

# Arthroscopic medial meniscus trimming or repair under nerve blocks: Which nerves should be blocked?

## ABSTRACT

**Background:** This study aimed to determine the role of the sciatic and obturator nerve blocks (in addition to femoral block) in providing painless arthroscopic medial meniscus trimming/repair.

**Materials and Methods:** One hundred and twenty patients with medial meniscus tear, who had been scheduled to knee arthroscopy, were planned to be included in this controlled prospective double-blind study. The patients were randomly allocated into three equal groups; FSO, FS, and FO. The femoral, sciatic, and obturator nerves were blocked in FSO groups. The femoral and sciatic nerves were blocked in FS group, while the femoral and obturator nerves were blocked in FO group. Intraoperative pain and its causative surgical maneuver were recorded.

**Results:** All the patients ( $n = 7$ , 100%) in FO group had intraoperative pain. The research was terminated in this group but completed in FS and FSO groups (40 patients each). During valgus positioning of the knee for surgical management of the medial meniscus tear, the patients in FS group experienced pain more frequently than those in FSO group ( $P = 0.005$ ).

**Conclusion:** Adding a sciatic nerve block to the femoral nerve block is important for painless knee arthroscopy. Further adding of an obturator nerve block may be needed when a valgus knee position is required to manage the medial meniscus tear.

**Key words:** Knee scope; obturator nerve block; sciatic nerve block

## Introduction

Knee arthroscopy is the most commonly performed orthopedic procedure.<sup>[1,2]</sup> Approximately, one million knee arthroscopies are performed in the United States per year.<sup>[1]</sup> The medial meniscus tear is the most common indication for knee arthroscopy.<sup>[1,2]</sup> Knee arthroscopy can be performed using peripheral nerve block.<sup>[3-12]</sup> Peripheral nerve blocks improve the recovery profiles and allow early discharge.<sup>[3]</sup> The knee joint is supplied by three nerves; femoral, sciatic, and obturator.<sup>[13]</sup> Different block combinations of these nerves have been used for knee arthroscopy.<sup>[3-12]</sup> Although reducing the number of blocked nerves decreases the required

local anesthetic dose and the block performance time, it may not provide adequate anesthesia. This study aimed to determine the role of the sciatic and obturator nerve blocks (in addition to femoral block) in providing painless arthroscopic medial meniscus trimming/repair.

## Materials and Methods

The Research and Ethical Committee of Abu Dhabi Knee and Sports Medicine Center approved this prospective controlled randomized double-blind study (#06:06:2012). Patients who

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had been scheduled to knee arthroscopy were planned to be included in the study group. Only patients with a radiological diagnosis of medial meniscus tear (with or without coexisting intra articular pathologies) were included. After obtaining the patients' written informed consent; the patients were randomly allocated (by the use of sealed envelopes) into three equal groups (FSO, FS, and FO). In the FSO group, the patients received femoral, sciatic, and obturator nerve blocks. In the FS group, the patients received femoral and sciatic nerve blocks. In the FO group, the patients received femoral and obturator nerve blocks in addition to lateral portal site infiltration. For blinding, placebo blocks were performed.

In the induction room, after application of routine monitoring and supplemental oxygen, all the patients received 3 mg of midazolam IV. Under aseptic condition, all blocks were performed using an S-Nerve ultrasound machine (SonoSite Inc., Bothell, WA, USA), curved (C60, 5-2 MHz) and linear (HFL 38, 13-6 MHz) probes, 20G 12 cm and 21G 5 cm needles (Locoplex, Vygon, Ecouen, France). The sciatic nerve was identified at the presacral area; deep and medial to the posterior border of ischium.<sup>[14]</sup> After electrical confirmation, 20 ml of 1.7% lidocaine (with epinephrine 5 mcg/ml) was slowly injected. The femoral nerve was blocked at the level of the inguinal crease, lateral to the femoral artery, using 15 ml of 1% lidocaine.<sup>[15]</sup> The obturator nerve was blocked between the pectineus and obturator externus muscles using 10 ml of 1% lidocaine (with epinephrine 5 mcg/ml).<sup>[16]</sup> All the above blocks were performed as described in the three groups, except that the sciatic and the obturator nerve blocks were performed using normal saline in FO and FS groups, respectively. The lateral portal site was infiltrated (in the first 20 patients) with 10 ml of 1% lidocaine with epinephrine in FO group or with 10 ml of normal saline in FS and FSO groups.

The adequacies of the nerve blocks were assessed every 10 min until successful blocks were achieved or to a maximum of 30 min. Successful femoral, sciatic, and obturator nerve blocks were defined as inability to extend a fully flexed knee, to flex the foot (plantar and dorsal flexion), and inability (or marked weakness) to adduct an abducted hip, respectively.<sup>[17]</sup> Incomplete blocks (corresponding to each group) were supplemented before taking the patient to the operating room. The nerve blocks, assessments, and supplementations were performed by a single operator (aviation maintenance technician).

No intraoperative sedations were used. The surgeon was asked to manage coexisting intra articular pathologies, when present, before managing the medial meniscus tear. Intraoperative pain was assessed using visual analog scale (VAS); 0 = No pain, 10 = Worst imaginable pain. A VAS up to three was considered as discomfort. A VAS more than three was

considered as pain that was managed with 10 mcg of sufentanil IV. If this could not control pain, general anesthesia (GA) was induced. Intraoperative pain, its causative surgical maneuver and any complications were recorded. All the patients were assessed neurologically before hospital discharge and also during the physiotherapy visits for 3 weeks after surgery. All the intraoperative measurements were performed by the assistant not aware of the used block solutions.

### Statistical analysis

Based on alpha and beta levels of 0.05 and 0.2, respectively, it was estimated that at least 40 patients were needed in each group to detect the difference in the frequency of intraoperative pain, assuming its average incidences in FSO group and FS group were 7% and 31%, respectively.<sup>[9-12]</sup>

Statistical analysis was performed using SPSS® for Windows v16 (SPSS Inc., Chicago, IL, USA). The age and the body mass index were presented as median (25<sup>th</sup>-75<sup>th</sup> percentiles) and were analyzed using Kruskal–Wallis and Mann–Whitney tests. Other variables were presented as frequency (%) and were compared using Chi-square or Fisher's exact test. A  $P < 0.05$  was considered statistically significant.

### Results

Five patients with normal arthroscopic medial meniscus were excluded and replaced. Eighty-seven patients completed the study and their characteristics were comparable across the three groups [Tables 1 and 2]. Among the first 20 patients; the incidences of intraoperative pain and GA requirement were high (45% and 35%, respectively), therefore, the Research and Ethical Committee requested an interim analysis. In FO group, all the patients ( $n = 7$ , 100%) had pain with piercing the knee capsule and thereafter necessitating induction of GA. FS and FSO groups, at this stage, were comparable [Table 3]. The research was terminated in FO group but completed in FS and FSO groups (40 patients each).

All the patients in FS and FSO groups were pain-free during surgical management of different coexisting intra articular pathologies [Table 2]. However, during surgical management of the medial meniscus tear, the patients in FS group experienced pain and discomfort more frequently than those in FSO group [Table 4]. Valgus positioning was responsible for the pain and discomfort in all these patients but one. The tourniquet was not inflated in any patient. No complications were recorded.

### Discussion

Knee arthroscopy is an approach to diagnose and to treat a wide

**Table 1: Patients characteristics (n = 20)**

	FSO group (n=5)	FS group (n=8)	FO group (n=7)	P value
Age (yr) [median (Q1-Q3)]	37 (24-42)	33.5 (27-40.5)	29 (25.5-33.5)	0.87
Gender male/female [n (%)]	5 (100%)/0 (0%)	7 (87.5%)/1 (12.5%)	7 (100%)/0 (0%)	1.00
ASA class I/II [n (%)]	4 (80%)/1 (20%)	6 (75%)/2 (25 %)	6 (86%)/1 (14%)	1.00
BMI (kg.m <sup>2</sup> ) [median (Q1-Q3)]	27.2 (27-28.1)	28.7 (26.7-30.6)	26 (25-27.9)	0.37
Coexisting procedures [n]				
No (only medial meniscus tear)	3	4	4	1.00
Lateral meniscus trimming/repair	1	2	2	1.00
Plica excision	1	2	1	1.00
Chondroplasty	0	1	0	1.00
Required supplementation [n]				
Sciatic nerve blocks	1	1	0	0.71

ASA = American Society of Anesthesiologists, BMI = Body mass index, Q1 = First quartile, Q3 = Third quartile

**Table 2: Patients characteristics in FSO and FO groups at the end of the study**

	FSO group (n=40)	FS group (n=40)	P value
Age (yr) [median (Q1-Q3)]	32 (25-43)	31 (25-40)	0.62
Gender male/female [n (%)]	36 (90%)/4 (10%)	34 (85%)/6 (15%)	0.74
ASA class I/II [n (%)]	32 (80%)/8 (20%)	33 (85.5%)/7 (17.5 %)	1.00
BMI (kg.m <sup>2</sup> ) [median (Q1-Q3)]	27 (24.5-28.4)	27.6 (26.1-30.3)	0.24
*Coexisting procedures [n]			
No (only medial meniscus tear)	20	18	0.82
Lateral meniscus trimming/repair	13	11	0.81
Plica excision	6	4	0.74
Chondroplasty	4	5	1.00
Microfracture	1	3	0.62
Partial synovectomy	0	1	1.00
Required supplementation of [n]			
Femoral nerve block	1	2	1.00
Sciatic nerve blocks	5	3	0.71

\*In some patients 3 pathologies were existed, ASA = American Society of Anesthesiologists, BMI = Body mass index, Q1 = First quartile, Q3 = Third quartile

**Table 3: Intraoperative pain among the first 20 patients**

	FSO group (n=5)	FS group (n=8)	FO group (n=7)	P value
Pain n (%)	0 (0%)	2 (25%)	7 (100%)	<0.001*
Discomfort n (%)	0 (0%)	1 (12.5%)	0 (0%)	
No pain n (%)	5 (0%)	5 (62.5%)	0 (0%)	

\*Significant difference between FO and other two groups (P < 0.001), °All these patients required general anesthesia

**Table 4: Intraoperative pain during the surgical management of the medial meniscus tear**

	FSO group (n=40)	FS group (n=40)	P value
Pain n (%)	2 (5%)	9 (22.5%)	0.005*
Discomfort n (%)	3 (7.5%)	7 (17.5%)	
No pain n (%)	35 (87.5%)	24 (60%)	

\*Significant difference, °Four patients in FS group required general anesthesia

variety of intra articular pathologies. The surgically dissected intra articular structures and the required knee positions are varied with the existing pathology.<sup>[1]</sup> The knee joint is supplied by the femoral, sciatic, and obturator nerves.<sup>[13]</sup> The femoral nerve innervates the majority of the joint and the skin at the medial portal site.<sup>[13]</sup> Hence, its successful block is important for painless knee surgery. The sciatic nerve supplies both the knee joint (via six articular branches) and the skin at the lateral portal site (via the lateral sural cutaneous nerve).<sup>[13]</sup> Therefore

without a sciatic nerve block, painless knee arthroscopy could not be achieved in FO group. It was reported that psoas compartment or femoral nerve blocks (without sciatic nerve block) can provide adequate anesthesia for knee arthroscopy.<sup>[4-6]</sup> However, in these studies; inhalational, intravenous, or intra articular anesthetics were added perioperatively.

The obturator nerve supplies the posterior capsule and cruciate ligaments and may innervate the skin at the

medial aspect of the knee.<sup>[16]</sup> However, these structures are not dissected during the usual arthroscopy, therefore, a combined femoral and sciatic nerve block (without obturator nerve block) was reported to provide adequate anesthesia for knee arthroscopy in some studies.<sup>[7,8]</sup> However, other studies showed that some patients (8% up to 100%) still had intraoperative pain and required opioid supplementation.<sup>[9-11]</sup> Unfortunately, in the later studies, pain was correlated only to the type of anesthesia but not to the precisely performed arthroscopic procedure. In FS group, combined femoral and sciatic nerve blocks (without obturator nerve block) provided excellent anesthesia for surgical management of different intra articular pathologies with the exception of the medial meniscus trimming/repair where 22.5% of the patients experienced pain. This associated pain was mainly related to the knee positioning.

Unlike other knee positions (as flexion, extension or figure of four), the valgus position is a nonphysiological position where the medial collateral ligament (MCL) is stretched.<sup>[1]</sup> This may be responsible for the associated knee pain. Innervation of the MCL, to our knowledge, has not been described. However, it is derived embryologically from the adductor magnus muscle.<sup>[18]</sup> Therefore, the obturator nerve may play a role in its innervation. This may explain why the valgus position associated pain was less frequent in FSO group as compared to FS group.

The performance times of different block combinations were not measured in this study. However, the ultrasound (US)-guided obturator nerve block is a simple block.<sup>[16]</sup> It is performed using the same position, skin preparation, draping, and US probe as that used for femoral nerve block. Therefore, adding an obturator nerve block to a combined femoral and sciatic nerve blocks can provide a reliable anesthesia of the knee without apparent significant prolongation of the whole block time. However, the risk of overdose local anesthetic toxicity must be always considered. No complications were reported, however, the majority of the patients in this study were middle-aged athletes. The tourniquet was not inflated in any patient; therefore, the current results may or may not be applicable when the tourniquet inflation is needed.

## Conclusion

Adding a sciatic nerve block to the femoral nerve block is important for painless knee arthroscopy. Further adding of an obturator nerve block may be needed when a valgus knee position is required to manage the medial meniscus tear.

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## Conflicts of interest

There are no conflicts of interest.

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