Femoral Nerve Block versus Spinal Anesthesia for Lower Limb Peripheral Vascular Surgery

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Abstract

Perioperative cardiac complications occur in 4% to 6% of patients undergoing infrainguinal revascularization under general, spinal, or epidural anesthesia. The risk may be even greater in patients whose cardiac disease cannot be fully evaluated or treated before urgent limb salvage operations. Prompted by these considerations, we investigated the feasibility and results of using femoral nerve block with infiltration of the genito4femoral nerve branches in these high-risk patients.

Methods: Forty peripheral vascular reconstruction of lower limbs were performed under either spinal anesthesia (20 patients) or femoral nerve block with infiltration of genito-femoral nerve branches supplemented with local infiltration at the site of dissection as needed (20 patients). All patients had arterial lines. Arterial blood pressure and electrocardiographic monitoring was continued during surgery, in PACU and in the intensive care units.

Results: Operations included femoral-femoral, femoral-popliteal bypass grafting and thrombectomy. The intra-operative events showed that the mean time needed to perform the block and dose of analgesics and sedatives needed during surgery was greater in group I (FNB,) compared to group II [P=0.01*, P0.029* , P0.039*], however, the time needed to start surgery was shorter in group I than in group II [P=0. 039]. There were no block failures in either group, but local infiltration in the area of the dissection with 2 ml (range 1-5 ml) of 1% lidocaine was required in 4 (20%) patients in FNB group vs none in the spinal group. The recovery times showed that the nerve block resolution and time to micturition was longer [P0. 0001 [p=0.0001*, p=0.00032*] in the Spinal group (group II) as compared with patients receiving femoral nerve blockade (group I). Moreover, the incidence of pain requiring analgesics in PACU and postoperative complications was higher in group II than in group I [P0.021*, p0.0028*].

Conclusion: lower limb vascular reconstruction can be done under local anesthesia (femoral nerve block with infiltration of genitor-femoral nerve branches) with acceptable complication rates specially in patients with high-risk diseases.

Introduction

Most patients presenting with lower limb ischemia are elderly, often with extensive co-morbidity. Early symptoms include intermittent claudication and leg ulcers, progressing to critical ischemia (rest pain and tissue loss) or acute ischemia (white leg). Patients commonly have widespread atherosclerosis involving coronary, cerebral and renal vasculature, and 10-year mortality in these patients is 45%, mainly as a result of coronary and cerebral events. About 20% of patients progress to critical ischemia within 6 years and require surgery. (1)

Pen-operative cardiac complications occur in 4% to 6% of patients undergoing infra-inguinal revascularizatioii under general, spinal, or epidural anesthesia. The risk may be even greater in patients whose cardiac disease cannot be fully evaluated or treated before urgent limb salvage operations.(2)

Furthermore, the most prevalent anesthetic techniques, general and neuro-axial anesthesia, are associated with some complications and have side-effects that make them less than ideal in such patients. For general anesthesia these include myocardial depression, postoperative nausea and vomiting(3), sore throat(4), and myalgias(5) On the other hand, postoperative backache(6), post-dural puncture headache(7), slow resolution of the block or the development of postural hypotension(8), can complicate the postoperative course of neuro-axial anesthesia and result in delayed discharge. By confining the anesthesia to the region that is being operated upon, nerve block anesthesia can avoid many of the disadvantages of both general and neuro-axial anesthesia.(9)

The purpose of this study was to investigate the feasibility and results of using femoral nerve block with infiltration of genito-femoral nerve branches in these high-risk patients.

Methods

The study was carried out- on 40 patients scheduled for either elective or emergency peripheral vascular surgery of the lower limbs. After written informed consent was obtained, patients scheduled for peripheral vascular surgery were randomly assigned to receive either spinal anesthesia or femoral nerve block with genito-femoral nerve branches infiltration. Patients excluded from randomization included those in whom regional anesthesia was contraindicated. Contraindications for regional anesthesia included preexisting coagulopathy (i.e., patients receiving preoperative infusions of heparin or urokinase), operations requiring arm veins, and prior lower back surgery.

Demographic data, medications, and surgical and medical history were obtained from the patient and from the medical record. All patients underwent preoperative 12-lead electrocardiography.

After an intravenous (IV) cannula had been inserted in the forearm, all patient received IV 7 ml/kg infusion of lactate Ringer's solution. Then, patients were allocated to receive either spinal anesthesia or femoral nerve block

Intra-operative monitoring was carried out with radial artery cannulation, pulse oximetry, noninvasive blood pressure measurements, and dual-channel electrocardiographic monitoring (leads II and V5). Pre-medication consisted of oral diazepam (5-10mg) often supplemented with either intramuscular meperidine (25-50 mg) or intravenous fentanyl (25-50 micro gram).

Spinal anesthesia was performed with hyperbaric bupivacaine 0.5% (7.5-10mg). This was administered via a 22-G spinal needle at L4-L5 or L3-L4 with the patient in the lateral decubitus position, operative side down. Patients were kept in this position for 10 mm after the intrathecal injection.

Femoral nerve block (FNB) was performed with the aid of a nerve stimulator using a short-beveled, Teflon-coated stimulating needle. Stimulation frequency was set at 2 Hz, while the intensity of stimulating current was initially set to deliver I mA and then gradually decreased to less than 0.5 mA. Paraesthesia was never intentionally sought, and a multiple injection technique was used, eliciting specific muscular twitches on nerve stimulation to confirm exact needle location.

Femoral nerve block (FNB) was performed with patients in the supine position, with the negative electrode connected to the needle and the reference electrode connected to the lateral thigh; contractions of the quadriceps femoris muscle were sought. After the contractions were obtained, 25 mL of the local anesthetic (10 ml of 1% lidocaine and 15 ml of 0.5% bupivacaine) was injected. Branches of the genitofemoral nerve were blocked by subcutaneous injection of 7 mL of 1% lidocaine. In case of specific complaints related to the surgical procedure (i.e., pain on instrumentation), infiltration with local anesthetic (1% lidocaine) was used instead of intravenous supplementation.

Sensory level was evaluated by loss of pinprick sensation (20-gauge hypodermic needle), whereas motor blockade was evaluated using a modified Bromage scale (0 = no motor block; 1= hip blocked; 2 = hip and knee blocked; 3=hip, knee and ankle blocked). Haemodynamic variables were measured every 5 min during the first 30 min after block placement, then every 15 min until the end of surgery; further assessments were performed every 30 min Clinically relevant hypotension was defined as a decrease in systolic arterial blood pressure by 30% or more from baseline values, and it was initially treated with 200 ml IV infusion of Ringer's lactate solution; if this proved to be ineffective, an IV bolus of phenylephrine (40-50 mcg) was given. Clinically relevant bradycardia was defined as heart rate decrease below 45 bpm, and it was treated with 0.5 mg IV atropine.

The time lasting from skin disinfection to the end of local anesthetic injection (preparation time) and then to achieve surgical anesthesia (readiness for surgery) were recorded. Surgical anesthesia was defined as the presence of adequate motor (complete motor blockade in the Spinal group or inability to move the ankle and the knee of the operated limb in the femoral group) and sensory (loss of pinprick sensation at T12 in the Spinal group, or in the femoral nerve distribution in the femoral group) blocks. The quality of the block was judged according to the need for supplementary IV analgesics and sedation: adequate nerve block = neither sedation nor analgesics required to complete surgery; inadequate nerve block = need for. additional analgesia (25 mcg IV bolus of fentanyl) or sedation (1mg midazolam) required to complete surgery; failed nerve block = general anesthesia required to complete surgery.

After completion of surgery, patients were managed in the post-anesthesia care unit (PACU) for the first 2 h with continuous electrocardiographic and arterial pressure monitoring. After discharge from the post-anesthesia care unit, patients were transferred to intensive care unit (ICU). Intravenous morphine (2-5 mg) and/or meperidine (12.5-50 mg) were given for analgesia as needed while the patient remained in a monitored care setting. Data regarding the time lasting from the end of local anaesthetic injection to complete resolution of sensory and motor blocks, urination, as well as occurrence of adverse events or complications, and pain treatments were also recorded.

The patients pain control regimens were changed to intramuscular meperidine, or oral analgesics on transfer to a general patient care floor. On the 1 st postoperative day, patients were given subcutaneous heparin (5,000 units every 12 h) until ambulating; oral aspirin (81 mg) was then given daily until discharge. Also, the patients were interviewed using a standardized questionnaire. Back pain, neurological sequelae, post-dural puncture headache (PDPH) and patient satisfaction were investigated.

The Data was collected and entered into the personal computer. Statistical analysis was done using Statistical Package for Social Sciences (SPSS/version 14) software. The statistical test used as follow: mean and standard deviation, student t-test, Chi-square test, the 5% was chosen as the cut off level of significance.

Results

This study was carried out on 40 patients scheduled for peripheral vascular surgery of the lower limbs. The operations included were thrombectomy, femoral-femoral and femoral-pophiteal bypass grafts. Twenty patients in group I received FNB with subcutaneous infiltration of genito-femoral nerve branches while 20 patients of group II received spinal anesthesia.

The two groups had comparable demographic data (Table1). However, Figure I showed a significant haemodynamic changes in group II which were clinically irrelevant (the decrease in MAP, the number of patients needing phenylephrine and the total amount of phenylephrine given was more in group11).

The intra-operative events (table 2) showed that the mean time needed to perform the block and dose of analgesics and sedatives needed during surgery was greater in group I (FNB) compared to group 11[P=0.0V',P=0.029*, P=0.039*],.However, the time needed to start surgery was shorter in group I than in group II [P 0.039*]. Also, the duration of surgery and quality of the block were comparable in both groups (There were no block failures in either group, but local infiltration in the area of the incision with 2 ml (range 1-5 ml) of 1% lidocaine was required in 4 (20%) patients in FNB group vs none in the spinal group).

Table (3) summarizes the recovery times. Nerve block resolution and time to rnicturition was longer [P= 0.0001*, P =0.00032*] in the Spinal group (group 11) as compared with patients receiving femoral nerve blockade (group I). Moreover, the incidence of pain requiring analgesics in PACU and postoperative complications was higher in group II than in group I [P0.021*,p 0.0028*].

Table (1): Demographic Data

	Group I n20	Group I n20	P Value
Age (years)	68±12	66±10	0.123
Sex			
Male	13	15	0.49
Female	7	5	
Weight (kg)	69+11	71±12	0.31
Type of surgery			
Thombectomy	8	10	
Femoral-Popliteal bypass	9	6	0.61
Femoral artery grafting	3	4	

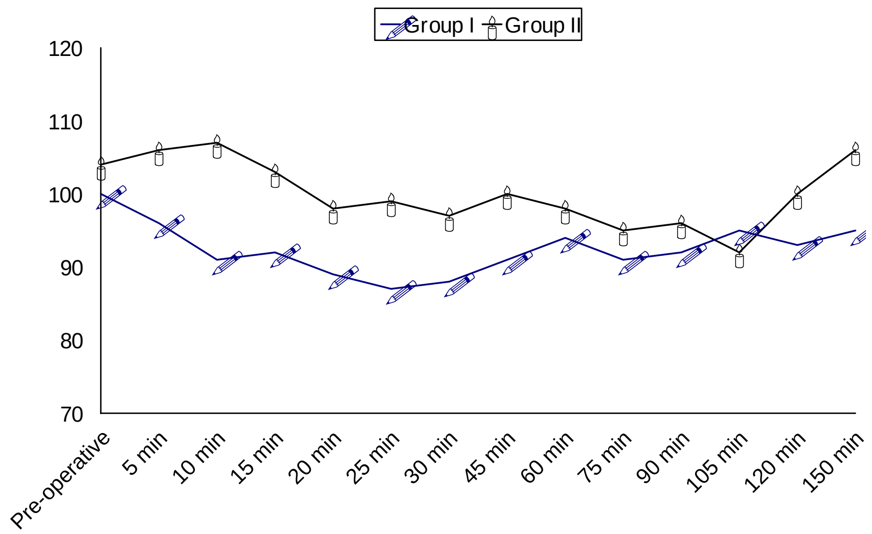

Figure (1): Pen-operative changes in mean arterial blood pressure in both groups.

Table(2): Intra-operative Clinical Data.

	Group I	Group II	P Value
Mean time to perform the block	14±3	9+4	0.0l*
Mean time to start surgery (min)	15 ± 5	20 + 5	0.039*
Duration of surgery (min)	124 ± 35	127 ± 30	0.28
Quality of the block			
Adequate	16 (80%)	18 (90%)	
Inadequate	4 (20%)	2 (10%)	0.41
Failed	0	0	
Mean dose of intraop.	105 + 60	50 ± 60	0.029*
analesics/sedations	3.8 + 1.5	2.5 + 1.0	0.039*

Table (3): Post-operative Data.

	Group I	Group II	P Value
Time to nreve block resolution	185±42s	127+39	0.0001*
Time to urination	135±46	225±83	0.00032*
Pain in PACU/ ICU requiring analgesia	45%	70%	0.021*
Complications			
Headach	none	20%	
Backache	10%	30%	0.0028*
Vomiting	*5%*	10%	
Patient satisfaction	80%	50%	0.041*

Discussion

In patients scheduled for vascular surgery, atherosclerotic disease is highly prevalent. Haemodynamic reactions are often aggravated when spinal analgesia is used in this population.[10] The cumulative results of many studies showed that the incidence of cardiovascular morbidity and mortality is similar regardless whether the patient receives a general, spinal, or epidural anesthetic[11,12,13] Therefore, optimal anesthetic management for peripheral vascular surgery requires that the anesthesia be handled expeditiously, with minimal residual postoperative anesthetic effects and side-effects that may affect the outcome of such operations and local nerve block may represent a safe alternative in such conditions.

In this study, femoral nerve block (FNB) resulted in a more favorable recovery, fewer complications, and better patient satisfaction than spinal anesthesia in patients undergoing lower limb vascular surgery.

Femoral nerve block (FNB) results in anesthesia in the antero-medial thigh and medial aspect of the lower leg. This distribution covers the entire operative field, except the inguinal region, where sensory innervations is derived from the branches of the genito-femoral nerve. The first sign of successful blockade was the inability of the patient to extend the leg at the knee joint. This was then followed by onset of surgical anesthesia in the described distribution.

This study demonstrated that, even though performing a femoral nerve block took slightly longer than spinal anesthesia, the time required to achieve surgical anesthesia and resolution of the block after the end of the procedure was shorter when performing lower limb vascular surgery using a femoral nerve block and a multiple injection technique.

When the motor component of the block had dissipated, allowing for early ambulation, the remaining sensory blockade after FNB provided longer lasting postoperative analgesia as evidenced by decreased need for analgesics in the PACU/ICU and the first 12 hours postoperatively in patients in the FNB group than in the spinal anesthesia group. This may be due to the fact that patients undergoing lower extremity peripheral vascular surgery do not experience the same intensity of postoperative pain as patients undergoing orthopedic or other major intra-abdominal procedures[14] Moreover, diabetics over time often develop sensori-motor peripheral neuropathies, which may minimize their analgesic requirements [15]

Taylor et al. reported successful use of FNB for long saphenous vein stripping (LSVS) operation in 1981 [16]. The authors used 20 mL of 1% lidocaine for FNB and infiltration of local anesthetic at the sapheno-femoral vein junction, but the recovery times were not reported. Since then, the authors in a subsequent reply to a comment have recommended use of 0.5% bupivacaine for the same operation[17]

Our results are consistent with Barkmeier et.al.[2] who found that limb salvage operations can be done under local anesthesia with acceptable complication rates. In selected patients with high-risk coronary artery disease, local anesthesia has theoretic and practical advantages and should be considered an alternative to general or regional anesthesia.

Since FNB does not result in complete anesthesia of the lower extremity as spinal anesthesia does, patients frequently express anxiety when the surgeon is manipulating the leg even in the absence of surgical stimuli. Thus, although the quality of anesthesia did not appear to differ between the groups, the patients in the FNB group received significantly more fentanyl and midazolam. Verbal reassurance and short-acting intravenously administered sedatives before the surgical manipulation is begun is very important here, as it is with most other regional anesthesia techniques. Additionally, local infiltration of the area of the dissection may occasionally be needed. It should be recognized, however, that discomfort on surgical manipulation is not considered a failure to achieve blockade of the femoral nerve.

Moreover, although the sample size of this study is not large enough to provide new information on the incidence of cardiovascular and neurological complications or other adverse events such as post-dural puncture headache and urinary retention, it should be pointed out that peripheral nerve blocks are associated with a lower morbidity than spinal anesthesia.

In summary, our results show that FNB results in excellent anesthesia in patients undergoing peripheral vascular surgery of the lower limb. When compared to spinal anesthesia, this technique resulted in a more favorable recovery, higher patient satisfaction and fewer complications.

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