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ORIGINAL RESEARCH

The effects of sufentanil added to low-dose hyperbaric bupivacaine in unilateral spinal anaesthesia for outpatients undergoing knee arthroscopy

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ABSTRACT

Background: Outpatient operations are increasingly becoming popular due to a reduction in costs through occupation of fewer hospital beds, minimizing the possibility of hospital-acquired infections; and for the positive effects on patient psychology. Therefore, spinal anesthesia is an acceptable option in surgery for outpatients, as it has a short anesthesia start time, provides an adjustable anesthesia level, postoperative analgesia and early recovery.

Aim & Objective: The aim of this study is to examine the effects of sufentanil added to low-dose hyperbaric bupivacaine in unilateral spinal anaesthesia for outpatients undergoing knee arthroscopy.

Methods: Study design: Experimental study. Study setting: tertiary care centre.
Study duration: Two years …….
Sample size: 62

Results: There were no statistically significant differences observed between the groups in terms of demographic data, hemodynamic parameters, maximum sensorial, sympathetic and motor block levels, time to motor block resolution, and time of discharge (p>0.05). When assessing side effects, three patients in Group BS and one patient in Group B were inserted a foley catheter due to urinary retention (p>0.05)

Conclusions: All patients were successfully given unilateral spinal anaesthesia with sufentanil added to low-dose hyperbaric bupivacaine for an outpatient knee arthroscopy, without affecting the time of discharge. However, for one-day interventions such as arthroscopy, it was concluded that administration of only low-dose hyperbaric bupivacaine was sufficient

Keywords: spinal anaesthesia, sufentanil, low-dose hyperbaric bupivacaine

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INTRODUCTION

Outpatient operations are increasingly becoming popular due to a reduction in costs through occupation of fewer hospital beds, minimizing the possibility of hospital-acquired infections; and for the positive effects on patient psychology.[1,2] The main goal in surgical anesthesia for outpatients is to provide sufficient preoperative anesthesia, and postoperative early recovery. Therefore, spinal anesthesia is an acceptable option in surgery for outpatients, as it has a short anesthesia start time, provides an adjustable anesthesia level, postoperative analgesia and early recovery.[3,4]

In recent years, the "unilateral spinal anesthesia" method has been popular. This method reduces the required amount of anesthetic agent and the incidence of side effects that limiting sensory and motor block within the region requiring anesthesia.[5,6] However, particularly in unilateral spinal anesthesia, insufficient spinal anesthesia was reported to occur when using low-dose local anesthetics. Addition of opioids to local anesthetic agents, due to their synergistic effect, results in enhancement of the quality of analgesia and anesthesia, extension of sensorial block and the reduction of local anesthetic requirement.[7-9]

Therefore, the combined use of low-dose local anesthetic and opioids is beneficial, concerning surgical anesthesia for outpatients.[10,11] However, the addition of opioid to local anesthetic agents may impact the time of discharge and side effect incidence. Particularly, in the case of spinal opioid administration, itching was demonstrated at a high rate of 20% to 80%.[12]

Consequently, the advantage of adding opioid to a low-dose local anesthetic agent in spinal anesthesia is still disputable in short term interventions. The primary objective of current study was to enhance the quality of anesthesia by adding sufentanil to local anesthetic, Our secondary objective was by adding opioid to local anesthetic would shorten discharge time.

AIM AND OBJECTIVE:

OBJECTIVES: The aim of this study is to examine the effects of sufentanil added to low-dose hyperbaric bupivacaine in unilateral spinal anaesthesia for outpatients undergoing knee arthroscopy

MATERIAL AND METHODS

Study design: Experimental study

Place of study - Tertiary health care centre

Study period: Two years from to

Study of group – patients between the ages of 20 and 50, awaiting knee arthroscopy and from the ASA I-II group were enrolled in the study.

Sample size: 62

Inclusion criteria:

1. All patients between the ages of 20 and 50, awaiting knee arthroscopy and from the ASA I-II group were enrolled in the study.

Exclusion criteria

1. Patients with psychiatric problems,
2. bone deformity,
3. infection or chronic skin problems on the knee's skin surface,
4. peripheral neuropathy,
5. diabetes,
6. previously known local anesthetic allergy and coagulopathy, and patients who use an anticoagulant were excluded from the study.

Preoperative assessment and medication:

Pre-anaesthetic evaluation was done on the evening before surgery including complete medical history and physical examination including assessment of vitals, weight and airway examination. History related to previous surgeries, co-morbidities were also taken. Written informed consent was taken.

The following investigations were done in all patients:

1. Complete hemogram
2. Random Blood sugar
3. Blood urea, Serum creatinine
4. Liver function tests

5. Serum electrolytes
6. Coagulation profile containing PT, INR and platelet count
7. Urine routine examination for albumin, sugar
8. Chest X-ray and 12 lead ECG.

All patients were pre-medicated on the night before surgery with Tab Ranitidine 150mg, and Tab Alprazolam 0.25mg, kept NBM for 6 hours. On arrival of the patient in the operation theatre room non- invasive monitors were like NIBP, Pulse oximeter and ECG were attached and baseline readings of HR, SBP, DBP, MAP, SPO2 were recorded. 18G IV cannula was inserted and IV fluids were started. IV fluid and study drug was connected to the cannula using a 3 way connector.

Procedure

Non-invasive artery pressure rates and heart rates (HR) of patients taken to the operating room prior to premedication were monitored through a Hewlett Packard, Viridia 24C monitor, and recorded at 5 minutes intervals during their operation. In all of the patients a vascular access was made available by 18 G branule from the adversary side of extremities to be operated, and an infusion of 10ml/kg 0.9% NaCl was started 15 minutes prior to the operation. Patients were divided into two groups randomly.

Unilateral spinal anesthesia with 1ml 0.5% hyperbaric bupivacaine was administered to Group B (n=33); and unilateral spinal anesthesia with 0.5ml (2.5 μg) sufentanil added to 1ml hyperbaric bupivacaine was administered to Group BS (n=29). The patients in Group B or Group BS were injected within 40 seconds with 1 ml (5 mg) of 0.5% hyperbaric bupivacaine (Marcain 0.5% Heavy®, AstraZeneca) and 1 ml (5 mg) of 0.5% hyperbaric bupivacaine + 0.5 ml (2.5 μg) of sufentatil (Sufenta® 5 μg/ml, Janssen-Cilag), respectively.

Two anesthesiologists took part in current study to ensure blindness. One of them administered the spinal anesthesia, the other one evaluated the study paramaters. Therefore neither the anesthesiologist who made the evaluation nor the patients were aware of the groups. All of the patients were laid down in the lateral decubitis position to have the side of which pathology remains beneath during spinal anesthesia, and the intervention was performed using a 25 G pencil-point spinal needle through L3-4 gap.

The aperture of the spinal needle was turned to the side to be operated. All of the patients were back to supine position after being held in lateral decubitus position for 20 minutes. During the operation, the arterial blood pressure was considered as significant where it was lower than the initial systolic value with more than 30%; fluid replacement (250 ml of 0.9% NaCl, IV infusion in 5 minutes) was performed, and, if necessary, IV 5mg ephedrine was given until the arterial pressure reached normal values.

In case of development of bradycardia (HR Th12) was recorded as the time for the genesis of surgical anesthesia. Pinprick test was used for maximum sensorial block level assessment; whereas cold test tube and Bromage scale were used for maximum sympathetic block level assessment and motor block level assessment, respectively.

Results were recorded individually at 5 minutes intervals. The time in which the sensory block goes two segments down, beginning from the maximum level was recorded as “two segments regression time,” and the time in which motor block was completely removed as “time of block resolution.” The time between local anesthetic administration and urinating without medical aid was recorded as “urination (micturation) time”, the time between local anesthetic administration and proper postoperative walking without dizziness and help as “ambulation time.” and finally, the time of discharge after local anesthetic administration [when reached 9-10 points as per (Postanesthetic Discharge Scoring System PADS)] as “time of discharge”.[13]

Where the patient had analgesic demand and having a VAS score of ≥5, it was recorded as "first analgesic requirement" within the period from the end of the operation until the time of discharge. The patients with analgesia requirement were administered 75 mg of diclofenac sodium IM. The side effects were recorded. Patients were monitored in a postoperative care unit until they were discharged

Statistical analysis

In current study our primary outcome was discharge time. Therefore to reach statistically significant difference between two groups; sample size was calculated by accepting an alpha risk of 5% and a power (1-β) of 80%. From this calculation 25 subjects in each group were found to be necessary for a significant difference. In our study, Chi Square test was used to compare hypotension development, additional fluid need, vasopressor need, and to compare maximum sensorial, sympathetic and motor block levels. The comparison of the onset time of surgical anesthesia, two segments regression time, motor block resolution time, urination time, ambulation and being home periods, additional requirement for analgesia, the incidence of side effects development were performed by using Student T-test. Variance analysis (Anova test) was applied for repetitive measurements of hemodynamic data. Paired comparisons of measurement times were performed using Bonferroni correction. P<.05 consider as a significant.

RESULT AND OBSERVATIONS

A total of 62 patients were included in the study. There was no statistically significant difference between groups in terms of demographic characteristics of the patients (Table 1).

Table 1: Demographic data

Group	**Gender Male Female**	**Age in year Mean SD**	**Weight Mean SD**	**Height Mean SD**
Group B	16 14	37.6±8.9	74.1±13.8	166.6±8.6
Group BS	10 19	38.4±9.9	77.5±14.7	168.5±9.9

The onset time of surgical anesthesia was determined as 11.1±3.48 min. in Group B, while as 11.2±3.22 min. in Group BS (p>0.05). There were no statistically significant differences between groups in terms of sensorial, sympathetic and motor block levels (p>0.05) (Table 2).

Table 2: Maximum sensorial block, sympathetic block and motor block levels of the groups

	Group B (n=30)		**Group B (n=7)**		**Group BS (n=29)**		**Group BS (n=7)**	
	operated side		**Non-operated side**		**operated side**		**Non operated side**	
Maximum sensorial block leve	N	%	N	%	N	%	N	%
Th 6	2	6.7%	0	0	3	10.3	0	0
Th 8	4	13.3	0	0	5	17.2	0	0
Th 10	24	80	2	28	18	62.1	2	28
T12	0	0	4	57	3	10.3	5	72
L 1	0	0	1	15	0	0	0	0
Maximum sympathetic								

block level								
Th 6	1	3.3	0	0	0	0	0	0
Th 8	6	20	0	0	7	24.1	0	0
Th 10	17	56.7	0	0	13	44.8	3	43
T12	6	20	6	85	9	31.1	3	43
L 1	0	0	1	15	0	0	1	14
Motor block degree								
1st degree block	0	0	3	43	0	0	4	57
2nd degree block	1	3.3	4	57	2	6.9	3	43
3 rd degree block	29	96.7	0	0	27	93.1	0	0

Three patients in Group B experienced tourniquet pain due to insufficient spinal anesthesia, and they were excluded from proceeding to general anesthesia, therefore 29 patients in Group BS and 30 patients in Group B were evaluated. There was no statistically significant difference between groups in terms of spinal anesthesia sufficiency ($p>0.05$). Although the patients were kept in lateral decubitus position for 20 minutes, seven patients in both groups (~23%) developed sensorial, sympathetic and motor blocks also on the non-operated side (bilateral) ($p>0.05$) (Table 2).There were no statistically significant differences between two groups in terms of hemodynamic parameters ($p>0.05$). One patient in Group BS experienced hypotension, requiring treatment during operation.

Table 3: Side effects

Side effects	**Group B**		**Group B**	
	N	**%**	**N**	**%**
Itching	0	0	7	24.7
Urinary retention	1	3.3	3	10.3
Respiratory depression	0	0	0	0

When assessing side effects, three patients in Group BS and one patient in Group B were inserted a foley catheter due to urinary retention ($p>0.05$). Those four patients were assessed in terms of urinary retention, and excluded from statistics during urination time measurements. Including urticaria in one of the patients in Group BS, and light erythema in another, a total of seven patients (24.7%) experienced itching, and there was a statistically significant difference when compared with Group B

patient's itching reached at a level to require medication or to develop extreme disturbance, except one. In Group B, two patients needed additional analgesia, but there was no statistical significant difference between groups in terms of additional analgesic need ($p>0.05$). No respiratory depression developed in either of the groups.

DISCUSSION

In current study, a sufficient anesthesia level without any problems was achieved at a rate of 90% by 5 mg bupivacaine alone in unilateral spinal anesthesia for outpatients undergoing knee arthroscopy, and also a sufficient anesthesia was provided for all of the patients without elongating the discharge time when 2.5 μg sufentanil is added to 5 mg bupivacaine.

Although unilateral spinal anesthesia is applied intensively in knee arthroscopy, there remains ongoing debate on the optimal local anesthetic dose.[14-16] In studies by Casati et al.[17] 5-8 mg of 0.5% of hyperbaric bupivacaine was reported to be sufficient, and 60-80% successive unilateral spinal anesthesia was reported at those doses, and a spinal block was reported to be provided for 50-120 minutes at Th10 level.

It has been shown that 7.5 mg 0.5% hyperbaric bupivacaine, levobupivacaine, ropivacaine along with 5 mg 0.5% hyperbaric levobupivacaine may be used in knee arthroscopy.[15] In this study, unilateral spinal anesthesia was performed using 5mg of 0.5% hyperbaric bupivacaine as a low-dose local anesthetic.

We provided sufficient anesthesia to Group B patients at a rate of 90% and Group BS patients at a rate of 100%. Kuusniemi et al.[18,19] compared the effects of lowdose 0.5% isobaric bupivacaine (1.2 ml=6 mg) and 0.18% hypobaric bupivacaine (3.4 ml=6.1mg).

In the literature, there are also studies indicating that reducing the local anesthetic dose increases the incidence of unsuccessful unilateral spinal anesthesia.

Valanne et al.,[16] in their study involving 106 patients, found insufficient blocks in two patients to whom 4 mg hyperbaric bupivacaine was administered, and in one patient to whom 6 mg hyperbaric bupivacaine was administered. Also, in our study, three of the patients in Group B to whom no opioid was added had insufficient spinal anesthesia and general anesthesia was therefore administered. There was no statistically difference was found in terms of sufficient spinal anesthesia in our study between the two groups.

Itching, unfortunately, is a well-known side effect of IT opioid. There is a correlation between itching and the sufentanil dose used.[20] Demiraran et al.[20] have used three different doses of sufentanil, 1.5, 2.5 and 5 μg, and they have determined 4%, 24%, and 32% rates of itching, respectively.

CONCLUSION

All patients were successfully given unilateral spinal anaesthesia with sufentanil added to low-dose hyperbaric bupivacaine for an outpatient knee arthroscopy, without affecting the time of discharge. However, for one-day interventions such as arthroscopy, it was concluded that administration of only low-dose hyperbaric bupivacaine was sufficient.

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