






## Research Article

# Comparison of the postoperative analgesic efficacy of ultrasound-guided suprainguinal fascia iliaca block applied with two different concentrations of bupivacaine in patients undergoing hip surgery under spinal anesthesia

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## ABSTRACT

**Aim:** Management of postoperative pain in hip surgeries is important for the quality of recovery. When regional anesthesia techniques are added to the multimodal analgesia plan, they increase the effectiveness of the analgesia plan. Supra-inguinal fascia iliaca block (SIFIB) is a technique that has been reported to be effective in hip surgery but requires the use of high-volume local anesthetics. Our aim in this retrospective study is to investigate the efficacy of local anesthetic in SIFIB when administered at a concentration lower than the conventional concentration.

**Method:** The files of the patients who underwent hip hemiarthroplasty were planned to be evaluated retrospectively. Patients were grouped according to the bupivacaine concentration used in SIFIB (0.25% vs. 0.20%) and statistically evaluated in terms of morphine requirement, pain scores, and time to first analgesic.

**Results:** There was no significant difference between the groups in terms of NRS score and cumulative morphine consumption at the 3rd, 6th, 12th, 18th, and 24th hours ( $p > 0.05$ ). When compared the first analgesia requirement times, there was no significant difference between Groups ( $p > 0.05$ ).

**Conclusions:** A single shot SIFIB administered at a concentration of 0.20% also has analgesic properties, as do the conventional concentration of SIFIB containing 0.25% bupivacaine.

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## 1. Introduction

A hip replacement surgery involves replacing a damaged or worn part of the hip joint with an artificial prosthesis [1]. This surgery is typically performed to treat conditions such as osteoarthritis, hip fractures, and other hip problems. After the surgery, patients may experience varying levels and types of pain, depending on

the type of surgical procedure and incision used [2]. The pain can be caused by several factors related to the surgical procedure, including tissue damage at the site of the surgery, stretching and straining of muscles during implant placement, and swelling of tissues after the surgery [3]. However, there are many different methods of pain management available to help reduce postoperative pain. These methods include both opioid and non-opioid

pain relievers, as well as peripheral or interfascial plane blocks and intra-articular injections [2]. The choice of pain management method depends on several factors, such as the patient's individual condition, the level of pain experienced, and the risk of post-surgical complications.

Regional anesthesia techniques such as epidural analgesia, lumbar plexus block, and conventional fascia iliaca block can be used for postoperative analgesia in patients undergoing total hip arthroplasty. Suprainguinal fascia iliaca block (SIFIB) was defined by Hebbard et al. [4] in 2011 as a simple, safe and easy technique that allows 'anterior blockage of the lumbar plexus'.

In this study, our aim was to investigate and compare the postoperative analgesic efficacy of SIFIBs administered with different local anesthetic concentrations at the end of surgery in patients undergoing hip surgery under spinal anesthesia.

## 2. Materials and Methods

Local ethics committee approval (SUKAEK 2022/7/12) was obtained for this retrospective study. The data of patients between the ages of 35-90, who underwent hip hemiarthroplasty procedure under spinal anesthesia at Samsun University Samsun Training and Research Hospital between January 2022 and August 2022, with physiological class I-III of the American Society of Anesthesiology (ASA) were analyzed retrospectively.

Patients who received SIFIB for postoperative analgesia and were given a patient-controlled analgesia (PCA) device with morphine in the postoperative analgesia protocol were included in the study. Exclusion criteria were defined as allergic reaction to local anesthetics, infection at the injection site, patients under the age of 18 years of age and ASA score over III, presence of cognitive dysfunction that may affect pain assessment'. All patients included in the study received the same anesthesia (spinal anesthesia) and preoperative and postoperative analgesia protocols 'except for SIFIB concentration.

Descriptive data such as age, gender, weight-height, and operation time of the patients were collected. In addition, data on postoperative pain evaluation such as block concentration used, time to first analgesia requirement, pain intensity at specified intervals, and use of analgesia at certain intervals were collected.

### 2.1. Standard anesthesia and analgesia protocol

We have standardized protocols for anesthesia and analgesia in patients undergoing hip surgery under spinal anesthesia in our clinic, and the standard protocol detailed below was applied to all patients included in the study.

To ensure consistency in anesthesia and perioperative pain management for all patients, data was collected using a standardized protocol. During surgery, vital signs such as electrocardiogram, noninvasive blood pressure, and peripheral oxygen saturation were closely monitored. Spinal anesthesia was performed in the sitting po-

sition using a 26-gauge spinal needle at the L3-L4/L4-L5 level with 2.5-3 mL of 0.5% heavy bupivacaine for surgical anesthesia, without any additional adjuvant drugs. The surgery began after confirming a sensory block at the T10 level through a pinprick test. The surgical team did not use infiltrative analgesia for the surgical site. After surgery, patients were given 1 g of intravenous paracetamol and 50 mg of intravenous dexamethasone.

In the ward, patients received 1 g of intravenous paracetamol every 8 hours and 50 mg of intravenous dexamethasone every 12 hours. Patient-controlled analgesia (PCA- BodyGuard 595, Pain Manager infusion pump, Israel) was initiated in the recovery room immediately after the performance of block procedure. PCA used morphine with a concentration of 0.3 mg/ml and a total volume of 100 ml, with a bolus dose of 1 mg and a lock-in time of 20 minutes. The 4-hour limit was set as 10 mg. There was no basal infusion. Patients were instructed to request analgesia when their Numeric Rating Scale (NRS) score was 4 or greater. The NRS score is a tool used to measure the intensity of pain in adults. It uses a numerical scale ranging from 0 to 10, with the patient selecting the integer that best describes their level of pain. The scale ranges from 0, indicating no pain, to 10, indicating the worst imaginable pain, while ensuring that the patients were not interrupted during their inhalation. If the NRS score remained at 4 or above despite the use of PCA in the first 24 hours, 25 mg of intravenous meperidine was administered as rescue analgesia. The total amount of morphine consumption was recorded at 3rd, 6th, 12th, 18th, and 24th hour intervals.

During the first 24 hours following surgery, the patients' pain levels were assessed at rest using the Numeric Rating Scale for static pain (NRS-S) at 3rd, 6th, 12th, 18th, and 24th hours.

### 2.2. Performance of SIFIB

In our clinic, SIFIB is performed for postoperative analgesia in the block room, in the supine position at the end of the surgery. All applications were performed by or under the supervision of an anesthesiologist (ST) experienced in regional anesthesia with ultrasound guidance. An in-plane technique and a high-frequency linear transducer (10-18 MHz, Esaote MyLab™30 Gold Genoa, Italy) were used to perform the block. The transducer was placed obliquely on the inguinal crease. Femoral artery, femoral nerve, fascia iliaca and iliacus muscle were identified.

The transducer was moved laterally and the fascia iliaca was identified between the sartorius muscle and the iliacus muscle. The 'bow-tie mark' was determined by rotating and sliding upward the transducer in the oblique plane. The block needle (Vygon Echoplex, 85 mm, 21 G, Ecoen, France) was inserted caudally and advanced into the space between the fascia iliaca and iliacus muscle. Hydrodissection was performed with 1 ml of saline, 50 ml of 0.25% or 0.20% Bupivacaine was administered slowly when the spread was determined to be in the correct location. Local anesthetic was confirmed to diffuse into the area just below the deep circumflex artery.

The preference for low concentration bupivacaine (0.20%) was not intentionally made in the patients included in this study. At a time when the commercial availability of bupivacaine was limited, this trend was made in order to provide analgesia to more patients.

**2.3. Statistics**

The openepi.com website was used for statistical analysis. The Kolmogorov-Smirnov test was used for normality assessment. Mean and standard deviation and/or median and interquartile range (25th and 75th percentiles) were used to present descriptive data. Mann-Whitney U test was used to compare continuous variables, and Chi-square test was used to compare rates (with Yates correction). Fisher's exact test was used to compare categorical variables (ASA classification, gender, etc.). Statistical significance threshold was determined as  $p < 0.05$ . Bonferroni correction was used for the analysis of NRS scores and statistical significance was set at  $p < 0.001$  due to measurements from 5 time points.

**3. Results**

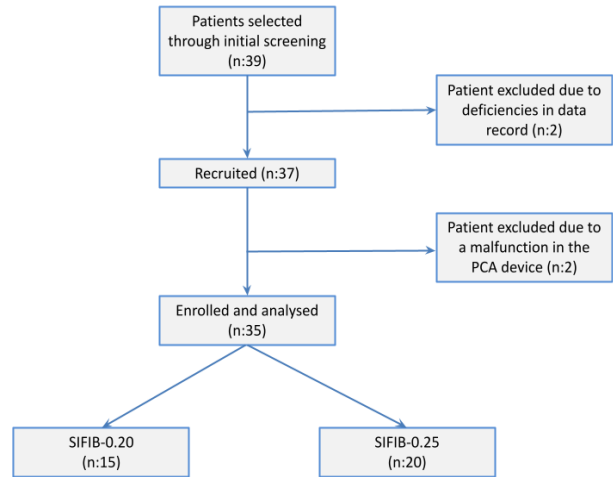
Between the specified dates, the data of 39 patients who met the criteria for inclusion in the study were collected. Two patients were excluded from the study due to lack of data in the records and 2 patients were excluded due to PCA device malfunction. All patients received SIFIB in a volume of 50 ml (n: 35). Bupivacaine concentration was 0.20% in 15 patients and 0.25% in 20 patients. When the patients were grouped as SIFIB-0.20 and 0.25, there was no statistical difference in descriptive data such as age, gender, ASA score, height, weight ( $p < 0.05$ ) (Table 1). Flow diagram of our study is presented in Fig. 1.

**Table 1.** Comparison of age, gender, ASA classifications, height and weight between groups.

	SIFIB-0.20 (n: 15)	SIFIB-0.25 (n: 20)	p
Age (years)	56.3±12.9	63.9±11.5	0.09
Gender F/M	12/3	12/8	NA
ASA II/III	15/0	15/5	NA
Height (cm)	162.3±5.8	163.9±10.7	0.57
Weight (kg)	73.2±8.6	74.8±10.5	0.62

The data are presented as mean ± standard deviation or number.

In addition, there was no significant difference in NRS score and cumulative morphine consumption between the groups at the 3rd, 6th, 12th, 18th, and 24th hours ( $p > 0.05$ ). When the first analgesia requirement times were compared, there was no significant difference between Group-0.20 and Group-0.25 (221.3±112.8 and 216.7±123.1 minutes, respectively,  $p > 0.05$ ) (Table 2, Fig. 2). Rescue analgesics were not required in both groups, our multimodal analgesia regimen was sufficient.

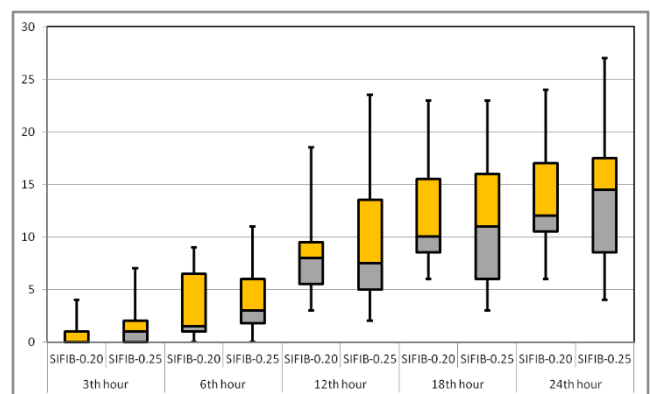


**Fig. 1.** The process from initial identification of patient files to inclusion is demonstrated.

**Table 2.** Comparison of groups in terms of pain intensity and cumulative opioid requirement.

	SIFIB-0.20 (n: 15)	SIFIB-0.25 (n: 20)	p
<b>NRS-S</b>			
3th hour	0(0-2.5)	2(0-4)	0.52
6th hour	3(2-4.5)	3.5(2-5)	0.44
12th hour	4(3-5.5)	3(1-4.3)	0.09
18th hour	4(3.6-5)	4(3-4.3)	0.20
24th hour	3(2-3.5)	4(3-5)	0.34
<b>Cumulative morphine Consumption (mg)</b>			
3th hour	0(0-1)	1(0-2)	0.24
6th hour	1(1-6.5)	3.5(1.75-6)	0.66
12th hour	8(5.5-9.5)	7.5(5-11)	0.82
18th hour	10(8.5-13.5)	11(6-16)	0.95
24th hour	12(10.5-17)	14.5(8.5-17.5)	0.92
The first analgesic demand time (minutes)	221.3±112.8	216.7±123.1	0.91

The data are presented as mean ± standard deviation or the median (percentiles 25-75).



Y axis: cumulative morphine consumption (mg), X axis: time frames, Box and lines indicate min, 1st quartile, median, 3rd quartile and max values.

**Fig. 2.** Box plot demonstration of morphine consumption at different time frames between groups.

#### 4. Conclusions

Our study has shown that there was no difference in terms of postoperative analgesic properties between the use of bupivacaine at a concentration of 0.25% and the relatively lower concentration of 0.20% used in SIFIB performed at the end of hip surgery under spinal anesthesia. Postoperative pain scores, cumulative morphine requirements in PCA, and time to first analgesic requirement were similar between groups.

The postoperative efficacy of SIFIB in hip surgery has been demonstrated by several clinical studies [5–7]. In fact, there are articles reporting its use in hip fractures before spinal anesthesia for the purpose of relieving positioning pain [8]. However, in these studies, the local anesthetic concentration for bupivacaine is 0.25% in almost all single-shot SIFIB applications.

Using a low concentration of local anesthetic in peripheral nerve blocks and fascial plane blocks will both reduce the cumulative dose and therefore reduce the complication rate [9]. With low concentrations, it can be logically said that motor blockade can be observed relatively less [10]. The issue of providing safer analgesia by eliminating the risk of motor blockade with the use of bupivacaine in low concentrations has been well demonstrated in epidural analgesia [11]. Unfortunately, this clear distinction has not been sufficiently studied in fascial plane blocks and nerve blocks.

Being able to reduce local anesthetic concentrations gains importance especially in blocks such as SIFIB, where 40–50 mL of local anesthetic is used, which are desired to be spread over a large surface area. SIFIB is a volume dependent block like other fascial plane blocks. Studies have shown that high volumes are required (40 ml to 62.5 ml) to block all three of the femoral, obturator, and lateral femoral cutaneous nerves [12–14]. Lower concentrations become even more important when an additional block is required, or bilateral block is required.

Our study has some limitations. First, it is relatively bias-prone due to our retrospective design. Another limitation is the absence of an evaluation of the quadriceps weakness of the patients. Unfortunately, we could not perform dermatome analysis or skin mapping, as we performed the block procedures under spinal anesthesia. Both the duration of the first analgesia longer than expected and the lower analgesia requirement according to our clinical experience were two indirect indicators of block success. In our hospital, orthopedists do not recommend mobilization for the first 24 hours in hip surgeries. Therefore, we were not able to look at the NRS-dynamic values. This can be taken into account as another limitation of our study.

In conclusion, single shot SIFIB performed at relatively lower concentrations also has analgesic properties like the usual concentration of SIFIB with 0.25% bupivacaine.

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#### Conflict of Interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this manuscript.

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