Sciatic nerve blockade in the supine position: a novel approach

[Le blocage du nerf sciatique en décubitus dorsal : une nouvelle approche]

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Purpose: Sciatic nerve block is useful for surgery below the knee both intra- and postoperatively. Several techniques to insert a catheter at the knee level or higher have been described but need mobilization (lateral decubitus) of the patient. We describe novel landmarks, using a high lateral approach, to block the sciatic nerve without moving the patient.

Clinical features: One hundred seven ASA I, II and III ASA patients scheduled for major foot or ankle surgery were studied prospectively. With patients awake and lying in the supine position, the catheter was introduced along novel landmarks in the peri-nervous adipose space using specifically designed material and nerve stimulation (< 0.5 mA). After a negative test dose (1% lidocaine with 1/200.000 epinephrine), 10 mL of 0.5% bupivacaine and 10 mL of 2% lidocaine were injected. Thirty minutes after performance of the block, the cutaneous and dermatomal sensory blockade were assessed using cold and pinprick tests while motor block was assessed using a modified Bromage scale. Complications and incidents were recorded. The tibial and superficial peroneal nerve were always blocked, while the deep peroneal and posterofemoral cutaneous nerves were blocked in only 97% and 83% of the patients, respectively. Anesthesia, was always present in the dermatome L5 and in the S1 dermatome in 98% of the patients. No major incidents or complications were noted. Three catheters could not be inserted and the anesthestic solution was injected through the needle.

Conclusion: The lateral technique for sciatic nerve anesthesia and catheter insertion allows patients to remain in the supine position for performance of the block and catheter insertion, and results in a high rate of homogeneous anesthesia and a low incidence of side effects.

Objectif : *Plusieurs techniques de bloc du nerf sciatique avec mise en place d'un cathéter ont déjà été décrites mais elles nécessitent la mobilisation du patient. Ce rapport décrit un abord latéral haut pour bloquer le nerf sciatique sans bouger le patient et mettre en place facilement un cathéter.*

Eléments cliniques : *Cent sept patients, ASA I, II et III, opérés au pied ou à la cheville ont bénéficié de cette technique. Leur nerf sciatique a été repéré en décubitus dorsal en utilisant une technique de stimulation nerveuse classique selon une approche adaptée de la technique latérale classique et suivant une direction céphalique. Par un cathéter introduit par l'aiguille, la solution anesthésique (10 mL de bupivacaïne à 0,5 % et 10 mL de lidocaïne à 2 %) a été injectée après une dose test négative (lidocaïne à 1 % adrénalinée à 1/200000). Trente minutes après l'injection, les tests au froid et à la piqûre ont permis l'évaluation du bloc sensitif dans les territoires nerveux et dans les dermatomes correspondants, tandis que le bloc moteur était évalué grâce à un score de Bromage modifié. Toutes les complications et incidents potentiels ont été notés. Les nerfs tibiaux et péroniers superficiels étaient toujours bloqués alors que le péronier profond et le fémoro-cutané postérieur ne l'étaient que chez 97 % et 83 % des patients. Le dermatome L5 était toujours anesthésié alors que S1 l'était dans 98 %. Aucune complication majeure n'a été notée. Trois échecs d'insertion de cathéter ont, néanmoins, conduit à l'injection de la solution anesthésique par l'aiguille.*

Conclusion : *Cette technique d'anesthésie du nerf sciatique par abord latéral avec insertion d'un cathéter permet de ne pas bouger le patient et cela avec une incidence élevée d'anesthésie homogène du nerf sciatique et une faible survenue d'effets secondaires.*

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THE sciatic nerve block represents a useful technique to provide either surgical anesthesia or postoperative analgesia for ankle or foot surgery in children[1] and in adult patients.[2–4] Compared to the popliteal[4,5] and the mid-femoral[6] approaches recently reported, a more proximal block, near the lateral cutaneous projection of the femoral trochanter major, could provide a complete and homogeneous anesthesia of the sciatic nerve, including the posterior cutaneous nerve. A new device for deep nerve or plexus location and catheter insertion being available, a novel lateral landmark for sciatic nerve block was developed to combine *firstly*, ease of performance on a supine patient, *secondly*, a puncture site allowing a complete blockade of the sciatic nerve, and *thirdly*, plexal catheter placement for postoperative analgesia. This new stimulation guided approach to the sciatic nerve has been evaluated prospectively with regard to sensory and motor neural blockade and side effects. This report focuses mainly on the technical feasibility of the block and of insertion of a catheter.

Material and methods

After approval of our Ethics Committee, insertion of a sciatic catheter, using the novel landmarks, was proposed to informed patients scheduled for major orthopedic ankle or foot surgery (mainly arthroplasty or complex osteotomy) during a two-year period (October 1997 to September 1999).

Based on Guardini's[2] and Raj's[7] descriptions, catheters were inserted just caudad to the gluteus muscles, where the sciatic nerve lies in an anatomical adipose space (Figure 1). Locating the cutaneous projection of the femoral trochanter major by palpation (Figure 2), the puncture site we describe is located 3 cm below and 1 cm caudal with respect to Guardini's site,[2] (adapted for adult). With the patient lying supine, the 110 mm Contiplex™ (BBraun™ Melsungen AG, Germany) needle connected to an HNS Stimuplex™ (BBraun™ Melsungen AG, Germany) stimulator using a stimulation current intensity of 0.5 mA (decreased to 0.3 mA to refine location), frequency and duration of the stimulus of 1 Hz and 300 µsec respectively), was introduced 20° up and 45° cephalad to localize the sciatic nerve behind the proximal femoral epiphysis. Muscular twitches in the peroneal (foot dorsal flexion) or tibial nerve (plantar flexion) supplies were considered to be an adequate response to neurostimulation. The stimulation needle was then withdrawn and the polyethylene 20-gauge catheter was introduced 3 cm cephalad in the peri-nervous adipose space through the 18-gauge plastic sheath left in place after the nerve stimulation. After a negative 3 mL test dose (1% lidocaine with 1/200.000 epinephrine), 10 mL of 0.5% bupivacaine and 10 mL of 2% lidocaine were injected. The catheter was anchored to the skin using a specific Epi-fix™ device (Maersk Medical™ Stonehouse, England) so as to not dislodge it. It can be left in place up to six days without manipulation.

Thirty minutes after local anesthetic injection, anesthesia and motor block were evaluated:

- *cutaneous sensory blockade* using cold and pinprick tests in the tibial, the superficial peroneal, the deep peroneal and the postero-femoral cutaneous nerve territories.
- *dermatomal blockade* using cold and pinprick tests in the L5 and S1 cutaneous dermatomes to appraise the segmental block.
- *motor block* using Bromage's[8] modified scale specially adapted to the tibial and peroneal nerves (from Bromage 1 - corresponding to the full capacity for flexion and adduction of the ankle for the tibial nerve, or the opposite for the peroneal nerve - to Bromage 4 - corresponding to a total inability to perform the relevant movement).

General side-effects or incidents, and local complications related to the performance of the block were recorded for 30 min.

After 30 min, depending on the patient or the surgical procedure, anterior lumbar plexus block or spinal anesthesia was performed. Alternatively, general anesthesia was induced to complete the sciatic nerve block, mainly because of tourniquet intolerance.

The SPSS 8.0 software (SPSS Inc, Chicago, IL, USA) was used for computation and statistical analysis of the data.

Results

The block and catheter insertion procedure was performed on 107 status I, II and III of the ASA informed patients (35 males and 72 females), aged 42 to 71 yr (mean of 61) and operated for 81 (75%) hallux valgus arthroplasty (Keller Lelievre or Mac Bride surgery), 12 (11%) ankle arthroplasties, 8 (7.5%) post-traumatic foot complex arthroplasties and 6 (6.5%) plantar arch complex surgery.

The mean weight was 69.5 kg (range 45–88) and the mean height was 168.5 cm (range 158–182cm).The mean depth at which the sciatic nerve was located was 9 cm (range 7–10 cm). The mean surgical duration was 125 min (range from 90–210 min).

A radiograph (Figure 3) was taken in a 48-yr-old female patient operated for hallux valgus Mac Bride surgery. It shows an example of the distribution of the

radio-opaque dye (5 mL of iohexol 240 mg·mL^{-1} added to 20 mL of the anesthetic mixture) within the peri-nervous adipose space through the catheter. It must be noted that the anesthetic solution extended not only caudad around the sciatic nerve but also cephalad and medially. Nevertheless it did not reach up to the plexic structures.

TABLE I Efficacy of and incidents with lateral sciatic nerve catheter in 107 ASA I–III patients

Sensory block		*No. of patients*	*Percentage*
Tibial nerve		107	100
Superficial peroneal nerve		107	100
Deep peroneal nerve		104	97
Posterior femoral cutaneous nerve		89	83
L5		107	100
S1		98	92
Motor block (modified Bromage > 2)		*No. of patients*	*Percentage*
Tibial nerve		107	100
Peroneal nerve		98	92
Incidents			
Paresthesia	Needle advancement	15	14
	Solution injection	8	7.4
	Catheter insertion	14	13
Local complications (two minor bleedings and two cutaneous redness without other inflammatory signs close to the catheter insertion point)		4	3.8
Blood reflux	Plastic sheath	3	2.8
	Catheter	7	6.5
Problems	More than two attempts (3 or 4)	7	6.5
	Catheter insertion failure	3	2.8

The effectiveness (sensory and motor block) after the first bolus of anesthetic solution, and incidents are summarized in Table I. Failure of insertion of the catheter was recorded in three patients. We were unable to define any specific cause to this problem. We decided to inject the anesthetic mixture through the plastic sheath and completed the anesthesia, in these patients, with three-in-one lumbar plexus anesthesia. In addition to the results presented in Table I, no hemodynamic instability (arterial hyper- or hypotension) or systemic toxicity was noted during the first 30 min after injecting the anesthetic mixture.

After block performance and catheter insertion, following the surgical and the individual context, 63 (58%) patients received three-in-one lumbar plexus anesthesia, 17 (16%) spinal anesthesia and 27 (26%) general *iv* anesthesia.

During the study period, three failures to locate the sciatic nerve were observed in patients with particularly thick thighs, even after increasing the stimulation intensity to 1 mA.

Discussion

Previous techniques described a pelvic approach to the sciatic nerve.[9,10] In this particular anatomical location, the neural trunk is often difficult to target. In addition, insertion of a catheter to prolong analgesia postoperatively has become more common.[11–13] For these reasons, several authors have reviewed and reevaluated the existing technique[14] or described a parasacral access.[15] Despite these technical modifications, the

TABLE II Sensitive and motor block reported with bupivacaine in the anesthetic solution for different approaches to the sciatic nerve

	Approach	*Anesthetic solution*	*Sensitive block*			*Motor block*	
			Tibial	*Peroneal*	*Post fem cutaneous*	*Tibial*	*Peroneal*
Pandin *et al.*	high lateral	lido 2%; bupi 0.5% (20 mL)	100% (30 min)	97% (30 min)	83% (30 min)	100% (30 min)	92% (30 min)
Naux *et al.*[6]	lateral mid-femoral (30 mL)	lido 1%; bupi 0.5% (30 min) Epi 1/200000	66% (30 min) 100% (120 min)	100%	not evaluated (30 min)	30% (30 min) 100% (120 min)	100%
Guardini *et al.*[2]	high lateral	bupi 0.25-0.5% (max 2 mg·kg^{-1})	94% success rate of complete block (patchy anesthesia in 6.4%)			not evaluated	
Kilpatrick *et al.*[3]	posterior	bupi 0.5% (max 2 mg·kg^{-1}) Epi 1/200000 Bicarbonate 0.1 mmol·10 mL^{-1}	95% success rate but not detailed			80% but not detailed	
Chang *et al.*[14]	posterior modified	bupi 0.375% (30 mL) Epi 1/200000	87.5% succes rate but not detailed			not evaluated	

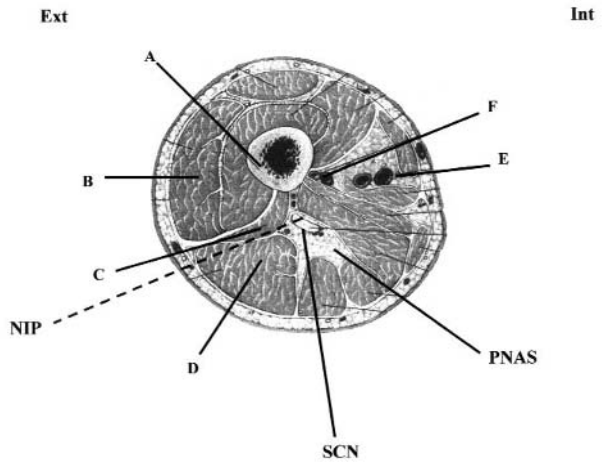

FIGURE 1 Proximal cross section of the thigh at the junction between the proximal femoral epiphysis and diaphysis. SCN = sciatic nerve; PNAS = peri-nervous adipose space; NIP = needle insertion pathway; A = shaft of the femur; B = vastus lateralis muscle; C = short head of biceps femoris muscle; D = long head of biceps femoris muscle; E = superficial femoral vessels; F = deep femoral vessels.

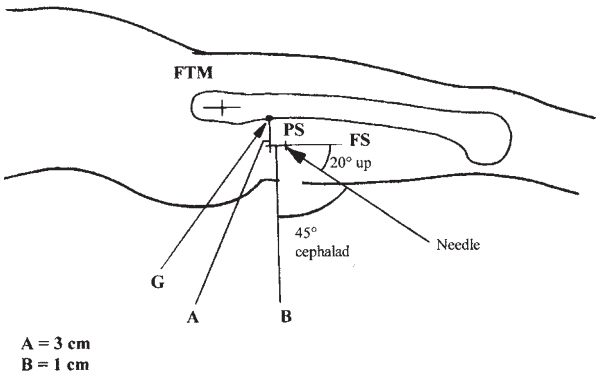

FIGURE 2 Landmarks for high lateral sciatic nerve block and catheter insertion. FTM = femoral trochanter major; FS = femoral shaft; G = classical Guardini approach; PS = puncture site. The needle is inserted 20° up and 45° cephalad to locate the sciatic nerve just below and behind the femoral trochanter major.

FIGURE 3 Radiograph showing the distribution of radio-opaque dye (5 mL of iohexol 240 mg·mL^{-1} added to 20 mL of the anesthetic mixture injected through the catheter) within the peri-nervous adipose space in a 48-yr-old female patient weighing 88 kg operated for hallux valgus surgery. Note that the anesthetic solution extended not only caudad around the sciatic nerve but also cephalad and medially albeit without infiltrating the plexus.

success rate of total sciatic nerve blockade remained limited.[11,16] The more recent popliteal technique[4,5,17] allows sciatic block involving the tibial and peroneal nerve supplies and easy insertion of a catheter for postoperative analgesia. Unfortunately, this more distal popliteal technique is not adequate to obtain a posterior femoral cutaneous nerve block which is mandatory for tourniquet tolerance. Sometimes patients also complain about discomfort arising from the popliteal pad of either the catheter and/or its dressing in the popliteal region.

We reviewed the sensitive and motor blocks reported with bupivacaine containing anesthetic solutions using different approaches,[2,3,6,14] to the sciatic nerve (Table II). Our results confirm the high incidence and rapid onset of blockade of both the proximal and the distal trunks of the sciatic nerve. Even in recently pub-

lished work as that of Naux *et al.*,[6] sensitive and motor blockade in the tibial nerve are delayed, and this may be a real problem in clinical practice. On the other hand, the mid-femoral technique[6] does not allow effective block of the posterior femoral cutaneous nerve. However, comparisons with other studies remain difficult because of the lack of complete and detailed results.[2,3,14]

Conclusion

Sciatic nerve anesthesia using the novel lateral technique described appears to be a useful technique for distal lower limb surgery. Compared to the previously described peripelvic or popliteal methods, the present technique offers the advantages of the supine position for performing the block and catheter insertion with a high rate of homogeneous anesthesia and a low incidence of side effects.

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