ABSTRACT

**Background:** Thoracolumbar interfascial plane (TLIP) block involves injection of local anesthetics between multifidus and longissimus muscles at the 3rd lumbar vertebral level assuming that it can block the dorsal rami of thoracolumbar nerves.

**Objective:** The objective of this study was to evaluate the analgesic effects gained after performing TLIP block (analogous to the transversus abdominis plane [TAP] block, but intended for the back) in patients undergoing lumbar discectomy.

**Methodology:** This was a prospective, randomized, double-blinded, controlled clinical trial. Computer-generated randomization numbers were used to allocate patients into two groups. A total of 102 patients scheduled for lumbar discectomy were considered eligible, of these 70 patients were randomly included in the analysis: 35 patients (control group) received the standard general anesthetic technique and 35 patients (TLIP group) received TLIP block with 20 ml mixture of 0.25% bupivacaine and 1% lidocaine on each side. The primary outcome was to compare the two groups with regard to pain scores, whereas the secondary outcomes included the time to first analgesic (TFA), 24-h morphine consumption, and side effects associated with morphine such as nausea, vomiting, and sedation.

**Results:** TLIP group compared with the control group showed a significant reduction in the postoperative Visual Analog Scale for pain score both on rest and movement, with no statistically significant difference at 24 h during movement. TFA was significantly shorter in the control group compared to the TLIP group (82.00 ± 69.01 vs. 442.7 ± 126.47 min, \( P < 0.001 \)). TLIP group had lower cumulative morphine consumption than control group of statistically significant difference (9.7 ± 6.38 vs. 25.88 ± 5.17 mg, \( P < 0.001 \)). TLIP block group compared with the control group showed a significant reduction of nausea and a lower incidence of sedation.

**Conclusion:** TLIP block is an effective and safe method for postoperative analgesia after lumbar discectomy.

**Key words:** Lumbar disc surgery; nerve block; postoperative pain; thoracolumbar

Introduction

The spinal nerve is formed by the union of the ventral motor root and the dorsal sensory root. It subdivides as it exits the intervertebral canal, into a large anterior primary ramus and a smaller posterior primary ramus. The posterior ramus runs around the facet joints and gives branches supplying ligaments, joints, and all the segmental spinal muscles in addition to providing for the cutaneous supply over the back from the vertex to the coccyx.[1] Surgeries for lumbar discectomy are usually associated with severe postoperative
pain; there are a variety of pharmacological options available for the effective relief of pain after spinal surgery. Each one of them has inherent pros and cons which restrict their universal usage,\(^2\) while regional anesthetic techniques such as neuraxial anesthesia, paravertebral blocks, and local anesthetic (LA) infiltration of the wound are less frequently used.\(^3\)

Enhanced Recovery After Surgery protocol recommends the use of regional anesthesia techniques to minimize opioid analgesics whenever possible.\(^4,5\)

Ultrasound-guided thoracolumbar interfascial plane (TLIP) block was first described in 2015 by Hand et al.\(^6\) TLIP block involves injection of LAs between multifidus (MF) and longissimus (LG) muscles at the 3rd lumbar vertebral level assuming that it can block the dorsal rami of thoracolumbar nerves.

**Objective**

The aim of our study was to evaluate the analgesic effects gained after performing TLIP (analogous to the transversus abdominis plane [TAP] block, but intended for the back) which targets the sensory component of the dorsal rami of the thoracolumbar nerves in patients undergoing lumbar discectomy.

**Methodology**

This study was a prospective, randomized, double-blinded, controlled clinical trial conducted at Ain Shams University Hospitals. The study was registered with a clinical trial registry (ClinicalTrials.gov ID: NCT03285282). The study trial was conducted and reported according to the Consolidating Standards of Reporting Trials 2010 statement.\(^7\) Seventy cases with herniated lumbar disc scheduled for lumbar single-level or multiple-level lumbar discectomy from May 2017 to February 2018 were selected for this study. Inclusion criteria were patients with American Society of Anesthesiologists physical status (ASA) I or II aged between 21 and 60 years of both genders scheduled for lumbar discectomy. Exclusion criteria were body mass index >32, history of relevant allergy to any of the drugs used in the procedure, previous lumbar spine surgery or back surgery with planed spinal fixation, or the inability to operate a patient-controlled analgesia (PCA) pump. All participants signed an informed consent after explaining them the objective of the study. Computer-generated randomization numbers were used to allocate patients into two groups using sealed opaque envelopes. The envelope was chosen by each patient which determined his/her group. Patients were randomized and divided into two groups, each containing 35 patients. Group I (control group) received the standard general anesthetic technique without TLIP block and Group II (TLIP group) received TLIP block with 20 ml mixture of 10 ml 0.25% bupivacaine and 10 ml 1% lidocaine on each side.

General anesthesia was standardized in the two groups using propofol (1–2 mg/kg) and fentanyl (2 µg/kg). Tracheal intubation was facilitated using atracurium (0.5 mg/kg) and maintenance of anesthesia was with 50:50% O\(_2\) and air with isoflurane and atracurium.

**Technique**

TLIP block was done after induction of anesthesia with patients in the prone position, and standard monitors were applied. A SonoSite S-Nerve high-frequency linear (HFL) 50X transducer using SONOSITE M-TURBO machine (FUJIFILM SonoSite, Inc., USA) was placed in transverse orientation in a midline position at approximately the level of the 3rd lumbar vertebra (L3). After identification of corresponding spinous process and interspinal muscles, the probe moved laterally to identify the MF and LG muscles as shown in Figure 1. At the most caudal level, the block was performed to allow reliable identification of the MF/LG interface. Differentiation of the MF and LG muscles may be difficult as these separate muscles can often appear as a single larger one.

Under complete sterile condition, a 22G spinal needle (BD Spinal needle Quincke type point 22G 0.7 × 90 mm, Becton Dickinson S.A.S Agustin del Guadalix, Madrid, Spain, REF: 405256) was advanced under real-time in-plane ultrasound guidance bevel up in lateral-to-medial direction at an approximate angle of 30° to the skin. The needle was inserted through the bulk of the LG toward the MF. The needle tip was directed toward the LG–MF interface deep into the midpoint. After an attempted aspiration with a

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**Figure 1: Identification of landmarks before proceeding for injection**
3-mL syringe is negative for blood, a small volume of LA was injected to confirm the position of needle tip between the MF and LG (i.e., hydrodissection). 20 ml of a mixture of LAs was incrementally injected with intermittently repeated negative aspiration into each side, as shown in Figure 2.

In one case after consenting the patient, 3 ml of X-ray contrast medium (Omnipaque, IOHEXOL 300 mg I/ml, GE Healthcare Ireland, Cork, Ireland) was added to the mixture of the injected LA, then an anteroposterior X-ray image was taken to view the spread of LA and the level of spread as shown in Figure 3.

In the two groups, the postoperative analgesic induction was as follows: intravenous paracetamol (1 g) every 6 h was started on admission to the postanesthesia care unit, and patient-controlled analgesia (PCA) (intravenous morphine) (bolus dose 1 mg, lockout interval 10 min, 4 h maximum dose 20 mg) was started on demand after the time to first analgesic (TFA) request and continued on the patient’s need. The primary outcome was to compare the two groups with regard to pain scores. Pain scores were observed and recorded using the Visual Analog Scale (VAS) both at rest and during movement. The acute pain service team recorded the scores in the ward at 2, 4, 8, 12, and 24 h, whereas secondary outcomes included the TFA, 24-h morphine consumption, and side effects associated with morphine such as nausea, vomiting, and sedation. Nausea was measured using a categorical system (0 = none, 1 = mild, 2 = moderate, and 3 = severe). Ramsay Sedation Scale, a 6-point scale, was used to assess sedation levels (1, agitated and anxious; 2, cooperative; 3, only responds to commands; 4, strong response to glabellar tapping or noisy stimulants; 5, weak response to glabellar tapping or noisy stimulants; and 6, no response). All data were collected by intern doctors who were blinded to the anesthetic technique.

**Sample size**

Sample size was selected using PASS program (version 2011. NCSS, LLC; Kaysville, Utah, USA), setting alpha error at 5% and power at 90%. Results from the previous study (10) as regard the mean VAS at 24 h postoperative determined that the needed sample was 30 cases per group, and to compensate for possible dropouts, we decided to include 35 patients per group.

**Statistical analysis**

Data were collected, revised, coded, and entered into the Statistical Package for the Social Sciences version 23 (IBM Inc., Chicago, IL, USA). The quantitative data were presented as mean, standard deviations, and ranges when their distribution was parametric and median with interquartile range when their distribution was nonparametric, while qualitative data were presented as number and percentages. The comparison between the two independent groups with qualitative data was done by using Chi-square test and/or Fisher’s exact test only when the expected count in any cell was found <5. The comparison between the two independent groups with quantitative data and parametric distribution was done using independent t-test, while that of quantitative data with nonparametric distribution was done using Mann–Whitney test. The confidence interval was set to 95% and the margin of error accepted was set to 5%. Hence, P < 0.05 was considered statistically significant.

**Results**

A total of 102 patients were considered eligible; of these, 70 patients were randomly included in the analysis as shown in Figure 4. No statistically significant difference was observed between the groups as regard demographic data (age, sex, and weight), operation times, and ASA classifications of patients [Table 1]. TLIP group compared
with control group showed a significant reduction in the postoperative VAS for pain score both on rest and movement [Table 2 and Figure 5]. During movement, there was a significant reduction in the postoperative VAS in TLIP group, while at 24 h, there was no statistically significant difference between the groups [Table 3 and Figure 6]. The first time of requirement for analgesic was significantly shorter in the control group compared to the TLIP group (82.00 ± 69.01 vs. 442.7 ± 126.47 min, \( P < 0.001 \)). At the end of 24 h, total morphine consumption was evaluated, in which TLIP group had lower cumulative morphine consumption than the control group of statistically significant difference (9.7 ± 6.38 vs. 25.88 ± 5.17 mg, \( P < 0.001 \)) [Table 4]. TLIP block group compared with the control group showed a significant reduction of nausea and a lower incidence of sedation [Table 5]. No cases of vomiting were recorded in both groups.

**Discussion**

This study showed that TLIP block provided more analgesia with less VAS scores and less postoperative rescue analgesic consumption compared to control group, which reduces PCA morphine requirements and the coexisting morphine-induced nausea, without clinically relevant oversedation. There are several postoperative pain control methods to reduce pain; among them, intramuscular injections, intermittent intravenous, and PCA are the most commonly used. Furthermore, these methods are generally insufficient to control pain arising from movement as well. Such an insufficient postoperative pain control may delay discharge from hospital and result in complications. Furthermore, using nonopioid medication to control postoperative pain has repeatedly been shown to benefit patients in terms of morbidity and mortality\(^{[16]}\). In line with studies demonstrating the efficacy of LA infiltration in back surgery, spine surgeons frequently perform a preoperative field infiltration for lumbar surgery with a total dose of anesthetics similar to that of the TAP block\(^{[11]}\), with significant reduction of morphine consumption and longer TFA requirement than the control group. However, the efficacy of this approach has not been well studied. Nevertheless, the safety of such a procedure with the typically used dose of LAs is supported by the extensive regional anesthetic practice using similar blocks. In

### Table 1: Demographic data of the patients and operation time

| Variable                        | Control group (\(n=35\)) | TLIP group (\(n=35\)) | Test value | \(P\) |
|--------------------------------|--------------------------|------------------------|------------|------|
| Age (years)                    | Mean±SD                  | 43.05±6.88             | 42.00±8.21 | -0.580* | 0.564 |
| Range                          | 33-57                    | 30-56                  |            |      |
| Sex, n (%)                     | Females                  | 12 (34.3)              | 14 (40.0)  | 0.245*  | 0.621 |
| Males                          | 23 (65.7)                | 21 (60.0)              |            |      |
| ASA, n (%)                     | ASA I                    | 22 (62.9)              | 23 (65.7)  | 0.062*  | 0.803 |
| ASA II                         | 13 (37.1)                | 12 (34.3)              |            |      |
| Weight (kg)                    | Mean±SD                  | 88.25±10.23            | 85.25±6.94 | 1.436*  | 0.156 |
| Range                          | 70-100                   | 70-99                  |            |      |
| Height (cm)                    | Mean±SD                  | 171.82±6.37            | 169.8±4.52 | 1.530*  | 0.131 |
| Range                          | 162-180                  | 160-179                |            |      |
| Surgical duration (min)        | Mean±SD                  | 124.5±34.3             | 132.88±24.48 | 1.176*  | 0.243 |
| Range                          | 80-180                   | 90-180                 |            |      |

Data are presented as range, mean±SD, or number and percentage. \(P > 0.05\): Nonsignificant; \(P < 0.05\): Significant. *Chi-square test; *Independent t-test. SD: Standard deviation; ASA: American Society of Anesthesiologists; TLIP: Thoracolumbar interfascial plane.
infiltration of the skin and subcutaneous tissue. Bianconi et al.\textsuperscript{13} concluded that continuous wound instillation by LAs after spine fusion surgery found to be more effective than systemic analgesia while plasma concentrations of the LAs remained below toxic levels. Reynolds et al.\textsuperscript{14} concluded that continuous infusion with LAs reduced postoperative morphine consumption with up to 0.5 mg/kg. After multiple trials for LA infiltration, ultrasound-guided TLIP block was first described by Hand et al. when ten participants underwent bilateral ultrasound-guided injections of 0.2% ropivacaine 20 mL in the fascial plane between the MF and LG muscles. After 20 min, the area surrounding the needle injection site where anesthesia was administered was 217.0 (84.7) cm\textsuperscript{2}. This area consistently covered the midline and had a predictable spread. Ueshima et al. described two cases of spinal surgeries where TLIP block was administered.\textsuperscript{15} In a cadaveric study, the dye added to the LA of the TLIP block colored the dorsal rami of the lumbar nerves.\textsuperscript{16} Hand et al.\textsuperscript{16} reported that the efficacy of the TLIP block is restricted to the lumbar region; however, Ueshima et al. determined that the TLIP block also affected the dorsal rami of the thoracic nerves.\textsuperscript{17} Ohgoshi et al.\textsuperscript{18} described TLIP block for multi-level spine surgery. Kumar et al.\textsuperscript{19} recorded a case report of a patient who received ultrasound-guided TLIP block for postoperative pain management after lumbar discectomy at L3–L4; the duration of surgery was 2 h and the demand for the first analgesic dose was 5 h after surgery. Another study\textsuperscript{20} discussed the efficacy of TLIP block in postoperative analgesia for lumbar laminoplasty compared with the control group which received intravenous analgesia, the TLIP group reported lower pain scores for pain at 1, 2, 4, and 24 h postoperatively and less analgesic requirement and showed no significant differences in the incidence of complications.

### Limitations

There are few limitations that were faced in this study. Since it was carried out on a live patient, the exact extent of the injected solution could not be exactly evaluated; although in one case after obtaining consent, a contrast medium was added to the mixture followed by an anteroposterior X-ray...
Table 4: Morphine consumption and time to first analgesia

| Parameters                          | Control group (n = 35) | TLIP group (n = 35) | Test value | P    |
|-------------------------------------|------------------------|--------------------|------------|------|
| Total morphine consumption at 24 h (mg) |                         |                    |            |      |
| Mean ± SD                           | 25.88 ± 5.17           | 9.7 ± 6.38         | 11.657*    | <0.001 |
| Range                               | 15-35                  | 4-25               |            |      |
| Time to first analgesia (min)       |                        |                    |            |      |
| Mean ± SD                           | 82.00 ± 69.01          | 442.7 ± 126.47     | 14.811*    | <0.001 |
| Range                               | 20-240                 | 240-630            |            |      |

P > 0.05: Nonsignificant; P < 0.05: Significant. *Independent t-test. TLIP: Thoracolumbar interfascial plane; SD: Standard deviation.

Table 5: Sedation and nausea scores

| Score                  | Control group (n = 35) | TLIP group (n = 35) | Test value | P    |
|------------------------|------------------------|--------------------|------------|------|
| Sedation score         |                        |                    |            |      |
| Median (IQR)           | 3 (2-4)                | 2 (2-2)            | -5.019*    | <0.001 |
| Range                  | 2-4                    | 2-3                |            |      |
| Nausea score           |                        |                    |            |      |
| Median (IQR)           | 0 (0-1)                | 0 (0-0)            | 3.027*     | 0.009 |
| Range                  | 0-3                    | 0-2                |            |      |

P > 0.05: Nonsignificant; P < 0.05: Significant. *Mann–Whitney test. TLIP: Thoracolumbar interfascial plane; IQR: Interquartile range.

as mentioned before, in a trial to understand the exact extension of the injectate. Furthermore, we could not exactly determine the proper or the ideal volume and concentration of LA that should have been used to perform the TLIP block. We were limited in the concentration of the LA for fear of reaching the toxic level of the drugs used. Moreover, further assessment of the patient after being discharged from the hospital could not be done, which could have shed some lights on the role of TLIP on preventing failed back surgery syndrome. Hence, a prospective study should be planned to deal with those limitations.

Conclusion

TLIP is an effective and safe method for postoperative analgesia after lumbar discectomy.

Financial support and sponsorship
Nil.

Conflicts of interest
There are no conflicts of interest.

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