-106	50-105	0.566[b]
Mean ± SD	79.7 ± 13.3	78.2 ± 13.5	
Height (m)			
min-max	1.52-1.89	1.55-1.85	0.663[b]
Mean ± SD	1.708 ± 0.98	1.715 ± 0.83	
BMI ($kg \bullet m^{-2}$)			
min-max	22.7-36.7	19.5-33.1	0.266[b]
Mean ± SD	27.3 ± 3.8	26.5 ± 3.7	

BMI, body mass index; kg, kilogram; $kg \bullet m^{-2}$, kilogram per square meter; m, meter; max, maximum; min, minimum; SD, standard deviation.
[a] Chi-square test.
[b] Student's *t*-test.

Table 2 Clinical and surgical characteristics.

Data	Group A (n = 27)		Group B (n = 26)		p
	Frequency	%	Frequency	%	
Physical status					
ASA I	23	85.2	22	84.6	0.100[a]
ASA II	4	14.8	4	15.4	
Side					
Right	18	66.7	17	65.4	0.922[a]
Left	9	33.3	9	34.6	
Graft					
Flexor	23	85.2	21	84.6	0.728[a]
Patellar	4	14.8	5	15.4	
Concomitant surgery					
Yes	25	92.6	23	88.5	0.669[a]
No	2	7.4	3	11.5	

ASA I and II, physical status 1 and 2, respectively, defined by the of the American Society of Anesthesiologists classification.
[a] Chi-square test.

(score = 0), mild (score = 1-3), moderate (score = 4-7), and severe (score = 8-10). There was difference between groups: GA patients reported moderate pain (55.6%) and GB mild pain (53.8%), p = 0.026. However, also at T2, both GA and GB patients reported severe pain, 3.7% and 11.5%, respectively (Table 7).

Of GA patients, 51.9% asked for the rescue analgesic, tramadol, in the postoperative period evaluated and only 38.5% of GB patients made the same request, but this data was not statistically significant, p = 0.412 (Table 8). No patient in both GA and GB requested more than one dose of the rescue analgesic (100 mg tramadol) in the study period.

Among patients who requested the rescue analgesic, the mean time for the request was 10.9 ± 2.7 hours in GA and 12.9 ± 4.4 hours in GB, but this difference was not statistically significant, p = 0.1 (Table 9).

None of the patients had serious surgical or anesthetic complications in this study. In GA, two patients (7.4%) had nausea and vomiting, one (3.7%) was treated for post-dural puncture headache, and one (3.7%) reported sensation of cold feet. Of the patients undergoing FNB in GB, 21 (80.8%)

Table 3 Pain intensity at rest.

Data	Group A (n = 27)	Group B (n = 26)	p
T1			
min-max	0-6	0-10	1.000[a]
Mean ± SD	2.1 ± 2.0	2.5 ± 3.0	
Median	2	3	
T2			
min-max	0-10	0-9	
Mean ± SD	3.9 ± 2.5	3.2 ± 2.5	0.180[a]
Median	4	2.5	
T3			
min-max	0-6	0-6	
Mean ± SD	2.4 ± 2	2.3 ±1.6	0.978[a]
Median	2	2	

Max, maximum; min, minimum; SD, standard deviation; T1, 6 hours after spinal anesthesia; T2, 12 hours after spinal anesthesia; T3, 24 hours after spinal anesthesia.
[a] Non-parametric Mann-Whitney test.

Table 4 Evolution of pain at rest in group A.

Data	Group A (n = 27)	p
T1		
min-max	0-6	
Mean ± SD	2.1 ± 2	
Median	2	
T2		
min-max	0-10	
Mean ± SD	3.9 ± 2.5	0.001[a]
Median	4	
T3		
min-max	0-6	
Mean ± SD	2.4 ± 2	
Median	2	

Max, maximum; min, minimum; SD, standard deviation; T1, 6 hours after spinal anesthesia; T2, 12 hours after spinal anesthesia; T3, 24 hours after spinal anesthesia.
[a] Friedman's nonparametric test.

Table 5 Time comparison regarding pain evolution in group A.

Data	p[a]
T1 vs. T2	< 0.001
T1 vs. T3	0.663
T2 vs. T3	< 0.001

T1, 6 hours after spinal anesthesia; T2, 12 hours after spinal anesthesia; T3, 24 hours after spinal anesthesia.
[a] Friedman's post-hoc multiple comparisons test.

had transient motor paralysis of thigh muscles and, of those, two (7.7%) fell while trying to walk during the study period. Still in GB, one patient (3.7%) reported pain at the FNB puncture site (Table 10).

Table 6 Evolution of pain at rest in group B.

Data	Group B (n = 26)	p
T1		
min-max	0-10	
Mean ± SD	2.5 ± 3	
Median	2	
T2		
min-max	0-9	
Mean ± SD	3.2 ± 2.5	0.203[a]
Median	2.5	
T3		
min-max	0-6	
Mean ± SD	2.3 ± 1.6	
Median	2	

Max, maximum; min, minimum; SD, standard deviation; T1, 6 hours after spinal anesthesia; T2, 12 hours after spinal anesthesia; T3, 24 hours after spinal anesthesia.
[a] Friedman's nonparametric test.

Discussion

Although new techniques have been developed for postoperative pain treatment, none of them proved to be completely effective; thus, researchers are still trying to improve them. In Western countries, about 40% of outpatients and up to 70% of hospitalized patients suffer from pain of moderate to severe intensity after an operation, with orthopedic surgeries identified as having the highest rate of pain complaints.[17] Improvement in treatment of acute pain is crucial to the well-being of patients and to reduce the chronicity of pain.[24-26]

Of patients undergoing routine surgical procedures, between 10% and 50% may suffer from chronic postoperative pain, especially female patients who presented with pain before surgery. Opioids have been used for treatment and prevention of postoperative pain; however, peripheral nerve blocks have a prominent place.[24-26]

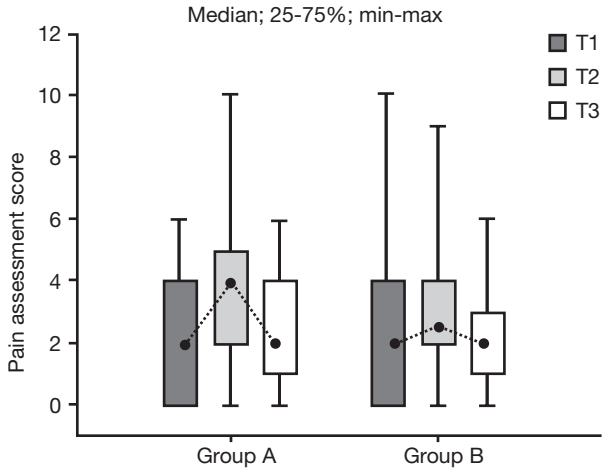

Figure 3 Intensity of pain at rest. Max, maximum; min, minimum; T1, 6 hours after spinal anesthesia; T2, 12 hours after spinal anesthesia; T3, 24 hours after spinal anesthesia.

Patients in this study had no difference in demographic, clinical and surgical profile, and these data are similar to those reported by other authors.[1,13,16,19,21] The choice of the flexor muscle tendon grafting was motivated by the tendons condition of each patient, but sometimes the choice was made according to the availability of material in the hospital and, therefore, did not allow further study of this variable. The meniscus surgery and simultaneous repair of chondral lesions occurred in most patients in this sample, which also happened in another study, as these lesions are often associated with ACL injury.[13]

The study groups had similar mean scores on assessments at 6, 12 and 24 hours after surgery, but GB, submitted to FNB, showed no increase in mean scores at 12 hours after anesthesia, which was reported by GA patients who were not submitted to FNB. In the same time interval of 12 hours (T2) after anesthesia, about half of the GB patients had mild pain, unlike GA that did not undergo such blockage, in which half of the patients reported moderate pain. These data allow us to say that when FNB was associated with spinal anesthesia there was better pain control within 12 hours after anesthesia for ACLR. However, still at T2, 3.7% of patients in GA and 11.5% of patients in GB reported severe pain, which shows that, regardless of the technique used in this study, adequate pain control has failed in some patients.

Table 7 Pain Stratified at T2 (12 hours after spinal anesthesia).

Data	Group A (n = 27)		Group B (n = 26)		p[a]
	Frequency	%	Frequency	%	
No pain	5	18.5	4	15.4	0.026
Mild	6	22.2	14	53.8	
Moderate	15	55.6	5	19.2	
Severe	1	3.7	3	11.5	

[a] Chi-square test.

Table 8 Tramadol request.

Data	Group A (n = 27)		Group B (n = 26)		p[a]
	Frequency	%	Frequency	%	
Yes	14	51.9	10	38.5	0.412
No	13	48.1	16	61.5	

[a] Fisher's exact test.

Table 9 Time between spinal anesthesia and tramadol request.[a]

Data	Group A (n = 27)	Group B (n = 26)	p[b]
min-max	8-17.5	8-20	0.100
Mean ± SD	10.9 ± 2.7	12.9 ± 4.4	
Median	10.5	12	

Max, maximum; min, minimum; SD, standard deviation.
[a] Time (hours).
[b] Student's *t*-test.

Table 10 Adverse events.

Data	Group A (n = 27)		Group B (n = 26)	
	Frequency	%	Frequency	%
Motor block of quadriceps muscle	-	-	21	80.8
Patient fall	-	-	2	7.7
PONV	2	7.4	-	-
Headache after spinal anesthesia	1	3.7	-	-
FNB local pain	-	-	1	3.8
Spinal anesthesia failure	1	3.7	-	-
Cold sensation in lower limb	1	3.7	-	-

FNB, femoral nerve block; PONV, postoperative nausea and vomiting.

Similar result was found by Souza et al.[1] who evaluated patients undergoing knee surgery with spinal anesthesia, alone or combined with FNB, and those who received FNB had less pain in the assessment between 6 and 10 hours and, in the evaluation between 10 and 24 hours, no difference was found between scores, with a predominance of "no pain" and "mild pain" answers. Patients evaluated by Chan et al.[21] also showed better control of postoperative pain when FNB was administered with 0.5% bupivacaine. Pain scores were significantly lower in patients who received FNB before or after ACLR, compared to controls receiving FNB with saline solution.

Other authors have found different results from those of this study and did not identify evidence for FNB regular indication.[2,13,26] A meta-analysis that included 13 studies assessed the quality of analgesia provided by FNB in ACLR and, although the authors conclude that there is no benefit in the regular indication of this blockade, the results showed better pain control with FNB combined with multimodal analgesia. The authors suggested that the studies included in the meta-analysis are heterogeneous, which hindered the comparison.[2]

The control of postoperative pain in this study could have been more effective with the combination of other blocks to FNB. Sciatic[14] and obturator[27] nerve blocks could have aided in controlling pain and decrease pain scores and, possibly, rescue analgesic request.

In this study, the rescue medication of choice for treating pain was tramadol because it is a weak opioid used in hospital routine. However, literature reports the use of morphine, oxycodone, and anti-inflammatory, among others, for ACLR.[1,6,13,16,21,26] The criteria for tramadol request in this study was the patient's perception that pain intensity would be moderate to severe, i.e., a VNS score equal to or greater than 4.[28,29] Despite the subjectivity of pain assessment, which depends on current and past individual experience of each patient, as well as level of anxiety, understanding, and cognition, some authors reported that there are similar scores between different pain scales.[30]

Some patients reported pain equal to or greater than 4 and chose not to request tramadol, despite clear guidance that they could do it. The most common allegations were: "Being in pain after surgery is normal" and "I was afraid to get addicted". Such assertions are frequent among patients who are not regular users of analgesics and may have affected the results of this study.[31]

Tramadol request was not different between groups A and B on the first postoperative day, which is in agreement with other authors.[13,26] However, the rescue analgesic request was different with the use of FNB in studies using general anesthesia or including other surgeries, such as knee arthroplasty.[16,21]

Most adverse events presented by patients in this study were not serious. Transient motor paralysis of quadriceps muscle occurred in most patients who received FNB. Such motor paralysis is often described in literature and may be related to the local anesthetic chosen, its concentration, and method of administration.[1,15,16,26] In this study, two patients who underwent FNB fell postoperatively, both presented motor paralysis and the fall was not associated with other causes, such as cardiac or neurological. None of these patients had surgery problems or new injury and all had a satisfactory outcome. After the fall of the first patient, the study protocol was amended and all patients in both groups were advised not to walk without an escort and always with the support of crutches, in addition to remain alert to the possibility of such accident. This warning may have prevented new falls and influenced the results. No patient in this study had severe complication, such as transient or permanent neuroplegia.

Other authors have associated motor paralysis of the thigh flexor muscles with single shot FNB, which seemed to be more intense with bupivacaine than with ropivacaine.[1,7,16,26,32] Studies evaluating repeated injections or continuous infusion of local anesthetic found no difference regarding motor paralysis.[15] Fall of patients has been reported in the literature, and some patients required a new surgical approach.[7,8]

FNB has a low complication rate when performed with proper technique. Reports of serious adverse events related to FNB are rare. However, vascular puncture and hematoma, local inflammation, infection, transient and permanent neuroplegia have been reported.[8,15,22]

There were two cases of nausea and vomiting in this study after tramadol administration. Patients were treated

with metoclopramide and there was no delay in the scheduled hospital discharge. Nausea and vomiting may be related to the administration of opioids, which, apart from causing discomfort to patients, increase costs and may delay hospital discharge.[5] When the analgesic technique reduced the request for rescue opioid, the episodes of nausea reduced.[6]

This study has limitations. Time of hospital discharge was not assessed because four patients had social condition that prevented complete observation of that time interval, which would lead to delay in intercity transportation. It would have been interesting to evaluate these patients' pain for a longer period of time, perhaps until full recovery; however, for the reason already mentioned, this evaluation was not viable. Spinal anesthesia and FNB motor block may have interfered with the assessment at T1 and also resulted in complaints of some patients.

Both techniques assessed (spinal and FNB) could be widely used in anesthesiologists' daily practice. Spinal anesthesia is managed by all anesthesiologists, while FNB is not; however, FNB is easy to perform and quite safe, as long as anatomy and principles of antisepsis are considered.

After data analysis, it can be concluded that postoperative analgesia evaluated with the use of VNS in patients undergoing ACLR was more effective with the combination of spinal and FNB and allowed better control of postoperative pain 12 hours after anesthesia compared to spinal anesthesia alone. Regarding tramadol request, there was no difference between groups. Adverse events presented by patients in this study were not serious, but one must be aware of quadriceps muscle paralysis and the possibility of falling after FNB. However, despite the techniques used, there are still complains of severe pain in patients undergoing ACLR, suggesting that further studies are needed for adequate control of postoperative pain.

Conflicts of interest

The authors declare no conflicts of interest.

Acknowledgments

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