MEPERIDINE, AS AN EFFECTIVE ADJUVANT AGENT IN UNILATERAL SPINAL ANAESTHESIA FOR KNEE ARTHROSCOPY

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Aim: Unilateral spinal anaesthesia permits early recovery and short ambulatory stay. Our study aimed to search if meperidine may prolong sensory block time when added to hyperbaric bupivacaine.

Methods: This is a prospective, double blinded study: Ambulatory, 46 consenting patients aged 18-60 years, undergoing unilateral knee arthroscopy were randomized in two groups. saline group (n=20): 1.3 ml of hyperbaric bupivacaine and 0.2 ml of serum physiologic was used. Meperidine group (n=20): 1.3 ml of hyperbaric bupivacaine and 0.2 ml of 5% meperidine was used. Sensory block times, duration of spinal anaesthesia, intraoperative adverse effects and patient satisfaction were recorded.

Results: Mean duration of sensory block was greater in the meperidine group compared with the saline group. Strict unilateral block and hypotension were comparable among groups.

Conclusion: Addition of meperidine to hyperbaric bupivacaine in unilateral spinal anaesthesia prolonged analgesia without effecting total anesthesia time with minimal adverse effects.

Key words: Unilateral spinal anaesthesia, meperidine, outpatient surgery, knee arthroscopy

Eur J Gen Med 2008;5(1):36-41

INTRODUCTION

Regional anaesthesia includes interesting techniques for ambulatory surgery. The ideal regional anaesthetics include ease of administration, rapidity and control of onset and offset of anaesthesia, minimal side effects and complications, and minimal expense (1).

Low doses of hyperbaric or hypobaric local anaesthetic solutions, directional spinal needles, and lateral decubitus position are used to restrict the spread of spinal anaesthesia to the operative side only. This technique provides high haemodynamic stability, fast recovery from anaesthesia, and high patient satisfaction (2-4). Studies showed that successful unilateral anaesthesia mostly depend on low dose of the local anaesthetic used and longstanding lateral decubitus position (5-6). Although early recovery from spinal anaesthesia is an advantage of unilateral spinal anaesthesia, it may also be disadvantageous because pain may start earlier and spinal anaesthesia may not last long enough for surgery when surgery prolongs. Adjuvant agents may be used to counteract disadvantageous effects of local anaesthetics in conventional spinal anaesthesia (4, 7-8).

The aims of our study were to evaluate whether meperidine would prolong the duration of sensorial block as in conventional spinal anaesthesia (9) to prolong surgery duration and improve the feasibility of strict unilateral block.

MATERIAL AND METHODS

After institutional approval, 46 consenting patients 18-60 years old, ASA physical status 1-3, undergoing unilateral knee arthroscopy were studied. Patients: a) who had contraindication for regional anaesthesia, b) who had severe respiratory and cardiac disease, c) who had diabetes mellitus and d) who had medication for pain were not included into the study.

Patients were randomized to two groups. Groups were named as saline

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Table 1. Demographic data of patients (Mean±SD).

	SP Group (n=20)	MEP Group (n=20)	p value
Age	39±11	43±11	ns
Height (cm)	167±10	163±9	ns
Weight (kg)	75±15	78±9	ns
Duration of surgery (min)	68±25	62±25	ns
Female, %	65.0	75.0	ns
Male, %	35.0	25.0	

ns; non significant

group (SP, n:20) and meperidine group (MEP, n:20).

Medication in SP group was formed by mixing 3.9 ml of hyperbaric bupivacaine (Marcaine® Spinal Heavy, Astra Zeneca, Turkey) and 0.6 ml of saline (0.09% NaCl) and medication in MEP group was formed by mixing 3.9 ml of hyperbaric bupivacaine and 0.6 ml of % 5 (30 mg) meperidine (Aldolan®, Liba, Turkey). Two milliliters of the medications were aspirated into a different 5 ml syringe by the anaesthesiologist who was blinded to the medication.

Patients were not premedicated and hydrated preoperatively. Peroperative hydration included infusion of saline at a rate of 3 ml/kg/hour when the patient arrived in the operating room. Blood pressure, ECG and peripheral oxygen saturation were monitored every five minutes throughout the procedure. If systolic arterial pressure decreased more than 50 mmHg from the initial value or decreased below 90 mmHg, a vasopressor (ephedrine (Efedrin®, Biosel, Turkey)) was administered intravenously. Bradycardia was treated with intravenous atropine if heart rate decreased below 50 beats/min and not hypotensive.

Patients were placed in the lateral decubitus position with the operative side down. After dural puncture at the third lumbar interspace (27 gauge pencil point spinal needle), the distal orifice of the needle was turned toward the dependent side. The local anaesthetic was injected using an “air buffered” technique as described before. (10) In this technique the injector is vertically oriented and medication is connected to the spinal needle by a stop-cock. Aspirated air is buffered over the medication. One and a half milliliters of the medication were injected in two minutes in each group.

After injection of the medication, the patients were kept in the lateral decubitus position for 15 minutes. The operating table was kept horizontally.

Sympathetic, sensory and motor blocks were evaluated on both sides by a blinded anaesthesiologist, every 5 minutes following subarachnoidal injection for 15 minutes and every 15 minutes thereafter. Patients were evaluated until spinal anaesthesia was totally worn off. Sympathetic blockade was determined by temperature method (alcohol aerosol applied to the skin). Sensory blockade was determined by pinprick discrimination (sharp versus dull). Motor blockage was determined by modified Bromage scoring test (0= no motor blockage, 1=flexion of hip is not possible, 2=flexion of hip and knee is not possible, 3=flexion of hip, knee and ankle is not possible but toes move, 4=hip, knee, ankle and toes don’t move).

Surgical anaesthesia was defined as the loss of pinprick sensation at T_{12} on the operated side since knee innervations includes lumbar 2, 3 and 4 segments. (11) Onset and regression of sensory and motor block were compared between groups. Complications during surgery like nausea, vomiting, pruritus, hypotension, bradycardia and analgesic (fentanyl) or sedative (midazolam) that were needed, were also recorded. Pruritus was treated with chlorpheniramine intravenously as required. When the patient complained from pain, fentanyl (Fentanyl®, Abbott, Ireland, 0,5 µg/kg) was applied. If the pain continues, another same dose of fentanyl was applied in 3 minutes. When the restlessness of the patient continued, midazolam (Dormicum®, Roche, USA, 1 mg) was applied to reach 0,05 mg/kg.

Duration of sensory block was defined as the time from intrathecal injection to two-segment regression of block from the highest block level. The quality of spinal anaesthesia was evaluated according to the need for supplementary

Table 2. Level of maximal sensory block on the dependent side.

	Level of maximal sensory block	
	SP (n:20)	MEP (n:20)
T2-T4	0	1
T4-T6	3	3
T6-T8	4	4
T8-T10	5	3
T10-T12	4	7
T12	4	2

Table 3. Bromage scores on the dependent side.

	Scoring of maximal motor block	
	SP (n:20)	MEP (n:20)
Bromage 0	0	0
Bromage 1	0	1
Bromage 2	4	2
Bromage 3	2	2
Bromage 4	14	15

intravenous analgesic and anaesthetics (0 (successful anaesthesia)= no iv analgesic or anaesthetics, 1= analgesic (fentanyl, 1 µg/kg in divided two doses) was needed, 2=sedative (midazolam, 1 mg repeated to reach 0,05 mg/kg) was needed in addition to analgesic, 3(unsuccessful anaesthesia)= propofol and general anesthesia was needed). Patients that were generally anaesthetized with propofol, were excluded from the study.

Strictly unilateral anesthesia was defined as the absence of motor, sensory, and sympathetic block on the nondependent side. (10)

The patients were teached to report pain. Twenty milligrams of tenoxicam (Tilcotil®, Roche, USA) was administered intravenously when they complained pain. Patients were also asked recording their satisfaction with the anesthesia the day after surgery and giving a number satisfaction with the anesthesia as poor, satisfactory or good. The time when the patient first voided was also recorded. Patients were interviewed by phone a week later. Each patient was asked about possible headache or backache and if they would choose the same anaesthesia next time for a next similar operation. Patient satisfaction was also sought at this time. Headache was sought for a postural type. Patients were asked the following criteria for the headache; a) if it was aggravated by erect or sitting position, b) if it was occipital or frontal headache and c) if it increased by coughing. Backache was considered to represent a transient neurological symptom (TNS) if there was pain or dysesthesia in the back or legs, resolved in 72 hours (12). All of the above evaluation methods, which include sympathetic, sensory, motor blocks and adverse effects, were validated in previous studies (5, 13).

Statistical analysis

Sample size was determined prospectively using data from our previous pilot study performed in our institution. Mean of sensorial block time in SP group was 63±23 minutes and 82±17 minutes in MEP group in our pilot study. Anesthesiologist who was performing the study was also blinded to the results of the pilot study. Power analysis indicated that 18 patients per group were required as we have taken the highest standard deviation for both groups ($\alpha=0.05$, $\beta=0.2$). Assuming a potential dropout rate of 10%, we decided to recruit 20 patients per group. Statistical calculations were performed using SPSS 10.0 (SPSS, Chicago, IL, USA). Tests of normality were analyzed with Kolmogorov-Smirnov tests. Student's t test was used when data were normally distributed and Mann Whitney U-test was also used when data were not normally distributed. Dichotomous data were analyzed with the X^2 test and Fischer's exact test. A value of $p<0.05$ was considered significant.

RESULTS

We obtained consent from 46 patients, 20 of whom were randomized to each group. One patient was excluded of the study because of prolonged surgery. Sensory block reaching T12 level that was determined as successful anaesthesia could not be obtained in five patients who were from SP group, so these patients were taken out of the study. Three patients from SP group needed analgesic and one patient from MEP group needed analgesic and sedative during anaesthesia.

Patient characteristics were similar between two groups (Table 1). Block height on the dependent side for highest level of

Table 4. Incidence of adverse intraoperative events.

	SP (n:20) n (%)	MEP (n:20) n (%)	p value
Hypotension	5 (25.0)	6 (30.0)	ns
Pruritis	0 (0.0)	2 (10.0)	ns
Nausea/vomiting*	0 (0.0)	6 (30.0)	0.020
Shivering	2 (10.0)	0 (0.0)	ns

**Nausea/vomiting is listed in all patients of both groups with hypotension. After correction of hypotension 4 (28.5%) in MEP group and 0 (0%) in SP group had nausea/vomiting (p=0.042). ns; non significant*

Table 5. Mean duration of sensory block and percentage of blocks among groups.

	SP (n:20)	MEP (n:20)
Duration of sensorial block (min), Mean±SD	57.3±20.0	83.3±18.5*
Strictly unilateral block, %	50.0	55.0
Bilateral block, %	50.0	45.0

**p:0.000,*

sensory block was T4 in SP group and T2 in MEP group (Table 2). The median level of sensory block was T10 for SP group and T8 for MEP group. Difference between groups was not statistically different (p=0.144). The median of Bromage score was 4 for SP group (0-4) and 4 for MEP group (1-4) (Table 3). The motor block was comparable among groups (p=0.144).

Incidence of adverse intraoperative events is listed in Table 4. Four patients in the MEP group had nausea and vomiting after correction of hypotension compared with none of the patients in the SP group. Nausea and vomiting was significantly high in MEP group (p=0.042).

Mean duration of sensory block was greater in the MEP group compared with the SP group (Table 5). Strictly unilateral block was comparable among groups (p=0.752). Postoperative inquiries are listed in Table 6. The time that patient first complained from pain was not different among groups (p=0.508). In addition, total anesthesia time that was totally worn off, was not different among groups (p=0.589). Postoperative patient satisfaction scores in first postoperative day and a week later were not different in both groups (p=0.602 for first postoperative day and p=1.000 a week later).

No patient in either group showed respiratory depression or had signs of residual neurological effects 24 hours later. One patient from MEP group complained about headache, three patients from SP group and two patients from MEP group complained about backache when inquiry was asked a week later. These symptoms were comparable among groups (p=1.000 for headache and p=1.000 for backache).

DISCUSSION

Adjuvants are administered with local anaesthetics to prolong the duration of anaesthesia or decrease the incidence of adverse effects associated with the technique or the medications. To our

Table 6. Times from the spinal injection to first voiding, pain, subjective feeling of total recovery from the sensory block and anaesthesia scores that are given a day and a week postoperatively.

	SP (n:20)	MEP (n:20)	p value
First voiding time (min), Mean±SD	329.8±96.4	362.3±111.6	ns
First time pain felt postoperatively (min), Mean±SD	246.5±70.1	261.3±69.4	ns
Duration of sensory block totally worn off (Total anaesthasia time) (min)	289.5±99	331±113	ns
Anaesthesia scoring postoperatively (1-3) Median (min,max)	3 (2, 3)	3 (2, 3)	ns
Anaesthesia scoring one week postoperatively (1-3), Median (min,max)	3 (2, 3)	3 (2, 3)	ns

ns; non significant

knowledge, morphine (14) and clonidine (15) were studied as adjuvant agents in unilateral spinal anaesthesia. However, it is noticed that morphine added to hyperbaric bupivacaine may spoil unilateral spinal block (14).

Many different hyperbaric bupivacaine doses are tested in several studies (5-6) without adjuvant agents. It is stated that successful unilateral spinal anaesthesia chance increases when low dose of hyperbaric bupivacaine is used and long stay time is established in lateral decubitus position (3). It was also shown that strict unilateral spinal block chance was increased with the use of an "air buffered technique. (10) We have decided to use 1.3 ml of heavy bupivacaine for unilateral anaesthesia in point of previous studies (6,16). We have also decided to use 10 mg of meperidine for two reasons; a) it was shown that 10 mg of meperidine was effective to prolong sensory block time in conventional spinal anaesthesia (9), b) high doses of meperidine would also increase the final volume of drug mixture and finally decrease the chance of strict unilateral block.

We found that maximal sensory block level and motor block scores were similar among groups. And also strict unilateral block percentages were similar among groups. Our strict unilateral block percentages were similar to the results found by Enk et al (17). In our study, mean sensory block time was significantly increased in MEP group (83.3±18.5 min) compared to SP group (57.3±20.0 min). Although duration of sensory block time is prologed in MEP group, the time the patient felt pain firstly and the time that sensory block was totally worn off, were not statistically different among groups. These results suggest that meperidine added to hyperbaric bupivacaine does not lengthen total anesthesia time (289.5±99 min versus 331±113 min) and does not prolong hospital stay of arthroscopy patients but, provides longer operation time.

As well as the surgical time, the incidence of intraoperative adverse effects like hypotension, pruritus and shivering were not different among groups however, incidence of nausea or vomiting was increased in the MEP group after correction of hypotension. Previous results also suggested that intrathecal meperidine, in doses as low as 10 mg, could increase nausea or vomiting. (9, 18). Increased nausea and vomiting may delay home discharge for outpatient surgery. It is obvious that antiemetic premedication may be used when adjuvant meperidine is used in unilateral spinal anaesthesia. It is also shown that 0.2 mg/kg meperidine that is added to hyperbaric bupivacaine decreases the incidence of shivering in obstetric patients (19).

Meperidine added to hyperbaric bupivacaine in unilateral spinal anaesthesia increase the sensory block time without effecting total anaesthesia time. It is widely available and inexpensive. However, nausea and vomiting incidence is increased with meperidine in outpatient surgery. Thus, this adverse effect may be overcome with antiemetic premedication.

In summary, addition of meperidine to hyperbaric bupivacaine in unilateral spinal anaesthesia prolonged sensory block time without effecting total anesthesia time with minimal adverse effects that may be treated with premedications.

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