Journal of Clinical Anesthesia (2008) **20**, 415–420

ELSEVIER

Journal of Clinical Anesthesia

Original contribution

Comparison of spinal anesthesia with combined sciatic-femoral nerve block for outpatient knee arthroscopy☆

Felix R. Montes MD (Associate Professor)[a,*], Eduardo Zarate MD (Assistant Professor)[b], Reinaldo Grueso MD (Assistant Instructor)[b], Juan C. Giraldo MD (Staff Anesthesiologist)[a], Maria P. Venegas MD (Resident)[b], Andrea Gomez MD (Resident)[b], Jose D. Rincón MD (Assistant Professor)[a], Marcela Hernadez MD (Resident)[a], Mariana Cabrera MD (Research Assistant)[a]

[a]*Department of Anesthesiology, Fundación Cardio Infantil-Instituto de Cardiología, Universidad del Rosario, Bogotá, Colombia*
[b]*Department of Anesthesia, Hospital de San Ignacio, Universidad Javeriana, Bogotá, Colombia*

Received 5 March 2007; revised 13 February 2008; accepted 2 April 2008

Keywords:
Ambulatory anesthesia;
Knee arthroscopy, outpatient;
Spinal anesthesia;
Peripheral nerve blocks

Abstract

Study Objective: To compare spinal anesthesia and combined sciatic-femoral nerve block for outpatient knee arthroscopy.

Design: Prospective, randomized, controlled study.

Setting: Postoperative recovery area at a university-affiliated medical center.

Patients: 50 ASA physical status I and II adult outpatients undergoing arthroscopic knee surgery.

Interventions: Study subjects were equally divided (n = 25 each) into spinal and sciatic-femoral groups. Spinal group patients received spinal anesthesia with 7.5 mg of 0.5% hyperbaric bupivacaine. Sciatic-femoral group patients received combined sciatic-femoral nerve blocks using a mixture of 20 mL of lidocaine 2% plus 20 mL of bupivacaine 0.5%.

Measurements: Times including that from arrival in the operating room to readiness for surgery, duration of surgery, recovery time, and patient satisfaction were recorded. Analgesia and occurrence of adverse events also were recorded.

Main Results: No significant differences between the two groups were found for any of the study measurements of recovery. After discharge, postoperative pain differed significantly between groups only at 6 hours ($P < 0.002$). Patient satisfaction was high with both techniques.

Conclusions: Combined sciatic-femoral nerve block for outpatient arthroscopic knee surgery offers satisfactory anesthesia, with a clinical profile similar to that of low-dose spinal anesthesia. Sciatic-femoral nerve blocks are associated with significantly lower pain scores during the first 6 postoperative hours.

☆ This study was supported by departmental funding.
* Corresponding author. Tranexco 1194tp6co, PO Box 025512, Miami, FL 33102, USA. Tel.: +57 1 271 07 20; fax: +57 1 679 11 40.
E-mail address: felix.ramon.montes@gmail.com (F.R. Montes).

0952-8180/$ – see front matter © 2008 Elsevier Inc. All rights reserved.
doi:10.1016/j.jclinane.2008.04.003

1. Introduction

Knee arthroscopy is a commonly performed ambulatory surgical procedure. Both general and diverse types of regional anesthesia have been used successfully for this surgery. Peripheral nerve blocks or spinal anesthesia may have some benefits in the outpatient setting and result in less postoperative resource use, better immediate postoperative analgesia, and better patient satisfaction [1-4].

In recent years, peripheral nerve blocks have become increasingly popular [5], but they are still less common than spinal anesthesia, mainly because of the increased time and expertise required as well as the delayed recovery associated with their use [6]. Few data are currently available in the literature comparing peripheral blocks with small-dose spinal anesthetic techniques [7]. To obtain more information on this topic, we conducted this prospective randomized study to test the hypothesis that using a combined sciatic-femoral nerve block results in shorter time to discharge as compared with spinal anesthesia in patients undergoing a less invasive category of outpatient knee surgery [3].

2. Materials and methods

After approval by the Fundación Cardio Infantil-Instituto de Cardiología, Bogotá, Colombia, institutional ethics committee and obtaining written informed consent from each individual, we enrolled into the study 50 patients undergoing elective outpatient knee arthroscopy. All patients were ASA physical status I or II and aged between 18 and 65 years. Exclusion criteria included anterior cruciate ligament repair, morbid obesity (body mass index >35 kg/m^2), medical contraindication to regional anesthesia (eg, allergy, bleeding disorders, localized infection, and neurologic disease), and respiratory or cardiac disease.

All patients received intravenous (IV) premedication with 0.03 mg/kg of midazolam and one μg per kg of fentanyl, followed by a 7-mL/kg infusion of lactated Ringer's solution. Using a computer-generated randomization table, we allocated patients to two groups to receive either spinal anesthesia (spinal group, n = 25) or a combined sciatic-femoral nerve block (sciatic-femoral group, n = 25).

Spinal anesthesia was performed at the L2-3 or L3-4 interspace with a 25-gauge Whitacre needle (Becton Dickinson Co, Flanklin Lakes, NJ) using the midline approach, with the patient placed in the lateral position with the operative side dependent. After free flow of cerebrospinal fluid, 7.5 mg of hyperbaric 0.5% bupivacaine was injected with the needle aperture directed laterally, toward the dependent side, with the patient turned supine.

Combined sciatic-femoral nerve blocks were performed using a mixture of 20 mL of lidocaine 2% plus 20 mL of bupivacaine 0.5%. Nerve blocks were placed with the aid of a nerve stimulator connected to a 21-gauge 100-mm Stimuplex block needle (B. Braun Medical Inc, Melsungen, Germany). Stimulation frequency was set at two Hz, whereas the intensity of the stimulating current was 0.3 to 0.5 mA. With the patient in the lateral decubitus position, we performed the sciatic nerve block according to the Labat approach [8]. After we noted a twitch of either the hamstring or soleus muscles, or the foot or toes, 20 mL of local anesthetic mixture was injected. The patient was immediately turned supine, and the femoral nerve block was performed. The stimulating needle was inserted lateral to the femoral artery at the intersection of the femoral artery and a line connecting the anterior superior iliac spine to the pubic tubercle. On elicitation of a quadriceps (patella twitch) response with a current of 0.3 to 0.5 mA, 20 mL of the anesthetic solution was injected.

Standard monitoring was used throughout the study, including continuous electrocardiography (lead II), heart rate, noninvasive arterial blood pressure measured every 5 minutes, and oxygen saturation via continuous pulse oximetry (Spo_2). Sensory block was evaluated using the pinprick test (22-gauge hypodermic needle), and it was judged adequate if there was a complete loss of pinprick sensation at T12 in the spinal group, or in the femoral and sciatic nerve distribution in the sciatic-femoral group. Motor block was evaluated using a modified Bromage scale (0 = no motor block; 1 = hip blocked; 2 = hip and knee blocked; and 3 = hip, knee, and ankle blocked). For the purpose of the study, hypotension was defined as systolic blood pressure less than 90 mmHg or a decrease of more than 25% from baseline mean arterial pressure, and it was treated with a bolus of ephedrine 5 to 10 mg IV. In addition to the loading dose of IV fluids, patients received lactated Ringer's solution as deemed necessary by the anesthesiologist. Inadequate anesthesia (patient complaint of pain) was treated with a bolus of fentanyl one μg per kg IV, with a second bolus allowed. If more than two μg/kg of fentanyl was required to maintain patient comfort, the regional anesthesia technique was considered a failure, and general anesthesia was induced.

The primary outcome measure was time to home discharge, which was defined as the interval from end of surgery until a patient was discharged home. In addition, anesthesia-controlled time and surgeon-controlled time were recorded [9,10]. Anesthesia-controlled time was defined as the sum of (1) the time from operating room (OR) entry until surgical preparation began (anesthesia preparation time), plus (2) time from the end of the surgical procedure until OR exit (OR emergence time). Surgeon-controlled time was defined as the time from the beginning of skin preparation to the start of surgery (surgical preparation time), plus the time from surgery start to surgery finish (duration of surgery). Because it is of particular importance to our practice, we calculated the total time elapsed between the moment the patient entered the OR until the patients left the OR (ie, total OR time).

Table 1 Demographic characteristics

	Sciatic-femoral nerve block (n = 24)	Spinal anesthesia (n = 25)
Age (yrs)	46 ± 15	49 ± 14
Weight (kg)	67 ± 11	66 ± 13
Height (cm)	166 ± 7	166 ± 8
ASA physical status		
I	18	15
II	6	9
Women, n (%)	14 (58)	15 (60)
Men, n (%)	10 (42)	10 (40)
Operating procedure		
Meniscectomy	16	18
Synovectomy	8	7
Chondroplasty	5	7
Lateral release	4	4
Plica removal	2	3
Loose body removal	1	2

Data are presented as means ± SD, percentage, or n as indicated.

All patients were assessed in the recovery area at 15-minute intervals with the Mayo Modified Discharge Scoring System (Appendix A), an accepted modification of the Aldrete postoperative discharge criteria [11] to asses readiness for primary recovery area discharge. A Mayo Modified Discharge Scoring System of 8 or higher was noted and was taken as a time that could be used as an index of fitness to move from a primary recovery area to a secondary area [2]. In the phase 2 recovery area, patients were assessed every 15 minutes. Once they had achieved a score of 9 points on the postanesthetic discharge scoring system (PADSS), they were deemed fit for discharge [12] (Appendix B). The time taken to obtain a PADSS score of 9 or higher and the time patients were actually discharged were both recorded. Voiding was not required before home readiness, but the time to void was recorded if the patient had not yet left the hospital. There was no minimum length of stay in either the primary or secondary recovery areas.

Pain was assessed at rest with a 100-mm visual analog scale (VAS) every 15 minutes until hospital discharge. In the phase 1 recovery area, morphine sulfate 2.5 mg was administered by IV injection every 5 to 10 minutes until the patient was comfortable (VAS score ≤40 mm). The pain management protocol in phase 2 and at home consisted of 400 mg of oral ibuprofen every 8 hours and rescue analgesia with oral acetaminophen (one g) if the patient asked for more analgesic. When patients were discharged from the hospital, they were asked to rate their pain intensity at rest on the VAS at 6, 12, 18, and 24 hours after surgery and record their analgesic consumption.

A standardized telephone questionnaire was conducted by a research assistant 24 hours after surgery. Patients were questioned about postoperative pain, nausea, backache, postdural puncture headache, and transient neurologic symptoms (TNS). Transient neurologic symptoms were defined as pain or dysesthesia in the buttocks, thighs, or calves occurring within 24 hours. Patient satisfaction was assessed by asking patients whether they would receive the same anesthesia in the future.

Sample size estimates were based on time to home discharge (in min). It was estimated that a sample size of 23 per group would provide 80% power to detect a clinically meaningful difference of 40 minutes (within-group SD, 49 mins) at $\alpha = 0.05$. Student's t test was used to determine the significance of normally distributed parametric values and Wilcoxon rank sum test for nonnormally distributed data. Categorical variables were tested using χ^2 test or, when appropriate, Fisher's exact test. Statistical significance was accepted at $P < 0.05$.

3. Results

Fifty patients were enrolled in the study, with 25 patients in each group. One patient in the sciatic-femoral group required general anesthesia because of failure of the regional technique; hence, this patient was excluded from the analysis. There were no significant differences between the two groups in demographic characteristics, ASA physical status, or type of surgical procedures performed (Table 1).

Total OR time, duration of surgery, and surgical preparation time did not differ significantly between the two groups, although mean anesthesia preparation time was longer (6 min) in patients given combined sciatic-femoral

Table 2 Postoperative outcomes

	Sciatic-femoral nerve block (n = 24)	Spinal anesthesia (n = 25)	*P*
Anesthesia-controlled time			
Anesthesia preparation time (min)	23 ± 10	17 ± 9	0.03
OR emergence time (min)	6 ± 3	7 ± 3	0.9
Surgeon-controlled time			
Surgical preparation time (min)	24 ± 9	24 ± 9	0.5
Duration of surgery (min)	38 ± 17	44 ± 15	0.08
Total OR time (min)	97 ± 35	91 ± 24	0.8
Mayo Modified Discharge score ≥8 (min)	27 ± 30	18 ± 20	0.33
PADSS ≥9	105 ± 51	99 ± 58	0.5
Actual home discharge (min)	219 ± 69	217 ± 85	0.87

Data are presented as means ± SD.
Anesthesia preparation time = patient enters operating room (OR) until surgical preparation begins OR; emergence time = from the end of surgery until OR exit; surgical preparation time = from when the skin preparation begins to when surgery starts; PADSS = post-anesthetic discharge scoring system.

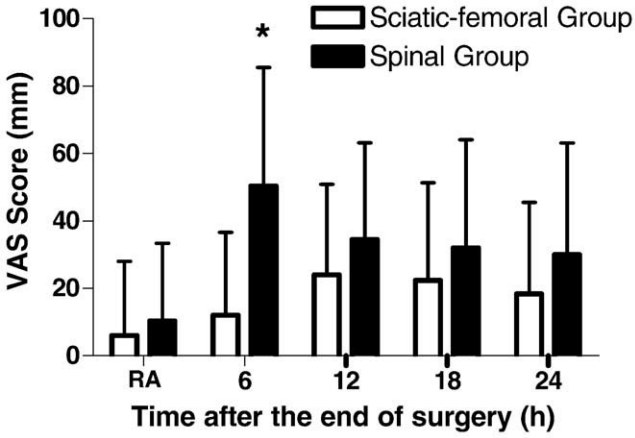

Fig. 1 Postoperative visual analog scores for pain. Data are shown as means ± SD. RA = recovery area. *$P < 0.05$ vs sciatic-femoral group.

nerve blocks (Table 2). Patients in both groups achieved in a similar period a Mayo Modified Discharge score of 8, which was the criterion for eligibility for discharge from the primary recovery area. No statistical differences were found between the two groups in the time to achieve a PADSS score of 9 or higher or in the time taken to leave the hospital (Table 2).

In the recovery area, no differences were found between the groups in VAS scores. After discharge, pain scores were significantly lower in the sciatic-femoral group (10 ± 24 mm) than in the Spinal group (50 ± 35 mm, $P = 0.002$). There were no differences in the postoperative VAS pain scores between the groups at 12, 18, or 24 hours (Fig. 1). In the hospital, three patients (12%) of the spinal anesthesia group received analgesics compared with two patients (8.3%) of the sciatic-femoral nerve block group ($P = 0.095$). After discharge, there was no significant difference between the groups in consumption of oral analgesics.

No patient required antiemetic therapy. No cases of postdural puncture headache or other complications were reported at postoperative follow-up. Patient satisfaction was high in both groups, and all patients reported that they would accept the same anesthesia technique again if required for future operations.

4. Discussion

The results of this study show that patients undergoing knee arthroscopy achieved home-readiness criteria and time to discharge home equally after both spinal anesthesia with small doses of bupivacaine and combined sciatic-femoral nerve blocks using a multiple-injection technique. Even though performing a sciatic-femoral nerve block took slightly longer than administering the spinal anesthesia, total OR time was similar with both techniques.

The increased time required to perform the anesthetic procedure in the sciatic-femoral group is explained by the need for more than one block to successfully accomplish this technique. Even though there was a statistically significant difference in anesthesia preparation time in favor of spinal anesthesia, the clinical relevance of this finding may be limited. Similar findings have been reported in other investigations comparing peripheral nerve blocks with general anesthesia [1,13] or spinal anesthesia [7]. As has been suggested, placing peripheral nerve blocks preoperatively in the holding area rather than in the OR would decrease OR time in this group of patients [10]. However, use of a separate block room has cost implications in itself that may outweigh any benefit from the reduced OR time [14].

Adequate pain management is essential to facilitate rehabilitation after knee arthroscopy. Regional techniques consistently provide superior postoperative analgesia when compared with general anesthesia [1,2,15,16]. The possible difference in postoperative analgesia between diverse regional anesthesia techniques has been investigated only minimally. In the present study, a sciatic-femoral nerve block provided better analgesia than spinal anesthesia only at 6 hours after surgery. Some investigators have postulated that in low invasive knee surgery, such as the type performed during this investigation, a multimodal analgesic approach maintains VAS pain scores less than 30 (100 mm scale) regardless of intraoperative anesthetic technique [15,17]. In our study, this approach to postoperative pain management was not used; however, postoperative analgesia was effectively provided with nonsteroidal anti-inflammatory drugs. Comparable results have already been reported in a similar clinical setting [4,13,18] and suggest that there may be minimal discomfort associated with standard outpatient knee arthroscopy. However, it is important to remember that our study was powered to detect differences for time to home discharge. Although the difference in other outcomes (ie, pain, postoperative nausea and vomiting, and TNS) between the groups was not statistically significant, it should be considered that a type 2 error cannot be excluded, and further sufficiently powered studies are advocated to evaluate these points.

In clinical studies such as ours, the choice of a control group becomes difficult. Admittedly, there are numerous alternative anesthetic techniques to use for outpatient knee arthroscopy. We chose the low-dose hyperbaric bupivacaine spinal anesthesia group as our control because this technique is the one that we use routinely when not using peripheral nerve blocks. Low-dose bupivacaine has been used for spinal anesthesia for procedures of short duration in an attempt to avoid the use of local anesthetics such as lidocaine, which is known to cause adverse effects such as TNS. In this study, sciatic-femoral nerve block failed to provide acceptable surgical anesthesia in one patient. This 4% failure rate is comparable with the failure rate found in previous work [19] that used a similar technique (ie, multiple-injection technique) to accomplish this block.

The failure rate after small-dose bupivacaine anesthesia is between 3% and 6% [2,4,20,21]. This finding shows that both techniques provide similar effective anesthesia, rendering them viable options for outpatient knee surgery, with no practical advantage of one over the other in success rate.

In the present study, recovery times after 7.5 mg of intrathecal bupivacaine were significantly lower than those recovery times reported in previous investigations with similar doses of bupivacaine [2,7,20,21]. In those studies, achievement of home-readiness criteria ranged from 129 to 241 minutes, with recovery of spontaneous voiding being the most common limiting factor to fulfill home discharge criteria. Mulroy et al [22] supported a relaxation of the requirements for voiding after outpatient spinal anesthesia with short-duration drugs (or small doses of hyperbaric bupivacaine) and in patients undergoing surgical procedures of low risk for urinary retention. This new approach to home discharge after outpatient procedures reduces the time required before the patient is ready to go home, and it is now part of our routine practice. In spite of changing the criteria for home readiness in patients undergoing spinal anesthesia, this approach did not result in a shorter time to hospital discharge when compared with combined sciatic-femoral nerve blocks. In our experience as well as that of other researchers, the overall length of stay in the postanesthesia care unit is often related to multiple administrative or nonmedical issues [23-25]. The most common cause of discharge delays in our unit was attributed to system factors such as paperwork processing handled by administrative personnel (filling out forms, invoicing, and billing clearance). In spite of these nonanesthesia-related factors, discharge time is relevant in an absolute way to patients when planning for assistance on the day of surgery [26].

Physicians are often concerned about discharging patients who were given a long-acting peripheral nerve block of the lower extremity, because of a loss of proprioception and the protective reflex of pain [6]. A large study showed that this practice may be done safely and is associated with a high degree of efficacy and satisfaction [27]. Based on this study, the presence of an insensate lower extremity was not considered a contraindication to home discharge. In addition, peripheral nerve blocks are frequently prolonged into the postoperative period at home so as to optimize pain relief [28]. However, a recent publication reported 4 falls among 233 patients (1.7%) who received a femoral perineural catheter for pain management at home [29]. This finding suggests that this practice may not be free of complications and, in some cases, may create unnecessary risk without apparent benefit.

In conclusion, our results show that in patients undergoing outpatient arthroscopy, there are no significant differences in recovery or discharge times after a combined sciatic-femoral nerve block compared with spinal anesthesia (using low-dose bupivacaine).

Appendix A. Mayo modified discharge scoring system [2]

Variable	Score
Motor activity	
Active motion, voluntary or on command	2
Weak motion, voluntary or on command	1
No motion	0
Respiration	
Coughs on command or cries	2
Maintains airway without support	1
Requires airway maintenance	0
Systolic blood pressure	
±20% of preanesthetic level	2
±20%-50% of preanesthetic level	1
±50% of preanesthetic level	0
Consciousness	
Fully awake or easily aroused when called	2
Responds to stimuli and exhibits protective reflexes	1
No response or absence of protective reflexes	0
Oxygen saturation	
≥Preoperative reading without supplemental oxygen	2
≥Preoperative reading with supplemental oxygen	1
<Preoperative reading with or without supplemental oxygen	0

Points are assigned from each variable and added.

Appendix B. Postanesthesia discharge scoring system [12]

Variable	Score
Vital signs	
±20% of preoperative values	2
±20%-40% of preoperative values	1
±40% of preoperative values	0
Ambulation and mental status	
Oriented ×3 and has ability to ambulate (with crutches)	2
Oriented ×3 or has ability to ambulate (with crutches)	1
Neither	0
Pain or nausea and vomiting	
Minimal	2
Moderate	1
Severe	0
Surgical bleeding	
Minimal	2
Moderate	1
Severe	0
Intake and output	
Has had oral fluid and has voided	2
Has had oral fluid or has voided	1
Neither	0

Points are assigned from each variable and added.

References

[1] Hadzic A, Karaca PE, Hobeika P, et al. Peripheral nerve blocks result in superior recovery profile compared with general anesthesia in outpatient knee arthroscopy. Anesth Analg 2005;100:976-81.

[2] Jankowski CJ, Hebl JR, Stuart MJ, et al. A comparison of psoas compartment block and spinal and general anesthesia for outpatient knee arthroscopy. Anesth Analg 2003;97:1003-9.

[3] Williams B, Kentor ML, Vogt MT, et al. Femoral-sciatic nerve blocks for complex outpatient knee surgery are associated with less postoperative pain before same-day discharge: a review of 1,200 consecutive cases from the period 1996-1999. Anesthesiology 2003; 98:1206-13.

[4] Korhonen AM, Valanne JV, Jokela RM, Ravaska P, Korttila KT. A comparison of selective spinal anesthesia with hyperbaric bupivacaine and general anesthesia with desflurane for outpatient knee arthroscopy. Anesth Analg 2004;99:1668-73.

[5] Auroy Y, Benhamou D, Bargues L, et al. Major complications of regional anesthesia in France: the SOS Regional Anesthesia Hotline Service. Anesthesiology 2002;97:1274-80.

[6] Klein SM, Pietrobon R, Nielsen KC, Warner DS, Greengrass RA, Steele SM. Peripheral nerve blockade with long-acting local anesthetics: a survey of the Society for Ambulatory Anesthesia. Anesth Analg 2002;94:71-6.

[7] Casati A, Cappelleri G, Fanelli G, et al. Regional anaesthesia for outpatient knee arthroscopy: a randomized clinical comparison of two different anaesthetic techniques. Acta Anaesthesiol Scand 2000;44: 543-7.

[8] Enneking FK, Chan V, Greger J, Hadzić A, Lang SA, Horlocker TT. Lower-extremity peripheral nerve blockade: essentials of our current understanding. Reg Anesth Pain Med 2005;30:4-35.

[9] Donham RT, Mazzei WJ, Jones RL. Association of anesthesia clinical directors' procedural times glossary: glossary of times used for scheduling and monitoring of diagnostic and therapeutic procedures. Am J Anesthesiol 1996;23(5S):3-12.

[10] Williams BA, Kentor ML, Williams JP, et al. Process analysis in outpatient knee surgery: effects of regional and general anesthesia on anesthesia-controlled time. Anesthesiology 2000;93:529-38.

[11] Aldrete JA. The post-anesthesia recovery score revisited. J Clin Anesth 1995;7:89-91.

[12] Chung F. Are discharge criteria changing? J Clin Anesth 1993; 5(6 Suppl 1):64S-8S.

[13] Casati A, Cappelleri G, Berti M, Fanelli G, Di Benedetto P, Torri G. Randomized comparison of remifentanil-propofol with a sciatic-femoral nerve block for out-patient knee arthroscopy. Eur J Anaesthesiol 2002;19:109-14.

[14] Armstrong KP, Cherry RA. Brachial plexus anesthesia compared to general anesthesia when a block room is available. Can J Anaesth 2004;51:41-4.

[15] Wong J, Marshall S, Chung F, Sinclair D, Song D, Tong D. Spinal anesthesia improves the early recovery profile of patients undergoing ambulatory knee arthroscopy. Can J Anaesth 2001;48:369-74.

[16] Patel NJ, Flashburg MH, Paskin S, Grossman R. A regional anesthetic technique compared to general anesthesia for outpatient knee arthroscopy. Anesth Analg 1986;65:185-7.

[17] Jacobson E, Forssblad M, Rosenberg J, Westman L, Weidenhielm L. Can local anesthesia be recommended for routine use in elective knee arthroscopy? A comparison between local, spinal, and general anesthesia. Arthroscopy 2000;16:183-90.

[18] Marsan A, Kirdemir P, Mamo D, Casati A. Prilocaine or mepivacaine for combined sciatic-femoral nerve block in patients receiving elective knee arthroscopy. Minerva Anestesiol 2004;70:763-9.

[19] Fanelli G, Casati A, Garancini P, Torri G. Nerve stimulator and multiple injection technique for upper and lower limb blockade: failure rate, patient acceptance, and neurologic complications. Study Group on Regional Anesthesia. Anesth Analg 1999;88:847-52.

[20] Cappelleri G, Aldegheri G, Danelli G, et al. Spinal anesthesia with hyperbaric levobupivacaine and ropivacaine for outpatient knee arthroscopy: a prospective, randomized, double-blind study. Anesth Analg 2005;101:77-82.

[21] Valanne JV, Korhonen AM, Jokela RM, Ravaska P, Korttila KK. Selective spinal anesthesia: a comparison of hyperbaric bupivacaine 4 mg versus 6 mg for outpatient knee arthroscopy. Anesth Analg 2001; 93:1377-9.

[22] Mulroy MF, Salinas FV, Larkin KL, Polissar NL. Ambulatory surgery patients may be discharged before voiding after short-acting spinal and epidural anesthesia. Anesthesiology 2000;97:315-9.

[23] Montes FR, Trillos JE, Rincón IE, et al. Comparison of total intravenous anesthesia and sevoflurane-fentanyl anesthesia for out-patient otorhinolaryngeal surgery. J Clin Anesth 2002;14:324-8.

[24] Waddle JP, Evers AS, Piccirillo JF. Postanesthesia care unit length of stay: quantifying and assessing dependent factors. Anesth Analg 1998; 87:628-33.

[25] Bekker AY, Berklayd P, Osborn I, Bloom M, Yarmush J, Turndorf H. The recovery of cognitive function after remifentanil-nitrous oxide anesthesia is faster than after an isoflurane-nitrous oxide-fentanyl combination in elderly patients. Anesth Analg 2000;91:117-22.

[26] Pavlin DJ, Rapp SE, Polissar NL, Malmgren JA, Koerschgen M, Keyes H. Factors affecting discharge time in adult outpatients. Anesth Analg 1998;87:816-26.

[27] Klein SM, Nielsen KC, Greengrass RA, Warner DS, Martin A, Steele SM. Ambulatory discharge after long-acting peripheral nerve blockade: 2382 blocks with ropivacaine. Anesth Analg 2002;94: 65-70.

[28] Ilfeld BM, Enneking FK. Continuous peripheral nerve blocks at home: a review. Anesth Analg 2005;100:1822-33.

[29] Williams BA, Kentor ML, Bottegal MT. The incidence of falls at home in patients with perineural femoral catheters: a retrospective summary of a randomized clinical trial. Anesth Analg 2007;104:1002.