Comparison of Parasacral and Posterior Sciatic Nerve Blocks Combined with Lumbar Plexus Block

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Objective: The aim of this study is to compare the effects of parasacral and posterior Winnie approaches when combined with the inguinal paravascular approach for lumbar plexus block.

Methods: After the approval of the Ethics Committee, 40 patients scheduled to undergo arthroscopic knee surgery were enrolled. The patients were randomly assigned into two groups in a double-blind manner to perform sciatic nerve block either by the parasacral technique (Group I) or by the posterior approach (Group II).

Results: The obturator nerve motor block success rate was found to be 80% (16/20) in Group I, whereas it was 10% (2/20) in Group II ($p<0.05$).

Conclusion: Inguinal paravascular block with parasacral sciatic nerve block led to a much higher incidence of obturator nerve motor block when compared to the inguinal paravascular block with posterior sciatic nerve block during knee arthroscopies.

Key Words: Nerve block, arthroscopy, obturator and sciatic nerve

Introduction

It is necessary to perform femoral, lateral femoral cutaneous, obturator, posterior femoral cutaneous and sciatic nerve blockades in order to achieve surgical anaesthesia in the lower limbs. To avoid numerous injections required to block all these nerves, performing a combined lumbar plexus and sciatic nerve block is being recommended (1). Although inguinal paravascular block (3-in-1 block) which was defined for single-injection blockade of the nerves originating from lumbar plexus, has been a simple acceptable technique, the rates of blockade of obturator and lateral femoral cutaneous nerves by using this technique, still remain controversial (2-5). It was reported in some studies that along with the blockade of sciatic and posterior femoral cutaneous nerves, obturator nerve blockade could be achieved with high rates via a parasacral block (6, 7). However, the effects of combination of parasacral block with paravascular technique have not been investigated. The aim of the present study is to compare the clinical effects of parasacral and posterior Winnie approaches for sciatic nerve block when combined with the inguinal paravascular approach for lumbar plexus block in patients who were scheduled to undergo unilateral arthroscopic knee surgery.

Methods

After approval of the Ethics Committee of Gazi University Medical Faculty (Approval date: 18.06.2002, No. 2002/1), ASA I-III male patients scheduled to undergo tourniquet assisted unilateral arthroscopic knee surgery, aged between 21 to 66 years, were included in the study. The study procedures were started after informed consents of the patients were obtained. Exclusion criteria were as follows: presence of severe hepatic, renal, cardiac, neurologic, and psychiatric diseases, presence of diabetes mellitus and/or peripheral neuropathy, anticoagulant or chronic analgesic use, history of known allergy to local anaesthetics, infection at the site of nerve block and refusal of the patient to participate in research.

Lumbar plexus block by inguinal paravascular technique, sciatic nerve block via parasacral approach and posterior sciatic nerve block via Winnie approach were performed in the present study (6, 8, 9).

Using SPSS software, 40 patient numbers were entered and patients were randomized into two groups using "random sample" command. Group I (n=20) received lumbar plexus block by inguinal paravascular technique and sciatic nerve block via parasacral approach, and Group II (n=20), received lumbar plexus block by inguinal paravascular technique and posterior sciatic nerve block via Winnie approach.

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The local anaesthetic solution used was a mixture of 1% lidocaine with epinephrine (1/400,000); 60 mL (600 mg), 30 mL for lumbar plexus block and 30 mL for sciatic nerve block.

All blocks were performed using a peripheral nerve stimulator (Stimuplex HNS11, B.Braun Melsungen AG, Germany) and 21G, teflon coated peripheral nerve block needles (Stimuplex A, B. Braun Melsungen AG, Germany) 15 cm and 5 cm in length. The nerve stimulator was set to deliver a current of 2 mA at a pulse duration of 0.1 ms, and the pulse frequency was set at 2 Hz. During parasacral sciatic nerve block, we sought dorsiflexion or eversion (peroneal nerve) of the foot and plantar flexion or inversion of the toes. During 3-in-1 paravascular nerve block, contractions of the quadriceps muscle and back and forth movements of the patella in response to femoral nerve stimulation were sought. When these movements appeared, the intensity of the current was reduced slowly. In case muscle contractions were still present, albeit minimal, at 0.3-0.5 mA, the required local anaesthetic agent was injected by performing aspiration tests at each 5 ml of injection.

According to the double-blind study design, both the patients and the anaesthetists who would evaluate the quality of the block were blinded to which approach was performed for sciatic nerve block.

The quality of the sensory and motor blocks was evaluated at 10 and 20 minutes after the completion of each inguinal paravascular lumbar plexus block and sciatic block. The surgeon was allowed to operate on patients in whom sensory block was achieved. Sensory loss was assessed with pinprick test, using a blunt-tipped needle (1: there is pain, 2: there is no pain but the patient feels the needle touch, 3: Not even feels the touch of the needle). The quality of motor block was assessed based on the loss of strength in the muscle group innervated by the nerve (1: normal strength, 2: reduction in strength = paresis, 3: no function = paralysis).

Motor block was assessed depending on the innervating nerve branches by the below movements: Femoral nerve: hip flexion, knee extension; obturator nerve: hip adduction; sciatic nerve: knee flexion; tibial nerve: plantar flexion, inversion; peroneal nerve: dorsiflexion (deep), eversion (deep and superficial).

Statistical analysis

To detect a clinically significant difference, for Yates corrected chi-square in a condition of 80% obturator nerve block, it was estimated that minimum 20 individuals in each group, and a total of 40 individuals should be recruited to have 90% power ($\beta=0.1$) and a one-sided $\alpha=0.05$ with minimum type I error.

Data were presented as mean $\pm$ standard deviation or number of cases (n). The Chi-square test or Fisher's exact Chi-square test, where appropriate, was used to compare the results of clinical success regarding the sensory and motor block assessments between the two groups. A p-value <0.05 was considered to show a statistically significant difference.

Results

All patients were male and two groups were similar in terms of age (Group I: 42 ± 15 and Group II: 41 ± 13 years).

Success rate of motor blockade of the obturator nerve was significantly higher in patients who underwent parasacral block, when compared to those who underwent posterior sciatic block ($p<0.05$), (Figure 1). There was no significant difference between the two groups in terms of motor blockades of femoral and sciatic nerves (Figure 2).

Complete sensory block of the femoral and obturator nerves was achieved in all patients whereas no sensory block could be achieved in the lateral femoral cutaneous (LFC) nerve in 8 patients (40%) from each group ($p=0.00015$), (Figure 3A). Isolated LFC nerve block was performed in these patients using 7 ml of the pre-prepared local anaesthetic solution.

In the assessment of superficial and deep peroneal nerves, posterior femoral cutaneous nerve (PFC) and other tibial nerves, all patients had full sensation to pinprick test (Figure 3B).

According to the institutionally adopted protocols of Orthopaedics and Trauma Department, patients were kept under observation at the night of the operation and were discharged on the next day.

Discussion

In the present study of patients who underwent lumbar plexus block using inguinal paravascular technique for unilateral knee arthroscopy, it was determined that a higher success rate was achieved in the motor blockade of obturator nerve using parasacral approach for sciatic nerve block than using Winnie approach for posterior sciatic nerve block. Similar success rates were achieved in the motor blockades of femoral and sciatic nerves in the two groups. Regarding success of sensory block, there was no sensory block in the LFC nerve in 40% of the patients from each group, whereas sensory block properties of the other nerves were similar in both groups.

Although arthroscopy is being performed on an outpatient basis in most centres, according to adopted protocols of our Orthopaedics and Trauma Department, patients are being discharged after one

Figure 3. The assessment of sensory block in the groups. A) Assessment of femoral, obturator and lateral femoral cutaneous (LFC) nerves. B) Assessment of superficial and deep peroneal nerves and posterior femoral cutaneous (PFC) and tibial nerves

night of observation. The reasons for preferring peripheral blocks in unilateral knee arthroscopies include refusal of general anaesthesia, development of undesired contralateral block during spinal anaesthesia, risk of post-spinal anaesthesia headache and urinary retention.

Obturator nerve should also be blocked in order to safely and successfully perform tourniquet assisted knee surgery. The reported motor blockade rate of obturator nerve using inguinal paravascular technique ranges from 0 to 27.5% (1). The lower limit of success for a regional block is being accepted to be 80%. It is known that lumbar plexus block may effectively be combined with sciatic nerve block and, if required, with obturator nerve block. It is also known that lumbar plexus can successfully be blocked using inguinal paravascular technique and ≥ 20 mL of local anaesthetics in most lower extremity surgeries (8-10). In one study where a selective obturator nerve block with 7 mL 0.75% ropivacaine and femoral block with 10 mL 0.75% ropivacaine were performed following a parasacral sciatic block with 30 mL 0.75% ropivacaine, the unreliability of parasacral sciatic nerve block in achieving obturator nerve block was demonstrated, and the authors concluded that a selective obturator nerve block was needed (11). Similarly, parasacral sciatic block, using 25 mL of local anaesthetic (2% lidocaine and 0.5% bupivacaine), alone failed to induce obturator nerve block when compared to combined parasacral sciatic block and obturator nerve block in patients who were scheduled for anterior cruciate ligament reconstruction. On the contrary, we observed that sciatic nerve block using 30 mL of 1%

lidocaine with epinephrine (1:400,000) and parasacral technique resulted in a marked increase in motor blockade rate of the obturator nerve achieved with inguinal paravascular block. In addition to lumbar plexus block, we observed a complete sensory block in femoral and obturator nerves by both parasacral and posterior sciatic nerve block applications. High success rate in obturator nerve blockade observed in our study, can be attributed both to the high volume (30 mL) of local anaesthetic used in the study, and to the close proximity of the obturator nerve to sciatic nerve within the parasacral region, as also described by Morris et al (7). In a cadaveric study supporting our results, 82% of the latex injections were observed to spread to the obturator nerve and the authors reported that parasacral nerve blockade might increase the success rate of obturator nerve block (13).

Success rate of clinical nerve blocks increases by increasing the volume of the local anaesthetic used in peripheral nerve blockade, without reaching toxic levels. Hence, Elmas et al (14) reported that success rate of the block increased by using 65 mL 1% lidocaine with epinephrine (1:400,000) in sciatic and inguinal paravascular block combinations. Additionally, that study showed that, despite the use of 650 mg lidocaine, plasma concentrations did not reach toxic levels. However, recent studies regarding the use of ultrasound guidance during peripheral nerve blockade investigated the effect of local anaesthetic volume and concentration on the duration of block and revealed that lower anaesthetic volumes can be preferred (15, 16). In the present study where we used nerve stimulators, for the purpose of increasing the success rate of motor blockade, we used higher volumes of local anaesthetics when compared to previous studies where ultrasound guidance was used.

In a study on patients who underwent elective knee arthroscopy, regions of complete sensory loss were mapped after femoral block, which was made using inguinal paravascular block of Winnie, and it was demonstrated that there was substantial interindividual variation in the area of sensory loss. Hence, it was concluded that absence of sensory anaesthesia of the skin overlying the antero-superior aspect of the thigh or medial malleolus was not suggestive of an unsuccessful nerve block (17). In our study, 8 patients from each group (40%) had painful sensation to pinprick test in areas innervated by LFC nerve, whereas none of the patients declared that they had painful sensation in areas innervated by superficial and deep peroneal nerve, PFC nerve and other tibial nerves. We think that the reason for 40% failure in LFC nerve block was due to the insertion of the needle between the femoral nerve and the artery. Thus, unintentional spread of local anaesthetic to both femoral and obturator nerves might have caused its inadequate spread through LFC nerve during inguinal paravascular block. Success rate of the block in femoral and obturator nerves was found to be increased due to the same reason.

Conclusion

The use of sciatic nerve block via parasacral approach, besides increasing the rate of obturator motor block via inguinal paravascular block, seems to decrease the general success of the block by 40% block failure in LFC nerve; however, we concluded that sciatic nerve block via parasacral approach may be recommended in combination with inguinal paravascular block when a higher degree of obturator nerve block is prompted.

Conflict of Interest

No conflict of interest was declared by the authors.

Peer-review: Externally peer-reviewed.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of Gazi University School of Medicine (18.06.2002, 2002/1).

Informed Consent: Written informed consent was obtained from patients who participated in this study.

Author Contributions

Concept - İ.G., E.Ö.; Design - İ.G., E.Ö., K.K.; Supervision - H.Ç., A.B., K.K.; Funding - E.Ö.; Materials - E.Ö.; Data Collection and/or Processing - E.Ö., İ.G.; Analysis and/or Interpretation - E.Ö., K.K., B.G., A.B., H.Ç.; Literature Review - B.G., K.K., İ.G., E.Ö.; Writer - E.Ö., B.G., K.K.; Critical Review - B.G., K.K., H.Ç.; Other - E.Ö., İ.G., K.K., B.G., A.B., H.Ç.

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