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ORIGINAL ARTICLE

Comparative Study Between Ultrasound Guided Thoracolumbar Plane Block and Patient Controlled Analgesia in Lumbar Spine Surgery

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Abstract

Background: ***Pain arising in the facet joints, muscles, skin, subcutaneous tissues, intervertebral disks, vertebra, and muscles can follow spinal surgery due to surgical trauma. Despite having a nociceptive origin, pain can also have a neuropathic pattern. Thus, it is crucial to have enough pain medication after spinal surgery. It can involve the use of recently popular non-steroidal anti-inflammatory medicines (NSAIDS), localized blocks, lidocaine infusion, gabapentin, pregabalin, systemic opioids, and neuraxial analgesia.***

Aim and objectives: ***To assess and compare the analgesic results of patient-controlled analgesia and thoracolumbar plane block in terms of safety and efficacy.***

Subjects and methods: ***Fifty-eight patients were split into two groups for this prospective, randomized, single-masked clinical investigation, which was done at AL-Azhar University Hospitals.***

Result: ***Regarding the baseline parameters, there were negligible differences between the study groups (Age, sex, weight, height, BMI, and ASA). There was no significant difference in the procedure duration across the study groups. The two groups had no noticeable disparity in problems resulting from local anesthesia.***

Conclusion: ***The results of the present study concluded that the analgesic outcome of the thoracolumbar plane block is more effective and safer than patient-controlled analgesia. Further studies are needed with larger scales to confirm our results. Longer periods are needed for Follow-up patients.***

Keywords: Ultrasound; Thoracolumbar Plane Block; Patient Controlled Analgesia; Lumbar Spine Surgery

1. Introduction

Postoperative pain after spine surgery can originate from multiple locations, such as the vertebral bodies, intervertebral disks, facet joints and skeletal muscles, the skin, and tissues beneath the skin, due to surgical injury.[1]

Hand et al. introduced the TLIP block to mitigate postoperative discomfort following spine surgery. Torturing the dorsal ramus of the thoracolumbar nerves with an anesthetic chemical precisely targets the region between the multifidus and longissimus muscles.[2]

That TLIP block was subsequently altered by administering a local anesthetic across the longissimus and iliocostalis muscles, resulting in a dermatomal dispersion pattern comparable to that of the TLIP block.[3]

Ultrasound guidance to identify multifidus and longissimus muscles is a recent approach for easy administration of TLIP.[4]

While the phrase patient-controlled analgesia (PCA) encompasses many procedures allowing patients to self-administer analgesic medicines, it typically refers to the self-administration of intravenous analgesics.[5]

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The approach was created for pain treatment in spine surgery through the use of a straightforward mechanical setup, where the patient operates a clamp to self-administer a diluted solution of Meperidine.[6]

An advanced electronic pump was subsequently created, primarily for research purposes.[7]

The introduction of simple transportable PCA pumps into everyday clinical practice did not occur until the late 1980s.[8]

Patient-managed analgesia (PCA) is widely utilized in numerous hospitals across Europe.[5]

Postoperative pain management is the most frequent reason for using patient-controlled analgesia (PCA). The approach is also employed in various instances of intense pain, such as pancreatitis, rib fracture, sickle cell crisis, and acute exacerbation of chronic pain.[1]

This study aims to evaluate and compare the pain-relieving effectiveness of thoracolumbar plane block with patient-controlled analgesia while considering both safety and efficacy.

2. Patients and methods

A prospective, randomized, single-masked study, a clinical trial, has been chosen as the design of this study. The study will be carried out in AL-Azhar University Hospitals.

Inclusion criteria: ASAI & II patients of both sexes aged 21 to 60 who are undergoing elective lumbar spine surgery.

Exclusion criteria: Factors that may contraindicate the procedure include the patient's refusal, presence of psychiatric problems or use of psychiatric drugs, usage of anticoagulants or corticosteroids, bleeding tendency, and allergy to local anesthetics.

Methods:

Upon receiving clearance from the Research/Ethics Committee and gaining informed written agreement, patients will be divided into two groups, A and B, regardless of gender. Each group will consist of 29 patients. Group A will have a thoracolumbar plane block, whereas Group B will undergo patient-controlled analgesia (PCA). Group A: Implementation of the TLIP block technique: The TLIP block will be performed following the administration of anesthesia while the patient is positioned in the prone position using standard monitoring equipment. A high-frequency linear transducer will be positioned at the midline of the third lumbar vertebra. Group B: Principal Component Analysis Methodology: Intravenous patient-controlled analgesia (IV-PCA) is administered with a combination of Paracetamol (4 g) and morphine 10 mg, in a total volume of 300 ml. Baseline dosage: 3 ml per hour. Additional dosage of self-control: 3 ml. Duration of lock: 10 minutes.

All patients will be evaluated preoperatively and post-operatively, using the postoperative standardization of the technique in all cases.

Preoperative: Full history taking and clinical examination of optimum skin hygiene, including showers with hexachlorophene soap on the table.

General anesthesia: Each patient will be administered general anesthesia, which includes an initial dosage of chloroform at a rate of two milligrams per kilogram, fentanyl at a rate of 2 micrograms per kilogram, and cis-atracurium at a rate of 0.2 milligrams per kilogram.

Maintenance: Isoflurane is mixed with oxygen and air.

All outcomes will be recorded: Measurements of heart rate (HR), blood pressure (BP), body temperature, and urine retention will take place at 2, 4, 6, 12, and 24.

The initial demand for suffering relief following surgery.Aggregate analgesic usage within the initial 24 hours following surgery. The assessment of postoperative pain will occur at certain time intervals (2, 4, 6, 12, 24, 36, and 48 hours) when the individual is resting and when the spine is passively flexed. The evaluation will utilize the Numerical Rating Scale score (NPR).

3. Results

A total of 89 patients were evaluated for their suitability in this study. Out of them, 19 patients did not match the required requirements, and an additional 12 patients declined to take part in the study. The remaining 58 patients were evenly distributed into two groups, with 29 patients in each group. The patients who were assigned to certain groups were monitored and subjected to statistical analysis, Figure 1.

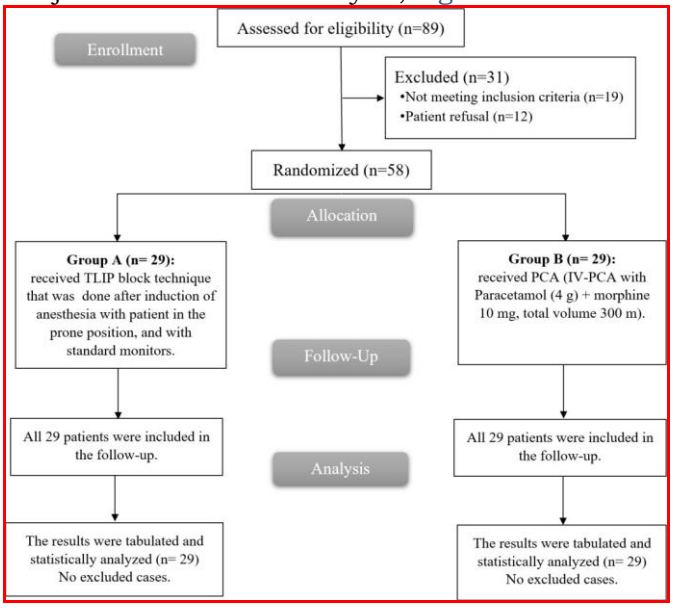

Figure 1: CONSORT flowchart of the enrolled patients.

Table 1. Baseline characteristics of the studied groups

		GROUP A (N=29)	GROUP B (N=29)	P VALUE
AGE (YEARS)	Mean ± SD	42.0 ±11.12	40.2 ±10.87	0.529
	Range	23-60	23-58	
SEX	Male	17 (58.62%)	15 (51.7%)	0.907
	Female	12 (41.38%)	14 (48.3%)	
WEIGHT (KG)	Mean ± SD	63.3 ±5.89	65 ±5.85	0.288
	Range	55-75	56-75	
HEIGHT (M)	Mean ± SD	1.7 ±0.06	1.7 ±0.05	0.364
	Range	1.55-1.75	1.57-1.75	
BMI (KG/M²)	Mean ± SD	22.8 ±2.79	23.8 ±2.51	0.177
	Range	18.17-28.58	19.49-28.93	
ASA	I	10 (34.48%)	13 (44.83%)	0.591
	II	19 (65.52%)	16 (55.17%)	
SURGERY TIME (MIN)	Mean ± SD	135.9 ±12.52	140.4 ±11.48	0.155
	RANGE	120-160	121-158	

The baseline variables (age, sex, weight, height, BMI, and ASA) showed negligible variations across the groups under investigation.

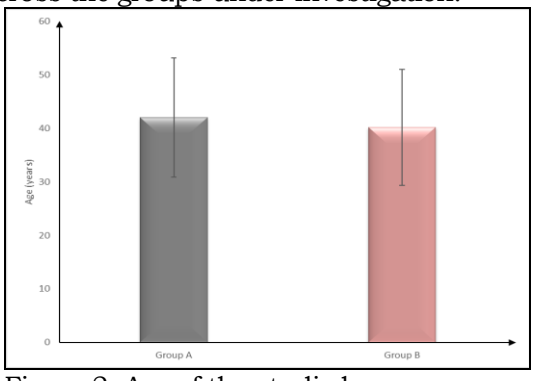

Figure 2. Age of the studied groups.

Table 2. Surgery time of the studied groups.

		GROUP A (N=29)	GROUP B (N=29)	P VALUE
SURGERY TIME (MIN)	Mean ± SD	135.9 ± 12.52	140.4 ± 11.48	0.155
	RANGE	120 - 160	121 - 158	

The surgical duration shown little variations among the groups under investigation.

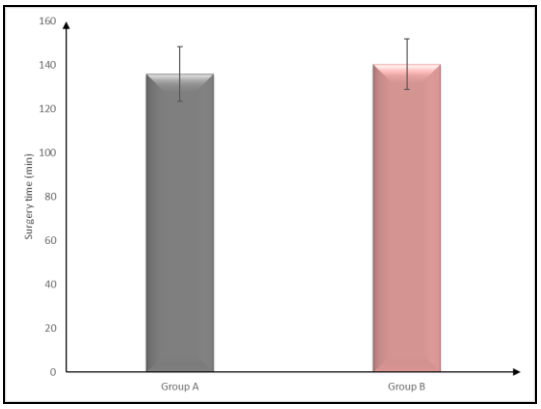

Figure 3: Surgery time of the studied groups.

` Table 3. Time to first postoperative rescue analgesia of the studied groups.

		GROUP-A (N=29)	GROUP-B (N=29)	P VALUE
TIME TO FIRST RESCUE ANALGESIA (HR)	Mean ± SD	4.4 ± 1.64	10.8 ± 2.84	<0.001*
	RANGE	2 - 6	1 - 13	

*: statistically significant as P value <0.05.

The time it took for the first postoperative rescue analgesia to be administered was substantially longer in group B comparing to group A (P<0.001).

Table 4. Total analgesic consumption during the 1st postoperative 24 hours of the studied groups

		GROUP-A (N=29)	GROUP-B (N=29)	P VALUE
TOTAL ANALGESIC CONSUMPTION (MG)	Mean ± SD	23.8 ± 4.94	13.1 ± 4.71	<0.001*
	RANGE	20 - 30	10 - 20	

*: statistically significant as P value <0.05.

The amount of pain-relieving medication used within the first 24 hours after surgery was significantly less in group B compared to group A (P<0.001).

Table 5. Postoperative pain assessment by numerical rating scale (NRS) score at rest of the studied groups.

	GROUP A (N=29)	GROUP B (N=29)	P VALUE
AT 2H POSTOPERATIVELY	3 (2 - 4)	2.5 (1 - 3)	0.003*
AT 4H POSTOPERATIVELY	3 (2 - 4)	2 (2 - 3)	0.005*
AT 6H POSTOPERATIVELY	4 (3 - 5)	3 (2 - 4)	<0.001*
AT 12H	5 (3 - 6)	4 (2 - 4)	0.036*

POSTOPERATIVELY			
AT 24H POSTOPERATIVELY	5 (3 - 6)	3 (2 - 4)	<0.001*
AT 36H POSTOPERATIVELY	2 (2 - 2)	3 (1 - 3)	0.140
AT 48H POSTOPERATIVELY	1 (1 - 3)	2 (1 - 2.25)	0.584

Data presented as median (IQR), NRS: numerical rating scale score, *: statistically significant as P value <0.05.

Group B exhibited considerably reduced postoperative pain levels at rest compared to group A, as evidenced by the NRS scores at 2, 4, 6, 12, and 24 hours postoperatively (P<0.05), and was insignificantly different at 12, 36 and 48 hrs postoperatively between the studied groups.

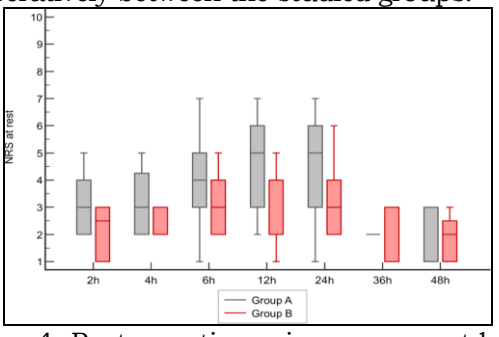

Figure 4. Postoperative pain assessment by numerical rating scale (NRS) score at rest of the studied groups.

Table 6. Postoperative pain assessment was conducted using the numerical rating scale (NRS) score while performing passive flexion of the spine in the groups under study.

	GROUP A (N=29)	GROUP B (N=29)	P VALUE
AT 2H POSTOPERATIVELY	3 (3 - 4.25)	3 (2 - 3)	<0.001*
AT 4H POSTOPERATIVELY	3 (3 - 5)	3 (2 - 3)	0.012*
AT 6H POSTOPERATIVELY	5 (4 - 6)	3 (2 - 4)	0.020*
AT 12H POSTOPERATIVELY	5 (3 - 6.25)	3 (2 - 4)	0.003*
AT 24H POSTOPERATIVELY	5.5 (3 - 6)	3 (3 - 4)	0.011*
AT 36H POSTOPERATIVELY	3 (2 - 3)	3 (2 - 3)	0.804
AT 48H POSTOPERATIVELY	2 (2 - 3)	2 (2 - 3)	0.344

Data presented as median (IQR), NRS: numerical rating scale score, *: statistically significant as P value <0.05.

In relation to evaluating pain after surgery while flexing the spine, the Numeric Rating Scale (NRS) scores at 2, 4, 6, 12, and 24 hours after surgery were considerably lower in group B compared to group A (P<0.05). However, there was no significant difference in NRS scores at 12, 36, and 48 hours postoperatively between the two groups.

Table 7. Postoperative heart rate of the studied groups.

		GROUP-A (N=29)	GROUP-B (N=29)	P-VALUE
AT 2H POSTOPERATIVELY	Mean ± SD	89.7 ± 12.87	81.6 ± 5.41	0.003*
	Range	71 - 113	70 - 90	
AT 4H POSTOPERATIVE	Mean ± SD	89.8 ± 13.63	77.6 ± 5.62	<0.001*
	Range	74 - 115	71 - 91	
AT 6H POSTOPERATIVELY	Mean ± SD	96.8 ± 12.38	87.5 ± 12.11	0.006*
	Range	72 - 113	70 - 112	
AT 12H POSTOPERATIVELY	Mean ± SD	99.6 ± 8.8	89.8 ± 15.89	0.006*
	Range	80 - 115	70 - 113	
AT 24H POSTOPERATIVELY	Mean ± SD	97.1 ± 12.82	88.4 ± 13.38	0.015*
	RANGE	75 - 115	71 - 114	

*: statistically significant as P value <0.05.

The heart rate measured at 2, 4, 6, 12, and 24 hours after surgery was considerably lower in group B than in group A (P<0.05).

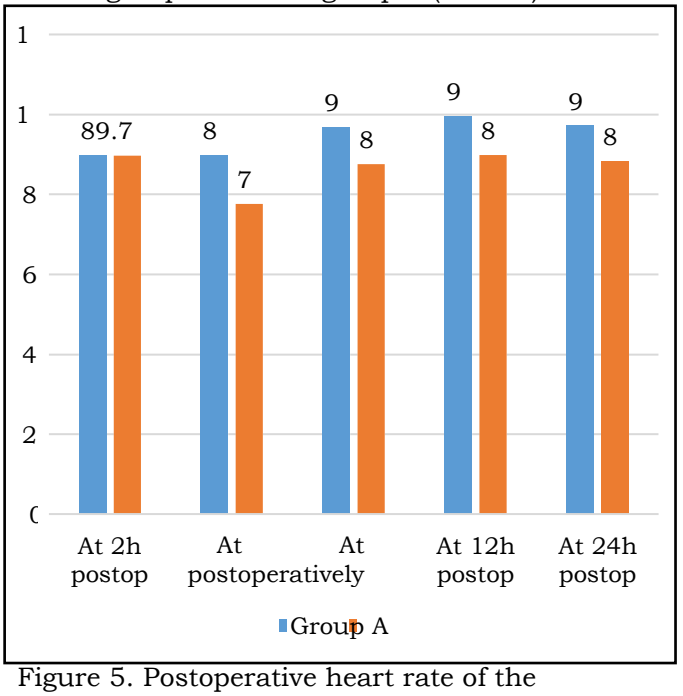

Figure 5. Postoperative heart rate of the studied groups.

Table 8. Postoperative mean arterial pressure (MAP) of the studied groups.

		GROUP-A (N=29)	GROUP-B (N=29)	P VALUE
AT 2H POSTOPERATIVELY	Mean ± SD	88.8 ± 12.47	80.1 ± 5.65	0.001*
	Range	72 - 110	70 - 90	
AT 4H POSTOPERATIVELY	Mean ± SD	88.1 ± 12.83	79.6 ± 6.2	0.002*
	Range	71 - 109	70 - 90	
AT 6H POSTOPERATIVELY	Mean ± SD	95.9 ± 12.55	85.7 ± 12.83	0.003*
	Range	71 - 110	70 - 111	
AT 12H POSTOPERATIVELY	Mean ± SD	98.03 ± 7.62	90.6 ± 13.41	0.012*
	Range	83 - 110	71 - 109	
AT 24H POSTOPERATIVELY	Mean ± SD	94.9 ± 10.75	86.1 ± 11.79	0.004*
	RANGE	70 - 109	70 - 108	

*: statistically significant as P value <0.05.

Postoperative MAP at 2, 4, 6, 12 and 24 hrs postoperatively was significantly lower in group B compared to group A (P<0.05).

4. Discussion

The results of the present study are consistent with Wang et al.,[9] The objective was to examine the impact of the study examines the effects of the TLIP block and ESP block on the utilization of analgesics and opioids during a certain period of the perioperative period of lumbar spine fusion surgery. Their investigation encompassed A cohort of 304 patients who underwent lumbar spine fusion and were chosen and allocated randomly into three groups: a control group (n=102), an ESP block group (n=100), and a TLIP block group (n=102). The authors observed no statistically significant disparities among the investigated groups for age, sex, weight, height, body mass index (BMI), and the American Society of Anesthesiologists (ASA) classification.

As well Goel et al., [10] The objective of this study is to assess the efficacy of ultrasound-guided ESP block in alleviating pain following lumbar spine fusion surgery at a single level, as compared to the conventional approach of multimodal postoperative pain treatment with opioids. One hundred consecutive patients requiring single-level lumbar spinal fusion treatment were randomly assigned to two groups: the block group, which got multimodal analgesia with US-ESP, and the control group, which received only multimodal analgesia. The authors observed no statistically significant disparities among the examined groups regarding age, gender, height, weight, BMI, and ASA.

The present study revealed a significant difference in the time before the first postoperative analgesia for rescue between groups B and A, with group B experiencing a considerably longer time (P<0.001). Group B exhibited a considerably lower usage of painkillers within the initial 24 hours following surgery compared to group A (P<0.001).

The results of the present study supported Wang et al.,[9]. The individual who conducted the study showed a significant difference in the overall amount of pain medication used by the groups under investigation within the first 24 hours after the surgery.

Singh et al.[11] the study found that patients in the block group experienced longer-lasting postsurgical analgesia. These patients required their first dosage of rescue analgesia after an average of 5.8 ± 0.75 hours, whereas patients in the control group required their first dose after an average of 2.42 ± 0.59 hours (P = 0.003). After surgery and six hours later, the control group's pain scores were higher than those of the ESP block group. Compared to patients in the control group, the ESP block group's patients expressed greater satisfaction. In the control and ESP block groups, overall (with an average deviation) satisfaction scores were 5.5 (0.74) and 7.7 (0.45), respectively (P < 0.0001).

According to the results of the present study, group B significantly lessened discomfort than Group A when it came to the Numeric Rating Scale (NRS) assessments of patients' pain at rest following surgery at 2, 4, 6, 12, and 24 hours after surgery (P<0.05). Nonetheless, following surgery,

at [12], 36, and 48 hours, there was no discernible difference in the two groups' pain levels.

When evaluating the pain experienced after surgery while the spine is being flexed passively, the Numeric Rating Scale (NRS) scores at 2, 4, 6, 12, and 24 hours after surgery were considerably lower in group B compared to group A (P<0.05). However, the two groups had no significant difference in NRS scores at 12, 36, and 48 hours postoperatively.

Wang et al.,[9] The results of the study showed that, in comparison to the patients in the control group, members of the ESP and TLIP groups experienced fewer PCA compressions, less remedial analgesia use, and shorter medical stays (P < 0.01). Within the 24-48 hour postoperative period, there was a significant decrease (P < 0.05) in the incidence of PCA compressions in Group ESP compared to Group TLIP. Using two planes, it was discovered that both groups' post-surgery Bruggemann Comfort Scale (BCS) scores and life quality scores (LQS) were comparable. However, compared to the control group, these results were better.

The current study showed that the heart rate following surgery at 2, 4, 6, 12, and 24 hours postoperatively was considerably reduced in group B compared to group A (P<0.05). The mean arterial pressure (MAP) measured at 2, 4, 6, 12, and 24 hours after surgery was considerably lower in group B compared to group A (P<0.05). The postoperative body temperature at 2, 4, 6, 12, and 24 hours showed no significant differences among the groups under study.

According to our findings, adverse events related to local anesthesia complications were observed in 1 (3.4%) patients in group A and 2 (6.9%) patients in group B. Nausea and vomiting were only reported in 6 (20.7%) patients in group B and did not occur in any patient in group A. Neither hemodynamic instability nor arrhythmias were observed in any patient in either group. While the incidence of issues associated with local anesthesia did not significantly differ between the two groups, group B experienced nausea and vomiting significantly more frequently than group A (P=0.023).

Wang, et al.,[9] According to a study, there were no appreciable variations in any of the three groups' opioid side effects, including nausea and vomiting, itching, and respiratory depression. Furthermore, they indicated no statistically significant disparities in the incidence of adverse reactions across the three cohorts.

Moreover, Ciftci et al.,[12] established the statistical significance of the differences in nausea between the groups under study.

5. *Conclusion*

The results of the present study concluded that the analgesic outcome of the thoracolumbar plane block is more effective and safer than patient-controlled analgesia. Further studies are needed with larger scales to confirm our results. Longer periods are needed for Follow-up patients.

Disclosure

The authors have no financial interest to declare in relation to the content of this article.

Authorship

All authors have a substantial contribution to the article

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Conflicts of interest

There are no conflicts of interest.

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