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The effects of ilioinguinal nerve block on acute and chronic neuropathic pain in patients following inguinal hernia repair with spinal anesthesia: A prospective cohort study

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All procedures in this study involving human participants were performed in accordance with the 1964 Helsinki Declaration and its later amendments.

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No conflict of interest was declared by the authors.

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Abstract

Background/Aim: Post-surgical pain is a major factor affecting the quality of life of patients. This study aims to investigate the effectiveness of ilioinguinal block on acute and chronic neuropathic pain after inguinal hernia surgery with spinal anesthesia.

Methods: This prospective cohort study included sixty ASA I-III patients aged 18-65 years, who underwent a unilateral inguinal hernia operation. The patients were divided into two groups: Those who received spinal block only (Group 1, n=30), and those who received spinal and ultrasound-guided ilioinguinal nerve block (Group 2, n=30). The perioperative and postoperative complications, Visual Analogue Scale (VAS) scores on rest and Leeds Assessment of Neuropathic Symptoms and Signs (LANSS) scores at the postoperative 2nd, 6th, 12th, and 24th hours, and in the 3rd and 6th months were noted.

Results: No significant difference was observed in the time of first analgesic administration among the groups, but tramadol use significantly reduced in Group 2 (P=0.019). Time until mobilization and discharge was significantly shorter among the Group 2 patients (P<0.001, P=0.021, respectively). Visual Analogue Scale scores at rest at the 12th and 24th hours, and in the 3rd and 6th months were significantly less in Group 2 (P=0.032, P=0.005, P=0.022, P=0.008, respectively). Leeds Assessment of Neuropathic Symptoms and Signs scores of the patients at the 24th hour, 3^{rd,} and 6th months were significantly lower in Group 2 (P<0.001, P<0.001, P=0.012, respectively).

Conclusion: We think that ilioinguinal nerve block with spinal anesthesia is a successful and reliable technique for acute postoperative and chronic neuropathic pain management in unilateral inguinal hernia repair.

Keywords: Inguinal hernia, Spinal anesthesia, Ilioinguinal nerve block, Chronic pain, Neuropathic pain

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Introduction

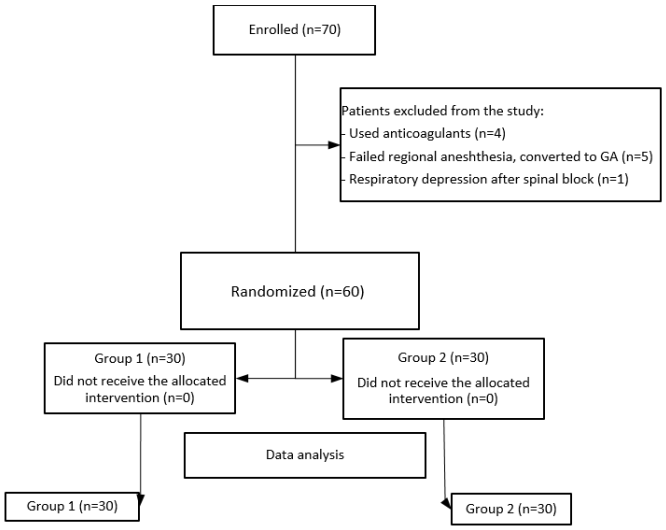
One of the most popular outpatient procedures is inguinal hernia repair. Chronic pain is a frequent complication of this procedure that places a significant financial strain on medical care and health services, causes depression and anxiety, limits daily activities, and increases painkiller use. Postoperative chronic pain incidence varies between 6-54% in numerous studies [1]. After inguinal herniorrhaphy, 5-10% of patients experience pain which makes it difficult to perform daily tasks [2]. While the actual source of this persistent discomfort is unknown, ilioinguinal nerve entrapment or trauma could be the leading reasons [3]. According to research, postoperative and preoperative pain, weight, age, anesthetic method, recurrence, and surgical approach are among the risk factors for postoperative pain [4]. Chronic postoperative pain indicates neuropathic pain that lasts for at least 3 months after the surgery, despite the healing of the surgical site [5]. Although many oral opioids and/or non-steroid agents can be utilized in the cure of chronic pain, regional anesthesia approaches have become popular due to increased systemic side effects. Regional nerve blocks are becoming increasingly common for postoperative pain management, allowing faster ambulation and discharge. Blocks of the iliohypogastric and ilioinguinal nerves (IHN/IIN) are two of the most often utilized regional blocks for analgesia after an inguinal hernia operation. Moreover, they are proven to considerably decrease discomfort related to herniorrhaphy [6]. Ultrasound-guided (USG) nerve block allows for precise needle placement, which may minimize the risk of drug toxicity and overdose, and block failure. This research aimed to explore the effects of ilioinguinal nerve block in addition to spinal anesthesia on postoperative chronic and acute neuropathic pain.

Materials and methods

Study design

Sixty ASA I-III patients aged 18-65 years, who underwent unilateral inguinal hernia surgery and gave consent were included in this prospective cohort study, which was approved by the Clinical Research Ethics Committee of Uludag University (approval number: 2017-17/24). The Clinical Trials number of the study is NCT04295629. Open anterior surgical treatment was performed on all patients with the Lichtenstein method. All patients received spinal anesthesia in the sitting position. With the closed envelope technique, the patients were split into two groups randomly: Thirty patients received spinal anesthesia only with 15 mg 0.5% hyperbaric bupivacaine (Group 1) to the subarachnoid gap, and the other thirty were administered 10 ml 5% bupivacaine during ultrasound-guided ilioinguinal block after the surgery in the reanimation unit, in addition to the prior spinal anesthesia (Group 2). Patients undergoing recurrent inguinal hernia surgery, those with failed spinal anesthesia or ilioinguinal block, those who had an infection at the site of intervention, patients with dysregulated hyperglycemia, bleeding diathesis, and history of neuropathic pain were excluded from the study. Permission forms were signed by 70 informed patients, who were originally recruited in the research after the exclusion criteria were implemented. Nevertheless, for a variety of reasons, such as switching to general anesthesia when spinal anesthesia failed (n=5), use of anticoagulants (n=4), and the development of respiratory depression after spinal block (n=1), ten patients were omitted from the research (Figure 1). Mean Arterial Pressure (MAP), Saturation of Peripheral Oxygen (SpO2), perioperative and postoperative complications, and Heart rate (HR) were recorded for both groups. The patients were interviewed at the postoperative 2nd, 6th, 12th, and 24th hours at the bedside and the 3rd and 6th-month follow-ups. The Visual Analog Scale (VAS) at rest was used to investigate chronic pain and Leeds Assessment of Neuropathic Symptoms and Signs (LANSS) tests were utilized to determine the neuropathic character of pain. A standard postoperative analgesia regimen was used within the first 24 hours. Patients who had a VAS score of ≥4 within the first 24 hours following the surgery were given tramadol (1 mg/kg) intravenously. The Visual Analog Scale scores at rest, the dose of tramadol, hospitalization duration, the first mobilization time, and postoperative complications were recorded. A VAS score of ≥ 4 at least three months following the operation was considered chronic pain and a LANSS score of ≥12 indicated that the pain was likely neuropathic.

Figure 1: Flow chart of the study



Spinal anesthesia technique

After routine monitoring, spinal anesthesia was performed with 15 mg 0.5% hyperbaric bupivacaine injection by a pen-tipped (M. Schilling) 25 G needle from the L3-4 subarachnoid space under sterile conditions and a proper body position in all patients. After achieving sensory blockage at the T10 level, surgery began. The sensory blockade was determined with the pin-prick test.

Ilioinguinal Nerve Block Technique (IINB)

The ilioinguinal block was performed using a high frequency, linear 10 MHz or greater ultrasound probe (GE Healthcare Logiq P5, USA) while the patient is lying down in the supine position. The probe was obliquely positioned along the line connecting the umbilicus and the anterior superior iliac spine. Ten milliliters of 5% bupivacaine were administered by a needle to patients in Group 2 postoperatively, after locating the region between the transversus abdominis and internal oblique muscles, towards the iliohypogastric and ilioinguinal nerves, which were observed as two circular hypoechoic structures near one another.

Visual Analog Scale (VAS)

The VAS is a commonly used pain severity outcome measure that is responsive, valid, and reliable [7]. It includes a ten cm bidirectional straight bar with two tags at either end, namely, "worst possible agony" and "no pain." Patients are encouraged to make a sign on the bar to indicate the level of their pain [8].

Leeds Assessment of Neuropathic Symptoms and Signs (LANSS)

LANSS is one of the neuropathic pain assessment scales. The LANSS is a seven-item pain scale with a simple scoring procedure that comprises a grouped sensory assessment and sensory description. The first section consists of five questions: Skin color changes (pink, mottled, or red), the existence of troublesome skin sensations such as prickling and needles or pins, pain bursts for no apparent cause, and heightened skin sensitivity to touch. An altered pinprick threshold and the existence of allodynia are assessed in the second phase by comparing non-painful and painful areas. Scores of ≥12 almost certainly indicate neuropathic pain. The LANSS has a specificity and sensitivity of 80% and 85%, respectively [9].

Statistical analysis

The results were analyzed with IBM SPSS 23.0 statistics package program. The power analysis of 60 patients, with $\alpha = 0.05$, and an effect size of 0.6 yielded a power of $(1-\beta) = 0.80$. The data were evaluated with descriptive methods (mean, frequency, standard deviation, percentage, min-max, median). The student t-test and Chi-Square (2) test were used in the comparison of qualitative data. $P<0.05$ was considered significant.

Results

The demographic and hemodynamic data of 60 patients were similar (Tables 1 and 2).

Table 1: Demographic data

	Group 1	Group 2	*P*-value
Age (years)	62.96 (7.25)	59.76 (11.08)	0.19
Gender (M/F)	24/6	26/4	0.11
BMI (kg/m^2)	28.23 (2.58)	27.20 (2.76)	0.13
ASA I/II	9/21	10/20	0.78

BMI: Body Mass Index, ASA: American Society of Anesthesiology

Table 2: Comparison of the groups' hemodynamic parameters

	Group 1	Group 2	*P*-value
HR			
0 hours	77.96 (12.78)	83.13 (13.48)	0.113
1 hour	81.50 (11.02)	82.23 (11.69)	0.802
2 hours	64.33 (16.13)	64.26 (15.78)	0.236
MAP			
0 hours	94.10 (11.66)	91.43 (6.17)	0.273
1 hour	90.64 (9.40)	89.03 (6.77)	0.443
2 hours	81.06 (22.49)	88.26 (17.47)	0.711
SpO_2			
0 hours	98.26 (0.73)	98.46 (0.86)	0.330
1 hour	98.10 (0.72)	98.13 (1.04)	0.882
2 hours	97.90 (1.32)	98.23 (1.35)	0.342

HR: Heart Rate, MAP: Mean Arterial Pressure, SpO_2: Peripheral Oxygen Saturation, *$P<0.05$, ** $P<0.001$, Student t-test

While there was no significant difference in the time of the first analgesic administration among the groups, tramadol dose used was significantly less in Group 2 ($P=0.019$) (Table 3). Time until mobilization and discharge was significantly shorter among the Group 2 patients ($P<0.001$, $P=0.021$, respectively) (Table 3). Visual Analogue Scale scores at rest at the 12th and 24th hours, and in the 3rd and 6th months were significantly less in Group 2 ($P=0.032$, $P=0.005$, $P=0.022$, $P=0.008$, respectively) (Table 4). Leeds Assessment of Neuropathic Symptoms and Signs scores of the patients at the 24th hour, 3^{rd,} and 6th months were significantly lower in Group 2 ($P<0.001$, $P<0.001$, $P=0.012$, respectively) (Table 4). No complications were observed perioperatively or postoperatively.

Table 3: Comparison of groups first analgesic times, tramadol dose, mobilization, and hospitalization durations

	Group 1	Group 2	*P*-value
First analgesic time (h)	5.33 (1.68)	5.23 (0.93)	0.772
Tramadol dose (mg)	140.0 (62.14)	103.33 (55.60)	0.019*
Mobilization (h)	5.83 (1.08)	4.80 (0.76)	<0.001
Hospitalization (h)	22.70 (5.46)	19.33 (5.56)	0.021*

*$P<0.05$ Student t-test, h: Hour, mg: Milligram

Table 4: Comparison of VAS on rest and LANSS values of the groups

	Group 1	Group 2	*P*-value
VAS			
2(h)	0.00 (0.00)	0.26 (1.01)	1.153
6(h)	4.46 (1.36)	4.00 (1.36)	0.620
12(h)	5.90 (1.24)	4.90 (1.14)	0.032*
24(h)	3.46 (1.22)	3.63 (0.99)	0.005*
3(m)	1.20 (1.29)	0.53 (0.86)	0.022*
6(m)	0.86 (1.04)	0.23 (0.72)	0.008*
LANSS			
2(h)	0.00 (0.00)	0.16 (0.91)	0.322
6(h)	4.83 (2.93)	3.60 (2.09)	0.062
12(h)	7.80 (3.38)	5.90 (2.69)	0.196
24(h)	9.73 (3.85)	5.56 (4.62)	<0.001
3(m)	9.03 (4.20)	5.46 (5.66)	<0.001 0.012*
6(m)	8.38 (3.93)	5.03 (5.69)	

VAS: Visual Analog Scale, LANSS: Leeds Assessment of Neuropathic Symptoms and Signs, h: hour, m: month, *$P<0.05$ Student t-test

Discussion

In this study, significantly lower doses of tramadol, earlier mobilization, short hospitalization time were observed in patients who received IINB in addition to spinal anesthesia. VAS scores at rest at the 12th and 24th hours, and in the 3rd and 6th months, as well as LANSS scores at the 24th hour, 3rd and 6th months, were lower in Group 2.

Open inguinal hernia surgery is among the most performed surgeries throughout the world, with general or regional anesthesia approaches. Postoperative pain may be related to surgical technique, the psychosocial structure, and the physiology of the patient [10]. The distribution of the iliohypogastric and ilioinguinal nerves causes parietal discomfort after hernia surgery. Studies on the localization and character of chronic pain after herniotomy indicate that this pain is a neuropathic pain syndrome related to sensorial disorder symptoms [11]. However, whether the underlying physiopathological process is a consequence of an intraoperative direct nerve injury or an indirect nerve injury related to the inflammatory response to mesh, is yet unknown. IL/IH or TAP nerve blocks were shown to minimize immediate post-operative pain, the need for extra analgesics, and the risk of persistent discomfort after hernia surgery [12, 13].

Santos et al. [6] assessed postoperative pain, analgesic consumption amounts, and time of discharge in their adult inguinal hernia treatment patients who received spinal anesthesia (SA) and iliohypogastric nerve block (IHNB)+SA. Postoperative VAS scores and amounts of analgesics used were lower and the time of discharge was earlier. Similarly, another study compared the postoperative pain and the need for analgesics of adult patients with SA and SA+IHNB in inguinal hernia surgery and indicated that IHNB with SA decreased postoperative pain and the need for analgesics for nearly six hours [21]. Gurkan et al. [14] compared SA and II/IHNB in patients who underwent unilateral inguinal hernia repair and found that the patients were

first mobilized about 150 min earlier with II/IHNB, and sensory block lasted 145 minutes longer. Our study was compatible with similar studies, as IINB in addition to spinal anesthesia resulted in a decrease in the amount of tramadol use, early patient mobilization, and discharge. VAS values were significantly higher at the 12th hour in the spinal anesthesia group, which may be associated with the wear-off of the spinal block. The ilioinguinal block yields a more prolonged sensorial block. We also think that ilioinguinal block administration provides a significant decrease in VAS values at the postoperative 12th hour.

The effects of different anesthesia and analgesia techniques on postoperative chronic pain are still not clear. In a study comparing general anesthesia combined with IHNB and SA+IHNB, the combination of IINB with spinal anesthesia provided only a short and sudden analgesia [15]. Patients who received general anesthesia were discharged earlier from the hospital than those who received SA. Unlike our study, Yılmazlar et al. [16] compared SA and IHNB separately to determine the optimal technique of anesthesia on 126 adult patients who underwent inguinal hernia surgery. IHNB was performed with 40 ml of 0.25% bupivacaine, and SA was performed with 3 ml of 0.5% hyperbaric bupivacaine. They found that patients who underwent IHNB were fed orally and discharged earlier. Sakalli et al. [21] evaluated the effect of GA+IHNB on postoperative pain and analgesic consumption elective cesarean section and showed that VAS scores, as well as the analgesic consumption of the IINB group, were significantly lower than those who received GA only. They stated that IHNB was a successful and preferable technique in acute pain treatment. Chronic pain was not assessed in this study. Studies comparing iliohypogastric block with other blocks reported that Transversus Abdominis Plane Block (TAP) decreased acute postoperative pain, the need for analgesics, and chronic pain incidence [12]. There are many different opinions about the superiority of these blocks to one another. Avleine et al. [17] showed that VAS scores of the patients who underwent inguinal hernia repair with TAP were lower within the first postoperative 24 hours than those who received IHNB. The pain scores at the 3rd and 6th postoperative months were similar between the two groups. Seyed Hamid et al. [18] observed that IHNB yielded better outcomes than TAP block in the follow-ups of patients with chronic pain, who underwent inguinal hernia repair. In the study of Okur et al., IHNB and TAP were performed on 30 patients each who underwent inguinal hernia repair with SA, and the results were compared with a control group of another 30 patients [13]. A decrease was noted in acute and chronic pain scores. In a similar study evaluating chronic and acute pain on 200 patients who underwent inguinal hernia repair, less acute and chronic pain were observed in the ones who underwent TAP block compared to the ones who underwent IHNB [19]. In our study, we preferred to compare the effects of the ilioinguinal block with patients who underwent spinal anesthesia only and observed significantly decreased LANSS and VAS scores in the third and sixth postoperative months among patients who received IINB. Also, chronic neuropathic pain was less common in these patients postoperatively.

Demographic features are also emphasized in pain studies. The female gender, young age, and high body mass index were effective in chronic pain development after herniotomy [3]. Decrease of peripheric nociceptive function with age and analgesic agent excretion were the presumed factors [7, 20]. In our study, the mean ages of groups 1 and 2 were 62 years and 59 years, respectively. Although the gender distribution of the groups was similar, the number of females in both groups was very low. Therefore, it is not possible to comment on gender-related pain in our study. The mean BMI values of the groups were also similar.

Although IHNB is an easy and reliable technique, the side effects, such as transient femoral nerve paralysis, abscess, hematoma, colon perforation, local anesthetic toxicity, should be kept in mind [6,14]. We did not observe any complications in our study. We attribute this to the use of the ultrasound and the increased experience of our clinic.

Limitations

Our study has a limited number of patients. The Visual Analog Scale score was not measured on knee flexion. Also, the analgesic use of the patients was not questioned preoperatively or postoperatively.

Conclusion

The ultrasound-guided ilioinguinal nerve block is easy and safe. It may be commonly used in inguinal hernia surgeries due to its outcomes of lessened acute and chronic neuropathic pain.

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